



- 1** A point is enlarged by scale factor -2 , centre $(0, 0)$. Write down the coordinates of the image of
- the point $P(3, 2)$,
 - the point $Q(-1, 4)$.

(2 marks)

Centre $(0, 0)$: multiply both coordinates by -2

a)

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

$$\boxed{(-6, -4)}$$

b)

$$(-1, 4) \rightarrow (-1 \times -2, 4 \times -2)$$

$$\boxed{(2, -8)}$$

- 2** Triangle P has vertices at $(2, 1)$, $(4, 1)$ and $(4, 2)$.
Triangle P is enlarged by scale factor -1 , centre $(0, 0)$, to give triangle Q.
Write down the coordinates of the vertices of triangle Q.

(2 marks)

Scale factor -1 with centre $(0, 0)$ sends each point (x, y) to $(-x, -y)$

$$(2, 1) \rightarrow (-2, -1); (4, 1) \rightarrow (-4, -1); (4, 2) \rightarrow (-4, -2)$$

$$\boxed{(-2, -1), (-4, -1), (-4, -2)}$$

- 3** Triangle A has vertices at $(1, 1)$, $(3, 1)$ and $(1, 2)$.
Triangle A is enlarged by scale factor -2 , centre $(0, 0)$, to give triangle B.
Write down the coordinates of the vertices of triangle B.

(2 marks)

Scale factor -2 with centre $(0, 0)$ sends each point (x, y) to $(-2x, -2y)$

$$(1, 1) \rightarrow (-2, -2); (3, 1) \rightarrow (-6, -2); (1, 2) \rightarrow (-2, -4)$$

The image is on the opposite side of the centre and twice the size, turned through 180°

$$\boxed{(-2, -2), (-6, -2), (-2, -4)}$$

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

Triangle T is enlarged by scale factor $-\frac{1}{2}$, centre (0, 0), to give triangle U.

Write down the coordinates of the vertices of triangle U.

(2 marks)

Scale factor $-\frac{1}{2}$ with centre (0, 0) sends each point (x, y) to $(-\frac{x}{2}, -\frac{y}{2})$

(4, 2) (-2, -1); (6, 2) (-3, -1); (4, 6) (-2, -3)

The image is half the size and on the opposite side of the centre

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

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

Triangle M is enlarged by scale factor -3, centre (1, 0), to give triangle N.

Work out the coordinates of the vertices of triangle N.

(2 marks)

For each vertex, find the vector from the centre (1, 0) to the vertex, multiply it by -3, then add it to the centre

(2, 1)

vector (1, 1) (-3, -3), image (1, 0) + (-3, -3) = (-2, -3)

(3, 1): vector (2, 1) (-6, -3), image (-5, -3)

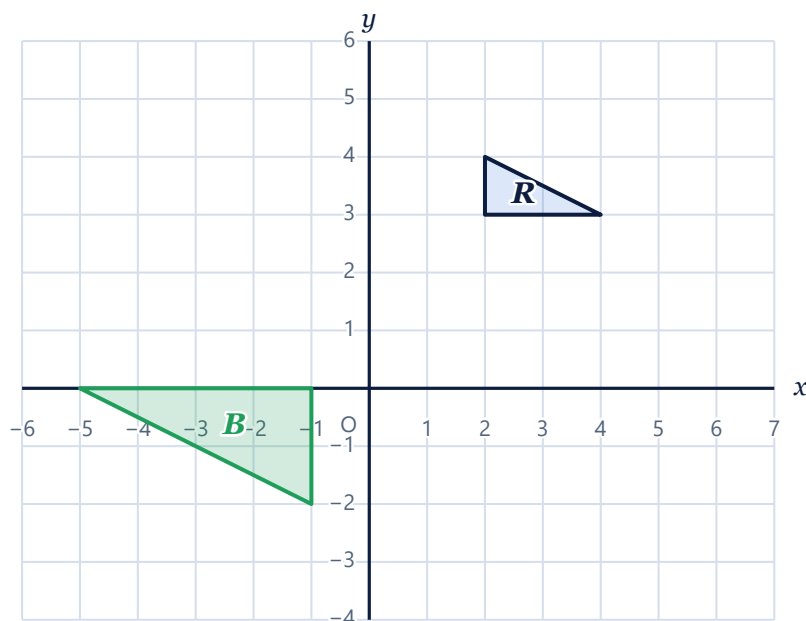
(2, 3): vector (1, 3) (-3, -9), image (-2, -9)

$(-2, -3), (-5, -3), (-2, -9)$

6

Triangle R is drawn on the grid with vertices at (2, 3), (4, 3) and (2, 4).

