

GCSE MATHS • GRADE 3

MATHS



MODEL ANSWERS

TRANSFORMATIONS

SCORE

/92

PERCENTAGE

%

STEM UP

- 1 Here are four transformations: translation, reflection, rotation, enlargement.
Which one is described using a column vector?

A translation is described by a column vector

Translation

/ 1

- 2 Here are four transformations: translation, reflection, rotation, enlargement.
Which one needs a mirror line?

A mirror line gives the position of the reflection

Reflection

/ 1

- 3 Here are four transformations: translation, reflection, rotation, enlargement.
Which one needs a scale factor to describe it fully?

The scale factor says how many times bigger or smaller the shape becomes

Enlargement

/ 1

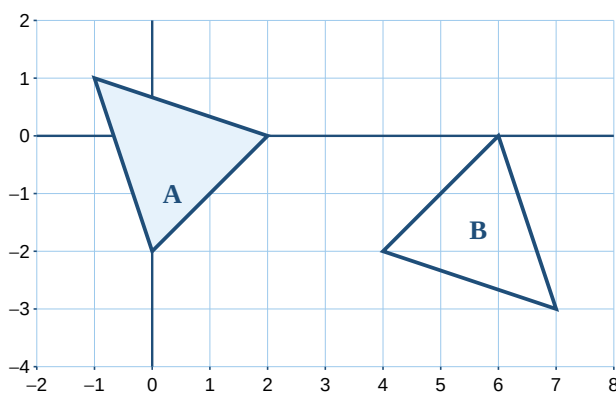
- 4 Here are four transformations: translation, reflection, rotation, enlargement.
Which one changes the size of a shape?

Only an enlargement changes the lengths of the sides (unless the scale factor is 1)

Enlargement

/ 1

- 5 Write down the name of the single transformation that maps shape A onto shape B.



Same size and turned

Rotation

/ 1

- 6 Here are four transformations: translation, reflection, rotation, enlargement.
Which one needs an angle and a direction to describe it fully?

A rotation needs an angle, a direction and a centre

Rotation

/ 1

- 7 Here are four transformations: translation, reflection, rotation, enlargement.
Which of these do not change the size of a shape?

Only an enlargement changes the lengths of the sides

Translation, reflection and rotation

/ 1

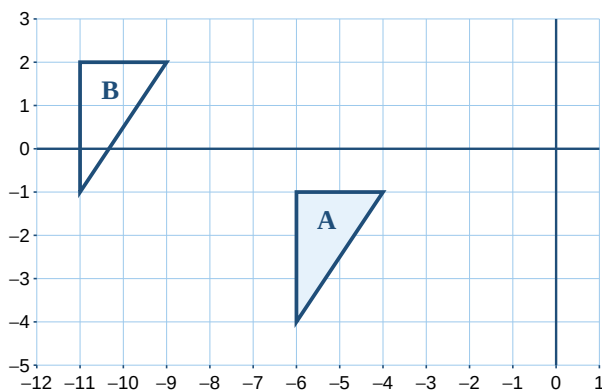
- 8 Here are four transformations: translation, reflection, rotation, enlargement.
Which two need a centre to describe them fully?

Both are done about a fixed point, the centre

Rotation and enlargement

/ 1

- 9 Describe fully the single transformation that maps shape A onto shape B.

