

HOME DÉCOR, COSTUME & UPHOLSTERY

A high-school year of sewing for real rooms and real stages: design a room and choose its fabrics with a trained eye, sew pillows, drapes, shades, quilts and slipcovers measured to fit, strip and re-upholster real furniture with webbing, padding and welting, and design and build modest historical costumes for a church play, a pageant or a history day, with the yardage math, cost sheets and construction logs of a working workroom.

This course teaches the sewing of the home and the stage. The student begins as a designer, learning line, color, texture, pattern, scale and proportion, and how a decorator judges a fabric by its fiber, weave, weight and wear rating. Then the work begins: knife-edge, zippered, piped and box cushions; curtains and drapes measured, lined and pleated for a real window; a Roman shade (made cordless for safety), a valance and a duvet cover; a pieced and bound quilt; a fitted slipcover; and two units of real upholstery, from stripping an old seat with safety glasses on to webbing, padding, pulling a cover and finishing with welting and gimp. The year ends with costume: how people actually dressed in Bible times, in Rome, in the Middle Ages and in colonial and pioneer America, and how a costume designer reads a script, researches, sketches, budgets and builds modest, sturdy costumes for a church play, a Christmas pageant or a history day.

Every lesson follows the same path. First comes **the story**: William Morris printing Strawberry Thief with carved blocks, the upholsterers of Chippendale's London, the quilting bees of the frontier, the milliners and tailors of colonial Williamsburg. Then **how they figured it out**: the problem they faced and what they tried. Then **the fabric science and the math**: fullness and cut length, pattern repeats, yardage and cost sheets, foam and batting, the geometry of a box cushion, worked step by step with units in every line. Last, **the studio lab**: the student makes the real thing, measures honestly, records it in a lab notebook and improves it. Unit tests, a midterm and a final check both the ideas and the arithmetic.

Sewing here is skill, stewardship and service: furnishing a home well and thriftily, mending and re-covering instead of throwing away, and giving, for a quilt is made to be given and a costume is made for someone else's part in the play. Scripture is full of this work, from the curtains of fine twined linen in the tabernacle to the capable woman of Proverbs 31 who makes herself coverings of tapestry, and Dorcas, whose coats and garments the widows held up with tears. *Fabricando fit faber*: by making, one becomes a maker.

Who it is for: Written for students in grades 9-12 working mostly on their own, with a parent checking work and present in the house for iron, serger, rotary-cutter, staple-gun and dye work. No prerequisite course is required: Unit 2 teaches the machine skills the year needs, and a student who has never sewn should simply take those lessons slowly. The math is arithmetic, fractions, percents and simple geometry; a calculator is allowed everywhere. To begin, the student needs a working sewing machine (borrowed is fine), a steam iron, fabric shears, pins and clips, a 60-inch tape measure, a clear quilting ruler, a rotary cutter and mat, a hand-sewing kit and a notebook; the upholstery units add a staple gun, safety glasses and a tack lifter.

50 lessons in 10 units · Every lesson has a video (links printed in each lesson), a picture study, a studio lab and notebook practice · Online: schoollaunch.org/courses/sewing/home-decor/

COURSE GUIDE

Most videos come from trusted teaching sources: museums such as the Victoria and Albert Museum and the William Morris Gallery, the workrooms of established drapery, quilting and upholstery teachers, long-running home-improvement programs, living-history channels such as Townsends, and careful sewing teachers chosen lesson by lesson. Every video was previewed for content, accuracy, safe practice and modest dress. Some channels sell fabric or tools and end with a mention of their shop; the teaching stands on its own, and you can stop the video when the lesson ends. Many lessons ask the student to watch once all the way through, then again with the tape measure, notebook or fabric in hand, pausing after each step.

HOW TO USE THIS COURSE

1. **The weekly rhythm.** The course runs five sessions a week of about 50 minutes. Each lesson takes three sessions: (1) the warm-up, video, teaching, picture study and worked examples; (2) the studio lab and the lab notebook; (3) the practice set and corrections. After each unit comes a unit test (100 points), with a review day and the midterm after Unit 5 and a review day and the final at the end of the year. Sewing labs may run long; the pacing table leaves room, and a lab can spill into an evening.
2. **Work like a workroom.** Every project starts with measurements written down, a sketch, a cutting plan and a cost estimate, and ends with the finished piece photographed in place and one honest note about what to change next time. That habit, not perfection, is what the course grades.
3. **Safety and the parent check.** A student in this course may use the sewing machine, serger, steam iron, rotary cutter and staple gun **only after a parent has watched him or her use each one safely**, and with a parent at home. Safety glasses are worn for all stapling, staple and tack removal and spring work. Pins and needles are counted out and back in every session and kept in a pincushion or magnetic dish, away from babies, toddlers and pets. The rotary cutter's blade is closed every time it is set down. Irons rest upright and are unplugged at the end; machines are unplugged before changing needles or blades.
4. **Old furniture is treated with respect and caution.** Assume the paint on old furniture may contain lead: do not sand old painted finishes, wipe them clean instead, and wear a dust mask when stripping old padding, which can be full of decades of dust. Work outdoors or by an open window and wash hands afterward. Any dyeing is done with gloves, ventilation and a parent present, never in a pot used for food.
5. **The story-to-science pattern.** The core ideas open with a real story and end with the lab. Read them before the video or after, as you prefer, but read them with a pencil: the worked examples are meant to be re-worked by hand, units and all, before the practice set.
6. **Picture study.** Each lesson pairs with one public-domain painting, photograph, printed fabric or patent drawing. Look at it quietly for two minutes, put it away and describe it from memory, then work through the look-for items and questions, which point at the cloth, the furniture, the tools and the hands.
7. **The lab notebook.** One notebook for the year. Every lab gets a dated page: measurements and math, a swatch or sketch, the data table where the lab calls for one, the cost sheet, and a one-line improvement note. The notebook is a tenth of the grade and the backbone of the capstone.
8. **Supplies and cost.** The projects use ordinary fabric-store and thrift-store supplies, and the course teaches you to hunt: decorator fabric remnants, clearance sheets (excellent yardage for linings, muslins and costume mock-ups), old furniture worth saving and the family's own rooms and windows. Before each unit, read the unit project and gather supplies ahead. Every machine project lists what it needs; a serger is never required.
9. **Optional books and tools.** Some units list free museum pages, trade references and simple tools. They are extras; every project works without them.
10. **Unit tests and exams.** Unit tests mix calculations, concepts, identification and a short essay, worth 100 points; calculators are allowed, and work must be shown with units. The midterm covers Units 1–5 and the final covers the year.
11. **The capstone.** Unit 10 ends with a capstone the student chooses: a complete costume set for a real play, pageant or history day, or a complete room's soft furnishings, either way with a design board, measured drawings, a cost sheet and a construction log. Start thinking about it at the midterm; the Unit 9 design work feeds straight into it.

SCOPE AND SEQUENCE

UNIT 1 • WEEKS 1–4

Design for the Home

The designer's eye: line, shape, texture, pattern, scale and proportion; the color wheel and real color schemes; decorator fabrics judged by fiber, weave, weight and double-rub wear ratings; William Morris and the Arts and Crafts movement; and a measured room plan with a mood board and fabric samples.

- 1.1 Useful or Beautiful: William Morris and the Designer's Eye
- 1.2 The Color Wheel in Cloth
- 1.3 Decorator Weight and the Double-Rub Test
- 1.4 The Right Fiber for the Room
- 1.5 The Mood Board and the Measured Plan

UNIT 3 • WEEKS 7–10

Curtains and Drapes

Curtains and drapes: window treatments through history and the tabernacle's curtains; measuring windows; fullness, cut length, panels and pattern repeats; rod-pocket, tab-top and back-tab headers; lining; and a pinch-pleated, lined drape for a real window.

- 3.1 Curtains of Fine Twined Linen: Windows Through History
- 3.2 Fullness, Widths and Cut Length
- 3.3 Pattern Repeats and the Toile of Jouy
- 3.4 Lining, Interlining and the Warm Window
- 3.5 Fifty Loops: Pinch Pleats and the Finished Drape

UNIT 5 • WEEKS 13–17

Quilting

Quilting: quilts in American history and the quilting bee; rotary cutting and the quarter-inch seam; nine-patch and half-square-triangle blocks and their math; batting and the quilt sandwich; machine quilting and binding; and a lap quilt made to give away.

- 5.1 Quilts in American History and the Quilting Bee
- 5.2 Rotary Cutting and the Quarter-Inch Seam
- 5.3 Half-Square Triangles and Block Math
- 5.4 The Quilt Sandwich: Batting and Quilting
- 5.5 Binding, Labeling and Giving

UNIT 7 • WEEKS 20–23

Upholstery I: Seats and Stools

Upholstery I: the upholsterer's trade from Chippendale's London to today; tools and safety glasses; stripping a seat with lead-paint and dust cautions; jute webbing woven and stretched; foam, batting and crown; and a drop-in dining seat and a padded stool re-covered with clean corners.

- 7.1 The Upholder's Trade: Chippendale's Director
- 7.2 The Archaeology of a Chair: Stripping Safely
- 7.3 Webbing: The Foundation
- 7.4 Foam, Batting and the Crown
- 7.5 The Cover and the Corners

UNIT 2 • WEEKS 4–7

Pillows and Cushions

The pillow as sewing school: straight seams and sharp corners on a knife-edge pillow, a zippered cover, welting cut on the bias and sewn with a zipper foot, a boxed cushion measured around its foam, and the science of feather, fiberfill and foam fills.

- 2.1 Ticking and the Knife-Edge Pillow
- 2.2 The Hookless Fastener: Zippers in Cushions
- 2.3 Welting: Bias, Cord and the Zipper Foot
- 2.4 The Box Cushion and the Morris Chair
- 2.5 Feathers, Fiberfill and Foam

UNIT 4 • WEEKS 10–13

Shades, Valances and Bed Linens

Shades, valances and bed linens: a cordless faux Roman shade, with the window-cord safety rule stated plainly, valances and padded cornice boards, the truth about thread count, percale and sateen, and a duvet cover and bed skirt measured to a real bed.

- 4.1 The Roman Shade and the Cord That Must Not Loop
- 4.2 Valances, Cornices and Lambrequins
- 4.3 Thread Count, Percale and Sateen
- 4.4 The Duvet Cover
- 4.5 Bed Skirts and the Measured Bed

UNIT 6 • WEEKS 17–20

Slipcovers

Slipcovers: fitting flat cloth to a three-dimensional chair; measuring and figuring yardage; pin-fitting muslin inside out; welting, skirts and box pleats; and a fitted slipcover for a footstool, ottoman or chair.

- 6.1 Case Covers: Fitting Flat Cloth to a Shape
- 6.2 Feed-Sack Thrift: The Cutting Plan and Yardage
- 6.3 The Tailor's Toile: Pin-Fitting Inside Out
- 6.4 Welting, Skirts and Pleats
- 6.5 Closures, Care and the Finished Slipcover

UNIT 8 • WEEKS 23–26

Upholstery II: A Chair

Upholstery II: inside a traditional chair, from frame and webbing to springs, burlap, edge roll and padding; eight-way hand-tying explained; pulling and stapling a top cover; welting and gimp; a cost sheet comparing re-upholstery with replacement; and a bench, headboard or chair of the student's own.

- 8.1 Inside a Traditional Chair
- 8.2 Eight-Way Hand-Tied Springs
- 8.3 Burlap, Edge Roll and Padding
- 8.4 Pulling the Cover: Welting, Gimp and Counting the Cost
- 8.5 Your Own Piece: A Headboard, Bench or Chair

UNIT 9 • WEEKS 27–30

Costume Design

Costume design: how people really dressed in Bible times and Rome, the Middle Ages and the Renaissance, and colonial and pioneer America; the costume designer's process from script to sketch to swatch; measuring actors modestly; and a costume plot, budget and design book for a real play or pageant.

- 9.1 Dressing the Bible Story
- 9.2 Rome and the Middle Ages
- 9.3 Renaissance Dress and Shakespeare's Stage
- 9.4 Colonial and Pioneer America
- 9.5 The Designer's Process: Script, Plot, Sketch and Budget

UNIT 10 • WEEKS 30–33

Costume Construction and the Capstone

Costume construction and the capstone: adapting patterns and drafting from a tunic block; theater tricks that survive quick changes; mob caps, kerchiefs and wise men's crowns; building and fitting a full costume; and the capstone presentation with design board, cost sheet and construction log.

- 10.1 Adapting Commercial Patterns
- 10.2 Costumes That Last and Change Fast
- 10.3 Aging and Distressing: Shepherds Don't Wear New Clothes
- 10.4 Headwear: Mob Caps, Tricorns and Wise Men's Crowns
- 10.5 The Capstone: A Costume Set or a Finished Room

WEEKLY PACING CALENDAR

WEEK	PLAN
1	- Day 1: Lesson 1.1 Useful or Beautiful: William Morris and the Designer's Eye: video, teaching and worked examples - Day 2: Lesson 1.1: studio lab and notebook - Day 3: Lesson 1.1: practice set and corrections - Day 4: Lesson 1.2 The Color Wheel in Cloth: video, teaching and worked examples - Day 5: Lesson 1.2: studio lab and notebook <i>Five sessions a week of about 50 minutes. Families on a four-day week can combine the practice day of one lesson with the teaching day of the next.</i>
2	- Day 1: Lesson 1.2: practice set and corrections - Day 2: Lesson 1.3 Decorator Weight and the Double-Rub Test: video, teaching and worked examples - Day 3: Lesson 1.3: studio lab and notebook - Day 4: Lesson 1.3: practice set and corrections - Day 5: Lesson 1.4 The Right Fiber for the Room: video, teaching and worked examples
3	- Day 1: Lesson 1.4: studio lab and notebook - Day 2: Lesson 1.4: practice set and corrections - Day 3: Lesson 1.5 The Mood Board and the Measured Plan: video, teaching and worked examples - Day 4: Lesson 1.5: studio lab and notebook - Day 5: Lesson 1.5: practice set and corrections
4	- Day 1: Unit 1 test - Day 2: Lesson 2.1 Ticking and the Knife-Edge Pillow: video, teaching and worked examples - Day 3: Lesson 2.1: studio lab and notebook - Day 4: Lesson 2.1: practice set and corrections - Day 5: Lesson 2.2 The Hookless Fastener: Zippers in Cushions: video, teaching and worked examples
5	- Day 1: Lesson 2.2: studio lab and notebook - Day 2: Lesson 2.2: practice set and corrections - Day 3: Lesson 2.3 Welting: Bias, Cord and the Zipper Foot: video, teaching and worked examples - Day 4: Lesson 2.3: studio lab and notebook - Day 5: Lesson 2.3: practice set and corrections
6	- Day 1: Lesson 2.4 The Box Cushion and the Morris Chair: video, teaching and worked examples - Day 2: Lesson 2.4: studio lab and notebook - Day 3: Lesson 2.4: practice set and corrections - Day 4: Lesson 2.5 Feathers, Fiberfill and Foam: video, teaching and worked examples - Day 5: Lesson 2.5: studio lab and notebook
7	- Day 1: Lesson 2.5: practice set and corrections - Day 2: Unit 2 test - Day 3: Lesson 3.1 Curtains of Fine Twined Linen: Windows Through History: video, teaching and worked examples - Day 4: Lesson 3.1: studio lab and notebook

WEEK	PLAN
	Day 5: Lesson 3.1: practice set and corrections
8	- Day 1: Lesson 3.2 Fullness, Widths and Cut Length: video, teaching and worked examples - Day 2: Lesson 3.2: studio lab and notebook - Day 3: Lesson 3.2: practice set and corrections - Day 4: Lesson 3.3 Pattern Repeats and the Toile of Jouy: video, teaching and worked examples - Day 5: Lesson 3.3: studio lab and notebook
9	- Day 1: Lesson 3.3: practice set and corrections - Day 2: Lesson 3.4 Lining, Interlining and the Warm Window: video, teaching and worked examples - Day 3: Lesson 3.4: studio lab and notebook - Day 4: Lesson 3.4: practice set and corrections - Day 5: Lesson 3.5 Fifty Loops: Pinch Pleats and the Finished Drape: video, teaching and worked examples
10	- Day 1: Lesson 3.5: studio lab and notebook - Day 2: Lesson 3.5: practice set and corrections - Day 3: Unit 3 test - Day 4: Lesson 4.1 The Roman Shade and the Cord That Must Not Loop: video, teaching and worked examples - Day 5: Lesson 4.1: studio lab and notebook
11	- Day 1: Lesson 4.1: practice set and corrections - Day 2: Lesson 4.2 Valances, Cornices and Lambrequins: video, teaching and worked examples - Day 3: Lesson 4.2: studio lab and notebook - Day 4: Lesson 4.2: practice set and corrections - Day 5: Lesson 4.3 Thread Count, Percale and Sateen: video, teaching and worked examples
12	- Day 1: Lesson 4.3: studio lab and notebook - Day 2: Lesson 4.3: practice set and corrections - Day 3: Lesson 4.4 The Duvet Cover: video, teaching and worked examples - Day 4: Lesson 4.4: studio lab and notebook - Day 5: Lesson 4.4: practice set and corrections
13	- Day 1: Lesson 4.5 Bed Skirts and the Measured Bed: video, teaching and worked examples - Day 2: Lesson 4.5: studio lab and notebook - Day 3: Lesson 4.5: practice set and corrections - Day 4: Unit 4 test - Day 5: Lesson 5.1 Quilts in American History and the Quilting Bee: video, teaching and worked examples
14	- Day 1: Lesson 5.1: studio lab and notebook - Day 2: Lesson 5.1: practice set and corrections - Day 3: Lesson 5.2 Rotary Cutting and the Quarter-Inch Seam: video, teaching and worked examples - Day 4: Lesson 5.2: studio lab and notebook - Day 5: Lesson 5.2: practice set and corrections
15	- Day 1: Lesson 5.3 Half-Square Triangles and Block Math: video, teaching and worked examples - Day 2: Lesson 5.3: studio lab and notebook - Day 3: Lesson 5.3: practice set and corrections - Day 4: Lesson 5.4 The Quilt Sandwich: Batting and Quilting: video, teaching and worked examples - Day 5: Lesson 5.4: studio lab and notebook
16	- Day 1: Lesson 5.4: practice set and corrections - Day 2: Lesson 5.5 Binding, Labeling and Giving: video, teaching and worked examples - Day 3: Lesson 5.5: studio lab and notebook - Day 4: Lesson 5.5: practice set and corrections - Day 5: Unit 5 test
17	- Day 1: Review day for the midterm - Day 2: Midterm exam - Day 3: Lesson 6.1 Case Covers: Fitting Flat Cloth to a Shape: video, teaching and worked examples

WEEK	PLAN
	- Day 4: Lesson 6.1: studio lab and notebook - Day 5: Lesson 6.1: practice set and corrections
18	- Day 1: Lesson 6.2 Feed-Sack Thrift: The Cutting Plan and Yardage: video, teaching and worked examples - Day 2: Lesson 6.2: studio lab and notebook - Day 3: Lesson 6.2: practice set and corrections - Day 4: Lesson 6.3 The Tailor's Toile: Pin-Fitting Inside Out: video, teaching and worked examples - Day 5: Lesson 6.3: studio lab and notebook
19	- Day 1: Lesson 6.3: practice set and corrections - Day 2: Lesson 6.4 Welting, Skirts and Pleats: video, teaching and worked examples - Day 3: Lesson 6.4: studio lab and notebook - Day 4: Lesson 6.4: practice set and corrections - Day 5: Lesson 6.5 Closures, Care and the Finished Slipcover: video, teaching and worked examples
20	- Day 1: Lesson 6.5: studio lab and notebook - Day 2: Lesson 6.5: practice set and corrections - Day 3: Unit 6 test - Day 4: Lesson 7.1 The Upholder's Trade: Chippendale's Director: video, teaching and worked examples - Day 5: Lesson 7.1: studio lab and notebook
21	- Day 1: Lesson 7.1: practice set and corrections - Day 2: Lesson 7.2 The Archaeology of a Chair: Stripping Safely: video, teaching and worked examples - Day 3: Lesson 7.2: studio lab and notebook - Day 4: Lesson 7.2: practice set and corrections - Day 5: Lesson 7.3 Webbing: The Foundation: video, teaching and worked examples
22	- Day 1: Lesson 7.3: studio lab and notebook - Day 2: Lesson 7.3: practice set and corrections - Day 3: Lesson 7.4 Foam, Batting and the Crown: video, teaching and worked examples - Day 4: Lesson 7.4: studio lab and notebook - Day 5: Lesson 7.4: practice set and corrections
23	- Day 1: Lesson 7.5 The Cover and the Corners: video, teaching and worked examples - Day 2: Lesson 7.5: studio lab and notebook - Day 3: Lesson 7.5: practice set and corrections - Day 4: Unit 7 test - Day 5: Lesson 8.1 Inside a Traditional Chair: video, teaching and worked examples
24	- Day 1: Lesson 8.1: studio lab and notebook - Day 2: Lesson 8.1: practice set and corrections - Day 3: Lesson 8.2 Eight-Way Hand-Tied Springs: video, teaching and worked examples - Day 4: Lesson 8.2: studio lab and notebook - Day 5: Lesson 8.2: practice set and corrections
25	- Day 1: Lesson 8.3 Burlap, Edge Roll and Padding: video, teaching and worked examples - Day 2: Lesson 8.3: studio lab and notebook - Day 3: Lesson 8.3: practice set and corrections - Day 4: Lesson 8.4 Pulling the Cover: Welting, Gimp and Counting the Cost: video, teaching and worked examples - Day 5: Lesson 8.4: studio lab and notebook
26	- Day 1: Lesson 8.4: practice set and corrections - Day 2: Lesson 8.5 Your Own Piece: A Headboard, Bench or Chair: video, teaching and worked examples - Day 3: Lesson 8.5: studio lab and notebook - Day 4: Lesson 8.5: practice set and corrections - Day 5: Unit 8 test
27	- Day 1: Lesson 9.1 Dressing the Bible Story: video, teaching and worked examples - Day 2: Lesson 9.1: studio lab and notebook

WEEK	PLAN
	- Day 3: Lesson 9.1: practice set and corrections - Day 4: Lesson 9.2 Rome and the Middle Ages: video, teaching and worked examples - Day 5: Lesson 9.2: studio lab and notebook
28	- Day 1: Lesson 9.2: practice set and corrections - Day 2: Lesson 9.3 Renaissance Dress and Shakespeare's Stage: video, teaching and worked examples - Day 3: Lesson 9.3: studio lab and notebook - Day 4: Lesson 9.3: practice set and corrections - Day 5: Lesson 9.4 Colonial and Pioneer America: video, teaching and worked examples
29	- Day 1: Lesson 9.4: studio lab and notebook - Day 2: Lesson 9.4: practice set and corrections - Day 3: Lesson 9.5 The Designer's Process: Script, Plot, Sketch and Budget: video, teaching and worked examples - Day 4: Lesson 9.5: studio lab and notebook - Day 5: Lesson 9.5: practice set and corrections
30	- Day 1: Unit 9 test - Day 2: Lesson 10.1 Adapting Commercial Patterns: video, teaching and worked examples - Day 3: Lesson 10.1: studio lab and notebook - Day 4: Lesson 10.1: practice set and corrections - Day 5: Lesson 10.2 Costumes That Last and Change Fast: video, teaching and worked examples
31	- Day 1: Lesson 10.2: studio lab and notebook - Day 2: Lesson 10.2: practice set and corrections - Day 3: Lesson 10.3 Aging and Distressing: Shepherds Don't Wear New Clothes: video, teaching and worked examples - Day 4: Lesson 10.3: studio lab and notebook - Day 5: Lesson 10.3: practice set and corrections
32	- Day 1: Lesson 10.4 Headwear: Mob Caps, Tricornes and Wise Men's Crowns: video, teaching and worked examples - Day 2: Lesson 10.4: studio lab and notebook - Day 3: Lesson 10.4: practice set and corrections - Day 4: Lesson 10.5 The Capstone: A Costume Set or a Finished Room: video, teaching and worked examples - Day 5: Lesson 10.5: studio lab and notebook
33	- Day 1: Lesson 10.5: practice set and corrections - Day 2: Unit 10 test - Day 3: Review day for the final - Day 4: Final exam

MATERIALS

A sewing machine in working order (required all year)

Any home machine with a straight stitch and zigzag, plus a zipper foot, spare universal and denim (size 100/16) needles for heavy decorator fabric, and bobbins that fit it. Borrowing from a relative or a friend at church is fine. A serger and a walking foot are helpful extras, never required.

A steam iron, ironing board and press cloth

Pressing is half of professional-looking work. A plain cotton dish towel makes a fine press cloth for synthetics and delicate faces.

Cutting tools

Fabric shears, small thread snips, a seam ripper, and a rotary cutter with a self-healing mat and a clear 6 × 24 inch quilting ruler (Units 5–8 especially). The rotary blade is closed every time it is set down.

Measuring and marking

A 60-inch tape measure, a yardstick or metal straightedge for long drapery cuts, tailor's chalk and a washable marker. A carpenter's square helps keep big rectangles true.

A hand-sewing kit and pins

Sharps and a long doll or upholstery needle, a curved needle for slip-stitching cushions and gimp, strong thread, dressmaker pins, T-pins for slipcover fitting, sewing clips, and a pincushion or magnetic dish for the needle-and-pin count.

Upholstery tools (Units 7–8)

A staple gun (manual or electric) with $\frac{3}{8}$ -inch staples, **safety glasses for everyone in the room**, a tack lifter or flat screwdriver, pliers, a dust mask for stripping, and a hot-glue gun for gimp.

Fabric, foam and batting as projects need

Medium-weight decorator cotton and remnants, muslin or old flat sheets for mock-ups, lining fabric, polyester fiberfill, pillow forms or old pillows to re-cover, upholstery foam and polyester or cotton batting sized to each project, jute webbing, burlap and welt cord in Units 7–8.

A lab notebook, glue stick, calculator and camera or phone

The notebook holds measurements, math, swatches, data tables, cost sheets and before-and-after photos for every lab and the capstone log.

GRADING

Grades reward the habits of a good workroom: measure honestly, cut once, record everything, and finish. A lab with a crooked first seam that is honestly recorded, unpicked and sewn again earns full credit; a test calculation earns its points by showing the formula, the substitution with units and the answer with its unit.

PART	%
Practice sets (completed and corrected)	15
Studio labs (safety, technique, measurement, honest records)	25
Lab notebook (swatches, math, data tables, cost sheets, improvement notes)	10
Unit tests	30
Midterm exam (Units 1–5)	10
Final exam (Units 1–10)	10

Scale: A 90–100, B 80–89, C 70–79, D 60–69. Below 60: rework the unit's labs and retake the test after review.

- Labs are graded on safety, technique, measurement and honest records, not on whether the piece was perfect the first time. Professional upholsterers pull staples and start over; so will you.
- Safety is pass or fail for any lab: glasses on for stapling and staple removal, blade closed on the rotary cutter, pins counted in and out, iron upright and unplugged at the end. An unsafe shortcut redoes the lab.
- Show work on every calculation: formula, substitution with units, answer with its unit. Right answers with no work earn half credit on tests.
- Measurements of people in Unit 9 are taken over light clothing, by a parent (a mother for a daughter, a father for a son), and are recorded for fit only. They are never discussed as good or bad numbers, and bodies are never compared.
- The capstone is a quarter of the Unit 10 grade on its own rubric: design, workmanship, budget kept, log complete and the piece actually used.

A NOTE TO PARENTS

You do not need to be a decorator or an upholsterer to run this course. Your work is to check the notebook weekly, watch the student run each new tool once before signing it off, be in the house during tool work, and ask the workroom questions: What does the cost sheet say? What would you change? The course is written to the student and the videos show the techniques; your judgment carries the safety rules.

Expect the house to gain things: new pillows on the sofa, a lined drape in a bedroom, a re-covered chair rescued from a curb or an attic, a quilt that leaves as a gift, and costumes for whatever play or pageant your church or co-op mounts this year. Let the student work on real rooms and real furniture; the measuring, the budget and the fitting are the education. A thrift-store footstool and a garage-sale dining chair are cheap tuition.

The costume unit is deliberately a history course in cloth. Costumes here are for Bible stories, pageants, history days and classic plays, built modestly and sturdily, and the student learns to serve a production rather than to show off a wardrobe. If a real play is nowhere on the calendar, a family Christmas tableau or a co-op history day gives the capstone a real deadline, and a finished costume set is a gift a church can use for years.

DESIGN FOR THE HOME

Before you sew a stitch for a room, you learn to see the room. This unit trains the designer's eye: the elements of design (line, shape, color, texture and pattern) and the principles that arrange them (scale, proportion, balance and rhythm); the color wheel and the classic schemes built from it; and the workroom questions that separate a decorator fabric from a dress fabric: What does it weigh? How is it woven? How many double rubs will it take before it wears through?

Your guide is William Morris, the English designer who insisted that the things of an ordinary house should be both useful and beautiful, and who spent years at the dye vats to get one pattern right. By the end of the unit you will measure a real room, draw it to scale, build a mood board and a fabric sample board for it, and defend every fabric on the board with numbers: fiber, weight, weave and wear rating, priced within a budget. That board is the map for everything you sew the rest of the year.

PREREQUISITES

- Comfortable with fractions of an inch, percents and a calculator
- Can measure accurately with a tape measure and record measurements in a notebook
- No sewing experience needed yet; the machine work begins in Unit 2

MASTERY CHECKLIST

- ☐ I can name the elements and principles of design and point to each one in a real room.
- ☐ I can build a monochromatic, analogous, complementary or split-complementary scheme from the color wheel and apply a 60-30-10 distribution.
- ☐ I can convert fabric weight between oz/yd² and g/m² and sort fabrics into top-, medium- and heavy-weight classes.
- ☐ I can read a double-rub rating, explain what the Wyzenbeek and Martindale tests measure, and match a rating to a job.
- ☐ I can choose a fiber for a sunny window or a hardworking sofa and give the reasons.
- ☐ I can measure a room, draw it to scale at ¼ inch = 1 foot, and present a mood board, sample board and budget.

OPTIONAL BOOKS AND TOOLS FOR THIS UNIT

- **V&A: William Morris, “Strawberry Thief” furnishing fabric:** Free. The Victoria and Albert Museum's page for a real length of Morris's block-printed cotton from 1883, with zoomable photographs. Look for the repeat.
- **A printed artist's color wheel:** A few dollars at any craft store. The pocket kind with turning windows shows tints, shades and the classic schemes at a glance. Lesson 1.2 shows you how to make your own from paint chips if you prefer.
- **A ¼-inch-grid graph paper pad and a clipboard:** For the scale floor plan in Lesson 1.5 and every measuring job this year. One square = one foot makes the plan almost draw itself.

Not required. Every project in this unit works with ordinary fabric-store supplies. School Launch has no ties to these authors, publishers or companies.

LESSONS IN THIS UNIT

1.1 Useful or Beautiful: William Morris and the Designer's Eye	3 sessions of 50 minutes
1.2 The Color Wheel in Cloth	3 sessions of 50 minutes
1.3 Decorator Weight and the Double-Rub Test	3 sessions of 50 minutes
1.4 The Right Fiber for the Room	3 sessions of 50 minutes
1.5 The Mood Board and the Measured Plan	3 sessions of 50–90 minutes

1.1 USEFUL OR BEAUTIFUL: WILLIAM MORRIS AND THE DESIGNER'S EYE

OBJECTIVES

- Tell who William Morris was, what the Arts and Crafts movement wanted for ordinary homes, and how Morris & Co. printed its patterns.
- Define the elements of design (line, shape, color, texture, pattern) and the principles (scale, proportion, balance, rhythm) and point to each in a real room.
- Use scale and proportion arithmetic to judge whether a piece of furniture or a pattern fits its room.

Warm-up. Stand in the doorway of the main room of your house and look at it the way a stranger would. Find the three things your eye lands on first, in order. Write them down; by the end of this lesson you will know why your eye went there.

WATCH

How was it made? Block printing William Morris Wallpaper | V&A

Victoria and Albert Museum · 3:13

<https://www.youtube.com/watch?v=quhnejd-h14>

WHEN TO WATCH

After “How they figured it out.” Watch the printer line up each block with the last repeat, and count how many separate blocks one pattern needs.

Note: A reconstruction of an 1875 Morris wallpaper design: 30 carved blocks and 15 colors, each printed by hand and lined up with pins. Morris printed his furnishing cottons the same way.

BACKUP VIDEO

Arts & Crafts Explained | William Morris and Woodblock Printing | Curator's Corner

William Morris Gallery · 2:57

<https://www.youtube.com/watch?v=TgctzHOLcoY>

A curator at the William Morris Gallery holds one of Morris's actual printing blocks and explains what the Arts and Crafts movement was after.

KEY TERMS

elements of design

The raw materials a designer arranges: line, shape, color, texture and pattern.

scale

The size of a thing compared with the room and the things around it. A huge print on a small footstool is out of scale.

repeat

The distance a printed or woven pattern travels before it starts over, measured along the fabric.

principles of design

The rules for arranging the elements: scale, proportion, balance, rhythm and emphasis.

proportion

The size relationship between parts of one thing, or between two things that belong together, often written as a ratio.

Arts and Crafts movement

A design movement of the 1860s–1890s, led in England by William Morris, that prized honest handwork, natural patterns and well-made ordinary things.

CORE IDEAS

The story. William Morris (1834–1896) was an English designer, poet and craftsman who looked at the cluttered, shoddily made furnishings pouring out of Victorian factories and refused to fill his house with them. When he married in 1859 he built Red House outside London and, finding nothing he wanted to buy for it, designed and made its furnishings with his friends. Out of that house came a company, Morris & Co., founded in 1861, that designed wallpapers, printed and woven fabrics, carpets and furniture. Morris

gave an audience a rule that has never stopped being quoted: “Have nothing in your houses that you do not know to be useful, or believe to be beautiful.” That one sentence is the starting point of this whole course.

How they figured it out. Morris did not sketch a pattern and hand it off. He learned the crafts himself: he drew the birds and plants of his own garden, carved designs into pearwood printing blocks, and revived the slow indigo-discharge method of dyeing when brighter, cheaper chemical dyes were sweeping the trade, because the old dyes gave deeper color that aged gracefully. One pattern could need a dozen or more blocks, one per color, each pressed by hand along the cloth, lined up on pins so the repeat never stumbles. He spent years at the dye vats mastering indigo discharge, and *Strawberry Thief* (1883), drawn from the thrushes that raided the strawberry beds at his country house, was the first of his designs printed successfully by that slow method. Beauty, Morris found, is mostly patience and craft.

The design grammar. Designers talk about rooms with a small vocabulary worth memorizing. The **elements** are what you have to work with: *line* (the long verticals of drapes, the horizontals of a sofa), *shape*, *color*, *texture* (nubby wool, smooth chintz, rough jute) and *pattern*. The **principles** are how you arrange them: *scale* (is the pattern sized to the piece and the room?), *proportion* (are the parts sized to each other?), *balance* (formal symmetry, or a looser balance of visual weight), *rhythm* (a color or shape repeated so the eye travels) and *emphasis* (one focal point, not five). A room that feels wrong almost always breaks one of these, and naming the broken rule is the first step to fixing it.

The numbers under the beauty. Proportion is arithmetic you can check. Decorators lean on simple ratios: a coffee table about two-thirds the length of its sofa; a rug large enough that at least the front legs of the seating stand on it; drapes hung so their length makes the window read taller. Pattern works by scale and repeat: a printed fabric's repeat is the distance before the motif recurs, and a 25-inch repeat that looks splendid on long drapes will be chopped into nonsense on a 16-inch pillow. When you mix patterns, the old workroom rule is to vary the scale: one large print, one medium, one small or a stripe, tied together by shared colors. You will test these rules with a tape measure, not take them on faith.

The studio lab. This week you become a design auditor. You will choose one real room in your home, measure it and its main furniture, photograph it, and write a one-page audit: where your eye goes first and why, which elements and principles are working, which rule is broken, and the single cheapest sewn thing that would most improve the room. Keep the audit; in Lesson 1.5 it grows into a full design plan, and over the year you will sew your way down its list.

PICTURE STUDY



Strawberry Thief, William Morris, 1883 · Indigo-discharge and block-printed cotton · Examples in the Victoria and Albert Museum, London, and other museums
Image: [Wikimedia Commons](#), public domain

This is not a painting but a working furnishing cotton, designed to be cut into curtains and chair covers. Morris drew the thrushes that raided the strawberry beds at Kelmscott Manor, his country house, and his printers built the cloth color by color with carved wooden blocks. It was one of Morris & Co.'s most expensive printed cottons, and one of its most popular.

Look closely

- Find one bird and trace outward until you find that same bird again. How far away is it? You have just measured the repeat with your eye.
- Find the mirror line: where does the left half of the design flip to make the right half?
- Count the distinct colors. Each one was a separate carved block and a separate pass down the printing table.
- Follow one curling stem. How does it lead your eye diagonally through the pattern without a straight line anywhere?
- Notice the dark indigo ground. What does the dark background do for the reds and whites laid on it?

Talk about it

1. A good repeating pattern hides its repeat, so the cloth feels alive rather than stamped. Did Morris succeed here? Where does the repeat still show?
2. This fabric was meant to be pleated into folds as curtains. Why does a design this dense survive folding better than one big centered picture would?
3. Is Strawberry Thief useful, beautiful, or both, by Morris's own rule?

Safety first. This unit's work is measuring, cutting paper and card, and gluing. Keep the design workspace separate from food, cap the glue, and carry scissors closed and points down. Start the year's habit now: pins and needles live in a pincushion or magnetic dish, counted out and counted back in every session, away from babies, toddlers and pets.

STUDIO LAB

The Room Audit

Every designer starts by reading the room that exists. You will measure, photograph and critique one real room with the elements and principles, then name the one sewn piece that would most improve it. This audit becomes the foundation of your Lesson 1.5 design plan and your sewing list for the year.

You will need

- A 60-inch tape measure (a helper makes long walls easier)
- Your lab notebook, pencil and clipboard
- A camera or phone
- ¼-inch graph paper for a rough sketch (the finished plan comes in Lesson 1.5)

Steps

1. Choose a real room you can work on all year, with at least one window and one seat. Get the household's blessing; you will be sewing for this room through Unit 8.
2. Stand in the doorway and write the eye-path test from the warm-up: first, second, third thing your eye lands on. Photograph the room from that doorway and from each corner.
3. Measure and record: room length and width, ceiling height, each window (width, height, sill height, distance to the floor), and the main furniture (sofa or bed length, seat heights, table sizes). Measure twice where numbers disagree.
4. Walk the elements: write one honest sentence each for line, shape, color, texture and pattern in this room. Two sentences for color: what is the anchor color, and what repeats?
5. Walk the principles: scale, proportion, balance, rhythm, emphasis. Run at least two arithmetic checks from the lesson (coffee-table ratio, rug reach, drape length, pattern repeat vs. piece size) and show the math.
6. Deliver the verdict: which principle is most broken, and what is the one sewn piece (pillow set, drape, cushion, slipcover, quilt) that would most improve the room for the least money? Defend it in three sentences.
7. File everything in the lab notebook: photos taped in, measurements in a table, the audit page dated and signed.

Tips

- Measure the room at floor level along the baseboard; tape sags over open space and reads long.
- If every principle seems fine, the room is probably bland instead of broken: look for a missing emphasis or a texture that is all one kind.

- Younger siblings make good eye-path subjects: walk one into the room and watch where they look first.

Check your work

- ☐ I measured the room, windows and main furniture and recorded every number with units.
- ☐ I named each element and principle in this specific room, not in general.
- ☐ I ran at least two proportion or scale checks with the math shown.
- ☐ I chose one sewn improvement and defended it.

LAB NOTEBOOK

1. Tape in your doorway photo and draw arrows numbered 1-2-3 showing your eye path. Under it, write which principle (emphasis, rhythm, scale) explains the path.
2. Make a measurement table for the room: walls, ceiling, windows, furniture, every entry with units.
3. Copy Morris's rule at the top of a fresh page, then list everything sewable in your chosen room under two columns: Useful and Beautiful. Circle anything that made both columns.

KEY FORMULAS

$$\text{drawing length} = \frac{\text{real length}}{\text{scale divisor}} \quad \left(\frac{1}{4} \text{ in} = 1 \text{ ft means divide feet by 4 to get inches} \right)$$

$$\text{drawing length} = \text{scale divisor} \times \text{real length} \quad (4 \text{ in} = 1 \text{ ft means divide feet by 4 to get inches})$$

$$\text{proportion check: } \frac{\text{part}}{\text{whole}} = \text{target ratio}$$

$$\text{proportion check: whole} \times \text{part} = \text{target ratio}$$

From history. Red House still stands in Bexleyheath, kept by the National Trust, and Morris & Co. patterns, including Strawberry Thief, are still in production more than 140 years after they were drawn. Few factory fabrics of 1883 can say the same.

WORKED EXAMPLES

Example 1. A sofa is 84 inches long. Using the two-thirds rule, how long a coffee table suits it?

Show solution

1. Two-thirds of the sofa's length: $\frac{2}{3} \times 84 \text{ in} = 56 \text{ in}$ $\frac{2}{3} \times 84 \text{ in} = 56 \text{ in}$.
2. Tables are sold in standard sizes, so anything close works: 54 in to 58 in.

Answer: About 56 in; a 54-inch table is a fine real-world match.

Example 2. A bedroom wall is 12 ft 6 in long. How long is it on a plan drawn at $\frac{1}{4}$ inch = 1 foot?

Show solution

1. Write the length in feet: 12 ft 6 in = 12.5 ft $12 \text{ ft } 6 \text{ in} = 12.5 \text{ ft}$.
2. Each foot becomes $\frac{1}{4}$ inch: $12.5 \times \frac{1}{4} \text{ in} = 3\frac{1}{8} \text{ in}$ $12.5 \times 4 \text{ in} = 50 \text{ in}$.

Answer: $3\frac{1}{8} \text{ in}$ on the plan, or 12½ squares on $\frac{1}{4}$ -inch graph paper.

Example 3. Design reasoning. A family room has a large navy sofa, and the family wants three fabrics: drapes, two armchair slipcovers and throw pillows. One candidate set is three florals, all with motifs about 3 inches tall. What is wrong, and what would a workroom suggest?

Show solution

1. Three patterns at the same scale compete; the eye cannot rank them, so the room buzzes instead of resting.
2. Apply the vary-the-scale rule: keep the floral the family loves best and make it the large pattern (drapes are the biggest canvas).
3. Give the chairs a medium-scale companion (a woven check or a smaller motif repeating the floral's colors) and the pillows a small stripe or solid texture.
4. Check the shared-color tie: each fabric should repeat at least one color from the others, with the navy sofa as the anchor solid.

Answer: Reject three same-scale florals; use one large print on the drapes, a medium check on the chairs and a small stripe or textured solid on the pillows, all repeating colors from the navy anchor.

PRACTICE

1. **Easy** List the five elements of design named in this lesson.

Show answer

Line, shape, color, texture, pattern.

2. **Easy** What does a fabric's repeat measure?

Show answer

The distance along the cloth before the pattern starts over.

3. **Easy** A room is 11 ft wide. How wide is it on a $\frac{1}{4}$ inch = 1 foot plan?

Show answer

$$11 \times \frac{1}{4} = 2\frac{3}{4} \text{ in } 11 \times 41 = 243 \text{ in}$$

4. **Medium** A 96-inch sofa needs a coffee table by the two-thirds rule. How long?

Show answer

$$\frac{2}{3} \times 96 = 64 \text{ in } 32 \times 96 = 64 \text{ in, so about 60--66 in.}$$

5. **Medium** A plan drawing of a wall is $4\frac{1}{2}$ inches at $\frac{1}{4}$ inch = 1 foot. How long is the real wall?

Show answer

$$4.5 \div 0.25 = 18 \text{ ft } 4.5 \div 0.25 = 18 \text{ ft}$$

6. **Medium** Name the broken principle: a 24-inch-wide window gets floor-length drapes in a 30-inch-repeat print, so only part of one motif shows across it.

Show answer

Scale: the pattern's repeat is far too large for the piece, so the motif cannot read.

7. **Medium** In what year was Morris & Co. founded, and what rule did Morris give for what belongs in a house?

Show answer

1861. Have nothing you do not know to be useful or believe to be beautiful.

8. **Hard** A drapery panel will be 90 inches long. The fabric's vertical repeat is 25 inches. How many full repeats show on one panel, and how many inches of partial repeat are left over?

Show answer

$$90 \div 25 = 3.6 \text{ } 90 \div 25 = 3.6, \text{ so 3 full repeats show, with } 90 - 3 \times 25 = 15 \text{ in } 90 - 3 \times 25 = 15 \text{ in of partial repeat left over.}$$

9. **Hard** In a conversation area, the front edge of the sofa and the front edge of the facing chairs are 9 ft apart. The rug should run 6 in under the front of each piece. How long must the rug be in that direction?

Show answer

$$9 \text{ ft} + 2 \times 0.5 \text{ ft} = 10 \text{ ft} \quad 9 \text{ ft} + 2 \times 0.5 \text{ ft} = 10 \text{ ft minimum.}$$

10. **Hard** Morris printed one pattern with 12 blocks, each block pressed once per repeat. A 10-yard length carries 30 repeats. How many separate block impressions is that?

Show answer

$$12 \times 30 = 360 \quad 12 \times 30 = 360 \text{ impressions, each lined up by hand.}$$

11. **Challenge** From the lesson's story: why did Morris choose the slow indigo-discharge method over the new chemical dyes, and what does that choice teach about judging materials by price alone?

Show answer

The old method gave deeper, longer-lasting color that aged well; the cheap, fast option was worse at the thing that mattered most. Price and speed are only two of a material's properties; judge the whole job.

COMMON MISTAKES

- Auditing a dream room instead of the real one. The course sews for the room you have; measure what is actually there.
- Writing taste instead of principles ("I don't like the curtains"). Name the element and the broken principle: the curtains' pattern is out of scale with the narrow window.
- Recording measurements without units. A 52 could be inches or centimeters; six months from now you will not remember.

Make it a game · Broken-Rule Bingo. With a parent or sibling, open any furniture catalog or walk through two rooms of the house. Take turns naming one design principle and pointing to a place where it is kept and a place where it is broken, in 20 seconds. One point per defensible call; the other player may challenge, and a lost challenge gives the point away. First to seven.

Scripture. "She maketh herself coverings of tapestry; her clothing is silk and purple." (Proverbs 31:22, KJV)

The capable woman of Proverbs 31 furnishes her home with her own skilled hands, and Scripture names it among her honors. Making a home useful and beautiful is old, good work.

1.2 THE COLOR WHEEL IN CLOTH

OBJECTIVES

- Tell how Michel-Eugène Chevreul, the chemist in charge of dyes at the Gobelins tapestry works, discovered that neighboring colors change how a color looks.
- Build monochromatic, analogous, complementary, split-complementary and triadic schemes from the color wheel, using tints, shades and tones.
- Apply a 60-30-10 distribution to a real room and compute the areas or yardages behind the percentages.

Warm-up. Lay a bright red item (a shirt, a book) first on a white sheet, then on a dark green towel, then on an orange one. Look hard each time. Does the red itself seem to change? Write one sentence about which background made it glow most.

WATCH

Color Theory choosing fabrics using the Quilty™ Color Wheel

Riley Blake Designs · 9:15

<https://www.youtube.com/watch?v=AZrXR1CMMaA>

WHEN TO WATCH

After “The color science.” She builds each scheme with real stacks of fabric; pause after each one and build the same scheme from your own scraps or paint chips.

Note: From a quilting-fabric maker; the schemes transfer straight to pillows, drapes and slipcovers.

BACKUP VIDEO

COLOR THEORY BASICS: Use the Color Wheel & Color Harmonies to Choose Colors that Work Well Together

Sarah Renae Clark · 6:58

<https://www.youtube.com/watch?v=Yel6Wqn4l78>

A clear animated walk through hue, value, saturation and every classic harmony. Watch if the wheel is new to you.

KEY TERMS

hue

The color itself: red, blue-green, yellow-orange, named by its place on the wheel.

complementary colors

Hues opposite each other on the wheel, such as blue and orange. Side by side they intensify each other.

simultaneous contrast

Chevreul's law: a color's appearance shifts according to the colors next to it. The eye pushes neighbors apart.

tint, shade, tone

A hue plus white (tint), plus black (shade), or plus gray (tone). Most decorator fabrics are tones; pure hues are loud.

analogous scheme

Two to four neighboring hues on the wheel, such as blue, blue-green and green. Restful because the colors share a parent.

60-30-10

A decorator's rule of thumb for distributing a scheme: about 60% of the visible room in the dominant color, 30% in the secondary, 10% in the accent.

CORE IDEAS

The story. In 1824 the French royal manufactory of Gobelins, weaver of the world's most famous tapestries, hired a chemist named Michel-Eugène Chevreul to run its dye works, because customers were complaining that the blacks in its tapestries looked weak and dull. Chevreul tested the black yarns every way a chemist could and found nothing wrong with them. The dye was good. The problem was not in the vat at all: the same black looked rich next to some colors and lifeless next to others, especially next to blues. The flaw was in the eye of the beholder, and it obeyed rules.

How they figured it out. Chevreul spent years laying dyed yarns side by side and recording what the eye reported. In 1839 he published his findings as the law of **simultaneous contrast**: when two colors sit next to each other, each one pushes the other toward its own opposite. A gray patch looks warm on a blue ground and cool on an orange one; two colors that share a border tint each other's edges. For weavers and decorators this was a turning point: you cannot judge a fabric alone on the shelf, because the room will change it. Chevreul's book became a handbook for designers and, later, for painters, who learned from a tapestry chemist how to make colors sing by placement rather than by pigment.

The color science. The wheel organizes hues in a circle: three primaries (red, yellow, blue in the traditional artist's wheel), three secondaries, six tertiaries. From it come the classic schemes: **monochromatic** (one hue in tints, shades and tones), **analogous** (neighbors), **complementary** (opposites), **split-complementary** (one hue plus the two neighbors of its opposite, which gives contrast with less glare) and **triadic** (three hues evenly spaced). Two more decorator facts: *value* (light vs. dark) does more for a room than hue, because a scheme with no value contrast goes muddy; and *warm* hues (reds through yellows) advance while *cool* hues (greens through violets) recede, which is why a warm color makes a big room cozier and a cool one makes a small room breathe.

The numbers. A scheme needs a distribution, and decorators reach for **60-30-10**: roughly 60% of what the eye sees in the dominant, usually quiet color (walls, large furniture, carpet), 30% in a secondary (drapes, a chair, bedding), 10% in the accent that gives the room its spark (pillows, trim, one lampshade). The percentages are estimates of visible area, so you can check them with arithmetic: a room's wall area, a drape panel's face, a sofa's upholstered surface. When the accent creeps to 25%, the room shouts; when there is no 10 at all, the room naps. Your worked examples run these numbers for a real room.

The studio lab. You will build a color scheme card for your audited room from Lesson 1.1: real paint chips and fabric scraps arranged as a labeled wheel position, a named scheme, a value strip, and a 60-30-10 plan tied to actual surfaces in the room. You will also run Chevreul's experiment yourself and mount the proof on the card: the same swatch on two grounds, photographed, so you never again judge a fabric on the shelf.

PICTURE STUDY



Bedroom in Arles, Vincent van Gogh, 1888 · Oil on canvas · Van Gogh Museum, Amsterdam

Image: [Wikimedia Commons](#), public domain

Van Gogh painted his own rented bedroom in the south of France and told his brother Theo in a letter that here color was to do everything: he named the pale violet walls, the fresh butter yellow of the bed, the scarlet coverlet, the green window. He wanted the flat, frank colors to make the viewer feel rest. It is one of the most famous color schemes ever put on canvas, and it is a *room*.

Look closely

- Find the biggest color area, the second biggest, and the accents. Estimate the painting's own 60-30-10.
- Find a complementary pair sitting touching each other. Where do the colors vibrate most?
- Look at the scarlet coverlet against the yellow bed frame. Which looks warmer than it would alone?
- Find every piece of cloth in the room: coverlet, pillows, towel, curtain. How much of a plain bedroom is textile?
- Squint until the details blur. Which value is lightest, which darkest? Does the room still read?

Talk about it

1. Van Gogh wanted this picture to express rest. Do the colors rest? Would they in a real bedroom, at full strength on every wall?
2. If you softened this exact scheme into tones (grayed violet walls, brick-red coverlet, butter-cream bed), what would be kept and what lost?
3. Which single textile in the painting would you re-color to calm the whole scheme, and to what?

Safety first. Scissors, paint chips and glue only this week. Keep fabric scraps and small chips away from toddlers, carry scissors closed and points down, and do the pin count if you pinned swatches to the card.

STUDIO LAB

The Scheme Card and the Chevreul Test

You will build the color plan your room will follow all year: a mounted card with the wheel position of your scheme, real swatches for each layer, a value strip, the 60-30-10 assignment to actual surfaces, and photographic proof of simultaneous contrast from your own test.

You will need

- Paint chips from a hardware store and fabric scraps or catalog clippings
- A sheet of card stock or a page of the lab notebook, glue stick, ruler
- The color wheel (bought, printed or drawn)
- A camera or phone for the Chevreul test

ROOM SCHEME CARD

Finished size: One $8\frac{1}{2} \times 11$ in card for the audited room · About 90 minutes plus the test

Fabric and notions

- 1 sheet of white card stock, $8\frac{1}{2} \times 11$ in
- Paint chips: at least 3 for the dominant hue (tint, tone, shade), 2 for the secondary, 2 for the accent
- Fabric scraps or clippings, about 2×2 in, one per layer
- A drawn or pasted color wheel, about 3 in across, with your scheme's hues marked

How to make it

1. Draw or paste the wheel in the top left corner and mark your scheme's hues with arrows. Name the scheme underneath (analogous, split-complementary, and so on).
2. Mount the dominant chips and swatch in a wide band across the middle (it should visually dominate the card, about 60% of the swatch area).
3. Mount the secondary band at about half that width, and the accent as small chips, roughly 10%.
4. Under each band, write the real surfaces it covers: walls, drapes, bedding, pillows, with their approximate areas from Lesson 1.1.
5. Add a value strip: your scheme's colors in grayscale order, lightest to darkest, to prove the scheme has value contrast.
6. Run the Chevreul test: lay your accent swatch on the dominant swatch, then on the secondary, in the same light. Photograph both. Print or sketch the pair and mount them with one sentence on what shifted.
7. Date and sign the card. It goes in the front of the lab notebook and gets consulted before every fabric purchase this year.

Fabric check: Any fiber works for scheme swatches, but collect them in the fabric types you actually intend to sew: a decorator-weight scrap for the sofa layer, a drapery-weight for the window layer. Colors shift between fiber types (the same dye looks different on shiny and matte cloth), so matching a paint chip to a velvet and a linen will teach you Chevreul's lesson twice.

Steps

1. Before building the card, test your scheme where it will live: carry the chips into the actual room at midday and again at night under lamplight. Note what the light does.

2. Build the card from the pattern card above.
3. Show the card to two family members in the room itself and record their first reactions without arguing.
4. Write the improve-it line: the one change you would make if you built the card again.
5. Clean up: cap the glue, sweep clippings, count any pins back into the cushion.

Tips

- Pull the dominant color from something immovable: the floor, the largest furniture, the most-loved quilt. Fighting an immovable color is a lost war.
- When two chips tie, pick the grayer one. Decorator colors are almost always tones; the pure hue on a 2-inch chip becomes a shout on a 12-foot wall.
- North-light rooms want warm whites and warmed hues; south-light rooms can carry cool schemes.

Check your work

- ☐ My card names the scheme and shows its wheel logic.
- ☐ Every 60-30-10 layer is tied to real surfaces with areas.
- ☐ My Chevreul test photos show a real shift and I described it in one sentence.
- ☐ The value strip shows real light-to-dark contrast.

LAB NOTEBOOK

1. Draw the color wheel from memory, then check it against a real one and correct in a second color of pen.
2. Tape in the Chevreul test photos with the one-sentence finding.
3. Find the 60-30-10 of two rooms you admire (a catalog photo and a real room) and write the percentages next to small sketches.

KEY FORMULAS

$$\text{part} = \text{whole} \times \text{percent}$$

$$\text{percent of room} = \frac{\text{area of surface}}{\text{total visible area}} \times 100\%$$

$$\text{percent of room} = \frac{\text{area of surface}}{\text{total visible area}} \times 100\%$$

From history. Chevreul lived to 102 and was studied by the pointillist painters, who placed pure color dots side by side and let the eye mix them, simultaneous contrast made into a whole technique. The tapestry chemist's complaint file became one of the most influential color books ever written.

WORKED EXAMPLES

Example 1. A bedroom's main visible surfaces total about 520 sq ft: walls 320, bedding 60, drapes 70, carpet 50, pillows and lampshade 20. The scheme is soft green (dominant), warm white (secondary), rust (accent). Check the actual distribution if walls and carpet are green, bedding and drapes warm white, pillows and shade rust.

Show solution

1. Green: $320 + 50 = 370$ sq ft $370 / 520 \times 100\% = 71\%$
2. Warm white: $60 + 70 = 130$ sq ft $130 / 520 \times 100\% = 25\%$
3. Rust: $20 / 520 \times 100\% = 3.8\%$
4. Compare with 60-30-10: the dominant is heavy and the accent is starved.

Answer: About 71% / 25% / 4%: the dominant is heavy and the accent starved. Laying a warm-white rug over most of the green carpet moves about 50 sq ft, giving $320/520 \approx 62\%$ green and $180/520 \approx 35\%$ warm white; then a rust throw and chair cushion (about 25 sq ft taken from the white) bring the room to roughly 62 / 30 / 9 without repainting.

Example 2. Design reasoning. A north-facing study gets cool gray light and feels cold. The family likes blue. Build a scheme that keeps the blue but warms the room, and name the wheel logic.

Show solution

1. Keep blue but shift it warm: a blue with a touch of green (toward teal) reads warmer than a violet-blue.
2. Choose the scheme for built-in warmth: split-complementary around blue brings in *both* warm neighbors of orange: red-orange and yellow-orange.
3. Assign by 60-30-10: 60% warm off-white or cream (not stark white, which goes gray in north light), 30% the teal-leaning blue in drapes and chair, 10% terracotta (red-orange) in pillows and trim.
4. Check value contrast: cream light, blue mid, terracotta mid-dark; the scheme reads even in dim light.

Answer: Split-complementary: cream 60, warm blue 30, terracotta 10. The warm neighbors of blue's complement supply the warmth the window cannot.

Example 3. An accent fabric costs \$18 per yard, and the 10% of the room it covers needs 2½ yards for pillows plus 1 yard for trim. What does the accent layer cost?

Show solution

1. Total yardage: $2.5 + 1 = 3.5$ yd
2. Cost: $3.5 \text{ yd} \times \$18/\text{yd} = \63

Answer: \$63: the 10% accent layer is the cheapest layer in the room, which is why decorators change accents, not sofas, when tastes change.

PRACTICE

1. **Easy** Name the three schemes: (a) one hue in tints and shades; (b) neighbors on the wheel; (c) opposites on the wheel.

Show answer

(a) Monochromatic, (b) analogous, (c) complementary.

2. **Easy** What is a tone?

Show answer

A hue mixed with gray.

3. **Easy** What did Gobelins hire Chevreul to fix, and where did the problem turn out to live?

Show answer

Complaints about dull blacks in its tapestries; the dye was fine, and the problem was simultaneous contrast in the viewer's eye.

4. **Medium** A living room's visible surfaces total 400 sq ft. How many square feet should each 60-30-10 layer cover?

Show answer

$240/120/40$ sq ft

5. **Medium** Name the split-complementary partners of blue on the traditional wheel.

Show answer

Red-orange and yellow-orange (the neighbors of orange, blue's complement).

6. **Medium** A fabric's accent layer needs 4 yards at \$14.50 per yard. Cost?

Show answer

$4 \times \$14.50 = \58

7. **Medium** Why does a gray pillow look warmer on a navy sofa than on a rust chair?

Show answer

Simultaneous contrast: each ground pushes the gray toward its own complement, so navy pushes it warm (toward orange), rust pushes it cool (toward blue).

8. **Hard** A room reads 45% dominant, 20% secondary, 35% accent by area. Describe what the room feels like and the cheapest correction.

Show answer

The accent at 35% shouts; the room feels busy and tiring. Cheapest fix: remove or recover accent pieces (pillows, throws) until the accent drops near 10%, letting the dominant rise.

9. **Hard** Walls 300 sq ft, drapes 80 sq ft, sofa 70 sq ft, rug 90 sq ft, pillows 15 sq ft. Assign colors to hit closest to 60-30-10 with a three-color scheme, and give the resulting percentages.

Show answer

Total 555 sq ft. One close fit: walls + pillows $315/555 \approx 57\%$, drapes + rug $170/555 \approx 31\%$, sofa $70/555 \approx 13\%$ (a bold sofa as the accent). Another: walls 54%, drapes + rug 31%, sofa + pillows 15%. Any assignment within about 5 points of each target, with the math shown, earns full credit.

10. **Hard** Your drapes are a strong warm yellow-orange and the room already feels hot in summer. Using the wheel, name two different scheme moves that would cool the room without replacing the drapes.

Show answer

Add the complement family: blue or blue-green in the 30% layer (a cool secondary recedes and balances); or shift everything else cool and neutral (gray-green walls, white bedding) so the warm drapes become the 10-30% layer instead of the dominant.

11. **Challenge** Chevreul found that a black yarn woven beside blue yarn looked weakest of all. Using his law, explain why, and say what a weaver could place beside black to make it look deepest.

Show answer

Blue's neighbor-effect pushes the black toward blue's complement (orange), tinging it brownish and robbing its depth; beside warm golds or oranges the contrast pushes black toward blue-violet, reading richer and deeper.

COMMON MISTAKES

- Choosing colors in the store's light. Fluorescent light lies; test chips in the room, day and night, before deciding.
- Building a scheme with no value contrast. Three mid-value colors go muddy together; the value strip catches this before the fabric is bought.
- Making the accent a third of the room because you love it. Love it at 10%; that is what makes it sing.

Make it a game • Scheme or Scream. One player pulls five colored items from around the house and arranges them as a room scheme; the other must name the closest wheel scheme and assign 60-30-10 roles in 30 seconds, or call it a scream and say exactly why (no contrast, two accents at war). Swap roles. Three rounds; the parent judges the best-defended call.

Scripture. "Now Israel loved Joseph more than all his children, because he was the son of his old age: and he made him a coat of many colours." (Genesis 37:3, KJV)

Color carries meaning: Jacob's gift said in cloth what he felt in his heart, and everyone who saw the coat read it. The colors you choose for a room say something too; choose them on purpose.

1.3 DECORATOR WEIGHT AND THE DOUBLE-RUB TEST

OBJECTIVES

- Distinguish apparel fabric from decorator fabric by width, weight and finish, and convert weights between oz/yd² and g/m².
- Explain what the Wyzenbeek and Martindale abrasion tests measure, what a double rub is, and why the two scales cannot be compared number for number.
- Match a wear rating to a job and estimate years of service from a rating.

Warm-up. Find the hardest-working fabric in your house (the most-sat-on seat) and the laziest (a guest-room curtain). Rub a thumb firmly across each, ten strokes. Which already shows wear: fuzzing, thin spots, flattened pile? Write down where the wear is worst on the seat, and notice it is exactly where a body rubs.

WATCH

Ultimate Guide to Upholstery Fabric Durability: Understanding Testing & Ratings for Lasting Quality

Discover Interior Design • 11:54

https://www.youtube.com/watch?v=SneOU0b7_tw

WHEN TO WATCH

After “How they figured it out.” Pause at each rating band she shows and copy it into your notebook beside the duty classes in this lesson.

Note: An interior-design teacher explains the Wyzenbeek and Martindale tests and how to read rub counts on a label.

KEY TERMS

decorator (home-décor) fabric

Fabric made for furnishings: usually 54 inches wide, heavier, tightly woven, often stain-finished, sold where upholstery and drapery goods are sold.

abrasion resistance

A fabric's ability to withstand rubbing before yarns break or wear through.

Wyzenbeek and Martindale

The American test (a pad rubbed straight back and forth; results in double rubs) and the European test (a pad rubbed in a figure-eight; results in cycles). Same purpose, different machines and motions, so their numbers are not interchangeable.

fabric weight

Mass per area of cloth, given in ounces per square yard (oz/yd²) or grams per square meter (g/m², also written gsm).

double rub

One back-and-forth pass of the testing machine's pad in the Wyzenbeek test, roughly the motion of a person sitting down and getting up.

haircloth

A legendarily durable 19th-century seat covering woven with a cotton or linen warp and a weft of actual horsehair.

CORE IDEAS

The story. Ask an antiques dealer what fabric survives from the 1800s still doing its job, and one answer comes up again and again: **haircloth**. Victorian parlors by the thousand were furnished with chairs and sofas covered in this stiff, faintly shiny black cloth, woven with a cotton warp and a weft of individual horsehairs, each hair running the full width of the seat. It was woven narrow, because it could only be as wide as a horse's tail hair is long. Families complained that it was slippery and prickly, but it simply would not wear out, and antique haircloth seats from the 1800s are still found in use. Haircloth is the ancestor of a question every decorator still asks first: *how long will this cloth take the rubbing?*

How they figured it out. For most of history the answer came the expensive way: cover the chair, wait ten years, and see. The modern trade got tired of waiting and built machines to do the sitting. In the American **Wyzenbeek** test, a piece of cotton duck is rubbed straight back and forth across the stretched sample, and each back-and-forth stroke is one **double rub**; the machine runs

until yarns break or the surface wears through, and the count is the rating. In the European **Martindale** test, the pad moves in an overlapping figure-eight, closer to the swiveling scrub of a real seat, and the result is counted in cycles. Because the motions differ, a Martindale 20,000 is not a Wyzenbeek 20,000; the tests sort fabrics into the same duty classes but their numbers live on different scales. The ratings go on the tag, and a buyer can now read in seconds what once took a decade of family life to learn.

The fabric science. What makes a fabric take rubbing? Mostly four things. *Fiber*: nylon and polyester resist abrasion outstandingly; wool is very good and hides wear in its crimp; cotton and linen are fair; rayon and silk are tender. *Yarn*: tightly twisted, plied yarns wear better than soft, loosely spun ones. *Weave*: a tight, flat weave with short floats (plain weave, tight twill) beats a loose or long-float weave (loose satin) because floats snag and shear. *Weight*: more fiber per square yard means more material to wear away, which is why decorator fabric runs heavy. Weight is measured in **ounces per square yard** or **grams per square meter**, with $1 \text{ oz/yd}^2 \approx 33.9 \text{ g/m}^2$ $1 \text{ oz/yd}^2 \approx 33.9 \text{ g/m}^2$. Rough decorator classes: under about 6 oz/yd² is top weight (quilting cottons, shirtings), 6–10 oz/yd² is medium (many drapery and light slipcover cloths), above 10 oz/yd² is heavy upholstery weight (canvas, denim, velvet, tapestry).

The numbers on the tag. Decorator fabric is typically **54 inches wide** (apparel runs 44/45 or 58/60), and its tag may carry fiber content, weight, a wear rating and cleaning codes. Duty classes used in the American trade: under about 9,000 double rubs, delicate duty (decorative pillows, drapes that hang untouched); 9,000–15,000, light duty (occasional chairs); 15,000–30,000, medium-to-heavy residential duty (family sofas, dining seats); 30,000 and up, heavy duty and commercial territory. A common rule of thumb says about 3,000 double rubs correspond to a year of ordinary residential use; like all rules of thumb it is a rough planning number, not a warranty, but it turns a tag into an estimate: a 30,000-double-rub cloth on a family-room sofa is a ten-year plan. Our course will not pretend quilting cotton is upholstery; when a seat is on the line, we check the class.

The studio lab. You cannot run 15,000 laboratory double rubs at the kitchen table, but you can run a controlled comparative abrasion test and watch the same physics work. You will rub four candidate fabrics with the same abrasive, the same stroke, the same count, and grade the damage at intervals, building a data table and ranking. The ranking, next to each fabric's fiber, weave and weight, shows you exactly what the testing machines know.

PICTURE STUDY



The Embroiderer (Die Stickerin), Georg Friedrich Kersting, 1811 · Oil on canvas · Klassik Stiftung Weimar, Weimar, Germany

Image: [Wikimedia Commons](#), public domain

Kersting painted small, honest rooms of his own time, about 1811 in Germany, and the people quietly working in them. Here Louise Seidler, a painter friend of his, sits at her work table by the window. Everything in the room earns its place: good light, a sturdy chair, an upholstered sofa, a curtain that can be drawn. It is a picture of exactly the kind of workspace this course asks you to set up.

Look closely

- Find every textile in the room and sort them by duty: which cloth works hardest (the sofa's cover and the chair seat), which rests (the window curtain)?

- Look at where she sits relative to the window. Why does a handworker sit with light coming from that side?
- Look at the curtain. How is it hung and drawn back, and what would happen to it in strong sun over many years?
- The room is nearly empty by our standards. What does each object do? Is anything only decoration?
- Look at the sofa's pink cover. Where would it wear first?

Talk about it

1. Which surfaces in this room would you cover in a 30,000-double-rub cloth, and where could delicate fabric live safely?
2. The painting is more than two hundred years old, yet the workspace would still work today. What makes a workroom timeless?
3. What would a picture of your sewing corner show about your working habits?

Safety first. The abrasion lab uses sandpaper and scissors: clamp or pin the sample so the rubbing hand never crosses your holding hand, and brush fiber dust off the table when done rather than blowing it into the air. Count pins out and in, and keep small swatches away from little children.

STUDIO LAB

The Kitchen-Table Abrasion Lab

A controlled comparative wear test: four fabrics, one abradant, one stroke, one count, graded at intervals. You will produce a data table, a damage ranking and a conclusion connecting the ranking to fiber, weave and weight, exactly the reasoning behind the ratings on the tag.

You will need

- Four contrasting fabric swatches, at least 4 × 6 in: for example, quilting cotton, denim or canvas, a polyester decorator fabric, a loose-weave or satin-face fabric
- Fine sandpaper (220 grit) wrapped snugly around a small wood block or eraser
- Masking tape or a clamp, a ruler, a permanent marker
- A magnifier or your phone's camera zoom
- The lab notebook with a prepared data table

COMPARATIVE ABRASION TEST BOARD

Finished size: Four graded swatches mounted on one labeled board · About 60–75 minutes

Fabric and notions

- 4 fabric swatches, 4 × 6 in (10 × 15 cm), labeled A–D with masking tape, with fiber content, weave and estimated weight class recorded for each
- 1 sandpaper block (220 grit), the same block for every sample
- 1 piece of corrugated cardboard, about 12 × 18 in, for mounting the finished samples

How to make it

1. Tape each swatch drum-tight over the edge of a table or a board, one at a time, so the test spot has firm backing: slack fabric cheats the test.
2. Mark a 2-inch test lane in the center of each swatch.
3. Rub the sandpaper block along the lane with your forearm's weight only, full strokes, one back-and-forth stroke = one double rub. Keep the same hand, pressure and speed for every sample.
4. Stop at 25 double rubs and grade the lane 0–4 (0 = no visible change; 1 = fuzzing; 2 = heavy fuzz or flattened surface; 3 = broken yarns; 4 = hole). Record, photograph, continue.
5. Grade again at 50, 100 and 200 double rubs (or until grade 4). Record every grade in the table.
6. Mount the four tested swatches on the cardboard, lanes visible, with each fabric's fiber, weave, weight class and final grade written beneath.

7. Write the ranking and a three-sentence conclusion: which fiber/weave/weight traits predicted the ranking, and which surprised you.

Fabric check: Choose genuinely different fabrics or the test teaches nothing: vary fiber (a cotton, a polyester or nylon, a rayon or silk-like fabric) and structure (one tight plain weave, one twill or canvas, one loose or long-float weave). Avoid stretch knits here; they dodge the abradant by giving, and seat fabric is woven. Prewashing is unnecessary for the test, but note any stain-resistant finish, which can change early results.

Steps

1. Predict before you rub: write your ranking in the notebook, best to worst, with one reason each.
2. Run the test from the pattern card, keeping stroke, pressure and count honest even when your arm is tired, because changing pressure mid-test invalidates the comparison.
3. Compare the result against your prediction and against each fabric's fiber, weave and weight. Where prediction failed, find the trait you underweighted.
4. Estimate: if your 200 hand rubs produced grade 1 on the winner, what does a 30,000-double-rub machine rating imply about that class of cloth?
5. Clean up: brush dust to the trash, store the board flat for the Unit 1 project, count pins in.

Tips

- The same person rubs every sample; two testers means two pressures and a broken experiment. That is also why the real tests specify the machine, not just the count.
- Test the fabric's face, not the back; some décor fabrics are backed and wear completely differently per side.
- A tally counter app, or marks in tens, saves losing count at stroke 73.

Check your work

- ☐ I tested four fabrics under identical conditions with a prepared data table.
- ☐ I graded at fixed intervals with the 0–4 scale and photographed each stage.
- ☐ My conclusion connects the ranking to fiber, weave and weight.
- ☐ I can explain what a double-rub rating on a tag means and its limits.

LAB NOTEBOOK

1. Rule the data table before lab day: rows A–D with fiber/weave/weight, columns for 25, 50, 100, 200 double rubs.
2. Tape in a thread pulled from your toughest and weakest fabric, labeled, and sketch the difference in twist and thickness.
3. Write the duty classes (delicate, light, medium, heavy) with their double-rub bands and one piece of furniture in your own house for each class.

KEY FORMULAS

$$\begin{aligned} \text{g/m}^2 &\approx \text{oz/yd}^2 \times 33.9 \\ \text{estimated years of service} &\approx \frac{\text{double rubs}}{3,000} \quad (\text{rule of thumb, ordinary home use}) \\ \text{estimated years of service} &\approx 3,000 \text{ double rubs} \quad (\text{rule of thumb, ordinary home use}) \\ \text{cost per 1,000 rubs} &= \frac{\text{price per yard}}{\text{double rubs} \div 1,000} \\ \text{cost per 1,000 rubs} &= \text{double rubs} \div 1,000 \text{ price per yard} \end{aligned}$$

WORKED EXAMPLES

Example 1. A decorator cotton twill is labeled 9.5 oz/yd². What is that in g/m², and which weight class is it?

Show solution

1. Convert: $9.5 \text{ oz/yd}^2 \times 33.9 = 322 \text{ g/m}^2$ $9.5 \text{ oz/yd}^2 \times 33.9 = 322 \text{ g/m}^2$.
2. Class: 9.5 oz/yd² sits at the top of the 6–10 medium band, drapery-to-light-upholstery territory.

Answer: About 322 g/m² 322 g/m²; a heavy-medium decorator weight, fine for slipcovers and sturdy drapes.

Example 2. A fabric is rated 24,000 double rubs. Estimate its service life on a daily-use family sofa, and say which duty class it belongs to.

Show solution

1. Years: $\frac{24,000}{3,000} = 8$ years $3,000 \times 8 = 24,000 = 8$ years by the rule of thumb.

2. Class: 24,000 falls in the 15,000–30,000 band: medium-to-heavy residential duty.

Answer: Roughly 8 years of ordinary use; heavy residential duty, a sound sofa choice.

Example 3. Fabric A costs \$22/30 yd at 30,000 double rubs. Fabric B costs \$12/9 yd at 9,000. Compare cost per 1,000 rubs and recommend one for a window-seat cushion the family sits in daily.

Show solution

1. A: $\frac{\$22}{30} = \0.7333 $\$22 = \0.73 per 1,000 rubs.

2. B: $\frac{\$12}{9} = \1.3333 $\$12 = \1.33 per 1,000 rubs.

3. B is cheaper per yard but nearly twice the price per unit of wear, and 9,000 double rubs is light duty: about $9,000 \div 3,000 = 3$ years on a daily seat.

Answer: Fabric A: it costs \$0.73 versus \$1.33 per 1,000 rubs and is rated for the duty. The cheap yard is the expensive seat.

Example 4. Design reasoning. A student wants to cover a dining-chair drop-in seat with a beloved quilting cotton (about 4.5 oz/yd², no wear rating). Give the workroom verdict and two honest ways to get the look anyway.

Show solution

1. Check the class: 4.5 oz/yd² is top weight, dress-shirt territory; dining seats take concentrated daily abrasion.

2. Verdict: as the seat cover it will fuzz, thin and split at the front edge, likely within a couple of years.

3. Workaround 1: find the same or a similar print in a decorator-weight cotton (many quilting prints have home-décor versions at 54 in wide).

4. Workaround 2: use the quilting cotton where hands, not seats, touch it: a table runner or valance in the same room, and put an honest 15,000+ double-rub cloth on the chair.

Answer: Reject it for the seat; buy the décor-weight version of the print, or spend the loved print where abrasion is low and let a rated fabric take the sitting.

PRACTICE

1. Easy What is the usual width of decorator fabric, and of quilting cotton?

Show answer

54 in; 44/45 in.

2. Easy What motion is one double rub?

Show answer

One back-and-forth stroke of the Wyzenbeek machine's pad, roughly one sit-down-and-get-up.

3. Easy Convert 6 oz/yd² to g/m².

Show answer

$6 \times 33.9 \approx 203$ g/m² $6 \times 33.9 \approx 203$ g/m²

4. Medium Convert 440 g/m² to oz/yd² and name its weight class.

Show answer

$440 \div 33.9 \approx 13$ oz/yd² $440 \div 33.9 \approx 13$ oz/yd²; heavy upholstery weight.

5. **Medium** Estimate years of home service for ratings of 6,000, 15,000 and 45,000 double rubs.

Show answer

About 2, 5 and 15 years by the 3,000-per-year rule of thumb.

6. **Medium** Why can't a Martindale 25,000 be read as a Wyzenbeek 25,000?

Show answer

Different machines and motions (figure-eight cycles vs. straight double rubs); the scales are not convertible, only the duty classes are comparable.

7. **Medium** Rank for abrasion resistance, best first: silk, nylon, wool, loosely spun cotton.

Show answer

Nylon, wool, loosely spun cotton, silk.

8. **Hard** Fabric C: \$28\$28/yd, 51,000 double rubs. Fabric D: \$16\$16/yd, 18,000. Compute cost per 1,000 rubs for each; which is the better value for a mudroom bench the whole family uses?

Show answer

C: $28/51 = \$0.5528/51 = \0.55 ; D: $16/18 = \$0.8916/18 = \0.89 . C wins on value and duty for a hard-use bench.

9. **Hard** A long-float satin weave and a tight plain weave are woven from the same polyester yarn at the same weight. Which wears better on a seat, and why?

Show answer

The plain weave: short interlacings anchor the yarns, while satin's long floats ride on the surface and abrade or snag first.

10. **Hard** Why was haircloth so durable? Name two of the four durability factors it maximized.

Show answer

Fiber (horsehair is coarse, smooth and extremely wear-resistant) and yarn/weave (each hair ran unbroken across the seat in a tight, flat weave); it was also naturally springy and shed dirt.

11. **Challenge** A maker could pass a weak fabric by testing it slack instead of stretched, or stopping at the first sign of wear instead of yarn break. Explain why standardized test conditions, not just the machine, make a rating trustworthy, and what a buyer should do when a tag shows a big number with no test named.

Show answer

A number only means something if the sample mounting, abradant, pressure and end-point are fixed the same way every time; change any of them and the count inflates. With no test named, the number is marketing: ask which test (Wyzenbeek or Martindale) and buy from sellers who say.

COMMON MISTAKES

- Comparing a Wyzenbeek number with a Martindale number. The duty classes compare; the raw numbers do not.
- Treating the 3,000-rubs-per-year rule as a guarantee instead of a planning estimate. A sofa with a dog and four children runs ahead of schedule.
- Buying seat fabric by color and width alone. The tag's weight and rating are the difference between re-covering in ten years and in two.

Make it a game · Duty Judge. A parent names furniture around the house (window-seat cushion, formal chair no one sits in, kitchen bench, footstool). You answer with duty class, a plausible minimum double-rub spec and one fiber you would shortlist, inside ten seconds each. Parent checks against the lesson's bands; seven of ten correct wins, and a wrong duty class costs two.

1.4 THE RIGHT FIBER FOR THE ROOM

OBJECTIVES

- Match the major fibers (cotton, linen, wool, silk, polyester, nylon, acrylic, rayon) to home jobs by their real strengths and weaknesses.
- Explain what sunlight does to fibers and dyes at a window, and tell the story of weighted silk as a caution about hidden treatments.
- Compute cost per year of service and judge make-or-buy and cheap-or-durable choices with numbers.

Warm-up. Open a closet or linen cupboard and read five care or content labels: a sheet, a towel, a blanket, a curtain if it has one, anything upholstered if you can find a tag. Tally the fibers. Which fiber shows up most, and does the hardest-working item (the towel) share a fiber with the fanciest one?

WATCH

How To Choose Upholstery Fabric

[Fabric Farms Interiors](#) · 5:50

<https://www.youtube.com/watch?v=n9P9hSoZuQ4>

WHEN TO WATCH

After “The fabric science.” She handles real bolts; listen for every time fiber content decides the recommendation, and note the questions she asks about where the piece will live.

Note: Filmed on the floor of a decorator-fabric shop; this is the conversation you will have at the cutting counter.

BACKUP VIDEO

How to Choose an Upholstery Fabric

[Sailrite](#) · 5:44

<https://www.youtube.com/watch?v=LxaSDRHLQVg>

A second fabric walk-through with samples in hand, including backing and weight checks worth copying at any store.

KEY TERMS

lightfastness

A dye's and fiber's resistance to fading and weakening in sunlight.

weighted silk

Nineteenth-century silk treated with metallic salts to add weight and rustle; the salts slowly destroy the fiber, which is why so many old silk furnishings have shattered.

cost per year of service

Price divided by expected years of use; the honest way to compare a cheap fabric with a durable one.

solution-dyed

Fiber colored while still liquid, before spinning, so the color runs all the way through; the most fade-resistant coloring, common in acrylic outdoor fabrics.

blend

A yarn or fabric combining fibers, labeled by percentage of weight, to get properties no single fiber has.

railroading

Running decorator fabric sideways (selvage horizontal) so wide pieces like sofa backs can be cut without seams.

CORE IDEAS

The story. Walk the costume and furnishing storerooms of a great museum and you will find a strange epidemic: silk from the late 1800s that looks perfect in the drawer and then splits along every fold, crumbling like old paper while the cotton and wool beside it survive. Curators call it **shattered silk**, and much of it was man-made ruin. Silk was sold by weight in those days, and raw silk loses weight when its natural gum is boiled off. So finishers learned to soak the cleaned silk in solutions of metallic salts, tin among them, until it weighed more than before: more rustle, more drape, more money per pound of thread sold. The buyer got a richer-feeling

cloth; the cloth got a slow ruin. The salts attack the fiber itself, and decades later the finest drawing-room drapes and gowns in America tore under their own weight.

How they figured it out. The failure took years to appear, so the market could not punish it quickly; a merchant could sell weighted silk for a decade before his customers' curtains began to split. Eventually chemists traced the damage, and in the twentieth century regulators required silk to be labeled if weighted beyond set limits. The lesson outlived the scandal and belongs in your toolkit: *a fabric's future is decided by what is in it, and what is in it does not always show in the hand.* That is why the United States requires a fiber-content label on textiles, and why a decorator reads the tag before stroking the cloth.

The fabric science. Each fiber brings fixed habits to a room. **Cotton:** comfortable, dyes beautifully, strong and washable, but wrinkles, shrinks if unwashed, and fades in strong sun. **Linen:** cool, strong, hangs with unmatched body, ages gracefully; wrinkles as a lifestyle and abrades at creases. **Wool:** springy, hides soil and wear, naturally flame-resistant (it chars instead of melting), insulates; must be protected from moths and hot washing. **Silk:** luminous and strong for its weight but tender to sunlight and abrasion; at a sunny window, unlined silk is on a countdown. **Polyester:** strong, abrasion-resistant, sunfast, wrinkle-shedding and cheap; holds oily stains, can pill, and melts rather than burns, so it never goes near a potholder. **Nylon:** the abrasion champion, often blended into velvets and carpets; can yellow in sun. **Acrylic:** the sunlight champion when solution-dyed, which is why awnings and outdoor cushions are acrylic; softer and less abrasion-proof indoors. **Rayon:** lovely drape and sheen, weak when wet, best in blends and low-stress jobs. No fiber is a villain and none is a saint; each is a set of trade-offs waiting for the right job.

The numbers. Sunlight is the quiet destroyer of home textiles: ultraviolet light breaks dye molecules and fiber polymers alike, and a south or west window delivers it daily. Defenses are fiber choice (acrylic, polyester), lining (a sacrificial cotton layer takes the sun), and placement. Money is the other arithmetic. Compare fabrics by **cost per year**: a \$12\$12-per-yard cloth that dies in 3 years costs \$4\$4 per yard-year; a \$24\$24 cloth good for 12 years costs \$2\$2. Blends tune the trade-offs: a 55/45 linen-cotton presses flatter than pure linen; polyester blended into cotton drapery adds sun-life and wrinkle recovery; a touch of nylon in a wool velvet armors the pile.

The studio lab. You will put sunlight itself on trial: a fade rack of labeled swatches, half of each swatch masked with card, set in the brightest window in the house. It runs for six weeks while you sew through Unit 2, and the reveal, half-fresh, half-faded stripes you can grade and rank, goes in the notebook as permanent evidence. You will also write fiber prescriptions for three real jobs in your chosen room, with reasons a store clerk could not argue down.

PICTURE STUDY



Dust Motes Dancing in the Sunbeams, Vilhelm Hammershøi, 1900 · Oil on canvas · Ørdrupgaard, Copenhagen

Image: [Wikimedia Commons](#), public domain

The Danish painter Hammershøi painted the quiet rooms of his own Copenhagen apartment over and over, often nearly empty, in grays and soft whites. Here the subject is simply sunlight itself, pouring through a window and made visible by dust in the air. For a decorator this picture is a diagram: that beautiful light is energy, and it lands on floors and fabrics every day, fading and weakening whatever it touches.

Look closely

- Trace the beam from the panes to the floor. Which wall, floor and furniture positions get this light every clear day?
- The window has no visible drape. If you hung unlined silk here, where exactly would it fade and weaken first?
- Find the brightest and darkest values in the picture. How does the painter make light feel like a substance?
- Look at the window's muntins (the bars). What pattern do they project, and how would a sheer change it?

Talk about it

1. Where in your own home does a beam like this land, and what cloth is lying in it right now?
2. If this room were yours, what window treatment would keep the beauty of the beam but protect the textiles: sheer, lined drape, shade, or nothing?
3. Hammershøi furnished the room with almost nothing. Does the light need the empty room to be the subject?

Safety first. No tools this week beyond scissors and pins: carry scissors closed, count pins in and out, and keep swatches and pins off the floor. The fade rack sits inside a window, never touching a heater, a stove or a lamp bulb.

STUDIO LAB

The Fade Rack: Sunlight on Trial

A six-week controlled lightfastness test. Half of every swatch hides behind card; half faces the sun. When you open the rack in Unit 2, the stripe line tells the truth about every fiber and dye on the board, and your grades and ranking go in the notebook as evidence you collected yourself.

You will need

- Six to eight labeled swatches, at least 3 × 5 in, varied by fiber and color: cotton print, cotton solid, polyester, acrylic or outdoor fabric if you have it, rayon or silk scrap, linen, a dark and a bright red or blue version of anything
- Stiff cardboard, aluminum foil, paper clips or staples (stapler, not staple gun), marker
- A south- or west-facing window with a sill or a taped position in full sun
- The lab notebook for the start-date record

WINDOW FADE RACK

Finished size: One board of 6–8 half-masked swatches · 45 minutes to build; six weeks in the window

Fabric and notions

- 1 piece of stiff cardboard about 10 × 16 in, faced with foil on the window side if you want to protect the sill area
- 6–8 fabric swatches, 3 × 5 in, each labeled in permanent marker on the masked half: fiber content, color, source
- 1 cardboard mask strip, 10 × 2½ in per row, clipped or stapled firmly over the lower half of every swatch
- Tape or a stand to hold the board flat against the glass, fabric facing the sun

How to make it

1. Record each swatch in the notebook: letter, fiber, fabric type, color, where it came from, and your predicted fade rank 1–8.
2. Mount the swatches in rows on the board; they must lie flat with no overlap.
3. Clip or staple the mask strip tight across the lower half of every swatch: the crisp masked line is the whole experiment.
4. Photograph the board in daylight before it goes up, with labels visible.
5. Place the board against the inside of the sunniest window, fabric to the glass, and write the start date on the board and in the notebook.
6. Leave it six weeks (into Unit 2). Do not peek under the masks; lifting them shifts the fabric and blurs the line.
7. On reveal day: remove masks, grade each swatch 0–4 for fade at the stripe line, photograph, rank, and compare with your predictions. Mount the board's photo and your table in the notebook.

Fabric check: Load the rack with real variety or it proves nothing: at least two cellulose fibers (cotton, linen, rayon), two synthetics (polyester, acrylic, nylon) and one protein fiber scrap if you have one (silk, wool), plus the same hue in two different fibers if possible. Dark and saturated dyes show fading soonest; include at least one bright red or deep blue.

Steps

1. Build and hang the rack from the pattern card, predictions recorded first.
2. While it runs, write the three fiber prescriptions for your audited room (sofa or seat, window, accent) with one-line defenses, and read them to a parent as if they were the client.
3. Mid-unit-2 check: confirm the board has not slipped and the sun still strikes it; log the weather pattern (mostly sunny? gray week?).
4. On reveal day, complete the grading table and write the conclusion: which fiber/dye traits predicted the ranking?
5. Improve-it line: what swatch or control would make the next rack better (a foil-backed control? a lined pair?).

Tips

- Add a lined pair if you can: two identical cotton swatches, one with a cotton lining behind it. The pair tests the decorator's favorite defense directly.
- Winter sun through glass still fades; glass blocks some ultraviolet but by no means all of it. The test is slower in December, not canceled.
- If no window gets direct sun for hours, a car's rear shelf (with the owner's permission) is a famously brutal test site: log it honestly as the hotter condition.

Check your work

- ☐ Every swatch is labeled with fiber and color, masked crisply, and recorded with a prediction.
- ☐ The board faces real sun with a logged start date.
- ☐ My three fiber prescriptions name the job's duties first and the fiber second.
- ☐ I did not peek.

LAB NOTEBOOK

1. Make the fiber habit chart from memory: eight fibers, each with two strengths, two weaknesses and one home job it deserves; check it against the lesson and correct in another color.
2. Tape in the before photo of the fade rack with its prediction table.
3. Write the weighted-silk story in five sentences as a warning label a museum might post beside a shattered curtain.

KEY FORMULAS

$$\text{cost per year} = \frac{\text{total fabric cost}}{\text{expected years of service}}$$

$$\text{cost per year} = \frac{\text{expected years of service}}{\text{total fabric cost}}$$

$$\text{blend content by weight: mass of fiber} = \text{fabric mass} \times \text{percent}$$

$$\text{blend content by weight: mass of fiber} = \text{fabric mass} \times \text{percent}$$

From history. Modern regulations cap how much weighting silk may carry without disclosure, and United States law has required fiber-content labels on most textiles since the Textile Fiber Products Identification Act of 1958. Your habit of reading the tag is that era's hard lesson made law.

WORKED EXAMPLES

Example 1. Drapes for a sunny window need 8 yards. Option A: silk-look polyester at \$11/yd, expected 10 years at that window. Option B: real silk at \$30/yd, expected 4 years unlined in that sun. Compare total cost per year.

Show solution

1. A total: $8 \times \$11 = \88 ; per year $\$88 \div 10 = \8.80 .
2. B total: $8 \times \$30 = \240 ; per year $\$240 \div 4 = \60 .
3. B could be rescued with lining: lined and interlined silk lasts far longer, at extra cost and sewing.

Answer: \$8.80 versus \$60 per year as specified; polyester wins the sunny window unless the silk is lined, which changes both numbers.

Example 2. A 300 g throw is labeled 70% acrylic, 30% wool. How many grams of each fiber is that?

Show solution

1. Acrylic: $300 \text{ g} \times 0.70 = 210 \text{ g}$
2. Wool: $300 \text{ g} \times 0.30 = 90 \text{ g}$

Answer: 210 g acrylic, 90 g wool: the label's percentages are percentages of weight.

Example 3. Design reasoning. Prescribe fibers for three jobs in one family room and defend each in one line: (a) sofa upholstery with children and a dog; (b) floor-length drapes at a west window; (c) a decorative lumbar pillow on a reading chair.

Show solution

1. (a) Needs abrasion resistance, cleanability, soil-hiding: a tightly woven polyester or poly-cotton blend in a mid-value tone, 15,000+ double rubs.
2. (b) Needs lightfastness and body: solution-dyed acrylic or polyester, or lined cotton/linen if the family wants natural fiber hand.
3. (c) Low duty, high delight: here silk, linen or a loved print is safe; the pillow takes hugs, not 3,000 rubs a year.

Answer: (a) Woven polyester blend rated for the duty; (b) solution-dyed acrylic/polyester or lined natural fiber; (c) the delicate beauty budget belongs on low-wear pieces.

PRACTICE

1. **Easy** Which fiber chars instead of melting and naturally resists flame: wool or polyester?

Show answer

Wool; polyester melts.

2. **Easy** What is solution-dyeing and why does it resist fading?

Show answer

The color is added to the liquid fiber before spinning, so it runs through the fiber instead of sitting on the surface.

3. **Easy** A \$45 fabric purchase serves 9 years. Cost per year?

Show answer

$\$45 \div 9 = \5 per year.

4. **Medium** Why did finishers weight silk with metallic salts, and what did the salts do over decades?

Show answer

Silk sold by weight, and salts restored (and padded) the weight lost in cleaning, adding rustle and drape; the salts slowly broke down the fiber until the silk shattered along folds.

5. **Medium** A 480 g slipcover fabric swatch batch is 65% polyester, 35% cotton. Grams of each?

Show answer

312 g 312 g polyester, 168 g 168 g cotton.

6. **Medium** Choose and defend: outdoor porch cushions in acrylic at \$19\$19/yd or cotton canvas at \$10\$10/yd.

Show answer

Solution-dyed acrylic: sun and mildew kill cotton outdoors in a few seasons; the acrylic's lightfastness earns its price. (Cotton defensible only for a covered, shaded porch and a short horizon.)

7. **Medium** Name two defenses, besides fiber choice, that extend a drape's life at a bright window.

Show answer

Lining (and interlining) as a sacrificial sun layer, and placement/management: sheers, shades or keeping delicate faces out of direct sun.

8. **Hard** Option A slipcover fabric: \$15\$15/yd $\times$ 10 yd, 4-year life. Option B: \$26\$26/yd $\times$ 10 yd, 12-year life. Compute each total cost per year, then name one non-money reason that might still justify A.

Show answer

A: $\$150 \div 4 = \37.50 $\$150 \div 4 = \37.50 /yr. B: $\$260 \div 12 \approx \21.67 $\$260 \div 12 \approx \21.67 /yr. B is cheaper per year; A could still win if the family expects to redecorate or outgrow the piece within a few years anyway.

9. **Hard** Why does a nylon-blend velvet wear better than an all-cotton velvet on a hallway bench, and what is the trade at a sunny window?

Show answer

Nylon's abrasion resistance armors the pile that feet and seats crush and rub; but nylon can yellow and weaken in prolonged sun, so at a bright window the blend needs lining or shade.

10. **Hard** A care tag says dry-clean-only on a slipcover for a family with small children. Is the fabric wrong, or the job assignment? Explain like a decorator.

Show answer

The job assignment: a slipcover's whole point is washability, so a dry-clean-only cloth contradicts the use. Either choose a prewashed, machine-washable fabric or accept upholstery (fixed cover) instead.

11. **Challenge** Weighted silk passed every showroom test a buyer of 1890 could run: look, hand, rustle, drape. Write the two questions a careful buyer should add for any treated or coated modern fabric, and connect them to the label laws this story helped justify.

Show answer

What was added to this cloth beyond its fiber, and what does the treatment do over years, not weeks (to wear, cleaning, sunlight)? Hidden treatments age differently from fibers, which is why law now requires content labeling and why weighting had to be disclosed.

COMMON MISTAKES

- Judging a fabric by hand and look alone. Weighted silk felt wonderful; the tag and the fiber facts carry information the fingers cannot.
- Putting the delicate beauty budget on high-wear pieces. Silk dies on a family sofa and lives for decades as a lumbar pillow.
- Buying dry-clean-only cloth for jobs whose whole point is washing: slipcovers, duvet covers, kitchen seats.

Make it a game · Fiber Draft Day. Shuffle eight slips labeled with the lesson's fibers. A parent announces a job (dog-friendly sofa, sunny kitchen valance, church-hall stage curtain, baby's quilt). Each player drafts the fiber slip they would spec and defends it in one sentence; the parent awards the point to the better defense, and a defense citing a number (rub rating, cost per year, fade behavior) breaks ties. First to five.

1.5 THE MOOD BOARD AND THE MEASURED PLAN

OBJECTIVES

- Draw a room to scale at $\frac{1}{4}$ inch = 1 foot from your own measurements, with windows, doors and furniture placed.
- Build a mood board and a fabric sample board that communicate a scheme to another person without explanation.
- Write a project budget allocating real dollars across the year's sewn pieces for the room.

Warm-up. Find two pictures of rooms you love (book, catalog, or a family photo of a room that felt right). Put them side by side and hunt for what they share: a color, a kind of light, bare or layered windows, pattern or plainness. Write the two common threads; they are the start of your board.

WATCH

Materials Board

Carol Batchelor Studio · 14:27

<https://www.youtube.com/watch?v=g41gOeCDf1E>

WHEN TO WATCH

Before you build your sample board. Watch her plan the layout, cut the board and mount real material samples by hand; then plan your own layout on scrap paper first.

Note: A design instructor's classroom lesson with real samples, scissors and board; a small channel chosen because it shows a physical board made start to finish.

KEY TERMS

mood board

A composed collection of images, colors and textures that communicates the intended feeling of a room before anything is bought or sewn.

floor plan

A to-scale drawing of a room seen from above, showing walls, openings and furniture footprints.

scale $\frac{1}{4}$ in = 1 ft

The common residential drawing scale: every quarter inch on paper is a foot in the room (a 1:48 ratio).

sample (fabric) board

The working version: actual fabric swatches, trims and paint chips for a specific room, labeled with widths, prices and jobs.

elevation

A to-scale drawing of one wall seen straight on; the drawing you design window treatments on.

budget allocation

Dividing the total money across the project's parts on purpose, before spending, instead of discovering the division afterward.