On the grid, enlarge triangle R by scale factor -2 , centre (1, 2).



(2 marks)

From the centre (1, 2)

(2, 3) is (1, 1) away, so its image is $(1, 2) + (-2, -2) = (-1, 0)$

(4, 3) is (3, 1) away, so its image is $(1, 2) + (-6, -2) = (-5, 0)$

(2, 4) is (1, 2) away, so its image is $(1, 2) + (-2, -4) = (-1, -2)$

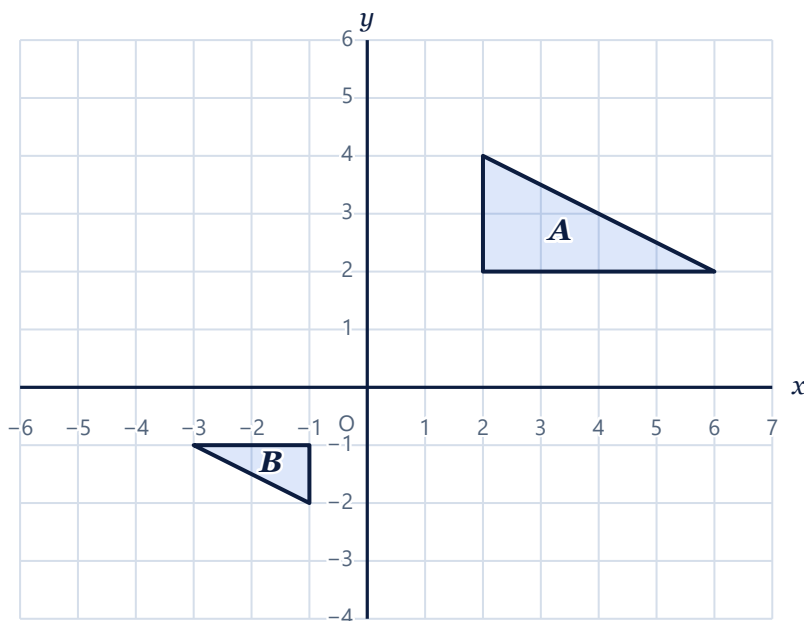
Join the three image points to draw the enlarged triangle

7

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

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

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



(2 marks)

The sides of B are half the length of the corresponding sides of A, and B is on the opposite side of the origin, so the scale factor is $-\frac{1}{2}$

Check with one vertex

$$(2, 2) \times -\frac{1}{2} = (-1, -1). \text{ Correct}$$

Lines joining corresponding points, for example (6, 2) to (-3, -1), all pass through (0, 0), so the centre is (0, 0)

The single transformation is an enlargement, scale factor $-\frac{1}{2}$, centre (0, 0)

8

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

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

B is an enlargement of A . Describe fully the enlargement.

(3 marks)

Compare lengths: base of $A = 4$, base of $B = 2$

$$\frac{2}{4} = \frac{1}{2}$$

B is inverted, on the opposite side of the centre

Check centre $(0, 0)$: $(2, 2) \times -\frac{1}{2} = (-1, -1)$

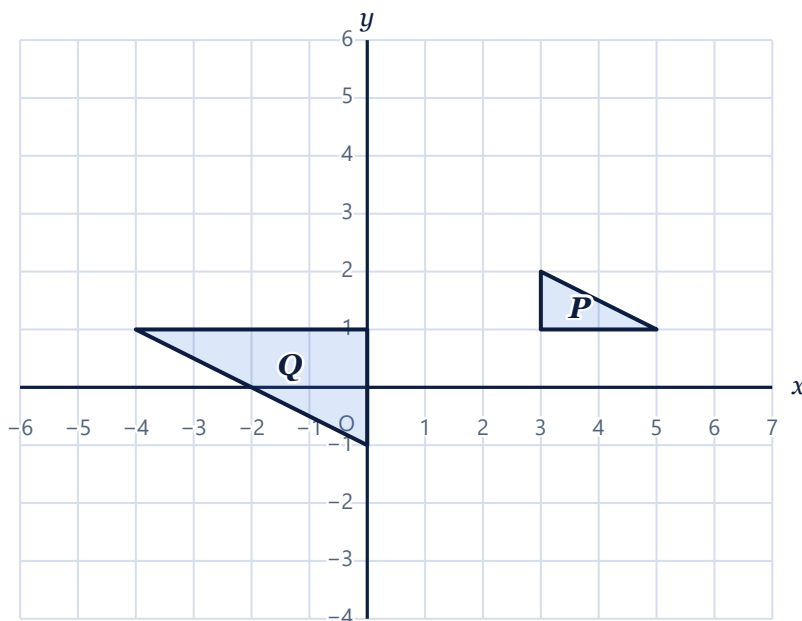
Enlargement, scale factor $-\frac{1}{2}$, centre $(0, 0)$

9

Triangle P has vertices at (3, 1), (5, 1) and (3, 2).

