



- 1** A triangle has vertices at (1, 2), (2, 2) and (1, 4).

The triangle is enlarged by scale factor 3, centre the origin.

Write down the coordinates of the vertices of the image.

(2 marks)

An enlargement with centre the origin and scale factor 3 maps

(x, y) to $(3x, 3y)$

$(1, 2)$ maps to $(3, 6)$; $(2, 2)$ maps to $(6, 6)$; $(1, 4)$ maps to $(3, 12)$

$(3, 6), (6, 6), (3, 12)$

- 2** A rectangle has vertices at (2, 2), (6, 2), (6, 4) and (2, 4).

The rectangle is enlarged by scale factor $\frac{3}{2}$, centre the origin.

Write down the coordinates of the vertices of the image.

(2 marks)

centre (0, 0): multiply every coordinate by $3/2$

$(2, 2) \rightarrow (3, 3)$

$(6, 2) \rightarrow (9, 3)$

$(6, 4) \rightarrow (9, 6)$

$(2, 4) \rightarrow (3, 6)$

$(3, 3), (9, 3), (9, 6), (3, 6)$

- 3** A triangle has vertices at (6, 3), (9, 3) and (6, 9).

The triangle is enlarged by scale factor $\frac{1}{3}$, centre the origin.

Write down the coordinates of the vertices of the image.

(2 marks)

centre (0, 0): multiply every coordinate by $1/3$

$(6, 3) \rightarrow (2, 1)$

$(9, 3) \rightarrow (3, 1)$

$(6, 9) \rightarrow (2, 3)$

$(2, 1), (3, 1), (2, 3)$

4 Rectangle A has vertices at $(1, 1)$, $(3, 1)$, $(3, 2)$ and $(1, 2)$.

Rectangle B has vertices at $(2, 2)$, $(6, 2)$, $(6, 4)$ and $(2, 4)$.

Describe fully the single transformation that maps rectangle A onto rectangle B .

(2 marks)

The sides of B are twice as long as the sides of A , so the scale factor is 2

Every vertex of B is exactly double the matching vertex of A : $(1, 1)$ maps to $(2, 2)$, $(3, 1)$ maps to $(6, 2)$, and so on

So the transformation is an enlargement, scale factor 2, centre the origin $(0, 0)$

5 A triangle has vertices at $(2, 2)$, $(6, 2)$ and $(2, 6)$.

The triangle is enlarged by scale factor $\frac{1}{2}$, centre $(2, 2)$.

Write down the coordinates of the vertices of the image.

(3 marks)

distance from centre $(2, 2)$:

$(2, 2) \rightarrow (0, 0)$

$(6, 2) \rightarrow (4, 0)$

$(2, 6) \rightarrow (0, 4)$

multiply by $1/2$

$(0, 0)$, $(2, 0)$, $(0, 2)$

add the centre $(2, 2)$ back

$(2, 2)$, $(4, 2)$, $(2, 4)$

6

Triangle A has vertices at (4, 4), (8, 4) and (8, 6).

Triangle B has vertices at (3, 3), (5, 3) and (5, 4).

Describe fully the single transformation that maps triangle A onto triangle B.

(3 marks)

compare side lengths

A: 4 B: 2

$$\text{scale factor} = 2 \div 4 = 1/2$$

lines through matching vertices meet at the centre

$$(4, 4) \rightarrow (3, 3) \text{ and } (8, 4) \rightarrow (5, 3)$$

they meet at (2, 2)

$$\text{check: } (2, 2) \text{ to } (8, 4) \text{ is } (6, 2), \text{ half is } (3, 1), (2, 2) + (3, 1) = (5, 3) \checkmark$$

Enlargement, scale factor $1/2$, centre (2, 2)

7

A triangle has vertices at (4, 2), (8, 2) and (4, 6).

The triangle is enlarged by scale factor $\frac{1}{2}$, centre the origin.

Write down the coordinates of the vertices of the image.

