

Similar Shapes

Solutions

For Pearson Edexcel GCSE Mathematics (1MA1) • 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)

Ella draws a rectangle 6 cm long and 4 cm wide.

She wants to draw a larger rectangle that is mathematically similar to it.

She says,

‘If I make the length 9 cm, the width must be 7 cm.’

Is Ella correct?

Explain your answer.

No.

For similar shapes the lengths are **multiplied** by the same scale factor, not increased by the same amount.

Scale factor = $9 \div 6 = 1.5$

New width = $4 \times 1.5 = 6$ cm, not 7 cm.

Answer: No: the scale factor is 1.5, so the width should be 6 cm

Tip: Adding the same amount to every side (here 3 cm) does not give a similar shape. Always multiply.

2 (2 marks)

Here are two triangles.

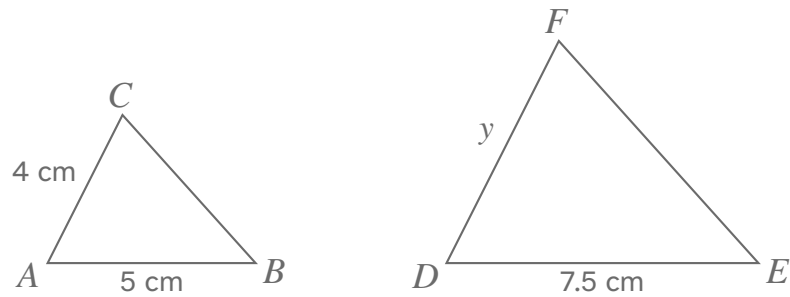


Diagram **NOT** accurately drawn

Triangles ABC and DEF are mathematically similar.

Work out the value of y .

$AB = 5\text{ cm}$ matches $DE = 7.5\text{ cm}$.

Scale factor $= 7.5 \div 5 = 1.5$

$y = DF$ matches $AC = 4\text{ cm}$.

$y = 4 \times 1.5 = 6$

Answer: 6 cm

Tip: Use a scale factor. Adding the difference ($7.5 - 5 = 2.5$, so $4 + 2.5$) is the most common wrong method.

Marks: 1 mark for the scale factor 1.5 (or $4 \div 5$). 1 mark for 6.

3 (4 marks)

Triangle KLM and triangle RST are mathematically similar.

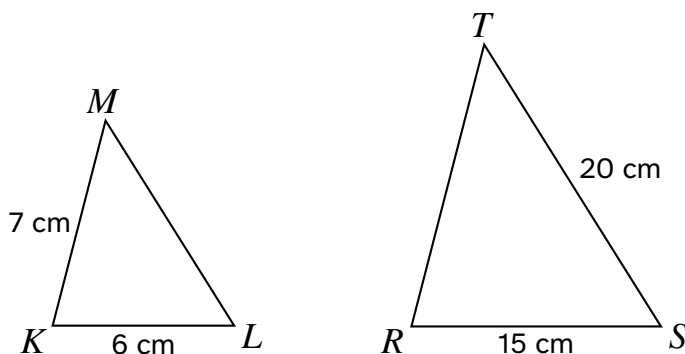


Diagram **NOT** accurately drawn

- (a) Work out the length of RT .

$RS = 15$ cm matches $KL = 6$ cm.

Scale factor $= 15 \div 6 = 2.5$

RT matches $KM = 7$ cm.

$RT = 7 \times 2.5 = 17.5$ cm

Answer: 17.5 cm

Marks: 1 mark for $15 \div 6 (= 2.5)$ or equivalent. 1 mark for 17.5.

- (b) Work out the length of LM .

LM matches $ST = 20$ cm.

KLM is the smaller triangle, so divide by the scale factor.

$LM = 20 \div 2.5 = 8$ cm

Answer: 8 cm

Tip: Going from the big triangle to the small one, divide. Check: LM should be shorter than 20 cm.

Marks: 1 mark for $20 \div 2.5$ or equivalent. 1 mark for 8.

4 (2 marks)

Here are two triangles, *A* and *B*.

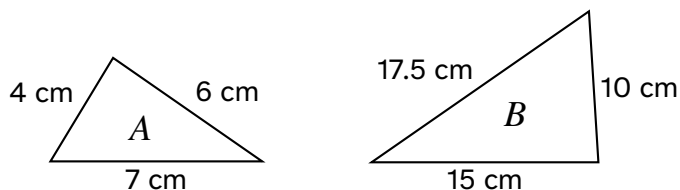


Diagram **NOT** accurately drawn

Show that triangle *A* and triangle *B* are mathematically similar.