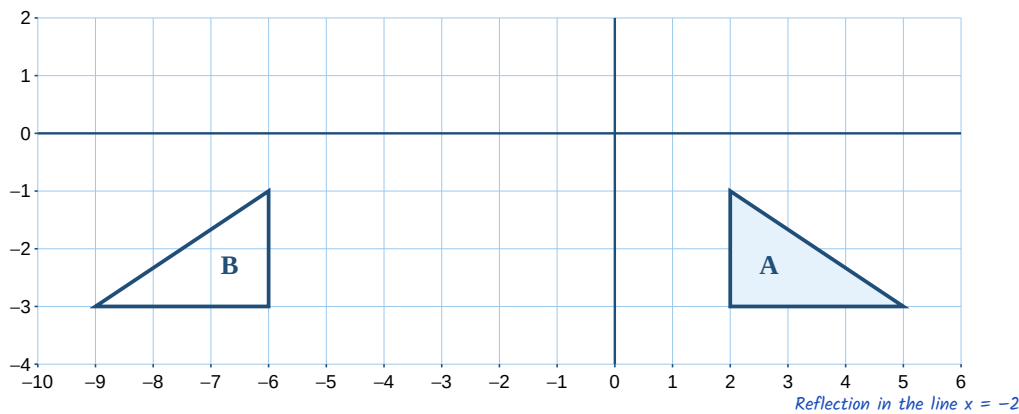


Decide which transformation it is, then give the extra detail it needs

Translation by 5 left and 3 up, the column vector (top -5, bottom 3)

/ 1

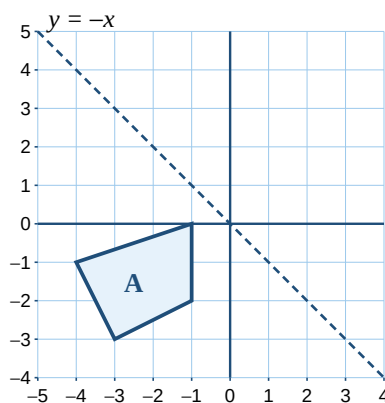
- 10 Describe fully the single transformation that maps shape A onto shape B.



B is a mirror image of A. The mirror line is halfway between matching points: $x = -2$

/ 1

- 11 Reflect shape A in the line with equation $y = -x$.

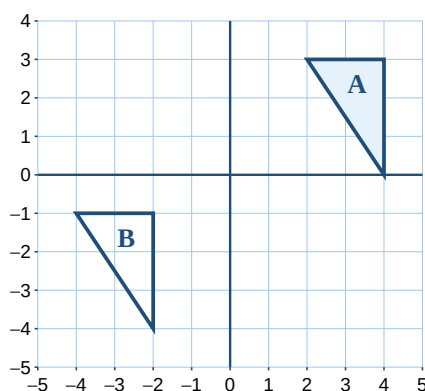


Each point is the same distance from the line $y = -x$ as its image, on the other side. Swap the x and y coordinates and change both signs.

Image vertices: (0, 1), (1, 4), (3, 3), (2, 1)

/ 1

- 12 Describe fully the single transformation that maps shape A onto shape B.

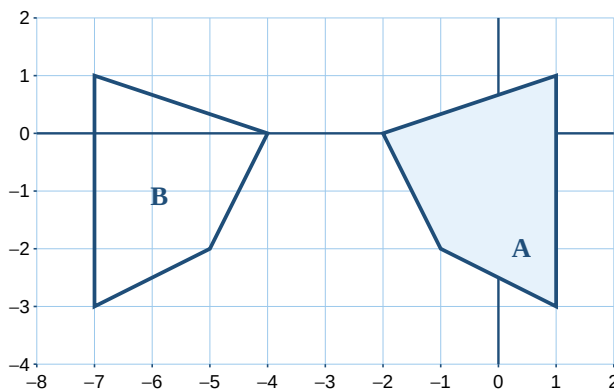


Decide which transformation it is, then give the extra detail it needs.

Translation by 6 left and 4 down, the column vector (top -6, bottom -4)

/ 1

- 13 Describe fully the single transformation that maps shape A onto shape B.

