TEACHER FIELD GUIDE



Five investigations in area, anchored in real Massachusetts places, people, and objects. Designed for about 14 students who know basic rectangular area.

Learning goals

Students measure rectangular prints in square centimeters, subtract areas, estimate irregular silhouettes, and explain when a map needs a scale.

Grouping and time

Make five groups: 3, 3, 3, 3, and 2 students. Plan 65 minutes: 5-minute do-now, 9-minute launch, five 8-minute rounds, four 1-minute transitions, and a 7-minute debrief/exit. Or split after round 2 into two sessions.

What each learner carries

One student packet, a pencil, and a ruler. Everyone records answers. Rotate Reader, Measurer, and Checker roles. In the pair, combine Reader and Checker.

Election framing

The teacher's November 4, 2026 screenshot shows AP calling Healey the winner at 81% reporting. It lists 62.75% as her vote share at that moment. These are different quantities. They are not final certified results.

PREPARATION / ABOUT 15 MINUTES

PRINT, PLACE, ROTATE

Print the student packet

Print pages 1–7 for 14 students. Give optional page 8 to advanced learners. Double-sided printing is fine for the packet. It is a recording booklet; students measure the separate station mats.

Print the station kit

Print pages 1–10 once each, single-sided. Odd pages are exhibit cards; even pages are measuring mats. Print pages 11–12 for the advanced option. Color helps reveal the artifacts. Use 100% / Actual Size, with "Fit" off.

Check the ruler square

Measure the 1 cm calibration square on every mat before class. If it is wrong, reprint at actual size. Place the mats flat in clear sleeves. Provide a dry-erase marker or tracing paper for the two irregular-outline stations.

Table supplies

All tables: exhibit card, measuring mat, ruler. Table 3: a classroom pen and spare grid paper for the optional footprint task. Tables 4 and 5: tracing paper or sleeves. Keep Station X at table 5 or on a nearby side desk.

ROTATION ORDER

GROUP	ROUND 1	ROUND 2	ROUND 3	ROUND 4	ROUND 5
A (3)	1	2	3	4	5
B (3)	2	3	4	5	1
C (3)	3	4	5	1	2
D (3)	4	5	1	2	3
E (2)	5	1	2	3	4

TEACHING THE INVESTIGATIONS

Launch script

"Yesterday's election connects to a real place where state government works. Today, you are a team of museum measurers. Every table gives you a real image or map. Your job is to decide what you can measure exactly and what you must estimate."

A short area reminder

Area counts equal square units. Length × width finds a rectangle's area. To find a border, subtract the opening from the outside rectangle. For an irregular outline, count full squares and combine partial squares. A photo's flat silhouette and a sculpture's curved surface answer different questions.

Scale support at Station 2

Core work: round the 9.4 cm × 5 cm court print to 9 × 5 and estimate 45 cm^2. Measure the photo print: 4 × 6 = 24 cm^2. The court print covers more paper. Real-court conversion is an optional extra: 1 cm^2 stands for 100 ft^2, so about 45 cm^2 stands for about 4,500 ft^2.

Support without reducing the task

Read exhibit text aloud first. Let partners share measuring while each records. Supply multiplication facts or allow repeated addition. For irregular outlines, mark full cells first and pair edge pieces in a second color. Ask for a reasonable explanation rather than identical totals.

Advanced alternative

Assign Station X instead of the map task at table 5. Use packet page 8. The Senate Chamber model has a 5.5 cm square base. Help learners partition it into a 5 × 5 square, two 5 × 0.5 strips, and a 0.5 × 0.5 corner. Volume uses cubic units. Its chosen 2 cm model height is not the real ceiling height.

Debrief prompts

"Which answers are exact for our prints?" "Which answers are estimates?" "Why does the tour map need a real-world scale?" Finish with the exit ticket. Keep election discussion factual and nonpartisan.

ANSWER KEY / EXACT AREAS

Do now

Blue: 9 × 9 = 81 square units. White: 100 – 81 = 19 square units. The 81% describes reporting progress. The 100-square model represents a percentage, not actual ballots. The screenshot gives Healey's vote share as 62.75% at that time.

01 / Massachusetts flags

Large flag: 10 cm × 6 cm = 60 cm^2. Small flag: 5 cm × 3 cm = 15 cm^2. Difference: 45 cm^2. Both side lengths double, so the area becomes four times as large. A valid picture explanation divides the large flag into four 5 cm × 3 cm rectangles.

02 / The governor's court

Court print: nearest whole centimeters give 9 × 5 = about 45 cm^2. It is an estimate because a side was rounded. Photo print: 4 × 6 = 24 cm^2. The court print covers more paper. Optional scale challenge: 45 × 100 = about 4,500 ft^2. Published court dimensions give 94 × 50 = 4,700 ft^2.