The triangles are drawn different ways round, so match the sides in order of size.

Shortest: $10 \div 4 = 2.5$

Middle: $15 \div 6 = 2.5$

Longest: $17.5 \div 7 = 2.5$

All three sides are multiplied by the same scale factor, 2.5.

So the triangles are similar.

Answer: All three pairs of sides are in the ratio 1 : 2.5

Tip: Do not match sides by where they are on the page. Match shortest with shortest and longest with longest.

Marks: 1 mark for dividing a pair of matching sides, e.g. $10 \div 4 (= 2.5)$. 1 mark for showing all three pairs give 2.5, with a conclusion.

5 (2 marks)

Triangle *A* has angles 40° and 75°

Triangle *B* has angles 65° and 75°

Show that triangles *A* and *B* are similar.

Angles in a triangle add up to 180° .

Third angle of *A*: $180 - 40 - 75 = 65^\circ$

Third angle of *B*: $180 - 65 - 75 = 40^\circ$

Both triangles have angles 40° , 65° and 75° .

Triangles with the same three angles are similar.

Answer: Both have angles 40° , 65° , 75°

Marks: 1 mark for working out a third angle. 1 mark for showing both triangles have the same three angles.

6 (2 marks)

Two cylinders are mathematically similar.

The smaller cylinder has height 8 cm and radius 3 cm.

The larger cylinder has height 20 cm.

Work out the radius of the larger cylinder.

Scale factor from the heights: $20 \div 8 = 2.5$

Multiply the radius by the same scale factor.

$$3 \times 2.5 = 7.5 \text{ cm}$$

Answer: 7.5 cm

Marks: 1 mark for the scale factor 2.5. 1 mark for 7.5.

7 (5 marks)

ST is parallel to QR .

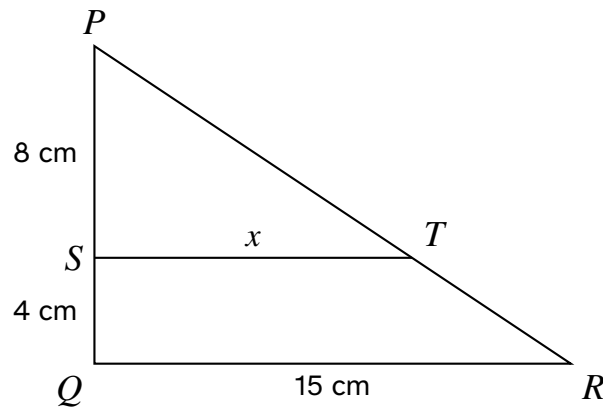


Diagram **NOT** accurately drawn

(a) Work out the value of x .

ST is parallel to QR , so triangles PST and PQR are similar.

$$PQ = PS + SQ = 8 + 4 = 12 \text{ cm}$$

$PS = 8$ matches $PQ = 12$, so the scale factor is $12 \div 8 = 1.5$

$x = ST$ matches $QR = 15 \text{ cm}$.

PST is the smaller triangle, so divide: $x = 15 \div 1.5 = 10$

Answer: 10 cm

Tip: Draw the two triangles separately and label them. Use the whole side $PQ = 12 \text{ cm}$, not $SQ = 4 \text{ cm}$.

Marks: 1 mark for $PQ = 12$. 1 mark for the scale factor 1.5. 1 mark for 10.

(b) $PR = 18 \text{ cm}$.

Work out the length of TR .

PT matches PR .

$$PT = 18 \div 1.5 = 12 \text{ cm}$$

$$TR = PR - PT = 18 - 12 = 6 \text{ cm}$$

Answer: 6 cm

Marks: 1 mark for $PT = 12$. 1 mark for 6.

8 (3 marks)

A model car is mathematically similar to a real car.
The model is 12 cm long and the real car is 3.6 m long.
The height of the real car is 1.5 m.
Work out the height of the model in centimetres.

Use the same units. $3.6 \text{ m} = 360 \text{ cm}$

Scale factor = $360 \div 12 = 30$

$1.5 \text{ m} = 150 \text{ cm}$

The model is smaller, so divide: $150 \div 30 = 5 \text{ cm}$

Answer: 5 cm

Tip: Change metres to centimetres ($\times 100$) before you work out the scale factor.

Marks: 1 mark for converting to the same units. 1 mark for the scale factor 30. 1 mark for 5.
