# Test answers - Similarity and enlargement

Year: Year 9 · Duration: 45 minutes · /20

## Answer to Question 1 (4 marks)

a. An enlargement multiplies every length by the scale factor: $6 \times 2.5 = 15$ cm (1 mark) and $4 \times 2.5 = 10$ cm (1 mark). Q is **15 cm by 10 cm**.
b. The long side of R corresponds to the long side of P, so the scale factor is $4.5 \div 6 =$**0.75**. (1 mark)
c. Multiply the short side of P by the same scale factor: $4 \times 0.75 =$**3 cm**. (1 mark)

A scale factor less than 1 makes the shape smaller, so R is a reduction of P even though it is still called an enlargement in mathematics. Check: in P the sides are in the ratio $6 : 4 = 3 : 2$; in Q $15 : 10 = 3 : 2$; in R $4.5 : 3 = 3 : 2$. Similar rectangles always keep this ratio.

## Answer to Question 2 (4 marks)

a. DE corresponds to AB, so the scale factor is $9 \div 6 =$**1.5**. (1 mark)
b. EF corresponds to BC: $8 \times 1.5 =$**12 cm** (1 mark). DF corresponds to AC: $7 \times 1.5 =$ **10.5 cm** (1 mark).
c. Match the sides by size: smallest with smallest and so on. The ratios are $12 \div 6 = 2$, $14 \div 7 = 2$ and $16 \div 8 = 2$. All three are equal, so **yes**, the triangle is similar to ABC with scale factor 2. (1 mark)

The letters tell you which sides correspond: D matches A and E matches B, so DE matches AB. If even one of the three ratios were different, the triangles would not be similar.

## Answer to Question 3 (4 marks)

a. With centre (0, 0), multiply each coordinate by the scale factor 3: $(1, 1) \to (3, 3)$, $(3, 1) \to (9, 3)$, $(1, 2) \to (3, 6)$. The new vertices are $(3, 3)$**,** $(9, 3)$**,** $(3, 6)$. (2 marks for all three, 1 mark for two)
b. To undo an enlargement by 3, enlarge by $\frac{1}{3}$ about the same centre. The transformation is an **enlargement** (1 mark), scale factor $\frac{1}{3}$, centre (0, 0) (1 mark).

A full description of an enlargement needs three things: the word enlargement, the scale factor and the centre. Check (a): the base of T is 2 units long and the image base

is $9 - 3 = 6$ units, three times as long.

## Answer to Question 4 (4 marks)

a. The sun's rays are parallel, so the stick, the tree and their shadows form similar triangles. The scale factor from the stick's shadow to the tree's shadow is $13.5 \div 1.8 = 7.5$ (1 mark). The tree is 7.5 times as tall as the stick: $1.2 \times 7.5 =$**9 m** (1 mark).

b. The stick's shadow grows from 1.8 m to 3 m, a factor of $3 \div 1.8 = \frac{5}{3}$ (1 mark).

The tree's shadow grows by the same factor: $13.5 \times \frac{5}{3} =$**22.5 m** (1 mark).

Another way to see it: at any moment, shadow ÷ height is the same for every object. In (a) that ratio is $1.8 \div 1.2 = 1.5$, and $13.5 \div 1.5 = 9$ m. Later it becomes $3 \div 1.2 = 2.5$, and $9 \times 2.5 = 22.5$ m.

## Answer to Question 5 (4 marks)

a. Use the same units: 30 m = 3 000 cm. The model is 50 times smaller: $3000 \div 50 =$**60 cm**. (1 mark)

b. The real building is 50 times larger: $14 \times 50 = 700$ cm, which is **7 m**. (1 mark)

c. Areas are multiplied by the square of the scale factor: $50^2 = 2\,500$ (1 mark). Real area $= 120 \times 2500 = 300\,000$ cm². There are $100 \times 100 = 10\,000$ cm² in 1 m², so this is $300000 \div 10000 =$**30 m²** (1 mark).

Multiplying the area by 50 only would give 6 000 cm², which is just 0.6 m², far too small for a building.