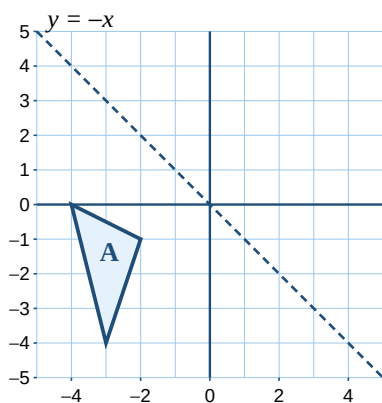


*B is a mirror image of A
The mirror line is halfway
between matching points: $x = -3$*

Reflection in the line $x = -3$

/ 1

- 14 Reflect shape A in the line with equation $y = -x$.

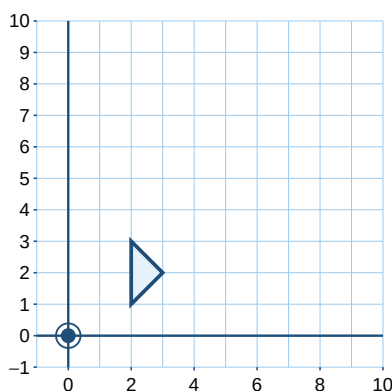


*Each point is the same distance from the line
 $y = -x$ as its image, on the other side
Swap the x and y coordinates and change
both signs*

*Image vertices: (0, 4), (4, 3),
(1, 2)*

/ 1

- 15 Enlarge the shaded triangle by scale factor 3, centre O.

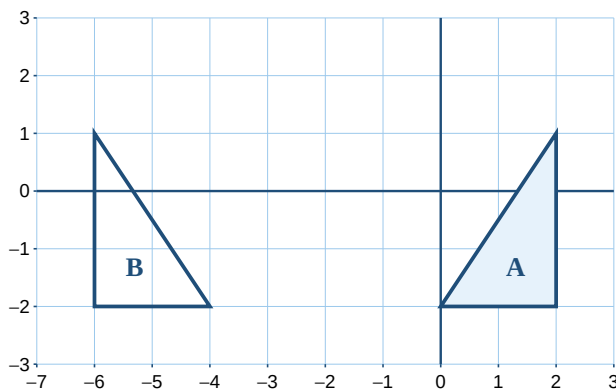


*Multiply the coordinates of each vertex by 3,
because the centre is the origin: (6, 3), (9,
6), (6, 9)*

*Image vertices: (6, 3), (9, 6),
(6, 9)*

/ 1

- 16 Describe fully the single transformation that maps shape A onto shape B.

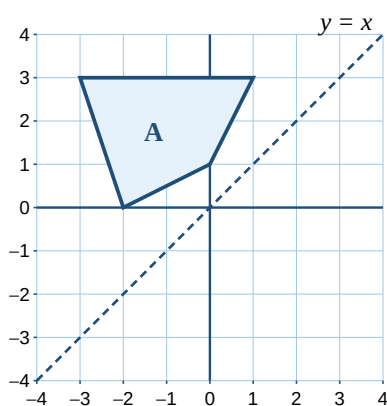


*B is a mirror image of A
The mirror line is halfway
between matching points: $x = -2$*

Reflection in the line $x = -2$

/ 1

- 17 Reflect shape A in the line with equation $y = x$.



*Each point is the same distance from the line
 $y = x$ as its image, on the other side
Swap the x and y coordinates of each vertex*

*Image vertices: $(3, -3)$, $(3, 1)$,
 $(1, 0)$, $(0, -2)$*

/ 1

- 18 The point P has coordinates $(1, 2)$.
P is reflected in the x -axis.
The image is then translated 3 left and 3 up.
Write down the coordinates of the final image.