CORE IDEAS

The story. In a cottage called Lilla Hyttlös in the Swedish village of Sundborn, the painter Carl Larsson and his wife Karin, herself trained as an artist, spent the 1890s turning a cramped family house into one of the most influential homes in the world. They did it mostly with paint, cloth and ingenuity rather than money: Karin wove and embroidered boldly modern textiles on her own loom, designed furniture, and hung plain, light curtains where heavy drapes were the fashion; Carl painted the rooms and the children living in them in a series of watercolors published in 1899 as *Ett hem*, “A Home.” The book carried their bright, practical, personal rooms across the world, and Swedish homes are still furnished in its light. The Larssons did not copy a fashionable style; they designed around their own family's life, and that is why it lasted.

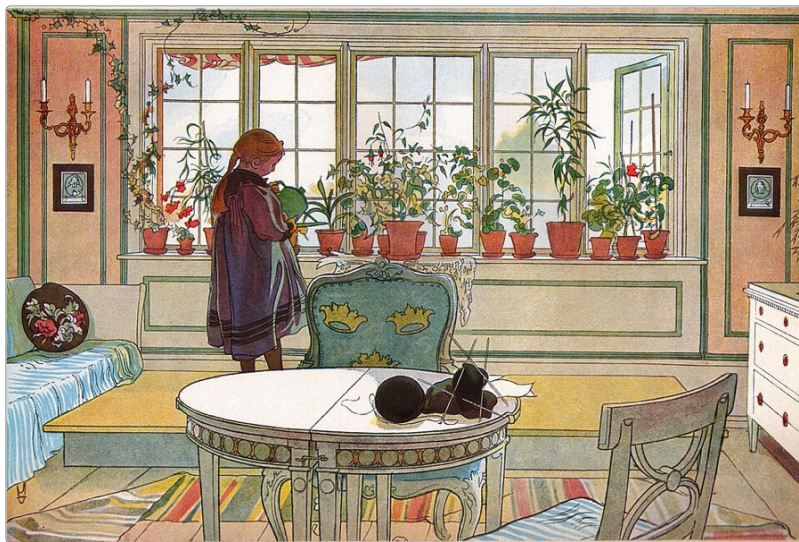
How they figured it out. No one furnishes a real home in one shopping trip, and the Larssons' house grew room by room, experiment by experiment, over years. What keeps a slow, piecemeal project from becoming a jumble is a *plan that survives between decisions*: a record of the scheme, the measurements and the intentions that every later purchase must answer to. Professionals keep that plan as drawings and boards: the **floor plan** and **elevations** hold the facts (what fits, what sizes, where the light comes from), the **mood board** holds the feeling, and the **sample board** holds the actual materials with their prices. When a tempting fabric appears months later, it auditions against the board, not against your mood that day.

The drawing science. A floor plan is measurement made visible. At $\frac{1}{4}$ inch = 1 foot, your tape-measure numbers from Lesson 1.1 divide by four and become inches on the page, and $\frac{1}{4}$ -inch graph paper does the division for you: one square, one foot. Draw the walls first, then openings: doors with their swing arcs, windows marked with sill heights noted beside them. Furniture goes in as paper cutouts to the same scale so you can slide arrangements without erasing. Then one **elevation** of the window wall, straight on, with the window, its trim, the floor and ceiling: this is the drawing you will design drapes on in Unit 3, because drape length and stacking space live on the elevation, not the plan. Check your plan by walking it: pick two points, scale the distance off the drawing, then measure the room. If they disagree, the drawing lies, and a lying drawing buys wrong yardage.

The money. A year of sewing for one room deserves a budget written before the first yard is cut. The method is allocation by percentage, exactly like the 60-30-10 of color: list the sewn projects the room needs in priority order from your audit, estimate each one's fabric honestly (your later units teach exact yardage; for now use catalog-style estimates), and fit them inside the family's real number. A sample allocation for a \$260 year: drapes 40%, slipcover or seat re-cover 25%, pillows and cushions 12%, quilt backing and batting 13%, trims and notions 5%, and a 5% overrun reserve, which every workroom keeps. The budget is a design tool, not a punishment: it is what lets you say yes to the good decorator fabric for the drapes, because the pillows agreed to be made from remnants.

The studio lab. Everything in this unit lands on one presentation: the measured plan and window elevation, the mood board, the sample board with priced swatches, and the budget, presented together to the household for approval exactly as a young designer presents to a client. This board set is the Unit 1 project, it is graded as one, and you will sew to it all year, amending it on purpose, in writing, when the room teaches you something new.

PICTURE STUDY



The Flower Window (Blomsterfönstret), Carl Larsson, c. 1894 · Watercolor, from the series published as "Ett hem" (1899) · Nationalmuseum, Stockholm
Image: [Wikimedia Commons](#), public domain

This is one of the watercolors of the Larssons' own house at Sundborn that made it the most famous home in Sweden. Notice how little expensive furniture there is: the design is done with light, plants, paint and textiles, most of them made in the house, Karin Larsson's loom standing just out of frame in other pictures of the series.

Look closely

- Inventory the textiles: cushions, the chair seat, the striped rug, anything draped. How many patterns, and at what scales?
- Look at the window. Why would a heavy lined drape be wrong for this particular window and its sill of plants?
- Find the 60-30-10 of this room: what color dominates, what seconds, what sparks?
- The cushions and chair seat are simple shapes. What does that tell you about where a home sewist should spend effort in a room like this?
- Where does your eye enter the picture and where does it rest? Name the principle doing that work.

Talk about it

1. The Larssons designed for their family's daily life, not for visitors. What in your chosen room exists only to impress, and what earns its place daily?
2. Which single textile in this picture could you already sew, and which will you be able to sew by Unit 4?
3. If your mood board had to promise the feeling of this room in three words, what are they?

Safety first. Scissors, pins and glue again this week: points down, caps on, pins counted. If you climb to measure window heights, a parent spots the ladder or holds the step stool, and the tape measure, not your balance, does the reaching.

STUDIO LAB

The Client Presentation: Plan, Boards and Budget

The Unit 1 capstone lab: you will finish the measured plan and elevation, compose the mood board and the priced sample board, write the year's budget, and present all of it to the household for a signature. After approval, the set governs the year's sewing for the room.

You will need

- ¼-inch graph paper, ruler, pencil, eraser, card stock for furniture cutouts
- A board base: foam board, corrugated board or two heavy card sheets, about 16 × 20 in (or two 11 × 14 boards: mood and samples)
- Collected images, paint chips and real fabric swatches; glue stick or double-sided tape; clips for loose swatches
- The lab notebook, a calculator, and the Lesson 1.2 scheme card and 1.3/1.4 findings

ROOM DESIGN BOARD SET

Finished size: One plan + elevation, one mood board, one sample board with budget, for one real room · About 3 hours across two sessions

Fabric and notions

- Floor plan at ¼ in = 1 ft on graph paper with every wall, door swing, window (sill height noted) and furniture cutout placed
- One elevation of the window wall at the same scale
- Mood board: 6–10 culled images plus the scheme's colors, arranged with one dominant image and a clear hierarchy
- Sample board: a real swatch, chip or stand-in for every planned sewn piece, each labeled with job, fiber, width, price per yard and estimated yardage
- Budget sheet: total, categories with percents and dollars, reserve line, signatures line

How to make it

1. Ink the floor plan from your Lesson 1.1 measurements; walk-check two scaled distances against the real room before inking.
2. Draw the window-wall elevation with the window, trim, sill height and ceiling line; this sheet waits for Unit 3's drape design.
3. Gather wide for the mood board (15–20 images), then cull hard to 6–10 that agree; arrange with the dominant image largest and the palette along one edge.
4. Compose the sample board: group swatches by job, hard-wearing fabrics labeled with their duty class from Lesson 1.3, window fabrics with their fiber defense from 1.4.
5. Write the budget: priority list from the audit, percentage allocation, dollars per budget line, 5–10% reserve. Total must equal the family's real number.
6. Present for fifteen minutes: room, audit verdict, scheme, boards, budget; answer questions without defensiveness and record every objection in the notebook.
7. Amend what the household overrules, date the amendment, and collect the signatures. File the set where you will see it every unit.

Fabric check: Real swatches beat pictures of fabric: a store's swatch service or remnant bin gives 2-inch truths no catalog can. Where you must use a stand-in image, label it STAND-IN so the board stays honest, and replace it before the unit that sews that piece. Every hard-wearing job's swatch must carry a weight or rub-class note; a sample board that ignores Lesson 1.3 is a mood board wearing a costume.

Steps

1. Assemble the full set from the pattern card.
2. Rehearse the presentation once alone, timed, before the real one.
3. Hold the family presentation and take notes like a professional: objections are free consulting.
4. Make the amendments, collect signatures, and photograph the whole approved set for the notebook.
5. Improve-it line: the one thing the next presentation gets that this one lacked.
6. Clean up: clippings swept, glue capped, pins counted, boards stored flat and dry.

Tips

- Cull by agreement, not by beauty: a gorgeous image that disagrees with the other nine belongs on some future board.
- Let the fabric swatches overlap on the sample board the way the fabrics will meet in the room: drape swatch beside wall chip, pillow swatch on sofa swatch.
- Present the budget last. A household that has just fallen for the boards funds them more cheerfully.

Check your work

- ☐ My plan and elevation are to scale and walk-checked against the room.
- ☐ My mood board reads as one feeling without a word of explanation.
- ☐ Every sample is labeled with job, fiber, price and duty where it matters.
- ☐ The budget sums exactly, holds a reserve, and carries signatures.

LAB NOTEBOOK

1. Tape in a photo of the signed board set and the budget sheet.
2. Write the minutes of your presentation: who said what, what you amended, what you defended and how.
3. Draw a 2-inch thumbnail of the floor plan from memory, then compare with the real plan: what did your memory move?

KEY FORMULAS

$$\begin{aligned} \text{plan inches} &= \frac{\text{real feet}}{4} & \text{real feet} &= \text{plan inches} \times 4 \\ \text{plan inches} &= 4 \text{real feet} & \text{real feet} &= \text{plan inches} \times 4 \\ \text{line dollars} &= \text{total budget} \times \text{line percent} \\ \text{line dollars} &= \text{total budget} \times \text{line percent} \end{aligned}$$

From history. Karin Larsson's bold, spare textiles, woven for her own rooms at Sundborn, anticipated twentieth-century design by decades, and the Larssons' home is kept today by their descendants and open to visitors. The best-known home in Sweden was a working family's long, patient project.

WORKED EXAMPLES

Example 1. A room is 13 ft 4 in by 11 ft 8 in. Find its plan outline in inches at $\frac{1}{4}$ in = 1 ft.

Show solution

1. Convert to feet: $13 \text{ ft } 4 \text{ in} = 13\frac{1}{3} \text{ ft}$ $13 \text{ ft } 4 \text{ in} = 1331 \text{ ft}$; $11 \text{ ft } 8 \text{ in} = 11\frac{2}{3} \text{ ft}$ $11 \text{ ft } 8 \text{ in} = 1132 \text{ ft}$.
2. Divide by 4: $13\frac{1}{3} \div 4 = 3\frac{1}{3} \text{ in}$ $1331 \div 4 = 331 \text{ in}$ and $11\frac{2}{3} \div 4 = 2\frac{11}{12} \text{ in}$ $1132 \div 4 = 21211 \text{ in}$.
3. On $\frac{1}{4}$ -inch graph paper: $13\frac{1}{3}$ squares by $11\frac{2}{3}$ squares; round wall thickness outside the line, not inside.

Answer: About $3\frac{1}{3} \times 2\frac{11}{12} \text{ in}$ $331 \times 21211 \text{ in}$ on paper ($13\frac{1}{3} \times 11\frac{2}{3}$ squares).

Example 2. A \$240 room budget is allocated 40% drapes, 25% seat re-cover, 15% pillows, 10% quilt materials, 5% trims and a 5% reserve. Find each budget line in dollars.

Show solution

1. Drapes: $\$240 \times 0.40 = \96
2. Seat: $\$240 \times 0.25 = \60
3. Pillows: $\$240 \times 0.15 = \36 ; quilt: $\$240 \times 0.10 = \24 ; trims and reserve:
 $\$240 \times 0.05 = \12 each.
4. Check the sum: $96 + 60 + 36 + 24 + 12 + 12 = 240$

Answer: \$96/\$60/\$36/\$24/\$12/\$12, and the categories sum back to the total, which is the whole point of allocating first.

Example 3. Design reasoning. On the sample board, the drape swatch is a large leafy print, the seat swatch a small woven check, the pillow swatch a stripe, all in green and cream; the mood board is all calm, pale, nearly solid rooms. A parent says the two boards disagree. Do they? Rule like a designer.

Show solution

1. Test the boards against each other, not against taste: the mood board promises calm through near-solids; the sample board delivers three patterns, one large.
2. The shared palette (green/cream) agrees; the pattern energy does not: the boards tell two stories.
3. Resolve toward the mood board, which the household approved: keep the leafy print but demote it (pillows, not drapes), promote a textured near-solid to the drapes, keep the check.
4. Rule: when boards disagree, the mood board wins, because it is the promise the client approved.

Answer: The parent is right: palette agrees but pattern energy does not. Demote the large print to the 10% layer and give the drapes a quiet texture; amend the sample board in writing.

PRACTICE

1. **Easy** At $\frac{1}{4}$ in = 1 ft, how long on paper is a 16-ft wall?

Show answer

$$16 \div 4 = 4 \text{ in}$$

2. **Easy** A plan line measures $2\frac{3}{4}$ in. How long is the real wall?

Show answer

$$2.75 \times 4 = 11 \text{ ft}$$

3. **Easy** What belongs on an elevation that a floor plan cannot show?

Show answer

Heights: the window's height and sill, trim, drape lengths, anything vertical on that wall.

4. **Medium** Allocate a \$180 budget at 45% drapes, 20% cushions, 20% quilt, 10% trims, 5% reserve.

Show answer

$$\$81/\$36/\$36/\$18/\$9$$

5. **Medium** A sofa is 7 ft long. How long is its paper cutout at $\frac{1}{4}$ in = 1 ft, and why are cutouts better than drawn furniture?

Show answer

$$1\frac{3}{4} \text{ in}$$

143 in; cutouts slide into new arrangements without redrawing the plan.

6. **Medium** Name the job of each: mood board, sample board, floor plan.

Show answer

Mood board holds the intended feeling; sample board holds the actual priced materials; floor plan holds the measured facts.

7. **Medium** Your plan scales a walkway between sofa and table at $\frac{3}{8}$ in. Comfortable walkways need about 30 in. Does it pass?

Show answer

$0.375 \times 4 = 1.5 \text{ ft} = 18 \text{ in}$. $0.375 \times 4 = 1.5 \text{ ft} = 18 \text{ in}$: fails; rearrange the cutouts.

8. **Hard** A window is 42 in wide and 54 in tall with a sill 26 in above the floor, ceiling 96 in. Draw the arithmetic for the elevation at $\frac{1}{4} \text{ in} = 1 \text{ ft}$: window width, height, sill line and ceiling line on paper (give sixteenths where needed).

Show answer

At $\frac{1}{4} \text{ in} = 1 \text{ ft}$, one real inch is $\frac{1}{48}$ plan inch, so divide inches by 48. Width $42 \div 48 = \frac{7}{8} \text{ in}$; height $54 \div 48 = 1\frac{1}{8} \text{ in}$; sill line $26 \div 48 \approx \frac{9}{16} \text{ in}$; ceiling line $96 \div 48 = 2 \text{ in}$.

9. **Hard** Your dream drape fabric costs \$19/yard and the window needs 9 yd; your drape budget line is \$96. Give two workroom-honest ways to close the gap without abandoning the scheme.

Show answer

Need $9 \times 19 = \$171$, gap \$75. Options: use the dream fabric where it shows (leading edges, a valance) over a cheap quality lining-weight body; choose a near-match at lower price and spend a few dollars of the trim budget on edging; re-allocate from a lower-priority budget line in writing; or watch remnant tables with the swatch in your wallet.

10. **Hard** Why does a workroom hold back a reserve percent in every budget, and what fraction is sensible for a first-year sewist?

Show answer

Fabric shortages, cutting mistakes, pattern-repeat waste and price changes are certainties, not possibilities; 5–10% reserve (more for a beginner, who miscuts more) keeps one mistake from wrecking the plan.

11. **Challenge** The Larssons' home was built over years of small projects, yet reads as one designed whole. Name the three documents from this lesson that make that possible for your room, and state for each the exact moment this year when you will consult it.

Show answer

The plan/elevation (consulted when measuring and buying for every piece, e.g. drape cut lengths in Unit 3); the mood+sample boards (consulted at every fabric purchase, auditioning the bolt against the approved scheme); the budget (consulted before each unit's buying trip, amended in writing when reality differs). Any answer naming all three with concrete consultation moments earns full credit.

COMMON MISTAKES

- Drawing the plan from remembered measurements. Re-measure anything not written down; memory rounds in whole feet.
- Mood-boarding other people's whole rooms instead of culling for one feeling: ten beautiful disagreeing images make a catalog, not a plan.
- Writing a budget with no reserve. The first miscut panel eats the trim money, then the plan.

Make it a game · Scale Sprint. Each player gets graph paper and the same three furniture sizes called aloud (sofa 84 in, table 48 in round, bed 60 × 80 in). Race to draw all three correctly at $\frac{1}{4} \text{ inch} = 1 \text{ foot}$; a parent checks with a ruler. Fastest correct set wins; any piece off by more than a square costs the round. Rematch with the scale flipped to $\frac{1}{2} \text{ inch} = 1 \text{ foot}$.

Scripture. “Through wisdom is an house builded; and by understanding it is established: And by knowledge shall the chambers be filled with all precious and pleasant riches.” (Proverbs 24:3-4, KJV)

Wisdom, understanding, knowledge: the verse's order is the designer's order. The plan and the boards come before the buying, and the chambers are filled rightly because someone thought first.

UNIT 1 TEST

Calculators are allowed. Show your work for every calculation: write the formula, substitute with units, and give the answer with its unit. Answer concept questions in complete sentences. The test is worth 100 points.

1. (7 pts)
Name the five elements of design and any three principles, and give one concrete example of a broken principle in a room.
2. (7 pts)
What rule did William Morris give for what belongs in a house, and in what decade did Morris & Co. begin producing furnishings?
3. (7 pts)
A sofa is 90 in long. Using the two-thirds rule, what coffee-table length suits it? Show the math.
4. (7 pts)
A drape panel is 96 in long and the fabric's vertical repeat is 27 in. How many full repeats show, with how many inches over?
5. (7 pts)
What problem was Chevreul hired to solve at the Gobelins works, what law did he publish in 1839, and what does that law say?
6. (7 pts)
Build a split-complementary scheme around red: name the partners, then assign the three colors to a 60-30-10 for a family room in one sentence.
7. (7 pts)
A room's visible surfaces total 480 sq ft. Compute the square footage of each 60-30-10 layer.
8. (7 pts)
Convert 11 oz/yd² to g/m² (1 oz/yd² $\approx$ 33.9 g/m²) and name the weight class.
9. (7 pts)
Explain what one double rub is, how Wyzenbeek and Martindale differ, and why their numbers cannot be swapped.
10. (7 pts)
Fabric A: \$24\$24/yd, 36,000 double rubs. Fabric B: \$10\$10/yd, 6,000 double rubs. Compute cost per 1,000 rubs for each and estimated years at 3,000 rubs/year, then choose for a daily family sofa.
11. (7 pts)
Why did nineteenth-century finishers weight silk, and what is the lesson for reading fabric today?
12. (7 pts)
Prescribe a fiber (with one-line defense) for: (a) drapes at a west-facing window; (b) a dog-family sofa; (c) a decorative pillow on a bookshelf chair.
13. (8 pts)
A room measures 14 ft by 12 ft 6 in with a 7-ft sofa. Give the plan dimensions and the sofa cutout length at $\frac{1}{4}$ in = 1 ft.
14. (8 pts)
Short essay (5–8 sentences): Your sample board's drape fabric is beautiful, on budget, 54 in wide, but rated 4 oz/yd² with no wear rating, and the mood board promises airy light. Judge the fabric for (a) the drapes and (b) a window-seat cushion in the same room, citing at least three ideas from this unit.

UNIT PROJECT: THE ROOM DESIGN BOARD SET

Finish and present the complete design package for your real room: the measured floor plan and window elevation at $\frac{1}{4}$ in = 1 ft, the mood board, the priced and labeled fabric sample board, and the year's budget with reserve, presented to the household and signed.

Include the supporting evidence from the unit: the room audit, the scheme card with the Chevreul test, the abrasion lab board and table, and the fade rack's before photo with its prediction table (the reveal is logged when it comes down in Unit 2). This package is the contract your next seven units of sewing will serve.

LOOK FOR	WHAT IT MEANS
Measured accuracy	Plan and elevation to scale, walk-checked, every measurement with units; furniture cutouts to the same scale.
Design judgment	Scheme named with wheel logic; 60-30-10 tied to real surfaces; patterns varied in scale; boards agree with each other.
Material honesty	Every hard-wearing swatch carries weight/duty evidence; window fabrics carry a fiber defense; stand-ins labeled.
Budget discipline	Allocation sums exactly, holds a 5–10% reserve, and matches the household's real number; amendments dated.
Record and presentation	Audit, scheme card, abrasion table and fade-rack record filed; presentation given, objections recorded, signatures collected.

ANSWER KEY

1. Elements: line, shape, color, texture, pattern. Principles (any three): scale, proportion, balance, rhythm, emphasis. Example: a tiny footstool in a 30-inch-repeat print breaks scale.
2. Have nothing you do not know to be useful or believe to be beautiful; the firm was founded in 1861 (the 1860s).
3. $\frac{2}{3} \times 90 = 60$ in $32 \times 90 = 60$ in.
4. $96 \div 27 \approx 3.696 \div 27 \approx 3.6$, so 3 full repeats (81 in) show, with 15 in over.
5. Dull-looking blacks in tapestries; the law of simultaneous contrast: adjacent colors shift each other's appearance, each pushing its neighbor toward its own complement.
6. Red with blue-green and yellow-green; e.g., 60% soft yellow-green-tinged neutral walls, 30% blue-green drapes and chair, 10% red pillows and trim (any sensible assignment with red as an accent-scale color).
7. 288/144/48 sq ft 288/144/48 sq ft.
8. $11 \times 33.9 \approx 373 \text{ g/m}^2$ $11 \times 33.9 \approx 373 \text{ g/m}^2$; heavy (upholstery) weight.
9. A double rub is one back-and-forth stroke of the Wyzenbeek pad (about one sit/stand). Wyzenbeek rubs straight back and forth; Martindale rubs in a figure-eight and counts cycles. Different motions and machines produce numbers on different scales, so only duty classes compare.
10. A: $24/36 = \$0.6724/36 = \0.67 per 1,000 rubs, ~12 years. B: $10/6 = \$1.6710/6 = \1.67 , ~2 years. Choose A.
11. Silk sold by weight, so metallic salts restored and padded the weight lost in degumming, adding body and rustle; the salts destroyed the fiber over decades. Lesson: hidden treatments decide a fabric's future, so read labels and ask what has been added.
12. (a) Solution-dyed acrylic or polyester, or lined natural fiber: lightfastness. (b) Tight-woven polyester or poly blend at 15,000+ double rubs: abrasion and cleanability. (c) Anything loved, silk or linen included: nearly zero duty.
13. $14 \div 4 = 3.5$ in $14 \div 4 = 3.5$ in by $12.5 \div 4 = 3\frac{1}{8}$ in $12.5 \div 4 = 381$ in; sofa $7 \div 4 = 1\frac{3}{4}$ in $7 \div 4 = 143$ in.
14. Full credit for: (a) likely acceptable for drapes: drapes are delicate duty, 4 oz/yd² is top weight but drapes hang rather than rub, and airy light fits the mood board promise, though body/lining and sun-fade (fiber?) must be checked; (b) reject for the window seat: seats need medium-to-heavy duty (15,000+ double rubs) and decorator weight; citing duty classes, weight classes, fiber lightfastness, and the mood-board-governs rule.

PILLOWS AND CUSHIONS

A pillow is the best sewing school in the house. It has straight seams and square corners, it must fit its filling exactly, and it can hold every finishing technique a decorator uses: tapered corners, zippers, welting and boxing. This unit takes you from a simple knife-edge pillow to a tailored box cushion, refreshing your machine skills on the way and checked by a parent before you sew alone.

The stories run from the feather ticks of colonial homes and Gideon Sundback's hookless fastener to the Morris chair and the eider down of Iceland. The math is the workroom's: cut sizes from form sizes, bias strip widths from cord diameters, plates and boxing from three foam measurements, board feet, density and percent recovery. By the end you will have sewn at least four pieces for your room and tested what goes inside them.

PREREQUISITES

- Unit 1's room design board, with fabrics chosen for the pillows and cushions
- Fractions, perimeter and area; using π and a square root on a calculator
- A working sewing machine and a parent available for the safety sign-off

MASTERY CHECKLIST

- ☐ I can set up and sew on the machine safely, with a parent's sign-off.
- ☐ I can size a cover to its form and taper the corners so they fill.
- ☐ I can install a zipper so a cover comes off for cleaning.
- ☐ I can calculate, make and apply bias welting with smooth corners and an invisible join.
- ☐ I can write a box cushion cut list from foam measurements and sew it square.
- ☐ I can compare fillings with density, fill power and percent recovery from a fair test.

OPTIONAL BOOKS AND TOOLS FOR THIS UNIT

- **A zipper foot and a cording (piping) foot for your machine:** Most machines come with a zipper foot; a cording foot is an inexpensive extra that makes welting easier. Buy the one made for your machine's brand and shank.
- **A point turner and a 6 × 24 in clear ruler:** A plastic or bamboo point turner pushes out corners without punching through; the ruler is used all year.
- **An electric carving knife (kitchen kind) kept for foam:** Cuts upholstery foam cleanly. Used only with a parent present; label it for foam, never food.

Not required. Every project in this unit works with ordinary fabric-store supplies. School Launch has no ties to these authors, publishers or companies.

LESSONS IN THIS UNIT

2.1	Ticking and the Knife-Edge Pillow	3 sessions of 50–90 minutes
2.2	The Hookless Fastener: Zippers in Cushions	3 sessions of 50–90 minutes
2.3	Welting: Bias, Cord and the Zipper Foot	3 sessions of 50–90 minutes
2.4	The Box Cushion and the Morris Chair	3 sessions of 50–90 minutes
2.5	Feathers, Fiberfill and Foam	3 sessions of 50 minutes

2.1 TICKING AND THE KNIFE-EDGE PILLOW

OBJECTIVES

- Explain why feather ticking was woven so densely and what that teaches about choosing a cover cloth for a filled object.
- Set up and run the sewing machine safely for decorator fabric: needle size, stitch length, seam allowance, backstitching and pivoting at a corner.
- Size a knife-edge pillow cover to its form and taper the corners so the finished pillow has no “dog ears.”

Warm-up. Find the oldest pillow in the house and look at its inner case, not the pretty cover. Is the cloth tightly woven? Striped? Can you see or feel any feather quills working through? Then squeeze a corner of a decorative pillow: is it full and square, or a floppy point?

WATCH

How to Make the Perfect Square Pillow - No more pointy corners!

[A Square Pillow Isn't Square!](https://www.youtube.com/watch?v=D08GflpbFbk) · 7:54

<https://www.youtube.com/watch?v=D08GflpbFbk>

WHEN TO WATCH

After “The fabric science.” Watch how she marks and trims the tapered corners; pause and copy her measurements into your notebook before you cut.

Note: A professional pillow maker's channel; the corner-tapering method here is the one the lab uses.

BACKUP VIDEO

Part 1 - Knife-Edge Pillow | Professional Pillow Fabrication with Laura Nelson

[The Workroom Channel](https://www.youtube.com/watch?v=mJcMMl4Xeko) · 4:40

<https://www.youtube.com/watch?v=mJcMMl4Xeko>

A workroom version of the same pillow on an industrial machine and serger: notice how the cut size compares with the form size.

KEY TERMS

tick, ticking

The case that holds the feathers of a pillow or featherbed, and the tightly woven cloth (usually a firm twill, often striped) made for it.

pillow form (insert)

The filled inner pillow that the decorative cover slips over; sold by its flat size, such as 18 × 18 in.

seam allowance

The strip of fabric between the cut edge and the stitching line; ½ inch is standard for home décor.

knife-edge pillow

The simplest decorative pillow: two flat pieces seamed around the edge, so the finished edge is thin like a blade.

dog ears

The thin, pointed corners a square cover gets when it is stuffed; caused by the center bulging and pulling each side inward.

pivot

Stopping with the needle down in the fabric, lifting the presser foot and turning the work to sew a sharp corner.

CORE IDEAS

The story. Before foam and polyester, a family's softest possessions were its feathers. Colonial and pioneer households saved goose and duck feathers for years to fill pillows and featherbeds, and the feathers lived inside a case called a **tick**. A feather has a stiff quill that wants to work its way out through any gap in the cloth, so the tick had to be woven so tightly that a quill could not find a hole. Weavers answered with **ticking**: a dense, firm twill of linen and later cotton, often in the narrow blue-and-white stripes you still see on farmhouse pillows. The stripes were decoration; the density was engineering.

How they figured it out. Ticking makers learned by failure. Loosely woven cloth leaked down and let quills prick the sleeper, so they packed more yarns into each inch and chose the twill weave, whose diagonal floats lie close and flat. The same lesson governs every

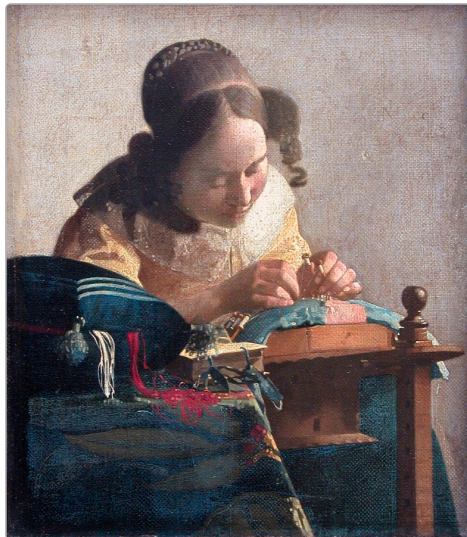
cover you sew this unit: the cover has to fit the job of the filling. A feather insert needs a down-proof inner case; a decorative cover over that insert needs to be sturdy, washable or removable, and sized so the filling presses out firmly against it.

The fabric science. A stuffed square does not stay square. When the center fills and bulges, each straight side is pulled in toward the middle while the corners stay where they were cut, so the corners stick out as thin, empty points: **dog ears**. Workrooms fix this two ways. First, they **taper the corners**: before sewing, they trim each side so it is a little narrower at the corners than at the middle (about ½ inch in from each corner on an 18-inch pillow, curving back to the full edge at the center), which removes the extra cloth that would have become the ear. Second, they cut the cover the *same size as the form* and sew with ½-inch seams, so the finished cover is 1 inch smaller than the insert and the filling packs firmly into the corners.

The machine. This lesson is also your machine check for the year. Decorator fabric wants a size 90/14 or 100/16 needle, a stitch length of about 2.5–3 mm (9–10 stitches per inch), and a ½-inch seam guided by the throat-plate line or a strip of tape. Backstitch three or four stitches at each start and stop. To turn a corner, stop with the needle *down*, lift the foot, pivot, lower the foot and go on. Clip the seam allowance diagonally across each corner before turning, press the seam, and push the corner out with a point turner, never the scissors' tip.

Let's sew. In the lab you will test the dog-ear problem with a muslin square before you cut your good fabric, then sew a knife-edge pillow cover for your room, with a centered motif, tapered corners and an opening closed by hand with an invisible ladder stitch.

PICTURE STUDY



The Lacemaker, Johannes Vermeer, c. 1669–1670 · Oil on canvas, mounted on panel · Musée du Louvre, Paris

Image: [Wikimedia Commons](#), public domain

Vermeer's tiny painting, smaller than a sheet of notebook paper, shows a lacemaker working pins and bobbins on a firm stuffed pillow. For her the cushion was a tool, not a decoration: it had to be packed hard enough to hold every pin exactly where she pushed it, all day long.

Look closely

- Find the two cushions: the lace pillow she works on and the blue sewing cushion in front. How are they shaped, and which looks more firmly stuffed?
- Look at the threads spilling from the blue cushion. What do they tell you about how it opens?
- Find the patterned tablecloth. Where does the pattern bend over the table edge?
- Look at her hands and the pins. Why must the lace pillow be firm rather than soft?

Talk about it

1. A working pillow and a sofa pillow are both stuffed covers. How do their jobs differ, and how would you choose the filling and the cover cloth for each?
2. Vermeer blurs the threads in the front and makes her fingers sharp. What is he asking you to look at?
3. What in your own sewing corner is a cushion used as a tool?

Safety first. Before you sew, a parent watches you thread the machine, sew a seam and pivot a corner, and signs off; until then, sew only with a parent beside you. Keep fingers at least an inch from the needle, take your foot off the pedal before reaching near the needle, pull each pin before it reaches the presser foot, and count pins out and back in.

STUDIO LAB

The Dog-Ear Test and a Knife-Edge Pillow

A two-part skill lab. First you prove the dog-ear problem and its cure on muslin; then you sew a real knife-edge cover for your room with a centered motif, tapered corners and a hand-closed opening, and record the measurements and the result.

You will need

- A sewing machine with a 90/14 or 100/16 needle and all-purpose polyester thread
- Muslin or an old sheet for the test
- Decorator fabric from your sample board
- A pillow form (or an old pillow to reuse)
- Shears, pins or clips, a clear ruler, chalk or a washable marker, a point turner, a hand needle

KNIFE-EDGE PILLOW COVER WITH TAPERED CORNERS

Finished size: One cover, 17 in finished, for an 18 × 18 in form (adjust to your form) · About 90 minutes

Fabric and notions

- 2 squares of decorator fabric, 18 × 18 in, the front centered on the motif
- 1 pillow form, 18 × 18 in
- All-purpose polyester thread to match
- 2 squares of muslin, 18 × 18 in, for the test

How to make it

1. Prewash washable fabric if the cover will be washed; press flat.
2. Cut the front with the motif centered (use a clear ruler to find the center both ways) and the back on the same grain.
3. Taper the corners: stack front and back right sides together, fold in quarters, and mark $\frac{1}{2}$ in in from the corner on both edges; draw a smooth line from that mark to the midpoint of each side, and trim along it.
4. Pin or clip around the edge, pins at right angles to the edge. Mark a 6-in opening centered on the bottom.
5. Sew a $\frac{1}{2}$ -in seam from one side of the opening around all four corners to the other side, backstitching at both ends and pivoting with the needle down at each corner.
6. Clip each corner diagonally, $\frac{1}{8}$ in from the stitching. Press the seam allowances open along the opening edges.
7. Turn right side out, push out the corners gently with a point turner, and press.
8. Fold the form in half, slide it in and work it into the corners.
9. Close the opening with a ladder stitch: small stitches taken alternately in each fold, pulled snug so the thread disappears.

Fabric check: Choose a medium-weight woven decorator fabric (cotton, linen blend, canvas or a polyester décor cloth). Avoid stretchy knits, slippery satins and very loose weaves for a first cover. If the cover will be washed, prewash and dry the fabric the way you will wash the cover. A feather insert needs its own sturdy inner case; check it before covering it.

Steps

1. Run the parent sign-off first: thread the machine, wind a bobbin, sew a straight $\frac{1}{2}$ -in seam on scrap, pivot a corner, and show your hands stay an inch from the needle.
2. Test: sew the two muslin squares with two corners tapered and two left square; stuff with the form and photograph. Record in the notebook which corners eared.
3. Measure your form and decide the cut size; write the math (form, seam allowance, finished size) on the lab page.
4. Sew the real cover from the pattern card.

5. Measure the finished cover and compare with the plan; note any difference and why.
6. Count pins back in, unplug the machine and set the iron upright and unplugged.
7. Improve it: write what you would change on the next pillow (taper depth, corner clipping, ladder-stitch spacing).

Tips

- A strip of masking tape on the machine bed $\frac{1}{2}$ in from the needle makes an easy seam guide.
- If the corners still ear, taper a little deeper on the next one; very full forms need less taper.
- Center the motif on the front first; the back can be cut from what is left.

Check your work

- ☐ A parent has signed off my machine safety check.
- ☐ My cover's finished size matches my calculation within $\frac{1}{8}$ in.
- ☐ My corners are full, not pointed, and my ladder stitch is nearly invisible.
- ☐ I recorded the test result and one improvement.

LAB NOTEBOOK

1. Tape in the photo of the muslin test with the tapered and square corners labeled.
2. Write the cover math: form size, cut size, seam allowance, finished size, yardage.
3. Sketch the corner taper with its measurements.

KEY FORMULAS

$$\begin{aligned} \text{finished size} &= \text{cut size} - 2 \times \text{seam allowance} \\ \text{finished size} &= \text{cut size} - 2 \times \text{seam allowance} \\ \text{cut size} &= \text{form size} \quad \left(\text{with } \frac{1}{2}\text{-in seams, for a firm fill}\right) \\ \text{cut size} &= \text{form size} \quad \left(\text{with } 2\frac{1}{2}\text{-in seams, for a firm fill}\right) \\ \text{pieces across the width} &= \left\lceil \frac{\text{fabric width}}{\text{piece width}} \right\rceil \\ \text{pieces across the width} &= \lceil \text{piece width} \rceil \text{fabric width} \end{aligned}$$

From history. Blue-and-white striped ticking was woven for mattress and pillow cases for centuries, and in the twentieth century decorators began using it on the outside of slipcovers and pillows because it is sturdy and plain. A cloth chosen for strength became a style.

WORKED EXAMPLES

Example 1. You have an 18×18 in pillow form. With $\frac{1}{2}$ -inch seam allowances, what size do you cut the front and back, and how much smaller than the form is the finished cover?

Show solution

1. Workroom rule: cut size equals form size, so cut 18×18 in 18×18 in.
2. Finished size: $18 \text{ in} - 2 \times \frac{1}{2} \text{ in} = 17 \text{ in}$ $18 \text{ in} - 2 \times \frac{1}{2} \text{ in} = 17 \text{ in}$.
3. Difference: $18 - 17 = 1 \text{ in}$ $18 - 17 = 1 \text{ in}$, so the form is squeezed $\frac{1}{2}$ inch on each side and fills the corners.

Answer: Cut two 18×18 in 18×18 in squares; the finished cover is 17×17 in square, 1 inch smaller than the form.

Example 2. Three 18-inch pillows need 6 squares cut 18×18 in from 54-inch decorator fabric (no motif to center). How many yards do you buy?

Show solution

1. Squares across the width: $\lceil 54 \div 18 \rceil = 3$ $\lfloor 54 \div 18 \rfloor = 3$.
2. Rows needed: $6 \div 3 = 2$ rows $6 \div 3 = 2$ rows, each 18 in long: $2 \times 18 = 36$ in $2 \times 18 = 36$ in.
3. Add about 4 in for straightening the cut end and shrinkage: $36 + 4 = 40$ in $36 + 4 = 40$ in.
4. Convert: $40 \div 36 \approx 1.11$ yd $40 \div 36 \approx 1.11$ yd, so buy $1\frac{1}{4}$ yd (stores cut in $\frac{1}{8}$ -yard steps).

Answer: Buy $1\frac{1}{4}$ yd: two rows of three squares with a little to spare.

Example 3. The same fabric has a large medallion that must be centered on each pillow front, and the vertical repeat is 27 in. How does that change the yardage for three fronts and three backs?

Show solution

1. Each front must be cut around a medallion, and the medallions repeat every 27 in down the bolt; assume one medallion per repeat across the width.
2. Three centered fronts need three repeats: $3 \times 27 = 81$ in $3 \times 27 = 81$ in.
3. The backs (no centering) fit beside the fronts in the leftover width or need one more row: 18 in 18 in.
4. Total: $81 + 18 + 4 = 103$ in ≈ 2.86 yd $81 + 18 + 4 = 103$ in ≈ 2.86 yd, so buy 3 yd.

Answer: About 3 yd instead of $1\frac{1}{4}$: centering a large motif can more than double the yardage, which is why the repeat goes on the sample board.

Example 4. How many stitches go into the seam of one 17-inch finished cover sewn at 10 stitches per inch, leaving a 6-inch opening for turning?

Show solution

1. Seam length: perimeter minus opening, $4 \times 17 - 6 = 62$ in $4 \times 17 - 6 = 62$ in.
2. Stitches: $62 \text{ in} \times 10 \frac{\text{stitches}}{\text{in}} = 620$ stitches $62 \text{ in} \times 10 \text{ stitches} = 620$ stitches.

Answer: About 620 stitches, plus a few dozen for backstitching.

PRACTICE

1. **Easy** Why was feather ticking woven so tightly?

Show answer

So feather quills and down could not work out through gaps between the yarns.

2. **Easy** A cover is cut 20×20 in and sewn with $\frac{1}{2}$ -in seams. What is its finished size?

Show answer

$$20 - 2 \times \frac{1}{2} = 19 \text{ in } 20 - 2 \times \frac{1}{2} = 19 \text{ in square.}$$

3. **Easy** What causes dog ears on a stuffed square cover?

Show answer

The bulging center pulls the middle of each side inward while the corners stay where they were cut, leaving empty points.

4. **Medium** What size do you cut a cover for a 16-in form by the workroom rule, and what is the finished size?

Show answer

Cut 16×16 in 16×16 in; finished 15 in 15 in.

5. **Medium** How many 20-in squares fit across 54-in fabric, and how much width is left over?

Show answer

$[54 \div 20] = 2 [54 \div 20] = 2$ squares, with $54 - 40 = 14$ in $54 - 40 = 14$ in left.

6. **Medium** Four 20-in pillows need 8 squares from 54-in fabric with no motif. How many inches of length, plus 4 in to spare, and how many yards?

Show answer

2 per row, 4 rows: $4 \times 20 + 4 = 84$ in $4 \times 20 + 4 = 84$ in; $84 \div 36 = 2.33$ $84 \div 36 = 2.33$ so buy $2\frac{3}{8}$ yd.

7. **Medium** Why stop with the needle down before pivoting?

Show answer

The needle holds the fabric in place so the stitching line turns exactly at the corner instead of shifting or leaving a gap.

8. **Hard** A 22-in form gets a cover cut 23 in square by mistake ($\frac{1}{2}$ -in seams). Compare the finished size with the form and predict the result.

Show answer

Finished $23 - 1 = 22$ in $23 - 1 = 22$ in, the same as the form: the pillow will look limp and the corners will be empty.

9. **Hard** Two medallion fronts must be centered on a print with a 25-in repeat; the two backs fit in one 20-in row. How many yards, with 4 in to spare?

Show answer

$2 \times 25 + 20 + 4 = 74$ in $2 \times 25 + 20 + 4 = 74$ in; $74 \div 36 \approx 2.06$ $74 \div 36 \approx 2.06$ so buy $2\frac{1}{8}$ yd.

10. **Hard** A seam is sewn at a $\frac{5}{8}$ -in allowance instead of $\frac{1}{2}$ in on all four sides of an 18-in cut cover. What is the finished size and how much tighter is the fit on the form?

Show answer

$18 - 2 \times \frac{5}{8} = 16.75$ in $18 - 2 \times \frac{5}{8} = 16.75$ in; $\frac{1}{4}$ in $\frac{1}{4}$ in smaller than planned, a tighter, firmer pillow (still usable).

11. **Challenge** Ticking makers chose a dense twill for feather cases. If you sewed a pillow cover for a feather insert from loosely woven linen and the insert's own case had worn thin, what would happen, and what two remedies would a workroom suggest?

Show answer

Feathers and quills would work through both layers and poke out of the cover. Remedies: put the insert in a new down-proof inner case (ticking or a tightly woven cotton), or line the decorative cover with a tightly woven fabric.

COMMON MISTAKES

- Cutting the cover larger than the form “for room.” The pillow goes limp; the cover should be the same cut size as the form or smaller.
- Clipping a corner through the stitching. Clip to within $\frac{1}{8}$ in and no closer.
- Pushing corners out with scissor points, which punch through. Use a point turner or a chopstick.

Make it a game • Corner Duel. Two players each sew a 6-inch muslin square pillow with one tapered and one square corner, stuffed with scraps, in 15 minutes. A parent judges blind which corners were tapered. Each correct call earns the judge a point; each corner that fools the judge earns the sewer two. Then swap and try a deeper taper.

Scripture. “And he was in the hinder part of the ship, asleep on a pillow” (Mark 4:38, KJV)

The Lord Himself slept on a pillow in a fishing boat in a storm. A pillow is a small, ordinary comfort, and making one well is good work.

2.2 THE HOOKLESS FASTENER: ZIPPERS IN CUSHIONS

OBJECTIVES

- Tell how Whitcomb Judson's clasp locker became Gideon Sundback's hookless fastener and why the new design worked.
- Name the parts of a zipper and choose a zipper type and length for a pillow or cushion.
- Install a lapped zipper in the bottom seam of a pillow cover so the cover comes off for washing.

Warm-up. Find three zippers in the house: on a coat, a cushion and a bag. Look at the teeth closely. Are they separate metal or plastic teeth, or a continuous coil? Is the zipper hidden under a flap of fabric or showing? Which ones open from both ends?

WATCH

How to Sew a Zipper into a Pillow Cover // Beginner Sewing Tutorial

Tamara's Joy // Sewing Channel • 8:34

<https://www.youtube.com/watch?v=iW7lg1UxA3Y>

WHEN TO WATCH

After “Let’s sew.” Watch once through, then again at the machine with your zipper and fabric, pausing after each numbered step.

Note: Shows a basted seam opened over the zipper, a clear beginner method; the lab adds a lap so the zipper is hidden.

KEY TERMS

zipper tape

The woven strips the teeth are attached to; you stitch through the tape, never the teeth.

coil zipper

A zipper whose teeth are a continuous nylon spiral; flexible and sold by the yard for cushions.

basting stitch

The machine's longest stitch, used to hold a seam temporarily so it can be pulled out easily.

slider and stops

The slider joins or separates the two rows of teeth; stops at the ends keep it from running off.

lapped zipper

A zipper hidden under a fold of fabric that laps over it from one side.

zipper foot

A narrow presser foot that lets the needle stitch close to the teeth.

CORE IDEAS

The story. In 1893 a Chicago inventor named Whitcomb Judson received a patent for a “clasp locker,” a row of hooks and eyes closed by a sliding guide, meant to save people from buttoning high boots. It was clever and it did not work well: the hooks popped open and jammed. A Swedish-born engineer, Gideon Sundback, went to work for Judson's company and kept at the problem for years. In 1913 he introduced the **hookless fastener**, with small nesting teeth instead of hooks, and he designed the machine that made it. A rubber company put it on galoshes in the 1920s and named it the **zipper**, for the sound it made.

How they figured it out. Judson's hooks failed because each one held by itself; one bent hook opened the whole row. Sundback's teeth each had a small bump on top and a hollow underneath, so every tooth nested into the teeth above and below it on the other side, and the slider pressed them together in order. The load spread along the whole row. He also increased the number of teeth per inch, which made the closure smoother and stronger. A good idea became a dependable one by patient testing.

The fabric science. In home décor the zipper's job is to let a cover come off for cleaning. Pillow covers usually take a zipper in the bottom seam, about 2 inches shorter than the finished side so the corners stay smooth; cushions take a coil zipper sold by the yard, cut to length, set into the back boxing (Lesson 2.4). Sew through the *tape*, not the teeth, with a zipper foot, and use a metal or nylon zipper sized to the fabric: a lightweight dress zipper chews through quickly in heavy cloth.

The method. The cleanest beginner method sews the zipper seam first, the whole length, with a regular stitch at each end and a basting stitch across the zipper's length; press the seam open, lay the zipper face down on the pressed seam allowances, and stitch it

in from the wrong side. For a **lapped** zipper, one seam allowance is pressed a little wider so its fold covers the teeth. Then open the basting and the zipper works. Leave the zipper partly open before sewing the rest of the cover, or you will have sealed it shut.

Let's sew. You will make a zippered cover for a real pillow in your room, from your sample-board fabric, and test it: zip, unzip, remove and replace the form ten times and check the seam ends.

PICTURE STUDY



Arrangement in Grey and Black No. 1 (Whistler's Mother), James McNeill Whistler, 1871 · Oil on canvas · Musée d'Orsay, Paris

Image: [Wikimedia Commons](#), public domain

Whistler called this portrait of his mother an “arrangement,” because he cared as much about the shapes and grays as about the sitter. For a home sewist it is a study of textiles in a quiet room: a printed curtain, a covered footstool, a lace cap and a plain dark dress, every one doing its job.

Look closely

- Find the curtain at the left. How is it hung, and how does the printed pattern change as the cloth folds?
- Look at the footstool under her feet. How is it covered, and why would a cover that comes off be useful on a footstool?
- Find the lace on her cap and cuffs. How do small white edges change a dark figure?
- Look at the shapes: rectangles of picture, curtain, wall and dress. Where does Whistler repeat a shape?

Talk about it

1. Which textile in this room gets the most wear, and how would you make it easy to clean?
2. Whistler limited himself almost to grays and black. What does the one printed curtain add to the picture?
3. If you sewed a cover for her footstool today, what fabric and closure would you choose, and why?

Safety first. Use the zipper foot and keep your fingers clear of the needle as it passes the slider; stop with the needle down, lift the foot and move the slider out of the way rather than sewing over it. Metal zipper teeth break needles: never sew across the teeth, and wear glasses if you must sew near them. Count pins in and out.

STUDIO LAB

A Zippered Cover That Comes Off

A skill lab in zipper installation: a lapped zipper in the bottom seam of a pillow cover, tested for smooth operation and durability, with the measurements recorded.

You will need

- Sewing machine with a zipper foot and a 90/14 needle
- Decorator fabric from your sample board
- A zipper 2 in shorter than the finished side (nylon coil or metal, #3–#5)
- A pillow form
- Pins or clips, ruler, chalk, iron and press cloth

PILLOW COVER WITH A LAPPED BOTTOM-SEAM ZIPPER

Finished size: One cover, 17 in finished, for an 18 × 18 in form · About 2 hours

Fabric and notions

- 2 squares of decorator fabric, 18 × 18 in
- 1 zipper, 14 or 16 in
- All-purpose polyester thread
- Optional: 1-in strips of fusible tape to steady the zipper seam allowances

How to make it

1. Finish the bottom edge of front and back with a zigzag or serger.
2. Place front and back right sides together. Center the zipper along the bottom edge and mark where its stops fall.
3. Sew the bottom seam at ½ in: regular stitch and backstitch from each corner to the zipper mark, basting stitch between the marks.
4. Press the seam open. For a lap, press the back's allowance flat and let the front's fold sit ⅛ in over the seam line.
5. Lay the zipper face down on the seam allowances, teeth centered on the seam; pin or glue-baste.
6. With the zipper foot, stitch down one side of the tape, across the bottom below the stop, up the other side ¾ in from the teeth on the lap side, and across the top above the stop.
7. Pick out the basting from the right side. Open the zipper halfway.
8. Pin the remaining three sides, taper the corners as in Lesson 2.1, and sew at ½ in, pivoting at the corners.
9. Clip corners, turn through the zipper, press, and insert the form.

Fabric check: A firm, medium-weight woven fabric is easiest. Very heavy fabric needs a sturdy zipper (#5) and a 100/16 needle. If the cover will be washed, prewash the fabric and use a polyester zipper tape, which does not shrink.

Steps

1. Practice first: put a zipper into a 6-in muslin seam using the same method and inspect it from both sides.
2. Record the plan: finished size, zipper length, length of regular stitching at each end.
3. Sew the real cover from the pattern card.
4. Durability test: unzip, remove the form, replace it and zip it ten times. Check the seam ends and the stitching at the stops; note any strain.
5. Measure and photograph the cover and the zipper from the outside; is the lap covering the teeth?
6. Clean up: count pins, unplug the machine, iron upright and unplugged.
7. Improve it: write one change for the next zipper (lap width, stitching distance, zipper weight).

Tips

- Glue-baste the zipper tape with a washable glue stick so it cannot shift.
- When the slider is in the way, stop with the needle down, lift the foot and slide it behind the needle.
- Mark the right side of the zipper tape with chalk; it is surprisingly easy to sew a zipper in upside down.

Check your work

- ☐ My zipper is straight, covered by the lap and opens smoothly.
- ☐ The seam ends held after ten removals.

- ☐ I recorded the measurements and one improvement.

LAB NOTEBOOK

1. Draw a cross-section of a lapped zipper: fabric, fold, tape, teeth and stitching lines.
2. Label the parts of a zipper on a sketch: tape, teeth or coil, slider, pull, top and bottom stops.
3. Tape in the muslin practice zipper with a note on what went wrong or right.

KEY FORMULAS

$$\begin{aligned}\text{zipper length} &\approx \text{finished side} - 2 \text{ in} \\ \text{zipper length} &\approx \text{finished side} - 2 \text{ in} \\ \text{each back piece height} &= \frac{\text{cut height}}{2} + \text{seam allowance} \\ \text{each back piece height} &= 2\text{cut height} + \text{seam allowance}\end{aligned}$$

WORKED EXAMPLES

Example 1. A cover is cut 20×20 in (finished 19 in). What zipper length goes in the bottom seam, and where do the basted section and the regular stitching go?

Show solution

1. Zipper length: $19 - 2 = 17$ in $19 - 2 = 17$ in, so buy the nearest stock size, 16 or 18 in; choose 18 in only if it leaves at least $\frac{1}{2}$ in clear at each end.
2. With a 16-in zipper on a 19-in seam: regular stitching $(19 - 16) \div 2 = 1.5$ in $(19 - 16) \div 2 = 1.5$ in at each end, basting across the middle 16 in.

Answer: A 16-in zipper, with $1\frac{1}{2}$ in of regular stitching at each end of the bottom seam.

Example 2. You want the zipper across the middle of the back instead. The cover is cut 18 in square with $\frac{1}{2}$ -in seams. What size are the two back pieces?

Show solution

1. Each back piece is half the height plus a seam allowance for the zipper seam: $18 \div 2 + \frac{1}{2} = 9.5$ in $18 \div 2 + 21 = 9.5$ in.
2. Width stays 18 in. Check: $9.5 + 9.5 - 2 \times \frac{1}{2} = 18$ in $9.5 + 9.5 - 2 \times 21 = 18$ in.

Answer: Two pieces $18 \times 9\frac{1}{2}$ in $18 \times 9\frac{1}{2}$ in.

Example 3. A family re-covers six sofa pillows a year for the seasons. Zippered covers cost \$14\$14 each to make and last 5 years; sewn-shut covers cost \$11\$11 but must be cut off and remade each time the insert is washed, about every 2 years. Compare cost per year for one pillow.

Show solution

1. Zippered: $\$14 \div 5 = \2.80 $\$14 \div 5 = \2.80 per year.
2. Sewn shut: $\$11 \div 2 = \5.50 $\$11 \div 2 = \5.50 per year.
3. Difference per pillow: $\$5.50 - \$2.80 = \$2.70$ $\$5.50 - \$2.80 = \$2.70$; for six pillows, $6 \times \$2.70 = \16.20 $6 \times \$2.70 = \16.20 per year.

Answer: The zippered cover costs about half as much per year, about \$16\$16 a year less for six pillows.

PRACTICE

1. Easy Who patented the clasp locker, and in what year?

Show answer

Whitcomb Judson, 1893.

2. **Easy** What did Gideon Sundback change in 1913?

Show answer

He replaced hooks with small nesting teeth (the hookless fastener) and built a machine to make it.

3. **Easy** Where do you stitch: through the teeth or the tape?

Show answer

The tape, close to the teeth, with a zipper foot.

4. **Medium** What zipper length suits the bottom seam of a cover finished at 17 in?

Show answer

$17 - 2 = 15$ in $17 - 2 = 15$ in; a 14-in stock zipper works.

5. **Medium** A cover is cut 22 in square. With a back zipper across the middle and $\frac{1}{2}$ -in seams, what are the back pieces?

Show answer

Two pieces $22 \times 11\frac{1}{2}$ in $22 \times 11\frac{1}{2}$ in.

6. **Medium** Why must the zipper be left partly open before you sew the cover's other three sides?

Show answer

Once the cover is closed you cannot reach the slider from inside, and you could not turn the cover right side out.

7. **Medium** Explain why one bent hook could open Judson's whole fastener but Sundback's did not fail that way.

Show answer

Each hook held alone, so one failure let the row separate; Sundback's teeth nest into their neighbors, spreading the load along the row.

8. **Hard** A 16-in zipper is centered in a 19-in finished seam. How much regular stitching is at each end?

Show answer

$(19 - 16) \div 2 = 1.5$ in $(19 - 16) \div 2 = 1.5$ in at each end.

9. **Hard** Zippered covers: \$18\$18 each, 6-year life. Sewn-shut: \$12\$12, remade every 2 years. Cost per year for each, and for four pillows over 6 years?

Show answer

Zippered \$3\$3/yr, sewn-shut \$6\$6/yr; over 6 years for four pillows $4 \times 18 = \$72$ $4 \times 18 = \$72$ vs. $4 \times 3 \times 12 = \$144$
 $4 \times 3 \times 12 = \$144$.

10. **Challenge** A friend wants an invisible zipper in heavy upholstery velvet. Name two problems and a better choice.

Show answer

Invisible zippers are light and their coils can split under heavy cloth, and velvet's bulk keeps the coil from rolling under cleanly. Use a sturdy #5 nylon coil or metal zipper, lapped, or set it in the back of a cushion's boxing.

COMMON MISTAKES

- Sewing the cover closed with the zipper shut.
- Stitching so close to the teeth that the slider binds, or so far that the lap gapes.
- Using a light dress zipper in heavy upholstery fabric.

Make it a game · Zipper Relay. Two players race to install a 7-in zipper in a muslin seam with the basted-seam method. A parent checks: straight stitching (2 points), teeth hidden or centered (2), slider runs smoothly (2), no stitches in the teeth (2), pins all counted (2). Highest score wins, not fastest; ties go to the faster sewer.

2.3 WELTING: BIAS, CORD AND THE ZIPPER FOOT

OBJECTIVES

- Explain why welting is cut on the bias, using the geometry of warp and weft.
- Calculate strip width and total length of welting for a pillow or cushion, and the length a continuous bias strip yields.
- Make welting, sew it to a pillow front, and join its ends invisibly.

Warm-up. Pull a square of woven fabric gently along the lengthwise grain, then the crosswise grain, then diagonally. Which way does it stretch? Then look at the edge of an upholstered chair or a good cushion: is there a cord covered in fabric running along the seam?

WATCH

How to Make & Sew Piping

[OnlineFabricStore](#) · 4:34

<https://www.youtube.com/watch?v=bJwe5bjXAvk>

WHEN TO WATCH

After “The geometry.” Watch how the strip width is figured from the cord; pause and write the formula she uses, then compare it with this lesson’s.

Note: A fabric retailer’s quick tutorial; the method is standard workroom practice.

KEY TERMS

welting (piping)

A cord covered with a strip of fabric and sewn into a seam to strengthen and outline an edge.

bias

Any direction at an angle to the grain; true bias is 45°, where woven fabric stretches most.

continuous bias

One long bias strip cut from a square that has been sewn into a tube, avoiding many short joins.

welt cord

The filler cord inside welting, sold by diameter (for example $\frac{5}{32}$ in or $\frac{1}{4}$ in), usually cotton or polyester.

grain

The direction of the yarns: lengthwise grain runs with the warp, crosswise grain with the weft.

zipper foot (cording foot)

A narrow foot that lets the needle stitch right beside the cord.

CORE IDEAS

The story. Look at almost any well-made upholstered piece from the 1800s, or at the seams of a Victorian dress bodice, and you will find the same detail: a thin fabric-covered cord running along the edges. Upholsterers and dressmakers of the period used piping everywhere because it does two jobs at once. It outlines a shape, so a cushion looks crisp and tailored from across a room, and it protects the seam, because the cord, not the stitching, takes the rubbing at the edge where wear begins.

How they figured it out. Early makers learned that a strip cut straight along the grain will not lie smoothly around a curve or a corner: it ripples on the outside and puckers on the inside. A strip cut on the **bias** bends easily because it can stretch. So the workroom rule became: cut welting strips on the bias for anything that turns corners or curves, and only use straight-grain strips on long straight runs where stretch would be a nuisance.

The geometry. Woven cloth is a grid of warp and weft. Pulled along either yarn direction, the yarns themselves resist, so the fabric barely stretches. Pulled at 45°, the force acts diagonally across each little square of the grid, and the squares can lean into diamonds, so the fabric gives. A 45° line across a square of side s has length

$$s\sqrt{2} \quad s \quad 2\sqrt{}$$

which is why bias strips cut from a square are longer than the square is wide. For the strip width, wrap the cord and add seam allowance: width $\approx$ cord circumference + $2 \times$ seam allowance, where circumference = πd .

The craft. Fold the strip over the cord, wrong sides together, and stitch close to the cord with a zipper or cording foot, using a slightly longer stitch. Sew the welting to the pillow front with its stitching on your seam line, clipping the welting's seam allowance at each corner so it turns. Where the ends meet, open one end, trim its cord to butt against the other, fold the fabric under and wrap it over the join. Finally sew the back on, stitching just inside the first line so no earlier stitching shows.

Let's sew. You will make welting from your room fabric or a contrasting accent from the 60-30-10 plan, sew a welted pillow, and keep a sample of each step for your notebook.

PICTURE STUDY



Armchair (fauteuil à la reine), Unknown French maker, Paris, c. 1690–1710 · Carved and gilded wood with upholstered seat and back · The Metropolitan Museum of Art, New York

Image: [Wikimedia Commons](#), public domain

This museum chair was made in Paris more than three hundred years ago, when the upholsterer's trade was becoming a fine art. Look at it as a workroom would: the frame is the carpenter's work, but the padding, the cover and the finished edges belong to the upholsterer, and the edges are where the wear and the eye both go first.

Look closely

- Trace the outline of the upholstered back. How is the edge of the cover finished where it meets the carved wood? Is there any cord or braid?
- Look at the seat. Is the padding flat or crowned in the middle?
- Find the places where a body would rub the cover most. Are those edges protected?
- Compare the carved wood with the cloth. Which parts would have to be replaced first over three centuries?

Talk about it

1. Why would an upholsterer put a strong edge treatment (braid, gimp or welting) exactly where the cloth meets the frame?
2. If you re-covered this seat, would you use straight-grain or bias strips to finish a curved edge? Why?
3. What does it tell you about the value of good upholstery that this chair still survives?

Safety first. Sewing welting puts the needle very close to your fingers: guide the strip with your fingertips well behind and beside the foot, never in front of it, and sew slowly. Rotary-cut the strips on a mat with the blade closed whenever it is set down. Count pins in and out.

STUDIO LAB

A Welted Pillow

Make continuous bias welting, apply it around a pillow front with turned corners and an invisible join, and complete a zippered cover. Keep a step sample of each stage.

You will need

- Machine with zipper or cording foot
- Welt cord, $\frac{5}{32}$ or $\frac{1}{4}$ in (about $2\frac{1}{2}$ yd)
- Fabric for strips (room fabric or the accent color)
- Pillow fabric and a zipper (from Lesson 2.2's method)
- Rotary cutter, mat and long ruler, or shears and chalk

WELTED ZIPPERED PILLOW COVER

Finished size: One cover, 17 in finished, for an 18 × 18 in form · About 3 hours

Fabric and notions

- 2 squares of decorator fabric, 18 × 18 in
- 1 square of strip fabric, 20 × 20 in, for continuous bias
- $2\frac{1}{2}$ yd welt cord, $\frac{1}{4}$ in, preshrunk if cotton
- 1 zipper, 14 or 16 in
- Polyester thread

How to make it

1. Make the continuous bias: cut the 20-in square in half on the diagonal, sew the two triangles into a parallelogram, mark 2-in lines, sew into an offset tube and cut along the spiral.
2. Fold the strip over the cord, wrong sides together, and stitch close to the cord with the zipper foot at a long stitch.
3. Starting at the middle of the bottom edge, pin welting to the right side of the front, raw edges together, leaving a 2-in tail.
4. Stitch on top of the welting stitching. At each corner stop $\frac{1}{2}$ in short, clip the welting's allowance three times, pivot and continue.
5. Join: stop 3 in short of the start. Open the end tail, cut the cord to butt the starting cord, fold the fabric end under $\frac{1}{2}$ in, wrap it around the start and finish stitching.
6. Install the zipper in the bottom seam (Lesson 2.2), sewing with the zipper foot against the cord.
7. Sew the remaining three sides with the front on top, stitching just inside the welting's stitching line.
8. Clip, turn, press with a press cloth, and insert the form.

Fabric check: Strips cut from medium-weight cotton or a cotton blend fold neatly; thick fabrics make bulky welting, so use thinner cord. Preshrink cotton cord by soaking and drying it if the cover will be washed, or use polyester cord. Plaids and stripes on the bias look striking but need careful matching at the join.

Steps

1. Calculate before cutting: the strip width for your cord and the welting length for your pillow; write both in the notebook.
2. Make 12 in of practice welting from scrap and turn one practice corner on a muslin square.
3. Make the pillow from the pattern card, saving a 4-in sample of the bias strip, the covered cord and a turned corner.
4. Measure how much welting you actually used and compare with your calculation.
5. Inspect from the outside: is any earlier stitching showing? Are the corners smooth?
6. Clean up: blade closed, pins counted, machine and iron unplugged.
7. Improve it: note one change (cord size, clipping, join).

Tips

- Start and join the welting at the bottom, where the join is least visible.
- If the welting ripples on the corners, clip its allowance more deeply, just short of the stitching.
- A slightly longer stitch on the welting keeps the fabric from waving.

Check your work

- ☐ My bias strip width and welting length were calculated and recorded.
- ☐ My corners are smooth and the join is nearly invisible.

- ☐ No earlier stitching shows on the outside.

LAB NOTEBOOK

1. Draw the bias geometry: a grid square leaning into a diamond, with the 45° pull marked.
2. Mount the step samples: strip, covered cord, turned corner, join.
3. Record the calculation for your strip width and length beside the amount actually used.

KEY FORMULAS

$$\begin{aligned} \text{strip width} &\approx \pi d + 2 \times \text{seam allowance} \\ \text{welting length} &= \text{perimeter} + \text{overlap (about 3 in)} \\ \text{continuous bias length} &\approx \frac{\text{area of square}}{\text{strip width}} \\ \text{diagonal of a square} &= s\sqrt{2} \end{aligned}$$

From history. Upholsterers call it welt or welting; dressmakers call it piping; both mean a cord wrapped in cloth. A double welt (two cords side by side) is often glued over the edge of an upholstered frame instead of gimp, as you will see in Unit 8.

WORKED EXAMPLES

Example 1. You will use ¼-in welt cord with ½-in seam allowances. How wide should you cut the bias strips?

Show solution

1. Circumference: $\pi \times 0.25 \text{ in} \approx 0.79 \text{ in}$
2. Add two seam allowances: $0.79 + 2 \times 0.5 = 1.79 \text{ in}$
3. Round up for easy handling: $1\frac{7}{8}$ or 2 in

Answer: Cut strips about 2 in wide.

Example 2. How much welting does an 18-in finished pillow need?

Show solution

1. Perimeter: $4 \times 18 = 72 \text{ in}$
2. Add about 3 in for joining the ends: $72 + 3 = 75 \text{ in}$

Answer: About 75 in, just over 2 yd of welting.

Example 3. You cut a 20-in square of fabric into a continuous bias tube and then into a 2-in strip. About how long a strip results, and is it enough for the pillow above?

Show solution

1. Area: $20 \times 20 = 400 \text{ in}^2$
2. Length: $400 \div 2 = 200 \text{ in}$; allow about 10% for seams and waste: $200 \times 0.9 = 180 \text{ in}$
3. Compare: 180 in is far more than 75 in.

Answer: About 180 in, enough for two welted pillows.

Example 4. How long is the first diagonal (true-bias) cut across a 36-in square of fabric, and how many 2-in strips of that length would you get from one triangle half?

Show solution

1. Diagonal:

$$36\sqrt{2} \approx 50.9 \text{ in}$$

2. The strips get shorter as you move into the corner; the height of the triangle measured from the diagonal is

$$50.9 \div 2 \approx 25.5 \text{ in}$$

3. so it holds about $25.5 \div 2 \approx 12$ strips of decreasing length.

Answer: The longest bias strip is about 51 in; one triangle half yields about 12 strips of decreasing length, which is why continuous bias saves joins.

PRACTICE

1. **Easy** Name two jobs welting does on a cushion edge.

Show answer

It outlines the shape crisply and protects the seam by taking the edge wear.

2. **Easy** Why cut welting on the bias?

Show answer

Bias strips stretch and bend smoothly around corners and curves without rippling or puckering.

3. **Easy** What is the perimeter of a 16-in square pillow, and how much welting with a 3-in overlap?

Show answer

$$64 \text{ in}; 67 \text{ in}$$

4. **Medium** Find the strip width for $\frac{5}{32}$ -in cord with $\frac{1}{2}$ -in seam allowances.

Show answer

$$\pi \times 0.156 \approx 0.49; 0.49 + 1 = 1.49, \text{ so cut } 1\frac{1}{2} \text{ in.}$$

5. **Medium** A 12 × 20 in lumbar pillow: how much welting with a 3-in overlap?

Show answer

$$2(12 + 20) + 3 = 67 \text{ in}$$

6. **Medium** A 15-in square becomes a continuous 1½-in strip. About how long, allowing 10% waste?

Show answer

$$225 \div 1.5 = 150; 150 \times 0.9 = 135 \text{ in}$$

7. **Medium** Why stitch the back on just inside the first row of stitching?

Show answer

So the earlier stitching line is hidden inside the seam and the welting sits tight against the cord.

8. **Hard** A box cushion 22 × 20 in needs welting around both plates. How much welting, with 3 in overlap per plate?

Show answer

$$2 \times (2(22 + 20) + 3) = 2 \times 87 = 174 \text{ in}$$

9. **Hard** How big a square do you need for the 174 in above with 2-in strips and 10% waste?

Show answer

$$174 \div 0.9 \approx 193 \text{ in of strip; area } 193 \times 2 = 386 \text{ in}^2$$

$$\sqrt{386} \approx 19.7, \text{ so a } 20\text{-in square.}$$

10. **Hard** Explain with the grid picture why fabric stretches on the bias but not on the grain.

Show answer

Along the grain the pull is carried straight by the yarns, which hardly stretch; on the bias the pull acts across the grid's squares, which can shear into diamonds.

11. **Challenge** Show that a strip cut along the full diagonal of a square of side s is about 41% longer than the side.

Show answer

$$\frac{s\sqrt{2}}{s} = \sqrt{2} \approx 1.414s$$

$\sqrt{2}$

$= 1.414$

$\sqrt{2}$

≈ 1.414 , so it is about 41% longer.

COMMON MISTAKES

- Cutting welting on the straight grain for a curved or cornered edge; it puckers.
- Stitching too far from the cord, which leaves a loose, wobbly edge.
- Forgetting to clip at the corners, which makes a rounded, bunched corner.

Make it a game · Bias Guess. A parent cuts five fabric strips, some on the straight grain and some on the bias, and lays them on the table without telling which is which. Each player gets one gentle pull per strip and calls grain or bias. Two points per correct call; then each player figures the strip width for a cord the parent names, and a correct formula answer earns three more.

2.4 THE BOX CUSHION AND THE MORRIS CHAIR

OBJECTIVES

- Tell the story of the Morris & Co. adjustable chair and why loose box cushions suited it.
- Measure foam and calculate plates, boxing, zipper panel and yardage for a box cushion.
- Sew a welted box cushion with a zippered back boxing and square corners.

Warm-up. Find a loose seat cushion in the house (sofa, chair or window seat). Measure its top, its depth (thickness) and the length of its zipper if it has one. Where does the zipper start and stop? Sketch the cushion and label every piece of fabric you can see.

WATCH

How to Make a Box Cushion with a Zipper

[OnlineFabricStore](#) · 8:20

https://www.youtube.com/watch?v=Gw_40jnJZBE

WHEN TO WATCH

After “The fabric science.” Watch once, then again with your foam and a notebook, writing down each cut size she uses and comparing it with your own calculations.

BACKUP VIDEO

Upholstery Method - HOW TO MAKE A BOXED AND WELTED CUSHION FOR UPHOLSTERY

[The Workroom Channel](#) · 24:19

<https://www.youtube.com/watch?v=5drVgRcGd6c>

A full professional workroom version with welting on both plates; watch the corner technique closely.

KEY TERMS

box cushion

A cushion with a top and bottom (plates) joined by a band (boxing) so the sides stand straight.

boxing

The band of fabric that forms the cushion's sides.

crown

The slight rounded fullness on top of a cushion, made by wrapping the foam in batting.

plate

The top or bottom panel of a box cushion.

zipper panel

The part of the boxing, usually across the back and around the back corners, that holds the zipper.

board foot

A volume of 144 cubic inches ($12 \times 12 \times 1$ in); foam and lumber are often priced by it.

CORE IDEAS

The story. In the 1860s, Warrington Taylor, the business manager of Morris & Co., saw an old reclining chair belonging to Ephraim Colman, a carpenter in Herstmonceux, Sussex. The firm's architect friend Philip Webb adapted it: a plain wooden frame with a back that could be set at several angles by moving a rod between pegs, and loose, thick cushions on the seat and back. Morris & Co. was selling it by the late 1860s, and the “Morris chair” was copied for decades, especially in America. Its comfort did not come from springs built into the frame but from the **box cushions** laid in it.

How they figured it out. A loose cushion has advantages a fixed seat does not: it can be turned over to share the wear, taken out to clean, re-covered without an upholsterer, and replaced when the filling tires. The box shape gives straight, square sides that fill a frame neatly. The cost is precision: a box cushion is a small piece of three-dimensional geometry, and if the plates, boxing and foam disagree by even half an inch, the cushion wrinkles or bulges.

The fabric science. Measure the foam, not an old cover. The **plates** are cut to the foam's top dimensions plus seam allowances; the **boxing** is cut to the foam's thickness plus two seam allowances, and long enough to go all the way around (the perimeter).

Workrooms put a **zipper panel** across the back that wraps a few inches around each back corner, so the foam can be folded in and out. The zipper panel is two strips, each half the boxing width plus a seam allowance, sewn to the zipper. Foam wrapped in polyester batting fills the cover snugly and gives it a slight **crown**.

The math. A box cushion's pieces all come from three foam numbers: length, width and depth. The perimeter decides the boxing length, the depth decides its width, and the foam volume (in board feet) decides its price. Get the three numbers right, write the cut list, and the sewing becomes simple.

Let's sew. Your lab is a welted box cushion for a real seat: a window seat, a bench, a chair or a footstool top, with welting on both plates and a zippered back boxing.

PICTURE STUDY



*A Morris chair, After the Morris & Co. design adapted by Philip Webb; a modern example, Design 1860s · Wooden reclining chair with loose leather-covered cushions · Photograph of a modern reproduction
Image: [Wikimedia Commons](#), public domain*

The Morris chair is a carpenter's frame filled with a sewist's cushions. Everything soft about it can be lifted out, turned, cleaned or re-covered, which is exactly why so many have survived.

Look closely

- Find the seat and back cushions. Are their sides straight like a box or rounded like a pillow?
- Look for the mechanism that lets the back recline. How does the back cushion stay in place at each angle?
- Where would the cushions wear first? Which edge would you protect with welting?
- Measure with your eye: how thick are the cushions compared with the arms?

Talk about it

1. Why does a loose cushion make the chair easier to keep for a hundred years?
2. If you re-covered these cushions, where would you put the zippers, and why?
3. Would you use foam, feathers or both in a seat cushion for a reading chair? Defend your choice.

Safety first. Cut foam with an electric carving knife or a long serrated bread knife only with a parent present, on a protected table, blade moving away from your body and your other hand behind the cut. Spray adhesive for batting is used outdoors or with windows open. Keep fingers clear of the needle when sewing around corners; count pins.

STUDIO LAB

A Welted Box Cushion

A skill lab in three-dimensional sewing: measure, calculate and cut a box cushion cover from a cut list, sew it with welting on both plates and a zippered back panel, and judge the fit honestly.

You will need

- Foam cut to size (or the old cushion's foam if it is still springy)
- Polyester batting to wrap the foam
- Decorator fabric, welt cord and strip fabric
- A coil zipper by the yard with sliders, or a long cushion zipper
- Machine with zipper foot, clear ruler, chalk, pins or clips

WELTED BOX CUSHION WITH ZIPPERED BACK

Finished size: One cushion for 22 × 20 × 4 in foam (adjust to your foam) · About 4–5 hours over two sessions

Fabric and notions

- 2 plates, 23 × 21 in
- 1 boxing strip, 5 × 55 in (pieced if needed)
- 2 zipper strips, 3 × 30 in
- 1 zipper, 28–30 in, or coil zipper cut to length with a slider
- About 5 yd welting (2 × 87 in)
- Foam, 22 × 20 × 4 in, wrapped in polyester batting

How to make it

1. Mark the center of each side on both plates and on the boxing pieces with small notches.
2. Make welting and sew it around each plate, turning the corners as in Lesson 2.3.
3. Sew the zipper strips to the zipper, folded edges meeting over the teeth, to make a 4-in-wide finished panel 30 in long; topstitch.
4. Sew one end of the boxing strip to each end of the zipper panel, making a loop that matches the perimeter. Check it against the plate before sewing the second seam.
5. Pin the boxing to the top plate, centering the zipper panel on the back and matching notches.
6. Sew with the zipper foot against the welting. At each corner, clip the boxing's seam allowance to the stitching so it turns square.
7. Open the zipper halfway. Sew the bottom plate on the same way, matching its corners exactly to the top plate's corners.
8. Clip, turn right side out through the zipper and push out the corners.
9. Wrap the foam in batting, fold it in half like a taco and slide it in; work it into the corners and zip.

Fabric check: Use a medium- to heavy-weight decorator fabric rated for seating (Lesson 1.3: at least light-to-medium duty for a seat). Very thick fabric makes welted corners hard; choose a thinner cord. Outdoor cushions need solution-dyed acrylic or polyester outdoor fabric, polyester thread and a polyester or nylon zipper.

Steps

1. Write the cut list from your foam measurements before you buy fabric; have a parent check the math.
2. Make a quick muslin of one corner (a 6-in plate corner and boxing) to practice the clipped turn.
3. Cut and sew the cushion from the pattern card.
4. Fit check: are the boxing seams straight, the corners square, the zipper hidden at the back? Measure the finished cushion against the foam.
5. Photograph the cushion in place and add it to the room board.
6. Clean up: foam crumbs vacuumed, knife stored, pins counted, machine unplugged.
7. Improve it: one change for the next cushion.

Tips

- A plastic grocery bag over the foam helps it slide into the cover; pull the bag out afterward.
- Matching the corners of the top and bottom plates exactly is what makes the boxing straight; mark them.
- If a plate is directional (a stripe or motif), mark which way is front and up.

Check your work

- ☐ My cut list matched the finished cushion within $\frac{1}{4}$ in.
- ☐ My corners are square and the boxing is straight.
- ☐ The zipper is centered on the back and hidden.
- ☐ I recorded the math, a photo and one improvement.

LAB NOTEBOOK

1. Draw an exploded view of the cushion with every piece labeled and dimensioned.
2. Write the full cut list and the board-foot price calculation.
3. Tape in a photo of the finished cushion in its chair or seat.

KEY FORMULAS

$$\begin{aligned} \text{plate} &= (L + 2SA) \times (W + 2SA) \\ \text{boxing width} &= D + 2SA \\ \text{zipper strip width} &= 2D + 2SA \\ \text{board feet} &= \frac{L \times W \times D \text{ (in}^3\text{)}}{144} \end{aligned}$$

From history. American furniture makers of the Arts and Crafts era, Gustav Stickley among them, sold their own versions of the Morris chair in the early 1900s with oak frames and leather or fabric cushions. Many are still in use, usually on their third or fourth set of cushions.

WORKED EXAMPLES

Example 1. Foam measures $22 \times 20 \times 4$ in. With $\frac{1}{2}$ -in seam allowances, find the plate size, the boxing width and the total boxing length.

Show solution

1. Plates: $(22 + 1) \times (20 + 1) = 23 \times 21$ in $(22 + 1) \times (20 + 1) = 23 \times 21$ in, cut two.
2. Boxing width: $4 + 1 = 5$ in $4 + 1 = 5$ in.
3. Perimeter: $2(22 + 20) = 84$ in $2(22 + 20) = 84$ in.

Answer: Two plates 23×21 in 23×21 in; boxing 5 in 5 in wide and 84 in around.

Example 2. For the same cushion, the zipper panel runs across the 22-in back and 4 in around each back corner. Find the zipper strips and the remaining boxing strip.

Show solution

1. Zipper panel length: $22 + 2 \times 4 = 30$ in $22 + 2 \times 4 = 30$ in.
2. Two zipper strips, each $\frac{4}{2} + 2 \times \frac{1}{2} = 3$ in $4 + 2 \times 1 = 6$ in wide by 30 in (they sew to the zipper with $\frac{1}{2}$ -in seams and give a 4-in finished panel plus allowances).
3. Remaining boxing must cover $84 - 30 = 54$ in $84 - 30 = 54$ in; add $\frac{1}{2}$ in at each end to join: $54 + 1 = 55$ in $54 + 1 = 55$ in, cut 5×55 in 5×55 in.

Answer: Zipper strips 3×30 in 3×30 in (two) and a boxing strip 5×55 in 5×55 in.

Example 3. The foam is priced at \$0.95\$0.95 per board foot. What does the $22 \times 20 \times 4$ in foam cost?

Show solution

1. Volume: $22 \times 20 \times 4 = 1,760 \text{ in}^3$ $22 \times 20 \times 4 = 1,760 \text{ in}^3$.
2. Board feet: $1,760 \div 144 \approx 12.2$ $1,760 \div 144 \approx 12.2$.
3. Cost: $12.2 \times \$0.95 \approx \11.61 $12.2 \times \$0.95 \approx \11.61 .

Answer: About \$11.60\$11.60 for the foam.

Example 4. Plan a layout on 54-in fabric for the plates (23×21 in), the boxing (5×55 in) and two zipper strips (3×30 in). How much fabric do you buy?

Show solution

1. Plates: lay them side by side with the 23-in side across: $23 + 23 = 46$ in $23 + 23 = 46$ in of the 54-in width, 21 in 21 in of length.
2. Boxing: 55 in is longer than the fabric is wide, so cut it as two pieces 5×28 in 5×28 in joined with a $\frac{1}{2}$ -in seam at a back corner: $28 + 28 - 1 = 55$ in $28 + 28 - 1 = 55$ in. Each piece takes its own 5-in row.
3. Zipper strips: 30 in each, so each takes its own 3-in row.
4. Length: $21 + 5 + 5 + 3 + 3 = 37$ in $21 + 5 + 5 + 3 + 3 = 37$ in, plus 4 in to square the end: 41 in ≈ 1.14 yd41 in ≈ 1.14 yd.

Answer: Buy $1\frac{1}{4}$ yd (more if a motif must be centered on the plates); the welting strips come from separate fabric.

PRACTICE

1. **Easy** Who adapted the Morris & Co. reclining chair, and from whose chair?

Show answer

Philip Webb, from an old chair belonging to Ephraim Colman, a Sussex carpenter, seen by Warington Taylor.

2. **Easy** Name the three kinds of pieces in a box cushion cover.

Show answer

Plates (top and bottom), boxing (sides) and the zipper panel.

3. **Easy** Foam is $18 \times 18 \times 3$ in. What is the boxing width with $\frac{1}{2}$ -in seams?

Show answer

$3 + 1 = 4$ in $3 + 1 = 4$ in.

4. **Medium** Find the plates and perimeter for $24 \times 21 \times 5$ in foam with $\frac{1}{2}$ -in seams.

Show answer

Plates 25×22 in 25×22 in; perimeter $2(24 + 21) = 90$ in $2(24 + 21) = 90$ in.

5. **Medium** How many board feet is $24 \times 21 \times 5$ in foam?

Show answer

$2,520 \div 144 = 17.5$ $2,520 \div 144 = 17.5$ board feet.

6. **Medium** Why should you measure the foam rather than the old cover?

Show answer

Old covers stretch and shrink; the foam is the true size the new cover must fit.

7. **Medium** Give two advantages of a loose box cushion over a fixed padded seat.

Show answer

It can be flipped to share wear, removed to clean, re-covered easily and replaced when the foam tires.

8. **Hard** For $24 \times 21 \times 5$ in foam, the zipper panel covers the back plus 4 in around each corner. Find zipper strip size and the remaining boxing strip ($\frac{1}{2}$ -in seams, join allowance 1 in).

Show answer

Zipper panel $24 + 8 = 32$ in $24 + 8 = 32$ in; two strips $3\frac{1}{2} \times 32$ in 21×32 in, since $5 \div 2 + 1 = 3.5$ in $5 \div 2 + 1 = 3.5$ in. Remaining $90 - 32 + 1 = 59$ in $90 - 32 + 1 = 59$ in; cut 6×59 in 6×59 in.

9. **Hard** Foam costs \$1.10 per board foot. Price foam for two $24 \times 21 \times 5$ in cushions.

Show answer

$2 \times 17.5 \times 1.10 = \38.50 $2 \times 17.5 \times 1.10 = \38.50 .

10. **Hard** Welting for both plates of the 24×21 cushion, with 3 in overlap each?

Show answer

$2(90 + 3) = 186$ in $2(90 + 3) = 186$ in, about $5\frac{1}{4}$ yd.

11. **Challenge** A window seat is a trapezoid: 48 in at the back, 40 in at the front, 18 in deep, cushion 3 in thick. Find the boxing length if the slanted sides are each about 18.4 in, and explain how the plates are cut.

Show answer

Perimeter $48 + 40 + 2 \times 18.4 = 124.8$ in $48 + 40 + 2 \times 18.4 = 124.8$ in; plates are cut from a paper pattern traced from the seat (or the foam) plus $\frac{1}{2}$ in all around, one flipped for the bottom.

COMMON MISTAKES

- Measuring an old, stretched cover instead of the foam.
- Sewing the boxing loop before checking its length against the plate.
- Letting the top and bottom corners drift out of line, which twists the boxing.

Make it a game • Cut-List Race. A parent calls out foam measurements (for example $20 \times 18 \times 3$ in, or $26 \times 24 \times 5$ in). Each player writes the plate size, boxing width, perimeter and board feet as fast as possible. The first correct complete list wins the round; a single wrong number loses it. Five rounds, then a bonus round with a trapezoid seat.

2.5 FEATHERS, FIBERFILL AND FOAM

OBJECTIVES

- Compare feather and down, polyester fiberfill and polyurethane foam by structure, loft, resilience, care and cost.
- Use density, fill power and percentage recovery to describe and compare fillings.
- Run a controlled compression-and-recovery test of three fillings and draw a conclusion from the data.

Warm-up. Collect three pillows or cushions with different fillings (a bed pillow, a sofa cushion, a throw pillow). Read the law labels if they have them. Press each down hard with both hands for ten seconds, let go and count how long it takes to spring back. Write your guess of which filling will win a fair test.

WATCH

Product Share - Understanding Foam for Home Furnishings

The Workroom Channel · 6:00

<https://www.youtube.com/watch?v=NnPIIFNXye4>

WHEN TO WATCH

After “The fabric science.” Pause at each foam she tests and write down its density and firmness numbers.

BACKUP VIDEO

Pillow Stuffing 101: Pros & cons of the 4 most common types of filler for decorative pillows

A Square Pillow Isn't Square! · 7:04

<https://www.youtube.com/watch?v=iffqtKuRV5E>

Watch after the foam video for the feather, down and fiberfill side of the lesson.

KEY TERMS

down

The soft, fluffy undercoating of waterfowl, with no quill; the warmest and lightest filling.

fill power

The volume in cubic inches that one ounce of down fills under a standard test; higher means loftier.

foam density

Mass per volume of foam, in pounds per cubic foot; higher density lasts longer.

feather

A plumage feather with a quill shaft; heavier and firmer than down, with more support.

fiberfill

Polyester staple fiber, often crimped or siliconized, used as loose stuffing or batting.

IFD (indentation force deflection)

The force in pounds needed to press a foam sample down by 25% of its thickness; a measure of firmness, not quality.

CORE IDEAS

The story. On the coasts of Iceland, families have gathered the down of the wild common eider duck for centuries. The mother eider plucks down from her own breast to line her nest; after the ducklings hatch and leave, the down is collected by hand, cleaned of seaweed and straw, and sold. It takes the down of many nests to make a single comforter, which is why eiderdown has always been costly, and why the old English word for a thick quilt was simply an “eiderdown.” The best filling known for warmth was the one a bird made to keep her own eggs warm.

How they figured it out. For most households, eiderdown was out of reach, so people tried whatever was at hand: straw, wool, horsehair, kapok from tree pods, and the feathers of their own geese and ducks. In the twentieth century chemists added two new fillings. **Polyester fiberfill**, crimped staple fiber that springs back and does not mind washing, came into wide use in the mid-twentieth century. **Polyurethane foam**, made by reacting liquid chemicals that release gas and rise like bread dough, became the standard seat cushion. Each has a job it does best.

The fabric science. *Down* is a cluster of fine filaments radiating from a center with no quill; it traps a great deal of still air for its weight, which is what loft and warmth are. *Feathers* have a quill that gives support but can poke through, so feather-and-down blends are graded by percentage (a 95/5 feather/down pillow is firm and inexpensive; 25/75 is soft and costly). *Fiberfill* is crimped polyester; it is washable, does not trigger feather allergies and is cheap, but it can mat into lumps over years. *Foam* is a network of tiny cells; its **density** (lb/ft³) predicts how long it lasts, and its **IFD** predicts how firm it feels. High-resiliency (HR) seat foam is usually at least about 2.5 lb/ft³. Foam is a petroleum product and burns readily, so modern furniture foam must meet flammability rules; keep it away from flames and heaters.

The numbers. Firmness and durability are separate measurements, and a fair test controls everything but the filling: the same load, the same time, the same measuring method. **Percentage recovery** compares the height after the load is removed with the original height. A cushion that loses a little height every time it is sat on is what people call “flat,” and the test shows it in minutes rather than years.

Let’s sew. This week’s lab is a test lab. You will compress three fillings with a standard load, record their heights, and rank them; then you will restuff or refill one tired pillow in the house based on the data. It is also reveal day for the Lesson 1.4 fade rack.

PICTURE STUDY



The Siesta (after Millet), Vincent van Gogh, 1889–1890 · Oil on canvas · Musée d'Orsay, Paris
Image: [Wikimedia Commons](#), public domain

Van Gogh painted this at the hospital in Saint-Rémy, working indoors from a print of a picture by Jean-François Millet. Two harvesters sleep at noon on the straw they have just cut. For most of history this was the cushion most people knew: straw, hay and chaff, the oldest fillings of all.

Look closely

- Find what the couple are lying on. How deep is the straw, and how does it hold their shape?
- Look at the haystack behind them. Why would a stack of straw or a stuffed tick of straw spring back less than a feather pillow?
- Find their tools and shoes. What do they tell you about the work that made them tired?
- Look at the brushstrokes in the straw. How does Van Gogh make it look springy?

Talk about it

1. Straw mattresses had to be restuffed every year after harvest. What does that tell you about the recovery of straw compared with foam?
2. If you could give these harvesters one modern cushion, which filling would you choose and why?
3. Van Gogh copied Millet in his own colors. What did he change, and what did he keep?

Safety first. When opening or restuffing a feather pillow, work in a closed room with no fan, wear a dust mask, and keep feathers and loose fiberfill away from babies and pets. Foam burns readily: keep foam scraps away from heaters, candles and stoves, and vacuum crumbs rather than sweeping them into the air. The fade-rack reveal uses only scissors.

STUDIO LAB

The Compression and Recovery Lab

A controlled test of three fillings: compress each under the same load for the same time, measure loaded and recovered heights, and rank them by compression and recovery. Then use the result to refill or restuff one tired pillow in the house, and grade the Lesson 1.4 fade rack.

You will need

- Three pillows or cushions of about the same size with different fillings (feather/down, fiberfill, foam), or three muslin bags filled with each
- A flat board or tray about 12 × 12 in
- A standard load: books or bags of rice totaling 10 lb, weighed on a bathroom or kitchen scale
- A ruler held upright or a yardstick, and a timer
- The lab notebook with a prepared data table

FILLING TEST SAMPLES

Finished size: Three 12 × 12 in test bags · About 45 minutes to sew and fill

Fabric and notions

- 6 squares of muslin, 13 × 13 in
- Fiberfill, about 6 oz
- A 12 × 12 × 3 in foam block wrapped in batting
- Feathers from an old pillow (inside a down-proof inner bag), about 8 oz

How to make it

1. Sew three muslin bags from pairs of squares with ½-in seams, leaving one side open.
2. Fill one with fiberfill, one with the wrapped foam, and one with an inner bag of feathers, each to the same starting height as nearly as possible.
3. Pin or baste the openings closed so the fillings stay put during testing.
4. Label each bag with its filling and starting weight.

Fabric check: Muslin is fine for test bags because it holds fiberfill and foam; feathers must go inside a tightly woven inner bag (an old pillow ticking works) or they will escape. If anyone in the house is allergic to feathers, test only fiberfill, foam and a wool or cotton batting bag instead.

Steps

1. Predict the ranking for compression and recovery and write your reasons.
2. Measure each sample's original height at the center with the ruler upright.
3. Lay the board on the sample, add the 10-lb load and start the timer. After 60 seconds measure the loaded height.
4. Remove the load and measure the height at 1 minute and again at 10 minutes.
5. Repeat three trials per sample; compute averages, percent compression and percent recovery.
6. Rank the fillings and write a conclusion that cites your numbers, then choose the filling for one real pillow or cushion that needs replacing and refill it.
7. Fade-rack reveal: remove the masks from the Lesson 1.4 board, grade each swatch 0–4, photograph and compare with your predictions.
8. Clean up: vacuum stray fibers, count pins, store foam scraps away from heat.

Tips

- Measure at the same spot every time; mark it with a pin.
- Fluff feather samples the same number of times before each trial, or the test is unfair.
- Three trials expose a fluke; one does not.

Check your work

- ☐ My test controlled the load, time and measuring method.
- ☐ My data table has three trials and averages for each filling.
- ☐ My conclusion cites the numbers and names one source of error.
- ☐ I graded and recorded the fade rack.

LAB NOTEBOOK

1. Tape in a pinch of each filling in a small bag, labeled.
2. Draw your data table and a bar graph of percent recovery.
3. Record the fade-rack grades beside your original predictions and note the biggest surprise.

KEY FORMULAS

$$\text{density} = \frac{\text{mass}}{\text{volume}} \quad (\text{lb}/\text{ft}^3)$$

$$\text{density} = \frac{\text{mass}}{\text{volume}} \quad (\text{lb}/\text{ft}^3)$$

$$\text{percent recovery} = \frac{\text{height after release}}{\text{original height}} \times 100\%$$

$$\text{percent recovery} = \frac{\text{height after release}}{\text{original height}} \times 100\%$$

$$\text{percent compression} = \frac{\text{original height} - \text{loaded height}}{\text{original height}} \times 100\%$$

$$\text{percent compression} = \frac{\text{original height} - \text{loaded height}}{\text{original height}} \times 100\%$$

$$1 \text{ ft}^3 = 1,728 \text{ in}^3$$

$$1 \text{ ft}^3 = 1,728 \text{ in}^3$$

From history. Kapok, the silky fiber from the seed pods of the kapok tree, was a common filling for cushions and life jackets in the early twentieth century because it is light and floats. It mats with use, which is one reason fiberfill and foam replaced it.

WORKED EXAMPLES

Example 1. A foam block $24 \times 24 \times 4$ in weighs 3.2 lb. Find its density and decide whether it is seat-grade HR foam (about 2.5 lb/ft³ or more).

Show solution

1. Volume: $24 \times 24 \times 4 = 2,304 \text{ in}^3$ $24 \times 24 \times 4 = 2,304 \text{ in}^3$.
2. Convert: $2,304 \div 1,728 = 1.33 \text{ ft}^3$ $2,304 \div 1,728 = 1.33 \text{ ft}^3$.
3. Density: $3.2 \text{ lb} \div 1.33 \text{ ft}^3 \approx 2.4 \text{ lb}/\text{ft}^3$ $3.2 \text{ lb} \div 1.33 \text{ ft}^3 \approx 2.4 \text{ lb}/\text{ft}^3$.

Answer: About 2.4 lb/ft³ 2.4 lb/ft³, just under the usual HR seat-foam mark: fine for a back cushion, borderline for a daily seat.

Example 2. A pillow 6.0 in tall is pressed under a 10-lb stack of books to 2.4 in. After one minute without the load it stands 5.4 in. Find the percent compression and percent recovery.

Show solution

1. Compression: $\frac{6.0 - 2.4}{6.0} \times 100\% = 60\%$ $\frac{6.0 - 2.4}{6.0} \times 100\% = 60\%$.
2. Recovery: $\frac{5.4}{6.0} \times 100\% = 90\%$ $\frac{5.4}{6.0} \times 100\% = 90\%$.

Answer: 60% compression and 90% recovery after one minute.

Example 3. Down that fills 650 cubic inches per ounce is called 650 fill power. How many ounces of 650-fill down would loosely fill a 1,950 in³ pillow chamber, and how many of 550-fill?

Show solution

1. 650 fill: $1,950 \div 650 = 3.0$ oz $1,950 \div 650 = 3.0$ oz.

2. 550 fill: $1,950 \div 550 \approx 3.5$ oz $1,950 \div 550 \approx 3.5$ oz.

Answer: 3.0 oz of 650-fill or about 3.5 oz of 550-fill: higher fill power means less down for the same loft.

Example 4. A 20-oz feather/down pillow insert is labeled 75/25 feather/down. How many ounces of each, and which part gives the support?

Show solution

1. Feather: $20 \times 0.75 = 15$ oz $20 \times 0.75 = 15$ oz.

2. Down: $20 \times 0.25 = 5$ oz $20 \times 0.25 = 5$ oz.

3. The quilled feathers give support and shape; the down adds softness and loft.

Answer: 15 oz feather and 5 oz down.

PRACTICE

1. **Easy** What makes down different from a feather?

Show answer

Down is a soft cluster with no quill; a feather has a stiff quill shaft.

