Lesson 89 SHAPE & SPACE

Enlargement and scale factor

CURRICULUM ALIGNMENT

SHA.TRN.4b analyse and show how shapes are enlarged on scaled diagrams.

SHA.TRN.4a perform and devise a range of steps involving transformations.

NUM.FRC.4b investigate proportionality and ratios of quantities (sets).

INTERACTIVES Transformation Playground · challenge, display, explore

WHAT THIS LESSON TEACHES

A transformation that makes a shape bigger while keeping its proportions. Every length is multiplied by the same number.

→ A 2 cm by 3 cm rectangle enlarged by scale factor 2 becomes 4 cm by 6 cm.

→ If a 4 cm side becomes 12 cm the scale factor is 3 because 4 times 3 equals 12.

MODEL THIS ON THE BOARD

ENLARGE A 2 CM BY 3 CM RECTANGLE BY SCALE FACTOR 2

1. Start with sides of 2 cm and 3 cm.
2. Multiply each length by **2**.
3. The new sides measure **4** cm and **6** cm.

LESSON ARC

Open with two rectangles side by side on the interactive — same shape, one bigger — and fish for 'twice as tall AND twice as wide' before naming anything. In Watch and Notice, pin the scale factor on one side: 3 squares becomes 6 by multiplying, not 5 by adding. Pupils draw a 2 cm by 3 cm rectangle and its ×3 copy in their copybook, labelling 6 cm and 9 cm. The Student Activity Book at their desks is the practice.

TEACHING MOVES

1. **Getting Started.** Take two or three hands-up answers, not open call-outs. Fish for 'bigger' and 'twice' or 'double', but hold out for the idea that both the height and the width grew by the same amount. Don't reveal 'scale factor' yet.
2. **Watch and Notice.** On the rectangle ×2, count grid squares along each side of the copy against the original so pupils see both sides doubled by the same multiplier — then name it: scale factor. On the triangle ×3, ask what stayed the same and draw out that the angles are unchanged. Pin the key slip on a side of 3: adding 2 gives 5, multiplying by 2 gives 6.
3. **Try It Together.** Pupils take turns at the board while the class agrees or corrects out loud. Before each enlargement, ask them to predict the new length of one named side. Catch the pupil who says a side 'went up by 2' — this round is for talking it through, not marking.
4. **Draw the Enlargement in Your Copy.** Walk the room glancing at the labelled side lengths — whole-class copybook practice, not marking. Look for the pupil who draws the copy the right shape but multiplies only one side by 3, leaving the other unchanged.
5. **Class Challenge.** Keep the board work brisk — pupils take turns, check each answer, class confirms, move on. After the ×4 target is matched, flip the question aloud: a side that was 2 squares is now 8, so what did

we multiply by? (8 ÷ 2 = 4.) Hold that reasoning-back discussion until after the strongest pupils have matched the target.

6. **What Did We Notice?.** Count the inside squares of both rectangles together — 6 becomes 24, not 12. Re-voice: both the length and the width doubled, so the space inside grows by two times two. Let the class land on 'it grows by more than the scale factor' and leave the full reasoning open — nothing to write down.

COMMON MISCONCEPTIONS

⚠ A pupil says a side 'went up by 2' — for a side of 3 squares they draw 5 instead of 6, treating enlargement as adding the scale factor to each side.

Pin it on the interactive on one named side: 3 + 2 = 5, but 3 × 2 = 6. Draw both copies and show only the multiplied one keeps the shape — the added-on version comes out squashed.

⚠ A pupil enlarges the rectangle correctly on one side but forgets to multiply the other side by the same factor, so a 2 cm by 3 cm copy becomes 6 cm by 3 cm.

Hold the copy against the original on the grid — it's now the wrong shape, stretched out. Say the rule again: every length is multiplied by the same scale factor, and re-check both labels together.

⚠ Pupils assume the area of the ×2 copy is just doubled, expecting 12 squares from the 6-square original.

Count the inside squares of the copy live on the interactive — 24, not 12. Draw out that both length and width doubled, so the space grows by two times two. Leave the general rule open; the aim is the noticing, not a formula.

DIFFERENTIATION

EMERGING

- Stay on scale factor 2 only while the class moves to ×3 and ×4, so the pupil is always doubling a countable side.
- In the copybook, let the pupil count grid squares to build the enlargement rather than multiplying cm lengths abstractly.

DEVELOPING

- After the copybook rectangle, swap to a 3 cm by 5 cm shape enlarged by 4 and ask them to predict both new lengths before drawing.
- Give a find-the-factor variant: a 3 cm side became 15 cm — what was the scale factor, and how do you know?

PROFICIENT

- While the class matches the ×4 triangle, narrate a harder variant to fast finishers: if a copy has 9 times the area of the original, what was the scale factor on the sides? Have them work it in their copybook.
- Pull them ahead into the Student Activity Book page and ask them to explain, as if to a younger pupil, why adding to each side does not enlarge a shape.

↗ **Cross-curricular:** Link to Visual Arts — pupils grid-enlarge a small sketch by scale factor 2, copying square by square onto a bigger grid to keep the proportions.

ANSWER KEY

Scaffold: visual check on the page

Q1: 225 cm

Q2: 196 cm

Q3: 56 cm

Q4: 10 cm

Q5: 18 cm

a) Always — Multiplying each side by 2 always doubles it.

b) Always — All sides scale equally so proportions and angles stay the same.

c) Never — Area multiplies by the square of the scale factor so it becomes four times as big.

d) Never — Proportions are kept so the shape type never changes.

EXTENSION SHEET · STRETCH ANSWERS

S1: 25 m

S2: 30 m

S3: 4.5 m