

Similar Shapes

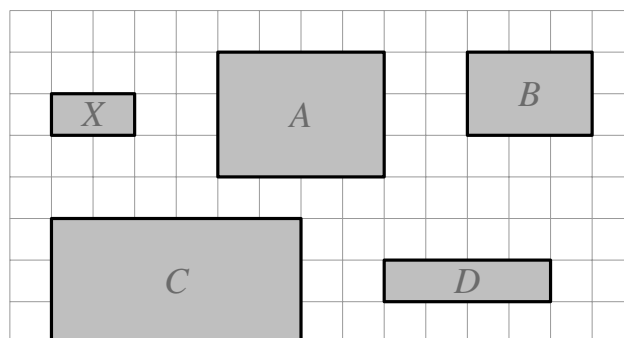
Solutions

For AQA GCSE Mathematics (8300) • Foundation tier

Each question is shown in grey, followed by the working, one step per line. The final answer is in a box. *Marks* shows how the marks are usually given in the exam, and **Tip** points out a common mistake.

1 (1 mark)

Here are five rectangles on a grid.



Which shape is similar to shape *X*?

Circle your answer.

Options: *A*, *B*, *C*, *D*

Similar shapes have all their lengths multiplied by the same number.

X is 2 squares by 1 square.

C is 6 squares by 3 squares.

$2 \times 3 = 6$ and $1 \times 3 = 3$, so both lengths are multiplied by 3.

The others do not work: *A* is 4 by 3, *B* is 3 by 2 and *D* is 4 by 1.

Answer: *C*

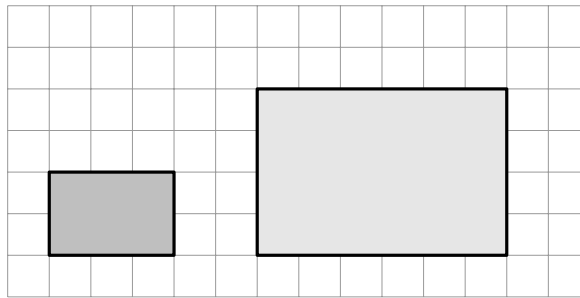
2 (1 mark)

On the grid, draw a rectangle that is similar to this rectangle but **not** congruent to it.

The rectangle is 3 squares by 2 squares.

Multiply **both** lengths by the same number (not 1).

For example, $\times 2$ gives 6 squares by 4 squares.



Answer: e.g. a 6 by 4 rectangle

Tip: Multiply, don't add. Adding 1 square to each side (4 by 3) does not give a similar rectangle.

3 (2 marks)

- (a) Rectangle *A* is 3 cm by 5 cm and rectangle *B* is 6 cm by 10 cm.

Are *A* and *B* similar? Tick a box.

Give a reason.

$$6 \div 3 = 2$$

$$10 \div 5 = 2$$

Both sides are multiplied by 2, so the rectangles are similar.

Answer: Yes, scale factor 2

- (b) Rectangle *C* is 5 cm by 7 cm.

Are *A* and *C* similar? Tick a box.

Give a reason.

$$5 \div 3 = 1.67 \text{ (to 2 d.p.)}$$

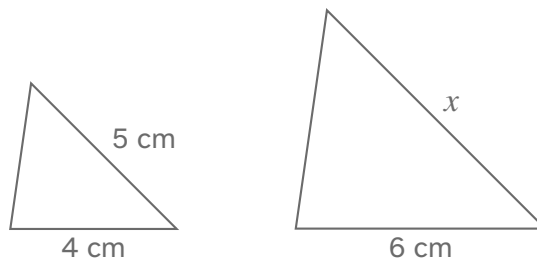
$$7 \div 5 = 1.4$$

The sides are not multiplied by the same number, so the rectangles are not similar.

Answer: No, different scale factors

4 (2 marks)

Here are two triangles.



Not drawn accurately

The two triangles are mathematically similar.

Work out the value of x .

The 4 cm side matches the 6 cm side.

Scale factor = $6 \div 4 = 1.5$

x matches the 5 cm side.

$x = 5 \times 1.5 = 7.5$

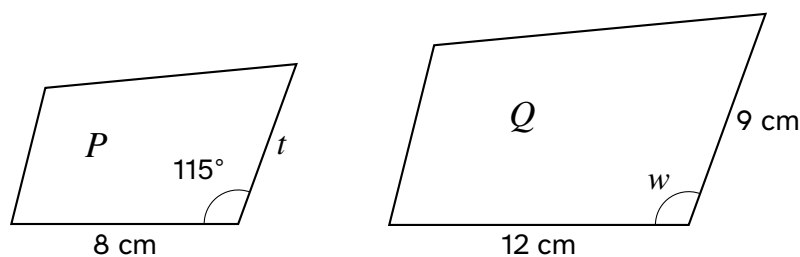
Answer: 7.5 cm

Tip: Use a scale factor. Adding the difference ($6 - 4 = 2$, so $5 + 2 = 7$) is a common wrong method.

Marks: 1 mark for the scale factor 1.5. 1 mark for 7.5.

5 (3 marks)

Shapes P and Q are mathematically similar.



Not drawn accurately

(a) Ben says,

‘Shape Q is bigger than shape P , so angle w must be bigger than 115° .’