2. **Easy** Which filling can usually be washed in a machine and suits a person allergic to feathers?

Show answer

Polyester fiberfill.

3. **Easy** Why was the eiderdown so costly?

Show answer

It is gathered by hand from wild nests, and many nests are needed for one comforter.

4. **Medium** Foam $20 \times 20 \times 3$ in weighs 2.1 lb. Density?

Show answer

$$1,200 \div 1,728 = 0.694 \text{ ft}^3 1,200 \div 1,728 = 0.694 \text{ ft}^3; 2.1 \div 0.694 \approx 3.0 \text{ lb/ft}^3 2.1 \div 0.694 \approx 3.0 \text{ lb/ft}^3.$$

5. **Medium** A cushion 5.0 in tall compresses to 3.0 in. Percent compression?

Show answer

$$\frac{2.0}{5.0} \times 100\% = 40\% 5.0 - 3.0 = 2.0 2.0 \div 5.0 \times 100\% = 40\%.$$

6. **Medium** After release it recovers to 4.6 in. Percent recovery?

Show answer

$$4.6 \div 5.0 \times 100\% = 92\% 4.6 \div 5.0 \times 100\% = 92\%.$$

7. **Medium** Does a higher IFD mean the foam will last longer? Explain.

Show answer

No. IFD measures firmness; density predicts durability. A soft foam can be dense and long-lasting.

8. **Hard** How many ounces of 600-fill down loosely fill a 2,400 in³ chamber?

Show answer

$$2,400 \div 600 = 4 \text{ oz } 2,400 \div 600 = 4 \text{ oz.}$$

9. **Hard** A 24-oz insert is 90/10 feather/down. Ounces of each? Which is firmer: 90/10 or 50/50?

Show answer

21.6 oz feather, 2.4 oz down; 90/10 is firmer.

10. **Hard** Design a fair test of two cushions. Name the variable you change, the one you measure, and three you control.

Show answer

Change: the filling. Measure: loaded height and recovered height. Control: load (same books), time under load, cushion size and cover, measuring point and method.

11. **Challenge** A family wants one filling for a dining-chair seat, a bed pillow for an allergic child, and a decorative pillow that should look full and soft. Prescribe each and give a number-based reason.

Show answer

Seat: HR foam about 2.5 lb/ft³ or denser, medium IFD, for durability and support. Allergic child: polyester fiberfill or a cluster-fiber pillow, washable. Decorative: a feather/down blend (for example 75/25) one size larger than the cover for full corners and soft loft.

COMMON MISTAKES

- Confusing firmness with quality: a firm cheap foam can wear out faster than a softer dense one.
- Testing with different loads or times and calling it a fair comparison.
- Opening a feather pillow near a fan or open window.

Make it a game · Fill Detective. A parent hides three test bags inside identical pillowcases. Players may squeeze, lift and press each for 20 seconds, then name the filling and guess its percent recovery. One point for the right filling, one more for a recovery guess within 5 points of the measured value. Best of three rounds.

Scripture. “I will both lay me down in peace, and sleep: for thou, LORD, only makest me dwell in safety.” (Psalm 4:8, KJV)

No filling makes a sleeper safe; the psalmist rests because the Lord keeps him. We make comfortable pillows, and we still sleep in His care.

UNIT 2 TEST

Calculators are allowed. Show your work for every calculation: write the formula, substitute with units, and give the answer with its unit. Answer concept questions in complete sentences. The test is worth 100 points.

1. (6 pts)
Why was feather ticking woven so densely, and what weave was typical?
2. (6 pts)
A cover is cut 20×20 in for a 20-in form with $\frac{1}{2}$ -in seams. Give the finished size and explain why the form should be larger than the finished cover.
3. (6 pts)
Explain what causes dog ears and how tapering prevents them.
4. (6 pts)
How many 20-in squares can be cut across 54-in fabric, and how many inches of length are needed for 6 squares with 4 in to spare?
5. (6 pts)
What did Gideon Sundback's 1913 hookless fastener change from Judson's clasp locker, and why did it work better?
6. (6 pts)
A cover finished at 18 in gets a bottom-seam zipper. What zipper length, and how much regular stitching at each end with a 16-in zipper?
7. (7 pts)
Find the bias strip width for $\frac{1}{4}$ -in cord with $\frac{1}{2}$ -in seam allowances. Show the formula.
8. (6 pts)
A 14×24 in lumbar pillow needs welting with a 3-in overlap. How much?
9. (7 pts)
About how long a continuous bias strip, 2 in wide, comes from an 18-in square, allowing 10% waste?
10. (7 pts)
Foam is $20 \times 19 \times 4$ in. With $\frac{1}{2}$ -in seams find the plates, boxing width and perimeter.
11. (7 pts)
For that cushion, the zipper panel spans the 20-in back plus 4 in around each corner. Find the zipper panel length and the remaining boxing strip length (1 in total join allowance).
12. (6 pts)
How many board feet is $20 \times 19 \times 4$ in foam, and what does it cost at \$1.00\$1.00 per board foot?
13. (6 pts)
Who adapted the Morris & Co. reclining chair, and why did its loose cushions help it last?
14. (6 pts)
A foam block $24 \times 18 \times 4$ in weighs 2.8 lb. Find its density.
15. (5 pts)
A cushion 5.0 in tall compresses to 2.0 in and recovers to 4.5 in. Find percent compression and percent recovery.

16. 7 pts

Short essay (5–8 sentences): A family wants new cushions for a sunny window seat used daily by children. Specify the fabric, the closure, the filling and the welting, and defend each choice with at least three ideas from Units 1 and 2.

UNIT PROJECT: THE CUSHION SET FOR YOUR ROOM

Make a coordinated set of at least three pieces for your room from the Unit 1 boards: a knife-edge or zippered pillow, a welted pillow and a box cushion, each with its cut list, calculations and a photo in place.

Add the compression-and-recovery report and the fade-rack results, and write a one-page note on how the test data changed or confirmed your filling and fabric choices.

LOOK FOR	WHAT IT MEANS
Measurement and math	Every piece has a cut list calculated from the form or foam; finished sizes match within ¼ in.
Technique	Corners fill, zippers are hidden and smooth, welting turns cleanly, boxing is straight.
Safety	Parent sign-off recorded; pins counted; blades and irons handled by the rules.
Testing and records	The filling test has controlled variables, three trials and a conclusion; the fade rack is graded.
Design fit	The set follows the room's scheme and 60-30-10 plan; any changes are noted on the board.

ANSWER KEY

1. To keep quills and down from working through the cloth; a dense twill, often striped.
2. $20 - 1 = 19$ in; $20 - 1 = 19$ in; the 1-in.-larger form presses firmly into the cover and fills the corners.
3. The bulging center draws each side inward while the corners stay out; trimming each side narrower toward the corners removes the cloth that would form the points.
4. 2 per row; 3 rows: $3 \times 20 + 4 = 64$ in $3 \times 20 + 4 = 64$ in (about $1\frac{7}{8}$ yd).
5. Nesting teeth replaced separate hooks, so each tooth locked into its neighbors and the load spread along the row instead of resting on single hooks.
6. $18 - 2 = 16$ in $18 - 2 = 16$ in; $(18 - 16) \div 2 = 1$ in $(18 - 16) \div 2 = 1$ in at each end.
7. $\pi(0.25) + 2(0.5) \approx 0.79 + 1 = 1.79$ in $\pi(0.25) + 2(0.5) \approx 0.79 + 1 = 1.79$ in; cut about 2 in.
8. $2(14 + 24) + 3 = 79$ in $2(14 + 24) + 3 = 79$ in.
9. $324 \div 2 = 162$ $324 \div 2 = 162$; $162 \times 0.9 \approx 146$ in $162 \times 0.9 \approx 146$ in.
10. Plates 21×20 in 21×20 in; boxing 5 in 5 in; perimeter 78 in 78 in.
11. Panel 28 in 28 in; remaining $78 - 28 + 1 = 51$ in $78 - 28 + 1 = 51$ in.
12. $1,520 \div 144 \approx 10.6$ $1,520 \div 144 \approx 10.6$ board feet; about \$10.56 \$10.56.
13. Philip Webb, from a Sussex carpenter's chair; loose cushions can be flipped, cleaned, re-covered and replaced.
14. $1,728 \text{ in}^3 = 1 \text{ ft}^3$ $1,728 \text{ in}^3 = 1 \text{ ft}^3$; density 2.8 lb/ft³ 2.8 lb/ft³.
15. 60% compression; 90% recovery.
16. Full credit for: a seat-rated (15,000+ double rubs) washable or solution-dyed fabric for sun (lightfastness); a zippered back boxing so covers come off; HR foam about 2.5 lb/ft³ or denser wrapped in batting for durability and crown; welting cut on the bias to protect the edges; numbers or tests cited (double rubs, density, recovery).

CURTAINS AND DRAPES

Windows are where a room meets the weather and the light, and curtains are where home sewing gets big. This unit begins with the tabernacle's curtains of fine twined linen and a quick history of the window, then measures real windows like a professional: rod width, extension, stack-back and finished length.

The math carries the unit: fullness and widths, cut lengths and yardage, repeat-adjusted cuts for printed fabric, lining cut lists, and the pleat-and-space calculation that turns a flat panel into an evenly pleated drape. You will sew a rod-pocket pair, a pattern-matched tab-top panel, a lined panel and finally a lined, pinch-pleated pair for the window you surveyed, with a light test along the way.

PREREQUISITES

- Unit 2's machine skills: straight seams, pressing and hems
- Your room's elevation drawing from Lesson 1.5
- Rounding up, ratios and percentages

MASTERY CHECKLIST

- ☐ I can measure a window for rod width, extension, stack-back and finished length.
- ☐ I can choose a fullness and calculate widths, cut lengths and yardage.
- ☐ I can adjust cut lengths for a pattern repeat and match a seam.
- ☐ I can cut and sew a lined panel with turnbacks and a lining that does not show.
- ☐ I can calculate pleats and spaces and sew a pinch-pleated heading.
- ☐ I can hang and dress drapes and judge them against my plan.

OPTIONAL BOOKS AND TOOLS FOR THIS UNIT

- **A 25-ft metal tape measure and a carpenter's level:** For measuring windows and marking rod lines; the sewing tape measure is too short and stretches.
- **4-in sew-in drapery buckram and drapery hooks:** Sold by the yard at fabric stores with home-décor departments; needed for Lesson 3.5.
- **A light meter app on a phone:** Free apps measure light in lux well enough for the Lesson 3.4 comparison.

Not required. Every project in this unit works with ordinary fabric-store supplies. School Launch has no ties to these authors, publishers or companies.

LESSONS IN THIS UNIT

3.1 Curtains of Fine Twined Linen: Windows Through History	3 sessions of 50 minutes
3.2 Fullness, Widths and Cut Length	3 sessions of 50–90 minutes
3.3 Pattern Repeats and the Toile of Jouy	3 sessions of 50–90 minutes
3.4 Lining, Interlining and the Warm Window	3 sessions of 50–90 minutes
3.5 Fifty Loops: Pinch Pleats and the Finished Drape	3 sessions of 50–90 minutes

3.1 CURTAINS OF FINE TWINED LINEN: WINDOWS THROUGH HISTORY

OBJECTIVES

- Describe the curtains of the tabernacle in Exodus 26 and compute their size in modern units.
- Trace how window treatments changed from shutters and wall hangings to layered drapes and simple modern curtains.
- Measure a window correctly for a curtain or drape: rod width, extension, stack-back, mount height and finished length.

Warm-up. Walk through the house and count the windows. For each, note what covers it (nothing, blinds, a shade, curtains, drapes) and what job it does: privacy, light, warmth, looks. Which window works hardest? Which treatment looks oldest?

WATCH

Windows used to be FUN : the History of Blinds and Curtains

[Nicole Rudolph](#) · 23:10

<https://www.youtube.com/watch?v=1G8gmV-VyD0>

WHEN TO WATCH

After “How they figured it out.” Watch the history first; jot down three window treatments from the past you would like to see again and the job each one did.

Note: A historical-sewing presenter using old decorating books and magazines. A short paid sponsor message for a phone app comes early in the video; skip past it.

BACKUP VIDEO

How to Measure for Custom Drapes and Curtains

[Uptown Drapes](#) · 6:53

<https://www.youtube.com/watch?v=Tr-ilk-Gh2U>

Watch before the lab. She shows inside width, rod extension (“rod space”) and how to sketch the window with every measurement.

KEY TERMS

cubit

An ancient measure from the elbow to the fingertip, about 18 inches (scholars estimate roughly 17½–21 in).

extension

How far the rod extends past the window frame on each side, so drapes can open clear of the glass.

finished length

The length of the curtain from the top of the heading (or the rod) to the hem, as it will hang.

rod width (face width)

The length of the rod from end bracket to end bracket, usually wider than the window frame.

stack-back

The space open drapes take up at the sides when pulled fully open.

inside / outside mount

Inside: the treatment fits inside the window opening. Outside: it is mounted on the wall or frame around it.

CORE IDEAS

The story. The first curtains described in detail in Scripture are not at a window at all. In Exodus 26 the Lord directs Moses to make the tabernacle with ten curtains “of fine twined linen, and blue, and purple, and scarlet,” worked with cherubims, each 28 cubits long and 4 cubits wide, coupled in two sets of five. Over them went curtains of goats' hair, and inside hung the veil that set apart the most holy place. Skilled weavers and embroiderers, filled with wisdom of heart, made it all by hand. At about 18 inches to the cubit, each linen curtain was about 42 feet long and 6 feet wide: a workroom job on a scale few modern drapers ever see.

How they figured it out. For most of history, ordinary windows were small and closed with wooden shutters, oiled cloth or paper, and the great textiles of a house hung on beds and walls, where they kept out drafts. As glass became cheaper in the 1600s and 1700s,

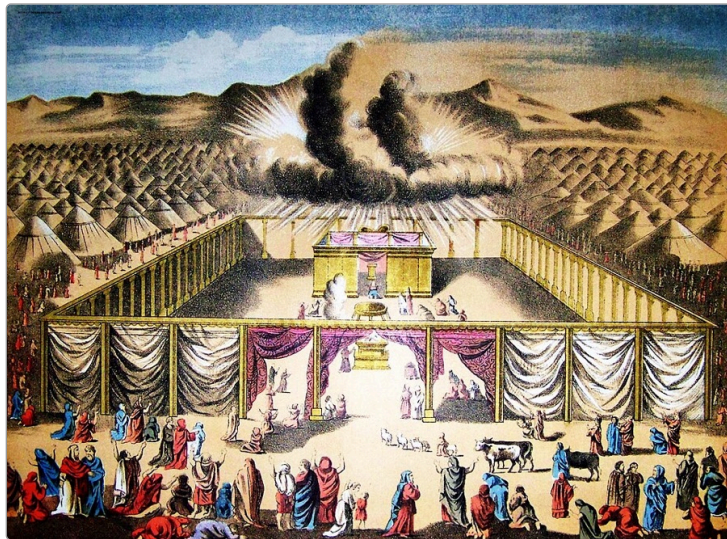
curtains moved to the windows: single panels, then pairs, then the pull-up festoon curtains of the eighteenth century. The Victorians layered lace or sheers, heavy lined drapes and a valance or lambrequin on top. The twentieth century stripped many of those layers away. Each change answered the same questions: how much light, how much privacy, how much warmth, and how much money.

The fabric science. Before any curtain is planned, the window is measured, and professionals measure in a fixed order. **Width:** the frame from outside edge to outside edge, then the **rod width** = frame width plus an **extension** of several inches on each side so the open drapes stack beside the glass, not over it. **Height:** from the rod (usually 4–6 inches above the frame, or higher to make a window look taller) to the sill, the apron below it, or the floor. Floor-length drapes usually finish ½ inch above the floor. Measure each window separately; old houses are rarely square, so measure the width at top, middle and bottom and use the largest for an outside mount, the smallest for an inside mount.

Look closely. A window treatment is designed on the elevation you drew in Lesson 1.5. Draw the rod, the open stack and the drape's hem on it before you buy a single yard: proportion (Lesson 1.1) decides whether the rod goes high, how long the drapes run and how wide the stack can be.

Let's sew. This lesson's lab is a measured window survey and a full-size mock-up: you will measure every window in your room, draw three treatment options on elevations, and test the winning one by clipping an old sheet to a rod or a taped line at the planned height and length.

PICTURE STUDY



The Tabernacle in the Wilderness, Illustration from a Holman Bible, Late 19th century · Color print · Published in A. J. Holman & Co. Bibles, Philadelphia

Image: [Wikimedia Commons](#), public domain

Bible publishers of the 1800s commissioned pictures like this to help readers imagine the tabernacle from the measurements in Exodus. The artist had only the text to go on, just as a drapery workroom has only the client's measurements: every hanging here is a guess built from numbers.

Look closely

- Find the white hangings around the court. How are they hung between the posts, and do they sag or hang straight?
- Look at the colored hangings at the entrance. How do they differ from the white ones around the sides?
- Find the tent in the center. Where would the curtains of fine twined linen and the coverings of goats' hair have been?
- Look at the people's clothing. How many of them wear long tunics, mantles and head coverings?

Talk about it

1. The artist had to turn measurements in cubits into a picture. Where do you think he guessed, and where did the text tell him exactly?
2. How is hanging a curtain between two posts like hanging a drape between two brackets?
3. Why might the Lord have commanded such careful, beautiful work for a tent that would be taken down and carried?

Safety first. Use a sturdy step stool or ladder with a parent spotting you for every measurement above shoulder height, and never lean out past the ladder rails. Do not climb on furniture or windowsills. If you test a rod, have a parent fix the brackets to the wall.

STUDIO LAB

The Window Survey and Mock-Up

A measuring lab. You will measure every window in your room by the professional order, draw three treatment options on the window-wall elevation, and test the chosen option full size with a sheet before any fabric is bought.

You will need

- A 25-ft metal tape measure and the 60-in sewing tape
- A sturdy step stool and a parent to spot
- Graph paper, the Lesson 1.5 elevation, pencil
- An old flat sheet, painter's tape and clothespins or clips
- A camera or phone

FULL-SIZE DRAPE MOCK-UP

Finished size: One window, one test panel · About 30 minutes

Fabric and notions

- 1 old flat sheet (twin or full)
- A strip of painter's tape marking the planned rod height and width, or a tension rod
- Clothespins or binder clips

How to make it

1. Mark the planned rod line on the wall with painter's tape, level, at the chosen height and full rod width.
2. Fold the sheet to roughly the planned panel width when closed.
3. Clip the sheet along the tape line with clothespins at about 6-in spacing.
4. Let it fall to the planned length; fold up the excess and pin it to show the hem line.
5. Gather it to one side to see the stack-back; photograph closed and open from the doorway.

Fabric check: Any old sheet works; a heavier sheet or a blanket gives a truer picture of how a lined drape will hang. Do not use the good fabric for a mock-up.

Steps

1. Measure each window in order: frame width (top, middle, bottom), frame height, sill height, frame top to ceiling, wall space beside the frame. Record every number with units.
2. Draw three options on the elevation: for example sill-length curtains on a frame-width rod, floor-length drapes on a high wide rod, and a café curtain with a valance.
3. For each option compute rod width and finished length.
4. Choose one and run the mock-up from the pattern card.
5. Photograph the mock-up from the doorway; compare with the elevation drawing and adjust the numbers if it looks wrong in the room.
6. Present the choice to the household with the photos.
7. Record the final numbers on the room board: rod height, rod width, finished length, stack-back.

Tips

- Measure in inches to the nearest $\frac{1}{8}$ in and write it down immediately.
- Check that the floor is level under the window: floors in old houses slope, and floor-length drapes show it.
- A laser level or a carpenter's level keeps the tape line straight.

Check your work

- ☐ Every window has a complete, labeled measurement record.
- ☐ I drew three options and calculated rod width and finished length for each.
- ☐ My mock-up photos match my chosen numbers.

LAB NOTEBOOK

1. Tape in the three elevations with their numbers.
2. Draw a cross-section of the tabernacle coverings as Exodus 26 describes them, labeled in cubits and feet.
3. Paste the mock-up photos with a one-line verdict.

KEY FORMULAS

$$\begin{aligned} \text{rod width} &= \text{frame width} + 2 \times \text{extension} \\ \text{finished length} &= \text{rod height above floor} - \text{clearance} \\ 1 \text{ cubit} &\approx 18 \text{ in} \end{aligned}$$

From history. Eighteenth-century householders often valued their textiles more than their furniture, and estate inventories list bed and window curtains, with their colors and fabrics, item by item. Museums use those inventories today to dress historic rooms accurately.

WORKED EXAMPLES

Example 1. Each tabernacle linen curtain was 28 cubits by 4 cubits. Taking a cubit as 18 in, find its size in feet and the size of one coupled set of five.

Show solution

1. Length: $28 \times 18 \text{ in} = 504 \text{ in} = 42 \text{ ft}$
2. Width: $4 \times 18 \text{ in} = 72 \text{ in} = 6 \text{ ft}$
3. A set of five, coupled side by side: $5 \times 6 = 30 \text{ ft}$ wide by 42 ft long.
4. Area of one set: $30 \times 42 = 1,260 \text{ ft}^2$

Answer: Each curtain about 42 × 6 ft; each set of five about 30 × 42 ft, or 1,260 sq ft of fine linen.

Example 2. A window frame is 46 in wide. You want 8 in of extension on each side. What rod width do you need?

Show solution

1. Rod width: $46 + 2 \times 8 = 62 \text{ in}$

Answer: A rod at least 62 in wide; an adjustable 48–84 in rod covers it.

Example 3. The top of the frame is 82 in above the floor. You mount the rod 5 in above the frame and want floor-length drapes finishing ½ in above the floor, hung from rings that drop 1½ in below the rod. What finished length do you sew?

Show solution

1. Rod height: $82 + 5 = 87 \text{ in}$
2. Subtract the ring drop and the floor clearance: $87 - 1.5 - 0.5 = 85 \text{ in}$

Answer: Sew the drapes to a finished length of 85 in from the ring pin to the hem.

Example 4. Design reasoning. A short, wide living-room window (60 in wide, 48 in tall, sill 36 in above the floor) looks squat. The ceiling is 96 in. Propose a rod height and drape length that make it look taller, and give the numbers.

Show solution

1. The frame top is $36 + 48 = 84$ in $36 + 48 = 84$ in above the floor, leaving 12 in to the ceiling.
2. Raise the rod most of the way up, about 8–10 in above the frame (92–94 in), so the eye reads the drape top as the window top.
3. Run the drapes to the floor, not the sill: a long vertical line makes the whole wall taller (line and proportion, Lesson 1.1).
4. Widen the rod 10–12 in each side so the stack does not cover the glass: $60 + 2 \times 12 = 84$ in $60 + 2 \times 12 = 84$ in.

Answer: Rod about 92–94 in high and 84 in wide, floor-length drapes: the window reads tall and wide, and no light is lost.

PRACTICE

1. **Easy** What materials and colors does Exodus 26:1 name for the tabernacle curtains?

Show answer

Fine twined linen, and blue, and purple, and scarlet, with cherubims of cunning work.

2. **Easy** Why is a rod usually wider than the window frame?

Show answer

So the open drapes stack beside the glass instead of blocking light and view.

3. **Easy** A frame is 36 in wide; extension 6 in each side. Rod width?

Show answer

$36 + 12 = 48$ in $36 + 12 = 48$ in.

4. **Medium** Convert the tabernacle's 4-cubit curtain width to inches using 18 in and using 20.6 in per cubit.

Show answer

72 in 72 in and 82.4 in 82.4 in.

5. **Medium** An old window measures $34\frac{1}{4}$ in wide at the top, 34 in at the middle and $33\frac{7}{8}$ in at the bottom. Which number do you use for an inside-mount shade, and why?

Show answer

$33\frac{7}{8}$ in 33 $\frac{7}{8}$ in, the smallest, so the shade fits the narrowest part of the opening.

6. **Medium** Rod 90 in above the floor, rings drop $1\frac{1}{4}$ in, $\frac{1}{2}$ in floor clearance. Finished length?

Show answer

$90 - 1.25 - 0.5 = 88.25$ in $90 - 1.25 - 0.5 = 88.25$ in.

7. **Medium** Name three questions every window treatment in history has answered.

Show answer

How much light, how much privacy, how much warmth (and how much money).

8. **Hard** Drapes stack back to about one-third of the rod width. For a 72-in window you want the whole glass clear when open. How wide must the rod be, with the stack split evenly to each side?

Show answer

Stack $= \frac{1}{3}R = 31R$; clear glass needs $R - \frac{1}{3}R \geq 72R - 31R \geq 72$, so $R \geq 108$ in $R \geq 108$ in, 18 in extension each side.

9. **Hard** Two windows 30 in wide stand 18 in apart. You want one rod across both with 8 in extension at each outer end. Rod width?

Show answer

$8 + 30 + 18 + 30 + 8 = 94$ in $8 + 30 + 18 + 30 + 8 = 94$ in.

10. **Hard** A five-curtain tabernacle set was 30 ft wide by 42 ft. How many square yards of linen is that?

Show answer

$1,260 \div 9 = 140$ yd² $1,260 \div 9 = 140$ yd².

11. **Challenge** Victorian windows often carried three layers: sheers, lined drapes and a valance. Give a reason for each layer and say which one you would keep in a modern room that needs privacy at night and light by day.

Show answer

Sheers: daytime privacy and softened light. Drapes: warmth, darkness and nighttime privacy. Valance: hides the hardware and finishes the top. Keep sheers plus lined drapes (or a lined drape alone) for day light and night privacy; the valance is optional.

COMMON MISTAKES

- Measuring only one width in an old window.
- Hanging the rod tight to the frame so the open drapes cover half the glass.
- Forgetting the ring or hook drop when figuring finished length.

Make it a game · Window Estimator. Before measuring, each player writes guesses for one window's frame width, height and sill height. Then measure. Score the total error in inches; lowest error wins the window. Play three windows, and finish with a bonus: guess the finished length for floor-length drapes on a rod 5 in above the frame.

Scripture. “Moreover thou shalt make the tabernacle with ten curtains of fine twined linen, and blue, and purple, and scarlet: with cherubims of cunning work shalt thou make them.” (Exodus 26:1, KJV)

The first great curtain commission in Scripture was given by God, with exact measurements and the finest materials. Careful measuring is part of doing the work well.

3.2 FULLNESS, WIDTHS AND CUT LENGTH

OBJECTIVES

- Explain fullness and choose a fullness ratio for sheers, medium and heavy fabrics.
- Calculate the number of fabric widths, the cut length and the total yardage for a pair of curtains.
- Sew an unlined rod-pocket curtain pair with double hems for a real window.

Warm-up. Take down a curtain (or look closely at one) and measure its flat width. Then measure the rod it hangs on. Divide the flat width by the rod width. That number is the curtain's fullness. Does the curtain look generous or skimpy?

WATCH

DIY | HOW TO CALCULATE FABRIC FOR CURTAINS & DRAPERIES | HOME DECOR

Comfy Home Couture • 9:45

<https://www.youtube.com/watch?v=oC6aYCZOjVw>

WHEN TO WATCH

After “The math.” Work along with her on paper, pausing at each step, then repeat the calculation with your own window's numbers.

Note: A drapery maker works the whole calculation on a whiteboard, step by step.

KEY TERMS

fullness

How much wider the flat curtain is than the space it covers, written as a ratio such as 2× or 2½×.

cut length

The length you cut each width: finished length plus hem and heading allowances.

header

The ruffle of fabric above a rod pocket.

width (of fabric)

One full selvage-to-selvage piece of fabric; curtains are planned in whole or half widths.

rod pocket

A channel sewn across the top of a curtain for the rod to slide through.

double hem

A hem turned up twice by the same amount so no raw edge shows; drapery hems are often a double 4 in.

CORE IDEAS

The story. In Acts 18:3 Paul stays with Aquila and Priscilla in Corinth, “for by their occupation they were tentmakers.” Scholars debate whether tentmakers of that day worked mostly in leather or in cloth. One thing is sure about the cloth tents of the ancient Near East: they were made of goat-hair fabric woven on narrow looms in long strips, and the strips were sewn edge to edge to make the roof and walls. Isaiah pictures God's people enlarging their tent and stretching forth “the curtains of thine habitations.” Every big piece of cloth in history was made the same way: narrow widths, joined.

How they figured it out. Curtain makers face the tentmaker's problem in reverse. The fabric comes in a fixed width (54 inches for most decorator cloth, wider for some sheers), and the window needs much more than that, because a curtain stretched flat looks like a bedsheet nailed up. Curtains look rich when they hang in soft folds, and folds need extra cloth. So workrooms plan in **widths**: they figure how many selvage-to-selvage pieces it takes to give the right fullness, and they join them with seams that hide in the folds.

The fabric science. **Fullness** depends on the fabric. Sheers and voiles need 2½ to 3 times the rod width, because thin cloth looks skimpy otherwise. Medium-weight cottons and linens look right at 2 to 2½. Heavy, lined or interlined drapes need about 2, because bulk does the work. More fullness also means more stack-back when the curtains open. Light passing through folds shows the fabric's weave and color differently from the flat bolt, which is another reason to test with a mock-up.

The math. Widths needed = (rod width × fullness + side hems) ÷ fabric width, always rounded *up*, and to an even number when you want two matching panels. Cut length = finished length + bottom hem + top allowance. For a rod pocket, the top allowance is the pocket plus the header, doubled under; for a double 4-inch hem, add 8 inches. Total yardage = widths × cut length ÷ 36, plus a little for straightening the ends.

Let's sew. You will sew an unlined rod-pocket pair for a real window, perhaps a bedroom, kitchen or bathroom: joined widths if needed, double side and bottom hems, a rod pocket with a header, hung and photographed.

PICTURE STUDY



Sunlight in the Blue Room, Anna Ancher, 1891 · Oil on canvas · Skagens Museum, Skagen, Denmark

Image: [Wikimedia Commons](#), public domain

Anna Ancher painted her daughter Helga crocheting in a blue sitting room of the family's home in Skagen, at the very top of Denmark. The real subject is light: how it comes through the window, past the curtains, and lands on wall, floor and child.

Look closely

- Find the curtains. How full are they? Do they hang in deep folds or nearly flat?
- Look at the curtains where the sun shines through them. What color does the light turn?
- Find the patches of sunlight on the wall. What shape are they, and what made that shape?
- Look at what the girl is doing. Why has she sat right by the window?

Talk about it

1. If these curtains were twice as full, what would change in the room's light?
2. Why might an artist choose warm golden curtains in a cool blue room? (Think back to the color wheel.)
3. Where in your house would you sit to do handwork, and what would you hang at that window?

Safety first. Cutting long lengths: work on a clean floor or a large table, carry shears closed and points down, and keep the rotary blade closed when set down. Ironing long hems: keep the cord out of the walkway and set the iron upright between presses. A parent fixes rod brackets to the wall. Count pins.

STUDIO LAB

A Rod-Pocket Curtain Pair

A skill lab in straight, long sewing: calculate, cut and sew an unlined rod-pocket pair for a real window, with joined widths if needed, double hems and a header, then hang and judge it.

You will need

- Machine and iron
- Lightweight to medium cotton, linen blend or a sheer (from your room board)
- Tape measure, yardstick or long ruler, chalk, shears
- A curtain rod already hung by a parent

UNLINED ROD-POCKET CURTAINS

Finished size: One pair for a 48-in rod, finished 63 in long (adjust to your window) · About 3–4 hours

Fabric and notions

- 3 widths of 54-in fabric, each cut 77 in (about $6\frac{5}{8}$ yd), one width split lengthwise
- Thread to match
- Optional: a strip of fusible web for the side hems

How to make it

1. Square the cut end of the fabric by pulling a crosswise thread or using a carpenter's square; cut all widths to the same cut length.
2. Split one width in half lengthwise. Join one full width and one half width for each panel with a $\frac{1}{2}$ -in seam, selvages trimmed or clipped every few inches so the seam does not pucker; press open.
3. Side hems: press under $1\frac{1}{2}$ in, then $1\frac{1}{2}$ in again; stitch close to the fold.
4. Bottom hem: press up 3 in, then 3 in again; stitch or hand slip-stitch.
5. Top: press under $\frac{1}{2}$ in, then fold down $3\frac{3}{4}$ in (pocket plus header) and press.
6. Stitch along the lower fold to close the pocket, then stitch $1\frac{1}{2}$ in from the top fold to form the header.
7. Slide the rod through the pocket between the two rows of stitching, gather evenly and hang.

Fabric check: A medium-weight cotton, linen-cotton blend or polyester sheer gathers well on a rod. Avoid heavy upholstery fabric (it will not gather) and stiff fabrics. Prewash washable fabric if the curtains will be washed; linen may shrink several percent. Sheers are slippery: use tissue paper under them while sewing.

Steps

1. Write the calculation sheet first: rod width, fullness, widths, finished length, cut length, yardage, cost. A parent checks it before you buy.
2. Sew a test rod pocket on a scrap and slide the real rod through; adjust the depth if it binds.
3. Make the curtains from the pattern card.
4. Hang them and measure the finished length at both sides and in the middle; record any difference from the plan.
5. Photograph closed and open from the doorway and compare with the mock-up photo from Lesson 3.1.
6. Clean up: pins counted, iron unplugged and upright, scraps saved for samples.
7. Improve it: one change for the next pair (fullness, hem depth, header height).

Tips

- Mark the right side of each width with chalk; prints are easy to flip by mistake.
- Press each hem before sewing it; long hems sewn unpressed wander.
- Turn the hem up and pin it with the curtain hanging, if the floor or sill is uneven, before stitching.

Check your work

- ☐ My calculation sheet was checked and matches the finished curtains.
- ☐ Both panels hang the same length within $\frac{1}{4}$ in.
- ☐ Hems are straight and the rod slides smoothly.

LAB NOTEBOOK

1. Copy your full calculation sheet.

2. Draw one panel flat with every measurement: widths, seams, side hems, pocket, header, hem.
3. Tape in before-and-after photos of the window.

KEY FORMULAS

$$\text{widths} = \left\lceil \frac{\text{rod width} \times \text{fullness} + \text{side hems}}{\text{fabric width}} \right\rceil$$

$$\text{widths} = \lceil \text{fabric width} \div \text{rod width} \times \text{fullness} + \text{side hems} \rceil$$

$$\text{cut length} = \text{finished length} + \text{hem allowance} + \text{top allowance}$$

$$\text{cut length} = \text{finished length} + \text{hem allowance} + \text{top allowance}$$

$$\text{yardage} = \frac{\text{widths} \times \text{cut length}}{36}$$

$$\text{yardage} = 36 \div \text{widths} \times \text{cut length}$$

$$\text{rod pocket depth} \approx \frac{1}{2}\pi d + \frac{1}{2} \text{ in}$$

$$\text{rod pocket depth} \approx 21\pi d + 21 \text{ in}$$

From history. In many Bedouin tents of the Middle East, the roof is still made of black goat-hair strips woven on narrow ground looms and sewn together, the method the ancient tents of Scripture used. Goat hair swells when wet and sheds rain.

WORKED EXAMPLES

Example 1. A 48-in rod gets a pair of medium-weight cotton curtains at $2\frac{1}{2}\times$ fullness from 54-in fabric. Each panel has double $1\frac{1}{2}$ -in side hems (3 in per side). How many widths?

Show solution

1. Fabric across the rod: $48 \times 2.5 = 120$ in $48 \times 2.5 = 120$ in.
2. Side hems: $2 \text{ panels} \times 2 \text{ sides} \times 3 \text{ in} = 12 \text{ in} = 12 \text{ in}$.
3. Widths: $(120 + 12) \div 54 = 2.44$ $(120 + 12) \div 54 = 2.44$, round up to 3; for two equal panels use 4 widths, or split one width down the middle so each panel gets $1\frac{1}{2}$ widths.

Answer: 3 widths ($1\frac{1}{2}$ per panel) gives about $(162 - 12) \div 48 \approx 3.1$ $(162 - 12) \div 48 \approx 3.1$ $\times$ fullness; 2 widths would give only about $2\times$. Use 3, split.

Example 2. The curtains finish at 63 in (sill length) with a double 3-in bottom hem and a top allowance of 8 in for a pocket and header. Find the cut length and total yardage for 3 widths, plus 6 in to straighten.

Show solution

1. Cut length: $63 + 2 \times 3 + 8 = 77$ in $63 + 2 \times 3 + 8 = 77$ in.
2. Fabric: $3 \times 77 + 6 = 237$ in $3 \times 77 + 6 = 237$ in.
3. Yards: $237 \div 36 = 6.58$ yd $237 \div 36 = 6.58$ yd, buy $6\frac{5}{8}$ yd.

Answer: Cut length 77 in; buy about $6\frac{5}{8}$ yd.

Example 3. The rod is 1 in in diameter. How deep should the rod pocket be, and with a $1\frac{1}{2}$ -in header above it, what top allowance do you cut (the top is turned under $\frac{1}{2}$ in first)?

Show solution

1. Half the circumference: $\frac{1}{2} \times \pi \times 1 \approx 1.57$ in $\frac{1}{2} \times \pi \times 1 \approx 1.57$ in; add $\frac{1}{2}$ in ease: about 2 in (round to $2\frac{1}{4}$ for easy sliding).
2. Pocket + header = $2.25 + 1.5 = 3.75$ in $2.25 + 1.5 = 3.75$ in.
3. The top folds down by that amount plus a $\frac{1}{2}$ -in turn-under: $3.75 + 3.75 + 0.5 = 8$ in $3.75 + 3.75 + 0.5 = 8$ in.

Answer: A $2\frac{1}{4}$ -in pocket and $1\frac{1}{2}$ -in header need an 8-in top allowance.

Example 4. Compare cost: 6 $\frac{5}{8}$ yd of a \$12/12/12 yd cotton versus buying two ready-made 63-in panels at \$34 each that hang at only 1.4 $\times$ fullness on this rod.

Show solution

1. Sewn: $6.625 \times \$12 = \79.50 . $6.625 \times \$12 = \79.50 , plus thread and time.
2. Bought: $2 \times \$34 = \68
3. Fullness: the ready-mades at 1.4 $\times$ will look flat; matching the sewn pair's 3 $\times$ fullness would take about four ready-made panels, $4 \times \$34 = \136

Answer: The sewn pair costs about \$80 for 3 $\times$ fullness; equal fullness from ready-mades costs about \$136.

PRACTICE

1. **Easy** What fullness suits a sheer voile? A heavy lined drape?

Show answer

About 2 $\frac{1}{2}$ –3 $\times$; about 2 $\times$.

2. **Easy** A rod is 40 in wide at 2 $\times$ fullness. How much flat fabric width?

Show answer

80 in.

3. **Easy** Finished length 84 in, double 4-in hem, 6-in top allowance. Cut length?

Show answer

$84 + 8 + 6 = 98$ in.

4. **Medium** A 60-in rod at 2 $\frac{1}{2}$ $\times$ with 12 in of side hems, 54-in fabric: how many widths?

Show answer

$(150 + 12) \div 54 = 3$ widths exactly; use 3, or 4 for extra fullness.

5. **Medium** 4 widths at a 98-in cut length plus 6 in: how many yards?

Show answer

$(392 + 6) \div 36 = 11.06$; buy 11 $\frac{1}{8}$ yd.

6. **Medium** Why round widths up and never down?

Show answer

Rounding down leaves the curtains too skimpy; you cannot add fullness after cutting.

7. **Medium** Rod 1 $\frac{3}{8}$ in diameter: rod pocket depth by the formula?

Show answer

$0.5 \times \pi \times 1.375 + 0.5 \approx 2.66$; about 2 $\frac{3}{4}$ in.

8. **Hard** A 36-in café rod gets 3 $\times$ fullness in a 45-in-wide cotton, two panels, side hems 3 in per side. Widths, and the resulting fullness?

Show answer

$(108 + 12) \div 45 = 2.67$, so 3 widths: $(135 - 12) \div 36 \approx 3.4$

9. **Hard** Seaming widths: each seam uses $\frac{1}{2}$ in from each width. For a panel of 2 widths of 54-in fabric with 3-in side hems each side, what is the finished flat width?

Show answer

$108 - 1 - 6 = 101$ in.

10. **Hard** From the story: ancient goat-hair tent strips were often about 2 ft wide. How many strips make a tent roof 20 ft wide, and how many seams?

Show answer

$20 \div 2 = 10$ strips, 9 seams.

11. **Challenge** A window needs either 3 widths of \$18/yard fabric (cut 98 in) or 2 widths of a 118-in-wide sheer at \$22/yard (same cut). Which costs less, and what else would you weigh?

Show answer

Option 1: $3 \times 98 \div 36 = 8.173 \times 98 \div 36 = 8.17$ yd, about \$147. Option 2: $2 \times 98 \div 36 = 5.442 \times 98 \div 36 = 5.44$ yd, about \$120. The wide sheer is cheaper and seamless, but weigh privacy, light, warmth and whether sheer suits the room's plan.

COMMON MISTAKES

- Forgetting side hems in the width calculation.
- Cutting lengths without squaring the end, which makes the hem crooked.
- Making the rod pocket too tight for the rod's end caps or finials.

Make it a game · Widths Showdown. A parent calls out a rod width, a fabric width and a fabric type (sheer, cotton, heavy). Players race to name the fullness and compute the number of widths. First correct answer scores; a wrong fullness choice for the fabric type costs a point. Play to five, then reverse: the parent gives widths and players find the fullness.

Scripture. “Enlarge the place of thy tent, and let them stretch forth the curtains of thine habitations: spare not, lengthen thy cords, and strengthen thy stakes;” (Isaiah 54:2, KJV)

Isaiah's picture of a growing household is a tent made bigger by adding curtains. Spare not: generous fullness is what makes a curtain look like a curtain.

3.3 PATTERN REPEATS AND THE TOILE OF JOUY

OBJECTIVES

- Tell how Christophe-Philippe Oberkampf's works at Jouy-en-Josas printed large pictorial repeats on cotton.
- Measure a fabric's vertical and horizontal repeat and tell a straight match from a half-drop.
- Adjust cut lengths and yardage for a repeat and sew a seam with the pattern matched.

Warm-up. Find a printed fabric in the house (a curtain, sheet, pillow or dress). Pick one distinctive spot in the print and measure straight down to where that exact spot appears again. Then measure across. Write both numbers; you have just measured the repeat.

WATCH

How to Join Patterned Fabric - Pattern Matching & Sewing

Sailrite · 6:48

<https://www.youtube.com/watch?v=48IJ7tWXQzY>

WHEN TO WATCH

After “The fabric science.” Watch how the fold is pressed on the pattern line and taped before sewing; you will use the same method in the lab.

BACKUP VIDEO

Figuring Fabric Yardage For Curtains Or Draperies

Vintage Coach Restoration | Jann Newton · 7:17

<https://www.youtube.com/watch?v=hLG9VECWBF0>

A worked yardage calculation that includes the pattern repeat; compare her steps with this lesson's formula.

KEY TERMS

vertical repeat

The distance down the fabric from one point of the pattern to the same point where the pattern starts again.

straight match

A repeat where the same motif falls at the same height on both selvages.

toile de Jouy

Fabric printed in one color on a light ground with pictorial scenes, named for the works at Jouy-en-Josas, France.

horizontal repeat

The distance across the fabric between repeats.

half-drop match

A repeat where the motif at one selvage falls half a repeat lower than at the other, so adjoining widths are offset.

copperplate printing

Printing from engraved copper plates, which allowed fine lines and large single-color scenes on cloth.

CORE IDEAS

The story. In 1760 a young German-born printer, Christophe-Philippe Oberkampf, set up a cotton-printing works in the village of Jouy-en-Josas, near Versailles. Printed cottons were the fashion of the day, and Oberkampf's prints were the best in France. At first his workers printed with carved wooden blocks, like Morris's printers a century later; then the works added engraved copper plates, which could print fine lines and whole pictures, a shepherd scene or a country fair, in a single color on pale cotton. The king honored the works as a royal manufactory in the 1780s. The one-color pictorial cloth it made famous is still called **toile de Jouy**, “cloth of Jouy.”

How they figured it out. A printing plate or block is a fixed size, so every printed pattern must **repeat**: when the plate is lifted and set down again, the next print must join the last so seamlessly that the eye never finds the edge. Designers learned to draw scenes whose edges flowed into each other top to bottom and side to side. A large plate allowed a large picture, but a large picture means a long repeat, and that is a problem the curtain maker inherits.

The fabric science. Every printed or woven pattern has a **vertical repeat**, printed on the selvage of most decorator fabrics. Two widths sewn side by side only look like one cloth if the pattern lines up across the seam, so every width must be cut at the same point in the pattern. That means each cut length must be rounded *up* to a whole number of repeats. In a **straight match**, the motif sits at the same height on both selvages, and widths cut at the same point match. In a **half-drop**, the pattern steps down half a repeat across the width, so alternate widths must be cut half a repeat lower, using more fabric.

The workroom rule. Decide where the motif should sit, usually with a full motif just below the heading of a long drape (where the eye goes) or just above the hem of a short curtain, and cut every width from that same point. Buy one extra repeat so you can choose the starting point. Match seams by pressing under one selvage on the pattern line, laying it over the other width until the pattern flows, taping or glue-basting, and stitching in the fold.

Let's sew. In the lab you will calculate repeat-adjusted yardage and sew a tab-top panel or valance of two joined widths of a printed fabric with the pattern matched so well a visitor cannot find the seam.

PICTURE STUDY



*Design for a printed fabric (toile de Jouy) with flowering sprays on a black ground, Unknown French designer, Late 18th or early 19th century · Watercolor and gouache on paper · Rijksmuseum, Amsterdam
Image: [Wikimedia Commons](#), public domain*

Before a single yard was printed, a designer painted the pattern on paper like this, planning exactly how the flowers would meet when the plate or block was set down again. This is a working drawing from the world of printed cottons that Jouy made famous.

Look closely

- Pick one large flower and look for where it might repeat if the design were tiled. Does the drawing show a full repeat?
- Look at the small background leaves. Why does a busy small ground help hide the edges of a repeat?
- Count the colors. How many separate blocks or plates would a printer need?
- Look at the edges of the painted area. Do the sprays run off the edge as if the pattern continues?

Talk about it

1. If this were your drapery fabric, where would you want a full spray to sit on each panel?
2. Is this a large-scale or a small-scale print by the rules of Lesson 1.1? What size of room or piece would it suit?
3. Why would a designer test a pattern on paper before cutting a printing plate?

Safety first. Rotary-cutting long widths: cut away from your body on a mat, blade closed whenever it is set down, the other hand flat on the ruler well away from its edge. When glue-basting, use a washable school glue stick and keep it capped. Count pins.

A Pattern-Matched Tab-Top Panel

A skill lab in pattern matching: calculate repeat-adjusted cuts, cut two widths from the same point of a printed fabric, match and sew the seam, and finish a tab-top panel or valance for a real window.

You will need

- Machine and iron
- Printed decorator fabric with a clear repeat (from your room board)
- Washable glue stick or double-sided basting tape
- Long ruler, chalk, shears or rotary cutter and mat
- A rod already hung by a parent

UNLINED TAB-TOP PANEL WITH A MATCHED SEAM

Finished size: One panel two widths wide (about 100 in flat), finished length to suit the window · About 3 hours

Fabric and notions

- 2 widths of printed fabric, each cut to the repeat-adjusted cut length
- 1 strip of fabric 6 in deep across the panel width for the top facing
- Tabs: about one per 6–8 in of flat width, each cut $4\frac{1}{2} \times 9$ in
- Thread to match

How to make it

1. Choose the motif position and mark it on the first width; cut it. Lay the second width beside it, slide it until the pattern matches, and cut it at the same point.
2. Press under the selvage of one width on the pattern line so the printed motif will meet its neighbor exactly.
3. Lay the pressed edge over the second width, matching the pattern, and glue-baste or tape it.
4. Fold the widths right sides together along the pressed line and stitch in the crease. Check from the right side; trim the seam to $\frac{1}{2}$ in and press open.
5. Make the tabs: fold each strip in half lengthwise right sides together, sew a $\frac{1}{2}$ -in seam, turn, press with the seam at the center back.
6. Fold the tabs in half and baste them, evenly spaced, to the top edge on the right side, with one at each end.
7. Sew the facing to the top over the tabs, turn it to the back, press and stitch along its lower edge.
8. Hem the sides (double $1\frac{1}{2}$ in) and the bottom (double 3 or 4 in).

Fabric check: Choose a medium-weight cotton print with a clear repeat between 6 and 27 in for a first match. Prints printed off-grain cannot be matched perfectly; check that the pattern runs square to the selvage before buying.

Steps

1. Measure the fabric's repeat yourself and check it against the selvage label.
2. Write the calculation: cut length, repeats per cut, adjusted cut length, waste, yardage.
3. Practice the matched seam on two leftover strips first.
4. Sew the panel from the pattern card.
5. Seam test: ask someone to find the seam from 6 ft away; record how long it took.
6. Measure the panel and compare with the plan; record any difference.
7. Clean up: blade closed, pins counted, iron unplugged.
8. Improve it: one change for the next matched seam.

Tips

- Match at the most obvious motif, not the background.

- Use an even-feed or walking foot if you have one; it keeps the layers from creeping.
- Cut tabs from the leftover waste lengths to save fabric.

Check your work

- ☐ My cut lengths were rounded up to whole repeats.
- ☐ My seam is matched within 1/8 in along its whole length.
- ☐ My tabs are evenly spaced and the panel hangs straight.

LAB NOTEBOOK

1. Tape in a strip of the fabric with the repeat marked in pen.
2. Show the yardage calculation for both a straight match and a half-drop of your fabric.
3. Sketch where the full motif falls on your panel.

KEY FORMULAS

$$\text{repeats per cut} = \left\lceil \frac{\text{cut length}}{\text{repeat}} \right\rceil$$

$$\text{repeats per cut} = \lceil \text{repeat} \rceil$$

$$\text{adjusted cut length} = \text{repeats per cut} \times \text{repeat}$$

$$\text{adjusted cut length} = \text{repeats per cut} \times \text{repeat}$$

$$\text{yardage} = \frac{\text{widths} \times \text{adjusted cut length} + \text{one repeat}}{36}$$

$$\text{yardage} = 36 \text{widths} \times \text{adjusted cut length} + \text{one repeat}$$

From history. Oberkampf's works also printed with engraved copper rollers in the early 1800s, which printed continuously instead of plate by plate. Roller printing made printed cotton cheap enough for ordinary homes.

WORKED EXAMPLES

Example 1. A drape's cut length is 97 in and the fabric's vertical repeat is 27 in. Find the adjusted cut length and the waste per width.

Show solution

1. Repeats: $97 \div 27 = 3.5997 \div 27 = 3.59$, round up to 4.
2. Adjusted cut length: $4 \times 27 = 108$ in $4 \times 27 = 108$ in.
3. Waste: $108 - 97 = 11$ in $108 - 97 = 11$ in per width.

Answer: Cut each width 108 in; 11 in per width is trimmed away (save it for pillows).

Example 2. The drapes need 4 widths. Find the yardage with the repeat, including one extra repeat for placement, and compare it with a solid fabric.

Show solution

1. Patterned: $4 \times 108 + 27 = 459$ in $4 \times 108 + 27 = 459$ in; $459 \div 36 = 12.75$ yd $459 \div 36 = 12.75$ yd.
2. Solid: $4 \times 97 + 6 = 394$ in $4 \times 97 + 6 = 394$ in; $394 \div 36 \approx 10.94$ yd $394 \div 36 \approx 10.94$ yd.
3. Difference: $12.75 - 10.94 \approx 1.8$ yd $12.75 - 10.94 \approx 1.8$ yd.

Answer: Buy $12\frac{3}{4}$ yd of the print, nearly 2 yd more than a solid.

Example 3. The same fabric is a half-drop. What changes for 4 widths?

Show solution

1. Widths 2 and 4 must start half a repeat lower than widths 1 and 3, so each of them uses $\frac{27}{2} = 13.5$ in $2 \times 13.5 = 27$ in more fabric.
2. Extra: $2 \times 13.5 = 27$ in $2 \times 13.5 = 27$ in.
3. Total: $459 + 27 = 486$ in $= 13.5$ yd $459 + 27 = 486$ in $= 13.5$ yd.

Answer: 13½ yd: the half-drop costs about another repeat of fabric.

Example 4. Design reasoning. A toile with a 36-in repeat has a large scene of a shepherd under a tree. For 96-in drapes, where would you place the scene, and why?

Show solution

1. The eye looks at a drape from eye level and the heading; a full scene just below the heading reads clearly when pleats break up the lower part.
2. At 96 in finished, $96 \div 36 = 2.67$ $96 \div 36 = 2.67$ repeats show: place a full scene starting just below the heading, a second full scene below it, and let the partial repeat fall at the hem, where it is least noticed.
3. Cut every width from the same point so the scenes line up across all panels and windows.

Answer: Start a full scene just below the heading on every width; the partial repeat goes at the hem.

PRACTICE

1. **Easy** Where is the vertical repeat often printed on decorator fabric?

Show answer

On the selvage.

2. **Easy** In what year and where did Oberkampf begin his printing works?

Show answer

1760, at Jouy-en-Josas near Versailles.

3. **Easy** Cut length 90 in, repeat 18 in. Adjusted cut length?

Show answer

$90 \div 18 = 5$ exactly: 90 in, no waste.

4. **Medium** Cut length 90 in, repeat 25 in. Adjusted cut length and waste?

Show answer

4 repeats, 100 in; 10 in waste.

5. **Medium** 3 widths at the adjusted 100 in, plus one 25-in repeat. Yards?

Show answer

$(300 + 25) \div 36 \approx 9.03$ $(300 + 25) \div 36 \approx 9.03$; buy 9¼ yd.

6. **Medium** What is the difference between a straight match and a half-drop?

Show answer

Straight: the motif is at the same height on both selvages. Half-drop: one selvage is half a repeat lower, so adjoining widths are offset.

7. **Medium** Why must every width be cut from the same point in the pattern?

Show answer

So the pattern lines up across the seams and the panels match each other.

8. **Hard** Two windows need 6 widths of 98-in cut length; repeat 21 in, straight match. Yards with one extra repeat?

Show answer

Repeats $\lceil 98/21 \rceil = 5$; $5 \lceil 98/21 \rceil = 5$; 105 in; $(6 \times 105 + 21) \div 36 = 18.08$; $(6 \times 105 + 21) \div 36 = 18.08$; buy $18\frac{1}{8}$ yd.

9. **Hard** The same order as a half-drop?

Show answer

Add half a repeat on 3 of the 6 widths: $3 \times 10.5 = 31.5$ in; $3 \times 10.5 = 31.5$ in; $(651 + 31.5) \div 36 \approx 18.96$; $(651 + 31.5) \div 36 \approx 18.96$; buy 19 yd.

10. **Hard** How did copperplate printing change what Jouy could print compared with wooden blocks?

Show answer

Engraved copper held very fine lines, so large detailed pictorial scenes could be printed in one color.

11. **Challenge** A 30-in-repeat fabric costs \$32/yd; a similar 9-in-repeat fabric costs \$36/yd. For 4 widths with a 97-in cut length (plus one repeat each), which costs less?

Show answer

30-in: $4 \times 120 + 30 = 510$ in = 14.17 yd, about \$453. 9-in: $4 \times 99 + 9 = 405$ in = 11.25 yd, about \$405. The dearer small-repeat fabric costs less overall.

COMMON MISTAKES

- Rounding the cut length down to save fabric, which makes the widths impossible to match.
- Cutting the second width from a different point in the pattern.
- Sewing a matched seam with pins only; the layers creep. Glue-baste or tape.

Make it a game · Repeat Hunt. A parent sets out four printed fabrics or wrapping papers. Players have two minutes to measure the vertical repeat of each and name it straight or half-drop. Closest measurement to the parent's wins each fabric; naming the match type correctly earns a bonus point.

3.4 LINING, INTERLINING AND THE WARM WINDOW

OBJECTIVES

- Explain how lining and interlining protect a face fabric and block light, drafts and heat loss at a window.
- Calculate face and lining cut sizes for a lined panel.
- Sew a lined back-tab or rod-pocket panel and test how much light it blocks.

Warm-up. On a cold or hot day, stand with your hand an inch from a window's glass, then from a curtained part of the same window. Feel the difference. Then hold a curtain up to a bright window: is it lined? Can you see the light through it?

WATCH

How to make basic lined curtains

[Adrian Birtwell](#) · 12:24

<https://www.youtube.com/watch?v=Yrg5vl6m0Ug>

WHEN TO WATCH

After “The fabric science.” Watch how the lining is cut narrower and shorter than the face and how the corners are mitered; pause and sketch each step.

Note: An experienced English curtain maker, Jean French, at her cutting table.

BACKUP VIDEO

How to make a basic lined drapery panel/curtain.

[mimzy & company](#) · 10:10

https://www.youtube.com/watch?v=xdpdXSf_HfE

An American workroom version on a padded table; notice the double hems and the lining set shorter than the face.

KEY TERMS

lining

A layer of fabric, usually cotton sateen or a blend, sewn behind the face fabric.

blackout lining

Lining coated with layers of foam or woven densely enough to block nearly all light.

mitered corner

A neat diagonal fold at a hem corner that removes bulk.

interlining

A soft, thick layer (cotton flannel or felt, sometimes called bump) between face and lining for body, warmth and silence.

turnback

The part of the face fabric folded around to the back at the sides, so the lining does not show from the front.

stack of still air

Air trapped between layers that cannot move; still air is a good insulator.

CORE IDEAS

The story. Look at a Dutch interior of the 1600s and you will see how serious the window was. Houses were heated by a hearth or a little foot stove, glass was thin, and the window was both the only good light and the coldest place in the room. Householders managed it with inside shutters, opened top or bottom to let in just as much light as the work needed, and with curtains on beds and windows. English workrooms later perfected the interlined curtain: face fabric, a thick soft interlining and a lining, sewn together by hand so they hang as one, heavy enough to stop drafts and soft enough to fold.

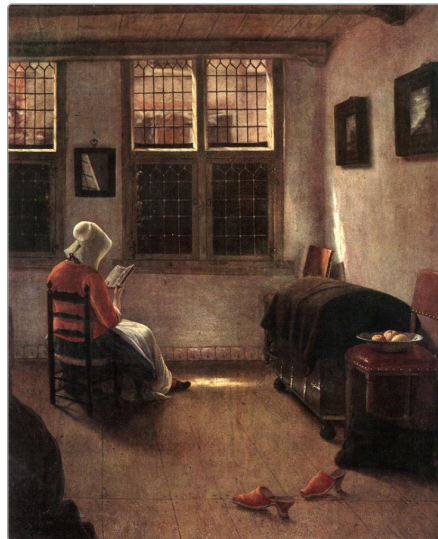
How they figured it out. Cold windows chill the air beside them; the cold air sinks and flows out along the floor, pulling warm room air down behind the curtain in a loop. Curtain makers learned to close that loop: lined drapes that reach the floor, returns that wrap to the wall, and a valance or cornice that closes the top. They also learned that the sun destroys an unlined face fabric (your fade rack showed it) while a plain lining facing the glass takes the damage instead.

The fabric science. Each layer has a job. The **lining** protects the face from sun and dust, gives body, hides seams and hems, and makes the window look tidy from outside. The **interlining** adds thickness and holds still air, which insulates, and it deadens sound. A **blackout** lining blocks light for bedrooms. The more layers of still air between room and glass, the slower the heat leaves. Lining is cut narrower and shorter than the face so that the face turns back at the sides (about 1½ in) and the lining's hem sits about 1 in above the face's hem.

The math. Cut the face and lining the same number of widths. Face width per panel = finished width + 2 × (side hem); lining width = face width – 2 × turnback – the side hem folds. The lining's cut length is shorter because its hem is shallower and it stops below the top. Writing two cut lists, face and lining, keeps the pieces straight.

Let's sew. Your lab is a lined back-tab (or rod-pocket) panel for a real window, plus a light test of four samples: face alone, face plus lining, face plus interlining and lining, and face plus blackout lining.

PICTURE STUDY



Woman Reading, Pieter Janssens Elinga, c. 1668–1670 · Oil on canvas · Alte Pinakothek, Munich
Image: [Wikimedia Commons](#), public domain

Elinga painted the light in a Dutch room more carefully than the woman in it. The lower shutters are closed and only the upper panes are open, so the light comes in high and falls just where she needs it. This is window management before curtains were common.

Look closely

- Find which shutters are open and which are closed. Where does that put the light?
- Look at the cloth laid over the bed or chest. What is it for: warmth, dust, looks?
- Find the bright squares of sun on the wall and floor. What would they do to a fabric left lying there for years?
- Look at her clothes. How is she dressed for a cool room?

Talk about it

1. If you hung lined drapes at these windows, how would they change the room's light and warmth?
2. Why do you think the lower shutters are closed: privacy, warmth, glare or all three?
3. What does this picture teach about controlling light, rather than just blocking it?

Safety first. Long lined panels are heavy: lift them with help and support the weight on a table while sewing so they do not drag the needle. Keep the iron's cord away from the trailing fabric. If you test with a light meter app at a sunny window, do not look at the sun. Count pins.

A Lined Panel and the Light Test

Sew a lined back-tab (or rod-pocket) panel for a real window with turned-back sides and a lining hem set above the face hem, then measure how much light four layer combinations block.

You will need

- Machine and iron
- Face fabric and cotton drapery lining (plus a scrap of interlining or flannel and of blackout lining for the test)
- Long ruler, chalk, shears
- A phone light-meter app or a camera's exposure reading
- A rod already hung by a parent

LINED BACK-TAB PANEL

Finished size: One panel, one width wide, finished 84 in long (adjust to your window) · About 3–4 hours

Fabric and notions

- 1 width of 54-in face fabric, cut 98 in
- 1 width of lining, cut 46 × 87 in
- 6–7 back tabs, each 3 × 6 in finished, from lining or face fabric
- 1 strip of facing 54 × 6 in (or a 4-in drapery header tape)
- Thread to match

How to make it

1. Hem the face: press up 4 in twice and stitch or blind-hem. Hem the lining: press up 2 in twice and stitch.
2. Lay the face right side up, the lining right side down on top, top edges even and the lining hem 1 in above the face hem.
3. Align one side edge of lining and face and sew a ½-in seam, stopping above the hem. Repeat on the other side; the face is wider, so it will bunch until turned.
4. Turn right side out and center the lining so the face wraps 1½ in around each side; press the turnbacks.
5. Miter the bottom corners of the face and slip-stitch the turnback to the hem by hand.
6. Make the back tabs and baste them, evenly spaced, to the lining side at the top.
7. Finish the top with the facing (or header tape), catching the tab ends; press, and topstitch.
8. Slip the rod through the tabs; the front shows a smooth heading and the tabs stay hidden.

Fabric check: Medium-weight cotton, linen blend or polyester face fabrics line well. Use a cotton or poly-cotton sateen drapery lining; it is made to hang well and resist sun. Prewash face and lining together if the panel will be washed (or plan to dry-clean); otherwise they may shrink by different amounts.

Steps

1. Write the face and lining cut lists and have a parent check them.
2. Light test: hold each combination (face; face + lining; face + interlining + lining; face + blackout) flat against the same sunny window and take a reading at the same distance. Record three readings each and the bare-window reading.
3. Sew the panel from the pattern card.
4. Hang it and check: does any lining show at the sides or hem? Is the hang straight?
5. Compute percent blocked for each test combination and graph them.
6. Clean up: pins counted, iron unplugged and upright.
7. Improve it: one change for the drapes you will make in Lesson 3.5.

Tips

- A long table or two tables side by side makes lined panels far easier.
- Weights sewn into the bottom corners help a lined panel hang straight.

- Cut lining from the same direction as the face so both hang on the same grain.

Check your work

- ☐ My lining does not show from the front at the sides or hem.
- ☐ My cut lists match the finished panel.
- ☐ My light test has a control (bare window), three trials and percentages.

LAB NOTEBOOK

1. Draw the panel's cross-section: face, turnback, lining, hems, with measurements.
2. Graph percent of light blocked for the four samples.
3. Tape in small squares of each layer used.

KEY FORMULAS

$$\text{lining cut width} = \text{face cut width} - 2 \times (\text{side hem} + \text{turnback})$$

$$\text{lining cut width} = \text{face cut width} - 2 \times (\text{side hem} + \text{turnback})$$

$$\text{lining cut length} = \text{face cut length} - (\text{face hem} - \text{lining hem}) - \text{top difference}$$

$$\text{lining cut length} = \text{face cut length} - (\text{face hem} - \text{lining hem}) - \text{top difference}$$

$$\text{percent light blocked} = \frac{\text{bare reading} - \text{covered reading}}{\text{bare reading}} \times 100\%$$

$$\text{percent light blocked} = \frac{\text{bare reading} - \text{covered reading}}{\text{bare reading}} \times 100\%$$

From history. English workrooms traditionally hand-sew a loose “lock stitch” every foot or so to hold interlining and lining to the face, so all the layers hang together without visible stitching on the front.

WORKED EXAMPLES

Example 1. A one-width panel is cut from 54-in face fabric with 1½-in side turnbacks folded once (3 in total per side including the hem fold). How wide do you cut the lining so it sits 1½ in in from each finished edge?

Show solution

1. Finished panel width: $54 - 2 \times 3 = 48$ in $54 - 2 \times 3 = 48$ in.
2. The lining reaches to 1½ in from each finished edge: $48 - 2 \times 1.5 = 45$ in $48 - 2 \times 1.5 = 45$ in finished lining width.
3. Add ½-in seam allowance each side where it is sewn to the face turnback: $45 + 1 = 46$ in $45 + 1 = 46$ in.

Answer: Cut the lining 46 in wide (8 in narrower than the face).

Example 2. The face is cut 98 in (84 in finished + double 4-in hem + 6 in top). The lining gets a double 2-in hem and sits 1 in above the face's hem, and its top is caught ½ in below the face's top fold. Find the lining's cut length.

Show solution

1. Finished lining length: $84 - 1 - 0.5 = 82.5$ in $84 - 1 - 0.5 = 82.5$ in.
2. Add its double 2-in hem and ½ in at the top: $82.5 + 4 + 0.5 = 87$ in $82.5 + 4 + 0.5 = 87$ in.

Answer: Cut the lining 87 in.

Example 3. A light meter app reads 5,200 lux at a sunny window. Behind face fabric alone it reads 1,560 lux; behind face and lining, 260 lux; behind blackout, 6 lux. Find the percent blocked for each.

Show solution

1. Face: $\frac{5,200 - 1,560}{5,200} \times 100\% = 70\%$
2. Face + lining: $\frac{5,200 - 260}{5,200} \times 100\% = 95\%$
3. Blackout: $\frac{5,200 - 6}{5,200} \times 100\% \approx 99.9\%$

Answer: 70%, 95% and about 99.9% blocked.

Example 4. Design reasoning. A north bedroom is cold in winter and the family's daughter wakes at sunrise in summer. Specify the layers and the details that stop the cold-air loop.

Show solution

1. Layers: face fabric, a flannel interlining for warmth and body, and a blackout lining for the summer sunrise.
2. Length: to the floor ($\frac{1}{2}$ in clearance), so cold air cannot pour out under the hem.
3. Sides: returns that wrap from the rod to the wall, and drapes overlapping at the center.
4. Top: a valance or cornice, or a rod mounted close to the ceiling, to close the top of the loop.

Answer: Interlined, blackout-lined, floor-length drapes with returns and a closed top.

PRACTICE

1. **Easy** Name three jobs of a drapery lining.

Show answer

Protects the face from sun and dust; adds body; hides seams and hems; blocks light; looks tidy from outside.

2. **Easy** What does an interlining add?

Show answer

Thickness, warmth (still air), body and quiet.

3. **Easy** Why does the lining hem sit above the face hem?

Show answer

So the lining never peeks below the face.

4. **Medium** Face cut width 54 in, 3 in per side for hems, lining sits $1\frac{1}{2}$ in in from each edge, $\frac{1}{2}$ -in seams. Lining cut width?

Show answer

$54 - 6 - 3 + 1 = 46$ in

5. **Medium** A light meter reads 4,000 lux bare and 1,000 lux behind a curtain. Percent blocked?

Show answer

75%

6. **Medium** Explain the cold-air loop at a window.

Show answer

Air chilled by the glass sinks, flows out under the curtain along the floor, and pulls warm room air down into the gap at the top.

7. **Medium** Face finished length 90 in; lining hem 1 in above; top caught $\frac{1}{2}$ in below. Finished lining length?

Show answer

88.5 in

8. **Hard** Lining for 4 widths at 87-in cut length: how many yards, and the cost at \$7.50\$7.50/yd?

Show answer

$348 \div 36 = 9.67$ $348 \div 36 = 9.67$ yd, buy $9\frac{3}{4}$; about \$73\$73.

9. **Hard** Why might you choose a light cotton lining rather than blackout for a living room?

Show answer

Blackout makes the room dark and heavy by day and costs more; a plain lining still protects the face and adds body while letting the drapes glow.

10. **Hard** A bare window reads 6,000 lux; you need at least 90% blocked. What is the highest acceptable reading behind the drape?

Show answer

$6,000 \times 0.10 = 600$ lux $6,000 \times 0.10 = 600$ lux.

11. **Challenge** Why does adding a second still-air layer slow heat loss more than simply making one fabric thicker in the same total space? Answer in terms of air movement.

Show answer

Separate layers trap pockets of still air that cannot circulate; a single thick but open fabric lets air move through it, carrying heat. Many thin still-air spaces resist heat flow better.

COMMON MISTAKES

- Cutting the lining the same width as the face, which lets it show at the sides.
- Forgetting that face and lining may shrink differently.
- Measuring light at different distances or times, which spoils the comparison.

Make it a game · Layer Guess. A parent stacks two to four layers of fabric (face, lining, flannel, blackout) inside a pillowcase so you cannot see them. Hold the stack to a bright window for five seconds and guess how many layers and which ones. Then check with the light meter. Two points for the right count, one for each layer named.

3.5 FIFTY LOOPS: PINCH PLEATS AND THE FINISHED DRAPE

OBJECTIVES

- Plan the finished width of a drape panel with returns and overlap, and calculate pleat size and spacing.
- Explain how buckram, pleats and hooks make a drape hang in even folds.
- Sew a lined, pinch-pleated drape pair for a real window and dress it so it hangs well.

Warm-up. Look at a pleated drape (in your house, a church, a hotel or a store). Count the pleats on one panel and measure the flat spaces between them. Are the spaces equal? Where are the first and last pleats?

WATCH

Figuring Pleats and Spaces for Pinch Pleated Curtains

[Vintage Coach Restoration | Jann Newton](#) · 12:09

https://www.youtube.com/watch?v=UJ2WA_VbzQA

WHEN TO WATCH

After “The math.” Most of the video is her worksheet on screen; pause and work her example on paper beside her, then do your own window.

Note: A longtime drapery maker's pleat-and-space worksheet, the same calculation as this lesson's formulas.

BACKUP VIDEO

Sewing Pinch Pleats

[Vintage Coach Restoration | Jann Newton](#) · 11:46

<https://www.youtube.com/watch?v=-xNmzVycCK8>

Watch before sewing: she folds, stitches and hand-tacks pinch pleats on a real drape.

KEY TERMS

pinch pleat

A group of two or three small folds stitched together at the top of a drape and tacked at the base, spaced evenly across the heading.

return

The part of a drape panel that wraps from the front of the rod back to the wall.

pleat allowance

The total width of fabric taken up by pleats: flat width minus finished width.

buckram

A stiff woven interfacing, usually 4 in deep, sewn into the heading to hold the pleats upright.

overlap

The part of each panel at the center that crosses over its partner when the drapes close.

drinking (training) drapes

Folding the hanging drapes into even folds and tying them loosely for a day or two so they learn to hang that way.

CORE IDEAS

The story. When the tabernacle curtains were joined, Exodus 26 specifies fifty loops of blue on the edge of one set and fifty on the edge of the other, coupled with fifty taches of gold, “that the loops may take hold one of another.” Fifty loops along the 42-foot edge of a curtain means a loop every ten inches or so, and the loops had to match, loop for loop, across two curtains, or the joined cloth would pucker. Evenly spaced fastenings on a long edge are exactly the problem of a pleated drapery heading.

How they figured it out. Gathered curtains on a rod (Lesson 3.2) bunch wherever the rod lets them. Workrooms wanted folds that were even, permanent and easy to open and close, so they stiffened the top of the drape with **buckram**, stitched the extra fullness into evenly spaced **pinch pleats**, and hung each pleat from a hook in a ring or a traverse-rod carrier. The fullness is the same as for any drape, about 2 to 2½ times; the pleats simply decide where it goes.

The math. Every pleated drape is planned from its **finished width**: half the rod's face width plus a **return** (the distance from rod to wall) plus an **overlap** (about 3½ in) at the center. The **flat width** is the hemmed panel before pleating. Pleat allowance = flat width – finished width; divide by the number of pleats (about five per width of 48–54-in fabric) to get the pleat size, usually 4–6 in. The spaces between pleats = (finished width – return – overlap) ÷ (pleats – 1), usually 3½–4½ in. The first pleat sits at the corner where the return turns, the last at the start of the overlap.

The craft. Mark the pleats and spaces across the buckram heading, fold each pleat allowance in half and stitch it straight down to the bottom of the buckram, divide it into two or three small folds, and hand-tack them together at the base. Hooks go in behind each pleat and at each end. Once the drapes hang, **dress** them: fold the fabric below each pleat back toward the window in even folds, tie loosely with strips of fabric, and leave them two days so the folds set.

Let's sew. This lab is the unit's project piece: a lined, pinch-pleated pair for the window you surveyed in Lesson 3.1, built from a full calculation sheet.

PICTURE STUDY



Interior, Carl Holsøe, Late 19th or early 20th century · Oil on canvas · Location not recorded

Image: [Wikimedia Commons](#), public domain

Carl Holsøe, a friend of Hammershøi, painted calm Copenhagen rooms full of soft northern light. The long pale curtain here does what a good drape does: it hangs in even vertical folds from top to floor, filters the light, and makes the window part of the room's architecture.

Look closely

- Follow the curtain from top to floor. Are the folds even? Where do they break?
- Look at where the curtain meets the floor. Does it touch, puddle or hang just clear?
- Find the light on the woman's collar and the table. How is the curtain changing that light?
- Look at the window's height compared with the room. What does the long line of the curtain do to the wall?

Talk about it

1. Would pinch pleats or a simple gathered heading suit this curtain better? Why?
2. If you lined this curtain, how would the room's light change?
3. What do you notice about how little decoration the room needs when the window is well dressed?

Safety first. Heavy pleated drapes are hung by two people from a sturdy ladder, with a parent fixing the rod or traverse brackets into studs or proper anchors. Hand-tacking pleats through buckram takes force: use a thimble and push the needle away from your other hand. Count pins and hooks.

Lined Pinch-Pleated Drapes for Your Window

The Unit 3 project lab: from your Lesson 3.1 survey, calculate, cut, sew, pleat, hang and dress a lined pair of pinch-pleated drapes, keeping a complete calculation sheet and construction log.

You will need

- Machine, iron, long table
- Face fabric and lining (from your board)
- 4-in sew-in drapery buckram
- Pin-on or slip-in drapery hooks
- A traverse rod or rings on a pole, installed by a parent
- Thimble, hand needle, strong thread, long ruler, chalk

LINED PINCH-PLEATED DRAPERY PAIR

Finished size: One pair for a 72-in rod face, 3½-in returns, finished 85 in long (adjust to your window) · About 8–10 hours over several sessions

Fabric and notions

- Face: 4 widths of 54-in fabric, cut length = $85 + 8$ (double 4-in hem) + 8 (double 4-in buckram heading) = 101 in, rounded up to whole repeats if printed
- Lining: 4 widths, joined to match the face panels and cut 8 in narrower than the face, each 88 in long ($85 - 1 - \frac{1}{2} + 4 + \frac{1}{2}$)
- Buckram: 2 strips, 4 in deep, each as long as the flat panel width
- About 22 drapery hooks
- Thread to match

How to make it

1. Join 2 face widths for each panel (match any print) and 2 lining widths; press seams open.
2. Hem face and lining (Lesson 3.4), the lining 1 in above the face hem.
3. Join lining to face at the sides with turnbacks; press.
4. Lay buckram along the top of the face on the wrong side, 4 in down from the top; fold the face over it, then over again so the buckram is enclosed in a double heading. Stitch the ends.
5. Mark the return and overlap at each end, then the pleat and space positions across the heading from your calculation.
6. Fold each pleat allowance in half, right sides together, and stitch straight down from the top to the bottom of the buckram.
7. Divide each pleat into two or three small folds at the base and hand-tack them together through all layers.
8. Insert hooks behind each pleat and at each end; hang, with returns hooked to the brackets.
9. Dress the drapes into even folds and tie them loosely for two days.

Fabric check: Choose a medium-weight decorator fabric; very heavy cloth makes bulky pleats, and very thin cloth needs interlining to pleat well. Use sew-in buckram for washable drapes, or fusible buckram for dry-clean-only. Patterned fabric needs repeat-adjusted cut lengths (Lesson 3.3).

Steps

1. Write the complete calculation sheet: rod face, returns, overlap, finished width, widths, flat width, pleat allowance, number of pleats, pleat size, space, cut lengths, yardage and cost. A parent checks it.
2. Make a 2-pleat sample heading from scraps with buckram to test your pleat size.
3. Sew the drapes from the pattern card, logging each session's work and time.
4. Hang, measure the finished width and length of each panel, and compare with the plan.
5. Dress the drapes; after two days photograph them closed and open from the doorway.
6. Clean up: pins and hooks counted, iron unplugged.
7. Improve it: write what you would change on the next pair.

Tips

- Lay out all pleat marks before stitching any; check the total adds up to the flat width.
- Hide seams inside pleats where you can by adjusting a space slightly.
- Pin-on hooks can be moved up or down to adjust the length by $\frac{1}{2}$ in.

Check your work

- ☐ My calculation sheet adds up exactly to the flat width.
- ☐ My pleats are equal within $\frac{1}{8}$ in and my spaces within $\frac{1}{4}$ in.
- ☐ The drapes hang level, clear the floor as planned and close at the center.

LAB NOTEBOOK

1. Draw the heading of one panel to scale with pleats, spaces, return and overlap labeled.
2. Paste the calculation sheet and the construction log.
3. Tape in the doorway photos and compare them with the Lesson 3.1 mock-up.

KEY FORMULAS

$$\text{finished width per panel} = \frac{\text{rod face width}}{2} + \text{return} + \text{overlap}$$

$$\text{finished width per panel} = 2\text{rod face width} + \text{return} + \text{overlap}$$

$$\text{pleat allowance} = \text{flat width} - \text{finished width}$$

$$\text{pleat allowance} = \text{flat width} - \text{finished width}$$

$$\text{pleat size} = \frac{\text{pleat allowance}}{\text{number of pleats}}$$

$$\text{pleat size} = \text{number of pleats} \times \text{pleat allowance}$$

$$\text{space} = \frac{\text{finished width} - \text{return} - \text{overlap}}{\text{number of pleats} - 1}$$

$$\text{space} = \text{number of pleats} - 1 \times \text{finished width} - \text{return} - \text{overlap}$$

From history. Before traverse rods with cords and carriers, heavy drapes were often pulled open by hand with a long baton or held back by tiebacks and hooks. Draw cords made opening easy; Lesson 4.1 explains why any cord in a home must now be made safe.

WORKED EXAMPLES

Example 1. A traverse rod has a 72-in face width and a $3\frac{1}{2}$ -in return; each panel overlaps $3\frac{1}{2}$ in. Find the finished width of each panel.

Show solution

1. Half the face: $72 \div 2 = 36$ in $72 \div 2 = 36$ in.
2. Add return and overlap: $36 + 3.5 + 3.5 = 43$ in $36 + 3.5 + 3.5 = 43$ in.

Answer: Each panel finishes 43 in 43 in wide.

Example 2. Each panel is 2 widths of 54-in fabric joined with a $\frac{1}{2}$ -in seam, with 3 in of side hem folded under on each side. Find the flat width, the pleat allowance, and the size of each of 10 pleats.

Show solution

1. Flat width: $2 \times 54 - 1 - 2 \times 3 = 101$ in $2 \times 54 - 1 - 2 \times 3 = 101$ in.
2. Pleat allowance: $101 - 43 = 58$ in $101 - 43 = 58$ in.
3. Pleat size: $58 \div 10 = 5.8$ in $58 \div 10 = 5.8$ in.

Answer: Flat width 101 in; 58 in of pleats; each pleat 5.8 in (about $5\frac{3}{4}$ in).

Example 3. Find the space between pleats for that panel, and check the fullness.

Show solution

1. Spaces: $\frac{43 - 3.5 - 3.5}{10 - 1} = \frac{36}{9} = 4$ in $10 - 143 - 3.5 - 3.5 = 936 = 4$ in.
2. Check: $10 \times 5.8 + 9 \times 4 + 3.5 + 3.5 = 58 + 36 + 7 = 101$ in $10 \times 5.8 + 9 \times 4 + 3.5 + 3.5 = 58 + 36 + 7 = 101$ in flat.
3. Fullness: $101 \div 43 \approx 2.35 \times 101 \div 43 \approx 2.35 \times$.

Answer: 4-in spaces; the layout uses exactly the 101-in flat width at about 2.35× fullness.

Example 4. The tabernacle curtain's coupling edge was about 504 in (28 cubits at 18 in) with fifty loops. If loops sat at each end and evenly between, what was the spacing?

Show solution

1. Fifty loops make $50 - 1 = 49$ spaces.
2. Spacing: $504 \div 49 \approx 10.3$ in $504 \div 49 \approx 10.3$ in.

Answer: About 10¼ in between loops, the same reasoning as spacing pleats: count the spaces, not the pleats.

PRACTICE

1. **Easy** What does buckram do in a pleated heading?

Show answer

It stiffens the heading so the pleats stand upright and even.

2. **Easy** A rod's face is 60 in; return 3½ in; overlap 3½ in. Finished width per panel?

Show answer

$30 + 7 = 37$ in $30 + 7 = 37$ in.

3. **Easy** How many spaces are there between 8 pleats?

Show answer

7.

4. **Medium** Flat width 96 in, finished 40 in, 10 pleats. Pleat size?

Show answer

$56 \div 10 = 5.6$ in $56 \div 10 = 5.6$ in.

5. **Medium** Finished 40 in, return 3½, overlap 3½, 10 pleats. Space?

Show answer

$33 \div 9 \approx 3.67$ in $33 \div 9 \approx 3.67$ in.

6. **Medium** Why plan about five pleats per width of fabric?

Show answer

It gives pleats of about 4–6 in and spaces of about 4 in, the proportions that hang well; seams can hide inside pleats.

7. **Medium** What is dressing a drape, and why do it?

Show answer

Folding the hung drape into even folds and tying it loosely for a day or two so the folds set and it hangs neatly.

8. **Hard** Rod face 90 in, return 4 in, overlap 3½ in, 2½ widths of 54-in fabric per panel (2 seams), side hems 3 in each side. Find finished width, flat width and pleat allowance.

Show answer

Finished $45 + 7.5 = 52.5$ in $45 + 7.5 = 52.5$ in; flat $135 - 2 - 6 = 127$ in $135 - 2 - 6 = 127$ in; allowance 74.5 in 74.5 in.

9. **Hard** For that panel with 13 pleats, find pleat size and space.

Show answer

Pleat $74.5 \div 13 \approx 5.73$ in $74.5 \div 13 \approx 5.73$ in; space $(52.5 - 7.5) \div 12 = 3.75$ in $(52.5 - 7.5) \div 12 = 3.75$ in.

10. **Hard** Fifty loops on a 42-ft edge: how many inches apart, with a loop at each end?

Show answer

$504 \div 49 \approx 10.3$ in $504 \div 49 \approx 10.3$ in.

11. **Challenge** A drape's pleat size comes out at 8 in, which is too deep. Give two ways to fix the layout and show the effect with numbers for flat width 101 in, finished 43 in.

Show answer

Add pleats: 12 pleats gives $58 \div 12 \approx 4.8$ in $58 \div 12 \approx 4.8$ in (spaces $36 \div 11 \approx 3.3$ $36 \div 11 \approx 3.3$); or reduce flat width (fewer widths or wider side hems), lowering fullness; or widen the finished width with a longer return.

COMMON MISTAKES

- Dividing the width by the number of pleats instead of the number of spaces.
- Forgetting the return, so the drape cannot reach the wall.
- Hanging drapes and never dressing them, so the folds splay.

Make it a game · Pleat Math Sprint. A parent writes a rod width, return, overlap, number of widths and number of pleats on a card. Each player races to find the finished width, pleat size and space. Fastest correct full set scores three; a correct set that also checks out (pleats + spaces + return + overlap = flat width) scores a bonus point.

UNIT 3 TEST

Calculators are allowed. Show your work for every calculation: write the formula, substitute with units, and give the answer with its unit. Answer concept questions in complete sentences. The test is worth 100 points.

1. **6 pts**
Give the size of each tabernacle linen curtain in cubits and in feet (1 cubit $\approx$ 18 in), and what materials Exodus 26:1 names.
2. **6 pts**
A window frame is 52 in wide. With 9-in extensions, what rod width?
3. **6 pts**
A rod is mounted at 88 in, rings drop $1\frac{1}{2}$ in, floor clearance $\frac{1}{2}$ in. Finished length?
4. **6 pts**
Give typical fullness ratios for sheers, medium-weight cottons and heavy lined drapes.
5. **7 pts**
A 56-in rod at $2\frac{1}{2}\times$ fullness, 12 in of side hems, 54-in fabric. How many widths?
6. **7 pts**
Finished length 84 in, double 4-in hem, 8-in top allowance, 4 widths, 6 in extra. Cut length and yards?
7. **6 pts**
Find the rod pocket depth for a $1\frac{1}{4}$ -in rod by the formula, and explain the $\frac{1}{2}$ in.
8. **7 pts**
Cut length 97 in, repeat 22 in, straight match. Adjusted cut length and waste per width?
9. **6 pts**
For 4 widths of that fabric plus one repeat, how many yards? How would a half-drop change it?
10. **6 pts**
Who founded the printing works at Jouy-en-Josas, when, and what did copper plates make possible?
11. **6 pts**
Name the jobs of a lining and of an interlining.
12. **6 pts**
Face cut width 54 in, 3 in per side for hems, lining $1\frac{1}{2}$ in in from each finished edge, $\frac{1}{2}$ -in seams. Lining cut width?
13. **6 pts**
A bare window reads 8,000 lux; behind a lined drape, 480 lux. Percent blocked?
14. **6 pts**
Rod face 64 in, return $3\frac{1}{2}$ in, overlap $3\frac{1}{2}$ in. Finished width per panel?
15. **7 pts**
Flat width 92 in, finished 39 in, 9 pleats. Find pleat size and space.
16. **6 pts**
Explain the cold-air loop at a window and three drapery details that block it.

UNIT PROJECT: LINED DRAPES FOR A REAL WINDOW

Finish and hang the lined, pinch-pleated drapes from Lesson 3.5 for the window you surveyed in Lesson 3.1, dressed and photographed.

Submit the window survey, the mock-up photos, the full calculation sheet (widths, cut lengths, repeat, lining, pleats and spaces, yardage and cost), the construction log, the light-test results and a one-page reflection comparing the finished drapes with the plan.

LOOK FOR	WHAT IT MEANS
Measurement and calculation	Survey complete; calculation sheet adds up; finished width and length within ½ in of plan.
Workmanship	Straight hems, matched seams, lining hidden, pleats even, heading crisp.
Hang and finish	Level, clears the floor as planned, closes at the center, returns reach the wall, dressed folds.
Safety	Ladder spotted, brackets installed by a parent, pins and hooks counted, tools handled by the rules.
Records and reflection	Log, photos and light test filed; honest comparison with the plan and one improvement.

ANSWER KEY

1. 28×4 cubits, about 42×6 ft; fine twined linen, blue, purple and scarlet, with cherubims.
2. $52 + 18 = 70$ in $52 + 18 = 70$ in.
3. 86 in 86 in.
4. Sheers $2\frac{1}{2}$ –3×; medium 2 – $2\frac{1}{2}$ ×; heavy lined about 2×.
5. $(140 + 12) \div 54 = 2.81$ $(140 + 12) \div 54 = 2.81$, so 3 widths (or 4 for equal panels of whole widths).
6. Cut 100 in 100 in; $406 \div 36 = 11.28$ $406 \div 36 = 11.28$, buy $11\frac{3}{8}$ yd.
7. $0.5\pi(1.25) + 0.5 \approx 2.46$ in $0.5\pi(1.25) + 0.5 \approx 2.46$ in; the $\frac{1}{2}$ in is ease so the rod slides.
8. $\lceil 4.41 \rceil = 5$ $\lceil 4.41 \rceil = 5$ repeats; 110 in; 13 in waste.
9. $(440 + 22) \div 36 = 12.83$ $(440 + 22) \div 36 = 12.83$ yd, buy $12\frac{7}{8}$; half-drop adds about half a repeat on 2 widths, 22 in more, about $13\frac{1}{2}$ yd.
10. Christophe-Philippe Oberkampf, 1760; fine-lined, large pictorial scenes printed in one color.
11. Lining: protects face from sun and dust, body, hides seams, blocks light, tidy outside. Interlining: warmth (still air), body, sound deadening.
12. 46 in 46 in.
13. 94% 94%.
14. $32 + 7 = 39$ in $32 + 7 = 39$ in.
15. Allowance 53 in; pleat $53 \div 9 \approx 5.89$ in $53 \div 9 \approx 5.89$ in; space $(39 - 7) \div 8 = 4$ in $(39 - 7) \div 8 = 4$ in.
16. Glass-chilled air sinks and flows out under the drape, pulling warm air in at the top. Floor-length hems, returns to the wall, and a closed top (valance, cornice or high rod).

SHADES, VALANCES AND BED LINENS

This unit finishes the window and moves to the bed. It begins with a safety rule stated plainly: looped and dangling window cords are a strangulation hazard for young children, so every shade in this course is cordless. You will make a faux Roman shade with fixed folds and a padded cornice board, your first stapled upholstery, and learn the valance and lambrequin traditions behind them.

Then the bed: the truth about thread count, percale and sateen, counted with your own linen tester; pillowcases with French seams; a duvet cover sewn from two sheets; and a bed skirt measured to a real bed. The math covers fold take-up and ring spacing, cornice sizing and railroading, thread count and plies, cost per night, closure spacing, and gathered and pleated skirt lengths.

PREREQUISITES

- Unit 3's hems, lining and measuring
- A parent's sign-off on the staple gun before Lesson 4.2
- Ratios, rounding and simple cost comparisons

MASTERY CHECKLIST

- ☐ I can state the window-cord rule and audit a house's window coverings with a parent.
- ☐ I can size and sew a cordless faux Roman shade.
- ☐ I can size, pad and cover a cornice board with safe stapling.
- ☐ I can count a fabric's thread count and explain what it does and does not mean.
- ☐ I can sew French seams, a duvet cover and a bed skirt measured to a real bed.

OPTIONAL BOOKS AND TOOLS FOR THIS UNIT

- **A linen tester (pick glass):** A small folding magnifier with a measured window, sold for a few dollars at fabric, stamp and hobby stores; used again in Units 5 and 9.
- **A manual staple gun, 3/8-in staples, a tack lifter and safety glasses:** The basic upholstery kit for Lesson 4.2 and Units 6–8. Safety glasses are required, not optional.
- **U.S. Consumer Product Safety Commission: window covering safety information:** Free. Search the CPSC's website for “window covering cords” for the agency's current advice to families.

Not required. Every project in this unit works with ordinary fabric-store supplies. School Launch has no ties to these authors, publishers or companies.

LESSONS IN THIS UNIT

4.1 The Roman Shade and the Cord That Must Not Loop	3 sessions of 50–90 minutes
4.2 Valances, Cornices and Lambrequins	3 sessions of 50–90 minutes
4.3 Thread Count, Percale and Sateen	3 sessions of 50–90 minutes
4.4 The Duvet Cover	3 sessions of 50–90 minutes
4.5 Bed Skirts and the Measured Bed	3 sessions of 50–90 minutes

4.1 THE ROMAN SHADE AND THE CORD THAT MUST NOT LOOP

OBJECTIVES

- State the window-cord safety rule plainly and explain why looped and dangling cords are a strangulation hazard for young children.
- Describe flat, hobbled and relaxed Roman shades and how rings, rods and folds work.
- Calculate the cut size, fold spacing and fabric take-up for a stationary (faux) Roman shade, and sew one.

Warm-up. Look at every blind, shade and curtain in the house. List each one that has a pull cord, a bead chain or a loop. How high off the floor does each cord hang? Could a toddler standing on a bed or sofa reach it? Write down what you find; you will use the list in this lesson.

WATCH

Faux (fake) Roman Shade (An easy project!)

Scott Weaver · 23:02

<https://www.youtube.com/watch?v=ep3ZmFAfanU>

WHEN TO WATCH

After “The fabric science.” Watch once through, then again at your cutting table, pausing at each fold he marks. His shade has fixed folds and no working lift cord, the same kind you will make.

Note: A professional drapery workroom owner. The rings are tied in fixed positions; nothing hangs or loops.

BACKUP VIDEO

Window Coverings Safety PSA

U.S. Consumer Product Safety Commission · 1:38

<https://www.youtube.com/watch?v=mVSQcFduNac>

Watch with a parent before the lab. It shows, with a doll, how quickly a child can become caught in a looped cord.

KEY TERMS

Roman shade

A fabric shade that rises in horizontal folds as it is lifted, guided by rings and rods on the back.

lift cord

A cord that raises a working shade; any reachable loop or long dangling end is a strangulation hazard.

fold depth

The depth of each fold when the shade is raised (or fixed), usually 3–5 in.

faux (stationary) Roman shade

A shade with its folds fixed in place, mounted like a valance; it does not raise or lower and has no lift cords.

cordless lift system

A commercial spring or clutch mechanism that raises and lowers a shade by hand on the bottom rail, with no exposed cords.

mounting board

The wooden strip the shade is stapled to and screwed to the window frame or wall.

CORE IDEAS

The story. This lesson begins with a safety story told plainly, because it is true and it matters. For decades, window blinds and shades were raised and lowered with long cords that hung in loops or dangled near the floor. Young children playing near windows, or climbing on beds and sofas beside them, could become caught by the neck in those cords, and it happened silently and quickly. The U.S. Consumer Product Safety Commission has reported for years that young children die this way in America, at times about one a month. Recalls and warning labels were not enough.

How they figured it out. Safety engineers concluded that the only dependable fix was to remove reachable cords altogether. The window-covering industry's 2018 safety standard required stock blinds and shades sold in the United States to be cordless or to have cords that are short or out of reach, and safety agencies urge families with children to use only cordless window coverings. **So this is the rule for this course: every shade you make is cordless. Make a stationary (faux) shade with fixed folds, or use a commercial cordless lift system installed exactly as its maker directs. Never make or hang a shade with a looped cord, a long dangling cord or a bead chain in a home where children live or visit.**

The fabric science. A Roman shade folds up from the bottom. Rows of small rings are sewn or tied on the back in columns 8–12 in apart; thin rods or dowels in pockets across the back make the folds crisp in a *flat* Roman; a *hobbled* (soft-fold) shade has extra fabric between ring rows so the folds hang in permanent loops down the face; a *relaxed* shade has no rods and curves gently at the bottom. In a *faux* Roman, the rings are tied together in fixed positions so the folds stay put and the shade is mounted like a valance across the top of the window, often over a working cordless shade or blind.

The math. For a flat shade, each fold takes up twice its depth when raised, so a 4-in fold uses 8 in of shade length. For a faux shade with fixed folds hanging over a straight drop, the cut length = finished length + (number of folds $\times$ 2 $\times$ fold depth) + hem and mounting allowances. Inside-mount shades are cut $\frac{1}{8}$ – $\frac{1}{4}$ in narrower than the window opening so they never rub the frame.

Let's sew. You will make a lined faux Roman shade for a real window, folds fixed, mounted on a board, with not a single cord anywhere, and you will finish the cord audit of your house with a parent.

PICTURE STUDY



Woman at a Window, Caspar D. Friedrich, 1822 · Oil on canvas · Alte Nationalgalerie, Berlin

Image: [Wikimedia Commons](#), public domain

Friedrich painted his wife, Caroline, at the window of his studio in Dresden overlooking the Elbe. The room is nearly empty, and Friedrich controlled its light with shutters rather than curtains so that the light fell cleanly on his easel. Every window treatment is a way of deciding how much light comes in and where.

Look closely

- Find which part of the window is opened and which is closed. How does that change the light on the floor and walls?
- Look for any curtain, cord or shade. Why might a painter's studio have none?
- Look at her long dress. How does its fabric fall from the high waist to the floor?
- Look at the window's proportions: the tall upper pane and the lower shutter. Where would a Roman shade mount on this window?

Talk about it

1. If you designed a fabric shade for this window, would you make it work (raise and lower) or fix it as a faux shade? Why?
2. How does Friedrich make an empty room feel calm rather than bare?
3. What is the safest way to control light at a window in a house with small children?

Safety first. Window-cord safety is the rule of this lesson: no shade you make will have a looped or dangling cord; make a stationary faux shade or use a commercial cordless lift system exactly as its maker directs. A parent drills and mounts the board. Wear safety glasses when stapling the shade to its board, and keep fingers clear of the staple gun's nose.

STUDIO LAB

A Cordless Faux Roman Shade and the Cord Audit

Make a lined faux Roman shade with fixed folds for a real window, mounted on a board, with no cords at all; and with a parent, finish a cord audit of every window covering in the house.

You will need

- Machine and iron
- Medium-weight decorator fabric and drapery lining
- Small plastic or brass shade rings and strong thread (or a ring tape)
- A 1 × 2 in board cut $\frac{1}{8}$ in shorter than the shade's finished width, stained or wrapped in lining
- Staple gun with $\frac{3}{8}$ -in staples and safety glasses
- L-brackets and screws (a parent mounts)

LINED FAUX ROMAN SHADE

Finished size: One shade, $34\frac{1}{2}$ in wide, hanging 18 in with 3 fixed folds (adjust to your window) · About 4 hours

Fabric and notions

- Face fabric, cut $37\frac{1}{2} \times 43$ in
- Lining, cut $34\frac{1}{2} \times 40$ in
- 15 small rings (5 columns × 3 rows)
- 1 mounting board, $1 \times 2 \times 34\frac{3}{8}$ in
- Strong thread or buttonhole twist

How to make it

1. Lay the face right side down; press under the $1\frac{1}{2}$ -in side hems.
2. Lay the lining on top, its edges tucked under the side hems; press and stitch the side hems through both layers, or slip-stitch by hand.
3. Press up the bottom: 2 in, then 2 in again, enclosing the lining; stitch.
4. On the lining side, mark the ring columns (Example 2) and the fold rows: the first row 3 in above the bottom, then every 6 in.
5. Sew or tie a ring at each mark through both layers with a few strong stitches.
6. Form the folds: for each column, tie the rings of all three rows together with a short loop of thread so the shade gathers into three 3-in folds; check that the folds are level across the shade.
7. Wrap the top 3 in over the mounting board and staple it to the top of the board, safety glasses on, starting at the center and working out.
8. A parent mounts the board with L-brackets inside or above the frame.

