

Chapter 15 — Scale, Maps, Drawings, and Similar Figures — Teacher Guide

Chapter at a glance

Lesson duration	5 lessons, 45–65 minutes each (see pacing table below)
Materials	Map strips, real-distance cards, scale-direction arrows, blueprint rectangles, photo enlargement cards, corresponding-side labels, rulers, graph paper, similarity factor tables, the three chapter diagrams
Launch question	“A map uses $1\text{ cm} = 5\text{ km}$. If the map shows 6 cm , should the real distance be larger or smaller? What if the real distance is 25 km — should the map length be larger or smaller?”
Key representation	The scale-direction arrows — keep them visible throughout instruction
Anticipated responses	Correct: predicts the direction before calculating and applies one consistent factor to every corresponding length. Partial: calculates a correct magnitude but reverses the direction or checks only one side pair. Incorrect: cannot interpret the scale statement or confuses which operation matches which direction.
If the readiness check fails	Reteach scale factors and inverse operations from Chapters 3 and 10 before starting the Launch; do not skip the direction-prediction step
Talk prompt	“Are you moving from drawing to real, or real to drawing? Should the answer be larger or smaller?”
Exit ticket	5 items — map to real, real to drawing, similarity check, photo enlargement, state the scale-direction routine (see Section 13)
Reteach / extend	Reteach: single-direction problems only, with physical scale strips. Extend: multi-step conversions, non-unit scale statements, and the distinction between length and area scale factors.

Purpose and pacing

Chapter 15 connects proportional reasoning to geometry and measurement. The essential idea is that a scale is a ratio with direction, while similarity requires one common factor across all corresponding lengths.

Lesson	Focus	Suggested time
Lesson 1	Readiness, launch, scale direction, and scale strips	45–60 minutes
Lesson 2	Maps, real-to-drawing, and blueprints	50–65 minutes
Lesson 3	Enlargements, reductions, and corresponding sides	50–65 minutes
Lesson 4	Similar figures, misconceptions, and Tripwire	50–65 minutes
Lesson 5	Mixed practice, Exit Ticket, and targeted reteaching	45–60 minutes

Materials

Prepare map strips, real-distance cards, scale-direction arrows, blueprint rectangles, photo enlargement cards, corresponding-side labels, rulers, graph paper, and similarity factor tables.

Teacher launch guidance

Begin with $1 \text{ cm} = 5 \text{ km}$ and intentionally ask both map-to-real and real-to-map questions. Students should predict whether the answer should be larger or smaller before calculating. This prediction is a powerful direction check.

For similarity, use figures that are larger but not similar. Students should compare all corresponding side pairs rather than relying on appearance or size alone.

When introducing blueprints, keep the scale statement visible beside both dimensions. The same direction and factor must apply to length and width.

Teacher prompts

Purpose	Prompt
Read scale	“What does one drawing unit represent?”
Track direction	“Are you moving from drawing to real or real to drawing?”
Predict magnitude	“Should the answer be larger or smaller?”
Identify correspondence	“Which sides occupy matching roles?”
Check similarity	“Does one factor work for every pair?”
Check units	“What unit should the answer have?”
Interpret factor	“Is this an enlargement or reduction?”
Diagnose	“What did the student multiply or divide,

Purpose	Prompt
	and why?"

Differentiation

Students needing concrete support

Use physical strips where one drawing centimetre is paired with the represented real distance. Have students count groups for real-to-drawing division. Use matching side cards before introducing similarity notation.

Students needing language support

Use the frames:

- "The scale says 1 _____ represents _____."
- "I am moving from _____ to _____, so I _____."
- "The scale factor is _____."
- "The corresponding sides are _____ and _____."
- "The figures are/are not similar because _____."

Students ready to extend

Use fractional scales, multi-step map conversions, non-unit scale statements, photo and model enlargements, and the distinction between length scale factor and area scale factor.

Formative assessment

Record whether students interpret the scale, predict the direction, choose multiplication or division, track units, match corresponding sides, use one factor consistently, and explain similarity. A correct numerical result with reversed units should be marked developing.

Revision Support: Expected Ideas and Teacher Moves

Use this compact guide with the new Cumulative Connection and Strategy Studio tasks. Accept equivalent representations when the relationship, units, and reasoning are correct.

Cumulative Connection: Find the scale factor from 4 cm to 10 cm. Use a map scale of 1 cm : 5 km to interpret 7 cm. Explain why area changes by the square of a linear scale factor. Decide whether two figures with side ratios 2:3 but different angle measures are similar.

Strategy Studio guidance: Expected ideas: factor 3 multiplies length and perimeter by 3 but area by 9; 5.5 cm represents 44 km; the 3-by-5 and 6-by-10 rectangles have factor 2 and area factor 4; use unit squares or a grid for the area misconception.

