



- 1 Rectangle A is 4 cm by 6 cm. Rectangle B is 8 cm by 10 cm.

Sam says, "Each side of rectangle B is 4 cm longer than the matching side of rectangle A, so the rectangles are similar."

Explain why Sam is wrong.

(1 mark)

For two shapes to be similar, corresponding sides must be in the same ratio (multiplied by the same scale factor), not increased by the same amount
 $8 \div 4 = 2$ but $10 \div 6 = \frac{5}{3}$, so the ratios are different and the rectangles are not similar

- 2 Triangle ABC is similar to triangle PQR.

AB corresponds to PQ, and BC corresponds to QR.

AB = 6 cm, PQ = 9 cm and BC = 8 cm.

Work out the length of QR.

(2 marks)

$$\text{Scale factor from ABC to PQR} = PQ \div AB = 9 \div 6 = 1.5$$

$$QR = BC \times 1.5 = 8 \times 1.5 = 12 \text{ cm}$$

12 cm

- 3 In triangle ABC, angle A = 35° and angle B = 80° .

In triangle DEF, angle D = 80° and angle E = 65° .

Show that triangle ABC is similar to triangle DEF.

(2 marks)

Angles in a triangle sum to 180° , so angle C = $180 - 35 - 80 = 65^\circ$

Also angle F = $180 - 80 - 65 = 35^\circ$

Both triangles have angles of 35° , 80° and 65° . Two triangles with the same three angles are similar

- 4 A photograph is 15 cm long and 10 cm wide.

The photograph is enlarged to make a print that is mathematically similar to it.

The print is 24 cm long.

a. Work out the scale factor of the enlargement.

b. Work out the width of the print.

(3 marks)

$$\text{a) Scale factor} = 24 \div 15 = 1.6$$

$$\text{b) Width of the print} = 10 \times 1.6 = 16 \text{ cm}$$

5

Quadrilateral ABCD is similar to quadrilateral PQRS.

AB corresponds to PQ, BC corresponds to QR, CD corresponds to RS and DA corresponds to SP.

AB = 6 cm, PQ = 15 cm and CD = 8 cm.

- Work out the scale factor of the enlargement from ABCD to PQRS.
- Work out the length of RS.

(3 marks)

a)

$$\text{scale factor} = 15 \div 6 = 2.5$$

2.5

b)

RS corresponds to CD

$$RS = 8 \times 2.5$$

20 cm

6

Triangle ABC is similar to triangle DEF.

AB corresponds to DE, BC corresponds to EF, and AC corresponds to DF.

AB = 5 cm, BC = 7 cm, DE = 7.5 cm and DF = 12 cm.

- Work out the length of EF.
- Work out the length of AC.

(4 marks)

$$\text{Scale factor from ABC to DEF} = DE \div AB = 7.5 \div 5 = 1.5$$

$$\text{a) } EF = BC \times 1.5 = 7 \times 1.5 = 10.5 \text{ cm}$$

b) Going the other way, divide by the scale factor

$$AC = DF \div 1.5 = 12 \div 1.5 = 8 \text{ cm}$$

7

In triangle ABC, D is a point on AB and E is a point on AC.

DE is parallel to BC.

AD = 4 cm, DB = 6 cm and DE = 5 cm.

Work out the length of BC.

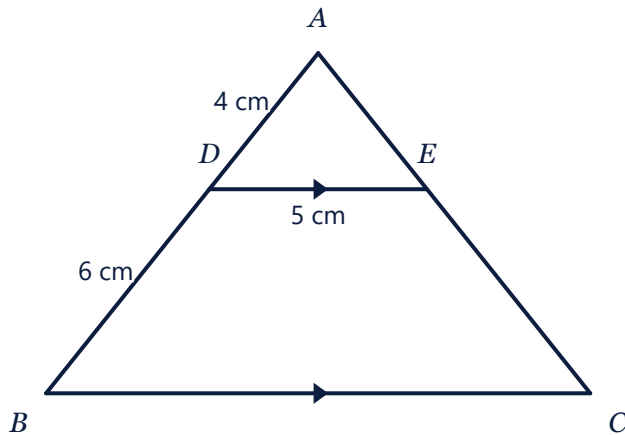


Diagram NOT accurately drawn

(3 marks)

The triangles share angle A, and the parallel lines give equal corresponding angles at D and B. Matching angles establish similarity before using a scale factor

Because DE is parallel to BC, triangle ADE is similar to triangle ABC

$AB = AD + DB = 4 + 6 = 10$ cm, so the scale factor from ADE to

$ABC = AB \div AD = 10 \div 4 = 2.5$

$BC = DE \times 2.5 = 5 \times 2.5 = 12.5$ cm

12.5 cm

8

A vertical post 1.5 m tall casts a shadow 2.4 m long. At the same time a tree casts a shadow 9.6 m long.