Fabric check: A medium-weight cotton, linen blend or polyester décor fabric with some body folds crisply. Very stiff fabric resists folding; very light fabric droops. Prints with a horizontal stripe show crooked folds, so mark rows carefully. Line the shade with drapery lining to protect it from sun.

Steps

1. Cord audit first: with a parent, check every window covering in the house against your warm-up list; record each cord, its height and the fix (replace, cut loops, raise and cleat, move furniture). The parent makes any changes.
2. Measure the window and write the cut sheet: opening width, finished width, cut width, folds, cut length, ring layout.
3. Make the shade from the pattern card.

4. Check: are the folds level within $\frac{1}{8}$ in? Is there any cord, loop or thread a child could pull? There must be none.
5. Photograph the shade in place and add it to the room board.
6. Clean up: staples and pins counted and picked up with a magnet, staple gun unloaded and stored, iron unplugged.
7. Improve it: one change for the next shade.

Tips

- Tie the folds while the shade lies flat, then hang it and adjust; folds look different hanging.
- A strip of lightweight dowel in a small pocket behind the bottom fold keeps it straight.
- If you want a working shade, buy a cordless lift kit made for Roman shades and follow its directions exactly.

Check your work

- ☐ My shade has no cords or loops anywhere.
- ☐ My folds are level and evenly spaced.
- ☐ The cord audit is complete and signed by a parent.

LAB NOTEBOOK

1. Write the cord audit table: room, window covering, cord type, height, fix, date fixed.
2. Draw the back of your shade with ring columns and rows measured.
3. Sketch flat, hobbled, relaxed and faux Roman shades side by side and label how each folds.

KEY FORMULAS

$$\text{finished width (inside mount)} = \text{opening width} - \frac{1}{4} \text{ in}$$

$$\text{finished width (inside mount)} = \text{opening width} - 41 \text{ in}$$

$$\text{cut length (faux)} = \text{finished length} + n \times 2d + \text{hem} + \text{mounting}$$

$$\text{cut length (faux)} = \text{finished length} + n \times 2d + \text{hem} + \text{mounting}$$

$$\text{cut width} = \text{finished width} + 2 \times \text{side hem}$$

$$\text{cut width} = \text{finished width} + 2 \times \text{side hem}$$

From history. Before cords and pulleys, many window shades were simply rolled or folded up by hand and tied with fabric ties, or fixed in place as valances. The cordless faux shade is an old solution brought back for safety.

WORKED EXAMPLES

Example 1. A faux Roman shade will cover the top 18 in of a window opening $34\frac{3}{4}$ in wide (inside mount), with 3 fixed folds 3 in deep. Side hems are $1\frac{1}{2}$ in, the bottom hem uses 4 in, and the board needs 3 in. Find the finished width and the cut size.

Show solution

$$1. \text{ Finished width: } 34.75 - 0.25 = 34.5 \text{ in } 34.75 - 0.25 = 34.5 \text{ in.}$$

$$2. \text{ Cut width: } 34.5 + 2 \times 1.5 = 37.5 \text{ in } 34.5 + 2 \times 1.5 = 37.5 \text{ in.}$$

$$3. \text{ Fold take-up: } 3 \times 2 \times 3 = 18 \text{ in } 3 \times 2 \times 3 = 18 \text{ in.}$$

$$4. \text{ Cut length: } 18 + 18 + 4 + 3 = 43 \text{ in } 18 + 18 + 4 + 3 = 43 \text{ in.}$$

Answer: Finished $34\frac{1}{2}$ in wide; cut $37\frac{1}{2} \times 43$ in $37\frac{1}{2} \times 43$ in.

Example 2. The same shade's rings are tied in columns no more than 10 in apart, with a column 1 in in from each edge. How many columns, and how far apart?

Show solution

1. Distance between the outer columns: $34.5 - 2 \times 1 = 32.5$ in $34.5 - 2 \times 1 = 32.5$ in.
2. Spaces needed: $[32.5 \div 10] = 4$ $[32.5 \div 10] = 4$, so 5 columns.
3. Spacing: $32.5 \div 4 = 8.125$ in $32.5 \div 4 = 8.125$ in.

Answer: 5 columns of rings, about $8\frac{1}{8}$ in apart.

Example 3. A working flat Roman shade 60 in long has folds 4 in deep. When fully raised, how many folds form, and how tall is the stack (each fold of fabric with its rod about $\frac{3}{4}$ in thick)?

Show solution

1. Each fold uses $2 \times 4 = 8$ in $2 \times 4 = 8$ in of shade length.
2. Folds: $60 \div 8 = 7.5$ $60 \div 8 = 7.5$, so 7 full folds and a half-fold at the bottom.
3. Stack height: the folds hang 4 in deep, and the layers stack about $7.5 \times 0.75 \approx 5.6$ in $7.5 \times 0.75 \approx 5.6$ in thick against the board.

Answer: About $7\frac{1}{2}$ folds, hanging in a stack about 4 in deep and $5\frac{1}{2}$ –6 in high below the board: plan the mounting height so the raised stack clears the glass.

Example 4. Design reasoning. A family with a two-year-old has three corded blinds and wants a soft fabric shade in the nursery. Write the plan.

Show solution

1. Rule first: no looped or dangling cords anywhere a child can reach, ever.
2. Nursery: a faux Roman valance for softness and looks, over a cordless cellular or roller shade (or a commercial cordless Roman lift system) for light control.
3. Existing corded blinds: replace them with cordless products; until then, a parent cuts the loops and secures cords high with cleats out of reach, and moves cribs, beds and furniture away from windows.
4. Record the audit and the fixes in the notebook.

Answer: Faux Roman valance plus a cordless shade in the nursery; corded blinds replaced, with interim cord safety by a parent and furniture moved away from windows.

PRACTICE

1. **Easy** State this course's rule for shades in one sentence.

Show answer

Every shade is cordless: a stationary faux shade or a commercial cordless lift system, never a looped or dangling cord where children live or visit.

2. **Easy** What is the difference between a flat and a hobbled Roman shade?

Show answer

Flat: folds only when raised, crisp with rods. Hobbled: extra fabric between ring rows makes permanent soft folds down the face.

3. **Easy** Opening $30\frac{1}{4}$ in wide, inside mount. Finished width?

Show answer

$$30\frac{1}{4} - \frac{1}{4} = 30 \text{ in } 30\frac{1}{4} - \frac{1}{4} = 30 \text{ in.}$$

4. **Medium** Finished width 30 in, 1½-in side hems. Cut width?

Show answer

33 in 33 in.

5. **Medium** Faux shade: finished length 20 in, 4 folds 2½ in deep, 4-in hem, 3-in mounting. Cut length?

Show answer

$20 + 4 \times 5 + 4 + 3 = 47$ in $20 + 4 \times 5 + 4 + 3 = 47$ in.

6. **Medium** A flat Roman 54 in long with 4½-in folds: how many folds when raised?

Show answer

$54 \div 9 = 6$ $54 \div 9 = 6$ folds.

7. **Medium** Why is an inside-mount shade cut slightly narrower than the opening?

Show answer

So it does not rub or bind on the frame, which is rarely perfectly square.

8. **Hard** Ring columns at most 10 in apart, 1 in in from each edge, finished width 46 in. Number of columns and spacing?

Show answer

$44 \div 10 = 4.4$ $44 \div 10 = 4.4$, 5 spaces, 6 columns, 8.8 in 8.8 in apart.

9. **Hard** Name three steps a parent can take today about existing corded blinds, while saving for cordless ones.

Show answer

Cut looped cords into separate short ends with safety tassels or remove loops; wind and secure cords high on cleats out of reach; move cribs, beds and climbable furniture away from windows; replace with cordless products as soon as possible.

10. **Hard** A hobbled shade with 6 hobbles, each with 3 in of extra fabric showing as a loop, has a finished length of 48 in. How much longer is its cut length than a flat shade's (ignore hems)?

Show answer

$6 \times 3 = 18$ in $6 \times 3 = 18$ in longer (66 in instead of 48 in plus hems).

11. **Challenge** Explain why engineers decided warning labels and recalls were not enough and that cords had to be removed, using the idea of a hazard that cannot be supervised away.

Show answer

The danger strikes silently in seconds, often during sleep or quiet play, so no parent can watch every moment; labels depend on every adult reading and acting. Removing reachable cords eliminates the hazard instead of relying on vigilance.

COMMON MISTAKES

- Making a working corded shade because a pattern shows one. In this course every shade is cordless.
- Marking ring rows from a crooked bottom hem, so every fold tilts.
- Stapling from one end of the board to the other, which pulls the fabric off-grain; work from the center out.

Make it a game · Fold Math Face-Off. A parent calls out a shade's finished length, number of folds and fold depth. Players race to give the cut length (add a 4-in hem and 3-in mounting). Then the parent names a window covering in the house; the first player to state its safety fix correctly earns a bonus point. First to six.

4.2 VALANCES, CORNICES AND LAMBREQUINS

OBJECTIVES

- Distinguish a valance, a cornice board and a lambrequin, and say what each does for a window.
- Size a cornice board from the treatment beneath it and estimate padding and fabric, including railroading.
- Build and upholster a padded cornice board with safe staple-gun technique.

Warm-up. Look at the top of any window treatment you can find: home, church, a restaurant. Is the rod and hardware showing, or hidden behind fabric or a board? Sketch one top treatment and estimate how tall it is compared with the whole window.

WATCH

How to Make a Fabric-Covered Window Cornice

Sailrite · 4:36

<https://www.youtube.com/watch?v=1w6G2TJaijo>

WHEN TO WATCH

After “The math.” Watch how the batting is wrapped and the fabric stapled at the corners; then watch again and list every material in order.

Note: A short supplier tutorial; it uses a box built from boards, the same plan as the lab.

KEY TERMS

valance

A short fabric treatment across the top of a window, hung from a rod or board, gathered, pleated, flat or swagged.

lambrequin

A shaped top treatment that comes down the sides of the window, often stiffened or decorated; popular in Victorian homes.

projection

How far the treatment sticks out from the wall.

cornice board

A rigid box of wood or foam board, padded and covered in fabric, mounted across the top of a window.

return

The short side of a cornice or valance that comes back to the wall.

railroading

Running fabric sideways, selvage horizontal, so a long piece can be cut without a seam.

CORE IDEAS

The story. Victorian householders loved to finish the top of a window. Heavy drapes hung below boxed cornices of carved and gilded wood, or below **lambrequins**, shaped hangings that framed the top and came partway down the sides. Many lambrequins were made at home from velvet, wool or the fashionable crazy patchwork of the 1880s, embroidered and fringed. A museum example from about 1890 (the picture study) is a whole crazy quilt in the shape of an arch. Today's cornice board is the same idea simplified: a padded, fabric-covered box that hides the hardware and finishes the window.

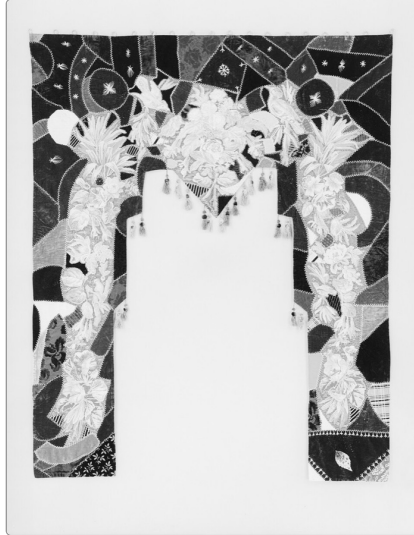
How they figured it out. A top treatment solves real problems. It hides the rod, cords and tops of drapes; it closes the top of the cold-air loop (Lesson 3.4); it can make a window look wider or taller by covering wall above or beside it; and it lets a small amount of a costly fabric make a strong statement. Workrooms learned to size it by proportion: a top treatment usually looks right at about one-fifth to one-sixth of the total height from its top to the bottom of the treatment below.

The fabric science. A cornice board has three layers over its wood or foam-board box: **padding** (polyester batting, sometimes a thin foam on the face) to soften the edges and hide the box, the **face fabric**, and a **lining or dust cover** inside. Medium-weight upholstery fabric is ideal, because it stretches slightly and wraps the corners neatly. Cornice faces are often longer than the fabric is wide, so the fabric is **railroaded** (turned sideways) to avoid a seam; that only works with a solid, a texture or a print that looks right sideways.

The math. The cornice's inside width = the treatment's width (rod or shade) + about 2 in clearance each side; its return depth = the treatment's projection + about 2 in; its face height by the one-fifth rule. The fabric must cover the face, both returns, and wrap about 3 in over the top and under the bottom edges.

Let's sew. This lab is your first upholstery: build a cornice box (or cut one from rigid foam board), pad it, and cover it with fabric pulled straight and stapled cleanly, safety glasses on. It may cap the drapes you made in Unit 3 or the shade from Lesson 4.1.

PICTURE STUDY



Lambrequin, Unknown American maker, c. 1890 · Pieced silks and velvets with embroidery (crazy patchwork) · The Metropolitan Museum of Art, New York

Image: [Wikimedia Commons](#), public domain

In the 1880s and 1890s American women pieced “crazy quilts” from scraps of silk and velvet, outlining every seam with fancy embroidery. This maker shaped her crazy patchwork into a lambrequin to frame a window or doorway. It is decoration, but it is also thrift: dozens of small scraps made into one showpiece.

Look closely

- Find the opening in the middle. How wide is the frame compared with the opening?
- Look at the shapes of the patches. Are any two the same?
- Follow the embroidered lines along the seams. What do they hide, and what do they add?
- Find the flowers that climb up the sides. Are they the same on both sides or mirrored? (The photograph is black and white; imagine the colors of silk and velvet.)

Talk about it

1. How does this lambrequin change the shape of the window behind it?
2. Would this treatment block light, warmth or neither? What was it really for?
3. If you made a top treatment from scraps for your room, what shape would you choose?

Safety first. Safety glasses on for every staple, for you and anyone in the room. Keep your free hand behind the staple gun's nose, never in front of it, and unplug or unload the gun before clearing a jam. Cut plywood or foam board only with a parent present; a parent drills and mounts the cornice with brackets into studs or anchors. Pick up stray staples with a magnet.

STUDIO LAB

A Padded Cornice Board

A first upholstery lab: build or cut a cornice box, pad it, cover it with railroaded fabric pulled straight and stapled cleanly, line the inside, and mount it over a real window.

You will need

- ½-in plywood or 1 × 6 pine (or ½-in rigid foam insulation board for a light cornice)
- Wood glue and screws (or hot glue and duct tape for foam board)
- Polyester batting
- Decorator fabric and lining
- Staple gun, ⅜-in staples, safety glasses, a tack lifter for mistakes
- L-brackets (a parent mounts)

PADDED, FABRIC-COVERED CORNICE

Finished size: One cornice, 76 in inside width, 6-in returns, 16-in face (adjust to your window) · About 4–5 hours

Fabric and notions

- Face board 77 × 16 in and two return boards 6 × 16 in (or one 1 × 6 top board 77 in long and returns as shown)
- Batting about 95 × 22 in
- Face fabric about 95 × 24 in, railroaded
- Lining about 95 × 20 in
- About 100 staples

How to make it

1. With a parent, cut the boards; glue and screw the returns to the ends of the face to make a three-sided box (add a top board if you want a dust cover).
2. Wrap the outside of the box in batting, stapling it to the back edges; trim it flush at the corners so they stay crisp.
3. Center the fabric on the face, right side out, the grain straight along the top edge.
4. Staple the top edge at the center first, then the bottom edge opposite it, pulling just firmly enough to remove wrinkles; work outward toward the corners, alternating top and bottom.
5. Wrap each return: fold the excess at the front corner into a neat vertical pleat like a gift-wrap corner, and staple inside.
6. Trim excess fabric inside, leaving 1 in past the staples.
7. Staple the lining inside the box, turning its raw edges under, to hide the wood and staples.
8. Optional: glue welting along the bottom edge (Lesson 2.3) for a tailored finish.
9. A parent mounts the cornice on L-brackets above the window.

Fabric check: Medium-weight upholstery fabric with a little give wraps corners best. Very thin fabric shows the batting and staples; very thick fabric makes bulky corners. Choose a solid, texture or non-directional print if you plan to railroad. Foam board makes a light cornice for renters or plaster walls.

Steps

1. Write the sizing: treatment width, projection, inside width, return depth, face height, fabric length and height, batting size, cost.
2. Hold a paper mock-up of the cornice face at the window and adjust the height before cutting wood.
3. Practice a corner wrap on a scrap block of wood with scrap fabric, glasses on.
4. Build the cornice from the pattern card.
5. Inspect: is the fabric straight along the top edge? Are the corners neat? Any staples showing?
6. Clean up: sweep and magnet up all staples, unplug or unload the gun, store blades.
7. Improve it: one change for your upholstery units.

Tips

- Staple in the center and work out in both directions; never staple one end and pull to the other.
- Keep staples ½ in apart and parallel to the edge for a clean line.
- If a staple goes in crooked, lift it with the tack lifter (glasses on) rather than hammering it.

Check your work

- ☐ I wore safety glasses for every staple and lift.
- ☐ My fabric is straight and smooth, corners neat, no staples visible.
- ☐ My cornice clears the treatment below with about 2 in to spare.

LAB NOTEBOOK

1. Draw the cornice in three views (front, side, top) with dimensions.
2. Record the fabric and batting calculations and the cost.
3. Sketch three top-treatment ideas for other windows: a valance, a cornice and a lambrequin.

KEY FORMULAS

$$\begin{aligned} \text{inside width} &= \text{treatment width} + 2 \times 2 \text{ in} & \text{inside width} &= \text{treatment width} + 2 \times 2 \text{ in} \\ \text{return depth} &= \text{projection} + 2 \text{ in} & \text{return depth} &= \text{projection} + 2 \text{ in} \\ \text{face height} &\approx \frac{1}{5} \text{ to } \frac{1}{6} \times \text{total height} & \text{face height} &\approx \frac{1}{5} \text{ to } \frac{1}{6} \times \text{total height} \\ \text{fabric length} &= \text{return} + \text{face width} + \text{return} + 2 \times 3 \text{ in} & \text{fabric length} &= \text{return} + \text{face width} + \text{return} + 2 \times 3 \text{ in} \end{aligned}$$

From history. Crazy quilting swept American parlors after the 1876 Centennial Exhibition in Philadelphia, where Japanese art with its broken, asymmetrical patterns drew huge crowds. Women made crazy-patch pillows, table covers and lambrequins as well as quilts.

WORKED EXAMPLES

Example 1. Drapes on a 72-in rod project 4 in from the wall. Find the cornice's inside width and return depth.

Show solution

1. Inside width: $72 + 2 \times 2 = 76$ in $72 + 2 \times 2 = 76$ in.
2. Return depth: $4 + 2 = 6$ in $4 + 2 = 6$ in.

Answer: Inside width 76 in; returns 6 in deep.

Example 2. The cornice top will be at 96 in and the drapes reach the floor. Using one-sixth, how tall should the cornice face be?

Show solution

1. Total height: 96 in 96 in.
2. Face: $96 \div 6 = 16$ in $96 \div 6 = 16$ in.

Answer: About 16 in (one-fifth would be about 19 in); choose by what looks right on the mock-up.

Example 3. The cornice is built from $\frac{1}{2}$ -in plywood: face 77 in long (76 inside + two $\frac{1}{2}$ -in return thicknesses), returns 6 in, face height 16 in. How long a piece of fabric runs around it, and can it be railroaded on 54-in fabric?

Show solution

1. Length around: $6 + 77 + 6 + 2 \times 3 = 95$ in $6 + 77 + 6 + 2 \times 3 = 95$ in.
2. Height to cover: $16 + 2 \times 3 = 22$ in $16 + 2 \times 3 = 22$ in (wrap over top and under bottom), plus a little more for the return tops.
3. Railroaded, the 95-in length runs along the bolt and the 22-in height uses less than half the 54-in width.

Answer: Railroad it: about 95 in ($2\frac{5}{8}$ yd) of 54-in fabric, cut 24 in wide, with no seam; a second strip from the same cut can line it.

Example 4. Design reasoning. A family's window is 40 in wide and looks narrow in a wide wall. How could a cornice make it look wider without changing the window?

Show solution

1. Extend the cornice and the rod well past the frame, perhaps 12 in each side, so the treatment spans
 $40 + 24 = 64$ in $40 + 24 = 64$ in.
2. Hang drapes from the wide rod so they stack on the wall, not the glass, and the eye reads the drapes' outer edges as the window's edges.
3. Keep the cornice face a calm solid or small print so the long horizontal line does the work.

Answer: A 64-in-wide cornice over a wide rod with drapes stacked on the wall makes the window read about 60% wider.

PRACTICE

1. **Easy** How does a cornice board differ from a valance?

Show answer

A cornice is a rigid padded box covered in fabric; a valance is soft fabric hung from a rod or board.

2. **Easy** What is a lambrequin?

Show answer

A shaped top treatment that frames the top of the window and comes down the sides.

3. **Easy** Rod 48 in; inside width of the cornice?

Show answer

52 in 52 in.

4. **Medium** Treatment projects $5\frac{1}{2}$ in. Return depth?

Show answer

$7\frac{1}{2}$ in 7 21 in.

5. **Medium** Cornice top at 90 in, treatment to the floor. Face height by one-fifth and one-sixth?

Show answer

18 in 18 in and 15 in 15 in.

6. **Medium** Face 53 in, returns $7\frac{1}{2}$ in, 3-in wraps. Fabric length around?

Show answer

$7.5 + 53 + 7.5 + 6 = 74$ in $7.5 + 53 + 7.5 + 6 = 74$ in.

7. **Medium** Name three problems a top treatment solves.

Show answer

Hides hardware; closes the top of the cold-air loop; changes the window's apparent size; adds a lot of design with little fabric.

8. **Hard** Why can't a directional print with upright trees be railroaded?

Show answer

Turned sideways, the trees would lie on their sides.

9. **Hard** Batting must cover the face and returns and wrap 2 in top and bottom, for a cornice 53 in face, $7\frac{1}{2}$ in returns, 15 in high. Size of batting?

Show answer

$(7.5 + 53 + 7.5) \times (15 + 4) = 68 \times 19$ in $(7.5 + 53 + 7.5) \times (15 + 4) = 68 \times 19$ in.

10. **Hard** A 1×6 pine board costs \$1.60\$1.60 per foot. Cost of a face 77 in long and two returns 6 in long, each cut from the board?

Show answer

Total length 89 in ≈ 7.4 ft 89 in ≈ 7.4 ft; buy an 8-ft board, $8 \times 1.60 = \$12.80$ $8 \times 1.60 = \$12.80$.

11. **Challenge** A cornice must be 108 in wide but your fabric is a non-railroadable print 54 in wide. Plan the seams so they look intentional.

Show answer

Use a full width centered on the face and split a second width in half for each end, seams placed symmetrically (about 27 in from each side), pattern matched (Lesson 3.3), never a single seam off-center.

COMMON MISTAKES

- Sizing the cornice to the window instead of to the treatment beneath it.
- Pulling the fabric so hard that the grain bows or the pattern distorts.
- Forgetting the returns, which leaves the drapes' sides showing.

Make it a game · Staple Line. With safety glasses on and a parent watching, each player staples a 12-in strip of fabric onto scrap board, aiming for ten staples exactly $\frac{1}{2}$ in apart and parallel to the edge. A parent measures: one point for each staple within $\frac{1}{8}$ in of the mark. Any unsafe hand position ends the round with zero.

4.3 THREAD COUNT, PERCALE AND SATEEN

OBJECTIVES

- Define thread count and count the ends and picks per inch of a sheet with a linen tester.
- Explain how percale and sateen weaves differ in structure, hand, sheen and wear, and why plied yarns can inflate a count.
- Sew a pair of pillowcases with French seams and judge a sheet by evidence, not by its label number.

Warm-up. Feel two different sheets or pillowcases in the house, one at a time, with your eyes closed. Is one crisp and cool, the other smooth and slippery? Check their labels for a thread count. Does the higher number feel better?

WATCH

Understanding Satin and Sateen Weaves | Tutorial #5

First Forest · 10:15

<https://www.youtube.com/watch?v=mC1ZfrabQp0>

WHEN TO WATCH

After “The fabric science.” She plots weaves on graph paper; follow along on your own graph paper and draw a plain weave, a satin and a sateen.

Note: A quiet, hands-only weaving-structure tutorial plotted on graph paper.

BACKUP VIDEO

The 3 Fundamental Textile Weaves: Plain, Twill and Satin

Textile with Alberto · 3:51

<https://www.youtube.com/watch?v=TYrQBcPBk3U>

A short overview with real swatches if the graph-paper method is new to you.

KEY TERMS

thread count

The number of warp ends plus weft picks in one square inch of fabric.

percale

A tightly woven plain-weave sheeting, usually 180 thread count or more: crisp, cool and durable.

ply

The number of single yarns twisted together to make one yarn; a 2-ply yarn has two strands.

ends and picks

Ends are warp yarns (lengthwise); picks are weft yarns (crosswise).

sateen

A weave in which weft yarns float over four warp yarns, giving a smooth, lustrous face; softer and warmer than percale but more prone to pilling.

linen tester (pick glass)

A small folding magnifier with a 1-inch or ½-inch window for counting yarns.

CORE IDEAS

The story. By the 2000s, sheet packages in American stores advertised thread counts of 800, 1,000 and even more. Weavers knew that so many yarns could not physically fit in one square inch of good cotton cloth. The trick was counting: a sheet woven with yarns made of two or three fine strands twisted together was advertised by counting each strand separately, doubling or tripling the number. In 2005 the staff of the Federal Trade Commission, answering a question from the textile industry, advised that a yarn twisted from several strands should be counted as one yarn, and that inflating a count by multiplying plies could mislead buyers. A 300-count sheet of good two-ply yarn is still a 300-count sheet.

How they figured it out. Textile testers count fabric the same way everywhere: with a pick glass or under a microscope, they count the warp **ends** in one inch and the weft **picks** in one inch, often in several places, and add the averages. That number tells you how

closely the cloth is woven. It does not tell you the fiber's quality (long-staple cotton is smoother and stronger than short), the yarn's size, or the finishing. A well-made 250-count percale of long-staple cotton can outlast a 1,000-count sheet of short, weak, multi-ply fiber.

The fabric science. Percale is a plain weave: each weft goes over one warp, under the next. The constant interlacing makes a crisp, matte, breathable cloth that wears very well. Sateen lets each weft float over four warps before going under one, so the face is mostly long, parallel weft floats that reflect light: smooth, lustrous and drapery, slightly warmer, but the floats can snag and pill. (Satin is the warp-faced cousin, usually in silk or filament yarns.) Neither is better; they suit different sleepers.

The numbers. Thread count = ends per inch + picks per inch. If the label counts plies, divide by the ply number to find the honest count. Fabric weight in g/m^2 (or oz/yd^2 , Lesson 1.3) adds information the count leaves out.

Let's sew. In the lab you will count three sheets with a linen tester, compare the counts with the labels, and then sew a pair of pillowcases with enclosed French seams from the sheet you judge best.

PICTURE STUDY



Weaver, Vincent van Gogh, 1884 · Oil on canvas · Museum of Fine Arts, Boston

Image: [Wikimedia Commons](#), public domain

In 1884, living with his parents in the Dutch village of Nuenen, Van Gogh painted the local linen weavers again and again, fascinated by their huge wooden looms. Each yard of sheeting they made was counted in ends and picks just as yours will be: every pick thrown by hand.

Look closely

- Find the cloth on the loom. Where is the woven part, and where are the warp threads still waiting?
- Find the spinning wheel. What would it have made for this loom?
- Look at the weaver's hands and position. Which part of the loom is he working?
- Compare the size of the loom with the man. Why did a loom take up most of a cottage room?

Talk about it

1. A hand weaver throws one pick at a time. How many picks would he throw in one yard of 140-pick cloth?
2. Why might Van Gogh have painted the loom so dark and heavy?
3. What does knowing how cloth is woven change about how you buy sheets?

Safety first. French seams mean pressing narrow seams often: keep fingers out from under the iron's soleplate and use the tip, set the iron upright between presses, and unplug it when you finish. Count pins in and out.

Count the Sheets, Then Sew the Pillowcases

An investigation and a skill lab. First count the ends and picks of three sheets with a linen tester and compare with their labels; then sew a pair of pillowcases with French seams and a cuff from the sheet with the best evidence.

You will need

- A linen tester (pick glass), or a strong magnifier and a ruler
- Three sheets or pillowcases with known labels if possible
- A sheet or sheeting fabric for the pillowcases (a thrift-store flat sheet is ideal)
- Machine, iron, pins

FRENCH-SEAMED CUFFED PILLOWCASES

Finished size: Two standard pillowcases, about 20 × 30 in finished · About 2 hours

Fabric and notions

- 2 bodies, 41 × 27 in, from sheeting
- 2 cuffs, 41 × 9 in, from matching or contrast sheeting
- 2 optional trim strips, 41 × 2 in, folded in half
- Thread to match

How to make it

1. Fold each cuff in half lengthwise, wrong sides together; press.
2. Lay a body right side up, the folded trim (if used) and then the cuff on its 41-in edge, raw edges even; roll the body up small, wrap the cuff around it like a tube, pin and stitch a ½-in seam (the “burrito” method).
3. Pull the body out through the tube; the seam is enclosed. Press.
4. French seam: fold the case in half, WRONG sides together, matching the cuff seams. Sew the side and bottom at ¼ in.
5. Trim the seam to ⅛ in and clip the corner; turn wrong side out, press the seam flat on the fold.
6. Sew the side and bottom again at ⅜ in, enclosing the raw edges.
7. Turn right side out, push out the corner and press.

Fabric check: Use 100% cotton or a cotton-polyester sheeting, prewashed. Percale presses crisply and makes neat French seams; sateen is slipperier, so pin closely. Old sheets that are thin at the center can still give sound pillowcases from their edges.

Steps

1. Count each test sheet in three places, warp and weft, and average; record in a data table with the label's claim.
2. Compute each thread count and compare: does the label agree? Divide by plies if the label counts them.
3. Rank the sheets by your evidence (count, feel, weight, weave) and choose one for the pillowcases.
4. Sew the pillowcases from the pattern card.
5. Inspect the French seams inside: no raw threads should show.
6. Give one pillowcase away, or use the pair on a family bed.
7. Clean up: iron upright and unplugged, pins counted. Improve it: one change.

Tips

- Count yarns with a needle point as a pointer, moving one yarn at a time.
- Mark the start of a count with a pin so you do not lose your place.
- A contrast cuff can use the leftover strips from another project.

Check your work

- ☐ My counts are averaged from three places and recorded.
- ☐ I explained any difference between my count and the label.

- ☐ My French seams enclose every raw edge.

LAB NOTEBOOK

1. Draw plain weave and 4-over-1 sateen on graph paper, side by side.
2. Tape in a small swatch of each sheet you counted with its count and label claim.
3. Draw a French seam in cross-section, both passes.

KEY FORMULAS

$$\begin{aligned}\text{thread count} &= \text{ends per inch} + \text{picks per inch} \\ \text{thread count} &= \text{ends per inch} + \text{picks per inch} \\ \text{honest count} &= \frac{\text{advertised count}}{\text{plies per yarn}} \quad (\text{if plies were counted}) \\ \text{honest count} &= \text{plies per yarn} \times \text{advertised count} \quad (\text{if plies were counted}) \\ \text{cost per night} &= \frac{\text{price}}{\text{expected nights of use}} \\ \text{cost per night} &= \text{expected nights of use} \times \text{price}\end{aligned}$$

From history. The word percale came into English from French in the 1600s for a fine cotton cloth, and sateen was coined in the 1800s from satin for a cotton made to imitate silk's sheen.

WORKED EXAMPLES

Example 1. With a $\frac{1}{2}$ -inch linen tester you count 76 warp ends and 70 weft picks. What is the thread count?

Show solution

1. Ends per inch: $76 \times 2 = 152$ $76 \times 2 = 152$.
2. Picks per inch: $70 \times 2 = 140$ $70 \times 2 = 140$.
3. Thread count: $152 + 140 = 292$ $152 + 140 = 292$.

Answer: About 292, a typical good percale.

Example 2. A package says "1,000 thread count" and, in small print, "3-ply yarns." What is the count by the honest method?

Show solution

1. Each yarn was counted as three: $1,000 \div 3 \approx 333$ $1,000 \div 3 \approx 333$.

Answer: About 333 thread count of 3-ply yarn.

Example 3. Sheet A: \$45\$45, percale, expected 5 years used 2 nights a week in rotation. Sheet B: \$30\$30, sateen, expected $2\frac{1}{2}$ years at the same use. Compare cost per night.

Show solution

1. Nights per year: $2 \times 52 = 104$ $2 \times 52 = 104$.
2. A: $\$45 \div (5 \times 104) = \$45 \div 520 \approx \$0.087$ $\$45 \div (5 \times 104) = \$45 \div 520 \approx \$0.087$.
3. B: $\$30 \div (2.5 \times 104) = \$30 \div 260 \approx \$0.115$ $\$30 \div (2.5 \times 104) = \$30 \div 260 \approx \$0.115$.

Answer: A costs about 9¢ a night, B about 12¢: the dearer sheet is the cheaper one per night.

Example 4. A queen flat sheet is 90×102 in. How many standard pillowcases (each cut 41×27 in, plus a 9×41 in cuff) can you cut from it?

Show solution

1. Body pieces 41 in wide (around the pillow): two fit across the 90-in width, $2 \times 41 = 82 \leq 90$ $2 \times 41 = 82 \leq 90$.
2. Down the 102-in length: rows of 27 in, $\lfloor 102 \div 27 \rfloor = 3$ $\lfloor 102 \div 27 \rfloor = 3$ rows, using 81 in, so 6 bodies, with 21 in left.
3. Cuffs 9 in deep: the 21-in strip holds 2 rows of 2, 44 cuffs.

Answer: 4 complete pillowcases (bodies and cuffs), with 2 extra bodies for contrast cuffs from another fabric.

PRACTICE

1. **Easy** Define thread count.

Show answer

Warp ends per inch plus weft picks per inch.

2. **Easy** Which weave is crisp and matte, and which smooth and lustrous?

Show answer

Percalé (plain weave) is crisp and matte; sateen (4-over-1 floats) is smooth and lustrous.

3. **Easy** Count 150 ends and 130 picks per inch. Thread count?

Show answer

280.

4. **Medium** With a $\frac{1}{2}$ -in window: 64 ends, 60 picks. Thread count?

Show answer

$128 + 120 = 248$ $128 + 120 = 248$.

5. **Medium** “800 thread count, 2-ply.” Honest count?

Show answer

400.

6. **Medium** Why does sateen pill and snag more than percalé?

Show answer

Its long weft floats lie loose on the surface where they rub and catch; plain weave anchors every yarn at every crossing.

7. **Medium** What does thread count NOT tell you? Name three things.

Show answer

Fiber quality and staple length, yarn size and ply, finishing, weave, weight.

8. **Hard** Sheet C \$60\$60, 6 years at 3 nights a week; Sheet D \$24\$24, 2 years at the same use. Cost per night?

Show answer

C: $60 \div 936 \approx \$0.06460 \div 936 \approx \0.064 ; D: $24 \div 312 \approx \$0.07724 \div 312 \approx \0.077 .

9. **Hard** Explain the 2005 FTC staff advice in your own words and why it protects buyers.

Show answer

Count each plied yarn once, not each strand; multiplying by plies inflates the number and suggests a finer cloth than the buyer gets.

10. **Hard** A sheet weighs 120 g/m^2 . Convert to oz/yd^2 ($1 \text{ oz/yd}^2 \approx 33.9 \text{ g/m}^2$).

Show answer

$120 \div 33.9 \approx 3.5 \text{ oz/yd}^2$ $120 \div 33.9 \approx 3.5 \text{ oz/yd}^2$.

11. **Challenge** Design a fair test of whether a higher thread count makes a sheet wear longer, using the Lesson 1.3 abrasion method.

Show answer

Same fiber and weave, different counts; same abrader, pressure, strokes and intervals; three samples each; grade wear at fixed intervals; also record weight and ply, since they may explain the result.

COMMON MISTAKES

- Trusting the biggest number on the package.
- Counting in only one place; weaving varies across the cloth.
- Sewing the first pass of a French seam right sides together, which puts the raw edges outside.

Make it a game · Count Off. Each player gets the same sheet sample and a linen tester. On “go,” count ends in the window; then picks. The player closest to the parent's careful count after 90 seconds wins the round. Three rounds, three different fabrics, then guess which fabric is percale and which sateen by feel alone.

4.4 THE DUVET COVER

OBJECTIVES

- Explain the duvet-and-cover system and why a removable cover makes a bed easier to keep clean.
- Calculate duvet cover dimensions from an insert, piece widths without a center seam, and space closures evenly.
- Sew a duvet cover from two flat sheets with a button or snap closure and inside corner ties.

Warm-up. Strip a bed (with permission) and look at every layer: mattress pad, fitted sheet, flat sheet, blanket, comforter or duvet. Which layers are washed every week, which every season, which hardly ever? Write the list and a guess at how long each takes to dry.

WATCH

How to Make Your Own Duvet Cover with Flat Sheets

Jan Howell · 15:18

<https://www.youtube.com/watch?v=s6ceva9AlcY>

WHEN TO WATCH

After “The math.” Watch how she sizes the cover from the duvet and spaces the snaps; pause and compare her measurements with your own bed's.

BACKUP VIDEO

How to Make a Duvet Cover

OnlineFabricStore · 8:58

<https://www.youtube.com/watch?v=qBNYc59g4S4>

A version pieced from 54-in decorator fabric with a center panel and side panels, for when you are not using sheets.

KEY TERMS

duvet

A soft, thick quilt filled with down, feathers or fiberfill, used inside a removable cover.

insert

The duvet itself when spoken of as the filling of the cover.

corner ties

Fabric ties sewn inside the cover's corners and tied to the duvet's corners so it cannot shift.

duvet cover

A large fabric envelope that holds the duvet and is washed like a sheet.

placket

The overlapping band where a closure (buttons, snaps, a zipper) is set.

center panel

When piecing, a full width in the middle with half widths at each side, so no seam runs down the center of the bed.

CORE IDEAS

The story. In much of northern Europe, beds have long been made not with layers of sheets and blankets but with a single thick quilt of down or feathers, the duvet, buttoned into a washable cover. A woven coverlet like the one in the picture study, made in America in 1834 for a girl named Sarah Ann Outwater, was a treasure that was rarely washed; it was kept clean by using it carefully. The duvet cover solved that problem from the other direction: the warm part stays dry and lofty, and only the light cover goes in the wash.

How they figured it out. Down is warm because it lofts and traps still air (Lesson 2.5), and it dislikes frequent washing. Sheets are easy to wash. So the bed was redesigned: a cover like a giant pillowcase, closed with buttons, snaps or ties so it opens wide for the duvet, and tied inside at the corners so the duvet does not slump to one end. It is one of the most practical inventions in the home sewist's repertoire, and it lets a family change the look of a bedroom for the cost of two sheets.

The fabric science. A cover is sized to its insert: usually the same size, or an inch or two smaller in each direction so the duvet fills it fully. Flat sheets are made in widths that fit beds without piecing, which makes them the cheapest cover fabric there is. If you use 54-

in decorator fabric instead, piece it with a full width in the center and half widths at the sides so no seam runs down the middle of the bed. Choose closures that survive washing: buttons, sturdy snaps or a long zipper.

The math. Cut size = finished size + seam allowances; spacing of closures = opening length ÷ number of spaces; the corner ties go into the seams at each corner. Write it all before you cut.

Let's sew. Your lab is a duvet cover for a real bed from two flat sheets, with a buttoned or snapped opening across the bottom and corner ties, and a cost comparison with a store-bought cover.

PICTURE STUDY



Coverlet woven for Sarah Ann Outwater, Unknown American weaver, 1834 · Wool and cotton, Jacquard-woven double cloth · The Metropolitan Museum of Art, New York

Image: [Wikimedia Commons](#), public domain

Professional weavers in the young United States used Jacquard attachments on their looms to weave coverlets like this one, often to order, with the owner's name and the date woven into the corners. Sarah Ann Outwater's coverlet was made to last a lifetime, and it has lasted almost two centuries.

Look closely

- Find the name and date in the corners. How many times are they woven, and which way do they read?
- Look at the border. Which animals and birds can you find?
- Look at the center pattern. Is it a straight repeat? How many motifs across?
- Find the fringe. Which edges have it, and why only those?

Talk about it

1. This coverlet was woven with the owner's name. What does that tell you about how it was valued?
2. Why might a family wash a coverlet like this rarely, and how does a duvet cover solve that problem?
3. If you sewed a duvet cover as a gift, how could you make it personal, as this weaver did?

Safety first. A duvet cover is very large: work on a clean floor or a big table, keep the trailing fabric off the iron's cord, and support the weight so it does not drag the needle. Snap setters and hammers are used on a solid surface with fingers clear; a parent sets metal snaps if a press or hammer is needed. Count pins and buttons; keep buttons away from toddlers.

STUDIO LAB

A Duvet Cover from Two Sheets

Make a duvet cover for a real bed from two flat sheets, with a buttoned or snapped bottom opening, corner ties and a cost comparison.

You will need

- Two flat sheets the right size for the duvet
- 7–10 buttons ($\frac{3}{4}$ in) or a set of sturdy snaps
- Twill tape or fabric strips for 8 corner ties
- Machine with a buttonhole stitch (or snaps), iron, long tape measure, pins

SHEET DUVET COVER WITH A BUTTON PLACKET

Finished size: One queen cover, 87 × 91 in finished, for an 88 × 92 in duvet (adjust to your duvet) · About 3–4 hours

Fabric and notions

- 2 queen flat sheets, each cut 88 × 96 in (92 in plus 4 in for the bottom placket)
- 7 buttons, $\frac{3}{4}$ in
- 8 ties, each 1 × 10 in (twill tape)
- Thread to match

How to make it

1. Prewash and dry both sheets the way the cover will be washed; press.
2. Cut both to 88 × 96 in, using the sheets' finished hems at the bottom if they are deep enough.
3. Placket: at the bottom of each piece press under 1 in, then 3 in, and stitch, making a 3-in band on each.
4. Lay the pieces right sides together, plackets even. Stitch the plackets together for 10 in at each end, through the bands, leaving the 67-in middle open.
5. Mark 7 buttonholes along the top placket, about $11\frac{1}{4}$ in apart, and stitch them; sew buttons on the under placket to match.
6. Fold the ties in half and pin one pair at each corner, inside the seam allowance, pointing inward.
7. Sew the two sides and the top at $\frac{1}{2}$ in, catching the ties; finish the seams with zigzag or serger.
8. Turn right side out through the opening, push out the corners, press.
9. Tie the cover's corners to the duvet's corners (sew loops on the duvet if it has none), turn, button and shake.

Fabric check: Cotton or cotton-blend sheets of 200–400 thread count work best; very slippery sateen is harder to keep square. Prewash both sheets together so they shrink the same. Use buttons that can be machine-washed and dried.

Steps

1. Measure the duvet (not the old cover) in three places each way; record and use the largest.
2. Write the cut sheet: finished size, cut size, opening length, closure spacing, ties, cost.
3. Make one test buttonhole on a doubled scrap of the sheet.
4. Sew the cover from the pattern card.
5. Fit test: put the duvet in. Does it fill the corners? Does it shift after a night's use?
6. Compare the cost with a store-bought cover and record the savings.
7. Clean up: pins and buttons counted, iron unplugged. Improve it: one change.

Tips

- The burrito method from Lesson 4.3 does not suit a cover this big; sew it flat on the floor or a big table.
- Turning the cover inside out and grabbing the duvet's corners through it is the fastest way to fill it.
- If the sheets have a decorative top hem, use it at the bottom as a ready-made placket.

Check your work

- ☐ My cover is sized from the duvet and fills its corners.
- ☐ My closures are evenly spaced and hold after washing.
- ☐ My cost comparison is recorded.

LAB NOTEBOOK

1. Draw the cover flat with every measurement, opening, closures and ties marked.
2. Record the cost comparison.
3. Tape in a scrap of the sheet with its thread count from Lesson 4.3.

KEY FORMULAS

$$\begin{aligned}\text{finished cover} &= \text{insert} - (0 \text{ to } 2 \text{ in}) \\ \text{cut size} &= \text{finished size} + 2 \times \text{seam allowance} \\ \text{closure spacing} &= \frac{\text{opening length}}{\text{number of closures} - 1} \\ \text{closure spacing} &= \text{number of closures} - 1 \text{ opening length}\end{aligned}$$

From history. Woven coverlets like Sarah Ann Outwater's were made in large numbers in New York, Pennsylvania, Ohio and Indiana from about the 1820s to the 1860s, often by weavers who signed and dated them in the corner blocks.

WORKED EXAMPLES

Example 1. A queen duvet measures 88×92 in. You want the cover 1 in smaller each way, with $\frac{1}{2}$ -in seams. Find the cut size of front and back.

Show solution

1. Finished: 87×91 in 87×91 in.
2. Cut: $(87 + 1) \times (91 + 1) = 88 \times 92$ in $(87 + 1) \times (91 + 1) = 88 \times 92$ in.

Answer: Cut front and back 88×92 in 88×92 in (plus the placket allowance at the bottom).

Example 2. The opening runs across the bottom, leaving 10 in sewn at each end of the 87-in bottom edge. How long is the opening, and where do 7 buttons go?

Show solution

1. Opening: $87 - 2 \times 10 = 67$ in $87 - 2 \times 10 = 67$ in.
2. Buttons at each end of the opening and evenly between: $67 \div (7 - 1) \approx 11.2$ in $67 \div (7 - 1) \approx 11.2$ in apart.

Answer: A 67-in opening with 7 buttons about $11\frac{1}{4}$ in apart.

Example 3. Without sheets, the cover is pieced from 54-in fabric with a center panel. For 88-in cut width, how wide is each side strip ($\frac{1}{2}$ -in seams)?

Show solution

1. The center panel is a full 54 in; its two seams use 0.5 in 0.5 in each side of the panel.
2. Width still needed: $88 - 54 = 34$ in $88 - 54 = 34$ in, plus 1 in for the two seams on the panel: 35 in 35 in,
3. so each side strip is $35 \div 2 + 0.5 = 18$ in $35 \div 2 + 0.5 = 18$ in cut (the extra $\frac{1}{2}$ in is its own seam allowance).

Answer: A 54-in center panel with two 18-in side strips per face; cut 2×92 in long, about $2 \times 2 \times 92 \div 36 \approx 10.2$ $2 \times 2 \times 92 \div 36 \approx 10.2$ yd for front and back.

Example 4. Cost: two queen flat sheets at \$16 each, 7 buttons at \$0.40, thread \$3. Compare with a store cover at \$69.

Show solution

1. Sewn: $2 \times 16 + 7 \times 0.40 + 3 = \37.80
2. Savings: $\$69 - \$37.80 = \$31.20$, about 45%.

Answer: About \$38 sewn versus \$69 bought.

PRACTICE

1. **Easy** Why use a duvet cover instead of washing the duvet itself?

Show answer

The cover washes and dries easily; down dislikes frequent washing and dries slowly.

2. **Easy** Twin duvet 68 × 88 in, cover the same size, ½-in seams. Cut size?

Show answer

69 × 89 in

3. **Easy** Why are flat sheets good duvet-cover fabric?

Show answer

They are wide enough to need no piecing, washable and inexpensive.

4. **Medium** Bottom edge 67 in finished, 9 in sewn at each end. Opening length?

Show answer

49 in

5. **Medium** 8 snaps along a 49-in opening. Spacing?

Show answer

$49 \div 7 = 7$ in

6. **Medium** Why put a full width in the center when piecing?

Show answer

So no seam runs down the middle of the bed, where it would be most noticed.

7. **Medium** King duvet 104 × 92 in, cover 2 in smaller each way, ½-in seams. Cut size?

Show answer

103 × 91 in

8. **Hard** Cut width 103 in from 54-in fabric with a center panel: side strip width (½-in seams)?

Show answer

$(103 - 54 + 1) \div 2 + 0.5 = 25.5$ in

9. **Hard** Yards of 54-in fabric for front and back of that king cover (cut length 91 in, two lengths per face because a center panel and two side strips fit in two widths)?

Show answer

Each face: 2 lengths (one full width; one width split into two strips), $4 \times 91 = 364$ in $\approx 10.14 \times 91 = 364$ in ≈ 10.1 yd; buy 10¼ yd.

10. **Hard** Sewn cover \$41, store cover \$89. Percent saved?

Show answer

$48 \div 89 \approx 54\%$

11. **Challenge** Design a reversible duvet cover with a hidden closure for a teenager's room. Specify the fabrics, the closure and how you keep the duvet from shifting, with reasons.

Show answer

Two contrasting washable sheets (or a solid and a print); a long zipper or snaps set inside a placket across the bottom so they are hidden; corner ties at all four corners (and two midpoints for a large duvet); colors chosen from the room's scheme so either side works.

COMMON MISTAKES

- Measuring the old cover instead of the duvet.
- Forgetting the ties, so the duvet bunches at one end.
- Using buttons too small for the buttonholes, so the cover gapes open.

Make it a game · Duvet Dash. Time each player putting a duvet into its cover by the inside-out corner method, starting with the cover flat and the duvet folded. Fastest time wins, but only if all four corners are filled and tied. The parent may add a penalty of 10 seconds for each empty corner.

Scripture. “She is not afraid of the snow for her household: for all her household are clothed with scarlet.” (Proverbs 31:21, KJV)

The capable woman prepares her household's warm things before winter comes. A good bed, ready for the cold, is part of that same care.

4.5 BED SKIRTS AND THE MEASURED BED

OBJECTIVES

- Measure a bed for a bed skirt: deck size, drop and corner posts.
- Calculate gathered and tailored skirt lengths, including kick pleats.
- Sew a bed skirt for a real bed, and finish the unit project: a valance or a duvet cover set for the room.

Warm-up. Lift the mattress corner of a bed (with help) and look at what lies between the mattress and the box spring or slats. Measure from the top of the box spring (or the bed's slats) to the floor at the middle and at each corner. Are the four numbers the same?

WATCH

Classic GATHERED BED SKIRT Tutorial. Learn how to make an unlined shirred dust ruffle

[A Square Pillow Isn't Square!](#) · 14:18

<https://www.youtube.com/watch?v=YnqJ5Q8qcOQ>

WHEN TO WATCH

After “The math.” She works the measurements and fullness on screen first; work them with her for your own bed before watching the sewing.

BACKUP VIDEO

the easiest way to make a bedskirt

[mimzy & company](#) · 3:47

<https://www.youtube.com/watch?v=tQ9NMP5pArw>

A quick method that attaches the skirt to an old fitted sheet instead of a deck; useful if you have one.

KEY TERMS

bed skirt (dust ruffle)

A skirt that hangs from under the mattress to the floor, hiding the box spring and bed frame.

drop

The distance from the top of the box spring to the floor (minus clearance).

split corner

A skirt sewn in separate side and foot panels so the corners open around bed posts.

deck

The flat panel of plain fabric that lies on the box spring, to which the skirt is sewn.

kick pleat

An inverted pleat at a corner or along a side that lets a tailored skirt bend neatly.

gathering

Drawing up fabric along a line of long stitches or over a cord to add fullness.

CORE IDEAS

The story. In Jan van Eyck's portrait of a merchant and his wife in Bruges in 1434, the most expensive object in the room may be the bed: hung all around with deep red curtains on rails, with a matching red coverlet. Bed hangings kept out drafts in cold houses, gave privacy in homes where rooms were shared, and showed the family's wealth. Over the centuries the canopy and curtains disappeared from most beds, but a little of them remains: the short skirt around the base, which Victorians called a dust ruffle because it kept dust from blowing under the bed.

How they figured it out. A bed skirt has to stay put while a mattress sits on it and people sit on the bed's edge. The solution is the **deck**: a flat panel of plain fabric, cut to the box spring's top, that the mattress holds down; the skirt is sewn to its sides and foot. For beds with posts, the skirt is made in separate panels so the corners split open around the posts. For a tailored look, the skirt hangs flat with **kick pleats** at the corners; for a softer look it is gathered.

The fabric science. The skirt is the most visible part of a bed and the least worn, so decorator fabrics, linens and even sheets suit it. A gathered skirt needs 2–2½ times the length it covers; a tailored skirt needs only the length plus the pleats. Hems must be even with

the floor, so measure the drop at several points: floors and bed frames are rarely level.

The math. Deck = box-spring top + seam allowances (but it can be pieced from scraps, since it is hidden). Skirt cut depth = drop – floor clearance + hem + seam allowance. For tailored skirts, an inverted pleat with folds of depth dd takes up $4d4d$ of fabric.

Let's sew. Your lab is a bed skirt for a real bed. It completes the unit project: a coordinated window and bed set for the room, the shade or cornice from this unit with the duvet cover and skirt.

PICTURE STUDY



The Arnolfini Portrait, Jan van Eyck, 1434 · Oil on oak panel · The National Gallery, London

Image: [Wikimedia Commons](#), public domain

Van Eyck painted this merchant couple in their room in Bruges with the precision of a jeweler, and much of what he painted is cloth: fur-lined gowns, a pleated headdress, a rug, and above all the great red bed. In the 1400s a bed's hangings could be worth more than the bed itself.

Look closely

- Find the bed's red hangings. How are they hung, and how high do they reach?
- Look at the hem of the red coverlet. Does it touch the floor?
- Find every fabric in the room and decide which was the most costly.
- Look at the wife's long gown and how it folds on the floor. How much cloth do you think it took?

Talk about it

1. Which of these bed hangings still survives, in small form, on beds today?
2. Why would a family in a cold, shared house spend so much on bed hangings?
3. If you made one textile for this room, what would it be?

Safety first. Lifting a mattress takes two people: bend the knees and lift together, and never crawl under a propped mattress. Long gathering stitches are pulled by hand; wind the bobbin thread around a pin to anchor it rather than wrapping it around a finger. Count pins.

STUDIO LAB

A Bed Skirt and the Room Set

Measure a real bed, calculate and sew a gathered or tailored bed skirt on a deck, and complete the Unit 4 room set.

You will need

- Machine and iron
- Fabric for the skirt (from your board) and an old sheet or muslin for the deck
- Strong thread or cord for gathering (dental floss or crochet cotton under a zigzag works well)
- Long tape measure and a helper to lift the mattress

GATHERED BED SKIRT ON A DECK

Finished size: One queen skirt, 60 × 80 in deck, 14½-in drop (adjust to your bed) · About 4 hours

Fabric and notions

- Deck: 61 × 81 in, from an old sheet or muslin
- Skirt: 11 crosswise strips 17 in deep (about 5¼ yd of 54-in fabric)
- Crochet cotton or dental floss for gathering
- Thread to match

How to make it

1. Hem the head end of the deck with a narrow double hem. Round the two foot corners slightly by tracing a saucer.
2. Join the skirt strips end to end into one long strip (or three panels for a post bed); press seams open.
3. Hem the bottom of the strip: press up 1 in twice and stitch. Hem the short ends the same way.
4. Divide the strip into eighths and the deck's sides and foot into eighths; mark both with pins.
5. Lay the gathering cord ⅜ in from the top edge and zigzag over it without catching it.
6. Pin the strip to the deck, right sides together, matching the marks; pull the cord to gather each section to fit and spread the gathers evenly.
7. Stitch at ½ in, gathers on top so they do not fold under; finish the seam with zigzag.
8. Press the seam toward the deck and topstitch, then place the deck on the box spring under the mattress.

Fabric check: Light- to medium-weight cottons, linens and sheets gather softly; heavy decorator cloth suits a tailored skirt instead. Prewash if the skirt will be washed. The deck can be any sturdy, hidden fabric.

Steps

1. Measure the bed: box-spring top, and the drop at both sides and the foot in three places; note any posts.
2. Write the cut sheet: deck, skirt depth, length covered, fullness or pleats, strips, yardage, cost.
3. Sew the skirt from the pattern card.
4. Fit check on the bed: is the hem ½ in above the floor all around? Are gathers even?
5. Assemble the room set (shade or cornice, duvet cover, bed skirt) and photograph it from the doorway.
6. Clean up: pins counted, iron unplugged.
7. Improve it: one change.

Tips

- Gathering over a cord is much stronger than pulling two rows of long stitches.
- Spread the gathers with the deck on the bed if you are unsure of the hang.
- A tailored skirt can be pinned to the box spring with long upholstery twist pins instead of a deck, if the family prefers.

Check your work

- ☐ My skirt clears the floor evenly within ¼ in.
- ☐ My gathers or pleats are evenly distributed.
- ☐ My cut sheet matches what I sewed.

LAB NOTEBOOK

1. Draw the bed from above with the deck and skirt panels labeled.

2. Record the cut sheet and costs for the whole room set.

3. Tape in the doorway photo of the room set.

KEY FORMULAS

skirt cut depth = drop – clearance + hem + seam allowance
skirt cut depth = drop – clearance + hem + seam allowance

gathered length = length covered $\times$ fullness

gathered length = length covered $\times$ fullness

inverted pleat take-up = $4d$

inverted pleat take-up = $4d$

WORKED EXAMPLES

Example 1. A queen box spring is 60×80 in, and its top is 15 in from the floor. Find the deck size and the skirt cut depth for a $\frac{1}{2}$ -in floor clearance, double 1-in hem and $\frac{1}{2}$ -in seam allowance.

Show solution

1. Deck: $(60 + 1) \times (80 + 1) = 61 \times 81$ in $(60 + 1) \times (80 + 1) = 61 \times 81$ in.

2. Skirt depth: $15 - 0.5 + 2 + 0.5 = 17$ in $15 - 0.5 + 2 + 0.5 = 17$ in.

Answer: Deck 61×81 in 61×81 in; skirt strips cut 17 in deep.

Example 2. The skirt goes around two sides and the foot of that bed, gathered at $2\frac{1}{2}\times$ fullness. How many inches of skirt strip, and how many 54-in widths cut crosswise?

Show solution

1. Length covered: $80 + 60 + 80 = 220$ in $80 + 60 + 80 = 220$ in.

2. Gathered: $220 \times 2.5 = 550$ in $220 \times 2.5 = 550$ in.

3. Widths: each crosswise strip gives about 53 in after seams: $550 \div 53 \approx 10.4$, so 11 strips.

Answer: About 550 in of strip: 11 crosswise strips 17 in deep, $11 \times 17 = 187$ in ≈ 5.2 yd (buy $5\frac{1}{4}$ yd).

Example 3. A tailored skirt for the same bed has kick pleats at the two foot corners and one in the middle of each long side, each with 3-in folds. Find the total strip length.

Show solution

1. Pleats: 4, each $4 \times 3 = 12$ in $4 \times 3 = 12$ in.

2. Total: $220 + 4 \times 12 = 268$ in $220 + 4 \times 12 = 268$ in.

3. Add $1\frac{1}{2}$ in at each of the two head ends for hems: $268 + 3 = 271$ in $268 + 3 = 271$ in.

Answer: About 271 in. Cut crosswise from 54-in fabric, each 17-in strip gives about 53 in after seams: $271 \div 53 \approx 5.1$
 $271 \div 53 \approx 5.1$, so 6 strips, $6 \times 17 = 102$ in $6 \times 17 = 102$ in (buy 3 yd). Hide the joining seams inside the kick pleats where you can.

Example 4. Design reasoning. The bed has corner posts at the foot. Should the skirt be one continuous piece? How do you handle the corners?

Show solution

1. A continuous skirt would have to be slit around each post, leaving raw edges and a poor hang.

2. Make the skirt in three panels (two sides and the foot), each hemmed at its ends, sewn to the deck so the panels meet at the posts.

3. Hems at the panel ends let each corner part neatly around the post.

Answer: Split corners: three hemmed panels meeting at the posts.

PRACTICE

1. **Easy** What is the deck of a bed skirt for?

Show answer

It lies under the mattress and holds the skirt in place; the skirt is sewn to it.

2. **Easy** Twin box spring 38×75 in. Deck with $\frac{1}{2}$ -in seams?

Show answer

39×76 in 39×76 in.

3. **Easy** Drop 14 in, clearance $\frac{1}{2}$ in, double 1-in hem, $\frac{1}{2}$ -in seam. Cut depth?

Show answer

16 in 16 in.

4. **Medium** Twin skirt around $75 + 38 + 75$ in at $2\times$ fullness. Strip length?

Show answer

$188 \times 2 = 376$ in $188 \times 2 = 376$ in.

5. **Medium** An inverted pleat has 4-in folds. Fabric taken up?

Show answer

16 in 16 in.

6. **Medium** Why measure the drop at several points?

Show answer

Floors and frames are often uneven; the hem must look level with the floor.

7. **Medium** Why can the deck be pieced from scraps or an old sheet?

Show answer

It is hidden under the mattress.

8. **Hard** Tailored queen skirt (220 in covered) with 3 kick pleats of 4-in folds. Total length?

Show answer

$220 + 3 \times 16 = 268$ in $220 + 3 \times 16 = 268$ in.

9. **Hard** King box spring 76×80 in, gathered skirt at $2\frac{1}{2}\times$ on three sides. Strip length and number of 53-in strips?

Show answer

$(80 + 76 + 80) \times 2.5 = 590$ in $(80 + 76 + 80) \times 2.5 = 590$ in; $590 \div 53 \approx 11.1$ $590 \div 53 \approx 11.1$, 12 strips.

10. **Hard** In the Arnolfini Portrait, what jobs did bed hangings do in a cold medieval house?

Show answer

Kept out drafts and held warmth around the sleepers, gave privacy in shared rooms, and showed the family's wealth.

11. **Challenge** Plan a skirt for a daybed against a wall: only one long side and two ends show. What changes in the measuring and the yardage?

Show answer

The skirt covers one long side and two ends only; the wall side gets no skirt (or a short plain strip); length covered is $L + 2W$ $L + 2W$, and the deck still covers the whole spring.

COMMON MISTAKES

- Measuring the drop at one point only.
- Gathering with two rows of basting that snap; use a cord.
- Cutting the deck from the good fabric, which no one will see.

Make it a game · Fullness Judge. Gather three short strips of the same fabric to the same 12-in length at $1\frac{1}{2}\times$, $2\times$ and $3\times$ fullness. A parent shuffles them; each player ranks them from least to most full and names each ratio. Then each player predicts which looks best on your bed and defends it in one sentence; the household votes.

UNIT 4 TEST

Calculators are allowed. Show your work for every calculation: write the formula, substitute with units, and give the answer with its unit. Answer concept questions in complete sentences. The test is worth 100 points.

1. **8 pts**
State the window-cord safety rule used in this course and explain in two sentences why removing cords is better than warning labels.
2. **6 pts**
Name three styles of Roman shade and how each folds.
3. **7 pts**
Faux shade: finished length 22 in, 3 folds $3\frac{1}{2}$ in deep, 4-in hem, 3-in mounting. Cut length?
4. **6 pts**
Opening $41\frac{1}{8}$ in, inside mount, $1\frac{1}{2}$ -in side hems. Finished and cut widths?
5. **6 pts**
Drapes on a 66-in rod project 5 in. Cornice inside width and return depth?
6. **6 pts**
Cornice top at 100 in, drapes to the floor. Face height by one-fifth?
7. **6 pts**
What is railroading, and when can't you do it?
8. **6 pts**
Distinguish a valance, a cornice and a lambrequin.
9. **7 pts**
With a $\frac{1}{2}$ -in linen tester you count 72 ends and 66 picks. Thread count? A label says "600, 2-ply." Honest count?
10. **6 pts**
Compare percale and sateen in weave, hand and wear.
11. **6 pts**
Sheet \$50\$50 lasting 5 years at 2 nights/week vs. \$28\$28 lasting 2 years. Cost per night of each?
12. **6 pts**
Full duvet 80×88 in, cover 1 in smaller each way, $\frac{1}{2}$ -in seams. Cut size?
13. **6 pts**
A 60-in opening gets 9 buttons, one at each end. Spacing?
14. **6 pts**
Queen box spring 60×80 , drop $14\frac{1}{2}$ in, $\frac{1}{2}$ -in clearance, double 1-in hem, $\frac{1}{2}$ -in seam. Deck and skirt depth?
15. **6 pts**
Gathered skirt at $2 \times$ around $80 + 60 + 80$ in. Strip length?
16. **6 pts**
Short essay (5–8 sentences): A grandmother asks you to make a nursery window and bed set for a new grandchild. Describe what you would make and why, including the safety decisions, the fabrics and at least two calculations you would run.

UNIT PROJECT: A WINDOW AND BED SET FOR THE ROOM

Complete a coordinated set for a real bedroom from this unit's labs: a cordless faux Roman shade or padded cornice for the window, and a duvet cover with pillowcases and a bed skirt for the bed, all in the room's scheme.

Submit the cord audit, the thread-count data, each piece's cut sheet and cost, and doorway photos before and after, with a one-page reflection.

LOOK FOR	WHAT IT MEANS
Safety	No cords on any shade; cord audit done with a parent; glasses worn for stapling; tools handled by the rules.
Measurement and math	Every piece sized from the window or bed with a cut sheet; finished sizes within ½ in of plan.
Workmanship	Level folds, neat cornice corners, enclosed seams, even gathers or pleats, closures that hold.
Evidence	Thread-count data averaged and compared with labels; cost comparisons recorded.
Design	The set follows the room's scheme and looks finished from the doorway.

ANSWER KEY

1. Every shade is cordless (a stationary faux shade or a commercial cordless system); never a looped or dangling cord where children live or visit. The hazard strikes silently in seconds and cannot be supervised away; removing reachable cords eliminates it.
2. Flat: crisp folds only when raised, with rods. Hobbled: permanent soft folds down the face. Relaxed: no rods, gentle curve at the bottom. (Faux: fixed folds, no lifting.)
3. $22 + 21 + 4 + 3 = 50$ in $22 + 21 + 4 + 3 = 50$ in.
4. Finished $40\frac{7}{8}$ in 40 $8\frac{7}{8}$ in; cut $43\frac{7}{8}$ in 43 $8\frac{7}{8}$ in.
5. 70 in 70 in; 7 in 7 in.
6. 20 in 20 in.
7. Turning fabric sideways so the length runs along the bolt and long pieces need no seam; not with directional prints or naps that would look wrong sideways.
8. Valance: soft fabric top treatment. Cornice: rigid padded box covered in fabric. Lambrequin: shaped top treatment that comes down the sides.
9. $144 + 132 = 276$ $144 + 132 = 276$; 300.
10. Percale: plain weave, crisp, matte, cool, durable. Sateen: weft floats over four warps, smooth, lustrous, warmer, more prone to snagging and pilling.
11. $50 \div 520 \approx \$0.096$ $50 \div 520 \approx \$0.096$; $28 \div 208 \approx \$0.135$ $28 \div 208 \approx \$0.135$.
12. 80×88 in 80×88 in.
13. $60 \div 8 = 7.5$ in $60 \div 8 = 7.5$ in.
14. Deck 61×81 in 61×81 in; depth 16.5 in 16.5 in.
15. 440 in 440 in.
16. Full credit for: cordless window treatment stated plainly (faux Roman or cordless shade; no cords; crib away from the window); washable, prewashed cotton for bedding; closures and buttons secure and out of a baby's reach; calculations such as shade cut length, cornice sizing, duvet cut size, skirt depth or yardage, with units.

QUILTING

Quilting is the most American of the home textile arts and one of the oldest forms of neighborly work. This unit tells its story from whole-cloth quilts and album quilts to the farm women photographed quilting in the 1930s and 1940s, and then makes one real quilt, a lap quilt or wall hanging, from plan to binding, ideally to be given away.

Precision carries the unit: rotary cutting with strict safety rules, a tested quarter-inch seam, half-square triangles and the geometry of the $\frac{7}{8}$ rule, the quilt sandwich and the right batting, and binding with mitered corners. The math is quilt math: finished and cut sizes, strips and yardage, error that adds up across seams, $\sqrt{2}$ on the diagonal, backing and batting sizes, shrinkage, and binding length.

PREREQUISITES

- Units 2–4 machine skills, pressing and accurate seams
- A parent available to sign off rotary cutting
- Fractions, square roots and percent

MASTERY CHECKLIST

- ☐ I can tell the history of the American quilt and the quilting bee.
- ☐ I can plan a quilt and compute pieces, strips and yardage.
- ☐ I can rotary cut safely and sew an accurate $\frac{1}{4}$ -in seam.
- ☐ I can make and trim half-square triangles and explain the $\frac{7}{8}$ rule.
- ☐ I can choose batting, baste a sandwich and quilt evenly spaced lines.
- ☐ I can bind with mitered corners, label a quilt and give it.

OPTIONAL BOOKS AND TOOLS FOR THIS UNIT

- **A 45 mm rotary cutter, an 18 × 24 in self-healing mat and a 6 × 24 in acrylic ruler:** The basic quilting cutting set; buy a cutter with a blade guard that closes, and spare blades.
- **A walking foot for your machine:** Makes straight-line machine quilting and binding much easier. Buy the one made for your machine's model.
- **International Quilt Museum online collection (University of Nebraska–Lincoln):** Free. Search thousands of quilts by date, pattern and region for your quilt plan and Lesson 5.1 study.

Not required. Every project in this unit works with ordinary fabric-store supplies. School Launch has no ties to these authors, publishers or companies.

LESSONS IN THIS UNIT

5.1 Quilts in American History and the Quilting Bee	3 sessions of 50 minutes
5.2 Rotary Cutting and the Quarter-Inch Seam	3 sessions of 50–90 minutes
5.3 Half-Square Triangles and Block Math	3 sessions of 50–90 minutes
5.4 The Quilt Sandwich: Batting and Quilting	3 sessions of 50–90 minutes
5.5 Binding, Labeling and Giving	3 sessions of 50–90 minutes

5.1 QUILTS IN AMERICAN HISTORY AND THE QUILTING BEE

OBJECTIVES

- Trace the American quilt from whole-cloth quilts through pieced, album and twentieth-century quilts, with what made each possible.
- Explain the quilting bee as shared work and how a quilt's layers and stitches hold together.
- Design a lap quilt on graph paper and calculate its blocks, pieces and fabric.

Warm-up. Find any quilt, comforter or patchwork in the house or a relative's. Who made it, when, and for whom? Count the blocks across and down and measure one block. If no one knows its story, write down what the quilt itself tells you.

WATCH

The Fabric of Humanity: Celebrating the International Quilt Museum

Craft in America · 15:40

<https://www.youtube.com/watch?v=teu6wUfP6ao>

WHEN TO WATCH

After “The story.” Watch for three quilts that show a change in American life (new fabrics, new tools, a new purpose), and note them.

Note: From the public-television series Craft in America, filmed at the International Quilt Museum at the University of Nebraska–Lincoln, home of one of the world's largest public quilt collections.

KEY TERMS

quilt

Three layers (a top, a batting and a backing) held together by stitching (quilting) or ties.

pieced (patchwork) quilt

A quilt whose top is sewn together from many smaller pieces, usually in blocks.

album quilt

A quilt of different blocks, often signed, made by several people as a gift or keepsake.

whole-cloth quilt

A quilt whose top is one fabric (or a few large pieces), decorated by its quilting stitches.

appliqué

Shapes of fabric sewn on top of a background.

quilting bee

A gathering of neighbors to quilt a top together on a large frame.

CORE IDEAS

The story. The earliest American quilts that survive from the 1700s are mostly **whole-cloth** quilts: one fine fabric, often a glazed wool or an imported cotton, with the beauty in thousands of tiny quilting stitches. As American mills and printers made cotton cheap in the 1800s, women could buy many colors and prints, and the **pieced** quilt of blocks took over. In the 1840s and 1850s, women in and around Baltimore made elaborate **album quilts**, each block made and often signed by a different friend, as gifts for a departing pastor, a bride or a neighbor. During the Civil War, Northern women sent quilts by the thousands to soldiers' hospitals. In the 1930s, government photographers recording rural America photographed women quilting in farmhouses, like Mrs. Bill Stagg of Pie Town, New Mexico, who quilted while she rested at noon from field work.

How they figured it out. A quilt top can be pieced by one person in the evenings, but quilting a full-size quilt by hand takes weeks. The answer was the **quilting bee**: neighbors set the layers in a large wooden frame, sat around it, and quilted together, talking as they worked. A bee turned months of solitary work into a day or two of shared work, and it was one of the main social events of rural life. Many quilts were made to be given: to a bride, a new baby, a family burned out of its home.

The fabric science. A quilt is a three-layer sandwich. The **top** carries the design; the **batting** (cotton, wool or polyester) traps still air for warmth; the **backing** closes the sandwich. The quilting stitches, or ties, pass through all three layers at intervals close enough

that the batting cannot shift or bunch when washed. The design is built from **blocks**: a nine-patch is a 3×3 grid of squares, and every block is planned at its finished size, with $\frac{1}{4}$ -inch seam allowances added at cutting.

The math. Quilt size = blocks across $\times$ block size (+ sashing and borders). Pieces per block $\times$ number of blocks = pieces to cut. Each unit is cut at finished size + $\frac{1}{2}$ in (two $\frac{1}{4}$ -in seams). With those three facts you can plan a whole quilt on graph paper.

Let's sew. This unit makes one lap quilt (about 48×60 in) or a smaller wall hanging, ideally given away. This lesson's lab is the plan: design on graph paper, choose fabrics from the room scheme, and write the full cutting and yardage list.

PICTURE STUDY



Mrs. Bill Stagg with state quilt that she made, Pie Town, New Mexico, Russell Lee (Farm Security Administration), October 1940 · Color slide photograph · Library of Congress, Washington, D.C.

Image: [Wikimedia Commons](#), public domain

Russell Lee photographed the homestead families of Pie Town, New Mexico, in 1940, in color film still new at the time. Mrs. Stagg worked in the fields beside her husband and quilted during her noon rest. This quilt has a block for each state, embroidered with its name and emblems.

Look closely

- Count the blocks across and down. How many blocks is that, and how many states were there in 1940?
- Look at the strips between the blocks. What is that sashing for?
- Look at her apron and dress. What do they tell you about her day?
- Look at the house and yard behind her. Where would she have set up a quilting frame?

Talk about it

1. Why might a farm woman choose a state quilt, with a block for each state, in 1940?
2. How is this quilt like an album quilt, and how is it different?
3. What would you put in the blocks of a quilt that told your family's story?

Safety first. Planning only this week: scissors carried closed, pins counted if you pin fabric swatches to your plan. Begin the unit's rotary-cutter rule now: no rotary cutting until a parent has watched you cut safely in Lesson 5.2.

STUDIO LAB

The Quilt Plan

Design a lap quilt or wall hanging on graph paper, choose fabrics from your room scheme, and write the complete cutting list and yardage. Decide now whom the quilt is for.

You will need

- Graph paper, colored pencils, ruler
- Fabric swatches from your room scheme or a fabric store
- Calculator and lab notebook

LAP QUILT PLAN

Finished size: One plan for a quilt about 48 × 60 in (or a 24 × 36 in wall hanging) · About 2 hours

Fabric and notions

- A drawn layout at 1 square = 2 in (or 1 square = 3 in)
- A block diagram with finished and cut sizes
- A fabric key: each fabric's color, role (dark, light, accent) and swatch
- A cutting list: pieces, sizes, strips, yardage for each fabric
- Batting, backing and binding estimates (finished in Lessons 5.4–5.5)

How to make it

1. Choose the recipient and the size. Measure the person's sofa throw or the bed it will lie on.
2. Choose a block: nine-patch, four-patch, a half-square-triangle block (Lesson 5.3), or alternating pieced and plain blocks.
3. Draw one block large, label finished and cut sizes.
4. Draw the whole quilt layout on graph paper and color it from the scheme.
5. Count every piece by fabric and write the cutting list.
6. Compute strips and yardage for each fabric; add about 10% for mistakes.
7. Estimate cost and compare with the budget from Lesson 1.5.

Fabric check: Quilting cotton (100% cotton, about 4–4.5 oz/yd², 42–44 in wide) is the standard: it presses crisply, holds a ¼-in seam and is easy to cut accurately. Prewash all fabrics or none, so they shrink together; prewash reds and other deep colors to check for dye bleeding. Old cotton shirts work beautifully for scrap quilts.

Steps

1. Study three quilts (family, museum website, library book) and record block size, layout and number of fabrics.
2. Make the plan from the pattern card.
3. Have a parent check the cutting list arithmetic.
4. Buy or gather fabrics; prewash, press and record any shrinkage of a measured 10-in square.
5. Write a one-paragraph note about the recipient and why this design suits them.
6. Improve it: one thing you would change in the plan after seeing the real fabrics together.

Tips

- Contrast between darks and lights matters more than color; squint at your fabrics to check.
- Graph paper at 1 square = 2 in makes a lap quilt fit on one page.
- A simple block made well beats a complicated block made badly.

Check your work

- ☐ My plan has a layout, a block diagram, a cutting list and yardage.
- ☐ My numbers check: pieces × blocks, strips, yards.
- ☐ I chose a recipient.

LAB NOTEBOOK

1. Tape in your graph-paper plan and fabric key.
2. Record three quilts you studied: size, block, layout, date, maker if known.
3. Write the recipient note.

KEY FORMULAS

$$\text{quilt size} = \text{blocks} \times \text{block size} + \text{sashing} + \text{borders}$$

$$\text{quilt size} = \text{blocks} \times \text{block size} + \text{sashing} + \text{borders}$$

$$\text{cut size} = \text{finished size} + \frac{1}{2} \text{ in}$$

$$\text{cut size} = \text{finished size} + 21 \text{ in}$$

$$\text{squares per strip} = \left\lfloor \frac{\text{usable width}}{\text{cut size}} \right\rfloor$$

$$\text{squares per strip} = \lfloor \text{cut size} \div \text{usable width} \rfloor$$

From history. Many nineteenth-century quilt tops were pieced by one woman over a winter and then quilted at a bee in spring, when the large frame could be set up in a room no longer needed for winter living.

WORKED EXAMPLES

Example 1. A lap quilt of 12-in finished nine-patch blocks, 4 across and 5 down. What size is the quilt without borders, and what size are the small squares cut?

Show solution

1. Size: $4 \times 12 = 48$ in $4 \times 12 = 48$ in by $5 \times 12 = 60$ in $5 \times 12 = 60$ in.
2. Each nine-patch square finishes $12 \div 3 = 4$ in $12 \div 3 = 4$ in; cut $4 + \frac{1}{2} = 4\frac{1}{2}$ in $4 + 21 = 42\frac{1}{2}$ in.

Answer: 48×60 in 48×60 in; squares cut $4\frac{1}{2}$ in $42\frac{1}{2}$ in.

Example 2. All 20 blocks are nine-patches with 5 dark and 4 light squares. How many of each, and how many $4\frac{1}{2}$ -in strips of 42-in usable width?

Show solution

1. Dark: $20 \times 5 = 100$ $20 \times 5 = 100$; light: $20 \times 4 = 80$ $20 \times 4 = 80$.
2. Squares per strip: $\lfloor 42 \div 4.5 \rfloor = 9$ $\lfloor 42 \div 4.5 \rfloor = 9$.
3. Strips: dark $\lfloor 100 \div 9 \rfloor = 12$ $\lfloor 100 \div 9 \rfloor = 12$, light $\lfloor 80 \div 9 \rfloor = 9$ $\lfloor 80 \div 9 \rfloor = 9$.

Answer: 100 dark and 80 light squares; 12 dark strips and 9 light strips, each $4\frac{1}{2}$ in wide.

Example 3. How many yards is 12 strips $4\frac{1}{2}$ in wide? 9 strips?

Show solution

1. Dark: $12 \times 4.5 = 54$ in $= 1.5$ yd $12 \times 4.5 = 54$ in $= 1.5$ yd.
2. Light: $9 \times 4.5 = 40.5$ in ≈ 1.13 yd $9 \times 4.5 = 40.5$ in ≈ 1.13 yd.

Answer: Buy $1\frac{5}{8}$ yd dark and $1\frac{1}{4}$ yd light (a little extra for squaring and mistakes).

Example 4. At a quilting bee, five women each quilt about 2 square feet an hour. How long would the bee take to quilt a 6×7 ft quilt? How long would one woman alone take?

Show solution

1. Area: $6 \times 7 = 42$ ft² $6 \times 7 = 42$ ft².
2. Together: $5 \times 2 = 10$ ft²/h $5 \times 2 = 10$ ft²/h; $42 \div 10 = 4.2$ h $42 \div 10 = 4.2$ h.
3. Alone: $42 \div 2 = 21$ h $42 \div 2 = 21$ h.

Answer: About 4 hours together, versus 21 hours alone: the bee turned weeks of evenings into an afternoon.

PRACTICE

1. **Easy** Name the three layers of a quilt.

Show answer

Top, batting, backing.

2. **Easy** What is a whole-cloth quilt?

Show answer

A quilt with a top of one fabric, decorated mainly by its quilting stitches.

3. **Easy** A 9-in nine-patch block: what size are its squares finished and cut?

Show answer

3 in finished, $3\frac{1}{2}$ in cut.

4. **Medium** Why did pieced quilts become common in the 1800s?

Show answer

American mills and printers made cotton prints cheap and plentiful.

5. **Medium** A quilt is 5 blocks across and 6 down of 10-in blocks, with a 4-in border all around. Finished size?

Show answer

$50 + 8 = 58$ in $50 + 8 = 58$ in by $60 + 8 = 68$ in $60 + 8 = 68$ in.

6. **Medium** How many $3\frac{1}{2}$ -in squares from one 42-in strip?

Show answer

$[42 \div 3.5] = 12$ $[42 \div 3.5] = 12$.

7. **Medium** What was an album quilt, and why were they made?

Show answer

A quilt of different, often signed, blocks made by friends as a gift or keepsake (for a bride, pastor or departing neighbor).

8. **Hard** 30 nine-patch blocks, each 4 dark + 5 light squares cut $3\frac{1}{2}$ in. Strips of each (42-in usable width) and yards?

Show answer

Dark $120 \rightarrow 10$ strips, 35 in ≈ 1 yd; light $150 \rightarrow 13$ strips, 45.5 in ≈ 1.3 yd.

9. **Hard** Six quilters at 1.5 sq ft per hour each quilt a 72×84 in top. How many hours?

Show answer

Area 42 ft^2 42 ft^2 ; $42 \div 9 \approx 4.7$ h $42 \div 9 \approx 4.7$ h.

10. **Hard** Why must quilting stitches be spaced no farther apart than the batting allows?

Show answer

Otherwise the batting shifts, bunches and tears apart when the quilt is washed and used.

11. **Challenge** Mrs. Stagg quilted at noon after field work. Using what you know about bees, explain why quilting was both work and rest for farm women, and why many quilts were given away.

Show answer

Quilting was useful work done sitting down, often in company, a change from heavy labor; quilts met real needs (warmth) and were natural gifts for weddings, births and families in trouble, so neighbors made them for one another.

COMMON MISTAKES

- Planning at cut size instead of finished size, which makes the quilt too big or the math wrong.
- Choosing fabrics with no contrast, so the blocks disappear.
- Forgetting borders, binding and backing in the budget.

Make it a game · Block Count Bee. A parent shows a photo of a quilt (from a book or museum website) for 20 seconds, then hides it. Players write the number of blocks across and down, the block type and the number of fabrics. Closest answers score; then everyone computes the finished size from a block size the parent supplies.

Scripture. “Two are better than one; because they have a good reward for their labour.” (Ecclesiastes 4:9, KJV)

The quilting bee is this verse in cloth: shared work goes faster, goes better and is happier. Find someone to sew with this unit.

5.2 ROTARY CUTTING AND THE QUARTER-INCH SEAM

OBJECTIVES

- Use a rotary cutter, mat and ruler safely to cut accurate strips and squares.
- Explain how small seam errors add up across a quilt and test your own $\frac{1}{4}$ -in seam.
- Piece accurate nine-patch blocks that measure to plan.

Warm-up. Lay three 2-in squares of paper side by side, overlapping each by $\frac{1}{4}$ in, and tape them. Measure the result. Now overlap by $\frac{3}{8}$ in instead. How much did the row shrink? Imagine that difference across fifteen seams.

WATCH

How to Cut Fabric Accurately for Quilting Stripsets - Krista Moser | Fat Quarter Shop

Fat Quarter Shop · 5:30

<https://www.youtube.com/watch?v=oAZrOFkvbRE>

WHEN TO WATCH

After “The fabric science.” Watch how she squares up the fabric edge before cutting strips and where she keeps her hand on the ruler.

BACKUP VIDEO

Sew Easy Lesson: Check your Quarter Inch Seam!

Fons & Porter's Love of Quilting · 4:01

<https://www.youtube.com/watch?v=aYMSc84t2ak>

Watch before the seam test: three strips sewn and measured, the same test you will run.

KEY TERMS

rotary cutter

A round blade on a handle that cuts fabric as it rolls, used with a self-healing mat and an acrylic ruler.

self-healing mat

A cutting mat whose surface closes up after the blade passes.

squaring up

Trimming a fabric edge exactly perpendicular to the fold before cutting strips.

quarter-inch seam

The standard quilting seam allowance, $\frac{1}{4}$ in from the raw edge.

scant quarter inch

A seam a thread or two narrower than $\frac{1}{4}$ in, to make up for the fold taken by pressing.

chain piecing

Feeding pairs of pieces through the machine one after another without cutting the thread between them.

CORE IDEAS

The story. For most of quilting history, every piece was marked with a template and a pencil and cut with scissors, one or two layers at a time. In 1979 the Japanese company Olfa introduced a rotary cutter, a round blade that rolls through fabric like a pizza cutter. Quilters adopted it with the self-healing mat and the thick acrylic ruler, and quilt making changed: strips could be cut through four layers at once, accurately, and sewn into strip sets that are cut again into units. Many of today's quick quilt methods exist because of that blade.

How they figured it out. Speed brought a new demand: accuracy. Quilters found that blocks pieced from rotary-cut strips only meet at their corners if every cut and every seam is exact, because errors *add*. A seam $\frac{1}{8}$ in too wide on a nine-patch row loses $\frac{1}{4}$ in per seam pair; across a quilt of five blocks with two seams each, the row comes up more than an inch short. So quilters learned to test their seam, mark the machine, and check every block against its planned size.

The fabric science. Fabric is cut on grain: strips across the width (selvage to selvage) are cut after the fabric is folded and the edge **squared** exactly perpendicular to the fold; otherwise strips come out with a bend (a “V”) at the fold. Pressing matters too: seams are

pressed (not ironed back and forth) toward the darker fabric, and seams in adjoining rows are pressed in opposite directions so they **nest** together at the corners. A pressed seam folds the fabric over itself, which uses a thread or two of width; that is why many quilters sew a scant $\frac{1}{4}$ in.

Safety. The rotary cutter is the sharpest tool in this course. The rules: close the blade every time you set it down, even for a second; cut standing up, away from your body; keep the hand on the ruler flat with fingertips well back from the edge, and walk that hand up the ruler as you cut; replace dull blades (a dull blade needs force, and force slips); store the cutter out of children's reach. A parent watches you cut safely before you cut alone.

Let's sew. In the lab you will test your $\frac{1}{4}$ -in seam with three strips and then cut and piece the nine-patch blocks for your quilt, checking each block's size.

PICTURE STUDY



Star of Bethlehem Quilt, Unknown American maker, c. 1835 · Pieced and appliquéd cotton, quilted · The Metropolitan Museum of Art, New York
Image: [Wikimedia Commons](#), public domain

This great star is made of hundreds of small diamonds, every one cut and sewn by hand, about 145 years before the rotary cutter. Every ring of the star had to meet the next exactly; one careless seam would have pushed the whole star out of shape.

Look closely

- Follow one ring of color around the star. Count how many diamonds it takes to go across one point.
- Look at the center. Do the points meet cleanly?
- Find the printed chintz bouquets in the corners. Are they pieced or cut out and sewn on?
- Look for the quilting stitches in the white areas. What patterns can you see?

Talk about it

1. If each diamond's seam were $\frac{1}{16}$ in off, what would happen by the time eight rings met at the tip of each point?
2. Why would a quilter use cut-out chintz flowers in the corners rather than piecing them?
3. Which would you rather make, and why: this star by hand, or a simple nine-patch with a rotary cutter?

Safety first. Rotary cutter rules: a parent watches you cut before you cut alone; close the blade every time you set it down; cut standing, away from your body; fingertips flat and back from the ruler's edge; replace dull blades; store it out of children's reach. Count pins in and out at every session.

STUDIO LAB

The Seam Test and the Nine-Patch Blocks

Test your $\frac{1}{4}$ -in seam, adjust your guide until three strips measure exactly, then cut and piece the nine-patch blocks for your quilt, checking every block.

You will need

- Rotary cutter (45 mm), self-healing mat at least 18 × 24 in, 6 × 24 in acrylic ruler
- Prewashed, pressed quilting cottons
- Machine with a ¼-in foot or a tape guide; iron
- Small square ruler (6½ in) for checking blocks

STRIP-PIECED NINE-PATCH BLOCKS

Finished size: Blocks for a 48 × 60 in quilt: 20 blocks, 12 in finished (adjust to your plan) · About 4–6 hours over several sessions

Fabric and notions

- Dark: 12 strips 4½ in × width of fabric
- Light: 9 strips 4½ in × width of fabric
- Neutral cotton thread (50 weight)
- Seam test: 3 strips 1½ × 6 in

How to make it

1. Seam test: sew the three test strips together, press, and measure. They should measure 3½ in; adjust the guide until they do.
2. Fold the fabric selvage to selvage, then fold again; square the edge with the ruler at right angles to the folds.
3. Cut strips 4½ in wide, checking the squareness every few strips.
4. Strip set A: dark–light–dark. Strip set B: light–dark–light. Sew with ¼-in seams.
5. Press A's seams toward the dark strips, and B's toward the dark strip as well (so they nest with A).
6. Square the end of each strip set and crosscut into 4½-in segments.
7. Sew A–B–A rows into blocks, nesting the seams where they cross.
8. Press and measure each block: 12½ in unfinished. Record any that are off and fix them before going on.

Fabric check: Use 100% cotton quilting fabric, prewashed and pressed, with spray starch if it is limp. Avoid stretchy, slippery or loosely woven fabrics, which distort under the rotary cutter. Old shirts can be used if they are woven cotton, not knit.

Steps

1. Parent sign-off: cut three strips safely with the parent watching; record the date.
2. Run the seam test until three strips measure 3½ in; record each try and the adjustment.
3. Cut and piece the blocks from the pattern card.
4. Make a data table: block number, measured size, error. Calculate the average error.
5. Fix any block more than ⅛ in off.
6. Clean up: blade closed and stored, pins counted, iron unplugged.
7. Improve it: one change to your cutting or seam.

Tips

- Stand to cut; you will see the ruler line and press more evenly.
- Cut no more than four layers at once.
- Chain piece the segments and press each set before the next seam.

Check your work

- ☐ A parent signed off my rotary cutting.
- ☐ My seam test measures 3½ in.
- ☐ My blocks measure 12½ in within ⅛ in.

LAB NOTEBOOK

1. Tape in your seam-test strips with their measurements.

- Record the block measurement table and average error.
- Draw the pressing plan for set A and set B with arrows.

KEY FORMULAS

$$\begin{aligned}\text{row length} &= n \times \text{finished unit} \quad (\text{if seams are exact}) \\ \text{row length} &= n \times \text{finished unit} \quad (\text{if seams are exact}) \\ \text{row error} &= \text{number of seams} \times 2 \times \text{error per seam allowance} \\ \text{row error} &= \text{number of seams} \times 2 \times \text{error per seam allowance} \\ \text{strip set width} &= \text{strips} \times \text{finished width} + \frac{1}{2} \text{ in} \\ \text{strip set width} &= \text{strips} \times \text{finished width} + 21 \text{ in}\end{aligned}$$

From history. Quilters' clear acrylic rulers, printed with lines every $\frac{1}{8}$ in and 45° and 60° angles, came into wide use in the 1980s alongside the rotary cutter. Together they made strip piecing the standard method for many traditional blocks.

WORKED EXAMPLES

Example 1. Three $2\frac{1}{2}$ -in strips are sewn together with exact $\frac{1}{4}$ -in seams. What should the strip set measure, and what if each seam allowance is $\frac{3}{8}$ in?

Show solution

- Exact: $3 \times 2 + \frac{1}{2} = 6.5$ in $3 \times 2 + 21 = 6.5$ in.
- With $\frac{3}{8}$ -in allowances: each of the 2 seams takes $2 \times \frac{3}{8} = \frac{3}{4}$ in $2 \times 83 = 43$ in instead of $\frac{1}{2}$ in, $\frac{1}{4}$ in too much per seam:
 $6.5 - 2 \times \frac{1}{4} = 6$ in $6.5 - 2 \times 41 = 6$ in.

Answer: Exact: $6\frac{1}{2}$ in. With $\frac{3}{8}$ -in seams: 6 in, half an inch short already.

Example 2. A quilt row has 5 blocks of 12 in, each block with 2 internal seams across it plus 4 seams joining the blocks. If each seam allowance is $\frac{1}{16}$ in too wide, how short is the row?

Show solution

- Seams across the row: $5 \times 2 + 4 = 14$ $5 \times 2 + 4 = 14$.
- Each seam is $2 \times \frac{1}{16} = \frac{1}{8}$ in $2 \times 161 = 81$ in short.
- Row: $14 \times \frac{1}{8} = 1.75$ in $14 \times 81 = 1.75$ in short.

Answer: $1\frac{3}{4}$ in short across a 60-in row: tiny errors add up.

Example 3. You need 100 dark squares cut $4\frac{1}{2}$ in. A strip of 42-in usable width gives 9 squares. If you cut through 4 layers at once, how many cutting strokes for the strips, and for crosscutting the squares?

Show solution

- Strips: fabric folded once is 2 layers, so each stroke cuts 2 strips: $12 \div 2 = 6$ $12 \div 2 = 6$ strokes (plus squaring the edge).
- Squares: stack 4 strips; 9 crosscuts give $4 \times 9 = 36$ $4 \times 9 = 36$ squares. For 100 squares you need 3 stacks:
 $3 \times 9 = 27$ $3 \times 9 = 27$ crosscuts.

Answer: About 33 strokes for 100 squares, against 400 sides marked and cut with scissors.

PRACTICE

- Easy** State four rotary cutter safety rules.

Show answer

Close the blade every time; cut away from your body; fingers flat and back from the ruler's edge; replace dull blades; store out of children's reach.

2. **Easy** A 3-in finished square is cut at what size?

Show answer

3½ in.

3. **Easy** Two 2-in finished strips sewn together: strip-set width?

Show answer

4½ in

4. **Medium** Why square up the fabric before cutting strips?

Show answer

So the strips are straight; an unsquared edge gives strips with a bend at the fold.

5. **Medium** A nine-patch should measure 6½ in unfinished. Yours measures 6¼. What happened, and by how much per seam allowance?

Show answer

Seams too wide: 2 seams across lose ¼ in, so each seam allowance was about $\frac{1}{16}$ in too wide.

6. **Medium** Why press seams in adjoining rows in opposite directions?

Show answer

So the seams nest where they cross and the corners match without bulk.

7. **Medium** What is chain piecing, and why is it faster?

Show answer

Feeding pairs through one after another without cutting threads; it saves stopping, cutting and repositioning.

8. **Hard** A row of 6 blocks, 3 internal seams each, plus 5 joining seams. Error $\frac{1}{32}$ in per seam allowance. How short is the row?

Show answer

$(18 + 5) \times \frac{1}{16} = \frac{23}{16} \approx 1.44$ in $(18 + 5) \times 161 = 1623 \approx 1.44$ in.

9. **Hard** A strip set of four 1½-in strips (1 in finished each) should measure what? Yours measures 4¼. Average error per seam allowance?

Show answer

Should be 4½ in; 3 seams lose ¼ in total, about $\frac{1}{24}$ in per seam allowance.

10. **Hard** Why does a dull rotary blade cause more accidents than a sharp one?

Show answer

It needs more force, skips threads and slips; the hand presses harder and the cutter can jump the ruler.

11. **Challenge** Before 1979 a quilter cut 300 pieces with scissors at about 40 seconds each; with a rotary cutter, strips and crosscuts take about 6 seconds per piece. Compute the hours saved and explain one way the faster method could lower quality if done carelessly.

Show answer

$300 \times 34 = 10,200$ s ≈ 2.8 h $300 \times 34 = 10,200$ s ≈ 2.8 h saved. Careless squaring or stacking too many layers produces crooked pieces in quantity, which then fail to match.

COMMON MISTAKES

- Leaving the rotary blade open on the table.
- Cutting strips without squaring, so they bend at the fold.
- Ignoring a block that is a little off; the errors add up row after row.

Make it a game • Seam Sniper. Each player sews three 1½-in strips together in two minutes and presses them. A parent measures: exactly 3½ in scores 5, within $\frac{1}{16}$ in scores 3, within $\frac{1}{8}$ in scores 1. Best of three rounds. Rotary cutters stay closed and off the table during the game; strips are cut beforehand.

5.3 HALF-SQUARE TRIANGLES AND BLOCK MATH

OBJECTIVES

- Explain why triangles are cut and sewn differently from squares, using the Pythagorean theorem and bias edges.
- Calculate cut sizes for half-square triangles made two at a time and for flying-geese units.
- Make accurate half-square-triangle units and trim them to size, then plan a block with them.

Warm-up. Fold a square of paper in half on the diagonal and cut it. You have two triangles. Measure the long side and compare it with the square's side. Now pull a fabric triangle gently along each edge: which edge stretches?

WATCH

How to Make Half Square Triangles (HSTs) | Super Simple Two-at-a-Time Method

modafabrics · 7:03

https://www.youtube.com/watch?v=Qi_PdhLDckg

WHEN TO WATCH

After “The math.” Watch the marking and sewing, then the trimming; pause before the trim and predict what size she will trim to.