03 / Constitution mat

Outside: 7 cm × 9 cm = 63 cm^2. White window: 5 cm × 7 cm = 35 cm^2. Visible blue: 63 – 35 = 28 cm^2. Perimeter measures the distance around an edge, not the space it encloses. The frame dimensions belong to this classroom print, not the historical manuscript.

Optional signing-pen footprint

Answers depend on the pen and grid. Accept the area of the traced top-view outline with units stated. It is a two-dimensional footprint, not the pen's total curved surface area. The classroom pen is a prop, not a governor-owned artifact.

ANSWER KEY / ESTIMATES

04 / Sacred Cod silhouette

Whole grid: 12 × 4 = 48 cm^2, or two groups of 6 × 4. A reference fish trace gives about 19 cm^2. Accept roughly 16–24 cm^2 with a careful full-square/partial-square method. Include fins and tail, but exclude the shadow and wires. The fish covers less than the grid because background space is outside the fish.

05 / Official floor-plan print

Whole grid: 8 × 9 = 72 cm^2. A reference building outline gives about 37 cm^2. Accept roughly 33–42 cm^2 with careful counting. Include walls and all enclosed space as one footprint. The print covers less than the whole grid. It does not show usable floor area, and no real-world scale is supplied.

X / Decimal area and volume

Model side: 5.5 cm. Base area: 5.5 × 5.5 = 30.25 cm^2 (25 + 2.5 + 2.5 + 0.25). Box-model volume: 30.25 × 2 = 60.5 cm^3. Bonus real square footprint: 55 × 55 = 3,025 ft^2. The model height is a chosen design dimension; it does not establish the real chamber's volume.

Exit ticket

Whole sign: 8 × 6 = 48 cm^2. Photo: 5 × 4 = 20 cm^2. Uncovered sign: 48 – 20 = 28 cm^2. Estimate examples: the fish or floor plan has an irregular outline; the court task rounds a measurement. Historical fact responses vary.

Quick assessment

Look for correct units, sensible ruler use, a visible calculation or counting strategy, and an explanation of exact versus estimated area. A reasonable irregular-area method matters more than matching the reference trace.

SOURCES & IMAGE CREDITS

Links below support the historical facts, biography, measurements, and source images. Full links are clickable in this PDF. The supplied election screenshot is an interim news snapshot.

01. State House rooms and history

02. Official self-guided tour and floor plan

03. Memorial Hall / Hall of Flags

04. Sculpture collection

05. Sacred Cod catalogue: 10 × 59½ inches

06. 1780 Constitution and John Adams

07. Governor biography and portrait

08. Healey's public family biography

09. Harvard basketball history

10. Harvard roster: jersey 14

11. NCAA court dimensions

12. 2026 reelection reporting

13. Massachusetts flag image

14. Sacred Cod photographsgraph and license

15. Harvard basketball photograph

Additional images: official interior gallery (Memorial Hall, governor's office, Senate Chamber). John Adams mural and Senate dimensions: Legislature virtual tour. Links are included on page 7.

THE REAL OBJECTS BEHIND THE MATH

Photographs and reproductions

State House exterior: Daderot, CC0, via Wikimedia Commons. Great Hall photograph: Citizens for Juvenile Justice. Maura Healey portrait: National Governors Association. Harvard action photograph: Harvard University, published by The Boston Globe. John Adams and Constitution images: Commonwealth Museum. Official interior photographs: Secretary of the Commonwealth. John Adams mural and Senate dimensions: Massachusetts Legislature.

Sacred Cod photographs

Close-up: Dennis Wright, CC BY 2.0, via Wikimedia Commons; grid added. Chamber view: Liberma, "Sacred Cod - For Wikipedia.jpg," CC BY-SA 4.0, via Wikimedia Commons; reproduced proportionally. Licenses: creativecommons.org/licenses/by/2.0/ and creativecommons.org/licenses/by-sa/4.0/ . A photograph cannot establish the sculpture's curved surface area.

Flag and official map

Flag artwork: Commonwealth of Massachusetts, public domain, via Wikimedia Commons. Tour map: Secretary of the Commonwealth, official self-guided tour PDF dated April 26, 2023. The second-floor map is cropped from that sheet, surrounding prose removed, and a centimeter grid added. Proportions of the map itself are preserved.

What is to scale?

Flags preserve 5:3 proportions without a claimed scale to one particular cloth flag. Court scale: 1 cm : 10 ft. Constitution mat: exact classroom dimensions. Cod and tour map: no real-world scale. Advanced Senate base: 1 cm : 10 ft using the published 55 ft square room. Its chosen model height has no real-world scale.

Public biography only

Healey's partner is Joanna Lydgate. Her public biography connects school, family, basketball, and government service. Keep discussion neutral and welcoming to different family structures. Students may share a fact from the biography without being asked to disclose their own family circumstances.