The post, the tree and their shadows form two similar right-angled triangles.

Work out the height of the tree.

(3 marks)

scale factor = $9.6 \div 2.4 = 4$

height = 1.5×4

6 m

- 9 Triangle ABC is isosceles with $AB = AC = 5$ cm and $BC = 8$ cm.
Triangle PQR is similar to triangle ABC with $PQ = PR = 12$ cm.
Work out the length of QR.

(3 marks)

PQ corresponds to AB, QR corresponds to BC

$$\text{scale factor} = 12 \div 5 = 2.4$$

$$QR = 8 \times 2.4$$

$$19.2 \text{ cm}$$

- 10 Triangle ABC has $AB = 6$ cm, $BC = 8$ cm and $CA = 10$ cm.
Triangle DEF is congruent to triangle ABC, with D matching A, E matching B and F matching C.
Triangle GHI is similar to triangle ABC, with G matching A, H matching B and I matching C. $GH = 9$ cm.
- Write down the length of EF.
 - Work out the length of HI.
 - Work out the length of GI.

(4 marks)

a)

congruent: same sides, $EF = BC$

$$8 \text{ cm}$$

b)

$$\text{scale factor} = 9 \div 6 = 1.5$$

$$HI = 8 \times 1.5$$

$$12 \text{ cm}$$

c)

$$GI = 10 \times 1.5$$

$$15 \text{ cm}$$

11

AB is parallel to DE.

The straight lines AE and BD cross at the point C.

AC = 9 cm, CE = 6 cm, AB = 12 cm and CD = 5 cm.

- Work out the length of DE.
- Work out the length of BC.

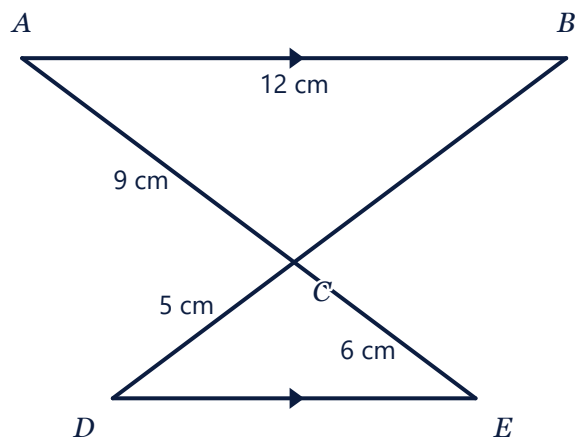


Diagram NOT accurately drawn

(4 marks)

Because AB is parallel to DE, alternate angles are equal and the vertically opposite angles at C are equal, so triangle ABC is similar to triangle EDC

The scale factor from triangle ABC to triangle EDC = $CE \div$

$$AC = 6 \div 9 = \frac{2}{3}$$

a) DE corresponds to AB, so $DE = 12 \times \frac{2}{3} = 8 \text{ cm}$

b) BC corresponds to DC, so $BC = CD \div \left(\frac{2}{3}\right) = 5 \times \frac{3}{2} = 7.5 \text{ cm}$

- 12 In triangle ADE, B is a point on AD and C is a point on AE.
BC is parallel to DE.
AB = 6 cm, BD = 3 cm and BC = 8 cm.
The area of triangle ABC is 24 cm^2 .
- Work out the length of DE.
 - Work out the area of the trapezium BDEC.

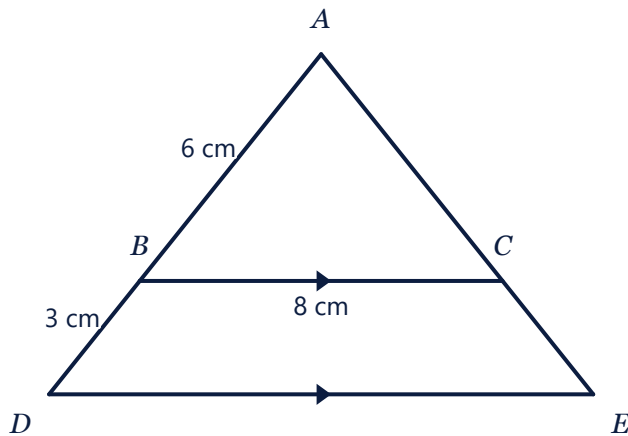


Diagram NOT accurately drawn

(4 marks)

Because BC is parallel to DE, triangle ABC is similar to triangle ADE

$$AD = 6 + 3 = 9 \text{ cm, so the scale factor} = 9 \div 6 = 1.5$$

$$\text{a) } DE = 8 \times 1.5 = 12 \text{ cm}$$

b) Areas of similar shapes scale by the square of the scale factor: area of ADE = $24 \times 1.5^2 = 24 \times 2.25 = 54 \text{ cm}^2$

$$\text{Area of trapezium BDEC} = 54 - 24 = 30 \text{ cm}^2$$

- 13 Rectangle A is 8 cm by 5 cm.
Rectangle B is similar to rectangle A and has a perimeter of 52 cm.
Work out the length and width of rectangle B.