Is Ben correct? Tick a box.

Give a reason for your answer.

Similar shapes are the same shape, so matching angles are equal.

w matches the 115° angle in P .

So $w = 115^\circ$, not bigger.

Answer: No. Angles do not change in similar shapes, so $w = 115^\circ$.

Tip: Angles do not change when a shape is enlarged. Only the lengths are multiplied by the scale factor.

(b) Work out the value of t .

The 8 cm side in P matches the 12 cm side in Q .

Scale factor from P to $Q = 12 \div 8 = 1.5$

t matches the 9 cm side in Q .

P is the smaller shape, so divide: $t = 9 \div 1.5 = 6$

Answer: 6 cm

Tip: t is on the smaller shape, so divide by the scale factor. Multiplying gives 13.5, which is too big.

Marks: 1 mark for the scale factor 1.5 (or $\frac{3}{2}$). 1 mark for 6.

6 (2 marks)

Rectangle R is 6 cm long and 4 cm wide.

Rectangle S is 15 cm long and 10 cm wide.

Show that these two rectangles are similar.

Compare matching sides by dividing.

Lengths: $15 \div 6 = 2.5$

Widths: $10 \div 4 = 2.5$

Both pairs of sides are multiplied by the same scale factor, 2.5.

So the rectangles are similar.

Answer: Both scale factors are 2.5

Tip: Do not compare areas, perimeters or differences of sides. Show the **same** scale factor for both pairs of sides, then write a conclusion.

Marks: 1 mark for $15 \div 6$ or $10 \div 4$ (or $6 \div 4$ and $15 \div 10$). 1 mark for both 2.5 (or both 1.5) with a conclusion.

7 (2 marks)

Triangles A and B are mathematically similar.

The perimeter of triangle A is 36 cm.

The perimeter of triangle B is 90 cm.

The shortest side of triangle B is 20 cm.

Work out the length of the shortest side of triangle A .

Perimeters of similar shapes are in the same ratio as their lengths.

Scale factor from A to $B = 90 \div 36 = 2.5$

Every length in B is 2.5 times the matching length in A .

Shortest side of $A = 20 \div 2.5 = 8$ cm

Answer: 8 cm

Tip: A is the smaller triangle, so its side must be shorter than 20 cm. Divide by the scale factor, do not multiply.

Marks: 1 mark for $90 \div 36 (= 2.5)$ or $36 \div 90 (= 0.4)$. 1 mark for 8.

8 (2 marks)

A pole 2 m tall casts a shadow 3 m long.
At the same time, a tree casts a shadow 12 m long.
Work out the height of the tree.

The pole and its shadow and the tree and its shadow make similar triangles.

Scale factor = $12 \div 3 = 4$

Height of tree = $2 \times 4 = 8$ m

Answer: 8 m

Marks: 1 mark for the scale factor 4 (or $2 \div 3$). 1 mark for 8.

9 (2 marks)

A photograph is 10 cm wide and 15 cm long.
It is enlarged so that its length is 45 cm.
Work out the width of the enlarged photograph.

Scale factor from the lengths: $45 \div 15 = 3$

Multiply the width by the same scale factor.

$10 \times 3 = 30$

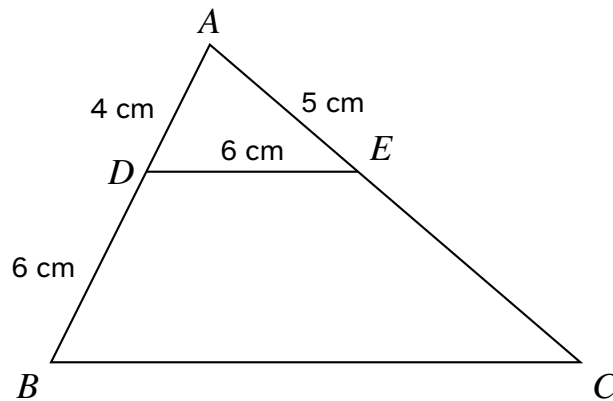
Answer: 30 cm

Marks: 1 mark for the scale factor 3. 1 mark for 30.

10 (5 marks)

DE is parallel to BC .

$AD = 4$ cm, $DB = 6$ cm, $DE = 6$ cm and $AE = 5$ cm



Not drawn accurately

- (a) Work out the length of BC .

DE is parallel to BC , so triangles ADE and ABC are similar.

$$AB = AD + DB = 4 + 6 = 10 \text{ cm}$$

$AD = 4$ matches $AB = 10$, so the scale factor is $10 \div 4 = 2.5$

BC matches DE .

$$BC = 6 \times 2.5 = 15 \text{ cm}$$

Answer: 15 cm

Tip: Use the whole side $AB = 10$ cm, not $DB = 6$ cm. Drawing the two triangles separately helps you match the sides.

Marks: 1 mark for $AB = 10$. 1 mark for the scale factor 2.5. 1 mark for 15.

- (b) Work out the length of EC .

AC matches AE in the small triangle.

$$AC = 5 \times 2.5 = 12.5 \text{ cm}$$

$$EC = AC - AE = 12.5 - 5 = 7.5 \text{ cm}$$

Answer: 7.5 cm

Marks: 1 mark for $AC = 12.5$. 1 mark for 7.5.