BACKUP VIDEO

Easy Half Square Triangles Tutorial // The easiest way to make HST quilt blocks for beginners

Homemade Emily Jane (Emily) · 5:40

<https://www.youtube.com/watch?v=arG2lmvkn0s>

The same method from a second teacher, with close-ups of pressing and trimming.

KEY TERMS

half-square triangle (HST)

A square made of two right triangles sewn along the diagonal.

two-at-a-time method

Sewing two squares together $\frac{1}{4}$ in on each side of a drawn diagonal, then cutting on the line, making two HSTs.

flying geese

A rectangle made of one large triangle (the goose) and two small ones (the sky), twice as wide as tall.

bias edge

A cut edge running diagonally to the grain, which stretches easily.

trim (square up)

Cutting an oversized unit down to its exact unfinished size.

$\frac{7}{8}$ rule

For HSTs made from squares, cut the squares the finished size plus $\frac{7}{8}$ in.

CORE IDEAS

The story. Look at the Flying Geese quilt from about 1840–1850 in the picture study: column after column of small triangles, each pointing the same way, set between strips of printed chintz. Its maker had no rotary cutter and no quick methods; every triangle was marked from a template, cut with scissors and sewn by hand, and the points still line up. Triangles let quilters make stars, geese, pinwheels and sawtooth borders, the motion and sparkle that squares alone cannot give.

How they figured it out. Triangles are harder than squares for two reasons, both of which quilters learned by trial. First, the long side of a right triangle runs on the **bias**, so it stretches if handled roughly. Second, the seam allowance on a diagonal is not simply $\frac{1}{4}$ in added to each side. The two-at-a-time method solves both: sew two whole squares together along a drawn diagonal (no bias edge is cut until after sewing), then cut them apart; adding $\frac{7}{8}$ in to the finished size makes the math come out.

The math. A right isosceles triangle with legs s has a hypotenuse of

$$s\sqrt{2} \text{ s } 2\sqrt{}$$

Offsetting all three sides of the finished triangle outward by a $\frac{1}{4}$ -in seam allowance lengthens each leg by $\frac{1}{4}$ in at the square corner

and by $\frac{1}{4} + \frac{1}{4}\sqrt{2}$ in at the sharp corner, $\frac{1}{2} + \frac{1}{4}\sqrt{2} \approx 0.854$ in in all. So the square must be about $\frac{7}{8}$ in larger than the finished unit, which is why the $\frac{7}{8}$ rule works; many quilters add 1 in instead and trim the unit down to exact size. A flying-geese unit finishes twice as wide as tall: a 2×4 in goose.

The craft. Draw the diagonal lightly on the lighter square, sew a scant $\frac{1}{4}$ in on each side, cut on the line, press toward the darker fabric, and trim each unit square to its unfinished size with the ruler's 45° line on the seam. Handle bias edges gently and press, never iron back and forth.

Let's sew. In the lab you will make a set of HSTs for your quilt (or a border), trim them precisely, and lay them out in at least two arrangements before choosing one.

PICTURE STUDY



Quilt, Flying Geese pattern, Unknown American maker, c. 1840–1850 · Pieced cotton, quilted · The Metropolitan Museum of Art, New York
Image: [Wikimedia Commons](#), public domain

Every one of these several hundred “geese” was cut and sewn by hand. The maker used up her printed scraps in the triangles and set them between strips of a single chintz, so the quilt is both thrifty and orderly.

Look closely

- Count the geese in one column. Does every column have the same number?
- Look at the tips of the triangles. Do they reach the triangle above, or is a little background left?
- How many different fabrics can you find in one column?
- Look at the chintz strips. What does the large print do between the busy columns?

Talk about it

1. Why might a quilter choose a pattern that uses hundreds of small scraps?
2. Which way do the geese fly? How would turning alternate columns change the feeling?
3. What does the evenness of these columns tell you about the maker's seams?

Safety first. Rotary-cut the squares by the rules from Lesson 5.2: blade closed whenever set down, cutting away from your body, fingers back from the ruler's edge. Trimming small units brings fingers close to the blade: hold the small ruler with your fingertips on top and well inside its edges. Count pins.

STUDIO LAB

Half-Square Triangles, Trimmed True

Make a set of HSTs (and optionally flying geese) for your quilt or its border, trim them exactly, record their accuracy, and test two layouts.

You will need

- Rotary cutter, mat and rulers, including a small square ruler with a 45° line
- Quilting cottons in contrasting values
- Pencil or fine fabric marker
- Machine with ¼-in guide; iron

TWO-AT-A-TIME HALF-SQUARE TRIANGLES

Finished size: 16 HSTs, 3 in finished (3½ in unfinished) · About 2 hours

Fabric and notions

- 8 light squares, 4 × 4 in
- 8 dark squares, 4 × 4 in
- Thread, a pencil and a ruler

How to make it

1. Draw a diagonal line corner to corner on the wrong side of each light square.
2. Pair each light square with a dark square, right sides together, edges aligned.
3. Sew a scant ¼ in on each side of the drawn line; chain piece all eight pairs.
4. Cut each pair on the drawn line.
5. Press the seam toward the dark fabric.
6. Trim each unit to 3½ in square: lay the ruler's 45° line on the seam, trim two sides, rotate, trim to exactly 3½ in.
7. Lay out the 16 HSTs in two different arrangements (for example pinwheels and a sawtooth star center), photograph both, choose one.

Fabric check: Use firm quilting cottons with strong contrast between light and dark. A light spray starch before cutting keeps bias edges from stretching. Avoid stretchy or slippery fabrics for triangles.

Steps

1. Calculate first: finished size, cut size by both methods, number of pairs, strips.
2. Make two test HSTs and measure them before making the rest.
3. Make the set from the pattern card.
4. Measure every unit before and after trimming; record how much you trimmed and the final size.
5. Lay out and photograph two arrangements; choose one and explain the choice.
6. Clean up: blade closed, pins counted, iron unplugged.
7. Improve it: one change in marking, sewing or trimming.

Tips

- Press the seam flat first to set the stitches, then open it toward the dark.
- If the drawn line shifts, a strip of masking tape on the machine bed marking the needle line can replace drawing.
- Trim with the ruler on top of the unit, not the unit on top of the ruler.

Check your work

- ☐ My calculations are recorded and checked.
- ☐ Every HST measures 3½ in within ¼ in after trimming.
- ☐ I tested two layouts and chose one with a reason.

LAB NOTEBOOK

1. Draw the geometry of an HST with legs, hypotenuse and seam allowances labeled.
2. Tape in one HST and the trimmings from it.
3. Paste the photos of your two layouts.

KEY FORMULAS

$$c = s\sqrt{2}$$

$$c = s \sqrt{2}$$

√

$$\text{HST cut square} = \text{finished size} + \frac{7}{8} \text{ in} \quad (\text{or } + 1 \text{ in and trim})$$

$$\text{HST cut square} = \text{finished size} + 87 \text{ in} \quad (\text{or } + 1 \text{ in and trim})$$

$$\text{HST unfinished} = \text{finished size} + \frac{1}{2} \text{ in}$$

$$\text{HST unfinished} = \text{finished size} + 21 \text{ in}$$

$$\text{flying geese: finished } h \times 2h$$

$$\text{flying geese: finished } h \times 2h$$

From history. Quilt block names like Flying Geese, Bear's Paw, Ocean Waves and Turkey Tracks came from the farm and frontier, and the same block might have three different names in three different states.

WORKED EXAMPLES

Example 1. You want HSTs that finish 3 in. What size do you cut the squares by the $\frac{7}{8}$ rule, and by the 1-in-and-trim method? What do you trim to?

Show solution

1. $\frac{7}{8}$ rule: $3 + \frac{7}{8} = 3\frac{7}{8}$ in $3 + 87 = 387$ in.
2. Trim method: $3 + 1 = 4$ in $3 + 1 = 4$ in,
3. trimmed to unfinished size $3 + \frac{1}{2} = 3\frac{1}{2}$ in $3 + 21 = 321$ in.

Answer: Cut $3\frac{7}{8}$ in (exact) or 4 in (then trim to $3\frac{1}{2}$ in).

Example 2. Show where the $\frac{7}{8}$ comes from for a 3-in finished HST.

Show solution

1. The finished triangle's legs are 3 in and its diagonal $3\sqrt{2} \approx 4.243$ in $2\sqrt{2}$
2. Offset all three sides outward by $\frac{1}{4}$ in. Each leg grows by $\frac{1}{4}$ in at the square corner and by $\frac{1}{4} + \frac{1}{4}\sqrt{2} \approx 0.604$ in $41 + 41 \quad 2\sqrt{2}$ at the sharp corner.
3. Cut leg: $3 + 0.25 + 0.604 \approx 3.854$ in $3 + 0.25 + 0.604 \approx 3.854$ in, a hair under $3\frac{7}{8} = 3.875$ in $387 = 3.875$ in.

Answer: The exact addition is about 0.854 in; $\frac{7}{8}$ in (0.875) rounds it up slightly, leaving a hair to trim.

Example 3. A block needs 16 HSTs finished 3 in. Using two-at-a-time, how many pairs of 4-in squares, and how many 4-in strips of each color (42-in usable width)?

Show solution

1. Each pair of squares makes 2 HSTs: $16 \div 2 = 8$ $16 \div 2 = 8$ pairs.
2. Squares per strip: $[42 \div 4] = 10$ $[42 \div 4] = 10$,
3. so one strip of each color gives 10 squares, enough for 8.

Answer: 8 dark and 8 light 4-in squares: one 4-in strip of each color.

Example 4. Flying-geese units 2×4 in finished run in columns down a 60-in quilt, and each column is paired with a 4-in chintz strip. How many geese per column, and how many columns fit across a 48-in quilt?

Show solution

1. Geese per column: $60 \div 2 = 30$
2. Each column is 4 in wide; with its 4-in chintz strip it takes 8 in.
3. Columns: $48 \div 8 = 6$

Answer: 30 geese per column and 6 columns: $6 \times 30 = 180$ geese in all.

PRACTICE

1. **Easy** What is a half-square triangle?

Show answer

A square made of two right triangles sewn along the diagonal.

2. **Easy** HST finished 2 in: cut squares by the $\frac{7}{8}$ rule?

Show answer

$2\frac{7}{8}$ in.

3. **Easy** Unfinished size of a 4-in finished HST?

Show answer

$4\frac{1}{2}$ in.

4. **Medium** Hypotenuse of a triangle with 5-in legs?

Show answer

$5\sqrt{2} \approx 7.07$ in

5. **Medium** Why does two-at-a-time avoid stretched bias edges?

Show answer

The squares are sewn before the diagonal is cut, so no bias edge is handled until the seam holds it.

6. **Medium** How many HSTs from 12 pairs of squares by two-at-a-time?

Show answer

24.

7. **Medium** A flying-geese unit finishes 3 in tall. How wide?

Show answer

6 in.

8. **Hard** 40 HSTs finished $2\frac{1}{2}$ in, cut by 1-in-and-trim: square size, pairs, squares per 42-in strip, strips of each color?

Show answer

$3\frac{1}{2}$ -in squares; 20 pairs; 12 per strip; 2 strips of each color.

9. **Hard** Compute the exact amount a $\frac{1}{4}$ -in seam adds to each leg, $\frac{1}{2} + \frac{1}{4}\sqrt{2}$, and compare it with $\frac{7}{8}$.

Show answer

$0.5 + 0.354 = 0.854$ in, a little less than $\frac{7}{8} = 0.875$ in, so the $\frac{7}{8}$ rule leaves about 0.02 in to trim.

10. **Hard** Why press HSTs toward the dark fabric?

Show answer

So the seam allowance does not shadow through the light fabric.

11. **Challenge** Four HSTs can make a pinwheel. If each HST finishes 3 in, what is the pinwheel's finished size, and how many $3\frac{7}{8}$ -in squares of each color make 5 pinwheels?

Show answer

6 in finished; $5 \times 4 = 20$ HSTs = 10 pairs: 10 squares of each color.

COMMON MISTAKES

- Cutting triangles first and then sewing their stretchy bias edges.
- Trimming without the 45° line on the seam, which makes lopsided units.
- Pressing back and forth, which stretches the bias.

Make it a game · Triangle Tycoon. A parent names a finished HST size and a number of units. Players race to give the cut square size ($\frac{7}{8}$ rule), the number of pairs and the number of $4\frac{1}{2}$ -in strips. First correct trio scores; a bonus point goes to anyone who can also give the diagonal of the finished unit to two decimals.

5.4 THE QUILT SANDWICH: BATTING AND QUILTING

OBJECTIVES

- Compare cotton, polyester, wool and blended battings by loft, warmth, shrinkage and maximum quilting distance.
- Size backing and batting for a quilt top and piece a backing.
- Baste a quilt sandwich and machine-quilt straight lines with even spacing.

Warm-up. Hold a quilt or comforter up to a lamp. Can you see the stitching lines? How far apart are they? Squeeze the layers between two fingers: is it thin and flat or thick and puffy?

WATCH

Quilt Sandwich Tricks Every Beginner Should Know- How to Baste Your Quilt.

Just Get it Done Quilts · 11:08

<https://www.youtube.com/watch?v=rHRsbSZpwTE>

WHEN TO WATCH

After “The fabric science.” Watch how the backing is taped taut before the batting and top go on; you will do the same on the floor or a large table.

BACKUP VIDEO

Our Best Tips for Straight Line Quilting

American Patchwork & Quilting · 8:19

<https://www.youtube.com/watch?v=TJlgU99JfRs>

Watch before you quilt: walking foot, marking, and starting and stopping lines.

KEY TERMS

batting

The middle layer of a quilt, sold by the package or the yard in cotton, polyester, wool or blends.

quilting distance

The farthest apart quilting lines may be spaced for a given batting, printed on its package.

walking foot

A presser foot that feeds the top layer at the same rate as the feed dogs feed the bottom, so layers do not shift.

loft

The thickness and springiness of batting; high loft is puffy, low loft is flat.

basting

Temporarily holding the three layers together with safety pins, thread or spray before quilting.

stitch in the ditch

Quilting right in the seam line so the stitching nearly disappears.

CORE IDEAS

The story. In the photograph for this lesson, two Amish women in Lancaster County, Pennsylvania, quilt a large top stretched on a frame in March 1941. A quilting frame holds all three layers taut so they cannot shift while the quilters work in from the edges. Look at the plain, bold pieced top: Amish quilts of that era were famous for strong solid colors and very fine, dense hand quilting, often 8 to 12 stitches to the inch, and the quilting itself made patterns of feathers and grids across the plain areas.

How they figured it out. Batting once meant carded raw cotton or wool laid in by hand, and if the quilting was too sparse, it slid and lumped into a corner the first time the quilt was washed. Quilters learned to quilt closely, and battings are now engineered with a stated **quilting distance**: a needle-punched cotton or blend may allow 8 to 10 inches between lines, while some bonded polyesters allow much more. Home machines added a new problem, the layers creeping as they feed; the **walking foot** and careful basting solved it.

The fabric science. Cotton batting is flat, breathable, drapes well and shrinks about 3–5% when washed, giving an old-fashioned crinkle. Polyester is light, lofty, washable, inexpensive and does not shrink, but it can beard (fibers migrate through the top) and

does not breathe as well. **Wool** is warm, light, resilient and hides fold lines. **80/20 cotton-polyester** blends combine cotton's look with polyester's stability. Warmth comes from trapped still air, so loft matters more than weight.

The math. Backing and batting are cut larger than the top, about 4 in extra on every side (8 in each way) for a machine-quilted quilt, because quilting draws the layers in and the edges need to be trimmed square. Backings wider than 42 in are pieced from two widths. Quilting lines are spaced evenly across the quilt within the batting's quilting distance.

Let's sew. In the lab you will piece the backing, make the sandwich, baste it, and quilt it with straight lines using a walking foot (or tie it at regular intervals with yarn, the traditional quick finish).

PICTURE STUDY



Lancaster County, Pennsylvania: two women quilting, Irving Rusinow (U.S. Bureau of Agricultural Economics), March 20, 1941 · Photograph · National Archives and Records Administration
Image: [Wikimedia Commons](#), public domain

A government photographer studying rural communities recorded these two women quilting in Lancaster County in 1941. The original caption notes that quilting bees were popular in the area and points out the illuminated family record on the wall.

Look closely

- Find the edge of the frame. How is the quilt held taut?
- Look at their hands. Where is each needle going, and which hand is under the quilt?
- Look at the pieced top. How many sizes of shapes do you see? Is it squares, steps or triangles?
- Find the family record on the wall. What does it tell you about this household?

Talk about it

1. Why does a frame make hand quilting more even?
2. How would this quilting session differ if eight neighbors sat around the frame?
3. What would you choose to quilt in the plain areas of your own quilt, and why?

Safety first. Safety pins for basting go back into a closed box, counted; a pin left in a quilt can scratch a baby. Work on the floor with knees padded and stand up to stretch; a parent helps lift and move the basted quilt so it does not drag the needle. Never sew over pins; remove basting pins before the foot reaches them.

STUDIO LAB

Sandwich, Baste and Quilt

Piece the backing, layer and baste the quilt sandwich, and machine-quilt evenly spaced straight lines (or tie the quilt at regular intervals), recording batting tests and spacing.

You will need

- Your finished quilt top
- Backing fabric, pieced as needed
- Batting (cotton, 80/20 or polyester) about 8 in larger than the top each way
- Curved basting safety pins (about 150 for a lap quilt) or basting spray used outdoors
- Masking tape, walking foot, hera marker or masking tape for lines

STRAIGHT-LINE QUILTED LAP QUILT SANDWICH

Finished size: One 48 × 60 in quilt · About 5–7 hours

Fabric and notions

- Backing 56 × 68 in
- Batting 56 × 68 in
- Quilt top 48 × 60 in, pressed
- About 150 curved safety pins
- Cotton or polyester quilting thread

How to make it

1. Press the backing; tape it right side DOWN to a clean floor or tables, taut but not stretched, starting at the centers of opposite sides.
2. Smooth the batting over it.
3. Center the top right side UP on the batting; smooth from the center out.
4. Pin through all layers every 4–5 in (about a fist apart), working from the center out, avoiding the lines you will quilt.
5. Mark the first quilting line down the center with masking tape or a hera marker.
6. With the walking foot and a slightly longer stitch, quilt the center line first, then lines to each side, alternating halves, removing pins as you come to them.
7. Roll the quilt's sides to fit under the machine arm; support the weight on a table so it does not pull.
8. Bury thread ends by tying and sinking them with a needle, or use tiny stitches at the starts and stops.

Fabric check: Choose batting to suit the use (Example 4): 80/20 is a good first choice. Prewash cotton batting only if you want no crinkle, and follow the maker's directions. The backing should be the same fiber and care as the top; a flat sheet makes a seamless backing for lap quilts. Wool batting needs gentle washing.

Steps

1. Batting test: wash and dry a 10-in square of your batting with a quilted scrap; measure shrinkage and record.
2. Write the plan: backing size and piecing, batting, line spacing within the quilting distance, number of lines, thread.
3. Make a 12-in practice sandwich and quilt three lines to set the stitch length and check the back.
4. Make the sandwich and quilt from the pattern card.
5. Check the back for puckers and tucks; unpick and redo any bad section.
6. Clean up: safety pins counted into their box, threads trimmed, machine unplugged.
7. Improve it: one change for your next quilting.

Tips

- Quilt every line in the same direction to keep the layers from shifting diagonally.
- Slow and steady: let the walking foot feed; do not pull.
- If you tie instead, place ties every 4–5 in in a grid with cotton yarn and a large needle, knotted with a square knot.

Check your work

- ☐ My batting shrinkage test is recorded.
- ☐ My lines are evenly spaced within the batting's limit.

- ☐ The back has no puckers or tucks.

LAB NOTEBOOK

1. Tape in the batting test square, before and after measurements.
2. Draw the quilting plan to scale.
3. Record each batting's strengths and weaknesses in a table.

KEY FORMULAS

$$\text{backing} = (\text{top width} + 8) \times (\text{top length} + 8) \text{ in}$$

$$\text{backing} = (\text{top width} + 8) \times (\text{top length} + 8) \text{ in}$$

$$\text{lines} = \frac{\text{width}}{\text{spacing}} + 1$$

$$\text{lines} = \text{spacingwidth} + 1$$

$$\text{shrinkage \%} = \frac{\text{before} - \text{after}}{\text{before}} \times 100\%$$

$$\text{shrinkage \%} = \frac{\text{before} - \text{after}}{\text{before}} \times 100\%$$

From history. Tied quilts, sometimes called comforters, were common on farms because they were quick: a top could be tied in an evening and taken apart for washing and re-batting. Many children's first quilts were tied.

WORKED EXAMPLES

Example 1. A quilt top is 48×60 in. What size must the backing be, and how do you piece it from 42-in usable fabric?

Show solution

1. Backing: $(48 + 8) \times (60 + 8) = 56 \times 68$ in $(48 + 8) \times (60 + 8) = 56 \times 68$ in.
2. 56 in is wider than 42 in, so join two pieces. Option A: two 68-in lengths seamed side by side give about 83×68 in 83×68 in, trimmed to 56 wide: 136 in 136 in of fabric.
3. Option B: two 57-in lengths ($56 + 1$ for the seam) seamed along their long edges give 57×83 in 57×83 in, turned and trimmed to 56×68 in 56×68 in 114 in 114 in of fabric.

Answer: Option B: two 57-in lengths ($114 \text{ in} \approx 3\frac{1}{8} \text{ yd}$ $114 \text{ in} \approx 381 \text{ yd}$), seamed and trimmed to 56×68 in 56×68 in, saving about $\frac{5}{8}$ yd.

Example 2. A cotton batting allows quilting up to 8 in apart. You quilt straight vertical lines every 4 in across the 48-in quilt. How many lines, and is it within the limit?

Show solution

1. Lines: $48 \div 4 + 1 = 13$ $48 \div 4 + 1 = 13$ lines (including both edges; the outer ones fall in the binding).
2. Spacing 4 in is less than 8 in: within the limit, with room to spare.

Answer: 13 lines (11 inside the edges), well within the 8-in quilting distance.

Example 3. A cotton-batting test square measured 10×10 in before washing and 9.6×9.7 in after. Find the shrinkage in each direction and predict the finished quilt's size change.

Show solution

1. Lengthwise: $\frac{10 - 9.6}{10} \times 100\% = 4\%$ $\frac{10 - 9.6}{10} \times 100\% = 4\%$.
2. Crosswise: $\frac{10 - 9.7}{10} \times 100\% = 3\%$ $\frac{10 - 9.7}{10} \times 100\% = 3\%$.
3. Quilt: $48 \times 0.97 \approx 46.6$ in $48 \times 0.97 \approx 46.6$ in by $60 \times 0.96 = 57.6$ in $60 \times 0.96 = 57.6$ in.

Answer: About 3–4% shrinkage: the quilt would finish near $46\frac{1}{2} \times 57\frac{1}{2}$ in after its first wash, with a soft crinkle.

Example 4. Design reasoning. Choose a batting for a baby quilt that will be washed weekly, and for a wall hanging that must hang flat.

Show solution

1. Baby quilt: needs washability, softness and breathability; an 80/20 cotton-polyester or a washable cotton, prewashed if a crinkle is not wanted, quilted closely (small hands and toes).
2. Wall hanging: needs to hang flat without sagging; a thin, flat cotton or an 80/20 blend, quilted evenly across the whole surface so it does not ripple.

Answer: Baby: washable 80/20 or cotton, quilted closely. Wall hanging: thin cotton or 80/20, quilted evenly.

PRACTICE

1. **Easy** Name four batting fibers.

Show answer

Cotton, polyester, wool, cotton-polyester blend (also bamboo, silk).

2. **Easy** What does a walking foot do?

Show answer

Feeds the top layer at the same speed as the bottom so the layers do not shift.

3. **Easy** Top 36×36 in. Backing size?

Show answer

44×44 in 44×44 in.

4. **Medium** Batting quilting distance 10 in. Is quilting every 12 in safe?

Show answer

No; lines must be no more than 10 in apart.

5. **Medium** Lines every 3 in across a 36-in quilt, counting both edges?

Show answer

$36 \div 3 + 1 = 13$ $36 \div 3 + 1 = 13$.

6. **Medium** A 12×12 in batting square shrinks to 11.5×11.6 . Shrinkage each way?

Show answer

4.2% and 3.3%.

7. **Medium** Why is the backing cut larger than the top?

Show answer

Quilting draws the layers in and shifts slightly; the extra lets you trim square.

8. **Hard** Top 60×72 in. Backing size, and how many yards of 42-in fabric if pieced with a seam across?

Show answer

68×80 68×80 ; two pieces 69 in long ($68 + 1$): 138 in ≈ 3.83 138 in ≈ 3.83 , buy $3\frac{7}{8}$ yd (two widths make 83 in, trimmed to 80).

9. **Hard** Why does warmth depend more on loft than on weight?

Show answer

Warmth comes from still air trapped in the batting; lofty batting traps more air for its weight.

10. **Hard** Hand quilting at 10 stitches per inch, how many stitches in 13 lines of 60 in?

Show answer

$13 \times 60 \times 10 = 7,800$ $13 \times 60 \times 10 = 7,800$ stitches.

11. **Challenge** The Amish quilters in the photograph worked 8–12 stitches per inch by hand. Compare the time for one 60-in line at 10 stitches per inch (about 1 stitch per second) with a machine at 10 stitches per inch and 5 in per second.

Show answer

Hand: 600 stitches $\approx$ 600 s = 10 min. Machine: $60 \div 5 = 12$ s $60 \div 5 = 12$ s. Hand quilting is about 50 times slower, which is why bees mattered.

COMMON MISTAKES

- Stretching the backing too tight while taping, so it puckers when released.
- Basting too far apart, so the layers shift.
- Quilting farther apart than the batting allows.

Make it a game • Fist Gap. On a practice sandwich, players race to place 20 basting pins about a fist apart (4–5 in) without closing them. A parent checks the gaps with a ruler: each pin within the 4–5 in range scores a point; each pin left open after the round costs two. Then every pin goes back into the box, counted.

5.5 BINDING, LABELING AND GIVING

OBJECTIVES

- Calculate the binding length, number of strips and fabric for a quilt.
- Make double-fold binding, attach it with mitered corners, and finish it by hand or machine.
- Label the quilt and give it, recording the whole project's cost and time.

Warm-up. Look at the edge of three quilts or blankets. How are the edges finished: binding, a fold-over, a facing, a hem? Which looks strongest? Find the corners: are they mitered (diagonal) or overlapped?

WATCH

Easy Mitered Corners for Quilt Binding

Quiltmaker Mag · 5:22

<https://www.youtube.com/watch?v=HpCow6SC89k>

WHEN TO WATCH

After “The math.” Watch the fold at each corner twice: first the 45° fold up, then the fold back down even with the edge.

BACKUP VIDEO

The Ultimate Quilt Binding Tutorial with Jenny Doan of Missouri Star (Instructional Video)

Missouri Star · 16:52

<https://www.youtube.com/watch?v=0vCWpxBRs20>

A complete binding from strips to the joined ends, if you want to see the whole process at once.

KEY TERMS

binding

A strip of fabric folded over the quilt's raw edges to finish them.

double-fold (French) binding

A strip folded in half lengthwise before sewing, so two layers protect the edge.

mitered corner

A neat 45° fold at each corner of the binding.

straight-grain vs. bias binding

Straight-grain binding is cut across the fabric and suits straight edges; bias binding bends around curves and wears longer on the fold.

quilt label

A small fabric label on the back with the maker, the recipient, the date and the place.

width of fabric (WOF)

The usable width of the fabric from selvage to selvage, about 42 in for quilting cotton.

CORE IDEAS

The story. The album quilt in the picture study was begun in 1846 by Elizabeth Morrison, and its blocks of flowers, wreaths, a lyre and an eagle were made with the care that went into a gift meant to be kept for generations. Many quilts were made to be given: album quilts for brides and departing pastors, crib quilts for new babies, quilts for families who had lost their homes. In the Civil War, Northern women sent quilts to soldiers' hospitals, and church sewing circles have made quilts for the needy ever since. A quilt is the most natural gift in the sewing world, because it is warmth with a person's work stitched into it.

How they figured it out. The edge of a quilt takes more wear than any other part: hands grab it, it drags on the floor, it is tucked and pulled. Quilters learned to protect it with a **binding**, and the double-fold binding, two layers of fabric over the edge, became standard because it wears so much longer. A worn binding can be replaced without disturbing the quilt. They also learned to sign their work: a quilt with a name, a date and a place on its back tells its story to every future owner.

The fabric science. Double-fold binding strips are usually cut 2¼ to 2½ in wide, folded in half and sewn to the front with a ¼-in seam, then folded over to the back and stitched by hand (invisible) or by machine (faster, sturdier for a child's quilt). Straight-grain

strips are fine for straight edges; bias binding is stronger on curves and wears longer because the threads run diagonally across the fold rather than one thread along it. Corners are **mitered**: stop $\frac{1}{4}$ in from the corner, fold the strip up at 45° , then down even with the next edge.

The math. Binding length = perimeter + about 12 in (for corners and joining the ends). Strips needed = binding length $\div$ (WOF – about 2 in lost to the diagonal joins), rounded up. Fabric = strips $\times$ strip width.

Let's sew. In the lab you will bind your quilt, make and sew on a label, wash it if planned, and give it away, recording the whole project's cost and hours.

PICTURE STUDY



Album Quilt, Elizabeth Morrison, Begun 1846 · Appliquéd and pieced cotton, quilted · The Metropolitan Museum of Art, New York
Image: [Wikimedia Commons](#), public domain

Album quilts of the 1840s were collections of blocks, each designed with great care, often by different hands, and joined into one quilt as a gift or keepsake. Elizabeth Morrison began this one in 1846. Its red sashing and border frame every block like a page in an album.

Look closely

- Count the blocks. Are any two exactly alike?
- Find the eagle and the lyre. Why might a maker include such emblems?
- Look at the red sashing and border. How does the binding (the outer edge) finish the frame?
- Look closely at the white backgrounds. Can you see the quilting stitches?

Talk about it

1. If friends each made a block for this quilt, what does that say about the person who received it?
2. Which block would you choose to make, and why?
3. What would you put on a label for this quilt if you were Elizabeth Morrison?

Safety first. Trimming the quilt square before binding is long rotary cutting: work on a large mat, close the blade every time you set it down, and walk your ruler hand along as you cut. Binding clips are safer than pins along a long edge; count them in and out. Hand-finishing uses a thimble.

STUDIO LAB

Bind It, Label It, Give It

Trim the quilt square, make and attach double-fold binding with mitered corners, sew on a label, and give the quilt, recording the full cost and time of the project.

You will need

- Your quilted lap quilt
- Binding fabric ($\frac{1}{2}$ yd for 48×60 in)
- Rotary cutter, mat, long ruler, binding clips
- Walking foot; hand needle and thimble
- Label fabric and a permanent fabric pen

DOUBLE-FOLD BINDING WITH MITERED CORNERS

Finished size: Binding for a 48×60 in quilt (228 in) · About 3–4 hours

Fabric and notions

- 6 strips $2\frac{1}{2}$ in $\times$ WOF
- Thread to match the binding
- One label, about 4×6 in, with edges turned under

How to make it

1. Trim the quilt square, $\frac{1}{4}$ in beyond the outermost quilting at the edges if needed, using the long ruler and keeping the corners at 90° .
2. Join the strips end to end with diagonal seams; trim to $\frac{1}{4}$ in and press open.
3. Fold the binding in half lengthwise, wrong sides together; press.
4. Starting midway along one side and leaving an 8-in tail, sew the binding to the quilt front, raw edges even, with a $\frac{1}{4}$ -in seam and the walking foot.
5. Stop $\frac{1}{4}$ in from the corner, backstitch, fold the binding up at 45° , then down even with the next edge, and continue; repeat at each corner.
6. Stop about 10 in from the start; join the two tails with a diagonal seam so the binding lies flat; finish sewing.
7. Fold the binding to the back over the raw edges; clip it, forming the miters on the back.
8. Hand-stitch it down with a blind stitch just covering the machine stitching, or machine-stitch it from the front in the ditch.
9. Write the label (maker, recipient, date, place, a verse or a note) and slip-stitch it to a back corner.

Fabric check: Cut binding from a firm quilting cotton in a color that frames the quilt; darker bindings hide wear. Prewash it with the other fabrics. A label written with a permanent fabric pen should be heat-set with an iron per the pen's directions.

Steps

1. Calculate the binding length, strips and fabric; record.
2. Practice one mitered corner on a scrap sandwich.
3. Bind and label the quilt from the pattern card.
4. Inspect: are the corners square, the binding full, the stitching hidden?
5. Complete the project cost sheet (materials, hours, cost per square foot) and the full construction log.
6. Give the quilt in person if you can; record the recipient's response.
7. Clean up and reflect: one thing you would do differently on your next quilt.

Tips

- Binding clips hold better than pins and never stab.
- A $\frac{1}{4}$ -in seam on the binding with a full fold gives a binding that feels “full”; if it feels empty, use a $\frac{3}{8}$ -in seam or a wider strip.
- Wash the quilt once before giving it if the recipient will wash it often; it shows the crinkle and proves it holds.

Check your work

- ☐ My binding length and strips were calculated and enough.
- ☐ My corners are mitered on both sides.

- The quilt is labeled and given, and the cost sheet and log are complete.

LAB NOTEBOOK

1. Tape in a sample mitered corner.
2. Copy your label text.
3. Complete the cost sheet and the time log, with total hours.

KEY FORMULAS

$$\begin{aligned} \text{binding length} &= \text{perimeter} + 12 \text{ in} \\ \text{strips} &= \left\lceil \frac{\text{binding length}}{\text{WOF} - 2} \right\rceil \\ \text{strips} &= \lceil \text{WOF} - 2 \text{binding length} \rceil \\ \text{binding fabric} &= \text{strips} \times \text{strip width} \end{aligned}$$

From history. During the Civil War, women's aid societies in the North collected quilts, blankets and clothing for military hospitals through organizations such as the U.S. Sanitary Commission. Very few of those quilts survive, because they were used until they wore out.

WORKED EXAMPLES

Example 1. Find the binding length, the number of $2\frac{1}{2}$ -in strips and the fabric for a 48×60 in quilt with 42-in WOF.

Show solution

1. Perimeter: $2(48 + 60) = 216$ in $2(48 + 60) = 216$ in.
2. Binding length: $216 + 12 = 228$ in $216 + 12 = 228$ in.
3. Strips: $\lceil 228 \div 40 \rceil = \lceil 5.7 \rceil = 6$ $\lceil 228 \div 40 \rceil = \lceil 5.7 \rceil = 6$.
4. Fabric: $6 \times 2.5 = 15$ in $6 \times 2.5 = 15$ in, about $\frac{1}{2}$ yd.

Answer: 228 in of binding; 6 strips $2\frac{1}{2}$ in wide, $\frac{1}{2}$ yd of fabric.

Example 2. Bias binding for the same quilt is cut from a square with continuous bias (Lesson 2.3) at $2\frac{1}{2}$ in. What size square?

Show solution

1. Area needed: $228 \times 2.5 = 570$ in² $228 \times 2.5 = 570$ in²; add 10% for seams: 627 in² 627 in².
2. Square side:
 $\sqrt{627} \approx 25$ in $\sqrt{627}$

Answer: A 25-in square (about $\frac{3}{4}$ yd of 42-in fabric).

Example 3. Project cost: quilt top fabrics \$46\$46, backing \$28\$28, batting \$22\$22, binding \$6\$6, thread and pins \$9\$9. You logged 26 hours. Find the materials cost per square foot and what the quilt would cost at \$15\$15 an hour of labor.

Show solution

1. Materials: $46 + 28 + 22 + 6 + 9 = \$111$ $46 + 28 + 22 + 6 + 9 = \$111$.
2. Area: $48 \times 60 \div 144 = 20$ ft² $48 \times 60 \div 144 = 20$ ft²; $\$111 \div 20 = \5.55 $\$111 \div 20 = \5.55 per sq ft.
3. Labor: $26 \times \$15 = \390 $26 \times \$15 = \390 ; total \$501\$501.

Answer: Materials \$111\$111 (\$5.55\$5.55/sq ft); with labor valued at \$15\$15/h, about \$500\$500; that is the gift's real worth.

PRACTICE

1. **Easy** Why is double-fold binding standard?

Show answer

Two layers of fabric protect the edge, where quilts wear most.

2. **Easy** Binding length for a 36×36 in quilt?

Show answer

$144 + 12 = 156$ in $144 + 12 = 156$ in.

3. **Easy** What four things belong on a quilt label?

Show answer

Maker, recipient, date and place (and the occasion).

4. **Medium** Strips for 156 in with 42-in WOF?

Show answer

$\lceil 156 \div 40 \rceil = 4 \lceil 156 \div 40 \rceil = 4$.

5. **Medium** Fabric for 4 strips cut $2\frac{1}{4}$ in?

Show answer

9 in 9 in ($\frac{1}{4}$ yd).

6. **Medium** When would you choose bias binding?

Show answer

For curved or scalloped edges, and for long wear on heirloom quilts.

7. **Medium** Why stop $\frac{1}{4}$ in from the corner when sewing binding?

Show answer

So the binding can fold to make the miter and turn the corner with the seam meeting exactly.

8. **Hard** A 60×72 in quilt: binding length, $2\frac{1}{2}$ -in strips (42-in WOF) and yards?

Show answer

$264 + 12 = 276$ in $264 + 12 = 276$ in; $\lceil 6.9 \rceil = 7 \lceil 6.9 \rceil = 7$ strips; 17.5 in 17.5 in, buy $\frac{5}{8}$ yd.

9. **Hard** Materials \$96\$96 for a 50×60 in quilt. Cost per square foot?

Show answer

$50 \times 60 \div 144 \approx 20.8$ ft² $50 \times 60 \div 144 \approx 20.8$ ft²; about \$4.61\$4.61/sq ft.

10. **Hard** Why might you machine-finish the binding on a child's quilt instead of hand-stitching it?

Show answer

Machine stitching is faster and stands up better to frequent washing and rough use.

11. **Challenge** Write a short argument (4–5 sentences) for giving the quilt away rather than keeping it, using the numbers from your cost sheet and one idea from this lesson's story or Scripture.

Show answer

Answers vary: e.g., the quilt holds about \$100 of materials and 25+ hours of work, worth far more as a gift to someone who needs warmth; quilts have always been made to be given; charity is the bond of perfectness; a gift carries the maker's care.

COMMON MISTAKES

- Starting the binding at a corner, where a join is bulky.
- Sewing all the way to the corner instead of stopping $\frac{1}{4}$ in short.
- Giving an unlabeled quilt; its story is lost within a generation.

Make it a game · Binding Calculator Relay. A parent calls out quilt sizes (crib, lap, twin, queen). Two teams relay: one player gives the perimeter, the next the binding length, the next the number of strips, the next the yardage. Fastest correct relay wins the round; a wrong answer passes the turn to the other team.

Scripture. “And above all these things put on charity, which is the bond of perfectness.” (Colossians 3:14, KJV)

Paul calls love the bond that holds every other virtue together, as a binding holds every layer and piece of a quilt. A quilt made to be given is charity you can wrap around someone.

UNIT 5 TEST

Calculators are allowed. Show your work for every calculation: write the formula, substitute with units, and give the answer with its unit. Answer concept questions in complete sentences. The test is worth 100 points.

1. (6 pts)
Name the three layers of a quilt and the job of each.
2. (6 pts)
Give two reasons quilting bees were important.
3. (6 pts)
A quilt is 6 blocks by 7 blocks of 9-in blocks with a 3-in border. Finished size?
4. (6 pts)
A 9-in nine-patch: cut size of its squares? How many from a 42-in strip?
5. (6 pts)
State four rotary-cutter safety rules.
6. (7 pts)
A row has 4 blocks with 2 internal seams each, plus 3 joining seams. Each seam allowance is $\frac{1}{8}$ in too wide. How short is the row?
7. (6 pts)
Three $1\frac{1}{2}$ -in strips sewn together should measure what? Yours measure $3\frac{1}{4}$. What does that tell you?
8. (7 pts)
HSTs finished 4 in: cut squares by the $\frac{7}{8}$ rule and by +1 and trim; unfinished size?
9. (5 pts)
Hypotenuse of a triangle with 4-in legs?
10. (6 pts)
Why does the two-at-a-time method help with bias edges?
11. (6 pts)
Compare cotton and polyester batting in two ways each.
12. (6 pts)
Top 54×66 in. Backing size?
13. (6 pts)
A batting square shrinks from 10 to 9.65 in. Shrinkage percent?
14. (7 pts)
A 54×66 in quilt: binding length, $2\frac{1}{2}$ -in strips (42-in WOF), and fabric?
15. (6 pts)
Why is double-fold binding standard, and when would you use bias binding?
16. (8 pts)
Short essay (5–8 sentences): Explain why accuracy matters more in quilting than in most sewing, using the idea of accumulating error, and describe three habits that keep a quilt accurate from cutting to binding.

UNIT PROJECT: A LAP QUILT MADE TO GIVE

Complete a lap quilt (about 48 × 60 in) or a wall hanging (about 24 × 36 in) from your plan: pieced blocks, quilted or tied, bound and labeled, and give it to someone.

Submit the plan, the seam test, the block measurement table, the batting test, the full cost sheet and construction log, photos of the giving, and a one-page reflection on accuracy and on giving.

LOOK FOR	WHAT IT MEANS
Planning and math	Complete plan with cutting list, yardage, backing, batting and binding calculations that proved correct.
Accuracy	Seam test passed; blocks within 1/8 in; points and seam crossings match.
Finishing	Even quilting within the batting's distance; full binding with mitered corners; label sewn on.
Safety	Rotary sign-off recorded; blade closed when set down; pins counted.
Records and giving	Cost sheet, hours log and reflection complete; the quilt is given.

ANSWER KEY

1. Top: design; batting: warmth (still air); backing: closes the sandwich. Quilting or ties hold them together.
2. They turned weeks of solitary quilting into a day of shared work, and they were a main social event and a way to make gifts for neighbors.
3. $54 + 6 = 60$ by $63 + 6 = 69$ in $63 + 6 = 69$ in.
4. $3\frac{1}{2}$ in 321 in; 12.
5. Close the blade every time; cut away from your body; fingers flat and back; replace dull blades; store out of reach; parent sign-off first.
6. $11 \times \frac{1}{4} = 2.75$ in $11 \times 41 = 2.75$ in.
7. $3\frac{1}{2}$ in; the seams are too wide (about $\frac{1}{16}$ in per seam allowance).
8. $4\frac{7}{8}$ in 487; 5 in; trim to $4\frac{1}{2}$ in 421 in.
9. $4\sqrt{2} \approx 5.66$ in $4\sqrt{2} \approx 5.66$ in.
10. The diagonal is sewn before it is cut, so the stretchy bias edge is already held by the seam.
11. Cotton: flat, breathable, shrinks 3–5%, closer quilting. Polyester: lofty, light, no shrinkage, can be used, wider quilting distance.
12. 62×74 in 62×74 in.
13. 3.5%.
14. $240 + 12 = 252$ in $240 + 12 = 252$ in; $[6.3] = 7$ [6.3] = 7 strips; 17.5 in 17.5 in.
15. Two layers protect the most-worn edge; bias for curves and longest wear.
16. Full credit for: errors add across many seams (with a numeric example); habits such as squaring fabric, testing the $\frac{1}{4}$ -in seam, measuring blocks, trimming HSTs, nesting seams, basting closely, quilting from the center out.

SLIPCOVERS

A slipcover is upholstery you can take off and wash, and it is one of the most useful things a home sewist can make. It turns a worn or mismatched ottoman, footstool or dining chair into a piece that belongs to your room, for a fraction of the cost of replacing it. This unit makes one fitted slipcover from start to finish.

The work is three-dimensional: flat cloth fitted to a shape by darts, ease and seams on the furniture's edges, pin-fitted in muslin wrong side out like a tailor's toile. The math covers rounded-corner perimeters and arc lengths, piece lists and cutting plans, railroading, welting and skirt lengths, box and kick pleats, and shrinkage. The stories run from the case covers of early American houses and Indian chintz seat panels to feed-sack thrift and a parable about new cloth on an old garment.

PREREQUISITES

- Welting and boxing from Unit 2
- Measuring and cutting plans from Units 1 and 3
- Percent, π and arc length

MASTERY CHECKLIST

- ☐ I can explain why flat cloth needs seams, darts or ease to fit a curved shape.
- ☐ I can measure furniture and write a piece list, cutting plan and yardage.
- ☐ I can pin-fit muslin wrong side out, mark, notch and true a pattern.
- ☐ I can calculate and sew a lined skirt with kick or box pleats.
- ☐ I can preshrink, place a hidden closure and finish a slipcover that fits after washing.

OPTIONAL BOOKS AND TOOLS FOR THIS UNIT

- **T-pins (1¼ in) and a pin magnet:** Long upholstery pins for fitting on furniture, and a magnet to sweep up every one.
- **Unbleached muslin by the bolt:** Inexpensive cotton for toiles and patterns; buy several yards for this unit and Units 7–10.
- **A flexible tape measure and a French curve:** For measuring curves and truing curved seam lines on patterns.

Not required. Every project in this unit works with ordinary fabric-store supplies. School Launch has no ties to these authors, publishers or companies.

LESSONS IN THIS UNIT

6.1 Case Covers: Fitting Flat Cloth to a Shape	3 sessions of 50 minutes
6.2 Feed-Sack Thrift: The Cutting Plan and Yardage	3 sessions of 50 minutes
6.3 The Tailor's Toile: Pin-Fitting Inside Out	3 sessions of 50–90 minutes
6.4 Welting, Skirts and Pleats	3 sessions of 50–90 minutes
6.5 Closures, Care and the Finished Slipcover	3 sessions of 50–90 minutes

6.1 CASE COVERS: FITTING FLAT CLOTH TO A SHAPE

OBJECTIVES

- Tell why households of the 1700s and 1800s put loose covers over their best upholstery.
- Explain why flat cloth wraps a box or a cylinder smoothly but needs seams, darts or ease to cover a doubly curved shape.
- Measure a footstool, ottoman or dining chair and draw its slipcover pieces with dimensions.

Warm-up. Try to wrap a sheet of paper smoothly around three objects: a shoebox, a can and a ball. Which can you cover without a single wrinkle or fold? Write down what you had to do to the paper on the ball.

WATCH

How to Make a Slipcover

[OnlineFabricStore](#) · 11:47

<https://www.youtube.com/watch?v=xjuylmfhxlk>

WHEN TO WATCH

After “The geometry.” Watch how each piece is roughed out in muslin on the chair, labeled and pinned; note every place she has to take in fullness at a curve.

Note: A complete chair slipcover in muslin; you will make a smaller piece this unit.

BACKUP VIDEO

Easy Ottoman Slip Cover | The Sewing Room Channel

[The Sewing Room Channel](#) · 7:25

<https://www.youtube.com/watch?v=w3Vl3CMn-0s>

A simpler box-shaped ottoman cover, a good first project if your piece is a plain rectangle.

KEY TERMS

slipcover (loose cover, case cover)

A removable fitted fabric cover for upholstered furniture.

developable surface

A surface that can be flattened without stretching or tearing, such as a box side, a cylinder or a cone.

doubly curved surface

A surface curved in two directions at once, like a ball or a rounded seat front, which flat cloth cannot cover without seams, darts or ease.

dart

A stitched, tapering fold that takes out fullness so flat cloth can curve.

ease

Extra fabric gently gathered or shrunk in so cloth can fit a curve without a visible fold.

muslin (toile)

Inexpensive plain cotton used to fit and test a pattern before cutting the good fabric.

CORE IDEAS

The story. In the 1700s and 1800s, the best chairs and sofas of a prosperous house were covered in costly silk damask, wool or leather, and the family did not sit on them every day in their bare upholstery. They protected them with **case covers**: loose, fitted covers of linen check, striped cotton or glazed chintz, tied or buttoned on, washed when dirty, and removed when company came. In summer, many households put the whole room into its light cotton covers. A fragment of a nineteenth-century glazed-chintz slipcover from Massachusetts, in this lesson's picture study, is a survivor of that habit. Slipcovers were thrift: they let the expensive cloth last a lifetime.

How they figured it out. A loose cover has to look fitted, or it looks like a sheet thrown over a chair. Upholsterers and seamstresses learned to cut a cover in pieces that follow the furniture's planes: an inside back, an outside back, a seat, arms, a front band, a skirt.

Each piece is nearly flat, and the seams fall exactly on the furniture's edges, where the eye expects a line. Where a shape curves, they took in the extra cloth with small darts, pleats or gathers, or eased it in.

The geometry. Paper (and cloth, which is almost as stiff along the grain) can bend in one direction at a time. A box is flat planes; a can or a chair's rolled back is a cylinder; both are **developable** and wrap smoothly. A ball, a rounded seat corner or a padded arm front curves in *two* directions at once, and flat cloth can only cover it if some of the cloth is removed (a dart), gathered (a pleat or ease), or stretched (bias and knit fabrics stretch a little). That is the whole art of slipcovering in one fact.

The math. Measure each plane at its widest and longest and add seam allowances; for curved edges, measure the curve with a flexible tape, never straight across. A rounded corner of radius r adds a quarter circle, $\frac{1}{4} \cdot 2\pi r = \frac{1}{2}\pi r$, in place of two straight sides of length r .

Let's sew. This unit makes one fitted slipcover for a real footstool, ottoman or dining chair. This lesson: choose the piece, measure it, draw the slipcover's pieces, and test the hardest curve in muslin.

PICTURE STUDY



Slipcover fragment, Unknown Massachusetts maker, 19th century · Glazed cotton chintz · Concord Museum, Concord, Massachusetts

Image: [Wikimedia Commons](#), public domain

This piece of printed cotton once covered a chair or sofa in a Massachusetts house. Glazed chintz was popular for slipcovers because its polished surface shed dust and its cheerful prints hid wear. It was meant to be used hard and washed, so few slipcovers survive at all.

Look closely

- Follow the stripes. How would a slipcover maker line them up on a chair back and seat?
- Find the faded areas. What might have caused them?
- Look at the medallions. How far apart are they? Is that the repeat?
- Look closely at the surface. Can you tell where the glaze has worn away?

Talk about it

1. Why would a family cover a good chair with a cheaper cotton instead of using the chair's own fabric?
2. How would stripes help or hurt a slipcover maker fitting a curved chair?
3. What in your house could use a washable cover?

Safety first. Measuring and muslin only this week: carry shears closed, count pins in and out, and use T-pins with their heads clear of where you sit or lean. Lift and turn furniture with a helper, bending your knees.

The Measured Piece and the Curve Test

Choose the piece you will slipcover this unit, measure it plane by plane, draw its slipcover pieces with dimensions, and test the hardest curve in muslin with darts or ease.

You will need

- A footstool, ottoman or dining chair the family agrees to cover
- Flexible tape measure, notebook, camera
- Muslin or an old sheet, T-pins, chalk, shears

MUSLIN CORNER TEST

Finished size: One corner or curve of the piece, fitted in muslin · About 45 minutes

Fabric and notions

- One muslin rectangle 4 in larger than the area being tested each way
- T-pins
- Chalk or a washable marker

How to make it

1. Lay the muslin wrong side out over the corner or curve, grain straight up and down.
2. Pin it to the piece along the top center and down the center front.
3. Smooth it toward the corner and pin along the edges where seams will go.
4. Where extra cloth collects, pinch it into a dart (or two) or a small pleat and pin it.
5. Mark every seam line and dart with chalk on the muslin.
6. Unpin, lay flat and true up the lines with a ruler and curve; add 1-in seam allowances.
7. Re-pin on the piece to check the fit.

Fabric check: Use plain cotton muslin or an old cotton sheet: it pins easily and shows marks. The final slipcover fabric should be a firm, washable decorator cotton or linen blend, preshrunk; avoid very slippery fabric for a first slipcover.

Steps

1. Photograph the piece from the front, side and back.
2. Measure every plane at its widest and longest, curves with a flexible tape; record in a table.
3. Draw the slipcover's pieces flat with dimensions and seam allowances.
4. Run the muslin corner test from the pattern card; photograph the darts or pleats.
5. Write which fitting method (dart, pleat, ease, extra seam) you chose and why.
6. Clean up: T-pins counted back into their box.
7. Improve it: what would you measure differently?

Tips

- Mark the center of each plane on the furniture with a pin; every piece is centered from there.
- Write measurements on a sketch, not in a list, so you know which is which.
- A box-shaped ottoman is the easiest first project; a chair with a rounded seat is the hardest.

Check your work

- ☐ My measurement table is complete with units.
- ☐ My piece drawing shows every slipcover piece with dimensions.
- ☐ My muslin test fits the curve smoothly.

LAB NOTEBOOK

1. Paste the photos and the measurement table.
2. Draw the slipcover's pieces flat, dimensioned.
3. Sketch the paper-and-ball experiment and write one sentence explaining it.

KEY FORMULAS

$$\begin{aligned} \text{perimeter of a rounded rectangle} &= 2(L + W) - 8r + 2\pi r \\ \text{perimeter of a rounded rectangle} &= 2(L + W) - 8r + 2\pi r \\ \text{cut piece} &= (\text{width} + 2SA) \times (\text{height} + 2SA) \\ \text{arc length of a quarter circle} &= \frac{1}{2}\pi r \\ \text{arc length of a quarter circle} &= 21\pi r \end{aligned}$$

From history. Colonial Williamsburg's inventories and furnishing plans include checked linen case covers for chairs, which the historic houses there reproduce. Checks and stripes were favored partly because they hid soil.

WORKED EXAMPLES

Example 1. A dining chair seat is 18 in wide and 17 in deep, with front corners rounded on a 2-in radius and square back corners. Find the length of the seat's front and sides (where a skirt band will attach).

Show solution

1. Straight front: $18 - 2 \times 2 = 14$ in $18 - 2 \times 2 = 14$ in.
2. Two straight sides: $2 \times (17 - 2) = 30$ in $2 \times (17 - 2) = 30$ in.
3. Two quarter-circle corners: $2 \times \frac{1}{2}\pi(2) = 2\pi \approx 6.28$ in $2 \times 21\pi(2) = 2\pi \approx 6.28$ in.
4. Total: $14 + 30 + 6.28 \approx 50.3$ in $14 + 30 + 6.28 \approx 50.3$ in.

Answer: About $50\frac{3}{4}$ in around the front and sides.

Example 2. An ottoman's top is 24×18 in, and its upholstered sides are 8 in tall above the legs. List the cut sizes for a top and a one-piece side band with $\frac{1}{2}$ -in seams (band joined once at a back corner).

Show solution

1. Top: $(24 + 1) \times (18 + 1) = 25 \times 19$ in $(24 + 1) \times (18 + 1) = 25 \times 19$ in.
2. Perimeter: $2(24 + 18) = 84$ in $2(24 + 18) = 84$ in.
3. Band: $(8 + 1) \times (84 + 1) = 9 \times 85$ in $(8 + 1) \times (84 + 1) = 9 \times 85$ in.

Answer: Top 25×19 in 25×19 in; band 9×85 in 9×85 in.

Example 3. Design reasoning. A footstool has a domed, padded top. Why will a flat square of fabric wrinkle at its corners, and what are two ways to fit it?

Show solution

1. The dome curves in two directions, so the flat square has too much cloth at the corners where the dome falls away.
2. Fix 1: cut a flat top and a side band, with the seam along the dome's edge, and ease the top's corners into the band.
3. Fix 2: keep one piece and take out the extra cloth at each corner with a dart or a small box pleat, pinned on the stool.

Answer: Remove the extra cloth at the corners with a seam and easing, or with darts or pleats: flat cloth cannot cover a dome without one of them.

PRACTICE

1. **Easy** What was a case cover for?

Show answer

To protect costly upholstery from everyday wear and dirt; it could be washed and removed for company.

2. **Easy** Which can paper wrap without wrinkles: a cylinder or a ball?

Show answer

A cylinder.

3. **Easy** Ottoman top 20×16 in, $\frac{1}{2}$ -in seams. Cut size?

Show answer

21×17 in 21×17 in.

4. **Medium** Name three ways to fit flat cloth to a doubly curved shape.

Show answer

Darts, pleats or gathers (ease), or seams that divide the curve into flatter pieces; bias or stretch fabric helps a little.

5. **Medium** Ottoman 20×16 in, sides 7 in tall. Band cut size with one join and $\frac{1}{2}$ -in seams?

Show answer

Perimeter 72 in; band 8×73 in 8×73 in.

6. **Medium** Arc length of a quarter circle of radius 3 in?

Show answer

$\frac{1}{2}\pi(3) \approx 4.71$ in $2\pi(3) \approx 18.8$ in.

7. **Medium** Why measure a curve with a flexible tape instead of straight across?

Show answer

The curve is longer than the straight line; a straight measurement makes the piece too short.

8. **Hard** A seat 20×18 in has all four corners rounded on a 3-in radius. Perimeter?

Show answer

$2(38) - 24 + 6\pi \approx 70.8$ in $2(38) - 24 + 6\pi \approx 70.8$ in.

9. **Hard** Why do slipcover seams fall on the furniture's edges?

Show answer

The eye expects a line there, the pieces between edges are nearly flat, and the seam allowance and welting reinforce the edges that wear most.

10. **Hard** A cover's top is 25×19 in and its band 9×85 in. Can both be cut from 1 yd of 54-in fabric if the band is railroaded?

Show answer

Railroaded, the band runs 85 in along the bolt (more than 1 yd), so no: the band alone needs about $2\frac{3}{8}$ yd of length (or must be pieced crosswise from two strips).

11. **Challenge** Explain, with the paper-and-ball experiment, why a stretch knit slipcover can fit a rounded chair with fewer seams than a woven one.

Show answer

A knit's loops can stretch in both directions, so it can take on a little double curvature without darts; a woven fabric is nearly inextensible on the grain, so its extra cloth must be removed by darts, pleats or seams.

COMMON MISTAKES

- Measuring a curve straight across.
- Fitting muslin right side out, so the seams end up on the outside.
- Choosing a deeply rounded wing chair for a first slipcover.

Make it a game · Wrap Challenge. Give each player a sheet of paper and three household objects (a box, a can, a ball or an orange). Players race to cover each object as smoothly as possible with tape and scissors, using the fewest cuts and folds. A parent judges smoothness; then each player names which surfaces were developable.

6.2 FEED-SACK THRIFT: THE CUTTING PLAN AND YARDAGE

OBJECTIVES

- Explain how a cutting plan saves fabric, and why patterned fabric changes the plan.
- Write a complete piece list for a slipcover and lay it out to scale on 54-in fabric, railroading where it helps.
- Calculate yardage including welting and a skirt, and compare the cost of the slipcover with re-upholstery or replacement.

Warm-up. Take a sheet of graph paper as your fabric (each square = 2 in, the paper's width = 54 in). Cut paper rectangles for a 25 × 19 in top and a 9 × 85 in band. Arrange them to use as little paper length as possible. How much length did you need?

WATCH

How To Calculate Slipcover Fabric Yardage

[Kim's Upholstery](#) · 16:03

<https://www.youtube.com/watch?v=ZJnLhMNCoc>

WHEN TO WATCH

After “The math.” Work along with her measuring sheet using your own piece's numbers.

BACKUP VIDEO

Calculate yardage for a slipcover...slipper chair slipcover series.

[mimzy & company](#) · 14:33

<https://www.youtube.com/watch?v=Wc7XgQZ884g>

A second workroom's yardage worksheet for a slipper chair; compare her allowances with Kim's.

KEY TERMS

piece list

Every piece of the slipcover with its cut size and how many to cut.

railroading

Turning the layout so long pieces run along the length of the bolt.

yield

How many pieces fit across the fabric width.

cutting plan (layout)

A to-scale drawing of the pieces laid on the fabric's width, showing the length needed.

motif placement

Centering a pattern's main motif on the seat, back or top.

waste factor

A percentage added to cover mistakes, shrinkage and squaring the ends.

CORE IDEAS

The story. From the late 1800s into the 1950s, flour, sugar and animal feed were sold in sturdy cotton sacks. Farm and town women washed the sacks and sewed them into dish towels, aprons, children's dresses, quilts, curtains and covers. Around the 1930s, mills began printing the sacks in flowers, checks and stripes to win customers, and a woman might ask the feed-store clerk for two more sacks of the same print so she would have enough for a dress. A large sack opened into roughly a yard of cloth, so every project was planned to the inch: the cutting plan decided what could be made.

How they figured it out. When fabric is scarce or costly, the order of operations is: list every piece, draw the pieces to scale, and fit them onto the fabric's width like a puzzle before a single cut. Workrooms still work this way, because decorator fabric is expensive and a slipcover can need 8 to 20 yards for a sofa. Patterned fabric adds rules: motifs must be centered on seat, back and top, stripes must run the same way on every piece, and a large repeat can double the yardage.

The fabric science. Pieces are cut on grain: lengthwise grain usually runs up and down the furniture, so the fabric hangs and wears evenly. **Railroading** (turning the fabric sideways) is useful for long bands and skirts because it avoids seams, but only with fabric that

looks the same sideways: plain weaves, many textures and non-directional prints. Napped fabrics like velvet must all run the same direction or they look like two colors.

The math. Piece list → yield across the width → rows down the length → length in inches → yards, plus welting and a waste factor of about 10%. Then compare cost: fabric and notions for the slipcover against new upholstery or replacement.

Let's sew. In the lab you will write the piece list, draw the cutting plan to scale, compute the yardage and cost, and cut your muslin pattern pieces.

PICTURE STUDY



Upholstery panel for a chair seat, Unknown makers, India, for the European market, 1725–1750 · Painted and dyed cotton (chintz) · The Metropolitan Museum of Art, New York

Image: [Wikimedia Commons](#), public domain

Indian cotton painters and dyers made panels like this one to order for European furniture, painting the design to the exact shape of a chair seat, with the bouquet centered and the border following the edges. It is a cutting plan and a motif placement done before the cloth was even dyed.

Look closely

- Find the notches at the back corners. What are they for?
- Look at how the border follows the outline. Where would the seams of the seat fall?
- Find the center of the bouquet. Is it in the center of the seat?
- Look at the unprinted cloth around the shape. Why leave it?

Talk about it

1. How is designing the print to the shape like centering a motif when you cut?
2. Why would a European buyer order seat panels from India rather than buying cloth by the yard?
3. If you were planning your slipcover in a print, which piece would get the best motif?

Safety first. Cutting muslin pattern pieces with shears or a rotary cutter: blade closed when set down, cut away from your body, pins counted. Work on a clean floor or large table, not on the furniture itself.

STUDIO LAB

Piece List, Cutting Plan and Muslin Pattern

Write the full piece list for your slipcover, draw the cutting plan to scale, calculate yardage and cost, and cut the pieces in muslin as your working pattern.

You will need

- Your Lesson 6.1 measurements and drawings
- Graph paper, ruler, calculator
- Muslin, shears, marker

MUSLIN PATTERN SET

Finished size: One set of muslin pieces for your slipcover · About 90 minutes

Fabric and notions

- Muslin enough for every piece, cut 1 in larger all around than planned for fitting
- A marker for labeling
- Your piece list

How to make it

1. Cut each piece from muslin by the piece list, 1 in larger all around than its cut size, for fitting allowance.
2. Label every piece: name, top edge, center line, grain arrow, “right side.”
3. Mark the center lines on each piece with a ruler.
4. Stack the pieces in the order you will fit them in Lesson 6.3.

Fabric check: Muslin is the standard pattern cloth. Your final fabric should be preshrunk, firmly woven, washable decorator cotton, linen blend or canvas (Lesson 1.3 duty rules for seats). Choose solids, textures or small prints for a first slipcover; large motifs and stripes add matching work.

Steps

1. Write the piece list with cut sizes.
2. Draw the cutting plan to scale on graph paper twice: pieced and railroaded. Compute the length of each.
3. Add welting and a 10% waste factor; write the yardage and cost.
4. Compare the cost with replacing or re-upholstering the piece.
5. Cut and label the muslin pieces from the pattern card.
6. Clean up: blade closed, pins counted.
7. Improve it: one change to your plan.

Tips

- Cut paper rectangles to scale and slide them on graph paper; it is faster than redrawing.
- Hide joins at back corners and inside pleats.
- Buy all your fabric from one bolt; dye lots differ.

Check your work

- ☐ My piece list includes every piece, welting and skirt.
- ☐ I compared two layouts and chose one with a reason.
- ☐ My yardage and cost are calculated and checked.

LAB NOTEBOOK

1. Paste both cutting plans with their lengths.
2. Record yardage, cost and the comparison with replacing the piece.
3. Tape in a fabric swatch of your chosen slipcover cloth.

KEY FORMULAS

$$\text{yield} = \left\lfloor \frac{\text{fabric width}}{\text{piece width}} \right\rfloor$$

$$\text{yield} = \left\lfloor \frac{\text{piece width}}{\text{fabric width}} \right\rfloor$$

$$\text{yards} = \frac{\text{total length of rows (in)}}{36} \times 1.10$$

$$\text{yards} = 36 \text{total length of rows (in)} \times 1.10$$

$$\text{skirt length} = \text{perimeter} + \text{pleat take-up} + \text{seam allowances}$$

$$\text{skirt length} = \text{perimeter} + \text{pleat take-up} + \text{seam allowances}$$

From history. By the 1940s some feed-sack makers printed patterns and doll outlines directly on the sacks, and the labels were made to wash out, because companies knew how families used the cloth.

WORKED EXAMPLES

Example 1. An ottoman slipcover has: top 25×19 in; band 9×85 in; skirt 10×133 in. On 54-in solid fabric, plan a layout with the top and band cut lengthwise-normal and the skirt pieced crosswise. Find the length needed.

Show solution

1. Top: one row 19 in long (25 in wide, leaving 29 in beside it).
2. Band: cut as two pieces 9×43 joined at the back corners ($43 + 43 - 1 = 85$). Two 43-in pieces cannot sit side by side on 54 in, so they take 2 rows of 9 in: 18 in.
3. Skirt: $133 \div 53 \approx 2.5$, so 3 crosswise strips, 3 rows of 10 in: 30 in.
4. Total: $19 + 18 + 30 = 67$ in; with 10%: $67 \times 1.1 \approx 74$ in ≈ 2.05 yd.

Answer: About 67 in of fabric; buy $2\frac{1}{8}$ yd (plus welting fabric).

Example 2. The same cover railroaded: band 9×85 in and skirt 10×133 in run along the bolt. Find the length needed.

Show solution

1. Across the 54-in width: band (9) + skirt (10) + top (19 wide if turned) = 38 in, so all three run side by side.
2. Length: the longest piece, the 133-in skirt.
3. Total: 133 in; with 10%: 146 in ≈ 4.1 yd.

Answer: Railroaded avoids every seam but needs about 4 yd; piecing needs about $2\frac{1}{8}$ yd. With a plain fabric, piecing at the back corners (hidden) is the thrifty choice.

Example 3. Welting: the cover has welting around the top (84 in) and along the skirt seam (84 in), 3 in overlap each. Strips cut $1\frac{1}{2}$ in on the bias from a square. What square do you need (10% waste)?

Show solution

1. Length: $2 \times (84 + 3) = 174$ in
2. Area: $174 \times 1.5 = 261$ in²; with 10%: 287 in²
3. Square:

$$\sqrt{287} \approx 17 \text{ in}$$

Answer: A 17-in square, about $\frac{1}{2}$ yd.

Example 4. Cost comparison: slipcover fabric $2\frac{1}{8}$ yd at \$18 + $\frac{1}{2}$ yd welting fabric at \$18 + cord and thread \$9, versus a new ottoman at \$180.

Show solution

1. Slipcover: $2.625 \times 18 + 9 = \$56.25$
2. Savings: $\$180 - \$56.25 = \$123.75$, about 69%.

Answer: About \$56 to slipcover versus \$180 to replace.

PRACTICE

1. **Easy** Why did mills begin printing feed sacks?

Show answer

To win customers, since women reused the sacks for clothing and household sewing.

2. **Easy** What is railroading, and when can't you do it?

Show answer

Running long pieces along the bolt; not with directional prints, stripes that must run vertically, or napped fabrics that would look different.

3. **Easy** How many 17-in-wide pieces fit across 54-in fabric?

Show answer

3.

4. **Medium** Rows of 19, 18 and 30 in. Total length and yards with 10% waste?

Show answer

$67 \times 1.1 = 73.7$ in, about 2.05 yd.

5. **Medium** Why must all pieces of a velvet slipcover run the same direction?

Show answer

Velvet's nap reflects light differently by direction, so pieces cut differently look like two colors.

6. **Medium** Skirt length for an 84-in perimeter with four 12-in kick pleats and two 1-in join allowances?

Show answer

$84 + 48 + 2 = 134$ in.

7. **Medium** How many 53-in crosswise strips make 134 in of skirt?

Show answer

$\lceil 2.53 \rceil = 3$

8. **Hard** A chair slipcover piece list: inside back 20×24 , outside back 20×30 , seat 21×20 , skirt 10×70 . Plan rows on 54-in fabric and find the length.

Show answer

Row 1: inside back (20) + seat (21) = 41 wide, 24 long. Row 2: outside back 30 long (20 wide). Row 3: skirt pieced: 2 crosswise strips, 20 in. Total $24 + 30 + 20 = 74$ in; with 10%, about $2\frac{1}{4}$ yd.

9. **Hard** Same chair in a print whose 18-in motif must be centered on inside back, outside back and seat (repeat 27 in). Estimate the extra fabric.

Show answer

Each centered piece may need up to one extra repeat: about $3 \times 27 = 81$ in more at most, so plan about 2 yd more; lay out on the actual fabric before buying.

10. **Hard** Cost: $4\frac{1}{2}$ yd at \$22\$22 plus \$15\$15 notions for a chair slipcover versus re-upholstery quoted at \$350\$350. Savings and percent?

Show answer

\$114\$114; savings \$236\$236, about 67%.

11. **Challenge** A woman of 1940 has three matching feed sacks, each about 36×42 in when opened. Could she make an ottoman slipcover with top 25×19 , band 9×85 and skirt 10×133 ? Show the plan.

Show answer

Total area $475 + 765 + 1,330 = 2,570 \text{ in}^2$ $475 + 765 + 1,330 = 2,570 \text{ in}^2$ vs. $3 \times 1,512 = 4,536$; area is enough.

Band and skirt must be pieced from 42-in strips: band 3 strips 9 in, skirt 4 strips 10 in; top from one sack. Yes, with several joins hidden at corners and pleats.

COMMON MISTAKES

- Forgetting the skirt and welting in the yardage.
- Railroading a stripe that must run vertically.
- Buying fabric from two bolts that turn out to be different dye lots.

Make it a game · Layout Tetris. Each player gets the same set of scaled paper pieces and a 54-in-wide graph-paper strip. In five minutes, lay out the pieces using the least length (no turning a piece unless the fabric could be railroaded). Shortest correct layout wins; any piece off-grain is disqualified.

6.3 THE TAILOR'S TOILE: PIN-FITTING INSIDE OUT

OBJECTIVES

- Explain why tailors and slipcover makers fit a trial in cheap cloth first, and why slipcovers are fitted wrong side out.
- Pin-fit muslin on a piece of furniture, mark seam lines, notches and darts, and true them on the table.
- Transfer the fitted muslin to a pattern and cut the final fabric from it.

Warm-up. Turn a shirt or pillowcase inside out and look at the seams. Where does the stitching sit relative to the edge of the shape? Now imagine fitting that shirt to a person while it is inside out. Why might that be easier than fitting it right side out?

WATCH

How to cut and pin fit a sofa slipcover without welt(piping).

[mimzy & company](https://www.youtube.com/watch?v=T4yjl2mHJYE) · 27:14

<https://www.youtube.com/watch?v=T4yjl2mHJYE>

WHEN TO WATCH

After “The craft.” Watch how she centers each piece, pins along the furniture's edges, and trims to an even seam allowance; you will do the same on a smaller piece.

Note: A long, thorough workroom demonstration on a full sofa; watch the first 15 minutes closely and the rest for technique.

KEY TERMS

toile

A trial version of a garment or cover in inexpensive muslin, fitted before the good fabric is cut.

wrong side out

Fitting with the fabric's back facing out, so seams can be pinned and then sewn as fitted.

truing

Straightening and smoothing marked seam lines with a ruler and curve after fitting.

pin-fitting

Pinning fabric directly on the furniture along the seam lines to fit it.

notch

A small clip or mark at matching points on two pieces, so they can be sewn back together correctly.

tuck-in

Extra fabric (3–6 in) left where seat meets back or arms, tucked into the gap to hold the cover in place.

CORE IDEAS

The story. Quiringh van Brekelenkam painted Dutch tailors at work in the 1650s and 1660s: men sitting cross-legged on a big table by the window, cutting and sewing, while customers came in with cloth. Tailors and dressmakers of that era and long after fitted their customers with a trial garment, pinning and marking it on the body before they risked cutting expensive cloth. French dressmakers called this trial a **toile**. Slipcover makers do exactly the same thing on a chair: they fit the cloth on the furniture itself.

How they figured it out. Measurements alone cannot capture a padded, rounded, slightly lopsided chair. Pinning the cloth on the piece captures everything at once: the slopes, the curves, the places where the padding is fuller on one side than the other. Slipcover makers fit the fabric **wrong side out**, pinning the seams right on the furniture's edges, so that when the pins are replaced with stitching and the cover is turned, the seams sit exactly where the pins were.

The craft. Center each piece by its center line on the furniture's center mark, grain straight. Pin it to the furniture with T-pins at the center and corners. Pin the pieces to each other along the edges, right sides facing (because the work is wrong side out). Where fullness collects at a curve, pin a dart or small pleats. Leave a **tuck-in** where seat meets back or arms. Mark the pin lines with chalk, mark notches across each seam every 6–10 in, trim to an even 1-in seam allowance, unpin, true the lines on the table, and you have a pattern.

The math. Fitting is measurement with the cloth itself. Seam allowances must be even, notches must match, and the two sides of a symmetrical piece must match each other: fit one half, then fold the pattern on the center line and copy it, so the cover is symmetrical even if the furniture is not quite.

Let's sew. In the lab you will pin-fit your muslin pieces on the furniture, mark and true them, and cut your final fabric from the fitted muslin, centering any motif.

PICTURE STUDY



The Tailor's Workshop, Quiringh van Brekelenkam, c. 1661 · Oil on panel · Rijksmuseum, Amsterdam (one of several versions)

Image: [Wikimedia Commons](#), public domain

Brekelenkam painted tailors' shops many times. This one shows the whole workshop: journeymen sewing on the table by the window, and the master showing a garment to a customer. It is a portrait of fitting, measuring and making, three hundred and sixty years before your slipcover.

Look closely

- Find the tailors on the table. How are they sitting, and why by the window?
- Look at the garment the master is holding. What might he be showing the customer?
- Find the scraps on the floor. What does that tell you about cutting?
- Look at the clothing hanging on the walls. Is it finished, in progress or waiting?

Talk about it

1. How is the master tailor's conversation with his customer like your presentation of the slipcover plan to your family?
2. Why would a tailor fit a customer before finishing a garment?
3. What tools can you spot, and which do you use in this lesson?

Safety first. T-pins are long and sharp: push them into the furniture at a shallow angle, heads out of the way of hands and knees, and count every pin in and out; sweep the floor and the furniture with a magnet. Never sit on furniture with pins in it. Cut final fabric with the blade rules from Unit 5.

STUDIO LAB

Pin-Fit, True and Cut

Pin-fit your muslin pieces wrong side out on the furniture, mark and true the seam lines and notches, and cut your final fabric from the fitted pattern.

You will need

- Labeled muslin pieces from Lesson 6.2
- T-pins (about 100) and a pin dish
- Chalk, washable marker, clear ruler, French curve or a plate for curves
- Shears; final fabric, preshrunk and pressed

FITTED SLIPCOVER PATTERN

Finished size: One complete fitted pattern for your piece · About 2–3 hours

Fabric and notions

- Muslin pieces, cut 1 in oversized
- About 100 T-pins
- Chalk and marker

How to make it

1. Mark the center lines of the furniture with pins or chalk.
2. Lay the top (or seat) piece wrong side out, center line on center line, grain straight; T-pin at the center and corners.
3. Add the band or side pieces, wrong side out, pinning them to the top along the furniture's edges, seams facing out.
4. At curves, pin out fullness with darts or small pleats, evenly spaced.
5. Leave tuck-ins where pieces meet in a crease.
6. Mark every pinned seam line on both pieces with chalk; mark notches across seams every 6–10 in.
7. Trim seam allowances to an even 1 in.
8. Unpin, lay each piece flat, and true the lines with ruler and curve; fold symmetrical pieces on the center line and even them.
9. Re-pin the trued pieces on the furniture to check; then use them as the pattern to cut the final fabric, centering any motif.

Fabric check: Fit in muslin, not the final fabric. Final fabric must be preshrunk by washing and drying the way the cover will be cleaned (Lesson 6.5), and pressed before cutting.

Steps

1. Fit from the pattern card, photographing each stage.
2. Record each change from the measured plan (darts added, pieces enlarged or reduced).
3. Cut the final fabric from the trued pattern, transferring notches and center marks.
4. Count T-pins in and out; sweep the furniture and floor with a magnet.
5. Improve it: what would you fit differently?

Tips

- Fit from the center outward, never from one end.
- Pin seams with pins parallel to the seam line so they are easy to mark.
- Keep the muslin pattern; it will fit the same piece again in ten years.

Check your work

- ☐ My pattern is trued, notched and symmetrical where it should be.
- ☐ My final pieces are centered on the motif and on grain.
- ☐ Every T-pin is accounted for.

LAB NOTEBOOK

1. Paste photos of the fitting stages.
2. Record the changes from the measured plan.
3. Draw one trued pattern piece small, with notches and grain line.

KEY FORMULAS

seam allowance after trimming = 1 in (fitting)

notches per seam $\approx \frac{\text{seam length}}{8 \text{ in}}$

notches per seam ≈ 8 in seam length

tuck-in allowance = 3 to 6 in per side

tuck-in allowance = 3 to 6 in per side

From history. Tailors of Brekelenkam's time sat cross-legged on the workbench, and the habit lasted into the twentieth century; the position kept garments off the dirty floor and close to the light.

WORKED EXAMPLES

Example 1. A seat's side seam is 18 in long and you want notches about every 8 in, plus one at each end. How many notches?

Show solution

1. Spaces: $[18 \div 8] = 3$ $[18 \div 8] = 3$.
2. Notches: $3 + 1 = 4$ $3 + 1 = 4$ (including both ends).

Answer: 4 notches, about 6 in apart.

Example 2. A chair's seat and back meet in a deep crease. You leave a 4-in tuck-in on the seat and a 4-in tuck-in on the inside back. How much extra length does that add to each piece's cut size?

Show solution

1. Seat: add 4 in at its back edge.
2. Inside back: add 4 in at its bottom edge.
3. Total extra across the two pieces: 8 in.

Answer: 4 in on each piece, 8 in in all, and they hold the cover in place.

Example 3. Design reasoning. Your footstool is $\frac{1}{2}$ in wider at the left back corner than the right. Should the slipcover follow the stool or be made symmetrical?

Show solution

1. A cover fitted exactly to the stool will fit only one way round; if turned, it will not fit.
2. A symmetrical cover (fit one half, mirror it) looks straighter and can go on either way, but may be $\frac{1}{4}$ in loose on one side.
3. For a stool that sits in a fixed position, fit the stool; for one that gets moved and turned, make it symmetrical and let the batting and tuck-ins absorb the $\frac{1}{2}$ in.

Answer: Usually make it symmetrical and absorb the small difference; fit exactly only if the piece always faces one way.

PRACTICE

1. Easy What is a toile?

Show answer

A trial version in inexpensive muslin, fitted before the good fabric is cut.

2. Easy Why are slipcovers pinned wrong side out?

Show answer

So the pinned seams can be sewn as fitted and end up exactly on the furniture's edges when turned.

3. **Easy** Notches every 8 in on a 24-in seam, including both ends?

Show answer

4.

4. **Medium** What is a tuck-in and why is it used?

Show answer

Extra fabric pushed into the gap between seat and back or arms; it holds the cover in place.

5. **Medium** Why fit one half and mirror it?

Show answer

To make the cover symmetrical and reversible even if the furniture is slightly uneven.

6. **Medium** After fitting, you trim to a 1-in seam allowance but sew at $\frac{1}{2}$ in by mistake. What happens?

Show answer

Each piece's seam line moves $\frac{1}{2}$ in outward, so the cover is 1 in looser around at that seam.

7. **Medium** Why mark notches across seams before unpinning?

Show answer

So the pieces can be matched exactly when sewing; without them, long seams drift.

8. **Hard** A tuck-in of 5 in on the seat's back and both sides of a 20×18 in seat ($\frac{1}{2}$ -in seams elsewhere). Cut size?

Show answer

Width $20 + 2 \times 5 = 30$, depth $18 + 5 + 0.5 = 23.5$ (front edge $\frac{1}{2}$ -in seam): 30×23.5 in.

9. **Hard** In the lab, your first fitting pins pull diagonal wrinkles across a seat. What does that tell you and how do you fix it?

Show answer

The piece is off-grain or not centered; unpin, re-center on the center marks with the grain straight, and repin from the center out.

10. **Hard** Why would a slipcover maker fit with muslin rather than directly with the good fabric?

Show answer

Muslin is cheap, marks easily and can be cut and re-cut while learning the shape; mistakes cost little.

11. **Challenge** Brekelenkam's tailors sit cross-legged on a table by a window. Using the painting, give two practical reasons for that working position.

Show answer

The window gives the best light for fine stitching; sitting on the table keeps the cloth clean and spread out within reach, and the lap and knees support the work.

COMMON MISTAKES

- Fitting right side out.
- Forgetting notches, so long seams cannot be matched.
- Leaving pins in the furniture.

Make it a game · Notch Match. A parent cuts two matching paper pattern pieces with notches and hides which notch matches which. Players race to align the pieces by notches alone, eyes on the notches only. Then the parent cuts a pair with one wrong notch; the first player to spot the mismatch wins a bonus point.

6.4 WELTING, SKIRTS AND PLEATS

OBJECTIVES

- Choose a skirt style (gathered, box-pleated, tailored with kick pleats) for a slipcover and calculate its length.
- Calculate box pleats so they fit a side exactly.
- Make welting for the slipcover and a lined skirt with kick pleats.

Warm-up. Look under the edge of an upholstered chair, sofa or ottoman. Does it have a skirt? Is it gathered, pleated or flat with pleats only at the corners? How high is it off the floor? Measure one pleat if you find one.

WATCH

Upholstery Method - HOW TO CONSTRUCT A KICK PLEAT SKIRT

[The Workroom Channel](#) · 13:35

<https://www.youtube.com/watch?v=eYZqemzYWWM>

WHEN TO WATCH

After “The math.” She plans the panels on a worksheet first; copy her worksheet layout for your own skirt before cutting.

Note: A professional upholsterer builds a lined, tailored skirt with kick pleats.

KEY TERMS

tailored skirt

A flat skirt with inverted (kick) pleats only at the corners.

kick pleat

An inverted pleat at a corner (or at the middle of a long side) so a tailored skirt can flex.

skirt lining

A lining that gives a skirt body and a clean hem, so it hangs straight.

box pleat

A pleat with two folds turned away from each other, making a flat box on the face.

underlay

A separate piece set behind a kick pleat instead of folding it from the skirt itself.

self-welting

Welting made from the same fabric as the cover.

CORE IDEAS

The story. Upholsterers borrowed pleats from the dressmaker. A box-pleated skirt on an ottoman uses the same folds as a pleated skirt or a pleated ruffle on a gown, and the same arithmetic. In the early twentieth century, ready-made and home-sewn slipcovers commonly finished with a skirt, gathered for a cottage look or tailored with corner pleats for a crisp one. The skirt hides legs and casters, finishes the piece at the floor, and adds weight that helps the cover hang straight.

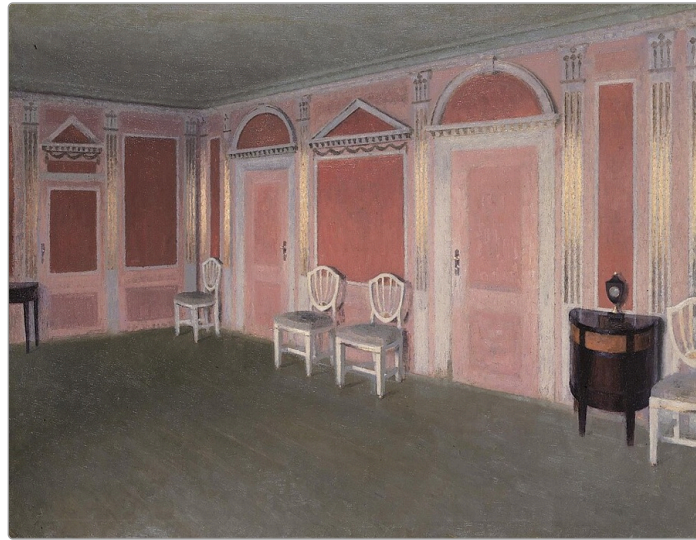
How they figured it out. A flat skirt around a corner cannot bend without either a pleat or a split. The **kick pleat** solved it: the skirt ends at each corner, and an inverted pleat (or a separate underlay piece behind the join) fills the gap and lets the skirt flex when a foot kicks it. Linings came next: a lined skirt hangs straight and never shows a raw hem, and welting at the top edge gives the skirt a crisp line.

The math. Gathered skirts need $2\text{--}2\frac{1}{2}$ times the length they cover. Box pleats laid edge to edge use three times the length: each finished box of width w takes $3w$ of fabric. A kick pleat with folds of depth d takes $4d$. To make box pleats fit a side exactly, divide the side's length by a whole number of pleats and use that width.

The craft. Cut skirt and lining the same length; sew them right sides together along the bottom, turn and press so a sliver of face fabric rolls to the back. Mark pleat lines with pins, fold and press, baste across the top. Sew welting to the cover's lower edge, then the skirt, matching the pleats to the corners.

Let's sew. In the lab you will make self-welting and a lined skirt for your slipcover, with kick pleats at the corners (or box pleats all around).

PICTURE STUDY



Interior in Louis Seize Style, from the Artist's Home, Vilhelm Hammershøi, Late 19th or early 20th century · Oil on canvas · Museum collection (Google Arts & Culture)
Image: [Wikimedia Commons](#), public domain

Hammershøi painted the rooms of his own homes again and again, nearly empty, in soft light. Here the pale Louis Seize chairs stand against the pink paneling like a row of shapes. Every chair's seat is padded and covered, and every one is a slipcover or re-covering job waiting to happen.

Look closely

- Look at the chair seats. What shape are they? Where would the seams of a slipcover go?
- Find the chairs' legs. Would a skirt suit these chairs? Why or why not?
- Look at the paneling and arches. How do the walls repeat a shape, like pleats repeat along a skirt?
- Find the darkest object in the room. What does it do to the pale chairs?

Talk about it

1. Some furniture is meant to show its legs; some is meant to be skirted. How do you decide?
2. If you made covers for these chairs, would you choose tie-on seat covers or full slipcovers?
3. What does the empty room tell you about the value of each piece of furniture in it?

Safety first. Long skirts mean long pressing: iron upright between presses, cord out of the walkway, steam held away from your hand. Welting goes close to the needle: guide with fingers to the side, never in front of the foot. Count pins.

STUDIO LAB

Welting and a Lined Kick-Pleat Skirt

Make self-welting for your slipcover's lower edge and a lined, tailored skirt with kick pleats at the corners (or box pleats all around), pleats placed to the corners.

You will need

- Final fabric and lining (muslin or drapery lining)
- Welt cord
- Machine with zipper foot, iron, pins, ruler

LINED TAILORED SKIRT WITH CORNER KICK PLEATS

Finished size: One skirt for a 24 × 18 in ottoman, 7 in finished drop (adjust to your piece) · About 3 hours

Fabric and notions

- Skirt fabric: 134 in long × 8 in deep (pieced from crosswise strips)
- Lining: 134 × 7½ in
- Welting: about 87 in
- Thread

How to make it

1. Piece the skirt strips and the lining strips, seams placed to fall inside pleats.
2. Sew skirt and lining right sides together along the bottom with ½-in seam; press the seam toward the lining, turn, and press so ⅛ in of face fabric rolls to the back.
3. Baste the top edges together.
4. Mark the corners and the pleat folds with pins (each kick pleat: 3 in each side of the corner, folded to meet).
5. Fold and press each kick pleat; baste across the top.
6. Sew the welting to the cover's lower edge, clipping at corners.
7. Sew the skirt to the cover over the welting, each pleat centered on a corner.
8. Press the seam up toward the cover.

Fabric check: Use the same preshrunk fabric as the cover. A lightweight muslin or drapery lining works for the skirt lining; preshrink it too. Heavy fabrics suit tailored skirts; light ones suit gathered skirts.

Steps

1. Calculate your skirt: style, length, pleats, strips, fabric and lining.
2. Make one kick pleat on scrap and check how it turns a corner of the furniture.
3. Make the welting and skirt from the pattern card.
4. Pin the skirt to the fitted cover on the furniture and check that the pleats meet the corners and the hem clears the floor by ½ in.
5. Clean up: pins counted, iron unplugged.
6. Improve it: one change.

Tips

- Mark the corners on the cover with chalk and on the skirt with pins; match them before anything else.
- Press pleats firmly with steam and a press cloth so they stay crisp.
- A ¼-in strip of welting at the top of a skirt hides any small error in the seam.

Check your work

- ☐ My skirt length was calculated and fit the cover exactly.
- ☐ Every pleat is centered on a corner.
- ☐ The hem is level and clears the floor evenly.

LAB NOTEBOOK

1. Draw the skirt laid flat with pleats marked and measured.
2. Show the box-pleat proof with a folded paper sample taped in.
3. Record your skirt calculations.

KEY FORMULAS

box-pleated length = $3 \times$ length covered

box-pleated length = $3 \times$ length covered

kick pleat take-up = $4d$

kick pleat take-up = $4d$

box width = $\frac{\text{side length}}{n}$ (n a whole number)

box width = n side length (n a whole number)

WORKED EXAMPLES

Example 1. An ottoman side is 24 in long. You want box pleats about 4 in wide. How many pleats fit exactly, how wide is each, and how much fabric does the side take?

Show solution

1. Pleats: $24 \div 4 = 6$, a whole number, so 6 boxes of exactly 4 in.
2. Fabric: $3 \times 24 = 72$ in $3 \times 24 = 72$ in.

Answer: 6 box pleats 4 in wide; 72 in of skirt for the side.

Example 2. The other side is 18 in. Box pleats close to 4 in?

Show solution

1. Try 4 pleats: $18 \div 4 = 4.5$ in $18 \div 4 = 4.5$ in.
2. Try 5 pleats: $18 \div 5 = 3.6$ in $18 \div 5 = 3.6$ in.
3. Choose 4 pleats of $4\frac{1}{2}$ in (closer to 4 in and easier to mark).
4. Fabric: $3 \times 18 = 54$ in $3 \times 18 = 54$ in.

Answer: 4 pleats of $4\frac{1}{2}$ in; 54 in of skirt.

Example 3. A tailored skirt for the 24×18 in ottoman has kick pleats at all four corners, each with 3-in folds. Find the skirt length (two 1-in join allowances).

Show solution

1. Perimeter: 84 in 84 in.
2. Pleats: $4 \times (4 \times 3) = 48$ in $4 \times (4 \times 3) = 48$ in.
3. Total: $84 + 48 + 2 = 134$ in $84 + 48 + 2 = 134$ in.

Answer: 134 in of skirt and the same of lining.

Example 4. Compare fabric for the three skirt styles on the 84-in perimeter: gathered at $2\frac{1}{2}\times$, box-pleated all around, tailored (134 in). Cut 10 in deep from 54-in fabric in crosswise strips (53 in each after seams).

Show solution

1. Gathered: $84 \times 2.5 = 210$ in $84 \times 2.5 = 210$ in $\rightarrow [210/53] = 4 [210/53] = 4$ strips = 40 in.
2. Box: 252 in 252 in $\rightarrow 5$ strips = 50 in.
3. Tailored: 134 in $\rightarrow 3$ strips = 30 in.

Answer: Tailored uses about 30 in of fabric, gathered 40 in, box-pleated 50 in (each plus lining).

PRACTICE

1. Easy What does a skirt do for a slipcover?

Show answer

Hides legs, finishes the piece at the floor and adds weight so the cover hangs straight.

2. **Easy** Box-pleated fabric for a 20-in side?

Show answer

60 in.

3. **Easy** Take-up of a kick pleat with 4-in folds?

Show answer

16 in.

4. **Medium** A 30-in side with box pleats near 4 in: how many and how wide?

Show answer

8 pleats of 3.75 in, or 7 of about 4.29 in; 8×3.75 in is easier to mark.

5. **Medium** Tailored skirt for a 22×22 in footstool with 4 kick pleats of $2\frac{1}{2}$ -in folds and 2 in for joins?

Show answer

$88 + 40 + 2 = 130$ in $88 + 40 + 2 = 130$ in.

6. **Medium** Why line a skirt?

Show answer

Body, a straight hang and a clean hem with no raw edges.

7. **Medium** Why must the pleats line up with the corners?

Show answer

So the skirt turns the corner at a pleat, which lets it flex and look intentional.

8. **Hard** Gathered skirt at $2\times$ on a 76-in perimeter, crosswise strips 53 in. Strips?

Show answer

$152 \div 53 \approx 2.9$ $152 \div 53 \approx 2.9$, 3 strips.

9. **Hard** A box pleat's three layers: if each finished box is 5 in, how much fabric is folded behind each box?

Show answer

10 in 10 in (two 5-in folds).

10. **Hard** Your skirt comes out 2 in too long after pleating. Name two places to take it up without re-pleating everything.

Show answer

Take in the join seams at a back corner, or deepen the back-corner kick pleats slightly.

11. **Challenge** Prove that box pleats laid edge to edge use 3 times the length covered.

Show answer

Each box shows w on the face. On each side, the cloth folds back under by $w/2$ and returns, two layers of $w/2$, to meet the next box: $2 \times 2 \times \frac{w}{2} = 2w$ $2 \times 2 \times 2w = 2w$ hidden. So each box uses $w + 2w = 3w$ $w + 2w = 3w$, and the whole side uses $3 \times$ its length.

COMMON MISTAKES

- Calculating pleats that do not divide the side evenly.
- Letting a strip seam fall on the face of the skirt instead of inside a pleat.
- Forgetting the lining in the yardage.

Make it a game • Pleat Puzzle. A parent calls out a side length. Players race to name a whole number of box pleats between 3 and 5 in wide that fit exactly, and the fabric needed. Exact fit scores two; a near fit within $\frac{1}{4}$ in scores one. Then fold a paper box pleat to prove the $3\times$ rule.

6.5 CLOSURES, CARE AND THE FINISHED SLIPCOVER

OBJECTIVES

- Choose a closure (zipper, ties, hook-and-loop, buttons) for a slipcover and place it where it is hidden and strong.
- Explain preshrinking and calculate shrinkage so the cover still fits after washing.
- Assemble and finish the fitted slipcover and write care instructions.

Warm-up. Think of a cover in your house that comes off: a cushion, a car seat cover, a pillow sham. How does it close? Where is the closure hidden? Is it easy or hard to put back on?

WATCH

How to Sew a Chair Slipcover - Custom Pattern and Assembly

Professor Pincushion · 25:09

<https://www.youtube.com/watch?v=lgzsXrPxqyY>

WHEN TO WATCH

After “The craft.” Watch the assembly order closely; write it down as a numbered list and compare it with your own plan.

KEY TERMS

preshrinking

Washing and drying fabric (and cord) before cutting, the way the finished cover will be cleaned, so it will not shrink later.

shrinkage allowance

Extra size added when fabric cannot be preshrunk.

hook-and-loop tape

A fastener of two tapes, one with tiny hooks and one with loops, invented by George de Mestral.

placket

An overlapping opening that hides a closure.

care label

Instructions for cleaning a textile; for a slipcover, you write your own.

ease of removal

How easily a cover comes off and goes back on; the whole purpose of a slipcover.

CORE IDEAS

The story. Jesus' small parable in Mark 2:21 is a lesson every sewist eventually learns the hard way: “No man also seweth a piece of new cloth on an old garment: else the new piece that filled it up taketh away from the old, and the rent is made worse.” New, unshrunk wool or linen shrinks when it is first wet; sewn onto an old garment that has already shrunk, it pulls and tears it. A slipcover that is washed must be made of cloth that has already done its shrinking, or the first wash will leave it too small to go back on.

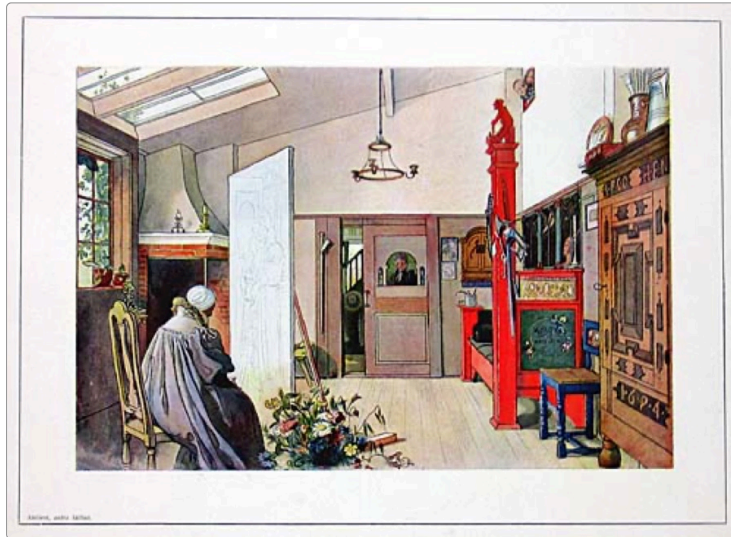
How they figured it out. Housekeepers of the 1800s washed slipcovers often and learned to wash new cloth before cutting it. Modern mills preshrink many fabrics, but home-decor fabrics are often not made to be washed at all. The rule is simple: if the slipcover will be washed, wash and dry the fabric (and cotton welt cord) first, exactly as the cover will be washed, measure it before and after, and cut from the shrunk cloth.

The fabric science. Cotton and linen fibers swell when wet and the yarns relax, so woven cloth shrinks, usually more in length than in width, often 2–5% and sometimes more. Polyester barely shrinks. A cover cut before shrinking can lose an inch or more on a 30-in seat. Closures must survive washing too: nylon zippers, sturdy hook-and-loop tape, or ties.

