

# Transformations

GCSE Mathematics • Foundation Tier • Grades 4–5 • Non-calculator

## WORKED SOLUTIONS

Name: worked example

Class: .....

Total: 52 / 52

Show all your working. Marks are given for correct method as well as the final answer.

1. Translate the point  $(3, 2)$  by the vector  $\begin{pmatrix} 4 \\ -1 \end{pmatrix}$ . Write down the image. [2 marks]

$$x: 3 + 4 = 7$$

$$y: 2 - 1 = 1$$

Answer: (7, 1)

2. Translate the point  $(-1, 5)$  by  $\begin{pmatrix} -2 \\ 3 \end{pmatrix}$ . [2 marks]

$$x: -1 - 2 = -3$$

$$y: 5 + 3 = 8$$

Answer: (-3, 8)

3. Write down the vector that translates  $(2, 3)$  to  $(6, 1)$ . [2 marks]

$$\text{across: } 6 - 2 = 4$$

$$\text{up: } 1 - 3 = -2$$

Answer:  $\begin{pmatrix} 4 \\ -2 \end{pmatrix}$

4. Reflect the point  $(4, 3)$  in the  $x$ -axis. [2 marks]

$x$  stays,  $y$  changes sign

Answer: (4, -3)

5. Reflect the point  $(4, 3)$  in the  $y$ -axis. [2 marks]

$y$  stays,  $x$  changes sign

Answer: (-4, 3)

6. Reflect the point  $(2, 5)$  in the line  $y = x$ . [2 marks]

swap the coordinates

$y = x$  just swaps them

Answer: (5, 2)

7. Reflect the point  $(3, 1)$  in the line  $y = -x$ . [3 marks]

swap AND change both signs

Answer: (-1, -3)

8. Rotate the point  $(3, 0)$  by  $90^\circ$  anticlockwise about the origin. [2 marks]

$$(x, y) \rightarrow (-y, x)$$

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

Answer: (0, 3)

9. Rotate the point  $(2, 5)$  by  $180^\circ$  about the origin. [2 marks]

both signs change

*180° is the same either direction*

Answer: \_\_\_\_\_ *(-2, -5)* \_\_\_\_\_

10. Rotate the point (1, 4) by 90° clockwise about the origin. [3 marks]

*(x, y) → (y, -x)*

Answer: \_\_\_\_\_ *(4, -1)* \_\_\_\_\_

11. State the three things you must give to describe a rotation fully. [3 marks]

*the angle  
clockwise or anticlockwise  
the centre of rotation  
miss one and you lose the mark*

Answer: *angle, direction, centre*

12. Enlarge the point (2, 3) by scale factor 3 about the origin. [2 marks]

*multiply both coordinates by 3*

Answer: \_\_\_\_\_ *(6, 9)* \_\_\_\_\_

13. A shape of area 5 cm<sup>2</sup> is enlarged by scale factor 4. Work out the new area. [3 marks]

*area scales by the SQUARE of the factor  
5 × 4<sup>2</sup> = 80  
not 20*

Answer: \_\_\_\_\_ *80* \_\_\_\_\_ cm<sup>2</sup>

14. Enlarge the point (6, 4) by scale factor  $\frac{1}{2}$  about the origin. [2 marks]

*halve both coordinates  
a fractional factor makes it smaller*

Answer: \_\_\_\_\_ *(3, 2)* \_\_\_\_\_

15. Enlarge the point (2, 1) by scale factor -2 about the origin. [3 marks]

*multiply by -2  
negative factor flips it through the centre*

Answer: \_\_\_\_\_ *(-4, -2)* \_\_\_\_\_

16. A shape is enlarged by scale factor 3. A side of 4 cm becomes how long? [1 mark]

*4 × 3 = 12*

Answer: \_\_\_\_\_ *12* \_\_\_\_\_ cm

17. Shape A has sides 3 cm and 5 cm. Shape B is an enlargement with a corresponding side of 12 cm from the 3 cm side. Work out the scale factor and the other side. [3 marks]

*12 ÷ 3 = 4  
5 × 4 = 20 cm*

Answer: *SF 4, other side 20 cm*

18. Describe fully the single transformation that maps (1, 2) to (1, -2). [2 marks]

*x unchanged, y sign flipped*

Answer: *reflection in the x-axis*

19. A triangle has vertices  $(1, 1)$ ,  $(3, 1)$  and  $(1, 4)$ .

(a) Write the vertices after a translation by  $\begin{pmatrix} 2 \\ -3 \end{pmatrix}$ .

[3 marks]

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

$$(3, 1) \rightarrow (5, -2)$$

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

(b) Write the vertices after reflecting the ORIGINAL triangle in the  $y$ -axis.

[3 marks]

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$$(1, 1) \rightarrow (-1, 1)$$

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

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

Answer: \_\_\_\_\_ *see working* \_\_\_\_\_

20. The point  $P(4, 2)$  is reflected in the  $x$ -axis to give  $Q$ .  $Q$  is then rotated  $180^\circ$  about the origin to give  $R$ .

(a) Write down the coordinates of  $Q$  and  $R$ .

[3 marks]

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$$Q = (4, -2)$$

$$R = (-4, 2)$$

(b) Describe the single transformation that maps  $P$  to  $R$ .

[2 marks]

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

*only x changed sign*

*reflection in the y-axis*

Answer:  *$Q(4, -2)$ ,  $R(-4, 2)$ ; reflection in the y-axis*