Transfer Bridge Teacher Guidance

Use the four tasks to distinguish imitation from transfer. Ask students to name the relationship, keep units visible, compare representations, and explain or repair an error. Accept equivalent methods when the structure and interpretation are correct.

Expected guidance: Familiar: length and perimeter scale by 3; area scales by 9. Altered: $5.5 \times 8 = 44$ km. Non-routine: 3×5 and 6×10 have side factor 2 and area factor 4. Repair: doubling both dimensions creates four times as many unit squares.

Record whether the difficulty is classification, representation, operation, computation, units, interpretation, or checking. Do not assign more routine practice until the source of the error is identified.

Discussion and evidence note

Ask students to name the relationship before calculating, compare at least two representations when appropriate, and revise an explanation after hearing another strategy. Record whether the difficulty is classification, representation, operation, computation, units, or checking.

Answer Key

Ready-to-Learn Check

One centimetre on drawing represents 5 metres in real life.

20 m.

5 cm.

Doubles length.

Halves length.

Matching-role sides.

Yes, if all corresponding lengths share one factor.

Worksheet A

- 20 km.** Likely wrong answer: 1.25 km (divides 5 by 4 instead of multiplying 4 by 5). Misconception: reversing the scale direction — treating map-to-real as division. Next move: “does one centimetre represent a bigger or smaller distance in real life? Should the answer be larger or smaller than 4?”
- 5 cm.** Likely wrong answer: 125 cm (multiplies 25 by 5 instead of dividing). Misconception: reversing the scale direction — treating real-to-map as multiplication. Next move: “does the drawing length need to be larger or smaller than 25? Should you multiply or divide?”
- 5 cm.** Likely wrong answer: 20 cm (multiplies 10 by 2 instead of dividing). Misconception: same reversed-direction error. Next move: “how many 2 m groups fit in 10 m?”
- 12 m.** Likely wrong answer: 3 m (divides 6 by 2 instead of multiplying). Misconception: same reversed-direction error, opposite case. Next move: “does drawing-to-real multiply or divide by the scale number?”
- Yes, factor 2.** Likely wrong answer: “no,” because the rectangles are different sizes, without checking whether one common factor connects both dimensions. Misconception: assuming different size automatically means not similar. Next move: “does the same factor turn 2 into 4 and 4 into 8?”
- No; long-side factor 2, short-side factor 2.4.** Likely wrong answer: “yes,” checking only one side pair (for example, just the long sides) and assuming the other pair matches. Misconception: checking only one corresponding pair instead of all of them. Next move: “does the short-side factor match the long-side factor?”
- 12 cm.** Likely wrong answer: 7 cm (adds 3 and 4 instead of multiplying). Misconception: confusing scaling with combining. Next move: “does a scale factor of 4 mean add 4, or multiply by 4?”
- 5 cm.** Likely wrong answer: 10.5 cm (adds 10 and 0.5 instead of multiplying). Misconception: same as #7. Next move:

“does a scale factor of 0.5 mean subtract, or multiply by 0.5?”

9. **Questions 1-2 end in km; Questions 3-4 end in cm or m as requested.** *Common flaw: gives correct numbers but omits or mismatches the units. Next move: “what unit does each question ask for?”*
10. **Map-to-real expands from one drawing unit; real-to-map finds how many drawing units fit.** *Common flaw: says the operations are “different” without explaining what each one actually represents. Next move: ask what question each operation answers.*

Worksheet B

1. **42 km.** *Likely wrong answer: 0.86 km (divides 6 by 7 instead of multiplying). Misconception: reversing the scale direction. Next move: “does one centimetre represent a bigger or smaller distance in real life?”*
2. **8 cm.** *Likely wrong answer: 648 cm (multiplies 72 by 9 instead of dividing). Misconception: reversing the scale direction. Next move: “how many 9 km groups fit in 72 km?”*
3. **45 km.** *Likely wrong answer: 1.8 km (finds the wrong unit rate by dividing the wrong pair). Misconception: not finding km per cm before scaling. Next move: “what does 1 cm represent? Find that first, then multiply by 5.”*
4. **9 cm.** *Likely wrong answer: 4 cm (finds the wrong unit rate). Misconception: same as #3. Next move: “what does 1 cm represent here? Find that first, then divide.”*
5. **7 cm.** *Likely wrong answer: 112 cm (multiplies instead of dividing). Misconception: reversing the scale direction. Next move: “how many 4 m groups fit in 28 m?”*
6. **42 m.** *Likely wrong answer: 1.17 m (divides instead of multiplying). Misconception: reversing the scale direction. Next move: “does drawing-to-*
- real multiply or divide by the scale number?”*
7. **5 cm by 3 cm.** *Likely wrong answer: 80 cm by 48 cm (multiplies instead of dividing for a real-to-drawing conversion). Misconception: reversing the scale direction. Next move: “should the drawing be bigger or smaller than the real room?”*
8. **No; factors 2 and 2.5.** *Likely wrong answer: “yes,” checking only one side pair. Misconception: checking only one corresponding pair instead of all of them. Next move: “does the second-side factor match the first?”*
9. **300 cm or 3 m.** *Likely wrong answer: 0.48 cm (divides instead of multiplying). Misconception: reversing the scale direction. Next move: “is the real object bigger or smaller than the model? Multiply or divide?”*
10. **Match corresponding sides and verify one common scale factor across all pairs.** *Common flaw: says to “compare the shapes” without specifying the actual side-by-side numerical check. Next move: ask for the specific calculation that confirms similarity.*