The craft. Sew the cover in the order fitted: darts first, then the top to the band over the welting, then the skirt. Put the closure where it is hidden and where the cover must open to go on: a back corner seam on an ottoman, the back of a chair. Finish all seams (zigzag or serger) because the cover will be washed. Try it on, adjust, and write a care label.

Let's sew. In the lab you will finish and fit your slipcover, write its care instructions and cost sheet, and present it as the Unit 6 project.

PICTURE STUDY



The Studio, the Other Half (from Ett hem), Carl Larsson, c. 1895–1899 · Watercolor, published in *Ett hem* (1899) · Nationalmuseum, Stockholm
Image: [Wikimedia Commons](#), public domain

In the Larssons' house at Sundborn the studio was also the family's gathering room. Furniture was painted, covered and re-covered, and Karin Larsson's textiles were everywhere. A home like this was furnished by making and re-making, not by buying new.

Look closely

- Find the woman at work by the window. What might she be doing with her hands?
- Find the red piece of furniture. How is it decorated?
- Look for textiles: cushions, covers, curtains. Which could be taken off and washed?
- Look at the light from the high windows. Where does it fall?

Talk about it

1. Which piece of furniture in this room would you slipcover, and in what fabric?
2. How does painting and covering old furniture fit the Larssons' way of making a home?
3. Why might a family keep a piece of furniture for generations and simply re-cover it?

Safety first. Hook-and-loop tape and zippers are sewn with the zipper foot, fingers clear of the needle. Washing and drying test fabric: an adult checks dryer settings, and the dryer lint trap is cleaned before and after. Count pins and T-pins; sweep the furniture with a magnet before anyone sits on it.

STUDIO LAB

The Finished Slipcover

Assemble your fitted slipcover with welting, skirt and a hidden closure; fit it on the piece, write its care label and cost sheet, and present it as the Unit 6 project.

You will need

- All cut pieces, welting and skirt from Lessons 6.3–6.4
- A nylon zipper, hook-and-loop tape or ties for the closure
- Machine, zipper foot, serger or zigzag, iron

FITTED OTTOMAN SLIPCOVER

Finished size: One slipcover for a 24 × 18 in ottoman, 8-in sides, 7-in skirt (adjust to your piece) · About 4–6 hours

Fabric and notions

- Top, 25 × 19 in
- Band, 9 × 85 in (pieced at a back corner)
- Lined skirt with kick pleats, 134 in
- Welting, about 174 in
- One 7-in nylon zipper or 7 in of hook-and-loop tape for a back corner

How to make it

1. Sew the welting around the top piece, clipping at the corners.
2. Sew the band into a loop at three corners, leaving one back corner open for the closure.
3. Sew the band to the top over the welting, matching notches and corners.
4. Install the zipper (or hook-and-loop tape) in the open back corner, from the bottom edge up to the top seam.
5. Sew the lower welting and the skirt to the band's lower edge, pleats centered on the corners, the skirt's ends meeting at the open corner (finish them with a narrow hem or a small overlap).
6. Finish every seam with zigzag or serger.
7. Turn right side out, press, and fit on the ottoman; close the corner.
8. Check the hem: level, ½ in above the floor all around.

Fabric check: Preshrunk, firmly woven washable decorator cotton, linen blend, twill or canvas suits slipcovers; check the seat's duty rating (Lesson 1.3). Use polyester thread and a nylon zipper. Preshrink cotton welt cord by soaking and drying, or use polyester cord.

Steps

1. Shrinkage test: wash and dry a measured 20-in square of your fabric and record the percentages (do this before cutting, in Lesson 6.3).
2. Assemble from the pattern card, recording time spent in a log.
3. Fit check: does it go on and off easily? Are seams on the edges? Is the skirt level?
4. Write the care label and sew or tape it inside.
5. Complete the cost sheet and the before-and-after photos.
6. Clean up: pins and T-pins counted, magnet sweep, machine unplugged.
7. Present the slipcover to the family with the plan, pattern and cost sheet.

Tips

- Put the cover on slightly damp after washing; it eases into place and dries to fit.
- Keep the muslin pattern in a labeled envelope.
- A spare strip of fabric stored with the pattern makes future repairs invisible.

Check your work

- ☐ My cover fits, goes on and off easily and closes invisibly.
- ☐ My seams are finished and my hem is level.
- ☐ My shrinkage test, care label and cost sheet are complete.

LAB NOTEBOOK

1. Record the shrinkage test and calculations.
2. Copy the care label and the assembly order.
3. Paste before-and-after photos and the cost sheet.

KEY FORMULAS

$$\text{shrinkage \%} = \frac{\text{before} - \text{after}}{\text{before}} \times 100\%$$

$$\text{shrinkage \%} = \frac{\text{before} - \text{after}}{\text{before}} \times 100\%$$

$$\text{size after washing} = \text{size} \times (1 - \text{shrinkage})$$

$$\text{size after washing} = \text{size} \times (1 - \text{shrinkage})$$

$$\text{cut size (unshrunk fabric)} = \frac{\text{needed size}}{1 - \text{shrinkage}}$$

$$\text{cut size (unshrunk fabric)} = \frac{\text{needed size}}{1 - \text{shrinkage}}$$

From history. George de Mestral, a Swiss engineer, got the idea for hook-and-loop fastening after studying the burrs that clung to his dog's coat on a walk in the 1940s; he patented it in the 1950s. It is now a common slipcover closure.

WORKED EXAMPLES

Example 1. You wash a 20-in square of slipcover cotton. It comes out 19.2 in lengthwise and 19.6 in crosswise. Find the shrinkage each way.

Show solution

1. Lengthwise: $\frac{20 - 19.2}{20} \times 100\% = 4\%$
2. Crosswise: $\frac{20 - 19.6}{20} \times 100\% = 2\%$

Answer: 4% lengthwise and 2% crosswise.

Example 2. If that fabric were not preshrunk, how much would a 85-in band (cut lengthwise) shrink in the first wash?

Show solution

1. New length: $85 \times (1 - 0.04) = 81.6$ in
2. Loss: 3.4 in

Answer: About 3 3/8 in shorter: the cover would no longer go around the ottoman.

Example 3. A dry-clean-only fabric cannot be washed. If its shrinkage under steam is 3%, what length do you cut a band that must finish 85 in after the first cleaning?

Show solution

1. Cut: $85 \div (1 - 0.03) \approx 87.6$ in

Answer: Cut about 87 5/8 in, or better, preshrink with steam before cutting.

Example 4. Final cost sheet: fabric 2 1/8 yd at \$18, welting fabric 1/2 yd at \$18, cord \$4, hook-and-loop tape \$3, thread \$2; 14 hours of work. Find the materials cost and cost per year if the cover lasts 6 years.

Show solution

1. Materials: $2.625 \times 18 + 4 + 3 + 2 = \56.25
2. Per year: $\$56.25 \div 6 \approx \9.38

Answer: About \$56 in materials, about \$9.40 a year, plus 14 hours of skill.

PRACTICE

1. Easy What does Mark 2:21 warn against?

Show answer

Sewing new, unshrunk cloth onto an old garment, because it shrinks and tears the old.

2. Easy What is preshrinking?

Show answer

Washing and drying fabric before cutting, the way the finished item will be cleaned.

3. Easy A 10-in square shrinks to 9.7 in. Shrinkage?

Show answer

3%.

4. Medium A 60-in skirt cut from fabric that shrinks 5% lengthwise. Length after washing?

Show answer

57 in

5. Medium Where should an ottoman slipcover's closure go, and why?

Show answer

In a back corner seam, where it is hidden and where the cover must open to slide on.

6. Medium Why finish all seams on a slipcover?

Show answer

It will be washed repeatedly, and raw edges would fray and unravel the seams.

7. Medium Which shrinks more when washed: cotton or polyester? Why?

Show answer

Cotton; its fibers swell and the yarns relax when wet, while polyester absorbs little water.

8. Hard Cut length needed so a seat piece finishes 24 in after 4% shrinkage?

Show answer

$24 \div 0.96 = 25$ in

9. Hard Materials \$62, 5-year life; a store slipcover \$95 lasting 3 years. Cost per year of each?

Show answer

\$12.40 vs. \$31.67

10. Hard Write a care label for a cotton slipcover with nylon zipper and welting of preshrunk cotton cord.

Show answer

e.g., Machine wash cold, gentle; zip closed before washing; tumble dry low and remove while slightly damp; put back on the furniture while damp to ease the fit; warm iron if needed.

11. Challenge Your finished cover is ½ in tight around the ottoman. Give three fixes, in order from easiest to hardest.

Show answer

Put it on slightly damp to ease it; let out the back-corner join seam (if allowance remains); add a narrow insert or replace the band with a longer one.

COMMON MISTAKES

- Cutting before preshrinking.
- Putting the closure where it shows from the front.
- Leaving raw seams that unravel in the first wash.

Make it a game • Shrink Predictor. Each player predicts the shrinkage percent of three fabric swatches (cotton, linen, polyester) before they are washed and dried. After washing, measure. The player whose three predictions are closest in total wins; a bonus point goes to whoever correctly predicted which direction (length or width) shrank more.

Scripture. “No man also seweth a piece of new cloth on an old garment: else the new piece that filled it up taketh away from the old, and the rent is made worse.” (Mark 2:21, KJV)

Jesus used a sewing fact everyone knew: unshrunk cloth pulls away when it is washed. Preshrink before you cut, and the cover will keep fitting.

UNIT 6 TEST

Calculators are allowed. Show your work for every calculation: write the formula, substitute with units, and give the answer with its unit. Answer concept questions in complete sentences. The test is worth 100 points.

1. **6 pts**
Why did households of the 1700s and 1800s use case covers?
2. **6 pts**
Explain why flat cloth covers a box but not a ball without darts or seams.
3. **7 pts**
A seat 20×18 in has its two front corners rounded on a $2\frac{1}{2}$ -in radius (back corners square). Find the length of the front and both sides.
4. **6 pts**
An ottoman top is 22×20 in and its sides 7 in tall. Cut sizes of the top and a one-piece band ($\frac{1}{2}$ -in seams, one join)?
5. **6 pts**
What is railroading, and name a fabric you cannot railroad.
6. **7 pts**
Rows of 21, 16 and 30 in on 54-in fabric. Total yards with a 10% waste factor?
7. **6 pts**
Why are slipcovers pin-fitted wrong side out?
8. **5 pts**
What are notches for?
9. **6 pts**
What is a tuck-in, and how much is usual?
10. **6 pts**
Box pleats laid edge to edge on a 26-in side. How much fabric? How many pleats near 4 in?
11. **7 pts**
A tailored skirt for a 22×20 in ottoman with four kick pleats of 3-in folds and 2 in for joins. Skirt length?
12. **6 pts**
A 20-in square shrinks to 19.4×19.7 in. Shrinkage each way?
13. **6 pts**
A band must finish 84 in on fabric that will shrink 4%. Cut length if not preshrunk?
14. **5 pts**
What does Mark 2:21 teach about unshrunk cloth?
15. **6 pts**
Slipcover materials \$58 vs. a new ottoman \$170. Savings and percent?
16. **4 pts**
Name two slipcover closures and where you would place one on an ottoman.

17. **5 pts**

Short essay (5–8 sentences): A family's dog-scratched armchair is solid but ugly. Argue for or against slipcovering it, using cost, fabric choice, fit and care.

UNIT PROJECT: A FITTED SLIPCOVER

Complete a fitted, washable slipcover for a real footstool, ottoman or dining chair, with welting, a lined skirt and a hidden closure.

Submit the measured drawings, the muslin corner test, the piece list and cutting plans, the fitted pattern (photographed), the shrinkage test, the care label, the cost sheet with a comparison to replacement, and before-and-after photos.

LOOK FOR	WHAT IT MEANS
Fit	Seams on the furniture's edges, smooth curves, tuck-ins hold, skirt level and clears the floor.
Planning and math	Piece list, cutting plan, yardage, skirt and shrinkage calculations complete and correct.
Workmanship	Even welting, pleats on corners, finished seams, hidden closure.
Safety and care	T-pins and pins counted; care label written; cover survives a wash and still fits.
Records	Photos, pattern, cost sheet and reflection filed.

ANSWER KEY

1. To protect costly upholstery from daily wear and dirt; covers could be washed and removed for company.
2. Flat cloth can bend in one direction at a time (developable surfaces); a ball curves in two directions, leaving extra cloth that must be removed or eased.
3. Front 1515, sides $2 \times 15.5 = 31$, arcs $2.5\pi \approx 7.85$; total about 53.9 in.
4. Top 23×21 ; band 8×85 in.
5. Running long pieces along the bolt; a vertical stripe, a directional print or a napped fabric like velvet.
6. $67 \times 1.1 \approx 73.7$ in, about 2.05 yd (buy $2\frac{1}{8}$).
7. So the pinned seams can be stitched exactly as fitted and lie on the furniture's edges when turned.
8. Matching points on two pieces so long seams are sewn back together correctly.
9. Extra fabric tucked into the seat-back or seat-arm crease to hold the cover; about 3–6 in.
10. 78 in; 6 pleats of about 4.33 in (or 5 of 5.2 in).
11. $84 + 48 + 2 = 134$ in.
12. 3% and 1.5%.
13. $84 \div 0.96 = 87.5$ in.
14. New cloth shrinks when wet and pulls away from an old garment, making the tear worse; preshrink before sewing.
15. \$112; about 66%.
16. Zipper, hook-and-loop tape, ties or buttons; in a back corner seam.
17. Full credit for a reasoned argument citing cost comparison, a seat-rated washable preshrunk fabric, fitting method (pin-fit, welting, tuck-ins) and care/closure.

UPHOLSTERY I: SEATS AND STOOLS

This unit begins real upholstery with the simplest pieces: a drop-in dining seat and a small padded stool. You will follow the upholsterer's order of work, unchanged in principle since the eighteenth century: survey the frame, strip it safely, rebuild the base, pad it, and pull a cover straight and tight with neat corners and a dust cover beneath.

Safety is strict: safety glasses for every staple and tack, a dust mask for old padding, and the rule that old paint may contain lead, so it is wiped, never sanded. The history runs from Chippendale's Director of 1754 and the upholder's trade to the Encyclopédie's plates of upholsterers at work, Dundee's jute mills and colonial needlework seat covers. The math covers staple counts, cost comparisons, webbing plans and lever advantage, foam board feet and cover sizes.

PREREQUISITES

- Units 1 and 2: fabric duty ratings and foam density
- The staple-gun practice from Lesson 4.2
- Area, volume, percent and simple levers

MASTERY CHECKLIST

- ☐ I can name the upholstery layers and the tools, with their safety rules.
- ☐ I can strip a seat safely and record its layers.
- ☐ I can plan and install interwoven webbing at even tension.
- ☐ I can size and fit foam and batting with a crown.
- ☐ I can center, pull and staple a cover with neat corners and finish it with a dust cover.

OPTIONAL BOOKS AND TOOLS FOR THIS UNIT

- **A webbing stretcher and jute webbing:** An inexpensive wooden or metal stretcher and a roll of 3½-in jute webbing from an upholstery supplier.
- **Safety glasses for everyone in the room, a dust mask and work gloves:** Required, not optional, for stripping and stapling.
- **An electric carving knife kept for foam:** Cuts foam cleanly; used only with a parent present and labeled for foam, never food.

Not required. Every project in this unit works with ordinary fabric-store supplies. School Launch has no ties to these authors, publishers or companies.

LESSONS IN THIS UNIT

7.1 The Upholder's Trade: Chippendale's Director	3 sessions of 50 minutes
7.2 The Archaeology of a Chair: Stripping Safely	3 sessions of 50–90 minutes
7.3 Webbing: The Foundation	3 sessions of 50–90 minutes
7.4 Foam, Batting and the Crown	3 sessions of 50–90 minutes
7.5 The Cover and the Corners	3 sessions of 50–90 minutes

7.1 THE UPHOLDER'S TRADE: CHIPPENDALE'S DIRECTOR

OBJECTIVES

- Describe the eighteenth-century upholsterer's trade and Thomas Chippendale's Director of 1754.
- Name the parts of an upholstered seat (frame, webbing or base, springs, padding, cover, dust cover) and the tools that build it, with their safety rules.
- Survey a drop-in dining seat and a stool, and decide by cost and condition whether to re-upholster.

Warm-up. Turn a dining chair or stool upside down (with permission) and look underneath. What do you see: staples, tacks, black cloth, webbing, plywood? Count the fasteners along one side. Write a guess at how many layers are inside the seat.

WATCH

Essential Tools for Upholstery

[Artisan Upholstery Studio](#) · 5:30

<https://www.youtube.com/watch?v=RjFOtfTafbY>

WHEN TO WATCH

After “The tools.” Make a checklist of every tool she shows; tick off the ones in your kit and note any you will borrow.

BACKUP VIDEO

BBC | Thomas Chippendale | World's finest furniture designer | Chippendale School

[Chippendale School of Furniture](#) · 3:27

<https://www.youtube.com/watch?v=udGdSPcLarw>

A short clip on Chippendale's life, the Director and the great houses he furnished.

KEY TERMS

upholder (upholsterer)

The tradesman who padded and covered seating and supplied the textiles of a house: curtains, bed hangings and wall coverings.

frame

The wooden structure of a chair; the upholsterer builds on it.

dust cover (cambric)

The thin black fabric stapled under a seat to hide the work and keep dust in.

drop-in (slip) seat

A padded seat on its own frame or board that lifts out of the chair frame and is held by screws or by fit.

tack lifter (staple remover)

A forked or chisel-like tool for prying out tacks and staples.

upholstery layers

From the bottom: base (webbing or board), springs if any, padding, batting, cover, dust cover.

CORE IDEAS

The story. In 1754 a London cabinet-maker named Thomas Chippendale published *The Gentleman and Cabinet-Maker's Director*, a large book of engraved furniture designs: chairs, sofas, beds, cabinets and more. It was the first pattern book of its kind devoted entirely to furniture, and makers in Britain and America copied its designs for decades; to this day an elegant eighteenth-century chair is called “Chippendale.” His workshop in St Martin's Lane did more than build frames. Like other leading firms, it acted as an **upholder**: it padded and covered chairs and sofas, made curtains and bed hangings, and could furnish a whole house.

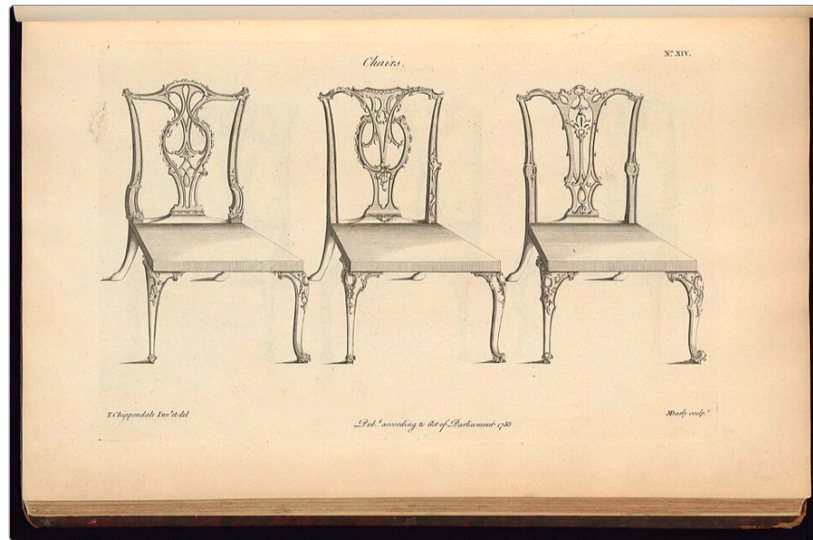
How they figured it out. In the eighteenth century the upholsterer, not the cabinet-maker, often earned the most from a room, because textiles were the most costly part of furnishing. A chair frame might be beautifully carved, but it was the upholsterer's webbing, stuffing, stitched edges and costly cover that made it comfortable and fine. The trade developed a fixed order of work that you will follow for two units: **frame**, **base** (webbing or a board), **springs** (in some seats), **padding**, **cover**, and a **dust cover** underneath.

The tools. Today's basic kit: a manual or electric staple gun with $\frac{3}{8}$ -in staples, a tack lifter or staple remover, needle-nose pliers, an upholstery hammer (one face magnetic for tacks), a webbing stretcher, sharp shears, a curved needle and strong thread, a measuring tape, chalk, and **safety glasses**, which are required whenever you staple or pull staples and tacks, because they snap and fly. A dust mask is worn when stripping old padding. A parent watches you use each tool safely before you work alone.

The math. Upholstery decisions start with numbers: the seat's measurements, the materials list, and a cost comparison. Re-covering a solid chair costs a fraction of a new one and keeps a good frame in use; a broken or wobbly frame must be repaired first or the work is wasted.

Let's sew. This lab sets up your upholstery workspace and tool kit, gets the parent sign-off on the staple gun and tack lifter, and surveys the two pieces you will re-upholster this unit: a drop-in dining seat and a small padded stool.

PICTURE STUDY



Chairs, Plate XIV, from The Gentleman and Cabinet-Maker's Director, Thomas Chippendale (designer); engraved by Matthias Darly, 1755 (second edition) · Engraving · Cooper Hewitt, Smithsonian Design Museum, New York
Image: [Wikimedia Commons](#), public domain

This plate from Chippendale's *Director* shows three chair designs side by side so a customer or a craftsman could choose. The carver would make the back and legs; the upholsterer would make the padded seat that the engraver shaded so carefully.

Look closely

- Compare the three chair backs. What is the same, and what changes?
- Look at the seats. How has the engraver shown that they are padded?
- Find the front edge of each seat. Is it straight or shaped?
- Look at the legs and feet. Which part of each chair would an upholsterer never touch?

Talk about it

1. Why would a furniture maker publish his designs where any rival could copy them?
2. If you were the upholsterer for one of these chairs, what would you need to ask the customer?
3. Which of these designs would you choose for a family dining room, and why?

Safety first. Safety glasses on for every staple, tack and staple removal, for you and anyone in the room; a parent has watched you use the staple gun and tack lifter safely before you work alone, and is in the house while you work. Wear a dust mask when stripping old padding (Lesson 7.2), and keep the staple gun pointed at the work, never at anyone.

The Upholstery Bench: Tools, Sign-Off and Survey

Set up an upholstery workspace and tool kit, complete a parent-watched staple-gun and tack-lifter sign-off, and survey the drop-in seat and stool you will re-upholster, with a cost comparison.

You will need

- Staple gun and $\frac{3}{8}$ -in staples, tack lifter or staple remover, pliers, magnetic dish
- Safety glasses (one pair per person in the room), dust mask, work gloves
- Scrap board and scrap fabric for the sign-off
- A drop-in dining seat and a small padded stool
- Tape measure, camera, notebook

STAPLE PRACTICE BOARD

Finished size: One 12 × 12 in practice board · About 30 minutes

Fabric and notions

- A 12 × 12 in scrap of plywood
- A 16 × 16 in scrap of fabric
- About 40 staples

How to make it

1. Put on safety glasses. Load the staple gun with it pointed down at the bench, safety catch on.
2. Center the fabric on the board and staple once at the middle of each side, pulling gently (center–opposite–center–opposite).
3. Work out from the centers toward the corners, staples $\frac{1}{2}$ – $\frac{3}{4}$ in apart, parallel to the edge.
4. Fold one corner as a single pleat and staple it.
5. Remove five staples with the tack lifter, prying away from your body with your other hand behind the tool.
6. Collect every removed staple in the magnetic dish.

Fabric check: Any medium-weight woven scrap works for practice. Avoid vinyl and leather for a first practice; they show every staple mark.

Steps

1. Set up the bench: a sturdy table at a comfortable height, good light, a magnet dish, a trash bag for old materials.
2. Sign-off: with a parent watching, load the gun, staple the practice board and remove staples safely; record the date and the parent's initials.
3. Survey the seat and stool: measurements, condition of frame, number of layers you can see, fastener type, photos.
4. Write a materials list and a cost comparison with buying new.
5. Decide: repair, re-upholster or replace? Write the reasons.
6. Clean up: staples into the dish, gun unloaded and stored, glasses put away.
7. Improve it: one thing to practice before Lesson 7.2.

Tips

- A cheap pair of safety glasses for every person in the room is part of the tool kit.
- Staple guns jam; unload before clearing a jam, every time.
- Photograph everything before you take it apart.

Check your work

- ☐ My staple-gun and tack-lifter sign-off is recorded.
- ☐ My survey has measurements, photos and condition notes.

- ☐ My cost comparison supports my decision.

LAB NOTEBOOK

1. Draw a cross-section of an upholstered seat with each layer labeled.
2. Record the survey and the cost comparison.
3. List your tool kit with a safety rule beside each tool.

KEY FORMULAS

$$\text{fasteners} \approx \frac{\text{perimeter}}{\text{spacing}}$$

$$\text{fasteners} \approx \text{spacing} \times \text{perimeter}$$

$$\text{cost per year} = \frac{\text{materials cost}}{\text{years of use}}$$

$$\text{cost per year} = \text{years of use} \times \text{materials cost}$$

$$\text{savings \%} = \frac{\text{replacement} - \text{re-cover cost}}{\text{replacement}} \times 100\%$$

$$\text{savings \%} = \frac{\text{replacement} - \text{re-cover cost}}{\text{replacement}} \times 100\%$$

From history. Chippendale's firm furnished great houses such as Harewood House and Nostell Priory in Yorkshire, supplying furniture, upholstery, curtains and wallpaper. Some of the original furniture is still in the rooms it was made for.

WORKED EXAMPLES

Example 1. A drop-in seat is 19×17 in. If staples are set about $\frac{3}{4}$ in apart around its underside, about how many staples hold the cover?

Show solution

1. Perimeter: $2(19 + 17) = 72$ in $2(19 + 17) = 72$ in.
2. Staples: $72 \div 0.75 = 96$ $72 \div 0.75 = 96$.

Answer: About 96 staples for the cover alone (plus more for the dust cover).

Example 2. Re-covering four dining seats needs $1\frac{1}{2}$ yd of fabric at \$24, foam and batting \$38, dust cover and staples \$10. New chairs cost \$120 each. Find the cost per chair and the savings percent.

Show solution

1. Materials: $1.5 \times 24 + 38 + 10 = \84 $1.5 \times 24 + 38 + 10 = \84 ; per chair $\$84 \div 4 = \21 $\$84 \div 4 = \21 .
2. Savings: $\frac{120 - 21}{120} \times 100\% \approx 82.5\%$ $\frac{120 - 21}{120} \times 100\% \approx 82.5\%$.

Answer: \$21 per chair, about 82% less than new.

Example 3. Design reasoning. A garage-sale stool has a loose leg and a torn vinyl top. Should you re-upholster it, and in what order?

Show solution

1. Frame first: tighten or re-glue the leg (a parent helps with clamps and glue); upholstery on a wobbly frame is wasted.
2. Then strip, re-pad and re-cover.
3. If the frame is cracked beyond repair, the stool is not worth the materials.

Answer: Repair the frame first, then upholster; never upholster a broken frame.

PRACTICE

1. **Easy** In what year was Chippendale's Director published?

Show answer

1754.

2. **Easy** Name the upholstery layers from bottom to top.

Show answer

Base (webbing or board), springs (if any), padding, batting, cover; dust cover underneath.

3. **Easy** When are safety glasses required in upholstery?

Show answer

Whenever stapling or pulling staples and tacks, and doing spring work.

4. **Medium** Why did eighteenth-century upholsterers often earn more from a room than cabinet-makers?

Show answer

Textiles were the most costly part of furnishing, and the upholsterer supplied and made them up.

5. **Medium** A stool top is 14 in square. Staples $\frac{5}{8}$ in apart. How many?

Show answer

$56 \div 0.625 \approx 90$

6. **Medium** What is a drop-in seat?

Show answer

A padded seat on its own frame or board that lifts out of the chair.

7. **Medium** Why repair the frame before upholstering?

Show answer

A loose or broken frame will move and ruin the new work; the upholstery depends on a sound frame.

8. **Hard** Six seats cost \$114 in materials; new chairs \$95 each. Savings percent per chair?

Show answer

Per chair \$19; $(95 - 19) \div 95 = 80\%$

9. **Hard** Re-covered seats cost \$21 each and last 8 years; cheap new chairs \$60 last 5. Cost per year of each?

Show answer

\$2.63 vs. \$12.

10. **Hard** What does a dust cover do?

Show answer

Hides the underside work, keeps stuffing and dust from falling out, and looks finished.

11. **Challenge** Chippendale's Director let makers far from London build his designs. Explain how a printed pattern book changed a craft, comparing it with a sewing pattern or a video tutorial.

Show answer

It spread designs and methods beyond one workshop, standardized styles, let distant makers copy and adapt them, and made the designer's name famous, just as printed patterns and tutorials let home sewists anywhere make the same item.

COMMON MISTAKES

- Stapling without safety glasses because it is “just one staple.”
- Clearing a jam with the gun loaded.
- Upholstering over a loose frame.

Make it a game · Layer Guess. Before stripping, each player draws the layers they think are inside the seat and stool, with a guess at each layer's material and thickness. In Lesson 7.2, check: one point for each layer correctly guessed in order, a bonus for the closest thickness guess.

Scripture. “Seest thou a man diligent in his business? he shall stand before kings; he shall not stand before mean men.” (Proverbs 22:29, KJV)

Chippendale was a craftsman who furnished the houses of the great because his work was diligent and excellent. Diligence in a small task, a dining seat, is where that begins.

7.2 THE ARCHAEOLOGY OF A CHAIR: STRIPPING SAFELY

OBJECTIVES

- Explain what conservators learn from the layers inside old upholstery.
- Strip a seat safely: lead-paint caution, dust control, glasses, gloves and fastener cleanup.
- Record the layers with photos and a layer chart, and save the old cover as a pattern.

Warm-up. Look at an old book, a wall or a piece of furniture that has been painted or covered more than once. Can you see layers at a chipped edge? List them in order, oldest first. That is what you will do with a chair seat.

WATCH

THE QUICKEST WAY TO REMOVE STAPLED ON FABRIC FROM DINING CHAIR SEAT (Manual remover vs oscillator)

[Fix It Furniture](#) · 13:38

<https://www.youtube.com/watch?v=PbbEKwMuosE>

WHEN TO WATCH

Before the lab. Watch how the staple remover is levered away from the body. Use the manual method; the power tool shown is for professionals.

Note: A furniture-repair shop compares hand and power staple removal. Wear the safety glasses this lesson requires even where the video does not show them.

KEY TERMS

stripping

Removing the old cover, padding and fasteners down to the frame or base.

layer chart

A record of every layer found, in order, with materials and condition.

horsehair, coir, cotton batting

Traditional stuffings: animal hair, coconut fiber and cotton wadding.

tack

A short, sharp nail with a flat head, used in upholstery before staples became common.

lead paint

Paint containing lead, common on furniture before the late 1970s; its dust is harmful, especially to children.

pattern from the old cover

The old cover, flattened, used as a guide for cutting the new one.

CORE IDEAS

The story. Look at the chairs in Vermeer's painting for this lesson: their seats and backs are covered in cloth or leather fixed with rows of brass-headed nails. Furniture conservators at museums sometimes find, under later covers, scraps of an original cover, the original stuffing, and the tack holes that show how a chair was first upholstered. Studying those layers, like an archaeologist reading a dig, lets them restore a chair accurately. Your dining seat may hold three or four generations of covers, one on top of another.

How they figured it out. Upholsterers learned to strip carefully rather than tear: every layer tells you how the seat was built, how tight the cover was pulled, where the corners were folded, and what padding was used. The old cover, flattened, is a ready-made pattern. And they learned that old furniture carries hidden hazards: dust, mold, pests, and old paint.

Safety first. Assume the paint or finish on old furniture may contain lead, which was common in paint until the late 1970s. **Never sand, scrape or heat old painted finishes;** wipe them clean with a damp cloth instead and wash your hands afterward. Strip outdoors or with a window open, wear a **dust mask** for old padding (it can hold decades of dust, mold or mouse nests), gloves for tacks, and **safety glasses** for every staple and tack you pull, because they snap and fly. Put fasteners in a magnet dish and old padding straight into a trash bag.

The method. Photograph every side first. Remove the dust cover, then the cover's fasteners, working with the tack lifter pushed away from your body and your other hand behind the tool. Lift each layer whole if you can, photograph it and note it on the layer chart. Keep the newest cover as a pattern. Stop at a sound base: good webbing or plywood can stay; torn webbing and crumbling foam go.

Let's sew. In the lab you will strip your drop-in seat (and the stool), record a layer chart, and decide what to keep.

PICTURE STUDY



Woman in Blue Reading a Letter, Johannes Vermeer, c. 1662–1663 · Oil on canvas · Rijksmuseum, Amsterdam

Image: [Wikimedia Commons](#), public domain

Vermeer painted the same chairs in several of his pictures: square Dutch chairs with blue cloth or leather seats and backs, fixed with rows of round brass nails. Every one of those nails is an upholsterer's fastener, set by hand.

Look closely

- Find the chairs. Count the brass nails you can see along one edge of a chair back.
- Look at how the cover meets the wooden frame. Is the edge folded under?
- Look at the seat. Is it flat or padded?
- Find the light on the nail heads. Why might an upholsterer use decorative nails instead of hiding the fasteners?

Talk about it

1. If you stripped one of these chairs, what layers might you find?
2. How is a row of decorative nails both a fastener and a design?
3. What would you do with the nail holes left in the frame when re-covering?

Safety first. Assume old paint contains lead: no sanding, scraping or heating of painted finishes; wipe clean only, and wash hands. Wear a dust mask and gloves while stripping old padding, and work outdoors or with a window open. Safety glasses on for every staple, tack and staple removal, for you and anyone in the room; a parent has watched you use the staple gun and tack lifter safely before you work alone, and is in the house while you work.

STUDIO LAB

Strip the Seat and Chart the Layers

Strip the drop-in seat and the stool safely, photograph and chart every layer, save the old cover as a pattern, and decide what to keep.

You will need

- Safety glasses, dust mask, work gloves
- Tack lifter or staple remover, pliers, magnet dish
- Trash bags, damp cloths
- Camera and notebook

STRIPPED SEAT BASE

Finished size: One drop-in seat and one stool, stripped to a sound base · About 1–2 hours

Fabric and notions

- The seat and stool
- A labeled bag for each saved layer (old cover, any reusable padding)
- A trash bag for discarded padding

How to make it

1. Glasses, mask and gloves on; work outdoors or with a window open.
2. Photograph every side.
3. Remove the dust cover's staples, prying away from your body; drop each one in the magnet dish.
4. Remove the cover's fasteners the same way; lift the cover off whole.
5. Photograph and record each layer of padding as you remove it; bag reusable layers and bin the rest.
6. Inspect the base: webbing tight and whole, or board solid? Mark anything to replace.
7. Pull any remaining staple legs with pliers so the frame is smooth.
8. Wipe the frame with a damp cloth (no sanding); wash your hands.

Fabric check: No new fabric is used. Flatten and press the old top cover (if clean) with a press cloth to use as a pattern; label its top edge and front.

Steps

1. Strip from the pattern card.
2. Write the layer chart: layer, material, condition, keep or replace.
3. Count the fasteners removed and time the job.
4. Measure the old cover flat and calculate how much it wrapped under.
5. Decide what new materials to buy; update the materials list.
6. Clean up: magnet-sweep the floor, bag the waste, wipe surfaces, wash hands and change clothes if dusty.

Tips

- A flat-head screwdriver works as a tack lifter if you have none; the same safety rules apply.
- Twist stubborn staples out with pliers rather than pulling straight up.
- Keep one swatch of every old cover for your notebook; it is the chair's history.

Check your work

- ☐ I wore glasses, mask and gloves and did not sand any finish.
- ☐ My layer chart and photos are complete.
- ☐ Every fastener is in the dish and the floor is magnet-swept.

LAB NOTEBOOK

1. Tape in swatches of each old cover with the layer chart.
2. Record fastener counts and time.
3. Write a short history of your chair based on its layers.

KEY FORMULAS

$$\begin{aligned}\text{fasteners removed} &= \text{fasteners per layer} \times \text{layers} \\ \text{fasteners removed} &= \text{fasteners per layer} \times \text{layers} \\ \text{removal rate} &= \frac{\text{fasteners}}{\text{minutes}} \\ \text{removal rate} &= \frac{\text{minutes}}{\text{fasteners}} \\ \text{seat area} &= L \times W \\ \text{seat area} &= L \times W\end{aligned}$$

From history. Upholsterers used hand-driven tacks for centuries; the pneumatic and electric staple guns used today spread through the trade in the twentieth century and made the work much faster.

WORKED EXAMPLES

Example 1. Your seat has three covers, each held by about 90 staples, plus a dust cover with 40. How many staples will you pull, and how long at 6 staples a minute?

Show solution

1. Staples: $3 \times 90 + 40 = 310$ $3 \times 90 + 40 = 310$.
2. Time: $310 \div 6 \approx 52 \text{ min}$ $310 \div 6 \approx 52 \text{ min}$.

Answer: About 310 staples, close to an hour of careful work.

Example 2. A layer chart lists: vinyl (1970s), floral cotton (1950s), cotton batting, horsehair, burlap, jute webbing. Which layers would a conservator keep, and which will you replace?

Show solution

1. Original structure: jute webbing, burlap and horsehair are likely the first upholstery; a conservator would study and keep them where sound.
2. For a family dining seat: keep sound webbing; save a horsehair pad if clean and springy; replace crumbling batting; discard the vinyl and the worn floral (photograph and keep a swatch).

Answer: Keep what is sound and original if possible; replace what is worn; record everything.

Example 3. The old cover, flattened, measures 23×21 in. The seat board is 19×17 in and $1\frac{1}{2}$ in thick with padding. How much did the old cover wrap under on each side?

Show solution

1. Extra width: $23 - 19 = 4$ in $23 - 19 = 4$ in, or 2 in per side; up and over $1\frac{1}{2}$ in of thickness leaves $\frac{1}{2}$ in 21 in under.
2. Extra depth: $21 - 17 = 4$ in $21 - 17 = 4$ in, the same.

Answer: Only about $\frac{1}{2}$ in wrapped under: too little to grip. Cut the new cover with at least $1\frac{1}{2}$ –2 in under each side.

PRACTICE

1. Easy Name three hazards in stripping old upholstery.

Show answer

Lead paint dust, old dust and mold, flying staples and tacks, sharp fasteners, pests.

2. Easy What do you do with old painted finishes?

Show answer

Never sand, scrape or heat them; wipe clean with a damp cloth and wash hands.

3. Easy Why keep the old cover?

Show answer

As a pattern and a record.

4. **Medium** Two covers of 80 staples and a dust cover of 36: total? At 5 per minute, time?

Show answer

196; about 39 min.

5. **Medium** Why work the tack lifter away from your body?

Show answer

If it slips, it moves away from you, not into you.

6. **Medium** Name traditional stuffings you might find.

Show answer

Horsehair, coir, moss, straw, cotton batting, wool.

7. **Medium** What is a layer chart?

Show answer

A record of every layer found, in order, with material, date guess and condition.

8. **Hard** The old cover is 22×20 in on an 18×16 in seat $1\frac{3}{4}$ in thick. How much wrapped under each side?

Show answer

$2 - 1.75 = \frac{1}{4}$ in $2 - 1.75 = 41$ in; far too little.

9. **Hard** Why might a conservator keep the original horsehair but a home upholsterer replace it?

Show answer

The conservator preserves historical evidence; the home upholsterer needs a clean, comfortable, practical seat.

10. **Hard** Why put old padding straight into a bag?

Show answer

To keep its dust, mold or pests from spreading through the house.

11. **Challenge** Write the safety plan for stripping a painted 1950s chair seat in a house with a toddler: location, equipment, cleanup and who watches the toddler.

Show answer

Strip outdoors or in a closed-off room with a window open, toddler kept away and watched by another adult; glasses, mask, gloves; no sanding of paint; fasteners in a magnet dish, padding bagged immediately; wet-wipe surfaces and wash hands and clothes after.

COMMON MISTAKES

- Sanding old paint “just a little.”
- Ripping layers off instead of lifting them, so the pattern and history are lost.
- Leaving broken staple legs in the frame.

Make it a game · Fastener Count. Before stripping, each player guesses the total number of staples and tacks in the seat. Every fastener removed goes into the magnet dish; at the end, count together. Closest guess wins; but any fastener found on the floor after the magnet sweep costs the whole team a point.

7.3 WEBBING: THE FOUNDATION

OBJECTIVES

- Explain how an interwoven grid of tight webbing carries a sitter's weight to the frame.
- Plan the number, spacing and length of webbing strips, and use a webbing stretcher with its lever advantage safely.
- Re-web a seat frame (or fit a plywood base) correctly.

Warm-up. Stretch a rubber band or a strip of cloth across the opening of a cup and press on the middle with a finger. Now stretch two strips crossing each other. Which holds your finger up better? Why?

WATCH

Install Jute Webbing DIY Upholstery Project Two Ways - Make a Jute Seat Base with Webbing Stretcher

[The Thoughtful Woodworker](#) · 12:39

<https://www.youtube.com/watch?v=CZZw1WnA1LA>

WHEN TO WATCH

After “The physics.” Watch both methods; note the turnover, the staple pattern and how the strips are woven before stretching.

BACKUP VIDEO

How to Fix / Re-web a Dining Room Chair Seat - Jute Webbing

[Beyond Fabric](#) · 7:58

<https://www.youtube.com/watch?v=27Rg4JgkByo>

A second demonstration of re-webbing a dining seat frame.

KEY TERMS

jute webbing

A strong woven strap, usually 3½ in wide, made of jute fiber, stretched across a seat frame.

interweaving

Weaving the crosswise strips over and under the lengthwise strips, so all share the load.

tension

The pull in a stretched strip; the right tension is drum-tight but not so tight that it strains the frame.

webbing stretcher

A paddle-shaped lever used to pull webbing tight before stapling or tacking.

turnover

The end of each strip folded back over itself before the final staples, so it cannot pull through.

plywood base

A modern alternative to webbing for drop-in seats: a ½-in board with air holes, padded with foam.

CORE IDEAS

The story. In the nineteenth century the city of Dundee in Scotland became the world center of jute manufacturing. Raw jute grown in Bengal was shipped to Dundee's mills and spun and woven into sacking, carpet backing and the strong, cheap webbing that upholsterers stretched across chair frames. Before jute, upholsterers used linen or wool webbing; the Encyclopédie plate in this lesson shows French upholsterers of the 1700s at work on a chair with its webbing already in place. The method has hardly changed: strips stretched tight across the frame, crossing and interwoven, form a flexible floor for everything above.

How they figured it out. A single strip sags when loaded, because one strip carries the whole weight. A grid of strips, each pulled tight and woven over and under the strips crossing it, shares the load among all of them and passes it to all four rails of the frame. Upholsterers learned to leave gaps no wider than a strip, to fold each end back on itself (the **turnover**) so it cannot tear out, and to stretch every strip to the same tension with a lever, the **webbing stretcher**.

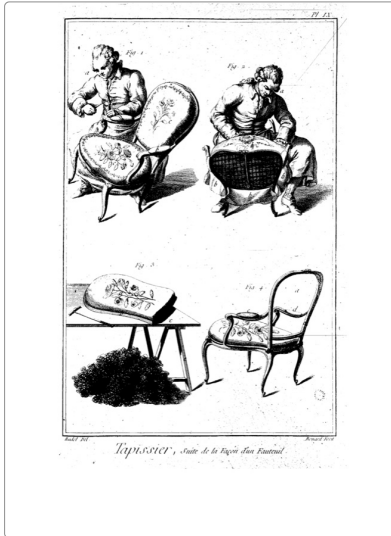
The physics. A stretched strip pressed in the middle pushes back up because its tension, pulled at an angle, has an upward component. The tighter the strip, the less it dips under the same load. The stretcher is a simple lever: pressing down on its long

handle multiplies your force at the short end that grips the webbing, so you can reach proper tension without straining. Too much tension can split an old rail, so you stop when the strip is drum-tight.

The math. Number of strips = enough that gaps are no wider than about the strip's width; each strip is cut to the span plus enough to grip in the stretcher and turn over. A drop-in seat frame might take 3 strips each way.

Let's sew. In the lab you will re-web your seat frame with interwoven jute webbing (or, if the seat is a solid board, check and prepare the plywood base), wearing safety glasses for every staple.

PICTURE STUDY



The Upholsterer: Continuing the Making of an Armchair (Plate IX, Tapissier), Engraving from Diderot and d'Alembert's Encyclopédie, Published 1770s · Engraving · Encyclopédie, Recueil de planches, Paris
Image: [Wikimedia Commons](#), public domain

The great French Encyclopédie of the eighteenth century included plates showing the crafts step by step. This one shows the upholsterer's work on an armchair in stages, from the webbing to the stuffed and covered seat.

Look closely

- Find the chair with its webbing showing. How many strips cross each way?
- Find the heap of stuffing on the floor. What material do you think it is?
- Look at the worker stitching the chair back. Why might stuffing need to be stitched in place?
- Compare the unfinished and finished chairs. Which layers have been added?

Talk about it

1. What has changed in upholstery since this plate was made, and what has stayed the same?
2. Why would an encyclopedia show a craft in stages?
3. Which stage in this plate is your lab today?

Safety first. Safety glasses on for every staple, tack and staple removal, for you and anyone in the room; a parent has watched you use the staple gun and tack lifter safely before you work alone, and is in the house while you work. Brace the frame on the bench and keep your free hand clear of the webbing stretcher's teeth and the staple gun's nose; the stretcher stores force and can slip.

STUDIO LAB

Re-Web the Seat

Plan and install interwoven jute webbing on your drop-in seat frame (or check and prepare a plywood base), with turnovers and even tension.

You will need

- Jute webbing, 3½ in wide (about 5 yd)
- Webbing stretcher
- Staple gun with ½-in staples for webbing, safety glasses
- Shears, chalk, ruler

INTERWOVEN JUTE WEBBING BASE

Finished size: One seat frame, about 18 × 16 in outside · About 1 hour

Fabric and notions

- 4 strips, 24 in, side to side
- 3 strips, 22 in, front to back
- About 70 staples, ½ in

How to make it

1. Mark the strip positions on the rails with chalk, evenly spaced, gaps no wider than 2 in.
2. Glasses on. Lay the first front-to-back strip with 1½ in of end turned over on the back rail; staple 5 staples in a W pattern through the fold.
3. Pull the strip across the front rail with the stretcher until drum-tight; staple 3 staples while holding the tension.
4. Release the stretcher, trim leaving 1½ in, fold the end back and staple 2 more.
5. Repeat for each front-to-back strip.
6. Install the side-to-side strips the same way, weaving each over and under the front-to-back strips before stretching.
7. Press the center: it should spring back evenly with no sag.

Fabric check: Use upholstery-grade jute webbing (or elastic rubber webbing for some modern seats, following its maker's directions). Do not substitute ribbon, belting or cotton tape; they stretch and fail.

Steps

1. Calculate strips, spacing and length; record them.
2. Practice one strip on a scrap frame or board with the parent watching.
3. Web the seat from the pattern card.
4. Test: press the center with a fist; note the dip and spring back compared with the old base.
5. Clean up: staples and trimmings collected, gun unloaded, stretcher stored teeth-down.
6. Improve it: one change in tension or spacing.

Tips

- Staple in a staggered W so the staples do not split the rail along the grain.
- Stretch each strip to the same feel; uneven tension makes a lumpy seat.
- If the seat was a plywood board, check it for cracks and drill a few ½-in holes for air if it has none.

Check your work

- ☐ My strips are evenly spaced with gaps no wider than 2 in.
- ☐ Every end is turned over and stapled in a W.
- ☐ The base is drum-tight and even.

LAB NOTEBOOK

1. Draw the webbing plan from above with strips, gaps and staple patterns.
2. Record your calculations and the press test.
3. Sketch the stretcher as a lever with effort arm, load arm and pivot labeled.

KEY FORMULAS

$$\text{strips} = \left\lceil \frac{\text{span} + \text{gap}}{\text{strip width} + \text{gap}} \right\rceil$$

$$\text{strips} = \lceil \text{strip width} + \text{gapspan} + \text{gap} \rceil$$

$$\begin{aligned} \text{cut length} &= \text{span across frame} + 6 \text{ in (stretcher grip and turnover)} \\ \text{cut length} &= \text{span across frame} + 6 \text{ in (stretcher grip and turnover)} \end{aligned}$$

$$\text{mechanical advantage} = \frac{\text{effort arm}}{\text{load arm}}$$

$$\text{mechanical advantage} = \text{load arm} \div \text{effort arm}$$

From history. Jute became the standard cheap webbing and sacking fiber in the 1800s because it is strong, plentiful and easy to spin; Dundee's mills processed it on a huge scale until the twentieth century.

WORKED EXAMPLES

Example 1. A seat frame's inside opening is 15 in wide (front to back). With 3½-in webbing and gaps no wider than 2 in, how many strips run side to side across it?

Show solution

1. Strips: $\lceil (15 + 2) \div (3.5 + 2) \rceil = \lceil 3.09 \rceil = 4 \lceil (15 + 2) \div (3.5 + 2) \rceil = \lceil 3.09 \rceil = 4$.
2. Check 3: $3 \times 3.5 = 10.5$ in, leaving 4.5 in for 2 gaps, 2¼ in each: just over 2 in. Four strips are safest; three acceptable for a small seat.

Answer: 3 or 4 strips; use 4 for a seat that gets heavy daily use.

Example 2. The frame is 18 in across from outside edge to outside edge, and you staple on the top of the rails. How long do you cut each strip, and how much webbing for 4 strips one way and 3 the other (the other span 16 in)?

Show solution

1. Cut length one way: $18 + 6 = 24$ in; the other: $16 + 6 = 22$ in.
2. Total: $4 \times 24 + 3 \times 22 = 162$ in = 4.5 yd

Answer: About 4½ yd of webbing (buy 5 yd).

Example 3. A webbing stretcher's handle is 10 in from the frame edge where it pivots, and the webbing grips 2 in from that edge. If you press with 15 lb, about how hard does it pull the webbing?

Show solution

1. Mechanical advantage: $10 \div 2 = 5$
2. Pull: $5 \times 15 = 75$ lb

Answer: About 75 lb of pull for 15 lb of push, which is why the tool is used and why it must be held firmly.

PRACTICE

1. Easy Why interweave the webbing?

Show answer

So all strips share the load and pass it to all four rails.

2. Easy What is a turnover?

Show answer

The end of a strip folded back over itself before the final staples so it cannot pull out.

3. **Easy** Where was the nineteenth-century center of jute manufacturing?

Show answer

Dundee, Scotland.

4. **Medium** Opening 16 in, 3½-in webbing, gaps ≤ 2 in. Strips?

Show answer

$$[18 \div 5.5] = 4[18 \div 5.5] = 4.$$

5. **Medium** Frame 20 in across: cut length per strip?

Show answer

26 in.

6. **Medium** Why stop at drum-tight instead of pulling as hard as possible?

Show answer

Too much tension can split old rails or tear the webbing.

7. **Medium** Stretcher handle 9 in, grip 1.5 in from pivot, push 12 lb. Pull?

Show answer

$$6 \times 12 = 72 \text{ lb} \quad 6 \times 12 = 72 \text{ lb}.$$

8. **Hard** Webbing for 4 strips of 26 in and 4 of 24 in, in yards?

Show answer

$$200 \div 36 \approx 5.6 \quad 200 \div 36 \approx 5.6 \text{ yd; buy 6.}$$

9. **Hard** Explain with forces why a tight strip sags less under the same weight.

Show answer

The strip's tension acts along it; when pressed down, the tension's upward component balances the load. Higher tension gives more upward force for the same dip, so it dips less.

10. **Hard** When would you choose a plywood base instead of webbing?

Show answer

For a drop-in seat originally built on a board, or where a firm, flat seat is wanted and comfort comes from foam.

11. **Challenge** A seat sags in the middle after years of use. Name three possible causes in the base and how a re-webbing fixes each.

Show answer

Stretched webbing (replace with new tight strips); too few strips or wide gaps (add strips); strips not interwoven or turnovers torn (interweave and fold ends back properly).

COMMON MISTAKES

- Leaving gaps wider than a strip.
- Skipping the turnover, so strips tear out.
- Stapling all staples in a straight line along the grain, which splits the rail.

Make it a game · Tension Test. Each player stretches one strip of webbing across a scrap frame with the stretcher (glasses on). A parent sets a 5-lb bag of flour in the center and measures the dip with a ruler. Smallest dip without splitting the frame wins; any strip without a turnover is disqualified.

7.4 FOAM, BATTING AND THE CROWN

OBJECTIVES

- Compare traditional stuffings with modern foam and batting, and choose foam by density and firmness for a seat.
- Size foam and batting for a drop-in seat and a stool, including a crowned top.
- Pad a seat neatly and safely, ready for its cover.

Warm-up. Sit on three different seats in the house for one minute each: a dining chair, a sofa, a stool. Which feels firm, which soft, which flat, which rounded on top? Press the front edge of each: does it feel hard or cushioned?

WATCH

HOW TO REUPHOLSTER DINING SEAT PADS IN FABRIC | UPHOLSTERY FOR BEGINNERS | FaceliftInteriors

FaceliftInteriors · 11:51

https://www.youtube.com/watch?v=wGA4_uClaEw

WHEN TO WATCH

After “The fabric science.” Focus on the padding stage: how the foam and batting are sized and fixed; you will cover the seat in Lesson 7.5.

KEY TERMS

crown

The gentle dome on top of a seat, made by extra padding at the center.

polyester batting (Dacron)

A soft layer wrapped over foam to round edges, fill the cover and reduce friction.

spray adhesive

Aerosol glue for holding foam layers; used outdoors or with strong ventilation.

high-density foam

Seat foam of about 2.5 lb/ft³ or more that keeps its shape for years (Lesson 2.5).

edge (front edge) comfort

Padding that keeps the seat front from pressing into the backs of the legs.

muslin undercover

An optional plain cotton layer stapled over the padding before the final cover, to shape it.

CORE IDEAS

The story. The Encyclopédie plate for this lesson shows the eighteenth-century upholsterer's tools and the stitched edge he built with horsehair and needle; a hammer, a webbing stretcher, needles, and the regulator used to push stuffing into place. For centuries seats were padded with curled horsehair, coconut coir, moss or wool, built up and stitched by hand into firm edges and a domed crown. In the twentieth century, foam rubber and then polyurethane foam replaced most of that labor: a block cut to size gives a uniform, durable seat in minutes.

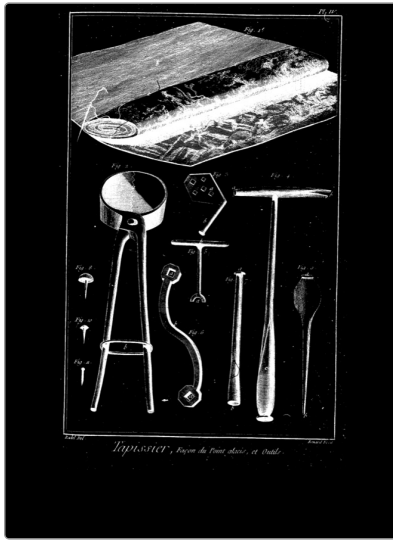
How they figured it out. Upholsterers learned what makes a seat comfortable: a firm base, a resilient middle that does not bottom out, a soft top layer, a slightly domed crown so the cover stays smooth, and a front edge that does not cut into the legs. Foam makes those layers easy to build: a firm high-density foam for the main pad, a thin softer layer or batting on top, and batting wrapped over the edges.

The fabric science. Foam is chosen by **density** (durability) and **firmness** (IFD) as in Lesson 2.5; a dining seat usually takes 1½–2 in of firm, high-density foam. Foam is cut slightly larger than the base (about ¼ in all around) so the cover compresses it and the edges stay full. A thinner layer or a pad of batting, a few inches smaller, under the main foam or on top at the center makes the **crown**. Batting wrapped over everything softens the edges and helps the cover slide smoothly as it is pulled. Foam is flammable: keep it away from heat and flame, and use spray adhesive only outdoors.

The math. Foam size = base size + ¼ in each side (for drop-in seats that must still fit the chair, check the clearance first). Volume and board feet set the cost. Batting is cut to cover the top and wrap the sides to the underside.

Let's sew. In the lab you will cut and fit foam and batting for the seat and the stool, building a gentle crown, ready for the cover in Lesson 7.5.

PICTURE STUDY



The Upholsterer: Stitched Edge and Tools (Plate IV, Tapissier), Engraving from Diderot and d'Alembert's *Encyclopédie*, Published 1770s · Engraving · *Encyclopédie*, Recueil de planches, Paris

Image: [Wikimedia Commons](#), public domain

This plate shows how an eighteenth-century upholsterer built a firm, stitched edge of stuffing, and the tools he used. Every one of these tools still has a cousin in a modern workroom.

Look closely

- Find the stitched edge at the top. Why stitch stuffing into a roll along the edge?
- Identify the webbing stretcher among the tools. How does its shape show it is a lever?
- Find the hammer. Why might one face be narrow?
- Which tool would you use to push stuffing into place?

Talk about it

1. How does foam replace the stitched edge in a modern seat?
2. Which of these tools is in your kit, and which has been replaced by a power tool?
3. Why might a restorer of antique chairs still use these tools today?

Safety first. Cut foam with an electric carving knife or long serrated knife only with a parent present, on a protected table, blade moving away from your body and your other hand behind the cut. Use spray adhesive only outdoors, away from any flame; foam itself burns readily, so keep it from heaters, candles and stoves. Safety glasses on for every staple, tack and staple removal, for you and anyone in the room; a parent has watched you use the staple gun and tack lifter safely before you work alone, and is in the house while you work.

STUDIO LAB

Pad the Seat and the Stool

Size, cut and fit foam and batting for the drop-in seat and the stool, building an even crown, and test the fit of the drop-in seat in its chair before covering.

You will need

- High-density upholstery foam (1½–2 in for the seat; 2–4 in for the stool)
- Polyester batting
- Electric carving knife or long serrated knife (parent present)
- Spray adhesive (outdoors) or a few staples
- Marker, long ruler, scissors

CROWNED SEAT PADDING

Finished size: One drop-in seat 18 × 16 in (adjust to your base) · About 1 hour

Fabric and notions

- Foam 18½ × 16½ × 2 in (or flush, if the seat fits tightly)
- Crown pad: 2 layers of batting 10 × 8 in
- Batting wrap 26 × 24 in

How to make it

1. Mark the foam size with a marker and long ruler.
2. With a parent present, cut the foam with the knife held straight up and down, in long smooth strokes.
3. Center the crown pad on the base.
4. Outdoors, lightly spray the base and the foam's underside and press the foam in place (or tack the foam's edges with a few staples through a strip of batting).
5. Check the drop-in seat in its chair frame with a scrap of the cover fabric over it; trim the foam if it binds.
6. Lay the batting wrap over the top and smooth it down the sides.
7. Staple the batting lightly to the underside at the centers of each side; trim the corners so they are not bulky.

Fabric check: Use upholstery-grade high-density foam, not packing foam or mattress toppers. Polyester batting is standard; cotton batting also works but is less springy. Choose a foam's firmness for the use (dining seats medium-firm).

Steps

1. Calculate foam and batting sizes and costs for the seat and the stool.
2. Pad the seat from the pattern card; pad the stool the same way with its own sizes.
3. Sit test: compare the new padding with the old (Lesson 7.2 notes).
4. Record the fit check in the chair frame.
5. Clean up: foam crumbs vacuumed, knife stored and unplugged, adhesive capped, staples collected.
6. Improve it: one change in padding.

Tips

- A long serrated bread knife used only for foam works if you have no electric knife.
- Cut foam with the blade vertical, or the edge will slope.
- Mark the front of the seat on the base so the crown and cover go on the right way.

Check your work

- ☐ My foam and batting are sized by calculation and cut straight.
- ☐ My crown is even and centered.
- ☐ The drop-in seat still fits its chair with fabric over it.

LAB NOTEBOOK

1. Draw a cross-section of the padded seat with each layer's thickness.
2. Record sizes, board feet and cost.
3. Compare old and new padding in a short table.

KEY FORMULAS

$$\text{foam size} = (L + \frac{1}{2}) \times (W + \frac{1}{2}) \times T$$

$$\text{foam size} = (L + 21) \times (W + 21) \times T$$

$$\text{batting size} = (L + 2T + 4) \times (W + 2T + 4)$$

$$\text{batting size} = (L + 2T + 4) \times (W + 2T + 4)$$

$$\text{board feet} = \frac{L \times W \times T}{144}$$

$$\text{board feet} = 144L \times W \times T$$

From history. Latex foam rubber cushions spread through the furniture industry in the mid-twentieth century, and polyurethane foam, cheaper and easier to cut, became the standard by the 1960s.

WORKED EXAMPLES

Example 1. A drop-in seat base is 18×16 in. You use 2-in high-density foam. Find the foam size, its board feet and cost at \$1.20 \$1.20 per board foot.

Show solution

1. Foam: $(18 + 0.5) \times (16 + 0.5) \times 2 = 18.5 \times 16.5 \times 2$ in $(18 + 0.5) \times (16 + 0.5) \times 2 = 18.5 \times 16.5 \times 2$ in.
2. Volume: $18.5 \times 16.5 \times 2 = 610.5$ in³ $18.5 \times 16.5 \times 2 = 610.5$ in³; $610.5 \div 144 \approx 4.24$ $610.5 \div 144 \approx 4.24$ board feet.
3. Cost: $4.24 \times \$1.20 \approx \5.09 $4.24 \times \$1.20 \approx \5.09 .

Answer: Foam $18\frac{1}{2} \times 16\frac{1}{2} \times 2$ in $18\frac{1}{2} \times 16\frac{1}{2} \times 2$ in, about \$5\$5.

Example 2. Batting must cover the top and wrap 2 in under each side. Size?

Show solution

1. Each way: base + 2 $\times$ thickness + 2 $\times$ 2 in: $18 + 4 + 4 = 26$ $18 + 4 + 4 = 26$, $16 + 4 + 4 = 24$ $16 + 4 + 4 = 24$.

Answer: Batting 26×24 in 26×24 in.

Example 3. You want a $\frac{1}{2}$ -in crown. You add a layer of batting 4 in smaller than the seat on each side, under the foam. If two layers of batting compress to about $\frac{1}{2}$ in, how big is the crown pad and how many layers?

Show solution

1. Crown pad: $(18 - 8) \times (16 - 8) = 10 \times 8$ in $(18 - 8) \times (16 - 8) = 10 \times 8$ in.
2. Layers: 2 (about $\frac{1}{2}$ in when compressed).

Answer: Two layers of batting 10×8 in 10×8 in centered under the foam.

PRACTICE

1. **Easy** Name three traditional stuffings.

Show answer

Horsehair, coir, moss, wool, straw, cotton.

2. **Easy** What is the crown of a seat?

Show answer

The gentle dome on top that keeps the cover smooth and the seat comfortable.

3. **Easy** Why wrap foam in batting?

Show answer

To soften edges, fill the cover and let it slide smoothly when pulled.

4. Medium Stool top 14×14 in, 3-in foam: foam size?

Show answer

$14.5 \times 14.5 \times 3$ in $14.5 \times 14.5 \times 3$ in.

5. Medium Board feet of that foam?

Show answer

$630.75 \div 144 \approx 4.38$ $630.75 \div 144 \approx 4.38$.

6. Medium Batting for a 14×14 in stool with 3-in foam, wrapping 2 in under?

Show answer

24×24 in 24×24 in.

7. Medium Why must spray adhesive be used outdoors?

Show answer

Its fumes are strong and flammable; ventilation keeps them from building up.

8. Hard A drop-in seat must fit a chair frame with only $\frac{1}{8}$ in clearance each side when covered. The cover fabric is about $\frac{1}{16}$ in thick, wrapping over the edge. Should the foam overhang the base by $\frac{1}{4}$ in? Explain.

Show answer

No; the covered seat would be too wide to drop in. Cut the foam flush with (or barely larger than) the base and check the fit with the fabric before stapling.

9. Hard Four seats, each 4.24 board feet, at \$1.20: foam cost?

Show answer

\$20.35

10. Hard Why does a firm, dense foam suit a dining seat better than soft foam?

Show answer

Dining seats take concentrated daily weight; dense, firm foam supports without bottoming out and lasts longer.

11. Challenge Design the padding for a piano bench used for an hour a day: layers, thicknesses, foam density and firmness, and edge treatment.

Show answer

Base board; 2-in high-density (≥ 2.5 lb/ft³) medium-firm foam; $\frac{1}{2}$ -in softer topper or batting crown; batting wrap with extra at the front edge so it does not press the legs; tight cover.

COMMON MISTAKES

- Cutting foam with a slanted blade.
- Making a drop-in seat too thick to fit back in the chair.
- Using spray adhesive indoors.

Make it a game · Board-Foot Bingo. A parent calls out foam sizes (for example $18 \times 16 \times 2$, $22 \times 22 \times 4$, $14 \times 14 \times 3$). Players compute board feet to one decimal. The first correct answer marks that square on a 3×3 card of board-foot values; first to three in a row wins.

7.5 THE COVER AND THE CORNERS

OBJECTIVES

- Center and cut a cover with enough to wrap and grip, keeping motifs and grain straight.
- Pull and staple a cover in the professional order and form neat pleated or folded corners.
- Finish the drop-in seat and the padded stool with dust covers, as the Unit 7 project.

Warm-up. Look at the corners of three upholstered pieces in the house or a store. Are they folded in one pleat, two pleats, or rounded with tiny gathers? Which looks neatest? Sketch the best one.

WATCH

How to recover a simple dining chair seat pad, strait edges domed top and pleated corners

Premier Upholstery - Upholstery help and advise · 13:55

<https://www.youtube.com/watch?v=kPzByZWKL1o>

WHEN TO WATCH

After “The craft.” Watch the corners twice; pause before each fold and predict it.

KEY TERMS

pulling

Drawing the cover tight over the padding, on grain, before stapling.

single-pleat corner

A corner finished with one neat fold; used on square seat corners.

cambric (dust cover)

Thin black fabric stapled under the seat to finish it.

center-out stapling

Stapling at the centers of opposite sides first, then working toward the corners.

double-pleat corner

Two folds meeting at the corner; used on rounded or deep corners.

motif centering

Placing the cover so its main motif sits in the center of the seat.

CORE IDEAS

The story. In colonial America, many families covered their chair seats with needlework made at home. The seat cover in the picture study, made about 1770, is worked in wool in a bold diamond pattern of “flame” or Irish stitch on linen canvas, shaped to a chair seat and ready to be mounted by an upholsterer. A woman might spend weeks stitching a set of covers; the upholsterer had minutes to ruin them with a crooked pull. Mounting a cover straight, tight and centered was a skill customers paid for.

How they figured it out. Upholsterers learned a fixed order that keeps a cover straight: center the cover on the seat, then fix one staple (or tack) at the center of the back, pull and fix one at the center of the front, then the centers of the sides, so the grain lines cross the seat at right angles. Then they worked from the centers toward the corners on opposite sides in turn, pulling evenly, and finished the corners last, where the extra cloth gathers.

The craft. Cut the cover with 2–3 in of wrap beyond the padding on every side so you have something to pull. Keep the grain straight: a pattern or stripe tells on you instantly. At each corner, pull the point of the fabric diagonally to the underside and staple it, trim the excess, then fold the remaining fullness into a single neat pleat (square corners) or two pleats meeting at the corner (rounded corners), and staple. Finish with a dust cover of cambric, edges turned under.

The math. Cover size = seat size + 2 × padded thickness + 2 × wrap. Staple count = perimeter ÷ spacing. The project's cost sheet compares the re-upholstered pieces with new ones.

Let's sew. The lab completes both pieces: the drop-in seat and the padded stool, covered, cornered and finished underneath, with a cost sheet and before-and-after photos.

PICTURE STUDY



Seat cover, Unknown American needleworker, c. 1770 · Wool embroidery (Irish or flame stitch) on linen canvas · The Metropolitan Museum of Art, New York
Image: [Wikimedia Commons](#), public domain

This colonial seat cover was stitched by hand, probably at home, in a pattern of bright diamonds. Its shape, wider at the front, follows the seat of a chair of the time. The plain canvas margin was left for the upholsterer to pull and fasten underneath.

Look closely

- Look at the shape. Which edge is the front of the seat?
- Find the unworked margin. Why leave it plain?
- Look at the diamonds. Would they show if the cover were pulled crooked?
- Find the colors. How many can you count?

Talk about it

1. How many hours of stitching might a set of six of these covers take?
2. Why would an upholsterer be especially careful mounting a cover like this?
3. What would you stitch, print or choose for your own seat cover?

Safety first. Safety glasses on for every staple, tack and staple removal, for you and anyone in the room; a parent has watched you use the staple gun and tack lifter safely before you work alone, and is in the house while you work. Keep your pulling hand behind the staple gun's nose and your fingers out of the line of the staple. Magnet-sweep the floor before anyone walks there barefoot.

STUDIO LAB

Cover the Seat and the Stool

Cut, center, pull and staple the covers on the drop-in seat and the stool, form neat corners, add dust covers, and complete the cost sheet and photos for the Unit 7 project.

You will need

- Seat-rated decorator fabric (Lesson 1.3)
- Cambric or black lining for dust covers
- Staple gun, $\frac{3}{8}$ -in staples, tack lifter, safety glasses
- Chalk, ruler, shears

RE-COVERED DROP-IN SEAT

Finished size: One drop-in seat, 18 × 16 in, 2 in padded · About 1–2 hours

Fabric and notions

- Cover, 27 × 25 in, motif centered
- Dust cover, 17 × 15 in
- About 110 staples

How to make it

1. Mark the center of each side on the seat's underside and on the cover's edges.
2. Lay the cover face down, the padded seat face down on it, centers matched.
3. Glasses on. Pull the back edge over and staple once at its center; pull the front and staple at its center; then the two sides.
4. Turn the seat over and check the grain and motif; adjust if needed.
5. Work from each center toward the corners, staples $\frac{3}{4}$ in apart, alternating opposite sides and pulling evenly.
6. At each corner, pull the point diagonally under and staple; trim the excess; fold the remaining fullness into a neat pleat and staple.
7. Trim excess fabric $\frac{1}{2}$ in beyond the staples.
8. Turn under the dust cover's edges and staple it to the underside, covering the raw edges.
9. Drop the seat into the chair and screw it in place (a parent helps).

Fabric check: Use a decorator fabric rated for seating (at least 15,000 double rubs for daily dining chairs, Lesson 1.3); a medium weight with a little give pulls best. Stripes and plaids need careful centering. Avoid very stretchy fabric, which bags.

Steps

1. Calculate cover sizes for the seat and the stool, the layout and the yardage.
2. Practice one corner on the staple practice board from Lesson 7.1.
3. Cover the seat from the pattern card, then the stool the same way.
4. Inspect: grain straight, motif centered, corners neat, no staples showing, fits the chair.
5. Complete the cost sheet and before-and-after photos.
6. Clean up: magnet sweep, gun unloaded, trimmings binned.
7. Present both pieces with the layer chart from Lesson 7.2.

Tips

- Staple the centers lightly first (staple only partly in, or use a few) so they are easy to adjust.
- Pull with the same force on opposite sides.
- Mark the cover's grain line with chalk on the back before you start.

Check your work

- ☐ The cover's grain is straight and its motif centered.
- ☐ Corners are neat and matching on all four sides.
- ☐ Dust covers are clean and the seat fits its chair.

LAB NOTEBOOK

1. Draw the stapling order with numbers on a seat outline.
2. Draw your corner fold in three steps.
3. Paste the cost sheet and before-and-after photos.

KEY FORMULAS

$$\text{cover} = (L + 2T + 2w) \times (W + 2T + 2w)$$

$$\text{staples} \approx \frac{\text{perimeter}}{\text{spacing}}$$

$$\text{staples} \approx \text{spacing} \times \text{perimeter}$$

$$\text{dust cover} = (L - 1) \times (W - 1) \text{ (edges turned under)}$$

$$\text{dust cover} = (L - 1) \times (W - 1) \text{ (edges turned under)}$$

From history. Irish stitch, also called flame stitch or bargello, was a favorite for colonial seat covers because its long upright stitches covered canvas quickly and wore well.

WORKED EXAMPLES

Example 1. The padded seat is 18×16 in with padding 2 in thick. With $2\frac{1}{2}$ in of wrap on each side, what size is the cover?

Show solution

- Length: $18 + 2(2) + 2(2.5) = 27$ in $18 + 2(2) + 2(2.5) = 27$ in.
- Width: $16 + 2(2) + 2(2.5) = 25$ in $16 + 2(2) + 2(2.5) = 25$ in.

Answer: Cover 27×25 in 27×25 in.

Example 2. How many such covers fit across 54-in fabric, and how much fabric for 4 seats with the motif centered (repeat $13\frac{1}{2}$ in, one motif per repeat across)?

Show solution

- Across: $\lceil 54 \div 25 \rceil = 2 \lceil 54 \div 25 \rceil = 2$ covers per row.
- Rows: 2 rows of 27 in for 4 covers, but each must start on a motif, so round 27 in up to 2 repeats: 27 in 27 in (exactly $2 \times 13\frac{1}{2}$).
- Length: $2 \times 27 = 54$ in $2 \times 27 = 54$ in, plus one repeat for placement: 67.5 in ≈ 1.9 yd 67.5 in ≈ 1.9 yd.

Answer: About $1\frac{7}{8}$ yd (buy 2 yd).

Example 3. Final cost sheet for the drop-in seat and stool: cover fabric \$18\$18, foam \$12\$12, batting \$6\$6, webbing \$7\$7, cambric and staples \$6\$6. A new chair and stool would cost \$165\$165. Find total cost and savings percent.

Show solution

- Total: $18 + 12 + 6 + 7 + 6 = \$49$ $18 + 12 + 6 + 7 + 6 = \$49$.
- Savings: $\frac{165 - 49}{165} \times 100\% \approx 70\%$ $165 - 49 \times 100\% \approx 70\%$.

Answer: \$49\$49 in materials, about 70% less than new.

PRACTICE

- Easy** In what order do you staple a cover?

Show answer

Centers of opposite sides first (back, front, then sides), then from the centers toward the corners, corners last.

- Easy** Why keep the grain straight?

Show answer

Crooked grain shows immediately, especially in stripes and patterns, and the cover pulls unevenly.

- Easy** What is cambric for?

Show answer

A dust cover under the seat to finish it and keep dust in.

4. **Medium** Seat 20×18 in, padding $1\frac{1}{2}$ in, wrap 2 in. Cover size?

Show answer

27×25 in 27×25 in.

5. **Medium** Stool top 14×14 in, padding 3 in, wrap $2\frac{1}{2}$ in. Cover?

Show answer

25×25 in 25×25 in.

6. **Medium** Staples at $\frac{3}{4}$ -in spacing around a 20×18 in seat underside?

Show answer

$76 \div 0.75 \approx 101$ $76 \div 0.75 \approx 101$.

7. **Medium** When do you use a double-pleat corner?

Show answer

On rounded or deep corners, where one pleat would leave too much bulk.

8. **Hard** Six covers 27×25 in from 54-in fabric with no motif: rows and yards (plus 4 in)?

Show answer

2 per row, 3 rows: $81 + 4 = 85$ in $\approx 2.481 + 4 = 85$ in ≈ 2.4 yd.

9. **Hard** Your stripe runs $\frac{3}{8}$ in off from front to back across the seat. Which step went wrong and how do you fix it?

Show answer

The centers were not aligned on grain before stapling; remove the staples on one side, re-align the stripe to the center marks and re-staple from the center out.

10. **Hard** Materials \$52\$52 vs. new pieces \$140\$140. Savings percent?

Show answer

$88 \div 140 \approx 63\%$ $88 \div 140 \approx 63\%$.

11. **Challenge** The 1770 needlework seat cover was made to the seat's shape. How would mounting a shaped needlework cover differ from mounting a cut rectangle of yardage?

Show answer

The needlework has a fixed design area and border that must line up with the seat's edges exactly, little spare to pull, and stitches that must not be distorted; it is centered and eased carefully, with the canvas margin (not the design) stapled underneath.

COMMON MISTAKES

- Stapling one whole side before the opposite side, which drags the grain.
- Cutting the cover too small to grip.
- Forgetting to check the drop-in seat's fit before stapling.

Make it a game • Corner Contest. Each player folds and staples one corner on the practice board (glasses on). A parent judges blind: smooth (2), even with the other corners (2), no fabric showing past the staples (1), no staple showing on top (1). Highest score wins; an unsafe hand position scores zero.

UNIT 7 TEST

Calculators are allowed. Show your work for every calculation: write the formula, substitute with units, and give the answer with its unit. Answer concept questions in complete sentences. The test is worth 100 points.

1. **6 pts**
What was Chippendale's Director, and when was it published?
2. **6 pts**
Name the upholstery layers in order from the bottom.
3. **7 pts**
State the safety rules for stripping old upholstery, including old paint.
4. **6 pts**
A seat 20×17 in: staples at $\frac{3}{4}$ -in spacing around it?
5. **6 pts**
Re-covering 6 seats costs \$126; new chairs \$110 each. Per-chair cost and savings percent?
6. **6 pts**
The old cover is 22×20 in on a seat 18×16 in with $1\frac{1}{2}$ -in padding. How much wrapped under each side?
7. **6 pts**
Why interweave webbing, and why turn over the ends?
8. **6 pts**
Opening 17 in, $3\frac{1}{2}$ -in webbing, gaps no more than 2 in. Number of strips?
9. **6 pts**
Webbing stretcher: handle 12 in, grip 2 in from the pivot, push 10 lb. Pull?
10. **6 pts**
Foam for an 18×17 in base, 2 in thick, $\frac{1}{4}$ in oversize each side. Size and board feet?
11. **5 pts**
Why is foam cut slightly larger than the base, and when should it not be?
12. **6 pts**
Seat 18×16 in, padding 2 in, wrap $2\frac{1}{2}$ in. Cover size?
13. **6 pts**
Describe the professional stapling order.
14. **6 pts**
How do you form a single-pleat corner?
15. **5 pts**
What is cambric used for?
16. **6 pts**
Materials \$49 vs. new \$165. Savings percent?
17. **5 pts**
Short essay (5–8 sentences): Explain how the upholsterer's order of work, from frame to dust cover, makes a seat last, and which step you think matters most, with reasons from your own lab.

UNIT PROJECT: A RE-UPHOLSTERED DINING SEAT AND STOOL

Re-upholster a drop-in dining seat and a small padded stool from the frame up: stripped safely, re-webbed or re-based, padded with a crown, covered with a centered, tight cover and neat corners, and finished with dust covers.

Submit the survey, sign-off record, layer chart, webbing plan, padding and cover calculations, cost sheet and before-and-after photos, with a one-page reflection.

LOOK FOR	WHAT IT MEANS
Safety	Glasses, mask and gloves as required; no sanding of old finishes; fasteners all collected.
Foundation	Sound frame; webbing evenly spaced and tight, or a solid base; correct padding with an even crown.
Cover	Grain straight, motif centered, corners neat and matching, no staples visible, dust cover finished.
Math and records	Layer chart, webbing, foam and cover calculations, cost sheet and photos complete.
Fit and use	The seat fits its chair and the stool is in use.

ANSWER KEY

1. A book of engraved furniture designs, The Gentleman and Cabinet-Maker's Director, 1754.
2. Base (webbing or board), springs (if any), padding, batting, cover; dust cover underneath.
3. Glasses for every staple and tack; dust mask and gloves; work outdoors or ventilated; never sand, scrape or heat old painted finishes (assume lead), wipe clean only; fasteners in a magnet dish, padding bagged; wash hands.
4. $74 \div 0.75 \approx 99$; $74 \div 0.75 \approx 99$.
5. \$21; about 81%.
6. $\frac{1}{2}$ in 21 in.
7. So the strips share the load and pass it to all rails; turnovers keep strips from pulling through.
8. $[19 \div 5.5] = 4$; $[19 \div 5.5] = 4$.
9. 60 lb 60 lb.
10. $18.5 \times 17.5 \times 218.5 \times 17.5 \times 2$; $647.5 \div 144 \approx 4.5$; $647.5 \div 144 \approx 4.5$.
11. So the cover compresses it and the edges stay full; not when a drop-in seat would then be too wide for its chair.
12. 27×25 in 27×25 in.
13. Centers of back and front, then sides; then work from the centers toward the corners on opposite sides alternately; corners last.
14. Pull the corner point diagonally under and staple; trim the excess; fold the remaining fullness into one neat pleat and staple.
15. The dust cover under the seat.
16. About 70%.
17. Full credit for: the order (sound frame, base, padding, cover, dust cover) and why each depends on the one beneath; one step defended with evidence from the student's work.

UPHOLSTERY II: A CHAIR

This unit goes inside a traditional upholstered chair, layer by layer: the frame, the webbing, the coil springs tied eight ways, the burlap and edge roll, the padding, the pulled cover and the trim that hides the staples. You will tie a spring grid with your own hands and then design and build a piece of your own: a headboard, a bench or a small chair.

The history comes from the Encyclopédie's plates of eighteenth-century upholsterers, the coil spring of the 1820s and the hand-tied seats still prized today. The physics is Hooke's law and shared loads; the math is spring grids, twine, burlap and edge roll, double welt strips, and a full cost sheet that counts the cost before building, as Jesus taught in Luke 14.

PREREQUISITES

- Unit 7: stripping, webbing, padding and covering
- Staple-gun and tack-lifter sign-off with safety glasses
- Proportions, square roots and simple physics ($F = kx$)

MASTERY CHECKLIST

- ☐ I can name the layers of a traditional sprung seat and their jobs.
- ☐ I can use Hooke's law to explain how tied springs share a load.
- ☐ I can tie springs eight ways, level, with glasses on.
- ☐ I can build burlap, edge roll and padding, and pull a cover in the professional order.
- ☐ I can make and apply double welt or gimp and write a complete cost sheet.
- ☐ I can design and build an upholstered piece of my own.

OPTIONAL BOOKS AND TOOLS FOR THIS UNIT

- **Spring twine, a curved needle and upholstery coil springs:** From an upholstery supplier; salvaged springs from a discarded chair are fine for practice if they are not rusty or broken.
- **Edge roll and jute burlap:** Sold by the foot and by the yard at upholstery suppliers.
- **A low-temperature hot-glue gun:** For gimp and double welt; keep it on its stand and unplug it after use.

Not required. Every project in this unit works with ordinary fabric-store supplies. School Launch has no ties to these authors, publishers or companies.

LESSONS IN THIS UNIT

8.1	Inside a Traditional Chair	3 sessions of 50 minutes
8.2	Eight-Way Hand-Tied Springs	3 sessions of 50–90 minutes
8.3	Burlap, Edge Roll and Padding	3 sessions of 50–90 minutes
8.4	Pulling the Cover: Welting, Gimp and Counting the Cost	3 sessions of 50–90 minutes
8.5	Your Own Piece: A Headboard, Bench or Chair	3 sessions of 50–90 minutes

8.1 INSIDE A TRADITIONAL CHAIR

OBJECTIVES

- Name the layers of a traditionally sprung chair from frame to dust cover and the job of each.
- Explain coil springs with Hooke's law and how a group of springs shares a load.
- Survey and draw a cross-section of the piece you will upholster this unit, and plan its layers.

Warm-up. Sit on an old armchair or sofa and then on a firm dining chair. Bounce gently. Which has springs? Press down on the front edge of the sprung seat with your hand: is the edge firm or soft? Write what you think is inside.

WATCH

Anatomy of Quality Furniture

Mark's Upholstery · 10:37

<https://www.youtube.com/watch?v=rB1F8A-iwII>

WHEN TO WATCH

After “How they figured it out.” A sofa is built from the frame up in a working shop; name each layer as it goes on and add it to your cross-section drawing.

KEY TERMS

coil spring

A spiral steel spring set upright in a seat to give it bounce and support.

Hooke's law

For a spring, force = spring constant × compression: $F = kx$.

edge roll

A firm roll along the front edge of a seat that keeps its shape and protects the sitter's legs.

spring constant (k)

How stiff a spring is: the force needed to compress it one unit of length.

burlap (hessian)

Coarse jute cloth stretched over springs or webbing to hold the stuffing.

corner blocks

Wooden blocks glued and screwed inside a frame's corners to strengthen the joints.

CORE IDEAS

The story. Eighteenth-century seats like those in the Encyclopédie plates were firm: stuffed with horsehair over webbing, stitched into crisp edges. In 1828 a London maker named Samuel Pratt is credited with patenting coiled springs for seats, and by the middle of the nineteenth century the deep, bouncy, sprung armchair had become a sign of a comfortable Victorian home. A traditional sprung seat is built in many layers by hand, and a good one can last a century with a new cover every generation.

How they figured it out. Springs alone would wobble and poke. Upholsterers learned to set them on webbing, sew them to it, tie them to each other with twine so they stay upright and level (Lesson 8.2), cover them with burlap, build a firm edge roll at the front, stuff and pad over that, and finish with muslin, cotton or batting, and the cover. Every layer has a job, and if a lower one fails, the whole seat sags. That is why upholsterers always strip to a sound layer and rebuild from there.

The physics. A coil spring obeys **Hooke's law**: the force it pushes back with is proportional to how far it is compressed, $F = kx$. A seat of many springs shares a sitter's weight: if a 150-lb person sits on nine springs that share the load evenly, each carries about 17 lb. Ties make the springs act together, so the load spreads and the seat stays level instead of one spring collapsing under a knee.

The frame. A chair frame must be sound before any upholstery: hardwood rails, glued joints, corner blocks. Wobbly joints are re-glued and clamped first (a parent helps). Frame wood that will be covered is never refinished, and old show-wood finishes are wiped clean, not sanded, in case of lead paint.

Let's sew. This unit's project is a piece of your own: a small upholstered chair seat, a bench or a headboard. This lab surveys the piece, draws its cross-section with every layer, and writes the plan and materials list.

PICTURE STUDY



The Upholsterer's Shop and Its Work (Plate I, Tapisserie), Engraving from Diderot and d'Alembert's Encyclopédie, Published 1770s · Engraving · Encyclopédie, Recueil de planches, Paris

Image: [Wikimedia Commons](#), public domain

The first of the Encyclopédie's upholstery plates shows the shop itself: customers choosing, workers at the table, finished chairs and a bed on display, and fabric everywhere. The upholsterer was a seller of comfort and a maker of rooms.

Look closely

- Find the finished seating. How many pieces can you count?
- Look at the shelves. What is stored there?
- Find the customers. What do you think they are choosing?
- Find the bed. What parts of it would the upholsterer have made?

Talk about it

1. How is this shop like a modern furniture store, and how is it different?
2. Why would an upholsterer display finished pieces?
3. Which piece in this shop would you most like to rebuild?

Safety first. Safety glasses on for every staple, tack and staple removal and all spring work, for you and anyone in the room; a parent is in the house and has watched you use each tool safely. Assume old frame finishes may contain lead: wipe clean, never sand. Re-gluing and clamping a frame is done with a parent, with glue used in a ventilated room.

STUDIO LAB

The Piece Survey and the Layer Plan

Choose the unit's project piece (a small chair seat to re-spring, a bench, or a headboard), survey it, draw its cross-section with every layer, and write the plan and materials list.

You will need

- The chosen piece (or plywood and materials for a new bench or headboard)
- Tape measure, camera, graph paper
- A spring or two to test, a bathroom scale, a ruler

SPRING TEST RIG

Finished size: One measured spring constant · About 20 minutes

Fabric and notions

- One coil spring from an old chair (or a new upholstery coil)
- A flat board to set on top
- A bathroom scale
- A ruler held upright

How to make it

1. Glasses on. Stand the spring on the scale and lay the board on it.
2. Measure the spring's free height.
3. Press down on the board until the scale reads 10 lb; measure the height.
4. Repeat at 20 and 30 lb (have a helper read the ruler).
5. Compute the compression at each load and $k = F/x$ for each.

Fabric check: No fabric. Use an intact spring; discard any with broken or sharp ends.

Steps

1. Survey: measure the piece, photograph it, check the frame joints, list visible layers.
2. Run the spring test from the pattern card; record a data table and average k .
3. Draw the cross-section of your finished piece with every layer and thickness.
4. Write the materials list with quantities and estimated costs.
5. Frame repair, if any, with a parent: re-glue and clamp loose joints.
6. Clean up: springs stored safely, tools put away.
7. Improve it: what will you check first next lesson?

Tips

- A headboard needs no springs; it is a good choice if you have no sprung frame.
- Old springs from a discarded chair are fine for practice if they are not rusty or broken.
- Write the order of layers on the drawing; you will follow it all unit.

Check your work

- ☐ My cross-section shows every layer with thickness.
- ☐ My spring test has three loads and a k value.
- ☐ My frame is sound or repaired.

LAB NOTEBOOK

1. Paste the cross-section and the materials list.
2. Graph force against compression from your spring test; the slope is k .
3. Record the survey photos and notes.

KEY FORMULAS

$$F = kx$$

$$F = kx$$

$$\text{load per spring} = \frac{\text{total load}}{\text{number of springs}}$$

$$\text{load per spring} = \text{number of springs} \times \text{total load}$$

$$x = \frac{F}{k}$$

$$x = kF$$

From history. Victorian upholsterers built deeply sprung, buttoned chairs whose comfort came from many layers of springs and stuffing; the style was a direct result of the coil spring.

WORKED EXAMPLES

Example 1. A coil spring has a spring constant of 20 lb/in. How far does it compress under 30 lb?

Show solution

1. Hooke's law: $x = \frac{F}{k} = \frac{30 \text{ lb}}{20 \text{ lb/in}} = 1.5 \text{ in}$ $x = kF = 20 \text{ lb/in} 30 \text{ lb} = 1.5 \text{ in}.$

Answer: 1.5 in 1.5 in.

Example 2. A 150-lb person sits on a seat of 9 tied springs that share the load evenly, each with $k = 20 \text{ lb/in}$. How much does each spring compress? What if the ties fail and only 3 springs take the load?

Show solution

1. Shared: $150 \div 9 \approx 16.7 \text{ lb}$ $150 \div 9 \approx 16.7 \text{ lb}$; $x = 16.7 \div 20 \approx 0.83 \text{ in}$ $x = 16.7 \div 20 \approx 0.83 \text{ in}.$
2. Three springs: $150 \div 3 = 50 \text{ lb}$ $150 \div 3 = 50 \text{ lb}$; $x = 50 \div 20 = 2.5 \text{ in}$ $x = 50 \div 20 = 2.5 \text{ in}.$

Answer: About $\frac{5}{6}$ in each when shared; $2\frac{1}{2}$ in each if only three carry it, which is why untied seats sag and wear out.

Example 3. A seat frame is 20 in wide and 18 in deep inside. Springs about 4 in across at the top are set with about $1\frac{1}{2}$ in between them and from the rails. How many fit in each direction?

Show solution

1. Across: $\lfloor (20 - 1.5) \div (4 + 1.5) \rfloor = \lfloor 3.36 \rfloor = 3$ $\lfloor (20 - 1.5) \div (4 + 1.5) \rfloor = \lfloor 3.36 \rfloor = 3.$
2. Front to back: $\lfloor (18 - 1.5) \div 5.5 \rfloor = 3$ $\lfloor (18 - 1.5) \div 5.5 \rfloor = 3.$

Answer: A 3×3 grid: 9 springs.

PRACTICE

1. **Easy** List the layers of a traditional sprung seat from the bottom.

Show answer

Frame, webbing, springs (tied), burlap, edge roll and stuffing, padding (cotton or batting), muslin, cover, dust cover.

2. **Easy** State Hooke's law.

Show answer

$F = kx$ $F = kx$: a spring's force is proportional to its compression.

3. **Easy** Who is credited with patenting coiled springs for seats, and when?

Show answer

Samuel Pratt of London, 1828.

4. **Medium** $k = 25 \text{ lb/in}$, $F = 40 \text{ lb}$. Compression?

Show answer

1.6 in 1.6 in.

5. **Medium** 180 lb shared by 12 springs. Load each?

Show answer

15 lb 15 lb.

6. **Medium** Why must the frame be repaired before upholstering?

Show answer

Upholstery depends on the frame; loose joints move and tear the work.

7. **Medium** What does burlap over springs do?

Show answer

Holds the stuffing above the springs and gives a base to build on.

8. **Hard** A spring compresses 2 in under 36 lb. Find k , and its compression under 54 lb.

Show answer

$k = 18 \text{ lb/in} = 18 \text{ lb/in}; 3 \text{ in} 3 \text{ in.}$

9. **Hard** Frame inside 24×20 in, springs 4 in across with $1\frac{1}{2}$ -in spacing. Grid?

Show answer

$\lceil 22.5/5.5 \rceil = 4 \lfloor 22.5/5.5 \rfloor = 4$ by $\lceil 18.5/5.5 \rceil = 3 \lfloor 18.5/5.5 \rfloor = 3$: 12 springs.

10. **Hard** Why does tying springs together make a seat last longer?

Show answer

Ties spread each load across many springs, keep them upright and level, and stop single springs from overloading and bending.

11. **Challenge** Two identical springs ($k = 20 \text{ lb/in}$) stacked one on top of the other carry 30 lb. How far does the stack compress? Compare with the same two side by side.

Show answer

Stacked (series): each carries 30 lb and compresses 1.5 in, total 3 in. Side by side (parallel): each carries 15 lb, 0.75 in. Side by side is twice as stiff as one spring; stacked is half as stiff.

COMMON MISTAKES

- Starting upholstery on a loose frame.
- Assuming more springs always means a better seat; spacing and tying matter as much.
- Measuring spring compression without a steady board.

Make it a game · Spring Guess. Each player predicts how far a spring will compress under 10, 20 and 30 lb before testing. After the test, score the total error in inches; lowest wins. Bonus: predict the compression for 25 lb from your measured k .

Scripture. “And I have filled him with the spirit of God, in wisdom, and in understanding, and in knowledge, and in all manner of workmanship, To devise cunning works, to work in gold, and in silver, and in brass, And in cutting of stones, to set them, and in carving of timber, to work in all manner of workmanship.” (Exodus 31:3-5, KJV)

God filled Bezaleel with skill for all manner of workmanship, timber included. Building a sound frame and a good seat is part of that same calling to make.

8.2 EIGHT-WAY HAND-TIED SPRINGS

OBJECTIVES

- Explain what “eight-way hand-tied” means and why the ties keep a sprung seat level and long-lasting.
- Plan a spring layout, the twine lines and their lengths.
- Sew springs to webbing and tie them eight ways on a practice frame or your project, wearing safety glasses.

Warm-up. Draw a 3×3 grid of circles (springs). Draw straight lines connecting them front to back, side to side, and on both diagonals. How many lines touch the center spring? How many directions is it tied in?

WATCH

How to Eight Way Tie in Upholstery.

Upholstery on Broadway · 13:07

https://www.youtube.com/watch?v=29zPNvL48_4

WHEN TO WATCH

Before the lab. Watch the knot at each spring closely; pause and practice the clove hitch on a spare coil (glasses on) before going on.

BACKUP VIDEO

Century- The Art of 8 Way Hand Tied Upholstery

Century Furniture · 3:01

<https://www.youtube.com/watch?v=EghtZvq4LLc>

A short factory film showing hand-tied springs in a furniture maker's shop.

KEY TERMS

eight-way tie

Tying each spring to its neighbors front-back, side-side and on both diagonals, so twine leaves it in eight directions.

clove hitch

The knot used to tie twine to each spring's top coil.

lashing height

The planned compressed height of the springs once tied.

spring twine

Strong waxed jute or polyester twine used to tie springs.

return tie

A tie from the second coil to the top coil of an edge spring, to crown or slant the edge.

spring clip

A metal clip sometimes used to join spring coils.

CORE IDEAS

The story. Fine furniture makers still advertise “eight-way hand-tied” springs, and with reason: an upholsterer ties every spring in a seat to its neighbors by hand with strong twine, a slow skill that machines have not replaced. Furniture companies make it a selling point because a hand-tied seat stays level and comfortable for decades. A seat built this way in the 1800s can often be re-covered without retying.

How they figured it out. Untied springs tip, rub and pop through the burlap. Upholsterers learned to sew each spring's bottom coil to the webbing, compress the springs slightly to a planned height, and tie their top coils into a single unit with twine running in four lines (front-back, side-side and two diagonals), which leaves each spring held in eight directions. The edge springs are tied to slant slightly outward or to stand straight, depending on the seat's shape.

The physics. Tying links the springs so that when a load presses one, the twine pulls its neighbors down a little too; the load spreads (Lesson 8.1). Tying also compresses the springs slightly so the seat starts firm and level. Springs under compression store energy: a slipped tie or a broken coil can snap upward, which is why **safety glasses** are required for spring work.

The math. Each twine line needs about twice the span it crosses (the knots eat length). Count the lines: a 3×3 grid has 3 front-back lines, 3 side-side lines and diagonal lines across both directions. The number of knots is the number of places twine meets a spring.

Let's sew. In the lab you will sew and tie a 2×2 or 3×3 practice grid of springs on a webbed frame (or on your project if it is sprung), check that it is level, and record the twine used.

PICTURE STUDY



Sofa, Unknown American maker, c. 1820 · Mahogany with carved and gilded details; upholstered in red velvet · The Metropolitan Museum of Art, New York
Image: [Wikimedia Commons](#), public domain

This sofa was made in the years just before coiled springs came into furniture; its comfort came from stuffing, bolsters and cushions. Compare its firm, crisp lines with the deep, bouncy sprung seats that Victorian makers built a generation later.

Look closely

- Look at the seat. Is it deep and soft-looking or firm and crisp?
- Find the bolsters. What are they for?
- Look at the edges of the seat cushion. How are they finished?
- Find the carved wood. Which parts would the upholsterer never cover?

Talk about it

1. If this sofa were rebuilt with eight-way tied springs, how would it look and feel different?
2. Why would a conservator rebuild it the way it was first made instead?
3. Which would you rather sit on for an evening, and why?

Safety first. Safety glasses on for every staple, tack and staple removal and all spring work, for you and anyone in the room; a parent is in the house and has watched you use each tool safely. Hold each spring firmly while tying; never put your face over a compressed spring; keep fingers out from between coils.

STUDIO LAB

Tie a Spring Grid

Sew and tie a 2×2 or 3×3 grid of coil springs eight ways on a webbed practice frame (or your project), level it, and record twine and time.