(2 marks)

An enlargement with centre the origin and scale factor $\frac{1}{2}$ maps

$$(x, y) \text{ to } \left(\frac{x}{2}, \frac{y}{2}\right)$$

$$(4, 2) \text{ maps to } (2, 1); (8, 2) \text{ maps to } (4, 1); (4, 6) \text{ maps to } (2, 3)$$

(2, 1), (4, 1), (2, 3)

- 8 A triangle has vertices at (4, 1), (4, 7) and (1, 7).
The triangle is enlarged by scale factor $\frac{2}{3}$, centre (1, 1).
Write down the coordinates of the vertices of the image.

(4 marks)

distance from centre (1, 1):

$$(4, 1) \rightarrow (3, 0)$$

$$(4, 7) \rightarrow (3, 6)$$

$$(1, 7) \rightarrow (0, 6)$$

multiply by $2/3$

$$(2, 0), (2, 4), (0, 4)$$

add the centre (1, 1) back

$$(3, 1), (3, 5), (1, 5)$$

- 9 Triangle P has vertices at (3, 3), (9, 3) and (3, 9).
Triangle Q has vertices at (3, 3), (5, 3) and (3, 5).
Describe fully the single transformation that maps triangle P onto triangle Q.

(4 marks)

compare side lengths

$$P: 6 \quad Q: 2$$

$$\text{scale factor} = 2 \div 6 = 1/3$$

the vertex (3, 3) stays where it is

so it is the centre

$$\text{Enlargement, scale factor } 1/3, \text{ centre } (3, 3)$$

- 10 Triangle T has sides of length 6 cm, 8 cm and 10 cm. It has a right angle between the 6 cm and 8 cm sides.

Triangle T is enlarged by scale factor $\frac{1}{2}$ to give triangle U.

- Write down the lengths of the sides of triangle U.
- Work out the area of triangle U.

(3 marks)

a)

multiply each side by $1/2$

$$6 \rightarrow 3, 8 \rightarrow 4, 10 \rightarrow 5$$

b)

$$\begin{aligned} \text{area} &= \frac{1}{2} \times 3 \times 4 \\ &= 6 \end{aligned}$$

$$\text{a) } 3 \text{ cm, } 4 \text{ cm, } 5 \text{ cm} \quad \text{b) } 6 \text{ cm}^2$$

11 Triangle A has vertices at (2, 2), (4, 2) and (2, 6).

Triangle B has vertices at (1, 1), (2, 1) and (1, 3).

Triangle C has vertices at (-1, 1), (-2, 1) and (-1, 3).

a. Describe fully the single transformation that maps triangle A onto triangle B.

b. Describe fully the single transformation that maps triangle B onto triangle C.

(4 marks)

Every vertex of B is exactly half the matching vertex of A: (2, 2) maps to (1, 1), (4, 2) maps to (2, 1), (2, 6) maps to (1, 3)

So A to B is an enlargement, scale factor $\frac{1}{2}$, centre the origin (0, 0)

Every vertex of C has the same y-coordinate as the matching vertex of B with the sign of the x-coordinate changed

So B to C is a reflection in the y-axis (the line $x = 0$)

12 A triangle was enlarged by scale factor $\frac{1}{2}$, centre the origin. The image has vertices at (1, 3), (4, 3) and (1, 5).

a. Write down the coordinates of the vertices of the original triangle.

b. Work out the area of the original triangle.

(4 marks)

a)

undo $\times \frac{1}{2}$ by multiplying by 2

$$(1, 3) \rightarrow (2, 6)$$

$$(4, 3) \rightarrow (8, 6)$$

$$(1, 5) \rightarrow (2, 10)$$

b)

$$\text{base} = 8 - 2 = 6$$

$$\text{height} = 10 - 6 = 4$$

$$\text{area} = \frac{1}{2} \times 6 \times 4$$

$$= 12$$

a) (2, 6), (8, 6), (2, 10) b) 12