Worksheet C

1. **90 km.** *Likely wrong answer: 0.625 km (divides instead of multiplying). Misconception: reversing the scale direction. Next move: “does one centimetre represent a bigger or smaller distance in real life?”*
2. **7 cm.** *Likely wrong answer: 3,150 cm (multiplies instead of dividing). Misconception: reversing the scale direction. Next move: “how many 15 km groups fit in 105 km?”*
3. **8 cm by 5 cm.** *Likely wrong answer: 50 cm by 31.25 cm (multiplies instead of dividing for a real-to-drawing conversion). Misconception: reversing the scale direction. Next move: “should*

- the blueprint be bigger or smaller than the real room?"
4. $8 \times 15 = 120$ cm. **Answer: 120 cm or 1.2 m.** Likely wrong answer: ≈ 0.53 cm (divides instead of multiplying). Misconception: reversing the scale direction. Next move: "is the real object bigger or smaller than the model?"
 5. **Yes, factor 2.5.** Likely wrong answer: checks only one side pair and assumes the other matches without verifying. Misconception: checking only one corresponding pair. Next move: "does the same factor work for both the 6-to-15 pair and the 10-to-25 pair?"
 6. **9, 13.5, and 18.** Likely wrong answer: 7.5, 10.5, and 13.5 (adds 1.5 to each side instead of multiplying by 1.5). Misconception: confusing scaling with combining. Next move: "does a scale factor of 1.5 mean add 1.5, or multiply by 1.5?"
 7. $600 \times 1.20 = 720$; $720 \times 0.85 = 612$. Likely wrong answer: $600 \times 1.05 = 630$ (adds the percentages, $20\% - 15\% = 5\%$, instead of applying them successively). Misconception: treating successive percent changes as additive rather than multiplicative. Next move: "does the 15% decrease act on 600, or on the already-increased amount?"
 8. **7 cm.** Likely wrong answer: 448 cm (multiplies instead of dividing). Misconception: reversing the scale direction. Next move: "how many 8 km groups fit in 56 km?"
 10. **Answers vary but must state direction and units.** Common flaw: solves a self-created problem correctly in one direction but doesn't demonstrate the reverse direction. Next move: require both a map-to-real and a real-to-map calculation.
 11. **One pair could match by coincidence; similarity requires the same factor for every corresponding pair.** Common flaw: says "you need more than one side" without explaining why a single matching pair isn't sufficient evidence. Next move: give an example where one pair matches but another doesn't.
 11. **180 km. The number of work hours per day (6) and the type of employer (mapping company) were not needed to find the real distance.** Likely wrong answer: works the 6 hours into the calculation somehow. Misconception: assuming every number in a word problem must be used. Next move: "what does the question actually ask for? Which numbers answer that?"
 12. **Answers vary; must describe two rectangles where 24 and 8 are corresponding side lengths and 3 is the scale factor connecting them, with each meaning stated.** Common flaw: gives a context but doesn't identify which numbers are the corresponding sides and which is the factor. Next move: ask the student to finish three sentences — "24 is __," "8 is __," "3 is __."

Extend, Tripwire, and Exit Ticket

1. $8 \div 2.5 = 3.2$ groups; $3.2 \times 15 = 48$ km.
2. $42 \div 14 = 3$; $3 \times 3 = 9$ cm.
3. 10 cm by 15 cm.
4. 3 cm, 4.2 cm, and 5.4 cm.
5. Answers vary but factors must differ.
6. Area is two-dimensional, so its scale factor is the square of the length factor.

Tripwire: 9 cm.

Exit Ticket: 24 km; 7 cm; yes, factor 2; 25 cm; read the scale, identify direction,

predict larger or smaller, calculate, and check units.

