

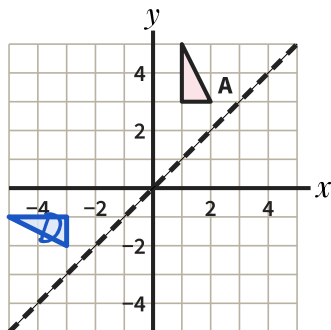
Combined Transformations *extend*

ANSWERS

1



Reflect A in the y axis, then the x axis, then the dashed line $y = x$ to give D. Describe fully the single transformation from A to D.

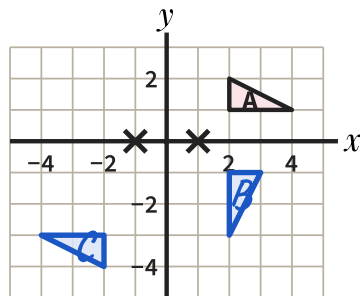


Answer Reflection in $y = -x$

2



Rotate A 90° clockwise about (1, 0) to give B, then B 90° clockwise about (-1, 0) to give C (centres marked $\times$). Describe fully the single transformation that maps A onto C.



Answer Rotation 180° about (0, -1)

3



A shape is reflected in the line $x = a$ and then in the line $x = 7$. The single transformation that does the same is a translation by $\begin{pmatrix} 6 \\ 0 \end{pmatrix}$. Find the value of a .

$$x \rightarrow 2a - x \rightarrow 14 - 2a + x$$

$$14 - 2a = 6, \text{ so } a = 4$$

Answer $a = 4$

4



Shape A is rotated 90° anticlockwise about (0, 0) to give B. Then B is mapped onto C by a single transformation T. C is the reflection of A in the x axis. Describe T fully.

$$(1, 2) \rightarrow B(-2, 1), C(1, -2)$$

$$B \text{ to } C: (u, v) \rightarrow (v, u)$$

Answer Reflection in $y = x$

5



A shape is reflected in the line $y = x$ and then translated by $\begin{pmatrix} 3 \\ -3 \end{pmatrix}$. This is a single reflection. Find its mirror line by finding the points that do not move.

$$(x, y) \rightarrow (y + 3, x - 3)$$

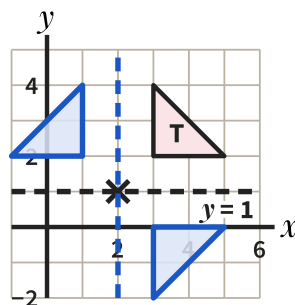
$$\text{it stays put when } x = y + 3, \text{ so } y = x - 3$$

Answer Reflection in $y = x - 3$

6



Tile T is reflected in $y = 1$, then rotated 180° about (2, 1) (marked $\times$). Kim says this is the same as one reflection. Is she right? If so, give the mirror line.



Answer Yes: reflection in $x = 2$

7



A shape is rotated 90° clockwise about (0, 0), then translated by $\begin{pmatrix} 4 \\ 0 \end{pmatrix}$. This is a single rotation of 90° clockwise. Find its centre.

$$(x, y) \rightarrow (y + 4, -x)$$

$$\text{centre: } x = y + 4 \text{ and } y = -x$$

Answer Centre (2, -2)

8



Prove that a rotation of 180° about (a, b) followed by a rotation of 180° about (0, 0) is a translation, and find its vector.

$$(x, y) \rightarrow (2a - x, 2b - y)$$

$$\rightarrow (x - 2a, y - 2b): \text{every point moves the same}$$

Proof Translation by $\begin{pmatrix} -2a \\ -2b \end{pmatrix}$