Triangle Q has vertices at (0, 1), (-4, 1) and (0, -1).

Describe fully the single transformation that maps triangle P onto triangle Q.



(3 marks)

The sides of Q are twice the length of the corresponding sides of P and Q is rotated through 180° relative to P, so the scale factor is -2

The centre lies on every line joining a point to its image. (3, 1) maps to (0, 1): the centre is on the line $y = 1$... it divides the join so that centre-to-image = 2 x centre-to-object on the opposite side, giving $x = 2$, so the centre is (2, 1)

Check with (5, 1)

vector from (2, 1) is (3, 0); $(3, 0) \times -2 = (-6, 0)$; $(2, 1) + (-6, 0) = (-4, 1)$.

Correct

Check with (3, 2)

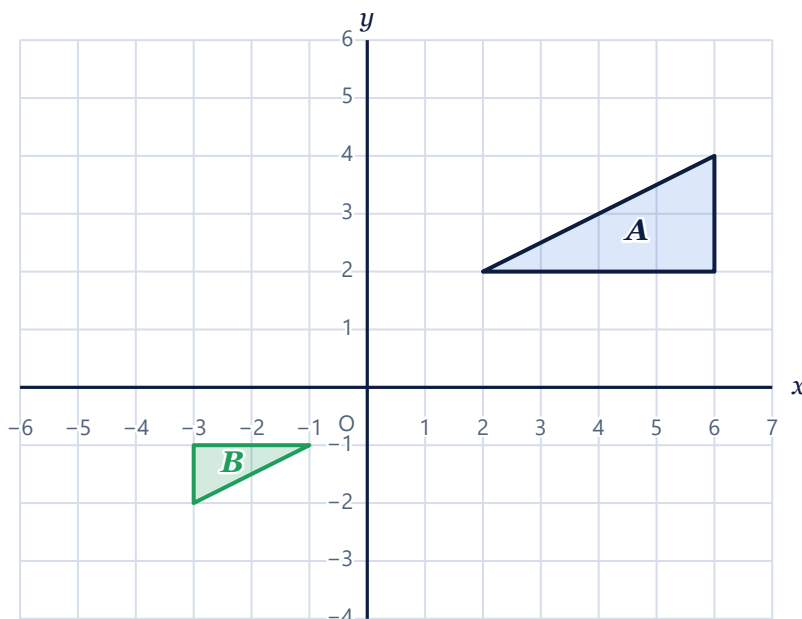
vector (1, 1) $\times -2 = (-2, -2)$; image (0, -1). Correct

The single transformation is an enlargement, scale factor -2, centre (2, 1)

10

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

- Triangle A is enlarged by scale factor $-\frac{1}{2}$, centre (0, 0), to give triangle B. Write down the coordinates of the vertices of triangle B.
- Describe fully the single transformation that maps triangle B back onto triangle A.



(3 marks)

a) Scale factor $-\frac{1}{2}$ with centre (0, 0) sends (x, y) to $(-\frac{x}{2}, -\frac{y}{2})$

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(2, 2) (-1, -1); (6, 2) (-3, -1); (6, 4) (-3, -2)

b) The inverse of an enlargement scale factor $-\frac{1}{2}$ about (0, 0) is an enlargement scale factor -2 about the same centre

Check

$(-1, -1) \times -2 = (2, 2)$. Correct

So the single transformation is an enlargement, scale factor -2, centre (0, 0)

11

Triangle A has vertices $(3, 2)$, $(4, 2)$ and $(3, 3)$.

Triangle B has vertices $(-1, -2)$, $(-4, -2)$ and $(-1, -5)$.

B is an enlargement of A . Describe fully the enlargement.

(3 marks)

Lengths: $1 \rightarrow 3$, so size $\times 3$

B is inverted, so the scale factor is negative

Centre: Lines through matching vertices cross at the centre

$$(3, 2) \rightarrow (-1, -2): y = x - 1$$

$$(4, 2) \rightarrow (-4, -2): y = \frac{x}{2}$$

$$x - 1 = \frac{x}{2}$$

$$x = 2, y = 1$$

Check: $(3, 2)$ is $(1, 1)$ from $(2, 1)$

$$(1, 1) \times -3 = (-3, -3)$$

$$(2, 1) + (-3, -3) = (-1, -2) \checkmark$$

Enlargement, scale factor -3 , centre $(2, 1)$