

GRADE 7 · GEOMETRY · ANSWER KEY

SCALE DRAWINGS

Today's goal: I can compute actual lengths from a scale drawing (using proportional reasoning), compute actual areas from a scale drawing (using proportional reasoning) and reproduce a scale drawing at a different scale (using proportional reasoning).



How to use this key. Problem numbers match the student sheets. Each answer shows the steps and the slip Mr DJ sees most, so a wrong answer tells you what to reteach. Pepper levels: **Mild** warm-up, **Medium** stretch, **Spicy** challenge, **Extra Spicy** big brain.

Practice

8 problems + Mr DJ's worked example

Use: During the lesson after the deck. Item 7 is the one that makes the rule make sense; item 3 catches the reverse direction, which is easy to lose. **Timing:** 15–25 min · pairs or independent · circulate on 6 and 9. Drawing four rows of four small rectangles inside the big one settles item 8 for most students.

- 1 100 cm 2 24 metres 3 6 cm 4 25 5 384 cm² 6 $\frac{3}{4}$ 7 12 cm by 32 cm gives 384 cm² — the same
8 They applied the LENGTH factor to an AREA; the area factor is $4^2 = 16$

1 **MILD** 5 cm at 1 : 20?

100 cm

1. $5 \times 20 = 100$ cm.

Watch for: Divided by 20.

2 **MEDIUM** 12 cm at 1 : 200, in metres?

24 metres

1. $12 \times 200 = 2400$ cm. Then $2400 \div 100 = 24$ m.

Watch for: Answered 2400 m by scaling and forgetting the unit change.

3 **MEDIUM** 6 m real, on a 1 : 100 drawing?

6 cm

1. This goes the other way: divide by the scale.
2. 6 m = 600 cm. Then $600 \div 100 = 6$ cm.
3. Going from real to drawing DIVIDES; going from drawing to real MULTIPLIES.

Watch for: Multiplied by 100 to get 600 cm, which would be a six-metre drawing.

4 **MEDIUM** Lengths $\times 5$, area factor?

25

1. $5^2 = 25$.

Watch for: Answered 5, or 10 by doubling.

5 **MEDIUM** 3 cm by 8 cm, lengths $\times 4$

384 cm²

1. Old area: $3 \times 8 = 24$ cm².
2. Area factor: $4^2 = 16$.
3. New area: $24 \times 16 = 384$ cm².

Watch for: Answered 96 by multiplying the area by 4.

6 **SPICY** Lengths halved, area factor?

$\frac{1}{4}$

1. The length factor is $\frac{1}{2}$, so the area factor is $(\frac{1}{2})^2 = \frac{1}{4}$.
2. Halving every length quarters the area.
3. Check: a 4 by 6 rectangle has area 24. Halved it is 2 by 3, area 6, and 6 is a quarter of 24.
4. The squaring rule works for shrinking exactly as it does for growing.

Watch for: Answered $\frac{1}{2}$. The rule applies to factors below 1 too, and squaring a fraction makes it smaller still.

7 **SPICY** Check by scaling each dimension

12 cm by 32 cm gives 384 cm² — the same

1. New dimensions: $3 \times 4 = 12$ cm and $8 \times 4 = 32$ cm.
2. New area: $12 \times 32 = 384$ cm². Matches.
3. This second route explains the first: each dimension picked up a factor of 4, so the product picked up $4 \times 4 = 16$.
4. The squaring is not an extra rule to remember — it is what happens when both dimensions scale.

Watch for: Got 384 both ways but did not connect them. The point of the second method is that it EXPLAINS the first.

8 **EXTRA SPICY** 'Scale factor 4, so area 4 times bigger'

They applied the LENGTH factor to an AREA; the area factor is $4^2 = 16$

1. A scale factor of 4 multiplies every LENGTH by 4.
2. Area is a product of two lengths, so it picks up the factor twice: $4 \times 4 = 16$.
3. Their answer, 4 times bigger, would give 96 cm², but the true area is 384 cm².
4. What they confused: they treated area as though it were a length. Length is one dimension, area is two.
5. A useful test: ask how many of the small shape fit inside the big one. Four rows of four is 16, not 4.

Watch for: Said they made an arithmetic mistake. The arithmetic is fine; they applied the right factor to the wrong kind of quantity.

Homework

7 problems + Mr DJ's worked example

Use: Parallels the practice sheet, then reverses it: items 6 and 7 go from an area factor back to a length factor, which is the direction assessments favour. **Timing:** ~15 min at home · independent · review item 7 as the next-day warm-up; the 6-versus-36 contrast is the memorable part.

1 210 cm

2 60 metres

3 100

4 180 cm²

5 10 cm by 18 cm = 180 cm²

6 3, because $3^2 = 9$

7 6, because $6^2 = 36$

1 **MILD** 7 cm at 1 : 30?

210 cm

1. $7 \times 30 = 210$ cm.

Watch for: Divided by 30.

2 **MEDIUM** 15 cm at 1 : 400, in metres?

60 metres

1. $15 \times 400 = 6000$ cm. Then $6000 \div 100 = 60$ m.

Watch for: Answered 6000 m.

3 **MEDIUM** Lengths $\times 10$, area factor?

100

1. $10^2 = 100$.