You will need

- A webbed frame (from Lesson 7.3 practice, or a sturdy 20 × 20 in frame with webbing)
- 4 or 9 upholstery coil springs
- Spring twine and stitching twine, a curved needle
- Staple gun or tacks, safety glasses, a straightedge

EIGHT-WAY TIED SPRING GRID

Finished size: One 3 × 3 grid on a 20 × 18 in frame (or 2 × 2 on a smaller frame) · About 2 hours

Fabric and notions

- 9 coil springs, about 6 in tall
- About 12 yd of spring twine
- Stitching twine for the bottoms

How to make it

1. Glasses on. Mark the spring positions on the webbing evenly in a grid.
2. Sew each spring's bottom coil to the webbing at three or four points with the curved needle.
3. Fix twine to the back rail in line with the first row, leaving a long tail.
4. Run the twine front to back over the row, tying a clove hitch on each spring's top coil (front and back of the coil), compressing each about 1 in; fix it to the front rail.
5. Repeat for each front-back line, then each side-side line.
6. Tie the two diagonal sets the same way, knotting where the twines cross at each spring's center.
7. Check with a straightedge that the tops are level; adjust knots as needed.
8. Trim tails long enough to retie later.

Fabric check: Use upholstery spring twine (jute or polyester), not string. Springs should be upholstery coils of matching height; replace rusty or bent springs.

Steps

1. Plan: grid layout, line count, twine lengths; record.
2. Tie the grid from the pattern card, timing each stage.
3. Level test: lay a straightedge across in four directions and measure any gaps.
4. Load test: press the center with a 10-lb bag and watch the neighbors move.
5. Clean up: twine scraps binned, springs and tools stored, glasses put away.
6. Improve it: one change to your knots or tension.

Tips

- Tie all front-back lines before any side-side lines.
- Count the turns of each knot so every spring is compressed the same.
- A practice grid can become the base of a bench or ottoman later.

Check your work

- ☐ Every spring is sewn down and tied in eight directions.
- ☐ The grid is level within ¼ in.
- ☐ I wore glasses for all spring work.

LAB NOTEBOOK

1. Draw the tie pattern from above with every line.
2. Record twine planned vs. used, and time.
3. Sketch a clove hitch in three steps.

KEY FORMULAS

twine per line $\approx 2 \times \text{span}$	twine per line $\approx 2 \times \text{span}$
tied height = free height – compression	tied height = free height – compression
lines in an $n \times n$ grid (no diagonals) = $2n$	lines in an $n \times n$ grid (no diagonals) = $2n$

From history. Before coil springs, the finest seats were stuffed with curled horsehair, which is springy and lasts for generations; some makers still combine horsehair with tied springs in traditional work.

WORKED EXAMPLES

Example 1. A 3×3 spring grid sits in a frame 20 in wide and 18 in deep. Front-back lines span 18 in; side-side lines span 20 in. How much twine for the 6 straight lines?

Show solution

1. Front-back: $3 \times 2 \times 18 = 108$ in $3 \times 2 \times 18 = 108$ in.
2. Side-side: $3 \times 2 \times 20 = 120$ in $3 \times 2 \times 20 = 120$ in.
3. Total: 228 in ≈ 6.3 yd 228 in ≈ 6.3 yd.

Answer: About $6\frac{1}{3}$ yd for the straight lines.

Example 2. The diagonal lines cross the 20×18 in frame. The two longest diagonals are about the frame's diagonal; there are also shorter ones. Estimate the longest diagonal and its twine.

Show solution

1. Diagonal:
 $\sqrt{20^2 + 18^2} = \sqrt{724} \approx 26.9$ in $20^2 + 18^2 \sqrt{}$
2. Twine: $2 \times 26.9 \approx 54$ in $2 \times 26.9 \approx 54$ in for each longest diagonal.

Answer: About 54 in for each corner-to-corner diagonal; shorter diagonals need less.

Example 3. Springs stand 6 in tall free. You tie them down 1 in. If $k = 20$ lb/in, how much force does each tied spring push up against its twine?

Show solution

1. Tied height: $6 - 1 = 5$ in $6 - 1 = 5$ in.
2. Force: $F = 20 \times 1 = 20$ lbF $= 20 \times 1 = 20$ lb.

Answer: Each spring pushes up with about 20 lb even before anyone sits; the stored energy that makes glasses necessary.

PRACTICE

1. Easy What does eight-way mean?

Show answer

Each spring is tied front-back, side-side and on both diagonals, so twine leaves it in eight directions.

2. Easy Why are safety glasses required for spring work?

Show answer

Springs under compression store energy and can snap a coil or tie upward.

3. Easy Which knot ties twine to each spring?

Show answer

A clove hitch.

4. **Medium** Twine for a straight line across a 22-in span?

Show answer

44 in 44 in.

5. **Medium** How many straight (non-diagonal) lines in a 4 × 4 grid?

Show answer

8.

6. **Medium** Free height 7 in, tied down 1½ in. Tied height?

Show answer

5.5 in 5.5 in.

7. **Medium** Why sew the springs' bottoms to the webbing first?

Show answer

So they cannot slide or tip before and after tying.

8. **Hard** Diagonal of a 24 × 20 in frame and twine for one long diagonal line?

Show answer

$\sqrt{976} \approx 31.2$ in 976

$\sqrt{\quad}$

≈ 31.2 in; about 62 in.

9. **Hard** $k = 18$ lb/in, tied down 1¼ in, 12 springs. Total upward force on the twine system?

Show answer

$12 \times 18 \times 1.25 = 270$ lb $12 \times 18 \times 1.25 = 270$ lb.

10. **Hard** Why do makers advertise eight-way hand-tied springs?

Show answer

It is skilled hand labor that keeps seats level and durable for decades, a sign of quality.

11. **Challenge** A 2 × 2 practice grid: count the lines (with diagonals) and the knots, if each line knots once at every spring it passes and twice at each end (to the frame).

Show answer

Lines: 2 front-back, 2 side-side, 2 diagonals = 6. Knots at springs: each straight line passes 2 springs ($4 \text{ lines} \times 2 = 8$), each diagonal passes 2 springs ($2 \times 2 = 4$): 12 spring knots; frame ends $6 \times 2 = 12$. About 24 knots.

COMMON MISTAKES

- Tying one direction too tight so the grid tilts.
- Skipping the diagonals.
- Working springs without glasses.

Make it a game · Knot Race. Players race to tie five clove hitches on a spare spring coil (glasses on), each pulled snug. A parent checks each knot by tugging; a knot that slips costs a point. Fastest clean set wins.

8.3 BURLAP, EDGE ROLL AND PADDING

OBJECTIVES

- Explain the jobs of burlap, an edge roll and each layer of padding in a seat or headboard.
- Calculate burlap, edge roll and padding for your project.
- Build up your project's foundation and padding neatly and safely.

Warm-up. Press the front edge of an old upholstered chair and the front edge of a cheap new one. Which edge is firm and rounded and which collapses? Run your hand along it. Is there a roll under the cover?

WATCH

Eastlake Chair Upholstery - Traditional Springing & Stuffing Techniques

Buckminster Upholstery · 21:26

<https://www.youtube.com/watch?v=vFPW897QyGM>

WHEN TO WATCH

After “The fabric science.” Watch the burlap go over the springs and the stuffing and edge built on top; compare each layer with your cross-section.

BACKUP VIDEO

How to Make Edge Roll

Buckminster Upholstery · 3:21

<https://www.youtube.com/watch?v=th5MguPBI7s>

How an upholsterer makes his own jute-filled edge roll on the sewing machine.

KEY TERMS

burlap (hessian)

Coarse jute cloth laid over springs or webbing to carry the padding.

stitched edge

The traditional hand-stitched roll of stuffing used before ready-made edge roll.

muslin undercover

A plain cotton cover pulled over the padding first to shape it before the final cover.

edge roll

A firm, ready-made roll (fiber or paper wrapped in burlap) stapled along a seat's front edge.

cotton felt / batting

Padding layers that soften the top and smooth out lumps.

turnover

Burlap folded back on itself where it is stapled, so it cannot tear out.

CORE IDEAS

The story. The Encyclopédie plates show upholsterers building firm edges by hand: stuffing rolled into burlap and stitched through and through with a long needle until the edge stood up hard and square. It took skill and hours. Modern upholsterers buy **edge roll** by the foot, a ready-made roll of compressed fiber or paper wrapped in burlap, and staple it along the edge in minutes. Both do the same job, and both sit on **burlap**, the jute cloth that has covered springs and webbing for two centuries.

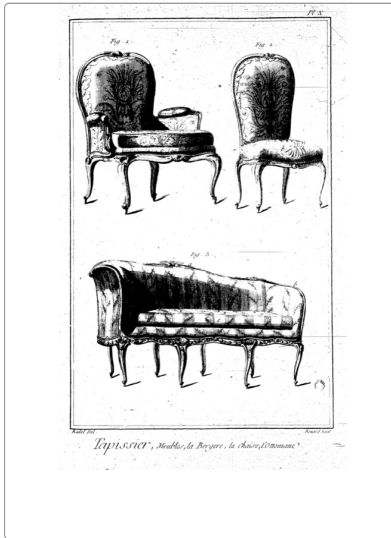
How they figured it out. Stuffing laid over springs falls between the coils, and a padded seat's front edge wears first, collapsing where the backs of the legs press. Upholsterers solved the first with a layer of burlap over the springs or webbing, stapled with turnovers and sewn to the spring tops, and the second with a firm edge. Then the padding goes on in layers from firm to soft: a fiber or foam layer, cotton felt or batting, and often a muslin undercover to shape everything before the final cover.

The fabric science. Jute burlap is strong, cheap and coarse; it does not stretch much, so it holds a shape. Edge roll is sized by its diameter (often ½–1 in). Each padding layer is cut to cover the seat and lap over the edge roll; the softer layers on top hide the firmer ones' edges. For a headboard, the same idea is simpler: a plywood board, foam, batting wrapped around the edges, and the cover.

The math. Burlap = seat area plus turnovers on every side. Edge roll = the length of the edges that need it, usually the front and sometimes the sides. Padding and batting are sized to the seat plus enough to lap over the edge and down the sides.

Let's sew. In the lab you will build your project's foundation and padding: burlap over springs or webbing, edge roll on the front, and padding layers (or, for a headboard, foam and batting on a board), ready for the cover in Lesson 8.4.

PICTURE STUDY



The Upholsterer: Bergère, Chair and Ottoman (Plate X, Tapissier), Engraving from Diderot and d'Alembert's *Encyclopédie*, Published 1770s · Engraving · *Encyclopédie*, Recueil de planches, Paris
Image: [Wikimedia Commons](#), public domain

This plate shows finished work: a bergère, a side chair and an ottomane, each with crisp edges and smooth padding. Every edge you see was built by hand with stuffing, burlap and stitches before the cover went on.

Look closely

- Look at the front edge of each seat. Is it square or rounded?
- Find the loose cushion. How is it different from the fixed seat of the side chair?
- Look at the back of the settee. How is its curve padded?
- Find any trim along the edges. What might it hide?

Talk about it

1. Which of these pieces would need the most padding? Why?
2. How would you build the crisp front edge of the side chair with modern materials?
3. Which piece is most like your project?

Safety first. Safety glasses on for every staple, tack and staple removal and all spring work, for you and anyone in the room; a parent is in the house and has watched you use each tool safely. Wear a dust mask when cutting or handling loose fiber and old stuffing. Foam is cut by the Lesson 7.4 rules with a parent present, and spray adhesive is used only outdoors.

STUDIO LAB

Build the Foundation and Padding

Build up your project's foundation and padding: burlap and edge roll for a sprung or webbed seat, or foam and batting on a board for a headboard or bench, ready for the cover.

You will need

- Burlap, edge roll (for seats)
- High-density foam and polyester batting
- Muslin (optional undercover)
- Staple gun, curved needle and twine, safety glasses, dust mask

PADDED HEADBOARD PANEL

Finished size: One queen headboard panel, 60 × 30 in (adjust to your bed) · About 2 hours

Fabric and notions

- ½-in plywood, 60 × 30 in (a parent cuts it)
- 2-in foam, 60 × 30 in
- Batting, 70 × 40 in
- Optional: edge roll along the top edge, 60 in

How to make it

1. Sand only the raw plywood edges smooth (new plywood, never old painted wood); round the corners slightly.
2. If you want a soft rolled top, staple edge roll along the top front edge, glasses on.
3. Outdoors, lightly spray-glue the board and lay the foam on it, edges flush.
4. Lay the batting over the foam and wrap it to the back on all sides; staple at the centers first, then work outward.
5. Trim excess batting at the corners so they stay smooth.
6. Optional: staple a muslin undercover over everything, pulled smooth.

Fabric check: Use upholstery-grade foam and polyester batting. Plywood is the base for headboards; for seats, jute burlap goes over springs or webbing. Keep all foam away from heat and flame.

Steps

1. Calculate burlap, edge roll, foam and batting quantities for your project.
2. Build the foundation and padding from the pattern card (or, for a sprung seat: burlap with turnovers over the springs, sewn to the spring tops; edge roll on the front; padding layers).
3. Check the shape: is the top even? Are the edges firm and rounded?
4. Photograph the padded piece from the side to show the profile.
5. Clean up: fiber and foam scraps bagged, staples collected, adhesive capped.
6. Improve it: one change to the padding.

Tips

- Lay padding layers slightly smaller than the layer beneath so the edges taper smoothly.
- A muslin undercover makes the final cover far easier.
- Mark the center line of the piece on the padding so the cover goes on straight.

Check your work

- ☐ My quantities were calculated and enough.
- ☐ My edges are firm and even and the top is smooth.
- ☐ I wore glasses and a mask as required.

LAB NOTEBOOK

1. Update your cross-section with actual thicknesses.
2. Record quantities and costs.
3. Paste the profile photo.

KEY FORMULAS

$$\text{burlap} = (L + 2t) \times (W + 2t) \quad (t = \text{turnover allowance})$$

$$\text{burlap} = (L + 2t) \times (W + 2t) \quad (t = \text{turnover allowance})$$

$$\text{edge roll length} = \text{front} + \text{sides that need it}$$

$$\text{edge roll length} = \text{front} + \text{sides that need it}$$

$$\text{batting} = (L + 2h + 4) \times (W + 2h + 4)$$

$$\text{batting} = (L + 2h + 4) \times (W + 2h + 4)$$

From history. Burlap and webbing from jute replaced earlier linen materials in the nineteenth century because jute was cheaper; upholsterers still call burlap “hessian” in Britain.

WORKED EXAMPLES

Example 1. A sprung seat measures 22×20 in across the top of the springs, and burlap must lap over each rail by 3 in for turnovers. Burlap size?

Show solution

1. Each way: $22 + 6 = 28$, $20 + 6 = 26$.

Answer: Burlap 28×26 in.

Example 2. Edge roll runs along the 22-in front and 8 in back along each side. How much?

Show solution

1. Length: $22 + 2 \times 8 = 38$ in.
2. Edge roll is sold by the foot: $38 \div 12 \approx 3.238$, buy 4 ft.

Answer: 38 in; buy 4 ft.

Example 3. A headboard is a 60×30 in plywood panel (queen) with 2-in foam and batting wrapped to the back by 3 in. Find foam size, batting size and board feet of foam.

Show solution

1. Foam (flush with the board): $60 \times 30 \times 2$ in.
2. Batting: $(60 + 2 \times 2 + 2 \times 3) \times (30 + 4 + 6) = 70 \times 40$ in.
3. Board feet: $60 \times 30 \times 2 \div 144 = 25$.

Answer: Foam $60 \times 30 \times 2$ in (25 board feet); batting 70×40 in.

PRACTICE

1. Easy What does burlap over springs do?

Show answer

Holds the padding so it cannot fall between the springs, and gives a firm base.

2. Easy What is edge roll for?

Show answer

A firm, rounded front edge that keeps its shape and protects the legs.

3. Easy Name the padding layers from firm to soft.

Show answer

Fiber or foam, cotton felt or batting, muslin undercover (then the cover).

4. **Medium** Seat 24×21 in, 3-in turnovers. Burlap?

Show answer

30×27 in 30×27 in.

5. **Medium** Edge roll for a 24-in front and 6 in back each side, in feet?

Show answer

36 in = 3 ft 36 in = 3 ft.

6. **Medium** Why fold burlap back on itself before the last staples?

Show answer

The turnover keeps it from tearing out at the staples.

7. **Medium** Why add a muslin undercover?

Show answer

To shape and compress the padding first, so the final cover goes on smoothly and wears less.

8. **Hard** Twin headboard 40×28 in, 2-in foam, batting wrapping 3 in to the back. Batting size and foam board feet?

Show answer

Batting 50×38 in 50×38 in; foam $40 \times 28 \times 2 \div 144 \approx 15.6$ $40 \times 28 \times 2 \div 144 \approx 15.6$.

9. **Hard** Foam at \$1.10 \$1.10 per board foot for the queen headboard above (25 board feet)?

Show answer

\$27.50 \$27.50.

10. **Hard** Why did the traditional stitched edge take so long, and what does ready-made edge roll trade away?

Show answer

Shaping and stitching stuffing by hand into a firm roll took skill and hours; edge roll is fast and uniform but less adjustable and less durable than a well-stitched horsehair edge.

11. **Challenge** A bench 48×16 in will be sat on along its long front edge. Plan the layers and quantities: base, edge roll, foam, batting and burlap if used.

Show answer

Plywood base 48×16 ; edge roll 48 in (4 ft) on the front; 2-3-in high-density foam 48×16 (≈ 10.7 -16 board feet); batting wrapping to the underside, about 58×26 in for 2-in foam; burlap not needed on a solid base.

COMMON MISTAKES

- Skipping the burlap so padding falls into the springs.
- Making the edge roll overhang the frame.
- Sanding old painted wood (never).

Make it a game · Edge Test. Each player builds a 12-in sample edge on a scrap board: one with edge roll and batting, one with batting only. Blindfolded, a parent presses both and judges which is firmer and rounder. Then everyone predicts which will hold its shape after 50 presses, and tests it.

8.4 PULLING THE COVER: WELTING, GIMP AND COUNTING THE COST

OBJECTIVES

- Pull and staple a top cover over a padded piece in the professional order.
- Make and apply double welt or gimp to finish edges and hide staples.
- Write a full cost sheet comparing re-upholstery with replacement, counting materials and hours.

Warm-up. Look closely where the fabric meets the wood on any upholstered piece with visible wood. What hides the staples: a braid, a double cord, nails, nothing? Run a finger along it.

WATCH

How to Make Double Welt Cord

[Sailrite](#) · 5:08

<https://www.youtube.com/watch?v=eQqeT6Mb-II>

WHEN TO WATCH

Before you make your trim. Watch the second row of stitching between the two cords; then make a 12-in test piece.

BACKUP VIDEO

How to apply gimp braid to upholstery Mollies

[Mollies Make & Create](#) · 1:07

<https://www.youtube.com/watch?v=rADJspUS9dA>

A one-minute look at gluing gimp along a seat edge.

KEY TERMS

top cover

The final visible fabric of an upholstered piece.

gimp

A narrow decorative braid glued or tacked over staples along an edge.

show wood

Wooden parts of a frame left uncovered and visible.

double welt

Two cords wrapped side by side in one fabric strip, glued over staples where fabric meets show wood.

decorative nails (nailheads)

Upholstery nails with round heads set in a row, as fastener and trim.

labor value

The worth of your hours, used to compare making with buying.

CORE IDEAS

The story. Jesus asked, “For which of you, intending to build a tower, sitteth not down first, and counteth the cost, whether he have sufficient to finish it?” Upholsterers have always lived by that question. A re-upholstery job is quoted before it begins: fabric, foam, springs, twine, trim, and hours. Families of the past re-covered good furniture rather than replace it because the numbers favored it, and the numbers often still do, especially when the frame is solid hardwood that a new, cheaper piece cannot match.

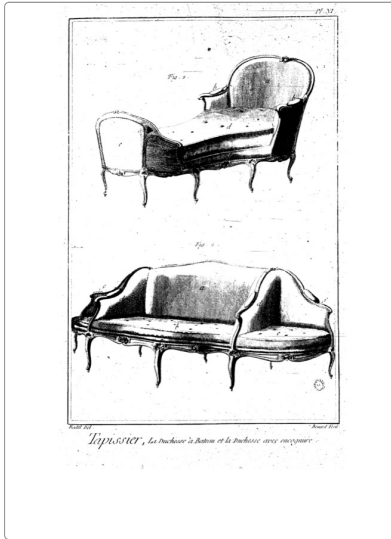
How they figured it out. Where fabric meets show wood, the staples or tacks must be hidden. French upholsterers of the 1700s used braid (galon) and rows of decorative nails; later upholsterers added **gimp** and **double welt**, glued over the staple line with hot glue. Each choice is both a finish and a design decision: nails look traditional, gimp looks delicate, double welt looks tailored.

The craft. The top cover goes on like the seat cover of Lesson 7.5 but on a larger, more shaped piece: mark centers, staple the centers of opposite sides first, work out toward the corners, pulling evenly on grain, cut relief slits carefully where fabric must pass around posts or arms, and fold neat corners. Trim the fabric just inside where the trim will cover it. Double welt is made by wrapping a strip around two cords and stitching between them; it is glued on in one continuous run.

The math. Double welt strip width $\approx$ the circumference around both cords plus a margin; length = the edge plus overlap. The cost sheet totals every material, adds a 10% allowance, values your hours, and compares with the price of a new piece of similar quality.

Let's sew. In the lab you will cover your project piece, finish its edges with double welt, gimp or nailheads, and write the full cost sheet.

PICTURE STUDY



The Upholsterer: Duchesse Daybeds (Plate XI, Tapissier), Engraving from Diderot and d'Alembert's Encyclopédie, Published 1770s · Engraving · Encyclopédie, Recueil de planches, Paris

Image: [Wikimedia Commons](#), public domain

The duchesse was an eighteenth-century daybed, and these plates show the upholsterer's finished work: smooth, tight covers pulled over shaped padding, edges crisp, carved legs left bare. Every place the cover meets the wood needed a finishing trim.

Look closely

- Find where the cover meets the carved frame. What might hide the fasteners there?
- Look at the curved back. How would you pull a cover smoothly over a curve?
- Compare the two pieces. Which looks harder to upholster, and why?
- Look at the cushions. Are they loose or fixed?

Talk about it

1. How many yards of fabric do you think one of these would take?
2. If you quoted for re-covering one, what would go on the cost sheet?
3. Why might a family in the 1700s have re-covered a duchesse rather than replaced it?

Safety first. Safety glasses on for every staple, tack and staple removal and all spring work, for you and anyone in the room; a parent is in the house and has watched you use each tool safely. A hot-glue gun for gimp and welt is set on its stand, never on the fabric; keep fingers clear of the nozzle and the hot glue, and unplug it when finished.

STUDIO LAB

Cover, Trim and Count the Cost

Pull and staple the top cover on your project, finish its edges with double welt, gimp or nailheads, and write the full cost sheet comparing it with replacement.

You will need

- Seat- or headboard-appropriate decorator fabric
- Double welt (fabric and two cords) or gimp, or decorative nails
- Hot-glue gun and glue sticks
- Staple gun, safety glasses, shears, chalk

DOUBLE WELT TRIM

Finished size: About 70 in of double welt · About 45 minutes

Fabric and notions

- Fabric strips 2½ in wide, joined to about 72 in
- 2 lengths of 5/32-in cord, 72 in each
- Thread

How to make it

1. Lay one cord on the wrong side of the strip near one edge; fold the strip over it and stitch close to the cord with a zipper or welt foot.
2. Lay the second cord beside the first, wrap the strip around it, and stitch between the two cords (in the groove).
3. Trim the excess strip close to the stitching on the back.
4. Test the welt against the edge it will cover; it should hide the staple line completely.
5. Glue it on in one continuous run, starting at an inconspicuous point; turn the end under at the join.

Fabric check: Use the same fabric as the cover, or a contrast from the room's scheme, medium weight so the welt is not bulky. Gimp comes ready-made in many colors.

Steps

1. Cover the project: mark centers, staple centers of opposite sides first, work out to corners, slit carefully around obstacles, fold neat corners.
2. Trim fabric just inside the line the trim will cover.
3. Make and apply double welt from the pattern card (or apply gimp or nailheads evenly spaced).
4. Write the cost sheet: every material, 10% allowance, hours, and the price of a comparable new piece.
5. Inspect: grain straight, corners neat, no staples showing, trim continuous.
6. Clean up: glue gun unplugged on its stand, staples collected, scraps saved.
7. Improve it: one change.

Tips

- Run glue a few inches at a time so it does not set before the trim is pressed.
- Space nailheads with a strip of cardboard cut to the spacing.
- Pull the cover with flat palms, not fingertips, to avoid dents in the padding.

Check your work

- ☐ My cover is straight, smooth and on grain.
- ☐ My trim hides every staple and has a neat join.
- ☐ My cost sheet is complete and honest.

LAB NOTEBOOK

1. Paste the cost sheet.
2. Tape in a sample of the double welt or gimp.
3. Write the stapling order you used and any changes from the plan.

KEY FORMULAS

double welt strip $\approx 2(\pi d) + 2d + 1$ in	double welt strip $\approx 2(\pi d) + 2d + 1$ in
total cost = $1.10 \times \text{materials} + \text{hours} \times \text{rate}$	total cost = $1.10 \times \text{materials} + \text{hours} \times \text{rate}$
savings = replacement price – materials	savings = replacement price – materials

From history. Decorative brass nails have finished upholstery for centuries; Vermeer's chairs (Lesson 7.2) show them in the 1600s, and many reproduction chairs still use them today.

WORKED EXAMPLES

Example 1. Double welt with two $\frac{5}{32}$ -in cords. About how wide should the strip be?

Show solution

1. Around both cords: $2\pi(0.156) + 2(0.156) \approx 0.98 + 0.31 = 1.29$ in $2\pi(0.156) + 2(0.156) \approx 0.98 + 0.31 = 1.29$ in.
2. Add about 1 in to hold and trim: 2.3 in 2.3 in.

Answer: Cut strips about $2\frac{1}{4}$ – $2\frac{1}{2}$ in wide (a test piece confirms).

Example 2. The show-wood edge around an upholstered seat is 64 in. How much double welt, and how much gimp if instead used?

Show solution

1. Double welt: $64 + 2 = 66$ in $64 + 2 = 66$ in (overlap to turn under at the join).
2. Gimp: the same 66 in 66 in, about $1\frac{7}{8}$ yd.

Answer: About 66 in of either.

Example 3. Cost sheet for an upholstered bench: plywood \$22\$22, foam \$24\$24, batting \$8\$8, fabric $1\frac{1}{2}$ yd at \$26\$26, legs \$20\$20, staples, glue, trim \$10\$10; 12 hours. Similar benches sell for \$260\$260. Find materials with 10%, and compare.

Show solution

1. Materials: $22 + 24 + 8 + 39 + 20 + 10 = \123 $22 + 24 + 8 + 39 + 20 + 10 = \123 ; with 10%: \$135.30\$135.30.
2. Savings vs. buying: $\$260 - \$135.30 = \$124.70$ $\$260 - \$135.30 = \$124.70$.
3. That is about $\$124.70 \div 12 \approx \10.39 $\$124.70 \div 12 \approx \10.39 per hour earned by your labor.

Answer: About \$135\$135 in materials; your 12 hours save about \$125\$125, roughly \$10\$10 an hour, plus a bench built to your own measure.

PRACTICE

1. Easy What hides staples where fabric meets show wood?

Show answer

Gimp, double welt, decorative nails or braid.

2. Easy What does Luke 14:28 teach about a project?

Show answer

Count the cost before starting, to be sure you can finish.

3. Easy In what order is a top cover stapled?

Show answer

Centers of opposite sides first, then outward toward the corners, alternating, corners last.

4. **Medium** Show-wood edge 52 in. Double welt needed?

Show answer

About 54 in.

5. **Medium** Materials \$90\$90; with a 10% allowance?

Show answer

\$99\$99.

6. **Medium** Why slit fabric carefully around a post or arm?

Show answer

So it can pass around the obstacle without tearing or puckering; a slit too deep shows.

7. **Medium** Name one look each for nailheads, gimp and double welt.

Show answer

Nailheads: traditional; gimp: delicate; double welt: tailored.

8. **Hard** Strip width for double welt with two ¼-in cords?

Show answer

$2\pi(0.25) + 0.5 + 1 \approx 3.07$; $2\pi(0.25) + 0.5 + 1 \approx 3.07$; about 3 in.

9. **Hard** Materials \$148\$148 (with 10%), 15 hours; a new chair \$425\$425. Savings and value per hour?

Show answer

\$277\$277; about \$18.47\$18.47/h.

10. **Hard** When might replacement be the better choice despite the cost sheet?

Show answer

When the frame is broken or poor-quality particleboard, or materials cost nearly as much as a good replacement.

11. **Challenge** Write a one-paragraph quote to a neighbor for re-covering her four dining seats: materials, your hours, a fair price, and what she gets compared with new chairs.

Show answer

Answers vary: e.g., materials about \$85 for four seats (fabric, foam, batting, cambric), about 6 hours; a fair price covering materials plus a modest hourly rate; she keeps her solid chairs with new comfort and a fabric she chose, at a fraction of new.

COMMON MISTAKES

- Trimming the fabric too far, so raw edges show beyond the trim.
- Gluing trim in short pieces with many joins.
- Leaving hours off the cost sheet.

Make it a game · Quote Battle. A parent describes an imaginary job (re-cover six dining seats, re-upholster a footstool, build a twin headboard). Each player writes a materials list and price in five minutes. Closest to the parent's worked estimate wins; any quote missing a major material (foam, fabric, trim) is disqualified.

Scripture. “For which of you, intending to build a tower, sitteth not down first, and counteth the cost, whether he have sufficient to finish it?” (Luke 14:28, KJV)

Jesus used a builder's habit to teach about following Him wholeheartedly. Counting the cost before you begin, in money and in hours, is wise in every kind of work.

8.5 YOUR OWN PIECE: A HEADBOARD, BENCH OR CHAIR

OBJECTIVES

- Design an upholstered piece to fit a real space, with measured drawings and a materials and cost plan.
- Build it from frame or base to finished cover, following the upholsterer's order of work safely.
- Present the finished piece with its construction log and cost sheet as the Unit 8 project.

Warm-up. Stand where your finished piece will go (beside the bed, at the end of the bed, at the table). Measure the space: width, depth and height. What is the largest piece that fits without blocking a path or a drawer?

WATCH

How To Make A Headboard In 10 Minutes!

Just Fabrics • 9:56

<https://www.youtube.com/watch?v=Pf5Dke4VRHA>

WHEN TO WATCH

After “The design.” Watch the whole build once, then list the steps in order and compare them with the pattern card.

Note: An English fabric shop builds a padded panel headboard on a board with foam and batting; the power saw work belongs to a parent.

KEY TERMS

headboard panel

An upholstered board fixed to a bed frame or the wall behind a bed.

bench base

A plywood top with legs or a frame, padded and covered.

construction log

A dated record of each work session: what was done, how long, problems and fixes.

mounting (French) cleat

Two strips of wood cut at 45° that interlock to hang a panel securely on a wall.

tufting

Buttons pulled through the padding to the base, making dimples; optional decoration.

proportion

The size relationship between the piece and the bed or room (Lesson 1.1).

CORE IDEAS

The story. The Encyclopédie plate for this lesson shows eighteenth-century beds with canopies, curtains and padded heads: the upholsterer's grandest work, a bed was dressed rather than built. Today's upholstered headboard is the last trace of those hangings, and a padded bench at the foot of a bed or by a door is a modern descendant of the upholsterer's stools and banquettes. Both are within reach of a careful student with a staple gun.

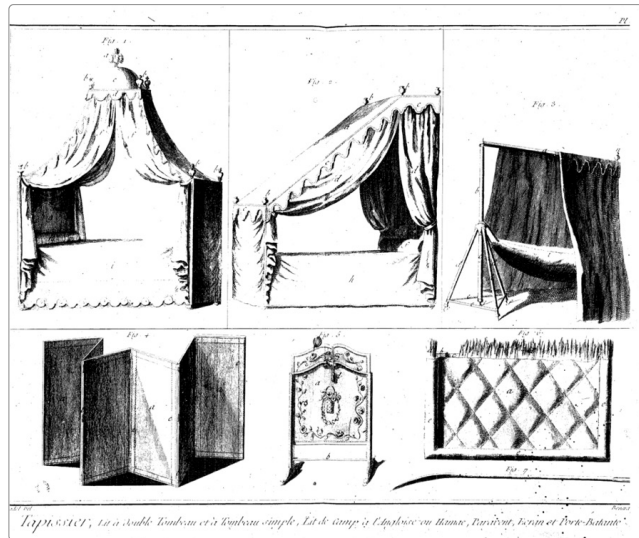
How they figured it out. A piece of your own design begins with the space and the use. A headboard is sized to the bed: as wide as the mattress or a little wider, and tall enough to lean against. A bench is sized to the space and the people: about 17–19 in high to sit on, 14–18 in deep. The order of work is the same as every upholstered piece: base, padding, cover, trim, and a finished back or underside.

The design. Use the room's scheme (Unit 1): the headboard or bench is often the room's largest single piece of fabric, so it may be the dominant color or a calm texture, with welting or nailheads as the accent. Check proportion: a headboard about $\frac{1}{2}$ to $\frac{2}{3}$ as tall above the mattress as the bed is wide often looks right; draw it on the elevation first.

The math. Plywood and foam to size, fabric by layout, trim by edge length, mounting hardware, and a complete cost sheet compared with a store-bought piece of similar quality.

Let's sew. This lab is the Unit 8 project: design, build and present your own upholstered headboard, bench or chair.

PICTURE STUDY



The Upholsterer: Beds and Screens (Plate VI, Tapissier), Engraving from Diderot and d'Alembert's *Encyclopédie*, Published 1770s · Engraving · *Encyclopédie, Recueil de planches*, Paris

Image: [Wikimedia Commons](#), public domain

In the eighteenth century a bed's value lay in its hangings, and this plate shows the upholsterer's beds with canopies, curtains and padded heads, along with screens he covered in fabric. A modern upholstered headboard is a small piece of this tradition.

Look closely

- Count the beds. How are their canopies shaped?
- Find the curtains. How are they hung and gathered back?
- Look at the screens below. Which one is padded or covered like a headboard?
- Find the lattice panel. How might it be made with fabric and trim?

Talk about it

1. Which part of these beds survives on modern beds?
2. How would you adapt the lattice panel's look on a headboard (welt, tufting, nailheads)?
3. Why might people in cold houses have valued bed hangings so highly?

Safety first. Safety glasses on for every staple, tack and staple removal and all spring work, for you and anyone in the room; a parent is in the house and has watched you use each tool safely. A parent cuts plywood with power saws and drills and mounts the headboard to studs or the bed frame; you do the padding, covering and trim. Lift large panels with a helper.

STUDIO LAB

Build Your Own Upholstered Piece

Design, build and present your own upholstered headboard, bench or chair for a real place in your home, with drawings, a construction log and a cost sheet.

You will need

- Plywood or the piece's frame (a parent cuts plywood)
- Foam, batting, muslin (optional)
- Decorator fabric and trim (double welt, gimp or nailheads)
- Mounting hardware (French cleat or bolts) or legs
- Staple gun, glasses, glue gun, tools

UPHOLSTERED HEADBOARD PANEL

Finished size: One queen headboard, 62 × 30 in panel · About 6–8 hours across sessions

Fabric and notions

- ½-in plywood, 62 × 30 in
- 2-in foam, 62 × 30 in
- Batting, 72 × 40 in
- Fabric, 72 × 40 in (railroaded)
- Double welt, about 190 in (optional)
- Black cambric for the back, 60 × 28 in
- A French cleat and screws

How to make it

1. A parent cuts the plywood and the cleat; round and smooth the new plywood corners.
2. Pad the panel (Lesson 8.3): foam glued outdoors, batting wrapped to the back.
3. Center the fabric face down, panel face down on it; staple the centers of the top and bottom, then the sides, glasses on.
4. Work out toward the corners, pulling evenly on grain; fold neat corners and staple.
5. Optional: glue double welt around the front edge.
6. Staple the cambric over the back, edges turned under.
7. A parent attaches one half of the cleat to the panel's back and the other to the wall studs (or bolts the panel to the bed frame's headboard brackets).
8. Hang the panel and check it is level.

Fabric check: Choose fabric from the room scheme with enough durability for leaning against (medium duty or better). Velvet, linen blends and tightly woven cottons are all good; check that the pattern can be railroaded if the panel is wider than the fabric.

Steps

1. Design: measured drawings (front and side), the room elevation with the piece drawn on, the scheme choice.
2. Plan: cut list, materials list, cost estimate; a parent approves.
3. Build from the pattern card (or your bench or chair plan), recording every session in the construction log.
4. Inspect against the drawings: size, level, straight grain, neat corners, finished back.
5. Final cost sheet with hours; compare with a store-bought piece.
6. Present the piece to the family with drawings, log and cost sheet.
7. Clean up and reflect: one thing you would do differently.

Tips

- Mark the panel's center lines on the back so the fabric goes on straight.
- If the fabric has a motif, center it first and work outward.
- A French cleat lets the headboard lift off for cleaning or moving.

Check your work

- ☐ My piece matches its drawings within ½ in.
- ☐ The cover is straight, smooth and trimmed, the back finished.
- ☐ My log and cost sheet are complete; the piece is in use.

LAB NOTEBOOK

1. Paste the drawings and the room elevation with the piece.
2. Keep the construction log.
3. Final cost sheet and before-and-after photos.

KEY FORMULAS

headboard width = mattress width + 0 to 4 in
headboard width = mattress width + 0 to 4 in
fabric = $(W + 2T + 2w) \times (H + 2T + 2w)$
total cost = $1.10 \times \text{materials}$

From history. Eighteenth-century inventories often valued a bed's hangings far above its wooden frame, and upholsterers were paid accordingly; the bed was the most expensive piece of furniture many families owned.

WORKED EXAMPLES

Example 1. A queen mattress is 60 in wide. The headboard will be 62 in wide, its padded panel 30 in tall, with 2-in foam and 3 in of fabric wrapped to the back. Find the fabric size and whether 54-in fabric needs a seam.

Show solution

1. Fabric: $(62 + 4 + 6) \times (30 + 4 + 6) = 72 \times 40$ in $(62 + 4 + 6) \times (30 + 4 + 6) = 72 \times 40$ in.
2. 72 in is wider than 54 in, so either railroad the fabric (72 in along the bolt, 40 in across: fits) or seam it.
3. Railroaded: buy $72 + 4 = 76$ in ≈ 2.1 yd $72 + 4 = 76$ in ≈ 2.1 yd.

Answer: Fabric 72×40 in 72×40 in; railroad it (if the pattern allows) and buy about $2\frac{1}{8}$ yd.

Example 2. A bench at the foot of the bed is 48×16 in, 18 in high overall with 3-in foam on a $\frac{3}{4}$ -in top. How tall must the legs be?

Show solution

1. Top and padding: $0.75 + 3 = 3.75$ in $0.75 + 3 = 3.75$ in (foam compresses a little in use).
2. Legs: $18 - 3.75 = 14.25$ in $18 - 3.75 = 14.25$ in.

Answer: Legs about $14\frac{1}{4}$ in.

Example 3. Total cost of the headboard: plywood \$34\$34, foam \$30\$30, batting \$12\$12, fabric $2\frac{1}{8}$ yd at \$24\$24, French cleat and screws \$14\$14, trim \$9\$9. A similar store headboard costs \$289\$289.

Show solution

1. Materials: $34 + 30 + 12 + 51 + 14 + 9 = \150 $34 + 30 + 12 + 51 + 14 + 9 = \150 ; with 10%: \$165\$165.
2. Savings: $\$289 - \$165 = \$124$ $\$289 - \$165 = \$124$, about 43%.

Answer: About \$165\$165 versus \$289\$289.

PRACTICE

1. Easy What is a French cleat?

Show answer

Two wood strips cut at 45° that interlock to hang a panel securely on a wall.

2. Easy Typical seat height of a bench?

Show answer

About 17–19 in.

3. Easy Twin mattress 38 in wide: headboard width range?

Show answer

38–42 in.

4. **Medium** Headboard 42×28 in, 2-in foam, 3-in wrap. Fabric size?

Show answer

52×38 in 52×38 in.

5. **Medium** Bench 18 in tall, $\frac{3}{4}$ -in top, 2-in foam. Leg height?

Show answer

15.25 in 15.25 in.

6. **Medium** Why might the headboard be the room's dominant color or a calm texture?

Show answer

It is often the largest single piece of fabric in the room (60-30-10).

7. **Medium** Name the order of work for a headboard.

Show answer

Plywood base, foam, batting, (muslin), cover, trim, back finish, mounting.

8. **Hard** Full mattress 54 in wide, headboard 56 in, panel 32 in tall, 2-in foam, 3-in wrap: fabric size; can it be cut from 54-in fabric without railroading?

Show answer

66×42 66×42 ; no, 66 in exceeds 54, so railroad it or seam it.

9. **Hard** Materials \$118 \$118 with 10%? Store price \$199 \$199: savings percent?

Show answer

\$129.80 \$129.80; about 35%.

10. **Hard** Using the $\frac{1}{2}$ - $\frac{2}{3}$ proportion rule, how tall should the panel above a 60-in-wide queen mattress be?

Show answer

About 30–40 in.

11. **Challenge** Design a storage bench for a mudroom: give dimensions, foam, fabric and trim choices, and three safety decisions for building it.

Show answer

Answers vary: e.g., $42 \times 16 \times 18$ in, 2-in high-density foam, a tightly woven 30,000-double-rub washable fabric or vinyl, double welt; safety: parent cuts plywood, glasses for stapling, lid with a soft-close hinge so it cannot slam on fingers.

COMMON MISTAKES

- Designing the piece without measuring the space.
- Forgetting to finish the back.
- Mounting a heavy headboard to drywall alone instead of studs.

Make it a game · Proportion Poll. Draw three headboard shapes to scale on paper cutouts (low and wide, tall and narrow, about $\frac{1}{2}$ the bed's width tall) and tape each above a bed in turn. The household votes on the best proportion; then each player measures the winner and checks it against the $\frac{1}{2}$ - $\frac{2}{3}$ rule.

Scripture. “Whatsoever thy hand findeth to do, do it with thy might” (Ecclesiastes 9:10, KJV)

A piece of your own is the best place to practice wholehearted work: measure carefully, pull evenly, finish the back no one sees.

UNIT 8 TEST

Calculators are allowed. Show your work for every calculation: write the formula, substitute with units, and give the answer with its unit. Answer concept questions in complete sentences. The test is worth 100 points.

1. **6 pts**
List the layers of a traditional sprung seat from frame to dust cover.
2. **6 pts**
State Hooke's law and find the compression of a spring with $k = 22 \text{ lb/in}$ under 33 lb.
3. **7 pts**
A 160-lb person sits on 10 tied springs ($k = 20 \text{ lb/in}$) that share the load evenly. Compression of each? If only 4 springs take the load?
4. **6 pts**
What does eight-way hand-tied mean, and why do makers advertise it?
5. **6 pts**
Why are safety glasses required for spring work?
6. **6 pts**
Twine for a 3×3 grid's straight lines in a 22×20 in frame ($2 \times$ span per line)?
7. **5 pts**
Diagonal of a 22×20 in frame?
8. **6 pts**
What do burlap and edge roll each do?
9. **6 pts**
Seat 22×20 in with 3-in turnovers: burlap? Edge roll for the 22-in front plus 7 in on each side?
10. **6 pts**
Strip width for double welt with two $\frac{1}{4}$ -in cords?
11. **6 pts**
Materials \$140\$140 plus 10%, 14 hours; a comparable piece \$330\$330. Savings and value per hour?
12. **6 pts**
What does Luke 14:28 teach, and how does it apply to upholstery?
13. **6 pts**
Queen headboard 62×30 in, 2-in foam, 3-in wrap: fabric size; must it be railroaded or seamed on 54-in fabric?
14. **6 pts**
A bench is 18 in tall overall with a $\frac{3}{4}$ -in top and 2-in foam. Leg height?
15. **6 pts**
Why must a heavy headboard be fixed to studs or the bed frame?
16. **5 pts**
Name three ways to hide staples where fabric meets show wood.

17. 5 pts

Short essay (5–8 sentences): Compare a traditional sprung, hand-tied seat with a foam seat on plywood for a dining chair and for a reading chair, using physics, durability and cost.

UNIT PROJECT: AN UPHOLSTERED PIECE OF YOUR OWN

Design and build an upholstered headboard, bench or small chair for a real place in your home, following the upholsterer's order of work, with welting, gimp or nailheads and a finished back or underside.

Submit the measured drawings, room elevation, spring test and spring grid (photos), the construction log, the cost sheet compared with a store-bought piece, and before-and-after photos.

LOOK FOR	WHAT IT MEANS
Design	Sized to the space and use; proportion and scheme checked on drawings.
Construction	Sound base, even padding, firm edges, cover straight and smooth, trim continuous, back finished.
Safety	Glasses for all stapling and spring work; parent cut and mounted; glue gun and foam rules followed.
Math and records	Calculations, log and cost sheet complete and honest.
Use	The piece is installed and used.

ANSWER KEY

1. Frame, webbing, springs (tied), burlap, edge roll and stuffing, muslin, cover, dust cover.
2. $F = kx$ $F = kx$; 1.5 in 1.5 in.
3. $16 \div 20 = 0.8$ in $16 \div 20 = 0.8$ in; $40 \div 20 = 2$ in $40 \div 20 = 2$ in.
4. Each spring tied front-back, side-side and on both diagonals (eight directions); it keeps seats level and long-lasting and is skilled hand work.
5. Compressed springs store energy and can snap upward.
6. $3(44) + 3(40) = 252$ in = 7 yd $3(44) + 3(40) = 252$ in = 7 yd.
7. $\sqrt{884} \approx 29.7$ in 884

 ≈ 29.7 in.
8. Burlap holds padding above springs or webbing; edge roll makes a firm, rounded front edge.
9. 28×26 in 28×26 in; 36 in 36 in (3 ft).
10. About 3 in.
11. \$154 \$154; \$176 \$176; about \$12.57 \$12.57/h.
12. Count the cost before you build; quote materials and hours before starting so you can finish.
13. 72×40 72×40 ; yes.
14. 15.25 in 15.25 in.
15. Drywall alone cannot hold it; it could pull out and fall.
16. Gimp, double welt, decorative nails (braid).
17. Full credit for: Hooke's law and how tied springs divide the load; durability of tied springs vs. foam density; cost and labor; a reasoned choice for each use.

COSTUME DESIGN

Costume is history you can wear. This unit studies how people actually dressed in Bible times, in Rome and the Middle Ages, in Shakespeare's England and in colonial and pioneer America, always as modest, historically sensible dress, and then learns the costume designer's process: read the script, plot the costumes, research, sketch, swatch, budget and schedule.

Costumes in this course are for church plays, Christmas pageants, history days and classic plays, nothing frightening or dark and nothing borrowed from comic books or movie franchises. Measurements are taken over light clothing by a parent and recorded for fit only. The math covers T-tunic drafts, semicircles for togas and cloaks, gores, apron gathering, budgets and backward schedules; the unit project is a design book for a real production that Unit 10 will build.

PREREQUISITES

- Units 2–6: seams, hems, gathering, pin-fitting and patterns
- A real production to design for (pageant, Bible play, history day or classic play)
- Circle measurements (π), area and budgeting

MASTERY CHECKLIST

- ☐ I can describe the basic garments of Bible times, Rome, the Middle Ages, Shakespeare's England and colonial and pioneer America.
- ☐ I can draft a T-tunic from measurements and fit it in muslin.
- ☐ I can calculate and sew a half-circle cloak and measured aprons.
- ☐ I can build a costume plot, budget and backward schedule.
- ☐ I can produce a modest, researched design book for a real production.

OPTIONAL BOOKS AND TOOLS FOR THIS UNIT

- **Colonial Williamsburg: clothing and trades pages:** Free. The foundation's website describes the tailor, milliner and mantua-maker trades and has articles on eighteenth-century dress.
- **Brooklyn Museum: James Tissot, The Life of Jesus Christ:** Free online collection. Hundreds of researched watercolors of Bible-era dress, ideal for pageant research.
- **A string compass (string, pushpin and chalk) and kraft paper:** For drafting circles, cloaks and tunics full size.

Not required. Every project in this unit works with ordinary fabric-store supplies. School Launch has no ties to these authors, publishers or companies.

LESSONS IN THIS UNIT

9.1 Dressing the Bible Story	3 sessions of 50 minutes
9.2 Rome and the Middle Ages	3 sessions of 50–90 minutes
9.3 Renaissance Dress and Shakespeare's Stage	3 sessions of 50–90 minutes
9.4 Colonial and Pioneer America	3 sessions of 50–90 minutes
9.5 The Designer's Process: Script, Plot, Sketch and Budget	3 sessions of 50–90 minutes

9.1 DRESSING THE BIBLE STORY

OBJECTIVES

- Describe the main garments of Bible times (tunic, mantle, girdle, head covering, sandals) and the fibers, weaving and dyes behind them.
- Explain why ancient garments were cut from rectangles of loom-width cloth, and what that means for a costume pattern.
- Research and sketch modest, historically sensible costumes for a Nativity or Bible-story play, and draft a T-tunic from measurements.

Warm-up. List every Bible verse you can remember that mentions a piece of clothing (Joseph's coat, Hannah's little coat, the seamless coat, the shepherd's cloak, Dorcas's garments). For each, write what you imagine it looked like and what it was made of.

WATCH

Lonesome Curator Episode 50 - Making Clothing in First Century Nazareth PT 1

Museum of the Bible • 6:20

<https://www.youtube.com/watch?v=PCsCVwKLTBc>

WHEN TO WATCH

After “The story.” Watch how wool is prepared and spun for first-century clothing, and note the garments and colors she names.

BACKUP VIDEO

1st Century Nazareth Village Comes to Life

Sergio & Rhoda in Israel • 5:47

<https://www.youtube.com/watch?v=CyDylyn-yRE>

A visit to Nazareth Village, a reconstructed first-century farm village, with its weaver, carpenter and shepherd in period dress.

KEY TERMS

tunic (coat)

The basic garment of Bible times: a long shirt of wool or linen, often reaching below the knee, belted at the waist.

girdle

A belt or sash of cloth or leather tied at the waist, which also held up the tunic for work.

loom width

The width of cloth a loom can weave; ancient garments were planned from whole woven pieces with little cutting.

mantle (cloak)

A large rectangular outer garment worn over the tunic by day and used as a blanket at night.

head covering

A cloth worn over the head for modesty, sun and dust; for men often a cloth held by a band.

purple and scarlet

Costly dyes in the ancient world; purple came from sea snails, so purple cloth marked wealth and royalty.

CORE IDEAS

The story. Scripture is full of clothes, and many of them were made by hand at home. Jacob made Joseph a coat of many colours. Hannah made the boy Samuel “a little coat,” bringing it to him “from year to year” at the tabernacle, a new one each year as he grew. At the cross the soldiers cast lots for Jesus’ coat because it “was without seam, woven from the top throughout.” Dorcas was remembered by the widows for “the coats and garments” she made. When you costume a Bible story, you are dressing people whose clothing the Bible itself thought worth mentioning.

How they figured it out. Historians and living-history museums such as Nazareth Village in Israel and the Museum of the Bible reconstruct first-century dress from archaeology (textile fragments from dry caves around the Dead Sea), from carvings and paintings of the period, and from written sources, Scripture among them. The picture they give is practical: a tunic of wool or linen, belted with a girdle; a mantle over it; a head covering against sun and dust; sandals. Most cloth was undyed or dyed in earthy colors; purple and scarlet were costly and marked wealth.

The fabric science. Ancient cloth was woven on looms of fixed width, and weaving took far longer than sewing, so garments were planned from whole rectangles with as little cutting as possible. A tunic might be woven as two long panels joined at the shoulders and sides, or even woven in one piece, as John's Gospel describes. That is good news for a costumer: Bible costumes are rectangles. A **T-tunic** cut from a bedsheet, a mantle that is simply a large rectangle, and a sash or girdle from a strip make a convincing shepherd, Joseph or wise man.

Modesty and dignity. Bible-story costumes are long, covered and dignified: tunics to the ankle or mid-calf, sleeves to the elbow or wrist, head coverings for women. Angels are dressed in simple white garments; animals for a Nativity are suggested with a hood, ears or a felt mask, never as anything frightening. Measurements of people are taken over light clothing by a parent (a mother for a daughter, a father for a son), recorded for fit only and never discussed as good or bad numbers.

Let's sew. This lab is research and design: a research sheet with sources, sketches for a shepherd, Joseph, Mary and a wise man (or the characters of your church's or co-op's play), and a T-tunic draft calculated from one actor's measurements.

PICTURE STUDY



The Return of the Prodigal Son, Rembrandt van Rijn, c. 1668 · Oil on canvas · Hermitage Museum, Saint Petersburg

Image: [Wikimedia Commons](#), public domain

Rembrandt painted Jesus' parable of the lost son near the end of his own life. He tells the story through cloth: the father's rich red mantle wraps the son, whose ragged tunic and broken shoes say everything about where he has been.

Look closely

- Look at the son's clothing. How does Rembrandt show it is worn out?
- Look at the father's mantle. How does it fall over his shoulders and around his son?
- Find the standing figure in red at the right. How is his cloak different from the father's?
- Look at the colors. Where is the warmest color, and why there?

Talk about it

1. Rembrandt dressed Bible figures in clothing partly from his own time and partly imagined. How would you costume this parable for a church play?
2. How could a costumer age the son's tunic so it looks as worn as this (Lesson 10.3)?
3. What does the father's cloak wrapped around his son say without any words?

Safety first. Stage costumes must be safe to move in: hems clear of the floor and stairs, nothing trailing, headwear secure, and no costume near open flame; pageants use battery candles. Measurements of people are taken over light clothing by a parent (a mother for a daughter, a father for a son), recorded for fit only and never discussed as good or bad numbers. Scissors and pins by the usual rules; count pins in and out.

Bible-Story Costume Research and a T-Tunic Draft

Research Bible-era dress from at least three good sources, sketch modest costumes for four characters of a Nativity or Bible-story play, and draft a T-tunic pattern from one actor's measurements.

You will need

- Library books, museum websites and Scripture
- Sketch paper, colored pencils, fabric swatches
- Tape measure, kraft or pattern paper, ruler
- A parent to take the actor's measurements

T-TUNIC PAPER DRAFT

Finished size: One paper pattern for a T-tunic, cut on the shoulder fold · About 45 minutes

Fabric and notions

- Kraft paper or newsprint at least 36 × 60 in (taped together if needed)
- The actor's chest, shoulder-to-hem and wrist-to-wrist measurements
- Ruler, pencil, a plate for the neck curve

How to make it

1. Draw a vertical center line (the center front) and a horizontal shoulder line (the fold).
2. Mark the body width each side of center: half the panel width.
3. Mark the sleeve: from the shoulder line out to half the sleeve span, about 7–8 in deep at the shoulder, tapering to the wrist width.
4. Mark the hem line below the shoulder line at the tunic length, plus hem.
5. Draw the underarm with a gentle curve from sleeve to side.
6. Draw a neck opening: about 7 in wide and a 3-in-deep curve at the front (shallower at the back), or a keyhole slit.
7. Label: grain line, fold, seam allowances, the actor's name and measurements.

Fabric check: No fabric yet. For the costume itself (Unit 10), flat sheets, muslin, linen-look cotton, wool-blend blankets for mantles and cotton gauze for head coverings are all good. Avoid shiny polyester satins for Bible costumes; they read as modern.

Steps

1. Research: three sources (one museum, one book, Scripture); record garments, fibers, colors.
2. Sketch four characters, each with swatch ideas and a one-line reason for each choice.
3. A parent measures the actor over light clothing; record chest, shoulder to hem, wrist to wrist.
4. Draft the T-tunic from the pattern card and check it against the actor's measurements.
5. Estimate fabric and cost for the four costumes.
6. Improve it: one change after showing the sketches to the director or a parent.

Tips

- Earth tones (oatmeal, brown, olive, rust, gray) read as ancient under stage lights.
- A strip of striped fabric as a sash or mantle edge adds authenticity cheaply.
- Children grow: add a deep hem that can be let down next year, as Hannah's coat had to be renewed.

Check your work

- ☐ My research has three sources recorded.
- ☐ My four sketches are modest and historically sensible, with reasons.
- ☐ My T-tunic draft matches the measurements.

LAB NOTEBOOK

1. Paste the research sheet and the four sketches with swatches.
2. Record the actor's measurements (for fit only) and the draft calculations.
3. List the Bible verses about clothing you found, with references.

KEY FORMULAS

$$\text{T-tunic width} = \frac{1}{2}\text{chest} + \text{ease} + 2\text{SA}$$

$$\text{T-tunic width} = 21\text{chest} + \text{ease} + 2\text{SA}$$

$$\text{T-tunic length} = \text{shoulder to hem} + \text{hem allowance}$$

$$\text{T-tunic length} = \text{shoulder to hem} + \text{hem allowance}$$

$$\text{sleeve span (cut on the fold)} = \text{wrist to wrist, arms out} + 2\text{hems}$$

$$\text{sleeve span (cut on the fold)} = \text{wrist to wrist, arms out} + 2\text{hems}$$

From history. Textile fragments preserved in the dry caves near the Dead Sea, including from the Cave of Letters, show that wool and linen tunics of the Roman period were often decorated with simple woven stripes (clavi) running from the shoulders.

WORKED EXAMPLES

Example 1. An actor's chest measures 34 in over light clothing, shoulder to ankle is 54 in, and wrist to wrist with arms out is 60 in. Draft a T-tunic cut on the shoulder fold with 6 in of ease, $\frac{1}{2}$ -in seams and 1-in hems.

Show solution

1. Panel width (front, and the same for the back): $(34 + 6) \div 2 + 2 \times 0.5 = 21$ in $(34 + 6) \div 2 + 2 \times 0.5 = 21$ in.
2. Length from the shoulder fold: $54 + 1 = 55$ in $54 + 1 = 55$ in front and back, so the folded piece is $2 \times 55 = 110$ in $2 \times 55 = 110$ in long.
3. Sleeve span across the fold: $60 + 2 \times 1 = 62$ in $60 + 2 \times 1 = 62$ in for full sleeves; elbow-length sleeves need about 40 in 40 in.

Answer: A T-shape 21 in wide in the body and 110 in long folded at the shoulders. No flat sheet is 110 in long, so cut front and back as two 55-in pieces and seam them at the shoulders: with elbow-length sleeves both 40×55 in pieces fit side by side on a full sheet (81×96 in).

Example 2. A Nativity needs costumes for 4 shepherds, Mary, Joseph and 3 wise men. Thrift-store flat sheets cost \$4 each and one sheet makes one tunic; mantles for 5 people use 1 sheet each; sashes and head coverings come from scraps. Find the cost.

Show solution

1. Tunics: $9 \times \$4 = \36 $9 \times \$4 = \36 .
2. Mantles: $5 \times \$4 = \20 $5 \times \$4 = \20 .
3. Total: \$56, about \$6.22 per character.

Answer: About \$56 for nine characters, about \$6 each.

Example 3. Design reasoning. A director wants Mary in bright royal blue satin with gold trim. Using the research, how would you advise, and what would you suggest instead?

Show solution

1. Ordinary women of Nazareth wore wool or linen in undyed or earthy colors; bright satin and gold suggest a queen, not a carpenter's betrothed.
2. The traditional blue for Mary comes from later Christian art, so a soft, dull blue in a matte cotton or linen honors the tradition while staying sensible.
3. Suggest: a cream or oatmeal tunic, a matte blue mantle and head covering, no shiny trim; dignity from simplicity.

Answer: A matte blue mantle and head covering over a plain tunic: true to the time and to the tradition, and modest.

PRACTICE

1. **Easy** Name the five basic garments of Bible times.

Show answer

Tunic, mantle (cloak), girdle (sash or belt), head covering, sandals.

2. **Easy** What did Hannah make for Samuel every year?

Show answer

A little coat (1 Samuel 2:19).

3. **Easy** Why were purple garments a sign of wealth?

Show answer

Purple dye came from sea snails and was very costly.

4. **Medium** Why are Bible-era garments mostly rectangles?

Show answer

Cloth was woven on fixed-width looms and was precious, so garments were planned from whole pieces with little cutting.

5. **Medium** Chest 30 in, 6 in ease, $\frac{1}{2}$ -in seams: T-tunic panel width?

Show answer

$(30 + 6) \div 2 + 1 = 19$ in $(30 + 6) \div 2 + 1 = 19$ in.

6. **Medium** Shoulder to mid-calf 44 in, 1-in hem: length of the folded tunic piece?

Show answer

$2 \times 45 = 90$ in $2 \times 45 = 90$ in.

7. **Medium** How do historians learn what first-century people wore?

Show answer

Textile fragments found in dry caves, carvings and paintings of the period, and written sources including Scripture.

8. **Hard** A full flat sheet is 81×96 in. Can it make an ankle-length tunic for an actor needing a 110-in folded length and a 62-in sleeve span? Explain a solution.

Show answer

No; neither side is 110 in. Cut front and back separately (each 55 in long) and join them at the shoulders; with elbow-length sleeves both pieces fit side by side across the 81-in width, or cut full-length sleeves separately and seam them on.

9. **Hard** Costumes for 12 characters at \$5.50\$5.50 each, with a \$75\$75 budget. Is it enough? How much is left or short?

Show answer

$12 \times 5.50 = \$66$ $12 \times 5.50 = \$66$; \$9\$9 left.

10. **Hard** Why should Nativity animal costumes be simple (a hood with ears) rather than full masks?

Show answer

Children must see, breathe and move safely; simple pieces suggest the animal without frightening anyone or blocking vision.

11. **Challenge** John 19:23 says Jesus' coat was "without seam, woven from the top throughout." Explain how a garment could be woven without seams on a loom, and what it tells us about its value.

Show answer

It could be woven as a tube or as one shaped piece on the loom, finished without cutting; it took great skill and time, so it was valuable enough that the soldiers cast lots rather than tear it.

COMMON MISTAKES

- Dressing Bible characters in shiny modern satins and costume-shop gold trim.
- Making tunics so long that children trip on stage.
- Discussing measurements as good or bad; they are only numbers for fit.

Make it a game · Costume or Not? A parent reads out costume ideas for a Bible play (a satin cloak with sequins, a striped wool mantle, a plastic crown with jewels, a linen head covering, sneakers, rope sandals). Players call “ancient” or “not” and give a reason. One point for each correct call with a good reason; then design a better version of each “not.”

Scripture. “Moreover his mother made him a little coat, and brought it to him from year to year, when she came up with her husband to offer the yearly sacrifice.” (1 Samuel 2:19, KJV)

Hannah sewed a new coat each year as Samuel grew. A costume made for a child in a church play is the same kind of love, sewn to fit and made again next year.

9.2 ROME AND THE MIDDLE AGES

OBJECTIVES

- Describe Roman dress (tunic, toga, cloak) and medieval dress (tunic, surcoat, mantle, hood) and how each was cut and worn.
- Calculate the cloth in a toga or a gored medieval tunic using the geometry of semicircles and triangles.
- Sew a muslin T-tunic from the Lesson 9.1 draft and fit it as the base for a Roman, medieval or Bible costume.

Warm-up. Take a twin flat sheet and try to wrap yourself in it like a Roman toga over your clothes, with nothing but your hands. How long does it stay put? What would make it easier?

WATCH

How to Wear a Toga the Ancient Roman Way.

[The Getty \(archived\)](#) · 3:59

https://www.youtube.com/watch?v=BQYloC_QcWY

WHEN TO WATCH

After “The fabric science.” Watch twice: once for the shape of the cloth laid flat, once for each step of the draping. Note how the toga goes over a tunic.

KEY TERMS

tunica

The Roman tunic, a T-shaped wool or linen garment belted at the waist, worn by nearly everyone.

sagum / paenula

Roman cloaks: a rectangular cloak pinned at the shoulder, and a hooded cloak like a poncho.

gores

Triangular panels set into seams to widen a garment's skirt without adding width at the shoulders.

toga

The Roman citizen's formal garment: a very large piece of wool with a curved edge, draped over the tunic.

surcoat

A medieval outer tunic, often sleeveless, worn over the main tunic.

hood (chaperon)

A medieval hood, often with a short shoulder piece and a long tail.

CORE IDEAS

The story. A Roman citizen dressed for public life by wrapping himself in a **toga**: a great piece of white wool, many feet long, with one curved edge, draped over his tunic and around his body and left arm with careful folds. Museums such as the Getty have reconstructed how it was worn from statues and writings. The toga was formal wear, awkward for work; laborers, soldiers and travelers wore the tunic with a cloak. The soldiers at the cross and the centurion of Acts 10 would have worn wool tunics, belts and cloaks, which is what a church Easter play needs.

How they figured it out. Medieval clothing in Europe kept the tunic but learned to shape it. Tailors and housewives set triangular **gores** into the side, front and back seams so a tunic could be narrow at the shoulders and full at the hem, letting the wearer walk and ride. Over the tunic came a surcoat or a mantle, and a hood with a short shoulder piece for weather. All of it was still cut from rectangles and triangles, so very little precious cloth was wasted.

The fabric science. Wool dominated both worlds: warm, water-resistant, dyeable and drapery. A toga's heavy wool held its folds by its own weight. For the stage, cotton sheeting is too light to drape like wool; a heavier cotton, a wool-blend blanket or flannel hangs far better. Gores work by geometry: each triangle adds width at its base and nothing at its tip.

The math. A semicircle of radius r has area $\frac{1}{2}\pi r^2$ and its curved edge is πr . Each of the gores adds its base width b to the hem; four gores add $4b$.

Let's sew. In the lab you will cut and sew a muslin T-tunic from your Lesson 9.1 draft, fit it on the actor, and plan how it becomes a Roman, medieval or Bible costume with a cloak, belt or surcoat.

PICTURE STUDY



Marble statue of a togatus (man wearing a toga), Roman sculptor, 1st century A.D. · Marble · The Metropolitan Museum of Art, New York
Image: [Wikimedia Commons](#), public domain

Roman sculptors carved citizens in their togas so carefully that historians use statues like this to work out how the garment was folded. The head is lost, but the cloth tells the story.

Look closely

- Follow the deep curved fold across the chest. Where does it start and end?
- Find where the toga falls straight to the feet. How many layers can you count?
- Look for the tunic underneath. Where does it show?
- Compare the weight of these folds with a bedsheet. What does that tell you about the fabric?

Talk about it

1. Why would a sculptor take such care over cloth?
2. How would you suggest this toga on stage with a cheaper fabric?
3. What does the toga tell you about the man's place in Roman society?

Safety first. Stage costumes must be safe to move in: hems clear of the floor and stairs, nothing trailing, headwear secure, and no costume near open flame; pageants use battery candles. Measurements of people are taken over light clothing by a parent (a mother for a daughter, a father for a son), recorded for fit only and never discussed as good or bad numbers. Prop armor and staffs are made of craft foam or cardboard, never with sharp edges or points. Count pins in and out of the muslin fitting.

STUDIO LAB

A Muslin T-Tunic, Fitted

Cut and sew a muslin T-tunic from your Lesson 9.1 draft, fit it on the actor over light clothing, mark changes, and plan how it becomes a Roman, medieval or Bible costume.

You will need

- Muslin or an old sheet
- The T-tunic paper draft
- Machine, pins, chalk, shears
- A parent for the fitting

MUSLIN T-TUNIC FITTING SHELL

Finished size: One fitting tunic for the measured actor · About 2 hours

Fabric and notions

- Muslin long enough for front and back (or cut on the shoulder fold)
- Thread
- Optional: 2 or 4 muslin gores for a medieval version

How to make it

1. Fold the muslin at the shoulder line; pin the draft on with the grain line straight; cut, adding ½-in seams at the sides and underarms.
2. Cut the neck opening a little small; it can be enlarged at the fitting.
3. For a medieval version, slash the side seams from the hem up 30 in and set in gores.
4. Sew the side and underarm seams in one pass each side, pivoting at the underarm; clip the curve.
5. Baste the hem and sleeve hems up; do not finish them yet.
6. Fit on the actor over light clothing: check neck, sleeve length, hem length (ankle or mid-calf), ease for walking and kneeling; mark changes with chalk.
7. Transfer the changes to the paper draft.

Fabric check: Muslin or a sheet is right for a fitting shell. The final costume (Unit 10) can be made in heavier cotton, linen-look cotton, or wool-blend for cloaks.

Steps

1. Calculate any gores or toga cloth you plan to add.
2. Sew and fit the shell from the pattern card, with the parent present.
3. Ask the actor to walk, sit, kneel and raise their arms; record what binds or trips.
4. Correct the draft; photograph the fitted shell.
5. Plan the full costume: list the additional pieces (cloak, belt, surcoat, head covering) and their fabrics and costs.
6. Clean up: pins counted, machine unplugged.
7. Improve it: one change.

Tips

- Mark the actor's name on every pattern piece.
- Leave a deep hem for growing actors.
- A tunic should let the actor kneel and climb stairs without lifting it.

Check your work

- ☐ My shell fits the actor with room to move and kneel.
- ☐ My changes are transferred to the draft.
- ☐ I have a full costume plan with costs.

LAB NOTEBOOK

1. Paste the toga and gores calculations.
2. Photograph and label the fitted shell with the changes.
3. Sketch the finished Roman, medieval or Bible costume built on the tunic.

KEY FORMULAS

$$A_{\text{semicircle}} = \frac{1}{2}\pi r^2$$

$$A_{\text{semicircle}} = 21\pi r^2$$

$$\text{hem circumference} = 2W + n \times b \quad (n \text{ gores of base } b)$$

$$\text{hem circumference} = 2W + n \times b \quad (n \text{ gores of base } b)$$

$$\text{arc length of a semicircle} = \pi r$$

$$\text{arc length of a semicircle} = \pi r$$

From history. Medieval tailors grew so skilled at shaping cloth with gores and curved seams that by the fourteenth century clothes began fitting the body closely, the beginning of tailoring as Unit 8 of Textile Science describes it.

WORKED EXAMPLES

Example 1. A stage toga is cut as a semicircle of radius 60 in (5 ft). Find its curved edge and its area in square yards.

Show solution

1. Curved edge: $\pi \times 60 \approx 188.5 \text{ in} \approx 15.7 \text{ ft}$; $\pi \times 60 \approx 188.5 \text{ in} \approx 15.7 \text{ ft}$.
2. Area: $\frac{1}{2}\pi(60)^2 \approx 5,655 \text{ in}^2$; $21\pi(60)^2 \approx 5,655 \text{ in}^2$; $5,655 \div 1,296 \approx 4.4 \text{ yd}^2$; $5,655 \div 1,296 \approx 4.4 \text{ yd}^2$.

Answer: About 15.7 ft along the curve and 4.4 square yards of cloth.

Example 2. A medieval tunic is 20 in wide front and back at the hem (40 in around) before gores. You add 4 gores, each 12 in at the base. What is the new hem circumference?

Show solution

1. Original: $2 \times 20 = 40 \text{ in}$; $2 \times 20 = 40 \text{ in}$.
2. Gores: $4 \times 12 = 48 \text{ in}$; $4 \times 12 = 48 \text{ in}$.
3. New hem: $40 + 48 = 88 \text{ in}$; $40 + 48 = 88 \text{ in}$.

Answer: 88 in around, more than twice the width, with no change at the shoulders.

Example 3. Can the semicircular toga (radius 60 in) be cut from a 108-in-wide queen sheet 102 in long?

Show solution

1. The semicircle needs $2r = 120 \text{ in}$; $2r = 120 \text{ in}$ along its straight edge and $r = 60 \text{ in}$ deep.
2. The sheet is $108 \times 102 \text{ in}$; 120 in will not fit in either direction.
3. Use radius 51 in instead (straight edge 102 in, depth 51 in), or join two sheets.

Answer: Not at 60 in; a 51-in radius fits the 102-in length, enough for a smaller actor or a child.

PRACTICE

1. Easy Who wore the toga, and what went under it?

Show answer

Roman citizens on formal occasions; a tunic underneath.

2. Easy What are gores?

Show answer

Triangular panels set into seams to widen the hem without widening the shoulders.

3. Easy Name two Roman cloaks.

Show answer

The sagum (rectangular, pinned) and the paenula (hooded, poncho-like).

4. Medium Semicircle radius 48 in: curved edge?

Show answer

$$\pi(48) \approx 150.8 \text{ in} \quad \pi(48) \approx 150.8 \text{ in.}$$

5. Medium Area of that semicircle in square yards?

Show answer

$$\frac{1}{2}\pi(48)^2 \approx 3,619 \text{ in}^2 \approx 2.8 \text{ yd}^2 \quad \frac{1}{2}\pi(48)^2 \approx 3,619 \text{ in}^2 \approx 2.8 \text{ yd}^2.$$

6. Medium Hem 36 in around with 2 gores of 10 in base. New hem?

Show answer

$$56 \text{ in} \quad 56 \text{ in.}$$

7. Medium Why does a heavier fabric make a better stage toga than light sheeting?

Show answer

Its weight holds the folds and drapes like wool; light cotton slides and puffs.

8. Hard A tunic hem must be 80 in around for walking; the body is 18 in wide front and back. How wide a base for each of 4 gores?

Show answer

$$(80 - 36) \div 4 = 11 \text{ in} \quad (80 - 36) \div 4 = 11 \text{ in.}$$

9. Hard Each of the gores is an isosceles triangle 11 in at the base and 30 in tall. Area of fabric in each of the gores, and in all four?

Show answer

$$\frac{1}{2}(11)(30) = 165 \text{ in}^2 \quad \frac{1}{2}(11)(30) = 165 \text{ in}^2; 660 \text{ in}^2 \quad 660 \text{ in}^2.$$

10. Hard A centurion costume for an Easter play: list the garments and safe materials.

Show answer

Wool or wool-look tunic, belt, cloak (sagum) pinned at the shoulder, sandals; a helmet and breastplate of craft foam or cardboard painted, a wooden or foam staff; nothing sharp.

11. Challenge Show that a semicircle of radius r has a curved edge about 1.57 times as long as its straight edge. Why does that matter when hemming a toga?

Show answer

Curved edge πr , straight edge $2r$; ratio $\pi/2 \approx 1.57$. The curved hem is long and on the bias, so it stretches; hem it with a narrow hem or leave the wool's edge unhemmed if it will not fray.

COMMON MISTAKES

- Making the neck opening too big before fitting.
- Using lightweight sheeting for a draped toga.
- Forgetting that actors must kneel, climb and sit in costume.

Make it a game • Drape Race. Each player has a large rectangle of fabric and three minutes to drape it over their clothes as a Roman cloak or mantle that stays in place while they walk across the room and kneel. A parent judges: stays put (2), looks ancient (2), modest and safe to walk in (2). Highest score wins.

9.3 RENAISSANCE DRESS AND SHAKESPEARE'S STAGE

OBJECTIVES

- Describe the layers of Elizabethan and Tudor dress and how Shakespeare's companies used costume.
- Calculate and draft a half-circle cloak, a costume piece useful in many plays.
- Design a costume for a role in a Shakespeare history play or another classic play, with research, sketch and swatches.

Warm-up. Look at the Holbein portrait of Sir Thomas More for this lesson for one full minute. List every layer of clothing you can see, from the shirt at his neck to the outer gown. How many fabrics?

WATCH

Fashion Through History: Episode 4 – Elizabethans

English Heritage • 14:44

<https://www.youtube.com/watch?v=piP8GCOElzU>

WHEN TO WATCH

After “The story.” A historian dresses a costumed interpreter layer by layer in Elizabethan clothing at Kenilworth Castle; list the layers in order.

Note: The first layer shown is a long linen smock with a petticoat, worn fully covered; every layer after it goes over the top.

KEY TERMS

doublet

A close-fitting padded jacket worn by men in the Tudor and Elizabethan periods.

gown

A long, loose outer robe worn by men of standing, often fur-lined.

half-circle cloak

A cloak cut as a half circle, with a small arc removed for the neck.

hose / trunk hose / breeches

Leg coverings: fitted stockings, padded short breeches over them, or knee-length breeches.

ruff

A starched, pleated collar of linen, fashionable in the later 1500s.

costume plot

A chart of which character wears which costume in which scene.

CORE IDEAS

The story. When Shakespeare's plays were first performed, the actors wore mostly the clothing of their own day: doublets, hose, gowns, cloaks and ruffs, made splendid for kings and nobles. Costumes were among an acting company's most valuable property; the surviving papers of the theater owner Philip Henslowe list garments and their costs, and a fine cloak could cost as much as a new play script. A Dutch visitor sketched the Swan playhouse in London in 1596, and his drawing (copied by a friend) is one of our only pictures of an Elizabethan stage, with actors in costume on it.

How they figured it out. With no stage lighting, no scenery to speak of and the audience close on three sides, an Elizabethan company told the audience who a character was by what he wore: a king's robe and crown, a soldier's buff coat, a servant's plain doublet. A few special pieces suggested Romans or foreign princes. Costumers today working on Shakespeare's history plays, such as *Henry V* or *Richard II*, still lean on that principle: silhouette and color tell rank, role and loyalty at a glance.

The fabric science. A Tudor or Elizabethan gentleman dressed in layers, as Holbein's portrait of Thomas More shows: a linen shirt next to the skin, a doublet, hose or breeches, then a gown of velvet or wool with fur at the collar, and a chain of office. Linen next to the skin could be washed; costly outer wools and velvets could not, and were kept clean by the linen beneath. For the stage, cotton velveteen, wool-blend suiting and upholstery remnants give the weight and richness of the period at a fraction of the cost.

The math. A half-circle cloak is a semicircle with a small half circle removed for the neck. The neck edge must equal the neck measurement, and a half circle of radius r has a curved edge of πr , so the neck radius is the neck measurement divided by π . The outer radius is the neck radius plus the cloak's length.

Let's sew. In the lab you will design a costume for a role in a Shakespeare history play or a classic play (a herald, a soldier, a nobleman, Christian in *Pilgrim's Progress*), and draft and sew a half-circle cloak usable for many roles.

PICTURE STUDY



Sir Thomas More, Hans Holbein the Younger, 1527 · Oil on oak panel · The Frick Collection, New York

Image: [Wikimedia Commons](#), public domain

Holbein painted Thomas More, then a royal councillor, with astonishing detail: you can almost feel the velvet and fur. Every layer of his dress says something about who he was: a learned, high-ranking servant of the king.

Look closely

- Count the layers: what is at the neck, at the wrists, on top?
- Look at the red velvet sleeves. How does Holbein show the soft pile and the folds?
- Find the fur collar. Why put fur at the collar?
- Look at the chain. What might it tell a viewer about his office?

Talk about it

1. If you costumed Thomas More for a play, which three pieces would you make first, and in what fabrics?
2. How do the green curtain and the dark gown work together?
3. What would an audience understand about this man from his clothes alone?

Safety first. Stage costumes must be safe to move in: hems clear of the floor and stairs, nothing trailing, headwear secure, and no costume near open flame; pageants use battery candles. Measurements of people are taken over light clothing by a parent (a mother for a daughter, a father for a son), recorded for fit only and never discussed as good or bad numbers. Cutting a large curved cloak: work on the floor or a big table, scissors carried closed, pins counted.

STUDIO LAB

A Classic-Play Costume Design and a Half-Circle Cloak

Design a costume for one role in a Shakespeare history play or another classic play, with research, a rendering and swatches; then draft and sew a half-circle cloak, a piece usable in many productions.

You will need

- Research sources (library, museum websites)
- Sketch paper, colored pencils, swatches
- Fabric for the cloak (wool-blend, heavy cotton, or a blanket) and thread
- String, pencil and a pushpin (as a compass) or a long tape measure

HALF-CIRCLE CLOAK

Finished size: One cloak, about 36 in long from the neck (adjust to your actor) · About 2 hours

Fabric and notions

- About 2½ yd of 54–60 in fabric
- Bias tape or a facing for the neck
- A hook and eye, or two ties, at the neck
- Thread

How to make it

1. Fold the fabric in half lengthwise if needed, or lay it flat, with the cloak's straight edge along one selvage.
2. Mark the center of the straight edge. With string and chalk pinned there, draw the neck arc at the neck radius and the hem arc at the outer radius.
3. Cut along both arcs and the straight edges.
4. Finish the two straight front edges with a narrow double hem.
5. Face or bind the neck edge with bias tape.
6. Hem the curved edge with a narrow hem, easing the fullness, or bind it.
7. Sew a hook and eye or ties at the neck.
8. Try it on the actor: it should clear the floor and not pull at the throat.

Fabric check: Medium to heavy fabric with some drape: wool-blend, flannel, a cotton blanket, velveteen. Heavy wool needs a heavy needle. Avoid stiff fabric (it stands out) and very light fabric (it floats and tangles).

Steps

1. Research the role's period and rank; record three sources.
2. Render the costume in color, front view, with swatches and a one-paragraph explanation.
3. Calculate the cloak (neck radius, outer radius, hem length, fabric).
4. Sew the cloak from the pattern card; fit it on the actor.
5. Add the cloak and costume to a draft costume plot for the play.
6. Clean up: pins counted, scraps saved for trim.
7. Improve it: one change.

Tips

- A string compass gives a true curve; measure the string from the center pin, not from your hand.
- Cut the neck small; it is easy to enlarge.
- A cloak lined in a contrasting color doubles as two costumes.

Check your work

- ☐ My rendering is researched, modest and readable from a distance.
- ☐ My cloak matches its calculation and fits.
- ☐ My costume plot is started.

LAB NOTEBOOK

1. Paste the rendering, swatches and sources.

- Record the cloak calculation and diagram.
- Start the costume plot for the play.

KEY FORMULAS

$$r_{\text{neck}} = \frac{\text{neck measurement}}{\pi}$$

$$r_{\text{neck}} = \pi \text{neck measurement}$$

$$R = r_{\text{neck}} + \text{cloak length}$$

$$\text{hem length} = \pi R$$

From history. The Swan drawing of 1596 survives only as a copy by Arend van Buchel of a sketch by Johannes de Witt, a Dutch visitor; it shows the stage, the gallery above it and three costumed actors in a scene.

WORKED EXAMPLES

Example 1. An actor's neck measures 15 in and the cloak should fall 36 in from the neck. Find the neck radius, the outer radius and the hem length of a half-circle cloak.

Show solution

- Neck radius: the neck opening is a half circle whose arc equals the neck measure, $\pi r = 15$, so
 $r = 15 \div \pi \approx 4.8$ in $r = 15 \div \pi \approx 4.8$ in.
- Outer radius: $R = 4.8 + 36 = 40.8$ in $R = 4.8 + 36 = 40.8$ in.
- Hem: $\pi \times 40.8 \approx 128$ in $\pi \times 40.8 \approx 128$ in.

Answer: Neck radius about $4\frac{3}{4}$ in, outer radius about 41 in, hem about 128 in (add hem and neck allowances).

Example 2. Does that cloak fit on 54-in fabric? On 60-in fabric?

Show solution

- The half circle is $2R \approx 82$ in $2R \approx 82$ in across and $R \approx 41$ in $R \approx 41$ in deep.
- Lay it with its straight edge along the fabric's length: it needs a width of about 41 in (fits both 54 and 60 in) and a length of about 82 in.
- Add 1 in at the hem and neck: buy 84 in $\approx 2\frac{1}{3}$ yd 84 in ≈ 231 yd.

Answer: Yes: about $2\frac{1}{3}$ yd, with the straight edge running down the length of the fabric.

Example 3. Design reasoning. A co-op is staging scenes from *Henry V* with 6 English soldiers and 4 French nobles, and a small budget. How do you make the two sides readable at a glance?

Show solution

- Use silhouette and color: English soldiers in plain, earth-toned tunics or doublets with a red cross badge; French nobles in blue with a gold fleur-de-lis badge and longer gowns or cloaks.
- Reuse the same basic tunic or doublet pattern for everyone; change only the cloaks, badges and hats.
- Make one splendid piece for each king (a robe and crown) and keep the rest simple.

Answer: Two color families with badges, a shared base pattern, and one rich robe per king: clear, cheap and in the spirit of Shakespeare's own company.

PRACTICE

- Easy** Name the layers of an Elizabethan gentleman's dress.

Show answer

Linen shirt, doublet, hose or breeches, gown or cloak, ruff, hat.

2. **Easy** What did Elizabethan actors mostly wear on stage?

Show answer

The clothing of their own day, made splendid for high-ranking characters.

3. **Easy** Why was linen worn next to the skin?

Show answer

It could be washed, protecting the costly outer garments.

4. **Medium** Neck 14 in: neck radius for a half-circle cloak?

Show answer

$$14 \div \pi \approx 4.46 \text{ in} \quad 14 \div \pi \approx 4.46 \text{ in.}$$

5. **Medium** Neck radius 4.5 in, cloak length 30 in: outer radius and hem length?

Show answer

$$R = 34.5 \quad R = 34.5; \pi(34.5) \approx 108.4 \text{ in} \quad \pi(34.5) \approx 108.4 \text{ in.}$$

6. **Medium** What is a costume plot?

Show answer

A chart of which character wears which costume in which scene.

7. **Medium** How did Elizabethan audiences recognize rank without programs or lights?

Show answer

By costume: silhouette, color, richness of fabric, and special pieces like a king's robe and crown.

8. **Hard** A child's cloak: neck 12 in, length 24 in. Fabric needed (straight edge along the length, 1 in allowances)?

Show answer

$$r \approx 3.8, R \approx 27.8 \quad r \approx 3.8, R \approx 27.8; \text{about } 57 \text{ in long} \times 29 \text{ in wide: about } 1\frac{5}{8} \text{ yd.}$$

9. **Hard** Ten soldier cloaks for a play, each $2\frac{1}{3}$ yd at \$6\$6/yd. Cost?

Show answer

$$10 \times 2.33 \times 6 \approx \$140 \quad 10 \times 2.33 \times 6 \approx \$140.$$

10. **Hard** Why might a costumer use upholstery remnants for Elizabethan nobles?

Show answer

They have the weight, pattern and richness of period brocades and velvets at low cost.

11. **Challenge** Prove the neck-radius formula: if the cloak's neck edge is a half circle whose arc must equal the neck measurement N , show $r = N/\pi$.

Show answer

A half circle of radius r has arc πr ; setting $\pi r = N$ gives $r = N/\pi$. (The cloak's neck edge wraps the whole neck because the two straight edges meet at the front.)

COMMON MISTAKES

- Using the neck circumference as the neck radius.
- Choosing costume fabric by how it looks close up instead of from the back of the room.
- Making a cloak so long it drags on stairs.

Make it a game · Who Is It? Show a parent three quick costume sketches (a king, a soldier, a servant) with no labels. They have five seconds each to name the role from silhouette and color alone. Each correct guess scores the designer a point; redesign any sketch that failed and try again.

9.4 COLONIAL AND PIONEER AMERICA

OBJECTIVES

- Describe the clothing of colonial and pioneer Americans and the trades that made it (tailor, milliner, mantua-maker, home sewing).
- Research and design a modest, historically sensible costume for a history day or living-history event.
- Make a colonial apron and neckerchief (or a tradesman's work apron) from measured rectangles.

Warm-up. Name three people from early American history you might portray on a history day. For each, write one garment you are sure they wore and one you would need to research.

WATCH

18th-Century Tailoring in Colonial Williamsburg

Colonial Williamsburg • 6:45

<https://www.youtube.com/watch?v=J0mM5lsnC-c>

WHEN TO WATCH

After “The story.” Watch the tailors cut and sew; note which garments they make and which tools you also own.

KEY TERMS

tailor

In the 1700s, the tradesman who made men's coats, waistcoats and breeches, and women's riding habits.

mantua-maker

A dressmaker who made women's gowns.

short gown, petticoat and apron

A working woman's jacket-like top, full skirt and apron, with a neckerchief at the neck.

milliner

A shopkeeper and maker who sold fabrics and accessories and made caps, aprons, cloaks and trimmings.

waistcoat

A vest worn under a man's coat, sometimes alone at work.

sunbonnet

A pioneer woman's cloth bonnet with a deep brim and neck curtain against the sun.

CORE IDEAS

The story. In colonial Williamsburg, Virginia's capital in the 1700s, clothing came from many hands. Tailors cut and sewed men's suits and women's riding habits; milliners sold imported fabrics and made caps, aprons, cloaks and trimmings; mantua-makers made gowns; and households did their own plain sewing, mending and knitting. Today the trades are practiced again at Colonial Williamsburg, where tailors and milliners use the methods of the period. John Singleton Copley's 1768 portrait of Paul Revere, a Boston silversmith, shows a working man in his linen shirt and waistcoat, no coat, at his bench.

How they figured it out. Clothing was expensive in time and cloth, so it was cut thriftily from rectangles, fitted with pleats and drawstrings, mended constantly, and handed down. On the frontier in the 1800s, pioneer families wore sturdy cottons, wool and linsey-woolsey; women wore long-sleeved calico dresses, aprons and sunbonnets; men wore shirts, trousers or overalls, vests and broad hats. Laura Ingalls Wilder's books describe Ma sewing the family's clothes by hand and turning old dresses into new ones.

The fabric science. Linen and cotton for shirts, shifts, aprons and caps because they wash and whiten; wool for coats, waistcoats and petticoats because it is warm and sheds weather. Printed calico became common and cheap in the 1800s (Unit 3's printing story). For a history day, cotton broadcloth, muslin, homespun-look cotton and wool-blend flannel are convincing and affordable.

Modesty and accuracy. Colonial and pioneer women's outer dress covered the arms to the elbow or wrist, the neck with a neckerchief, and the legs to the ankle; men wore long shirts, waistcoats and breeches or trousers. A history-day costume shows the outer garments and needs no historical undergarments at all. Measurements of people are taken over light clothing by a parent (a mother for a daughter, a father for a son), recorded for fit only and never discussed as good or bad numbers.

Let's sew. In the lab you will research and design a history-day costume and make two quick, useful pieces: a gathered apron and a square neckerchief (or a tradesman's bib apron), all from measured rectangles.

PICTURE STUDY



Paul Revere, John Singleton Copley, 1768 · Oil on canvas · Museum of Fine Arts, Boston
Image: [Wikimedia Commons](#), public domain

Copley painted Paul Revere, a Boston silversmith, as a working craftsman: in his shirtsleeves and waistcoat, holding a teapot he had made, his tools beside him. It is one of the best pictures of an eighteenth-century working man's clothes.

Look closely

- Look at the shirt. How full are the sleeves, and how is the neck finished?
- Look at the waistcoat. How does it close, and how long is it?
- Find the tools on the table. What do they tell you about him?
- Look at the reflection in the teapot. How does Copley show polished metal and soft linen differently?

Talk about it

1. If you portrayed Paul Revere on a history day, which garments would you make or find first?
2. Why might Revere have chosen to be painted at work rather than in his best coat?
3. What does this portrait teach a costumer about getting the ordinary details right?

Safety first. Stage costumes must be safe to move in: hems clear of the floor and stairs, nothing trailing, headwear secure, and no costume near open flame; pageants use battery candles. Measurements of people are taken over light clothing by a parent (a mother for a daughter, a father for a son), recorded for fit only and never discussed as good or bad numbers. Iron hems and waistbands with the iron upright between presses and unplugged at the end; count pins.

STUDIO LAB

History-Day Design, Apron and Neckerchief

Research and design a colonial or pioneer costume for a history day or living-history event, and make a gathered apron and a neckerchief (or a tradesman's bib apron) from measured rectangles.

You will need

- Research sources (Colonial Williamsburg website, library books)
- Cotton or linen-look fabric (about 1½ yd), thread
- Machine, iron, pins, tape measure

GATHERED COLONIAL APRON AND NECKERCHIEF

Finished size: One apron and one neckerchief for the measured actor · About 2 hours

Fabric and notions

- Apron panel 32 × 30 in (width × length, adjust)
- Waistband/tie strip 68 × 4 in (pieced if needed)
- Neckerchief square 30 × 30 in, in white or a small check
- Thread

How to make it

1. Hem the apron's sides with narrow double hems and its bottom with a 2-in hem.
2. Run two rows of long gathering stitches along the top.
3. Fold and press the waistband strip in half lengthwise and press the raw edges in.
4. Mark the waistband's center and the points 7 in each side (for a half-waist apron on a 28-in waist).
5. Gather the apron to fit between the marks and sandwich it in the waistband; topstitch the whole band and ties closed.
6. Neckerchief: hem all four edges with a narrow rolled or double hem.
7. Fold the neckerchief on the diagonal and try the outfit on the actor over a modest dress or shirt.

Fabric check: Linen, linen-look cotton, cotton broadcloth or a small check are right for colonial aprons; calico for pioneer aprons. Avoid shiny or stretch fabrics. Prewash so the apron can be washed after an outdoor event.

Steps

1. Research the character and period; record three sources.
2. Sketch the full costume with swatches and a cost estimate.
3. Make the apron and neckerchief (or bib apron) from the pattern card.
4. Dress the actor in the pieces you have and photograph the costume.
5. List what is still needed and where to find it (thrift shop, sewing in Unit 10).
6. Clean up: pins counted, iron unplugged.
7. Improve it: one change.

Tips

- Hand-finished hems look more authentic for living history; machine hems are fine for a stage.
- A child's apron can be cut from a pillowcase.
- Ties should be long enough to wrap and tie in front, as many period aprons did.

Check your work

- ☐ My design is researched, modest and historically sensible.
- ☐ My apron and neckerchief match their measurements.
- ☐ I have a plan for the rest of the costume.

LAB NOTEBOOK

1. Paste the research and the design sketch.
2. Record the apron and neckerchief math.
3. Photograph the actor in the pieces.

KEY FORMULAS

apron width = waist $\times$ gather ratio

apron width = waist $\times$ gather ratio

tie length = waist + 2 $\times$ tie tail

tie length = waist + 2 $\times$ tie tail

diagonal of a square = $s\sqrt{2}$

diagonal of a square = $s\sqrt{2}$

$\sqrt{\quad}$

From history. Many colonial women's gowns were cut and fitted by mantua-makers on the customer, pinned and stitched to her shape, an early form of the pin-fitting you practiced in Unit 6.

WORKED EXAMPLES

Example 1. A colonial apron covers the front from side to side and is gathered at 1.5 $\times$ onto a waistband. The actor's waist (over clothes) is 28 in and the apron should reach halfway around. How wide is the apron panel?

Show solution

1. Halfway around: $28 \div 2 = 14$ in $28 \div 2 = 14$ in.
2. Gathered at 1.5 $\times$: $14 \times 1.5 = 21$ in $14 \times 1.5 = 21$ in; for fuller coverage aprons were often wider, so use about 30 in 30 in (about 2 $\times$).
3. Add 1-in side hems: 32 in 32 in.

Answer: A panel about 32 in wide before hemming.

Example 2. The waistband with ties: 28-in waist, ties to tie a bow at the back with 20-in tails. How long a strip?

Show solution

1. Length: $28 + 2 \times 20 = 68$ in $28 + 2 \times 20 = 68$ in.
2. Cut 4 in wide (folds to 1 $\frac{3}{4}$ in finished).

Answer: A strip about 68 $\times$ 4 in (pieced if needed).

Example 3. A neckerchief is a 30-in square folded on the diagonal. How long is the folded edge, and how much fabric for three neckerchiefs from 45-in-wide cotton?

Show solution

1. Diagonal:
 $30\sqrt{2} \approx 42.4$ in $30\sqrt{2}$
2. On 45-in fabric only one 30-in square fits across each row, leaving a 15-in strip: three rows take
 $3 \times 30 = 90$ in = 2.5 yd $3 \times 30 = 90$ in = 2.5 yd.
3. The three 15 $\times$ 30 in strips left beside the squares make the apron ties and waistband.

Answer: Folded edge about 42 in; three neckerchiefs take 2 $\frac{1}{2}$ yd of 45-in cotton, with strips left for ties.

PRACTICE

1. **Easy** What did a milliner make and sell in the 1700s?

Show answer

Fabrics and accessories, and caps, aprons, cloaks and trimmings.

2. **Easy** Name three garments of a pioneer woman.

Show answer

Long-sleeved calico dress, apron, sunbonnet (shawl, wool petticoat).

3. **Easy** Why were shirts and caps made of linen or cotton?

Show answer

They could be washed and whitened.

4. **Medium** Waist 32 in, apron covers half, gathered 2×. Panel width before hems?

Show answer

32 in 32 in.

5. **Medium** Waistband for a 32-in waist with 18-in tails?

Show answer

68 in 68 in.

6. **Medium** Diagonal of a 27-in square?

Show answer

$27\sqrt{2} \approx 38.2$ in 27×2
 $\sqrt{\quad}$
 ≈ 38.2 in.

7. **Medium** What does Copley's portrait of Paul Revere show about working dress?

Show answer

A craftsman at work in his linen shirt and waistcoat, without a coat.

8. **Hard** A history-day costume: muslin shirt 2 yd at \$4\$4, wool-blend waistcoat $\frac{3}{4}$ yd at \$12\$12, breeches $1\frac{1}{2}$ yd at \$8\$8, buttons \$5\$5. Cost?

Show answer

$8 + 9 + 12 + 5 = \$34$ $8 + 9 + 12 + 5 = \$34$.

9. **Hard** Why does a history-day costume not need historical undergarments?

Show answer

Only outer garments are seen; modern modest underlayers serve, and the costume stays simple and decent.

10. **Hard** A tradesman's bib apron: 24 in wide, 34 in from chest to knee, 1-in hems all round, neck strap 24 in, ties 2×30 in. Fabric pieces?

Show answer

Body 26×36 in 26×36 in; neck strap and ties from strips, about 84 in of 3-in strip.

11. **Challenge** Plan a history-day costume for Laura Ingalls as a girl on the prairie, citing what her books describe, and give a budget.

Show answer

Long-sleeved calico dress (or skirt and blouse) to the ankle, apron, sunbonnet, wool shawl, sturdy shoes; about 3–4 yd of calico, 1 yd for apron and bonnet; total perhaps \$25–40 with thrift finds.

COMMON MISTAKES

- Costume-shop “colonial” outfits with low necklines and short skirts; real outer dress covered the neck, arms and legs.
- Shiny polyester for period linen.
- Forgetting that ties need tails long enough to bow.

Make it a game · Period Detective. A parent shows three pictures of people in costume (a museum portrait, a living-history photo, and a costume-shop catalog image). Players list three details that are accurate or inaccurate in each. One point per well-defended observation; double points for spotting a modesty problem in a costume-shop outfit and proposing the fix.