(3 marks)

$$\text{perimeter of A} = 2 \times (8 + 5) = 26$$

$$\text{scale factor} = 52 \div 26 = 2$$

$$\text{length} = 8 \times 2 = 16$$

$$\text{width} = 5 \times 2 = 10$$

16 cm by 10 cm

14

In triangle PQR, angle PQR = 90° , PQ = 6 cm, QR = 8 cm and PR = 10 cm.

S is the point on PR such that QS is perpendicular to PR.

Work out the length of QS.

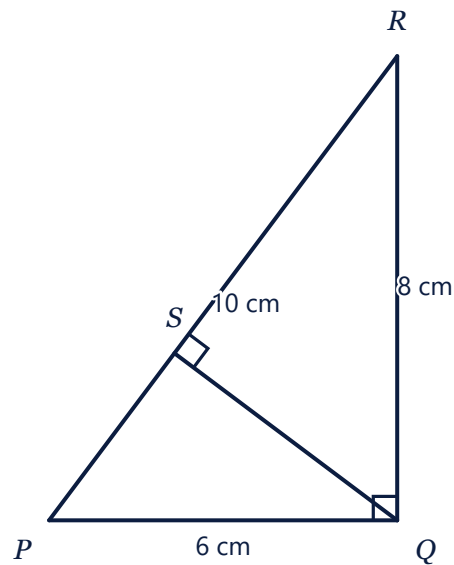


Diagram NOT accurately drawn

(4 marks)

Triangles PSQ and PQR share angle P, and each has a right angle (at S and at Q), so they are similar

In similar triangles, $QS \div QR = PQ \div PR$

$$QS = QR \times PQ \div PR = 8 \times 6 \div 10 \\ = 4.8 \text{ cm}$$

Check using area

$$\frac{1}{2} \times 6 \times 8 = 24 \text{ cm}^2 \text{ and } \frac{1}{2} \times 10 \times 4.8 = 24 \text{ cm}^2, \text{ which agree}$$

4.8 cm

15

In triangle ABC, D is a point on AB.

Angle ACD = angle ABC.

AC = 8 cm and AD = 4 cm.

- Prove that triangle ACD is similar to triangle ABC.
- Work out the length of BD.

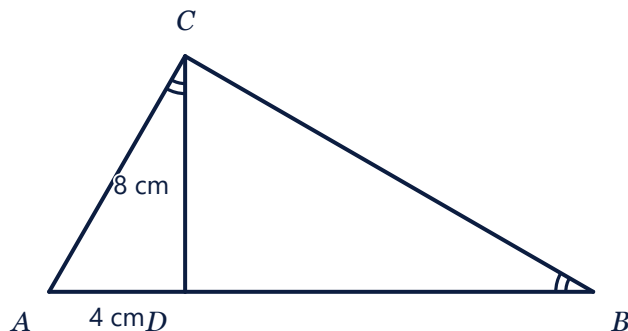


Diagram NOT accurately drawn

(5 marks)

a) In triangles ACD and ABC

angle A is common to both triangles, and angle ACD = angle ABC
(given)

Two pairs of equal angles means the third pair must also be equal, so triangle ACD is similar to triangle ABC

b) Corresponding sides: AC in ACD corresponds to AB in ABC, and AD in ACD corresponds to AC in ABC

So $AC \div AB = AD \div AC$, giving $8 \div AB = 4 \div 8$

$$AB = 8 \times 8 \div 4 = 16 \text{ cm}$$

$$BD = AB - AD = 16 - 4 = 12 \text{ cm}$$

16 Triangle ABC is similar to triangle PQR.

AB = 4 cm, PQ = 10 cm, BC = x cm and QR = $(x + 9)$ cm.

Work out the value of x and the length of QR.

(4 marks)

$$\text{scale factor} = 10 \div 4 = 2.5$$

$$x + 9 = 2.5x$$

$$\begin{array}{rcl} -x & & \\ 9 & = & 1.5x \end{array}$$

$$\begin{array}{rcl} \div 1.5 & & \\ x & = & 6 \end{array}$$

$$QR = 6 + 9 = 15$$

$$x = 6, QR = 15 \text{ cm}$$