Watch for: Answered 10, or 20.

4 **MEDIUM** 5 cm by 9 cm, lengths $\times 2$

180 cm²

1. Old area: 45 cm². Area factor: $2^2 = 4$.
2. $45 \times 4 = 180$ cm².

Watch for: Answered 90 by doubling the area.

5 **MEDIUM** Check by dimensions

10 cm by 18 cm = 180 cm²

1. $5 \times 2 = 10$ and $9 \times 2 = 18$.
2. $10 \times 18 = 180 \text{ cm}^2$. Matches.

Watch for: Scaled only one dimension, giving 90.

6 **SPICY** Area $\times 9$ — length factor?

3, because $3^2 = 9$

1. Area scales by k^2 , so $k^2 = 9$.
2. The number that times itself gives 9 is 3, so $k = 3$.
3. Check: a 2 by 5 rectangle has area 10. Scaled by 3 it is 6 by 15, area 90, which is 9 times 10.
4. Going from an area factor back to a length factor means undoing the squaring.

Watch for: Answered 9, giving the area factor rather than the length factor the question asked for.

7 **SPICY** Area $\times 36$ — length factor?

6, because $6^2 = 36$

1. $k^2 = 36$, so $k = 6$.
2. Found by asking what number times itself gives 36: $6 \times 6 = 36$.
3. Check: a 3 by 4 photo has area 12. Scaled by 6 it is 18 by 24, area 432, and $432 \div 12 = 36$.
4. Note the lengths grew only 6 times while the area grew 36 times — which is why an enlarged photo uses far more ink than the length change suggests.
5. The gap between 6 and 36 is the whole idea of this lesson.

Watch for: Answered 18 by halving 36, or 36 by repeating the area factor. The relationship is squaring, not halving or copying.

Exit Ticket

4 problems

Use: End of the scale drawings lesson, opening G7 Geometry. 5–8 min, independent. Item 4 derives the squaring rule instead of testing recall of it. **Timing:** 5–8 min · independent. An answer of 12 on item 3 is the area error and predicts item 4 as well.

1 150 cm

2 2 metres

3 24 cm²4 12 cm by 18 cm; area 216 cm²; nine times bigger

1 MILD 3 cm at 1 : 50?

150 cm

1. Every 1 cm represents 50 cm, so multiply by 50.
2. $3 \times 50 = 150$ cm.

Watch for: Divided by 50 to get 0.06 cm. The real object is larger than the drawing, so the scale multiplies.

2 MEDIUM 8 cm at 1 : 25, in metres?

2 metres

1. $8 \times 25 = 200$ cm.
2. Convert: $200 \text{ cm} \div 100 = 2$ metres.
3. Do the scaling first and the unit conversion second — mixing them is where errors creep in.

Watch for: Answered 200 without converting, or converted first and then scaled.

3 MEDIUM Area 6 cm², lengths doubled?**24 cm²**

1. Doubling every length multiplies the area by $2^2 = 4$.
2. $6 \times 4 = 24$ cm².
3. Why: a rectangle 2 by 3 has area 6. Doubled it is 4 by 6, with area 24 — both dimensions grew, so the area grew twice over.

Watch for: Answered 12 by doubling the area. Area scales by the SQUARE of the length factor, not the factor itself.

4 SPICY 4 cm by 6 cm, lengths $\times 3$ **12 cm by 18 cm; area 216 cm²; nine times bigger**

1. New dimensions: $4 \times 3 = 12$ cm and $6 \times 3 = 18$ cm.
2. New area: $12 \times 18 = 216$ cm².
3. Old area: $4 \times 6 = 24$ cm².
4. $216 \div 24 = 9$, so the area is NINE times bigger.
5. That is 3^2 . Multiplying every length by 3 multiplies area by $3^2 = 9$, and this calculation is the proof rather than the rule.

Watch for: Answered 72 cm² by multiplying the original area by 3. Working through the dimensions shows why that is too small.

Lesson slides

teaching notes & timing

Slide	Time	What to do
1	0:00	Frame it: scaling a length is easy. Scaling an area is where marks are lost.
2	1:00	Hook — poll 12 vs 24. Do NOT resolve. 12 is the majority answer and feels obviously right.
3	2:30	Lengths, both directions. The real-to-drawing direction is the one students forget.
4	4:30	WE1 — resolve the hook by DRAWING it. Show four copies of the small rectangle filling the big one.
5	7:00	WE2 — the dimension check. Say explicitly that this explains the rule rather than restating it.
6	11:30	Backwards, and the shrinking case. Assessments favour the backwards direction; students rarely practise it.
7		Show the problem and the slip. Pairs: what went wrong, and what is the right answer? Take two answers before moving on.
8		Solve it together, one step at a time. It is also the worked example at the top of the practice sheet, so students can look back at it.
9	9:30	CFU — all-student response. 216 cm ² . Watch for 72, which scaled the area by 3. Whiteboards: everyone tries Mild, then climbs. These are #1, #2, #6 on the practice sheet.
10		Fingers up: 3 = got it, 2 = almost, 1 = not yet. Pull the 1s for a quick reteach while everyone else starts the practice sheet.
11	13:30	Launch the in-class practice sheet. Launch the practice sheet. Exit ticket in the last 5–8 minutes.