9.5 THE DESIGNER'S PROCESS: SCRIPT, PLOT, SKETCH AND BUDGET

OBJECTIVES

- Follow the costume designer's process from reading the script to the dress parade.
- Build a costume plot and a budget for a real play, pageant or history day, and schedule the work backward from opening night.
- Assemble a design book with research, renderings, swatches, measurements and costs as the Unit 9 project.

Warm-up. Read a short Bible passage that could be staged (Luke 2:1-20, the Christmas story, works well). List every character who appears, every scene or place, and how many costume changes, if any, each would need.

WATCH

Entrance/Exit Breakdowns & Costume Plots | The (Almost) Complete Guide to Stage Management #16

Half Hour Call • 7:41

<https://www.youtube.com/watch?v=gA7YhmLvHfA>

WHEN TO WATCH

Before you build your costume plot. Pause on each spreadsheet and copy its column headings into your design book.

BACKUP VIDEO

The Costume Design Process

Mason Alexander Stanley • 8:52

<https://www.youtube.com/watch?v=4vk9DhWx2-0>

A working costume designer explains the stages from script to stage.

KEY TERMS

script analysis

Reading the script to list characters, scenes, time, place, season and any clothing the text requires.

rendering

A colored drawing of a costume design, usually with swatches attached.

quick change

A costume change that must happen in very little time offstage.

costume plot

A chart with characters down one side and scenes across, showing what each wears in each scene.

dress parade

Showing every costume on its actor under the lights before dress rehearsal, to check fit and look.

backward schedule

A schedule made by starting from the opening date and counting back the time each task needs.

CORE IDEAS

The story. The French painter James Tissot decided in the 1880s to paint the whole life of Christ, and he resolved to get the clothes, buildings and landscapes right. He traveled to Palestine several times from 1886 on, sketching people, garments and places, and spent years on about 350 watercolors, first shown in Paris in 1894; the Brooklyn Museum bought the series in 1900. His Magi, in this lesson's picture, ride through a real Judean landscape in mantles and headdresses he had studied. That is the costume designer's process in one man's life: research first, then design.

How they figured it out. Theater costume designers work in a fixed order because a production has a fixed deadline. They **read the script** and list every character, scene and requirement; build a **costume plot** showing who wears what in each scene and where the quick changes are; **research**; **sketch and render**; choose **swatches**; write a **budget**; take **measurements**; build or find each costume; hold **fittings**; and finally a **dress parade**. Every step serves the story and the actors.

The fabric science. Stage costumes are seen from a distance under strong light: texture and color read, fine detail does not. Matte fabrics photograph and light better than shiny ones; mid-tones read better than pure white or black; a bold trim reads where a tiny

print vanishes. Costumes must survive many wearings, fast changes and washing between performances, so seams are strong, closures are quick, and fabrics are durable.

The math. The costume plot counts costumes and changes; the budget divides money across characters; the backward schedule counts weeks from opening night. Measurements of people are taken over light clothing by a parent (a mother for a daughter, a father for a son), recorded for fit only and never discussed as good or bad numbers.

Let's sew. This lab is the Unit 9 project: a complete design book for a real production your family, church or co-op will stage, a Christmas pageant, a Bible-story play, a history day or a classic play, ready for Unit 10's construction.

PICTURE STUDY



The Magi Journeying, James Tissot, 1886–1894 · Opaque watercolor over graphite on gray wove paper · Brooklyn Museum, New York
Image: [Wikimedia Commons](#), public domain

Tissot painted this as part of his life of Christ, after traveling in the Holy Land to study its people and landscapes. His wise men are not storybook kings in velvet but travelers dressed for a long desert journey.

Look closely

- Look at the wise men's garments. How do they protect against sun and dust?
- Find the colors. Which three colors mark the three riders?
- Look at the caravan behind them. How are the servants dressed differently?
- Look at the landscape. How does it help explain the clothing?

Talk about it

1. How would you adapt Tissot's wise men for a church pageant with a small budget?
2. What did Tissot gain by traveling and researching before he painted?
3. How would you make the three wise men easy to tell apart from the back of the church?

Safety first. Stage costumes must be safe to move in: hems clear of the floor and stairs, nothing trailing, headwear secure, and no costume near open flame; pageants use battery candles. Measurements of people are taken over light clothing by a parent (a mother for a daughter, a father for a son), recorded for fit only and never discussed as good or bad numbers. Fittings are done with the actor fully dressed, by or in the presence of a parent: a father for a son, a mother for a daughter.

STUDIO LAB

The Production Design Book

Assemble a complete design book for a real production: script analysis, costume plot, research, renderings with swatches, measurement cards, a budget and a backward schedule, ready for construction in Unit 10.

You will need

- A binder or sketchbook
- The script or passage
- Research sources, colored pencils, swatches
- Measurement cards, calculator

COSTUME PLOT CHART

Finished size: One plot for the whole production · About 1 hour

Fabric and notions

- A large sheet of graph paper or a spreadsheet
- The character list and scene list from your script analysis

How to make it

1. List characters down the left side, in order of appearance.
2. List scenes across the top.
3. In each box, write the costume (A, B, C) the character wears, or leave it blank if offstage.
4. Mark every change between scenes and how much time it allows.
5. Total the number of distinct costumes and pieces.
6. Add a column for the actor's name and a column for the status (found, to build, fitted, done).

Fabric check: No fabric; swatches go in the renderings. Choose matte, durable, washable fabrics in mid-tones for most stage costumes.

Steps

1. Script analysis: characters, scenes, requirements; write it up.
2. Make the costume plot from the pattern card.
3. Research and render each principal costume in color with swatches; chorus costumes may share one rendering.
4. Measurement cards for each actor, taken over light clothing by parents, for fit only.
5. Budget with a reserve, and a backward schedule from opening night.
6. Present the book to the director (or parent) and record changes.
7. Improve it: one change after the presentation.

Tips

- Use one color family per group (shepherds, wise men, angels) so the stage reads clearly.
- Plan to reuse costumes: a church's costume closet grows every year.
- Label everything with the actor's name from the start.

Check your work

- ☐ My plot covers every character and scene.
- ☐ Renderings are researched, modest and readable.
- ☐ Budget and schedule are realistic and approved.

LAB NOTEBOOK

1. The design book is the notebook for this lesson; add a contents page.
2. Record the director's feedback and your changes.
3. Write a one-paragraph statement of the design idea.

KEY FORMULAS

$$\text{costumes needed} = \sum (\text{distinct looks per character})$$
$$\text{costumes needed} = \sum (\text{distinct looks per character})$$
$$\text{budget per costume} = \frac{\text{total budget} - \text{reserve}}{\text{number of costumes}}$$
$$\text{budget per costume} = \text{number of costumes} \times \text{total budget} - \text{reserve}$$
$$\text{start date} = \text{opening date} - \text{total weeks of work}$$
$$\text{start date} = \text{opening date} - \text{total weeks of work}$$

From history. Tissot's Life of Christ watercolors drew large crowds when exhibited in Paris, London and American cities in the 1890s, and many Bible illustrations of the twentieth century followed his researched style of dress.

WORKED EXAMPLES

Example 1. A Christmas pageant has 4 shepherds, 3 wise men, Mary, Joseph, an innkeeper, 6 angels and 2 sheep (children). The angels also appear later as choir members in their own clothes. How many costumes?

Show solution

1. Count: $4 + 3 + 1 + 1 + 1 + 6 + 2 = 18$ costumes.
2. No character changes, so 18 looks; the angels' later choir scene uses no costume.

Answer: 18 costumes.

Example 2. The budget is \$180 with a 10% reserve. Find the budget per costume, and suggest how to divide it more wisely.

Show solution

1. Reserve: \$18; spendable \$162.
2. Even split: $\$162 \div 18 = \9 each.
3. Wiser: simple shepherd and angel costumes from sheets at about \$5 (10 costumes, \$50), leaving \$112 for the 8 principal and wise-men costumes, about \$14 each.

Answer: \$9 each on an even split; better to spend about \$5 on the chorus and about \$14 on the principals.

Example 3. Opening night is December 20. Tasks: research and design 2 weeks, approvals 1 week, measuring 1 week, construction 5 weeks, fittings and fixes 1 week, dress parade 1 week before opening. When must design begin?

Show solution

1. Total: $2 + 1 + 1 + 5 + 1 + 1 = 11$ weeks.
2. Count back 11 weeks from December 20: about October 4.

Answer: Begin by about the first week of October.

PRACTICE

1. Easy List the steps of the costume designer's process.

Show answer

Script analysis, costume plot, research, sketches and renderings, swatches, budget, measurements, build or find, fittings, dress parade.

2. Easy What is a costume plot?

Show answer

A chart of characters and scenes showing what each character wears in each scene.

3. **Easy** Why do matte fabrics often suit the stage better than shiny ones?

Show answer

They light evenly; shiny fabrics glare and look cheap under strong light.

4. **Medium** A play has 12 characters; 3 change once. How many costumes?

Show answer

15.

5. **Medium** Budget \$240\$240, 10% reserve, 15 costumes. Per costume?

Show answer

$\$216 \div 15 = \14.40 $\$216 \div 15 = \14.40 .

6. **Medium** Opening March 15; 9 weeks of work. Start?

Show answer

About January 11.

7. **Medium** What did James Tissot do before painting the life of Christ?

Show answer

Traveled to Palestine to sketch the people, clothing and landscape, researching for years.

8. **Hard** A quick change allows 45 seconds. Name three construction choices that make it possible.

Show answer

Hook-and-loop or magnetic closures instead of buttons, a pre-set second costume, layered pieces (a cloak over a tunic), elastic waists, a dresser to help.

9. **Hard** Divide \$300\$300 (10% reserve) between 6 principals at twice the chorus rate and 12 chorus members. Rates?

Show answer

Spendable \$270\$270; $6(2x) + 12x = 24x = 270$ $6(2x) + 12x = 24x = 270$, $x = \$11.25$ $x = \$11.25$ chorus, \$22.50\$22.50 principals.

10. **Hard** Why are measurements recorded only for fit, and taken over light clothing by a parent?

Show answer

To protect modesty and dignity; the numbers serve the costume, never comparison or comment.

11. **Challenge** Write the costume plot for Luke 2:1-20 as a pageant in three scenes (the road to Bethlehem, the shepherds' field, the stable). Include every character and any doubling an actor might do.

Show answer

Answers vary; e.g., Scene 1: Mary, Joseph, innkeeper, travelers; Scene 2: shepherds, angel(s); Scene 3: Mary, Joseph, shepherds, (wise men if included); a traveler could double as a shepherd with a mantle change.

COMMON MISTAKES

- Designing the stars and forgetting the chorus.
- Starting construction without a costume plot.
- Leaving no reserve in the budget.

Make it a game · Plot Twist. A parent reads a short scene list and announces a surprise: an actor is ill and another must double two roles. Players race to revise the costume plot so the doubling works, noting the quick change and how it will be managed. Best workable plan wins.

Scripture. "Put on therefore, as the elect of God, holy and beloved, bowels of mercies, kindness, humbleness of mind, meekness, longsuffering;" (Colossians 3:12, KJV)

Paul speaks of character as clothing we put on. A costume designer serves the actors and the story with kindness and humility, putting the production before her own display.

UNIT 9 TEST

Calculators are allowed. Show your work for every calculation: write the formula, substitute with units, and give the answer with its unit. Answer concept questions in complete sentences. The test is worth 100 points.

1. **6 pts**
Name the five basic garments of Bible times and their purposes.
2. **6 pts**
Why were ancient garments mostly rectangles?
3. **7 pts**
Chest 36 in, 6 in ease, ½-in seams: T-tunic panel width? Shoulder to hem 50 in, 1-in hem: folded piece length?
4. **6 pts**
Describe the toga and what was worn under it.
5. **7 pts**
A stage toga is a semicircle of radius 54 in. Curved edge and area in square yards?
6. **6 pts**
A tunic hem is 40 in around; four gores of 9-in base are added. New hem?
7. **6 pts**
Name the layers of an Elizabethan gentleman's dress.
8. **7 pts**
Neck 15 in, cloak length 32 in: neck radius, outer radius, hem length.
9. **6 pts**
What did tailors, milliners and mantua-makers make in colonial Williamsburg?
10. **6 pts**
Waist 30 in; an apron covers half and is gathered at 2×. Panel width before hems? Waistband with 20-in tails?
11. **6 pts**
List the steps of the costume designer's process.
12. **6 pts**
A pageant has 20 costumes; budget \$200\$200 with a 10% reserve. Even budget per costume?
13. **5 pts**
Opening night April 10; 10 weeks of work. Start date?
14. **6 pts**
What rules does this course set for costume subjects and for measuring?
15. **6 pts**
Name three ways stage costumes must be safe.
16. **8 pts**
Short essay (6–10 sentences): Choose one character from your production and explain your design from research to rendering: what you learned, what you chose and why, how it reads from the back of the room, and how it serves the story.

UNIT PROJECT: A PRODUCTION DESIGN BOOK

Create a complete costume design book for a real production (a Christmas pageant, a Bible-story play, a history day or a classic play): script analysis, costume plot, research with sources, color renderings with swatches, measurement cards, budget and backward schedule.

Include the muslin T-tunic fitting, the half-circle cloak and the apron and neckerchief as samples or as the first finished pieces, with photos.

LOOK FOR	WHAT IT MEANS
Research	At least three good sources per period; designs historically sensible.
Design	Modest, readable from a distance, coherent color families, serves the story.
Planning	Complete costume plot, realistic budget with reserve, backward schedule, approvals recorded.
Construction samples	Fitted muslin tunic, cloak and apron made to their calculations.
Care for people	Measurements taken modestly and recorded for fit only; actors' needs (movement, safety) considered.

ANSWER KEY

1. Tunic (main garment), mantle (outer cloak and blanket), girdle (belt), head covering (modesty, sun), sandals.
2. Loom widths were fixed and cloth was precious, so garments were planned from whole woven pieces with little cutting.
3. $(36 + 6) \div 2 + 1 = 22$ in $(36 + 6) \div 2 + 1 = 22$ in; $2 \times 51 = 102$ in $2 \times 51 = 102$ in.
4. A very large piece of wool with a curved edge, draped around the body over a tunic; formal wear of Roman citizens.
5. $\pi(54) \approx 169.6$ in $\pi(54) \approx 169.6$ in; $\frac{1}{2}\pi(54)^2 \approx 4,580$ in² ≈ 3.5 yd² $21\pi(54)2 \approx 4,580$ in² ≈ 3.5 yd².
6. 76 in 76 in.
7. Shirt, doublet, hose or breeches, gown or cloak, ruff, hat.
8. 4.84.8; 36.836.8; $\pi(36.8) \approx 115.6$ in $\pi(36.8) \approx 115.6$ in.
9. Tailors: men's coats, waistcoats, breeches (and riding habits); milliners: caps, aprons, cloaks, trimmings and sold fabrics; mantua-makers: women's gowns.
10. 30 in 30 in; 70 in 70 in.
11. Script analysis, costume plot, research, renderings, swatches, budget, measurements, build or find, fittings, dress parade.
12. \$9\$9.
13. About January 30.
14. Only Bible, historical, pageant and classic-play costumes (nothing frightening or dark, nothing from comic books or movie franchises); measurements over light clothing by a parent (a father for a son, a mother for a daughter), for fit only, never discussed as good or bad.
15. Hems clear of floor and stairs; nothing trailing; secure headwear; no open flame near costumes (battery candles); no sharp props.
16. Full credit for: named sources; specific garment, fabric and color choices with reasons; stage readability; modesty; connection to the story's meaning.

COSTUME CONSTRUCTION AND THE CAPSTONE

The last unit builds what Unit 9 designed. You will adapt commercial patterns for period costumes, rig costumes to change fast and last for years, age them honestly so shepherds look like shepherds, and make the headwear that finishes a costume: mob caps, tricornes and crowns for the wise men.

The year ends with a capstone you choose: a complete costume set for a real pageant, Bible play, history day or classic play, or a complete set of soft furnishings for the room you designed in Unit 1. Either way it is planned, budgeted, logged, presented and given, because sewing in this course is skill, stewardship and service. The math draws on the whole year, from pattern length changes and cost per wear to value scales, circle caps, tricorn arcs, variance and schedules.

PREREQUISITES

- Unit 9's design book, costume plot, measurements and muslin tunic
- All tool sign-offs from earlier units
- π , ratios, percent and budgeting

MASTERY CHECKLIST

- ☐ I can read a pattern envelope and adapt a pattern for size, period and modesty.
- ☐ I can build costumes to last and rig them for quick changes.
- ☐ I can age a costume safely and measurably.
- ☐ I can calculate and make mob caps, crowns and a tricorn.
- ☐ I can plan, build, record, present and give a capstone.

OPTIONAL BOOKS AND TOOLS FOR THIS UNIT

- **Sew-on hook-and-loop tape and large costume hooks and eyes:** For rigging quick changes; buy sew-on, not iron-on, for washable costumes.
- **A printed value scale (0–10 gray steps):** Print or paint one on card to measure aging and dye results.
- **Butterick, McCall's and Simplicity historical costume pattern lines:** The pattern companies' own websites list historical and costume patterns that adapt well for pageants and history days; check every view for modesty before buying.

Not required. Every project in this unit works with ordinary fabric-store supplies. School Launch has no ties to these authors, publishers or companies.

LESSONS IN THIS UNIT

10.1 Adapting Commercial Patterns	3 sessions of 50–90 minutes
10.2 Costumes That Last and Change Fast	3 sessions of 50–90 minutes
10.3 Aging and Distressing: Shepherds Don't Wear New Clothes	3 sessions of 50–90 minutes
10.4 Headwear: Mob Caps, Tricornes and Wise Men's Crowns	3 sessions of 50–90 minutes
10.5 The Capstone: A Costume Set or a Finished Room	3 sessions of 50–90 minutes

10.1 ADAPTING COMMERCIAL PATTERNS

OBJECTIVES

- Tell how Ebenezer Butterick's graded paper patterns brought sized patterns into homes, and read a pattern envelope and guide sheet.
- Choose a size from measurements, blend between sizes, and lengthen, shorten and modify a pattern for a period silhouette and for modesty.
- Adapt a commercial pattern (or your T-tunic) for a costume in your design book and test it in muslin.

Warm-up. Look at a sewing pattern envelope (any pattern in the house, or one online). Find the size chart, the yardage chart, the notions list and the line drawings on the back. What would you need to change to make this garment look like it came from 1850, or from Bible times?

WATCH

Lengthen Or Shorten a Sewing Pattern

[Professor Pincushion](#) · 8:33

<https://www.youtube.com/watch?v=rw2vACmAU-I>

WHEN TO WATCH

After “The fabric science.” Watch how the pattern is cut on the lengthen/shorten line, spread or overlapped evenly, and the side seams redrawn; then practice on a paper copy.

KEY TERMS

graded pattern

A pattern drafted in a range of sizes, each slightly larger or smaller than the next by fixed amounts.

blending sizes

Drawing a smooth line from one size's cutting line to another's where a body falls between sizes.

period silhouette

The overall outline of the clothing of a time: long and loose, fitted and full-skirted, and so on.

lengthen/shorten line

A double line printed on a pattern piece where it can be cut and spread or folded to change its length.

finished garment measurements

The garment's own measurements printed on the pattern; finished minus body = ease.

modesty adaptations

Raising necklines, adding sleeves, lengthening hems and adding facings or linings to a pattern.

CORE IDEAS

The story. In 1863 Ebenezer Butterick, a tailor in Sterling, Massachusetts, began selling paper patterns graded in sizes, first for men's and boys' shirts, then for women's and children's clothes. His wife Ellen is often credited with the idea of a pattern that came in sizes, after she struggled with patterns made to one size. Graded tissue patterns spread through the country by mail, and for the first time a home sewist anywhere could make a well-fitted garment in the newest style from a printed guide.

How they figured it out. Grading works by rules: from one size to the next, the pattern grows by set amounts at the chest, waist, hip and length. Costumers use that system and then bend it. A plain modern pattern with the right bones, a peasant dress, a simple shirt, a robe or a tunic, can become a pioneer dress, a Bible-era tunic or a medieval kirtle by lengthening it, raising the neck, adding fullness or sleeves, and leaving off modern details like zippers and pockets.

The fabric science. Choose the size by the body measurements (taken modestly) and check the **finished garment measurements** for ease (Unit 8 of Textile Science calls this wearing ease and design ease). Lengthen or shorten on the printed lines so the shape stays true: cut, spread or overlap evenly, tape, and redraw the side seams smoothly. Blend between sizes where needed. Every change is tested in a muslin before cutting the costume fabric.

The math. Length changes are measured from the actor (nape to hem, waist to hem) and compared with the pattern's finished length; the difference is the change. Fullness changes: to make a skirt or tunic fuller, slash and spread it, adding the same amount at each slash. Yardage on the envelope changes accordingly: added length $\times$ number of lengths cut.

Let's sew. In the lab you will adapt one pattern for a costume in your Unit 9 design book, make the changes on paper, test them in muslin on the actor, and record every change. Measurements are taken over light clothing by a parent (a father for a son, a mother for a daughter), recorded for fit only and never discussed as good or bad numbers.

PICTURE STUDY



The Cranberry Harvest, Island of Nantucket, Eastman Johnson, 1880 · Oil on canvas · Timken Museum of Art, San Diego

Image: [Wikimedia Commons](#), public domain

Eastman Johnson painted the cranberry harvest on Nantucket, when whole families went into the bogs to pick. His painting is a catalog of practical working dress of the 1870s and 1880s: long skirts, aprons, shawls and sunbonnets, the clothes of a history-day pioneer or harvest scene.

Look closely

- Find three women's outfits. What layers can you see: skirt, apron, shawl, bonnet?
- Look at the sunbonnets. How do they shade the face and neck?
- Find the children. How is their clothing like and unlike the adults'?
- Look at how the women kneel and bend. How must their clothes be cut to allow that?

Talk about it

1. Which commercial pattern shapes would you adapt to costume this scene?
2. How did practical working dress protect from sun, wind and wet?
3. What would you change in a modern pattern to make a harvest costume a child could kneel in?

Safety first. Stage costumes must be safe to move in: hems clear of the floor and stairs, nothing trailing, headwear secure, and no costume near open flame (pageants use battery candles). Measurements are taken over light clothing by a parent (a father for a son, a mother for a daughter), recorded for fit only and never discussed as good or bad numbers. Cutting long muslin pieces: work on the floor or a large table, shears carried closed, pins counted.

STUDIO LAB

Adapt a Pattern for Your Production

Adapt a commercial pattern (or your Unit 9 T-tunic draft) for one costume in your design book: choose the size from measurements, make length, fullness and modesty changes on paper, and test them in muslin on the actor.

You will need

- A commercial pattern suited to the costume (or the T-tunic draft)
- Tracing paper or kraft paper, tape, ruler, curve
- Muslin, machine, pins, chalk
- The actor's measurement card

ADAPTED PATTERN MUSLIN

Finished size: One muslin test of the adapted pattern, for the measured actor · About 3 hours

Fabric and notions

- Traced copies of the pattern pieces in the chosen size (keep the original intact)
- Muslin, about the pattern's yardage plus the added length
- Thread

How to make it

1. Choose the size from the actor's measurements and the finished garment measurements; trace the pieces.
2. Lengthen or shorten on the printed lines: cut, spread or overlap evenly, tape onto paper, redraw the side seams.
3. Add fullness by slashing and spreading if the design needs it.
4. Make the modesty changes: raise the neck, lengthen sleeves, add facings.
5. Remove modern details the period would not have; plan period closures.
6. Cut and sew the muslin with long stitches, leaving hems basted.
7. Fit on the actor over light clothing with a parent present; mark changes; transfer them to the paper pattern.

Fabric check: Muslin for the test. Choose the costume fabric for the period and the stage (Lesson 9.5): matte, durable, washable where possible.

Steps

1. Write the change list with measurements before touching the pattern.
2. Adapt and test from the pattern card.
3. Have the actor walk, kneel, climb a step and raise both arms; record any problems.
4. Correct the pattern and label every piece with the actor, the costume and the changes.
5. Recalculate yardage and update the budget.
6. Clean up: pins counted, original pattern refolded in its envelope.
7. Improve it: one change after the fitting.

Tips

- Trace, never cut, the original pattern; you may need another size next year.
- Mark the adapted pieces in a different color so you know they are changed.
- Write the actor's name and the date on every piece.

Check your work

- ☐ My size choice is justified with ease numbers.
- ☐ My changes are measured, drawn smoothly and tested in muslin.
- ☐ My pattern and yardage are updated.

LAB NOTEBOOK

1. Paste the change list and calculations.
2. Photograph the muslin fitting with the marked changes.
3. Sketch the original pattern view beside your adapted costume.

KEY FORMULAS

$$\text{length change} = \text{desired finished length} - \text{pattern finished length}$$

$$\text{length change} = \text{desired finished length} - \text{pattern finished length}$$

$$\text{ease} = \text{finished garment measurement} - \text{body measurement}$$

$$\text{ease} = \text{finished garment measurement} - \text{body measurement}$$

$$\text{added yardage} \approx \frac{\text{length change} \times \text{lengths in layout}}{36}$$

$$\text{added yardage} \approx 36 \text{length change} \times \text{lengths in layout}$$

From history. Butterick's company was publishing patterns by the millions within a few years, and fashion magazines began printing pattern offers; by the end of the century home pattern companies had made sized patterns an everyday part of family sewing.

WORKED EXAMPLES

Example 1. A pattern's dress finishes 41 in from the back neck to the hem. The actor's nape-to-ankle measurement is 54 in, and the hem should clear the floor by 1 in for safety on stage. How much do you lengthen it?

Show solution

1. Desired finished length: $54 - 1 = 53$ in $54 - 1 = 53$ in.
2. Change: $53 - 41 = 12$ in $53 - 41 = 12$ in.

Answer: Lengthen 12 in: split between the bodice line (if any) and the skirt line so the waist stays in place.

Example 2. The layout on the envelope uses 2 skirt lengths (front and back) and calls for $3\frac{1}{4}$ yd. Estimate the new yardage after adding 12 in to the skirt.

Show solution

1. Added: $2 \times 12 = 24$ in ≈ 0.67 yd $2 \times 12 = 24$ in ≈ 0.67 yd.
2. New total: $3.25 + 0.67 \approx 3.92$ yd $3.25 + 0.67 \approx 3.92$ yd, buy 4 yd.

Answer: About 4 yd.

Example 3. The actor's chest measures 32 in (over light clothing); the pattern's finished chest is 36 in for size 12 and 38 in for size 14. A period look wants about 6 in of ease. Which size?

Show solution

1. Ease in size 12: $36 - 32 = 4$ in $36 - 32 = 4$ in.
2. Ease in size 14: $38 - 32 = 6$ in $38 - 32 = 6$ in.

Answer: Size 14 gives the 6 in of ease the loose period look wants; blend to the 12 at the shoulders if they fit better there.

Example 4. Design reasoning. A plain modern pattern for a peasant blouse has a deep scoop neck and short sleeves. List the changes to make it a modest pioneer or colonial blouse.

Show solution

1. Raise the neckline: redraw it 3–4 in higher, close to the base of the neck, or add a neckerchief.
2. Lengthen the sleeves to the elbow or wrist, with a band or casing.
3. Lengthen the body to tuck well into a long skirt.
4. Leave off modern details (zippers, elastic shirring at the waist) and use a drawstring neck or buttons.

Answer: Higher neck, longer sleeves and body, and period closures: the same pattern becomes a modest costume blouse.

PRACTICE

1. **Easy** Who began selling graded paper patterns, and when?

Show answer

Ebenezer Butterick, 1863 (with his wife Ellen).

2. **Easy** What is a lengthen/shorten line for?

Show answer

Where to cut and spread or fold a pattern piece to change its length without distorting its shape.

3. **Easy** Finished chest 40 in, body 34 in. Ease?

Show answer

6 in.

4. **Medium** Pattern finished length 38 in; desired 50 in. Change?

Show answer

Lengthen 12 in.

5. **Medium** Added length 10 in, 3 lengths in the layout. Extra yardage?

Show answer

$30 \div 36 \approx 0.8330 \div 36 \approx 0.83$ yd.

6. **Medium** Why test changes in muslin first?

Show answer

Cheap fabric shows fit and proportion problems before the costume fabric is cut.

7. **Medium** Name four modesty adaptations a costumer makes to patterns.

Show answer

Raise necklines, add or lengthen sleeves, lengthen hems, add facings, linings or modesty panels.

8. **Hard** Hip falls in size 16, waist in size 12. How do you blend?

Show answer

Draw a smooth line from the size 12 cutting line at the waist to the size 16 line at the hip, on every side seam.

9. **Hard** To make a tunic 16 in fuller at the hem, you slash it in 4 places. How much at each slash?

Show answer

4 in at each slash, at the hem, tapering to nothing at the shoulder.

10. **Hard** Why might Ellen Butterick's idea of sizes have mattered so much to home sewists?

Show answer

One-size patterns had to be refitted by trial; graded sizes let ordinary women cut a close fit from the start.

11. **Challenge** Plan the adaptation of a modern robe pattern into a wise man's costume for a pageant: list every change, the muslin test, and a yardage estimate if the robe gains 10 in of length on 2 lengths and wide sleeves add $\frac{1}{2}$ yd.

Show answer

Lengthen 10 in, widen sleeves, raise and finish the neck with a band, leave off belt loops and pockets, add a sash and trim; muslin test on the actor; yardage = original + $20 \div 36 \approx 0.5620 \div 36 \approx 0.56 + 0.5 \approx$ original + 1.1 yd.

COMMON MISTAKES

- Choosing a pattern size by ready-to-wear size instead of measurements.
- Adding length only at the hem, so the waist or knee falls in the wrong place.
- Cutting up the original pattern instead of a tracing.

Make it a game · Pattern Doctor. A parent shows three pattern envelope pictures (from a catalog or website) and names a costume for each (a shepherd, a pioneer girl, a colonial printer). Players list the changes each pattern needs in one minute. One point per sensible change, two for each modesty fix; the parent judges.

10.2 COSTUMES THAT LAST AND CHANGE FAST

OBJECTIVES

- Explain how theater costume shops build costumes to survive many performances, washes and future actors.
- Plan and rig a quick change with fast closures, layering and a preset, and time it.
- Compare the cost of costumes per performance and per wearer over their life.

Warm-up. Time yourself putting on and fastening a buttoned shirt or a coat with many buttons. Then time a zip-up jacket. Then a pullover. Write the three times. Which would you want if you had 30 seconds offstage?

WATCH

Inside Access: Colonial Williamsburg costumes

13News Now · 2:12

<https://www.youtube.com/watch?v=KjNd9mP2i4A>

WHEN TO WATCH

After “The story.” A short news visit to Colonial Williamsburg's costume department; notice the labels, the racks of stock garments and the fitting.

Note: A brief local-news feature; the lesson's text carries the techniques.

KEY TERMS

costume stock

A theater's or church's stored collection of costumes, reused and altered for new productions.

rigging

Changing a costume's closures or construction so it goes on and off quickly, such as hook-and-loop hidden under false buttons.

dresser

A backstage helper who assists actors with quick changes.

alteration allowance

Extra-wide seam allowances (often 1–2 in) left in costumes so they can be let out for future actors.

preset

Laying out a costume offstage, opened and in order, ready for a quick change.

tiring-house

The Elizabethan theater's dressing room behind the stage, where actors changed.

CORE IDEAS

The story. On the Swan drawing of 1596, behind the stage, is a building labeled *mimorum aedes*, “the actors' house”: the tiring-house where players dressed and changed. Elizabethan companies had a dozen or so actors for plays with many more parts, so actors often played two or three roles and changed costume between scenes. Theaters ever since have needed costumes that change fast and last long. Today Colonial Williamsburg's costume department dresses hundreds of interpreters, fitting, labeling and maintaining every garment so it can be worn day after day and passed to the next person.

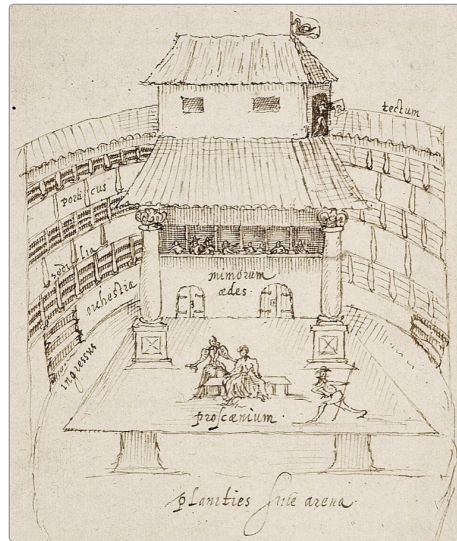
How they figured it out. Costume shops learned to build for the long run: strong seams, reinforced stress points (underarms, crotch seams, waistbands), generous **alteration allowances** so a costume can be let out for a different actor, labels with names and sizes, and washable fabrics wherever the look allows. For speed they **rig** costumes: hidden hook-and-loop or large hooks instead of many buttons, zippers with decorative buttons sewn on top, elastic waists, sewn-together layers that go on in one piece, and a **preset** laid out offstage in the order it goes on.

The fabric science. Repeated wear stresses the same places every night: the underarm seam stretches when arms lift, knees and hems abrade, closures pull. Double-stitching or a second row of stitching inside the seam allowance, bias tape on curved stress seams, and underarm shields extend a costume's life. Hook-and-loop tape is strong in shear (sliding) but peels easily, which is why it suits quick changes; it must be sewn around all four edges.

The math. A costume's cost spread over its life is cost per wear: $\text{cost} \div \text{number of wearings}$. Quick-change planning is a timing problem: the time available offstage must exceed the time the change takes, with a margin.

Let's sew. In the lab you will rig one costume (from your design book) for a quick change, reinforce its stress points, add a label, and time the change with a helper as dresser.

PICTURE STUDY



The Swan Theatre, London, Arend van Buchel, after a sketch by Johannes de Witt, c. 1596 · Pen and ink · Utrecht University Library, Netherlands
Image: [Wikimedia Commons](#), public domain

This copy of a Dutch visitor's 1596 sketch is one of our only views inside a playhouse of Shakespeare's London. The actors entered through the two doors at the back of the stage from the tiring-house, where they dressed and changed.

Look closely

- Find the two doors at the back of the stage. What happened behind them?
- Find the three actors. What can you tell about their costumes from the sketch?
- Look at how close the audience galleries are. What does that mean for costume detail?
- Find the flag on top. Why might a theater fly a flag on performance days?

Talk about it

1. How would an actor playing two roles get from one door, change, and come out the other?
2. Why would costumes be among the company's most valuable property?
3. What would you want in the tiring-house to make quick changes safe and fast?

Safety first. Stage costumes must be safe to move in: hems clear of the floor and stairs, nothing trailing, headwear secure, and no costume near open flame (pageants use battery candles). Quick changes are rehearsed slowly first; nothing is pulled over the head with pins in it; hook-and-loop and closures are checked before every performance. Women dress girls and men dress boys, and modest underlayers (a T-shirt and knee-length shorts worn under costumes) are standard.

STUDIO LAB

Rig, Reinforce and Time a Costume

Choose one costume from your design book, reinforce its stress points, leave alteration allowances, rig it for a quick change, label it, and time the change with a helper as dresser.

You will need

- A costume in progress (tunic, robe, cloak or dress)
- Sew-on hook-and-loop tape, large hooks and eyes, elastic as needed
- Bias tape, twill tape for labels, a permanent marker
- A stopwatch and a helper

RIGGED QUICK-CHANGE ROBE FRONT

Finished size: One robe or tunic front opening rigged for a fast change · About 1–2 hours

Fabric and notions

- Hook-and-loop tape, 1 in wide, the length of the opening
- Decorative buttons (optional, sewn on top for looks)
- Bias tape for underarm reinforcement
- A twill-tape label

How to make it

1. Open the front of the robe (or a back seam) with a placket overlap of at least 1 in.
2. Sew the loop side to the underlap and the hook side to the overlap, stitching around all four edges of each strip.
3. Sew decorative buttons on the overlap if the design shows buttons.
4. Reinforce the underarm seams with a second row of stitching $\frac{1}{8}$ in inside the first, or bias tape over the seam.
5. Leave or let out 1–1½ in allowances at the side seams.
6. Sew a label inside the neck: production, character, actor, size, date.
7. Preset the costume: opened, in order of putting on, on a chair or hook offstage.

Fabric check: Use sew-on (not iron-on) hook-and-loop for costumes that are washed. Choose durable, washable fabrics for costumes that will be worn many times.

Steps

1. List the stress points and the change sequence before sewing.
2. Rig and reinforce from the pattern card.
3. Time three changes with a dresser, slowly first, then at speed; record the times.
4. Compute the margin against the time available in the costume plot.
5. Compute the costume's cost per wear for its expected life.
6. Clean up: pins counted, hook-and-loop scraps saved.
7. Improve it: one change to the rigging.

Tips

- Put hook-and-loop with the hooks facing away from the skin and hair.
- A small loop of tape sewn inside the neck lets the costume hang neatly for presets.
- Practice the change in the dark-ish wings, as it will be done.

Check your work

- ☐ My costume is reinforced, labeled and has let-out room.
- ☐ My quick change is timed with a safe margin.
- ☐ My cost-per-wear is calculated.

LAB NOTEBOOK

1. Draw the rigging plan (where every closure is).
2. Record three timed trials and the margin.
3. Write the label text and the cost per wear.

KEY FORMULAS

$$\text{cost per wear} = \frac{\text{total cost}}{\text{number of wearings}}$$

$$\text{cost per wear} = \frac{\text{total cost}}{\text{number of wearings}}$$

$$\text{margin} = \text{time available} - \text{change time}$$

$$\text{margin} = \text{time available} - \text{change time}$$

$$\text{let-out room} = 2 \times \text{extra allowance per seam} \times \text{number of seams}$$

$$\text{let-out room} = 2 \times \text{extra allowance per seam} \times \text{number of seams}$$

From history. Elizabethan acting companies often bought cast-off clothing of the wealthy for costumes, because the fine fabrics of the court looked splendid on stage and were too costly to buy new.

WORKED EXAMPLES

Example 1. A shepherd costume cost \$14 and will be worn in 3 performances a year by different children for 6 years. Find the cost per wear.

Show solution

1. Wearings: $3 \times 6 = 18$
2. Cost per wear: $\$14 \div 18 \approx \0.78

Answer: About 78¢ a wearing, if it is built to last and to be altered.

Example 2. A tunic has 2 side seams, each with 1½-in allowances instead of the usual ½ in. How much can the tunic be let out around the body?

Show solution

1. Extra per allowance: $1.5 - 0.5 = 1$ in
2. Each seam has two allowances (front and back): $2 \times 1 = 2$ in
3. Two seams: $2 \times 2 = 4$ in

Answer: Up to 4 in larger around, enough for a bigger actor next year.

Example 3. An actor exits at 3:10 into a scene and re-enters at 4:05 in a different costume. The rigged change takes 35 seconds with a dresser. Is there enough time, and what is the margin?

Show solution

1. Time available: $4:05 - 3:10 = 55$ s
2. Margin: $55 - 35 = 20$ s

Answer: Yes, with a 20-second margin; aim for at least 10–15 s.

PRACTICE

1. Easy What is the tiring-house?

Show answer

The Elizabethan theater's dressing room behind the stage.

2. Easy Name three ways to rig a costume for a quick change.

Show answer

Hook-and-loop or hooks instead of buttons, zipper with false buttons, elastic waists, layers sewn together, presets, a dresser.

3. Easy Why label every costume?

Show answer

So it returns to the right actor and production and can be found in stock later.

4. **Medium** A costume costs \$22 and is worn 40 times. Cost per wear?

Show answer

\$0.55

5. **Medium** Four seams with 1-in allowances (normally $\frac{1}{2}$ in). Let-out room?

Show answer

$2 \times 0.5 \times 4 = 4$ in

6. **Medium** Exit at 1:45, re-enter at 2:20; change takes 25 s. Margin?

Show answer

35 s available; margin 10 s.

7. **Medium** Why must hook-and-loop be stitched on all four edges?

Show answer

It peels easily from an edge; stitching all around keeps it from peeling off the costume.

8. **Hard** Which stress points of a tunic would you reinforce, and how?

Show answer

Underarm seams (double stitch, bias tape), neck opening (facing), hem (deep hem), belt area; also any closure points.

9. **Hard** Why do costume shops leave wide allowances even though they use more fabric?

Show answer

So the costume can be altered for future actors, saving the cost of a new one.

10. **Hard** Elizabethan companies doubled roles. How does doubling change the costume plot and the build?

Show answer

More costumes per actor, quick changes between scenes, rigged closures and layered pieces, and careful presets.

11. **Challenge** Design a 30-second change from shepherd to wise man for one actor, with the pieces, rigging, preset and the dresser's steps, and time each step.

Show answer

e.g., shepherd's mantle off (3 s); wise man's robe, rigged with hook-and-loop front, on over the tunic (10 s); sash (5 s); headdress on a preset stand (5 s); gift box handed by dresser (2 s): about 25 s with 5 s margin.

COMMON MISTAKES

- Sewing hook-and-loop on only two edges.
- Rehearsing a quick change for the first time on opening night.
- Trimming costume seam allowances to $\frac{1}{4}$ in, leaving no room to alter.

Make it a game · Fastener Face-Off. Prepare three sample closures on scraps: six buttons, a zipper, and hook-and-loop. Each player opens and closes each one against the clock, wearing gloves to imitate a hurried, clumsy change. Record the times and rank the closures; then argue which one you would choose for a 20-second change and why.

10.3 AGING AND DISTRESSING: SHEPHERDS DON'T WEAR NEW CLOTHES

OBJECTIVES

- Explain why stage costumes are aged and how wear shows on real clothing.
- Age a costume with tea or dye baths, sanding and fraying safely, using a test strip and a controlled method.
- Measure and record color change with a value scale.

Warm-up. Find the most worn piece of clothing in the house (old work jeans, a gardening shirt). Where is it most faded, frayed or stained? Make a list. Those are the places a costumer ages first.

WATCH

HOW ART IS MADE | Dyeing, Distressing, Ageing Costumes

UBCFA - University at Buffalo Center for the Arts · 6:57

https://www.youtube.com/watch?v=MXTUu_stGQs

WHEN TO WATCH

After “The fabric science.” A university costume shop dyes and ages costumes; note the gloves, the vats and how gradually color is added.

KEY TERMS

aging (breaking down)

Making a new costume look worn and lived-in, to suit the character.

value

How light or dark a color is; aging usually lowers value (darkens) at hems, knees and cuffs.

fraying and sanding

Wearing edges and high points with sandpaper or a rasp so they look used.

tea or coffee dye

A gentle household stain that tones down bright white and adds warmth.

test strip

A scrap of the same fabric used to test a dye bath or technique before the costume.

value scale

A strip of gray steps from white to black used to measure lightness.

CORE IDEAS

The story. Luke tells of “shepherds abiding in the field, keeping watch over their flock by night.” Shepherds lived outdoors in all weather; their tunics and mantles would have been sun-faded, dusty at the hems, worn at the elbows and knees, patched and mended. Millet's shepherdess in this lesson's picture wears a cloak worn soft and pale with use. A pageant shepherd in a crisp, bright new bedsheet tells the wrong story. Costume shops age costumes so the clothes speak for the character.

How they figured it out. Theater and film costume shops studied how real clothes wear: light fades the shoulders and the top of the head covering first; dirt collects at hems, knees and cuffs; elbows and knees thin; edges fray; sweat darkens necklines. They reproduce those effects in order, gently and gradually, starting with an overall toning and then adding wear where it naturally falls, always testing first on a scrap. Aging stops well short of anything frightening: the goal is honest work and weather, never anything grisly or frightening.

The fabric science. Cotton and linen take tea and coffee stains and fiber-reactive dyes readily; polyester barely takes them at all, which is why natural fibers age better. A dye bath darkens fabric depending on concentration and time; rinsing removes loose color. Sanding breaks surface fibers and lightens raised areas. A **value scale** lets you measure how much darker a swatch has become so the effect can be repeated on a second costume.

Safety. Dyeing is done with a parent present, gloves on, windows open, in a bucket or pot used only for dye, never for food; follow the dye maker's directions, and never mix bleach with anything. Sanding is done outdoors with a dust mask. Hot tea baths are

handled with care: let them cool before putting hands in.

Let's sew. In the lab you will age a shepherd's tunic and mantle (or another costume from your book) with a tea or dye bath and dry-brush and sanding wear, after testing on strips and measuring value changes.

PICTURE STUDY



Shepherdess Seated on a Rock, Jean-François Millet, 1856 · Oil on wood · The Metropolitan Museum of Art, New York
Image: [Wikimedia Commons](#), public domain

Millet painted the shepherds and peasants of rural France with deep respect. This shepherdess knits as she watches her sheep, and her cloak is everything a costumer wants to reproduce: soft, pale and worn with weather and use.

Look closely

- Look at the cloak. Where is it palest, and why?
- Look at the hem of her skirt and cloak. Are they clean and crisp?
- Find what her hands are doing. What does that say about her day?
- Look at the colors. How many are bright, and how many are faded?

Talk about it

1. What would you do to a new white sheet to make it look like her cloak?
2. Why would bright new costumes look wrong for the shepherds of Luke 2?
3. How do you show hard work in clothing without making it look dirty or ugly?

Safety first. Dyeing: a parent present, gloves, open windows, a bucket or pot used only for dye and never for food, the dye maker's directions followed, and never mix bleach with anything. Sanding outdoors with a dust mask. Let hot tea baths cool before hands go in. Stage costumes must be safe to move in: hems clear of the floor and stairs, nothing trailing, headwear secure, and no costume near open flame (pageants use battery candles).

STUDIO LAB

Age a Shepherd's Costume

Age a shepherd's tunic and mantle (or another costume from your design book) in controlled stages, testing first on strips and measuring value changes.

You will need

- Costume pieces of cotton or linen
- Tea bags or instant coffee, or a fiber-reactive dye (with a parent)
- A large bucket used only for dye, rubber gloves
- Sandpaper (80–120 grit), a stiff brush, fabric paint or chalk pastels in brown and gray
- A value scale (print one or paint gray steps on card)

TEA-AGED SHEPHERD'S TUNIC

Finished size: One cotton tunic and mantle · About 3 hours plus drying

Fabric and notions

- About 24 tea bags for 8 L of hot water (from the test)
- Brown and gray fabric paint thinned with water, or chalk pastels
- Patching scrap and thread

How to make it

1. Test: three strips in tea for 10, 20 and 30 min; rinse, dry, measure their values; choose a time.
2. Wet the costume pieces, then submerge them in the cooled tea bath for the chosen time, stirring now and then.
3. Rinse in cool water until the water runs nearly clear; dry flat or on a line.
4. Outdoors with a mask, sand elbows, knees, the hem and the mantle's edges.
5. Dry-brush thinned brown paint (or rub chalk) at the hem, knees and cuffs, heaviest near the hem; let dry.
6. Fray the hem slightly and stitch above it so it will not keep running.
7. Stitch on a patch where a real shepherd would mend.
8. Measure the final value at the shoulder and at the hem.

Fabric check: Cotton and linen age well; polyester barely takes stain. Prewash to remove sizing so the tea takes evenly. Set fabric paint by its directions so it survives washing.

Steps

1. Write the aging plan in stages with locations and reasons.
2. Run the strip test and record values.
3. Age the costume from the pattern card.
4. Record before-and-after values at shoulder, knee and hem; photograph.
5. Clean up: dye bucket rinsed and stored, gloves off, sandpaper dust swept outdoors.
6. Improve it: one change after seeing it on stage or under a bright lamp.

Tips

- Stand back 15 ft to judge aging; up close always looks too much.
- Less is more: you can always add wear, never remove it.
- Keep notes so a second shepherd can match.

Check your work

- ☐ I tested on strips and recorded values.
- ☐ My aging follows real wear and stops well short of anything frightening.
- ☐ All dye and sanding safety rules were followed.

LAB NOTEBOOK

1. Tape in the three test strips with their values.
2. Draw the costume with arrows showing where each effect went.
3. Record before-and-after values and photos.

KEY FORMULAS

value change = value before – value after (on a 0–10 scale)

value change = value before – value after (on a 0–10 scale)

$$\text{tea concentration} = \frac{\text{tea bags}}{\text{liters of water}}$$

tea concentration = liters of water ÷ tea bags

$$\text{percent darker} = \frac{\text{steps darkened}}{\text{steps from start to black}} \times 100\%$$

percent darker = steps from start to black ÷ steps darkened × 100%

From history. Before synthetic dyes, households dyed and over-dyed faded clothes with walnut hulls, onion skins and tea to give them new life, the same toning a costumer uses in reverse.

WORKED EXAMPLES

Example 1. On a value scale where 10 is white and 0 is black, an off-white muslin measures 9. After a tea bath it measures 7. How many steps darker, and what percent of the way to black?

Show solution

1. Steps: $9 - 7 = 2$
2. Percent: $\frac{2}{9} \times 100\% \approx 22\%$

Answer: 2 steps, about 22% of the way to black.

Example 2. Your test bath used 6 tea bags in 2 liters and gave the color you want after 30 minutes. The tunic needs 8 liters of water to move freely. How many tea bags?

Show solution

1. Concentration: $6 \div 2 = 3$ bags per liter.
2. Tea bags: $3 \times 8 = 24$

Answer: 24 tea bags in 8 liters for the same 30 minutes.

Example 3. Design reasoning. Plan the aging of a shepherd's costume in order, saying where each effect goes and why.

Show solution

1. Overall tea bath to knock down bright white (whole tunic and mantle).
2. Sun fading: leave the shoulders and the top of the head covering lighter (lighten with a little sanding or skip the darker step there).
3. Dirt: dry-brush diluted brown fabric paint or rub dirt-colored chalk at the hem, knees and cuffs, heavier near the hem.
4. Wear: sand elbows, knees and the mantle's edges; fray the hem slightly and stitch to stop it running.
5. Mend: add a visible patch, as a real shepherd would.

Answer: Tone, fade, soil, wear and mend, in that order, each where real life puts it.

PRACTICE

1. **Easy** Why are stage costumes aged?

Show answer

So clothes look lived-in and fit the character's life and story.

2. **Easy** Where does dirt collect on real clothing?

Show answer

Hems, knees, cuffs, elbows, necklines.

3. Easy What does a value scale measure?

Show answer

How light or dark a color is.

4. Medium Value 8 before, 5 after. Steps darker, and percent of the way to black?

Show answer

3 steps; $3/8 = 37.5\%$

5. Medium 8 tea bags in 2 L gave the right color. Bags for 6 L?

Show answer

24.

6. Medium Why do natural fibers age better than polyester?

Show answer

Cotton and linen absorb tea, coffee and dye; polyester resists them.

7. Medium State the dye safety rules.

Show answer

Parent present, gloves, ventilation, a dye-only container never used for food, follow directions, never mix bleach with anything.

8. Hard Why age in stages and test on strips first?

Show answer

Aging cannot be undone; testing and building gradually keeps control and lets you match two costumes.

9. Hard A pageant has 4 shepherds. How do you make them look different yet belong together?

Show answer

Same tea-bath base, different fabrics or stripes, different degrees of wear and patches, one darker and one lighter mantle.

10. Hard Why does a real shepherd's mantle fade at the shoulders first?

Show answer

The sun strikes the shoulders and head most; light breaks down dyes and fibers there.

11. Challenge Design a controlled test of tea-bath time: variables, measurements, and how you will choose the time for the costume.

Show answer

Change: time (10, 20, 30, 40 min). Control: same fabric, tea concentration, temperature, rinse and drying. Measure: value after drying on a value scale. Choose the time that gives the target value; repeat for confirmation.

COMMON MISTAKES

- Aging evenly all over, which looks like a dyed costume, not a worn one.
- Skipping the test strip.
- Using a food pot for dye.

Make it a game · Value Match. A parent ages three swatches to different values without telling. Players estimate each swatch's value on the 0–10 scale by eye, then check with the printed value scale. Closest total wins; the winner then tries to match a fourth swatch's value with a tea test.

Scripture. “And there were in the same country shepherds abiding in the field, keeping watch over their flock by night.” (Luke 2:8, KJV)
The first to hear of Christ's birth were working men living outdoors with their sheep. Dressing them honestly, in worn and mended clothes, tells the story as Luke tells it.

10.4 HEADWEAR: MOB CAPS, TRICORNS AND WISE MEN'S CROWNS

OBJECTIVES

- Describe the milliner's trade and the headwear of the periods in your design book.
- Calculate a mob cap's circle and casing, a crown's band and points, and the fold lines of a tricorn from a round hat.
- Make a mob cap and a headpiece (a wise man's crown or turban, or a tricorn) that fits securely.

Warm-up. Measure around your head (and a family member's) where a hat sits: across the forehead and around the back. Write the numbers. How many times would a 6-in-wide strip of paper go around?

WATCH

How to Sew a Classic Mop Cap

[YouCanSew by ModestyMatters](#) · 10:00

<https://www.youtube.com/watch?v=v6fbRsChkrg>

WHEN TO WATCH

Before the lab. Watch the circle drafted and the casing sewn; then work out your own circle's radius before you cut.

BACKUP VIDEO

Making an easy 18th century mobcap

[The Antiquarian Clothier](#) · 6:48

<https://www.youtube.com/watch?v=6uGBkBUe3Z4>

A second mobcap method, with the circle marked from a paper pattern.

KEY TERMS

mob (mop) cap

A round cap of linen or cotton gathered to fit the head, worn indoors by women and girls in the 1700s and 1800s.

tricorn (cocked hat)

An eighteenth-century hat whose round brim is turned up and fastened in three places.

crown band

The strip that goes around the head in a crown, sized to the head circumference.

casing

A channel stitched near an edge to hold elastic or a drawstring.

head circumference

The measurement around the head where a hat sits.

milliner

A maker and seller of hats and headwear.

CORE IDEAS

The story. Edgar Degas painted a Paris milliner's shop in the early 1880s: a young woman in a plain dress examines a hat among others on stands, flowers and ribbons heaped on the table. Milliners had been part of town life for centuries; in colonial Williamsburg the milliner's shop made caps, cloaks and trimmings. A hat finishes a costume more than any other piece, because the audience looks at faces, and the hat frames the face.

How they figured it out. Period headwear was built from simple geometry. A **mob cap** is a circle of linen gathered in by a casing to fit the head, with a ruffle around the face. A **tricorn** is a round, wide-brimmed felt hat with its brim turned up at three points and fastened. A crown for a king or a wise man is a band sized to the head with points or decorations, and the wise men of Matthew 2 came bearing “gold, and frankincense, and myrrh,” so their headdresses may be turbans, crowns or both. Every one starts with a head measurement.

The math. A mob cap circle's diameter is about head circumference $\div \pi$ plus twice the drop over the head and the ruffle. The casing is set a ruffle-width in from the edge, and its elastic is a little shorter than the head circumference. A crown band is head circumference plus overlap. Folding a round brim into a tricorn divides the brim's circle into three equal arcs, 120° each.

Safety and fit. Headwear on stage must stay on without pins near the face: elastic, ties, combs or a snug band. Crowns use craft foam, felt or cardboard with no sharp points, and nothing that blocks vision or breathing. Hot glue for trims is used by the Lesson 8.4 rules.

Let's sew. In the lab you will make a mob cap and one more headpiece from your design book: a wise man's crown or turban, a shepherd's head covering, or a tricorne trimmed from a round felt hat.

PICTURE STUDY



The Millinery Shop, Edgar Degas, 1879–1886 · Oil on canvas · Art Institute of Chicago
Image: [Wikimedia Commons](#), public domain

Degas painted several pictures of Paris millinery shops. Here a young woman, perhaps a milliner at work or a customer, studies a hat in her hands. The hats on their stands, with flowers, ribbons and feathers, are works of craft in their own right.

Look closely

- Find the hat stands. How many hats can you count?
- Look at the hat in her hands. What is she checking?
- Look at the colors of the trims. How do they stand out from her plain dress?
- Look at her gloves and hands. How do they show careful work?

Talk about it

1. How is trimming a hat like finishing a costume?
2. Why might a milliner keep hats on stands rather than in boxes?
3. Which hat in this painting would you adapt for a play, and for which character?

Safety first. Stage costumes must be safe to move in: hems clear of the floor and stairs, nothing trailing, headwear secure, and no costume near open flame (pageants use battery candles). Crowns and headpieces have no sharp points or edges and never cover the eyes, nose or mouth. Hot glue: gun on its stand, fingers clear, unplugged after use. Measurements are taken over light clothing by a parent (a father for a son, a mother for a daughter), recorded for fit only and never discussed as good or bad numbers.

STUDIO LAB

A Mob Cap and a Headpiece

Make a mob cap from a calculated circle with an elastic casing and ruffle, and one more headpiece from your design book (a wise man's crown or turban, a shepherd's head covering or a tricorne), fitted securely.

You will need

- Cotton or linen for the cap, ¼-in elastic
- Felt, craft foam, cardboard and trims for a crown; or a long scarf for a turban; or a round wool felt hat for a tricorn
- String compass, chalk, machine, hand needle, hot-glue gun (low temperature)

MOB CAP WITH ELASTIC CASING

Finished size: One cap for a 22-in head · About 1 hour

Fabric and notions

- One circle of white cotton or linen, 19½ in across
- Bias tape or a 1-in strip for the casing (about 48 in), or sew the casing as a tuck
- ¼-in elastic, about 20 in
- Thread

How to make it

1. Draw the circle with a string compass and cut it out.
2. Hem the edge with a narrow rolled or double hem.
3. Mark a circle 2 in in from the edge (the casing line).
4. Sew bias tape along the casing line on the wrong side, leaving a 1-in gap to insert the elastic.
5. Thread the elastic through the casing with a safety pin, overlap its ends ½ in and stitch them together.
6. Close the gap; spread the gathers evenly.
7. Try the cap on: it should sit securely with the ruffle framing the face.

Fabric check: White or natural cotton or linen in a light to medium weight gathers well; avoid stiff or shiny fabrics. For a crown, felt or craft foam is light and safe; for a turban, a long soft cotton scarf; for a tricorn, a wool felt hat.

Steps

1. Measure each actor's head (gently, by the rules) and calculate the cap and headpiece.
2. Make the mob cap from the pattern card.
3. Make the second headpiece; for a crown, cut the band and points, glue trims, and close it with hook-and-loop or a stitched overlap; for a tricorn, turn up the brim at three marked points and tack them with a few stitches.
4. Fit both on the actor; test walking, bowing and kneeling.
5. Record sizes and photos in the design book.
6. Clean up: glue gun unplugged on its stand, pins counted.
7. Improve it: one change.

Tips

- A cap that slips back can be held with a hidden bobby pin, never a straight pin.
- Make wise men's crowns distinct: one tall, one jeweled, one wrapped in a turban.
- Lightweight is best: heavy headpieces tip and fall.

Check your work

- ☐ My cap circle and casing match their calculations.
- ☐ My headpiece fits securely without pins near the face.
- ☐ Nothing blocks vision or has sharp points.

LAB NOTEBOOK

1. Record head measurements (fit only) and all the calculations.
2. Sketch the headpiece pattern pieces with dimensions.
3. Photograph the actor in each headpiece.

KEY FORMULAS

$$d = \frac{C_{\text{head}}}{\pi} + 2h \quad (h = \text{drop over the head plus ruffle})$$

$$d = \pi C_{\text{head}} + 2h \quad (h = \text{drop over the head plus ruffle})$$

$$\text{crown band} = C_{\text{head}} + \text{overlap}$$

$$\text{crown band} = C_{\text{head}} + \text{overlap}$$

$$\text{arc between tricorn points} = \frac{\pi D}{3}$$

$$\text{arc between tricorn points} = 3\pi D$$

From history. Eighteenth-century men often wore their tricorns tucked under the arm indoors; the cocked brim also made it easier to carry and to wear a powdered wig beneath.

WORKED EXAMPLES

Example 1. A head measures 22 in. You want the cap to drop 4 in over the head from the casing and to have a 2-in ruffle beyond the casing. Find the diameter of the circle to cut.

Show solution

1. Head diameter: $22 \div \pi \approx 7.0$ in $22 \div \pi \approx 7.0$ in.
2. Add the drop and ruffle on each side: $h = 4 + 2 = 6$ in $h = 4 + 2 = 6$ in; $d = 7.0 + 2 \times 6 = 19$ in $d = 7.0 + 2 \times 6 = 19$ in.
3. Add a narrow hem allowance: cut about $19\frac{1}{2}$ in $19\frac{1}{2}$ in.

Answer: Cut a circle about $19\frac{1}{2}$ in across; this matches the 18–20-in circles common in cap patterns.

Example 2. The casing is sewn 2 in in from the edge of the 19-in circle. How long is the casing, and how much elastic?

Show solution

1. Casing circle diameter: $19 - 2 \times 2 = 15$ in $19 - 2 \times 2 = 15$ in; circumference $\pi \times 15 \approx 47$ in $\pi \times 15 \approx 47$ in.
2. Elastic: a little less than the head, about $22 - 2 = 20$ in $22 - 2 = 20$ in.

Answer: About 47 in of casing gathered onto about 20 in of elastic.

Example 3. A wise man's crown: head 22 in, band 4 in tall with 7 points, overlap 1 in. Find the band length and the width of each point's base.

Show solution

1. Band: $22 + 1 = 23$ in $22 + 1 = 23$ in.
2. Points: $22 \div 7 \approx 3.1$ in $22 \div 7 \approx 3.1$ in per base.

Answer: Cut a band 23×4 in plus points; each point about $3\frac{1}{8}$ in wide at the base.

Example 4. A round felt hat has a brim edge 12 in in diameter. To cock it into a tricorn, you turn up the brim at three equal points. How far apart are the points, measured along the brim edge?

Show solution

1. Brim circumference: $\pi \times 12 \approx 37.7$ in $\pi \times 12 \approx 37.7$ in.
2. Spacing: $37.7 \div 3 \approx 12.6$ in $37.7 \div 3 \approx 12.6$ in.

Answer: Mark three points about $12\frac{1}{2}$ in apart around the brim, with one point centered at the front.

PRACTICE

1. **Easy** What is a mob cap?

Show answer

A round linen or cotton cap gathered to fit the head, worn by women and girls in the 1700s and 1800s.

2. **Easy** Why does headwear matter so much on stage?

Show answer

The audience looks at faces; the hat frames the face and tells period and role at a glance.

3. **Easy** Head 21 in: crown band with 1-in overlap?

Show answer

22 in.

4. **Medium** Head 20 in, drop 3 in, ruffle 2 in: circle diameter?

Show answer

$20/\pi + 2(5) \approx 6.4 + 10 = 16.4$ in $20/\pi + 2(5) \approx 6.4 + 10 = 16.4$ in.

5. **Medium** Casing 2 in in from the edge of an 18-in circle: casing length?

Show answer

$\pi(14) \approx 44$ in $\pi(14) \approx 44$ in.

6. **Medium** Crown with 6 points on a 21-in head: base width of each point?

Show answer

3.5 in 3.5 in.

7. **Medium** Tricorn brim 13 in across: spacing of the three points?

Show answer

$\pi(13)/3 \approx 13.6$ in $\pi(13)/3 \approx 13.6$ in.

8. **Hard** Why are elastic and ties better than pins for stage headwear?

Show answer

Pins near the face can scratch or fall; elastic and ties hold securely through movement.

9. **Hard** Five mob caps from 45-in fabric, circles 19½ in: how many per row and how many yards?

Show answer

2 per row; 3 rows: $3 \times 19.5 = 58.5$ in $\approx 1.63 \times 19.5 = 58.5$ in ≈ 1.6 yd.

10. **Hard** Name the gifts of the wise men in Matthew 2:11 and one way to suggest each on stage.

Show answer

Gold (a small painted box), frankincense (a carved jar), myrrh (a flask); light, safe props with no real smoke.

11. **Challenge** Derive the mob cap formula: explain why the circle's diameter is the head diameter plus twice the drop and ruffle.

Show answer

The cap's crown covers the top of the head (about the head's diameter across, C/π) and must also hang down by the drop h on every side; across the circle that adds h on both sides, so $d = C/\pi + 2h$.

COMMON MISTAKES

- Using the head circumference as the circle's diameter.
- Making crowns of stiff card with sharp points.
- Elastic so tight it gives the actor a headache.

Make it a game · Circle Sense. Each player looks at a cut paper circle and guesses whether it will make a mob cap for their own head (using the formula only in their heads). Then measure and calculate. One point for each correct yes/no call; a bonus for the closest diameter guess before measuring.

Scripture. “and when they had opened their treasures, they presented unto him gifts; gold, and frankincense, and myrrh.” (Matthew 2:11, KJV)

The wise men brought their best to the Child. Making their crowns and gifts with care for a pageant is a small way of bringing our best too.

10.5 THE CAPSTONE: A COSTUME SET OR A FINISHED ROOM

OBJECTIVES

- Plan, budget and build a capstone: a complete costume set for a real production or a complete room's soft furnishings for a real use.
- Keep a design board, cost sheet and construction log that a client or director could follow.
- Present and give the finished work, and reflect on the year's growth in skill, stewardship and service.

Warm-up. Lay out every piece you have made this year, or photographs of them, in order. Which piece are you proudest of? Which taught you the most? Which would you make differently now? Write three sentences.

WATCH

Making an 18th Century Gown | Life of a Mantua-Maker (Part 1)

JYF Museums · 9:50

<https://www.youtube.com/watch?v=qqaX2WPxv8k>

WHEN TO WATCH

Any time during the capstone. A museum interpreter talks through planning and hand-sewing a period gown; listen for how she records and plans her work.

Note: From the Jamestown-Yorktown Foundation's living-history museums.

BACKUP VIDEO

Plays in Days - Creating Bible Era Hats for Men

Plays in Days · 3:52

<https://www.youtube.com/watch?v=LWi9lO-cP08>

Quick Bible-era head coverings for men, useful for finishing a pageant costume set.

KEY TERMS

capstone

A final project that brings together the skills of a whole course.

design board

A presentation of the design: sketches or plan, color scheme, swatches and notes.

cost sheet

A full list of materials, quantities, prices, reserve and hours, compared with the budget.

construction log

A dated record of each work session: what was done, how long, problems and fixes.

client

The person or group the work serves: a director, a church, a family.

hand-off

Delivering the finished work with care instructions and any spare parts or patterns.

CORE IDEAS

The story. When Peter came to Joppa after Dorcas died, “all the widows stood by him weeping, and shewing the coats and garments which Dorcas made, while she was with them.” She was remembered by what her hands had made for others. Millet's Knitting Lesson, this lesson's picture, shows another kind of giving: a mother bending over her daughter's hands, passing the skill on. The capstone is your chance to do both: make something whole for someone else's real use, and show what you have learned.

How they figured it out. Professional workrooms and costume shops finish big jobs the same way: a design approved by the client, a budget with a reserve, a schedule worked backward from the deadline, a cut list, a construction log that records every session, fittings or installation, and a hand-off with care instructions. The records are not busywork; they are what let the work be finished on time, repaired later, and repeated by someone else.

The choice. Choose one: (A) a costume set for a real production in your Unit 9 design book, at least three complete costumes (tunic or garment, outer layer, headwear and accessories) for a pageant, Bible play, history day or classic play; or (B) a room's soft furnishings for the room you designed in Unit 1, at least three coordinated pieces not already made this year (for example, a second pair of drapes, cushions for a window seat, a slipcover and a valance). Either way, the work must be used by someone else.

The math. The capstone uses every calculation of the year: yardage and layouts, repeats, fullness, foam, pleats, circles, budgets and schedules. The cost sheet compares the final cost with the budget and with buying or renting; the log totals the hours.

Let's sew. Plan, build, present and give the capstone, with its design board, cost sheet and construction log. Measurements are taken over light clothing by a parent (a father for a son, a mother for a daughter), recorded for fit only and never discussed as good or bad numbers.

PICTURE STUDY



The Knitting Lesson, Jean-François Millet, 1869 · Oil on canvas · Saint Louis Art Museum

Image: [Wikimedia Commons](#), public domain

Millet painted this mother teaching her daughter to knit more than once. It is a picture of skill passing from one generation to the next, through patient hands. That is how most of the crafts in this course were learned for most of history.

Look closely

- Look at the mother's hands. How are they guiding the girl's?
- Look at their clothing. What is plain, and what is made to last?
- Find the light. Where does it fall, and what does it pick out?
- Look at the girl's face. What do you think she is feeling?

Talk about it

1. Who taught you a skill this year, and whom could you teach?
2. How is passing on a skill a kind of giving, like giving a quilt or a costume?
3. What would you most like to teach a younger sibling from this course?

Safety first. Every tool rule of the year applies: parent sign-offs, glasses for stapling, rotary blades closed, irons upright and unplugged, pins counted, dye and paint rules, cordless window treatments, and stage-safe costumes. Stage costumes must be safe to move in: hems clear of the floor and stairs, nothing trailing, headwear secure, and no costume near open flame (pageants use battery candles).

STUDIO LAB

The Capstone

Plan, budget, build, present and give a complete costume set for a real production or a complete set of soft furnishings for a real room, with a design board, cost sheet and construction log.

You will need

- Everything the chosen project needs, from the year's tools and supplies
- Your design book (Unit 9) or room board (Unit 1)
- A folder or binder for the cost sheet and construction log
- Camera

CAPSTONE PLAN SHEET

Finished size: One plan for the whole capstone · About 2 hours to write; the build takes the rest of the unit

Fabric and notions

- Client and use (who, what, when)
- Piece list with sizes or actors
- Cut lists and yardage for each piece
- Budget with a reserve; backward schedule to the deadline
- Safety notes for every tool the plan uses

How to make it

1. Name the client, the use and the deadline; get the client's approval of the design.
2. List every piece with its measurements (or actor and costume).
3. Write each piece's cut list and yardage, from the methods of the units that taught it.
4. Total the materials into a budget; add a 10% reserve.
5. Write a backward schedule from the deadline.
6. Start the construction log; record every session.
7. Fit or install each piece as it is finished; record changes.
8. Present the finished work and the records to the client; give it with care instructions.

Fabric check: Use the fabric rules of each unit: duty ratings for seats, lining and lightfastness for windows, preshrinking for washables, matte durable fabrics for the stage, modest cuts for every costume.

Steps

1. Write the plan from the pattern card and have a parent sign the budget and schedule.
2. Build, logging every session with date, hours, work done and problems.
3. Hold fittings or test installations; fix and record changes.
4. Assemble the design board, final cost sheet (actual vs. budget, variance, reserve used, hours) and the log.
5. Present to the client and the family; deliver and give the work.
6. Write the closing reflection on the year: skills, mistakes, service.
7. Clean the workroom and store tools, patterns and leftover fabric labeled for next time.

Tips

- Build the hardest piece first, while time remains.
- Photograph every stage; the photos are half the presentation.
- Leave the last week for finishing and fixes, not for starting.

Check your work

- ☐ My capstone is complete, safe and in use by someone else.
- ☐ My design board, cost sheet and log are complete and honest.
- ☐ My reflection names specific growth and service.

LAB NOTEBOOK

1. The capstone binder is the notebook: plan, log, cost sheet, photos.

2. Write the closing reflection.
3. Make a contents page for the whole year's lab notebook.

KEY FORMULAS

$$\begin{aligned} \text{variance} &= \text{actual cost} - \text{budget} \\ \text{variance} &= \text{actual cost} - \text{budget} \\ \text{reserve used \%} &= \frac{\text{reserve spent}}{\text{reserve}} \times 100\% \\ \text{reserve used \%} &= \text{reserve} \times 100\% \\ \text{value of labor} &= \text{hours} \times \text{rate} \end{aligned}$$

From history. Church costume closets and community theater stocks are built one production at a time by volunteers, and many costumes are worn for decades; a well-made costume set is a gift that keeps serving.

WORKED EXAMPLES

Example 1. A costume-set capstone has a budget of \$150 including a 10% reserve. Actual spending: fabric \$86, trims \$18, notions \$21, headwear materials \$14. Find the total, the variance and the reserve used.

Show solution

1. Total: $86 + 18 + 21 + 14 = \$139$
2. Variance: $139 - 150 = -\$11$ (under budget).
3. Planned spending without reserve: \$135; overrun into reserve $139 - 135 = \$4$;
 $\frac{4}{15} \times 100\% \approx 27\%$

Answer: \$139 spent, \$11 under the total budget, using about 27% of the reserve.

Example 2. The construction log shows 31 hours. Renting three comparable costumes for one weekend costs \$45 each. Compare buying materials and sewing with renting, and with valuing your time at \$12/h.

Show solution

1. Rent: $3 \times \$45 = \135 for one weekend only.
2. Sewn: \$139 in materials, owned and reusable for years.
3. With labor valued: $139 + 31 \times 12 = \$511$.

Answer: For one weekend renting is cheaper in cash; owned costumes serve every future pageant, and the 31 hours are the year's skill made useful.

Example 3. Design reasoning. Your room capstone is cushions and a valance for a window seat used by younger siblings. List the decisions you would justify to the client with numbers from this course.

Show solution

1. Fabric duty: seat cushions need 15,000+ double rubs and a washable or cleanable fabric (Unit 1).
2. Foam: high-density, about 2.5 lb/ft³ or more, sized from the seat with a zippered boxing (Unit 2).
3. Valance: proportion about one-sixth of the treatment height; cordless anything (Unit 4).
4. Budget and schedule with a reserve and a backward plan to the date the family needs it.

Answer: Durability, foam density, proportion, cord safety, budget and schedule: each decision defended with a number.

PRACTICE

1. **Easy** What must every capstone include besides the finished work?

Show answer

A design board, a cost sheet and a construction log, and it must be used by someone else.

2. **Easy** What is variance?

Show answer

Actual cost minus budget.

3. **Easy** Who remembered Dorcas, and how?

Show answer

The widows, showing the coats and garments she had made (Acts 9:39).

4. **Medium** Budget \$200\$200, actual \$214\$214. Variance?

Show answer

+\$14+\$14 (over budget).

5. **Medium** Reserve \$20\$20, reserve spent \$14\$14. Percent used?

Show answer

70%.

6. **Medium** 38 hours at \$11\$11/h. Value of labor?

Show answer

\$418\$418.

7. **Medium** Why keep a construction log?

Show answer

To track time and progress, record problems and fixes, finish on schedule, and let the work be repaired or repeated later.

8. **Hard** Opening night is 9 weeks away; your schedule needs 2 weeks of design, 5 of building, 1 of fittings and 1 of finishing. Is there slack?

Show answer

No slack: 9 weeks exactly; start immediately and protect the reserve week by simplifying where possible.

9. **Hard** List the hand-off items for a costume set.

Show answer

Costumes labeled by character and actor, care instructions, spare fabric and buttons, patterns and the design book for future reuse.

10. **Hard** Your room capstone's drapes came out 1 in short. Name two fixes from this course.

Show answer

Re-hang the rod or adjust pin-on hooks; let down the hem if allowance remains; add a contrast band at the hem.

11. **Challenge** Write the closing reflection's outline: three skills you gained, one mistake that taught you most, and how your work served someone else this year.

Show answer

Answers vary; full credit for specific skills, an honest mistake with its lesson, and a concrete act of service (a quilt given, costumes for a pageant, a room improved).

COMMON MISTAKES

- Choosing a capstone too large for the time left.
- Spending the reserve early.
- Forgetting the hand-off: care instructions and spares.

Make it a game · Year in Review Quiz Bowl. Players write one question from each unit of the year on cards (a calculation, a safety rule, a story). Shuffle and play in teams: correct answers score 1 point, calculations 2. The family judges; the losing team cleans the workroom.

Scripture. “Then Peter arose and went with them. When he was come, they brought him into the upper chamber: and all the widows stood by him weeping, and shewing the coats and garments which Dorcas made, while she was with them.” (Acts 9:39, KJV)

Dorcas was remembered for the garments she made for others. A year of sewing is best measured by what it has made for someone else.

UNIT 10 TEST

Calculators are allowed. Show your work for every calculation: write the formula, substitute with units, and give the answer with its unit. Answer concept questions in complete sentences. The test is worth 100 points.

1. **6 pts**
Who introduced graded paper patterns, and why did sizes matter?
2. **6 pts**
A pattern finishes 40 in long; the actor needs 52 in. Change? If 2 lengths are in the layout, extra yardage?
3. **6 pts**
Body chest 30 in; finished chests 34 in (size 10) and 36 in (size 12). For 6 in of ease, which size?
4. **6 pts**
Name four modesty adaptations to commercial patterns.
5. **6 pts**
What is the tiring-house, and why did Elizabethan actors need quick changes?
6. **6 pts**
A costume costs \$18\$18 and is worn 30 times. Cost per wear?
7. **6 pts**
Three seams with 1½-in allowances instead of ½ in. Let-out room?
8. **6 pts**
Exit at 2:40, re-enter at 3:25; change takes 30 s. Margin?
9. **6 pts**
Value 9 before, 6 after on a 0–10 scale. Steps and percent of the way to black?
10. **6 pts**
Test: 5 tea bags in 2 L. How many for 7 L?
11. **6 pts**
State the dye and sanding safety rules.
12. **6 pts**
Head 21 in, drop 4 in, ruffle 2 in: mob cap circle diameter?
13. **5 pts**
Crown for a 22-in head with 8 points and 1-in overlap: band length and base of each point?
14. **5 pts**
Tricorn brim 12 in across: spacing of the three points?
15. **6 pts**
Capstone budget \$160\$160 (with a \$16\$16 reserve); actual \$151\$151. Variance and reserve used?
16. **6 pts**
What must a capstone hand-off include?
17. **6 pts**
Short essay (5–8 sentences): How does Acts 9:36-39 describe Dorcas, and how did your year of sewing serve someone else? Give specific pieces and people.

UNIT PROJECT: THE CAPSTONE: A COSTUME SET OR A FINISHED ROOM

Complete the capstone of Lesson 10.5: a costume set of at least three complete, modest, stage-safe costumes for a real production, or a set of at least three coordinated soft furnishings for the room you designed in Unit 1, used by someone else.

Submit the design board, the plan, the construction log, the final cost sheet with variance and hours, photos of the work in use, and the year's closing reflection.

LOOK FOR	WHAT IT MEANS
Design and planning	Client-approved design, complete cut lists, budget with reserve, backward schedule.
Workmanship	Pieces fit their measurements or actors, finished cleanly, durable and safe.
Records	Construction log, cost sheet with variance and hours, photos: complete and honest.
Safety and modesty	All tool rules followed; costumes modest and stage-safe; window treatments cordless.
Service and reflection	The work is given or used by others; reflection is specific and honest.

ANSWER KEY

1. Ebenezer Butterick (with Ellen Butterick), 1863; sizes let home sewists cut a close fit without refitting a one-size pattern.
2. Lengthen 12 in; $24 \div 36 \approx 0.67$ yd.
3. Size 12.
4. Raise necklines, add or lengthen sleeves, lengthen hems, add facings, linings or panels.
5. The dressing room behind the stage; companies doubled roles, so actors changed between scenes.
6. \$0.60.
7. $3 \times 2 \times 1 = 6$ in $3 \times 2 \times 1 = 6$ in.
8. 45 s available; 15 s margin.
9. 3 steps; $3/9 \approx 33\%$.
10. 17.5, about 18.
11. Parent present, gloves, ventilation, dye-only container never used for food, follow directions, never mix bleach; sand outdoors with a dust mask.
12. $21/\pi + 12 \approx 6.7 + 12 = 18.7$ in $21/\pi + 12 \approx 6.7 + 12 = 18.7$ in.
13. 23 in; 2.75 in.
14. $\pi(12)/3 \approx 12.6$ in $\pi(12)/3 \approx 12.6$ in.
15. -\$9-\$9; planned spending \$144, so \$7 of reserve, about 44%.
16. Labeled pieces, care instructions, spare fabric and notions, patterns and records.
17. Full credit for: Dorcas full of good works, garments made for widows, remembered for them; specific pieces made and given or used by others this year; reflection on service.

MIDTERM EXAM

Covers Units 1–5. Time: 100 minutes.

You have 100 minutes. A calculator is allowed; no notes. Use $1 \text{ oz/yd}^2 \approx 33.9 \text{ g/m}^2$, $1 \text{ board foot} = 144 \text{ in}^3$ and $1 \text{ ft}^3 = 1,728 \text{ in}^3$. For every calculation write the formula, substitute with units and give the answer with its unit; correct work earns partial credit. Answer concept questions in complete sentences. The exam has 27 problems worth a total of 100 points.

1. **3 pts** Lesson 1.1
State William Morris's rule for what belongs in a house, and give the year Morris & Co. was founded.
2. **4 pts** Lesson 1.1
A sofa is 78 in long. Use the two-thirds rule to size a coffee table.
3. **4 pts** Lesson 1.2
A room's visible surfaces total 450 sq ft. How many square feet belong to each layer of a 60-30-10 scheme?
4. **3 pts** Lesson 1.2
Name the split-complementary partners of yellow on the traditional wheel, and state Chevreul's law in one sentence.
5. **4 pts** Lesson 1.3
Convert 8 oz/yd^2 to g/m^2 ($1 \text{ oz/yd}^2 \approx 33.9 \text{ g/m}^2$) and name its weight class.
6. **4 pts** Lesson 1.3
Fabric A: \$20\$20/yd, 25,000 double rubs. Fabric B: \$14\$14/yd, 9,000. Find cost per 1,000 rubs and estimated years at 3,000 rubs a year for each.
7. **4 pts** Lesson 1.4
Prescribe a fiber for drapes at a hot west window and defend it; then explain why weighted silk shattered.
8. **4 pts** Lesson 1.5
A wall is 15 ft 9 in. How long is it on a plan at $\frac{1}{4} \text{ in} = 1 \text{ ft}$?
9. **3 pts** Lesson 2.1
What size do you cut a knife-edge cover for a 20-in form with $\frac{1}{2}$ -in seams, what is its finished size, and why?
10. **4 pts** Lesson 2.1
Six 18-in squares are cut from 54-in fabric with no motif, plus 4 in to spare. How many yards?
11. **3 pts** Lesson 2.2
A cover finishes at 21 in. Choose a bottom-seam zipper length and give the regular stitching at each end with an 18-in zipper.
12. **4 pts** Lesson 2.3
Find the bias strip width for $\frac{5}{32}$ -in cord with $\frac{1}{2}$ -in seam allowances, and the welting for a 20-in pillow with a 3-in overlap.
13. **4 pts** Lesson 2.4
Foam is $24 \times 22 \times 5 \text{ in}$. Give the plate size, boxing width and perimeter with $\frac{1}{2}$ -in seams, and the board feet.
14. **4 pts** Lesson 2.5
A $22 \times 22 \times 4 \text{ in}$ foam block weighs 2.9 lb. Find its density and say whether it meets the usual HR seat mark of 2.5 lb/ft^3 .
15. **4 pts** Lesson 2.5
A cushion 5.5 in tall compresses to 2.2 in and recovers to 5.1 in. Find percent compression and percent recovery.

16. **3 pts** Lesson 3.1
A frame is 40 in wide with 10-in extensions; the rod is at 92 in, rings drop $1\frac{1}{2}$ in, floor clearance $\frac{1}{2}$ in. Find rod width and finished length.
17. **4 pts** Lesson 3.2
A 64-in rod at $2\frac{1}{2}\times$ fullness, 12 in of side hems, 54-in fabric. How many widths?
18. **4 pts** Lesson 3.2
Finished length 90 in, double 4-in hem, 8-in top allowance. Cut length, and yards for 4 widths plus 6 in?
19. **4 pts** Lesson 3.3
The same drapes in a print with a 25-in repeat (straight match): adjusted cut length and yards with one extra repeat?
20. **3 pts** Lesson 3.4
Name two jobs of a drapery lining. A bare window reads 6,500 lux and 390 lux behind the drape; what percent is blocked?
21. **4 pts** Lesson 3.5
Rod face 80 in, returns $3\frac{1}{2}$ in, overlap $3\frac{1}{2}$ in. Flat width per panel 101 in with 10 pleats. Find the finished width, pleat size and space.
22. **5 pts** Lesson 4.1
State the window-cord rule of this course. Then find the cut length of a faux Roman shade finished at 16 in with 3 folds 3 in deep, a 4-in hem and 3 in for mounting.
23. **3 pts** Lesson 4.3
With a $\frac{1}{2}$ -in linen tester you count 70 ends and 62 picks. Thread count? A label says “900, 3-ply”: honest count?
24. **3 pts** Lesson 4.4–4.5
A twin duvet is 68×86 in; the cover is the same size with $\frac{1}{2}$ -in seams. Cut size? A bed skirt has a 15-in drop, $\frac{1}{2}$ -in clearance, double 1-in hem and $\frac{1}{2}$ -in seam. Cut depth?
25. **3 pts** Lesson 5.2–5.3
HSTs finish $3\frac{1}{2}$ in: cut size by the $\frac{7}{8}$ rule? A row of 5 blocks with 2 internal seams each plus 4 joining seams has every seam allowance $\frac{1}{16}$ in too wide: how short is the row?
26. **3 pts** Lesson 5.4–5.5
A quilt top is 50×62 in. Backing size? Binding length and number of 42-in strips?
27. **5 pts** Lesson Units 1–5
Short essay (6–10 sentences): Choose one piece you sewed this semester and explain how the design ideas of Unit 1, a calculation from its own unit, and one safety rule shaped it from plan to finished piece. Say what you would change next time.

ANSWER KEY

1. Have nothing in your houses that you do not know to be useful, or believe to be beautiful; 1861.
2. $\frac{2}{3} \times 78 = 52$ in $32 \times 78 = 52$ in.
3. $270/135/45$ ft² $270/135/45$ ft².
4. Blue-violet and red-violet. Simultaneous contrast: neighboring colors change each other's appearance, each pushing the other toward its own complement.
5. $8 \times 33.9 \approx 271$ g/m² $8 \times 33.9 \approx 271$ g/m²; medium weight.
6. A: \$.80\$.80, about 8 years. B: \$1.56\$1.56, about 3 years.
7. Solution-dyed acrylic or polyester, or a lined natural fiber, for lightfastness. Silk was weighted with metallic salts to restore weight lost in degumming; the salts slowly destroyed the fiber.
8. $15.75 \div 4 = 3\frac{15}{16}$ in $15.75 \div 4 = 3$ 16 in.
9. Cut 20×20 in 20×20 in; finished 19 in 19 in; the larger form fills the corners firmly.
10. 3 per row, 2 rows: $36 + 4 = 40$ in $36 + 4 = 40$ in; buy $1\frac{1}{8}$ yd.
11. $21 - 2 = 19$ $21 - 2 = 19$, so an 18-in stock zipper; $(21 - 18) \div 2 = 1.5$ in $(21 - 18) \div 2 = 1.5$ in at each end.
12. $\pi(0.156) + 1 \approx 1.49$ $\pi(0.156) + 1 \approx 1.49$, cut $1\frac{1}{2}$ in; $4 \times 20 + 3 = 83$ in $4 \times 20 + 3 = 83$ in.
13. Plates 25×23 25×23 ; boxing 6 in; perimeter 92 in; $2,640 \div 144 \approx 18.32$, $640 \div 144 \approx 18.3$ board feet.
14. $1,936 \div 1,728 = 1.12$ ft³ $1,936 \div 1,728 = 1.12$ ft³; $2.9 \div 1.12 \approx 2.6$ lb/ft³ $2.9 \div 1.12 \approx 2.6$ lb/ft³; yes.
15. 60% compression; $5.1 \div 5.5 \approx 92.7\%$ $5.1 \div 5.5 \approx 92.7\%$ recovery.
16. 60 in; 90 in.
17. $(160 + 12) \div 54 \approx 3.19$ $(160 + 12) \div 54 \approx 3.19$, so 4 widths.
18. Cut 106 in; $430 \div 36 \approx 11.94$ $430 \div 36 \approx 11.94$, buy 12 yd.
19. $[4.24] = 5$ $[4.24] = 5$ repeats, 125 in; $(500 + 25) \div 36 \approx 14.58$ $(500 + 25) \div 36 \approx 14.58$, buy $14\frac{5}{8}$ yd.
20. Protects the face from sun; adds body; hides seams; blocks light. 94% 94%.
21. Finished 47 in 47 in; pleats $54 \div 10 = 5.4$ in $54 \div 10 = 5.4$ in; spaces $40 \div 9 \approx 4.44$ in $40 \div 9 \approx 4.44$ in.
22. Every shade is cordless: a faux shade or a commercial cordless system, never a looped or dangling cord where children live or visit. $16 + 18 + 4 + 3 = 41$ in $16 + 18 + 4 + 3 = 41$ in.
23. 264; 300.
24. 69×87 in 69×87 in; 17 in 17 in.
25. $4\frac{3}{8}$ in 483 in; $14 \times \frac{1}{8} = 1.75$ in $14 \times 81 = 1.75$ in.
26. 58×70 in 58×70 in; $224 + 12 = 236$ in $224 + 12 = 236$ in; 6 strips.
27. Full credit for: a real piece; at least one design principle or scheme idea; one correct calculation with units; one specific safety rule; an honest improvement.

FINAL EXAM

Covers Units 1–10. Time: 120 minutes.

You have 120 minutes. A calculator is allowed; no notes. Use $1 \text{ oz/yd}^2 \approx 33.9 \text{ g/m}^2$, $1 \text{ board foot} = 144 \text{ in}^3$, $1 \text{ ft}^3 = 1,728 \text{ in}^3$ and $\pi \approx 3.14$. For every calculation write the formula, substitute with units and give the answer with its unit; correct work earns partial credit. Answer concept questions in complete sentences. The exam has 28 problems worth a total of 100 points.

1. **3 pts** Lesson 1.2
A room's visible surfaces total 520 sq ft. Give the 60-30-10 areas.
2. **4 pts** Lesson 1.3
Convert 380 g/m^2 to oz/yd^2 and name the weight class; estimate the years of home service of a 27,000-double-rub fabric.
3. **3 pts** Lesson 2.3
Find the welting needed for a 20×14 in lumbar pillow with a 3-in overlap, and the bias strip width for $\frac{1}{4}$ -in cord with $\frac{1}{2}$ -in seams.
4. **4 pts** Lesson 2.4
Foam $26 \times 22 \times 4$ in: plates, boxing width, perimeter ($\frac{1}{2}$ -in seams) and board feet.
5. **4 pts** Lesson 3.2–3.3
A 70-in rod at $2\frac{1}{2}\times$ fullness with 12 in of side hems on 54-in fabric; cut length 96 in; repeat 24 in. Find the widths, the adjusted cut length and the yards with one extra repeat.
6. **4 pts** Lesson 3.5
Rod face 76 in, returns $3\frac{1}{2}$ in, overlap $3\frac{1}{2}$ in, flat width per panel 101 in, 11 pleats. Finished width, pleat size and space?
7. **4 pts** Lesson 4.1
State the window-cord safety rule and give the cut length of a faux Roman shade finished 20 in long with 4 folds $2\frac{1}{2}$ in deep, a 4-in hem and 3 in for mounting.
8. **3 pts** Lesson 4.3
Explain why a “1,200 thread count, 4-ply” label is misleading, and give the honest count.
9. **4 pts** Lesson 5.2–5.3
HSTs finish $2\frac{1}{2}$ in. Give the cut square by the $\frac{7}{8}$ rule, the unfinished size, and the exact amount added ($\frac{1}{2} + \frac{1}{4}\sqrt{2}$) to two decimals.
10. **3 pts** Lesson 5.5
Binding for a 50×64 in quilt: length and number of 42-in strips (40 usable).
11. **3 pts** Lesson 6.1
A seat 20×18 in with all four corners rounded on a 2-in radius. Perimeter?
12. **4 pts** Lesson 6.4
A tailored skirt for a 22×22 in ottoman with four kick pleats of 3-in folds plus 2 in for joins: length? Box pleats all around instead?
13. **3 pts** Lesson 6.5
A band must finish 90 in on a fabric that will shrink 4% lengthwise. Cut length if not preshrunk, and what is better practice?
14. **4 pts** Lesson 7.2–7.3
State the lead-paint and dust rules for stripping old furniture, and give the number of $3\frac{1}{2}$ -in webbing strips across a 19-in opening with gaps of at most 2 in.

15. **3 pts** Lesson 7.4–7.5
A drop-in seat base is 18×17 in, foam 2 in thick, $\frac{1}{4}$ in oversize. Find foam size and board feet, and the cover size with $2\frac{1}{2}$ in of wrap.
16. **4 pts** Lesson 8.1
A 180-lb person sits on 12 tied springs ($k = 18$ lb/in) that share the load. Compression of each? If only 5 springs carry it?
17. **3 pts** Lesson 8.2
Why are springs tied eight ways, and what safety equipment does spring work require?
18. **4 pts** Lesson 8.4
Materials \$128\$128 plus a 10% allowance, 16 hours; a comparable new piece costs \$350\$350. Total materials, savings and value per hour.
19. **3 pts** Lesson 8.5
Queen headboard panel 62×32 in, 2-in foam, 3-in wrap: fabric size?
20. **4 pts** Lesson 9.1–9.2
T-tunic for chest 32 in, 6 in ease, $\frac{1}{2}$ -in seams: panel width. A stage toga is a semicircle of radius 50 in: curved edge and area in square yards.
21. **4 pts** Lesson 9.3
Neck 16 in, cloak length 34 in: neck radius, outer radius and hem length of a half-circle cloak.
22. **3 pts** Lesson 9.5
A pageant needs 16 costumes with a \$176\$176 budget including a 10% reserve. Even budget per costume? Opening night is December 18 with 10 weeks of work: start date?
23. **4 pts** Lesson 9 (rules)
State this course's rules for costume subjects, for measuring actors, and for stage safety.
24. **3 pts** Lesson 10.1
A pattern finishes 39 in; the actor needs 51 in. Change? Extra yardage for 2 lengths?
25. **3 pts** Lesson 10.2
A costume cost \$20\$20 and will be worn 25 times. Cost per wear? Exit 5:10, re-enter 5:50, change 28 s: margin?
26. **3 pts** Lesson 10.3
Value 9 before, 6.5 after on a 0–10 scale: steps darker and percent of the way to black? Name two dye safety rules.
27. **3 pts** Lesson 10.4
Head 23 in, drop 4 in, ruffle 2 in: mob cap circle diameter?
28. **6 pts** Lesson Units 1–10
Essay (8–12 sentences): Choose two pieces you made this year, one for the home and one costume (or two for the home if you did not costume). For each, explain one design decision, one calculation, one safety rule and one way the piece served someone else. End with what Scripture's picture of the capable woman, Dorcas, or the tabernacle's skilled workers says about the work of sewing.

ANSWER KEY

1. $312/156/52 \text{ ft}^2$ $312/156/52 \text{ ft}^2$.
2. $380 \div 33.9 \approx 11.2 \text{ oz/yd}^2$ $380 \div 33.9 \approx 11.2 \text{ oz/yd}^2$, heavy; about 9 years.
3. 71 in 71 in; about $1\frac{3}{4}$ –2 in.
4. Plates 27×23 27×23 ; boxing 5 in; perimeter 96 in; $2,288 \div 144 \approx 15.92$, $2,288 \div 144 \approx 15.9$ board feet.
5. Widths $(175 + 12) \div 54 \approx 3.46 \rightarrow 4$ $(175 + 12) \div 54 \approx 3.46 \rightarrow 4$; cut 9696 in (exactly 4 repeats); $(384 + 24) \div 36 \approx 11.33$
 $(384 + 24) \div 36 \approx 11.33$, buy $11\frac{3}{8}$ yd.
6. 45 in; $56 \div 11 \approx 5.09$ in $56 \div 11 \approx 5.09$ in; $38 \div 10 = 3.8$ in $38 \div 10 = 3.8$ in.
7. Every shade cordless; never a looped or dangling cord where children live or visit. $20 + 20 + 4 + 3 = 47$ in $20 + 20 + 4 + 3 = 47$ in.
8. Each 4-ply yarn was counted as four; counting yarns, it is 300.
9. $3\frac{3}{8}$ 383 in; 3 in 3 in; 0.85 in.
10. $228 + 12 = 240$ in $228 + 12 = 240$ in; 6 strips.
11. $2(38) - 16 + 4\pi \approx 72.6$ in $2(38) - 16 + 4\pi \approx 72.6$ in.
12. $88 + 48 + 2 = 138$ in $88 + 48 + 2 = 138$ in; $3 \times 88 = 264$ in $3 \times 88 = 264$ in (plus joins).
13. $90 \div 0.96 \approx 93.75$ in $90 \div 0.96 \approx 93.75$ in; preshrink before cutting.
14. Never sand, scrape or heat old painted finishes, wipe only; mask, gloves, glasses, ventilation, bag padding, wash hands.
 $[21 \div 5.5] = 4$ $[21 \div 5.5] = 4$ strips.
15. Foam $18.5 \times 17.5 \times 2$ $18.5 \times 17.5 \times 2$, $\approx 4.5 \approx 4.5$ board feet; cover 27×26 in 27×26 in.
16. $15 \div 18 \approx 0.83$ in $15 \div 18 \approx 0.83$ in; $36 \div 18 = 2$ in $36 \div 18 = 2$ in.
17. So they act as one level unit and share loads; safety glasses.
18. \$140.80 \$140.80; \$209.20 \$209.20; about \$13.08 \$13.08/h.
19. 72×42 in 72×42 in.
20. 20 in 20 in; 157 in 157 in; $\frac{1}{2}\pi(2,500) \approx 3,927 \text{ in}^2 \approx 3.0 \text{ yd}^2$ $\frac{1}{2}\pi(2,500) \approx 3,927 \text{ in}^2 \approx 3.0 \text{ yd}^2$.
21. $16/\pi \approx 5.116/\pi \approx 5.1$; 39.139.1; $\pi(39.1) \approx 122.8$ in $\pi(39.1) \approx 122.8$ in.
22. $\$158.40 \div 16 = \9.90 $\$158.40 \div 16 = \9.90 ; about October 9.
23. Only Bible, historical, pageant and classic-play costumes, nothing frightening or dark and nothing from comic books or film franchises; measurements over light clothing by a parent (father for a son, mother for a daughter), for fit only; hems clear, nothing trailing, secure headwear, no open flame, no sharp props.
24. Lengthen 12 in; about $\frac{2}{3}$ yd.
25. \$0.80 \$0.80; 12 s.
26. 2.5 steps; about 28%. Parent present, gloves, ventilation, dye-only container, never mix bleach.
27. $23/\pi + 12 \approx 7.3 + 12 = 19.3$ in $23/\pi + 12 \approx 7.3 + 12 = 19.3$ in.
28. Full credit for: two specific pieces; a design decision each with reason; a correct calculation each with units; a specific safety rule each; service named; a thoughtful connection to Proverbs 31, Acts 9 or Exodus 35/31.