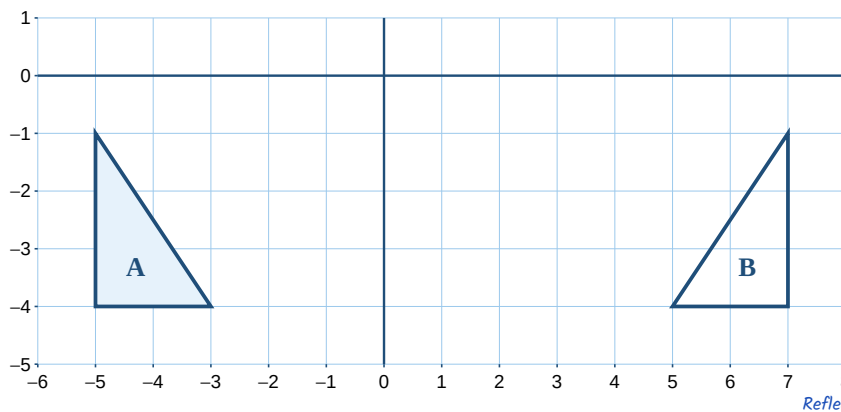
Reflect first: $(1, -2)$

Then translate

$(-2, 1)$

/ 1

- 19 Describe fully the single transformation that maps shape A onto shape B.

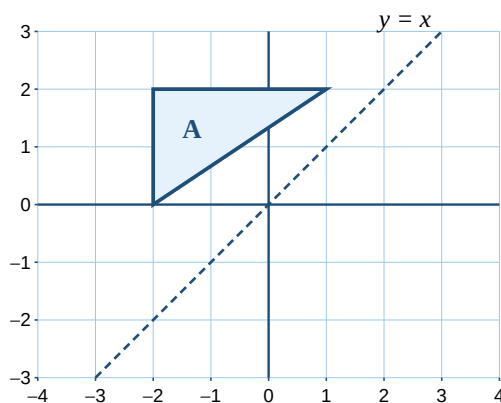


*B is a mirror image of A
The mirror line is halfway between matching points: $x = 1$*

Reflection in the line $x = 1$

/ 1

- 20 Reflect shape A in the line with equation $y = x$.



*Each point is the same distance from the line $y = x$ as its image, on the other side
Swap the x and y coordinates of each vertex*

Image vertices: $(0, -2)$, $(2, -2)$, $(2, 1)$

/ 1

- 21 Shape A is translated 5 right and 4 up.
The image is then translated 4 right and 2 down.
Describe fully the single transformation that is equivalent to these two translations.

Add the movements

*Translation by 9 right and 2 up,
the column vector (top 9,
bottom 2)*

/ 2

- 22 The point P has coordinates (3, 4).
 P is reflected in $y = -x$.
 The image is then translated 1 right and 4 down.
 Write down the coordinates of the final image.

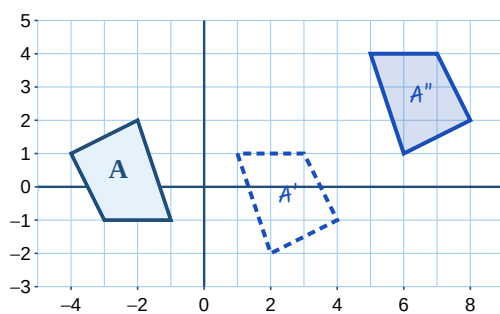
Reflect first: (-4, -3)

Then translate

(-3, -7)

/ 2

- 23 Rotate shape A 180° about the origin O.
 Then translate the image 4 squares to the right and 3 squares up.
 Draw the final image.



/ 2

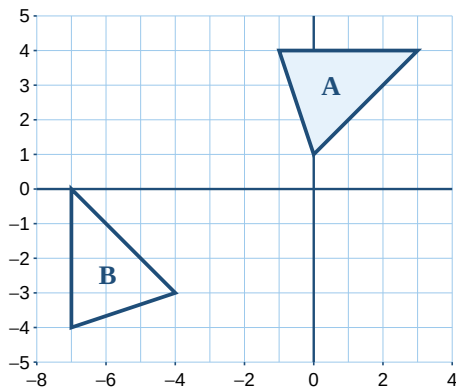
- 24 Shape A is rotated 90° anticlockwise about the origin O.
 The image is then rotated 90° anticlockwise about the origin O.
 Describe fully the single transformation that is equivalent to these two rotations.

$90^\circ + 90^\circ = 180^\circ$, about the same centre

Rotation, 180° , centre O (0, 0)

/ 2

- 25 Describe fully the single transformation that maps shape A onto shape B.

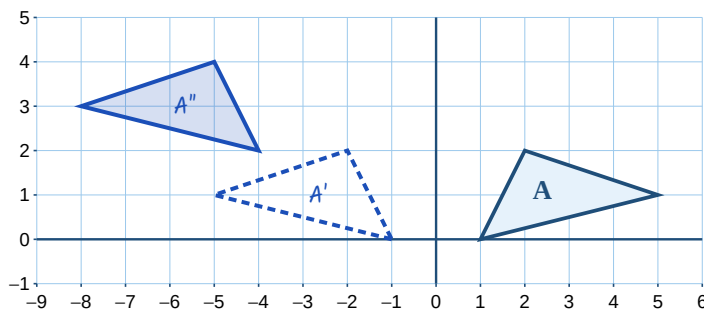


*Decide which transformation it is, then
give the extra detail it needs*

*Rotation, 90° anticlockwise,
centre $(0, -3)$*

/ 2

- 26 Reflect shape A in the y-axis.
Then translate the image 3 squares to the left and 2 squares up.
Draw the final image.



/ 2

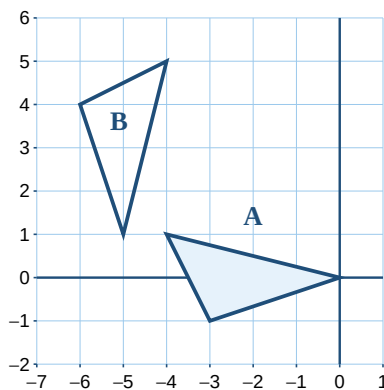
- 27 The point P has coordinates $(-3, 1)$.
P is rotated 90° anticlockwise about the origin O.
The image is then enlarged by scale factor 2, centre O.
Write down the coordinates of the final image.

*Rotate first: $(-1, -3)$
Then multiply by 2*

$(-2, -6)$

/ 2

- 28 Describe fully the single transformation that maps shape A onto shape B.

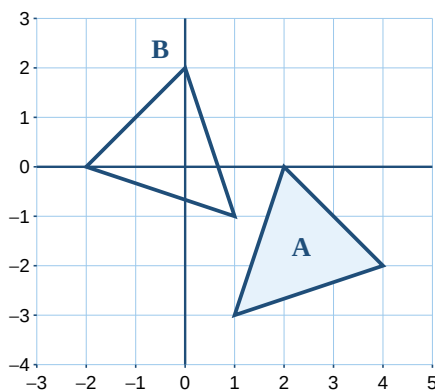


Decide which transformation it is, then give the extra detail it needs

Rotation, 90° clockwise, centre $(-2, 3)$

/ 2

- 29 Describe fully the single transformation that maps shape A onto shape B.

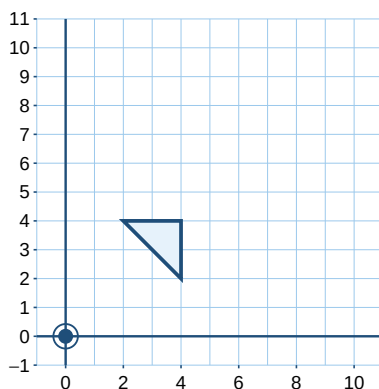


The shape has been turned through a quarter turn anticlockwise about $(0, -2)$

Rotation, 90° anticlockwise, centre $(0, -2)$

/ 2

- 30 Enlarge the shaded triangle by scale factor 2.5, centre O.

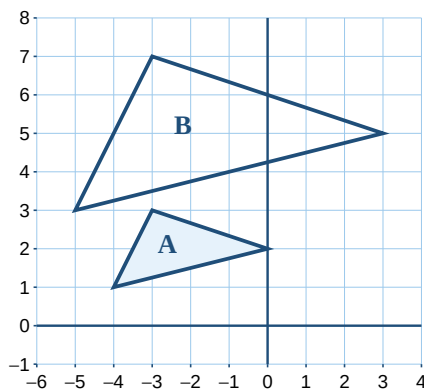


Multiply the coordinates of each vertex by 2.5, because the centre is the origin: $(5, 10)$, $(10, 10)$, $(10, 5)$

Image vertices: $(5, 10)$, $(10, 10)$, $(10, 5)$

/ 2

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

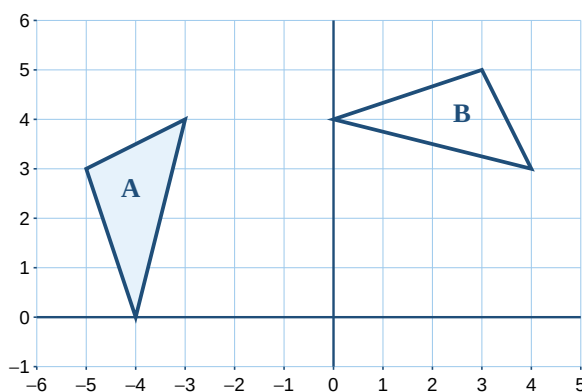


The sides of B are 2 times the sides of A,
so the scale factor is 2
Draw lines through matching vertices: they
cross at the centre $(-3, -1)$

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

2 / 2

- 32 Describe fully the single transformation that maps shape A onto shape B.

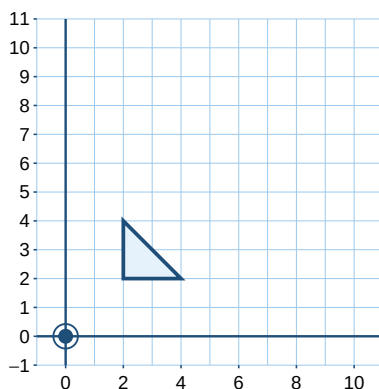


The shape has been turned
through a quarter turn clockwise
about the origin

Rotation, 90° clockwise, centre O
 $(0, 0)$

2 / 2

- 33 Enlarge the shaded triangle by scale factor 2.5, centre O.

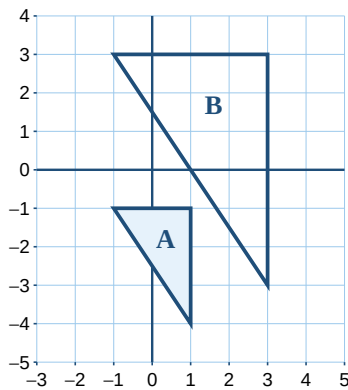


Multiply the coordinates of each vertex by 2.5,
because the centre is the origin: $(5, 5)$, $(10, 5)$, $(5, 10)$

Image vertices: $(5, 5)$, $(10, 5)$,
 $(5, 10)$

2 / 2

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

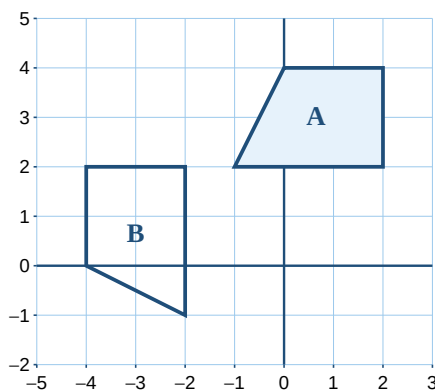


The sides of B are 2 times the sides of A, so the scale factor is 2
Draw lines through matching vertices: they cross at the centre $(-1, -5)$

Enlargement, scale factor 2,
centre $(-1, -5)$

2 / 2

- 35 Describe fully the single transformation that maps shape A onto shape B.

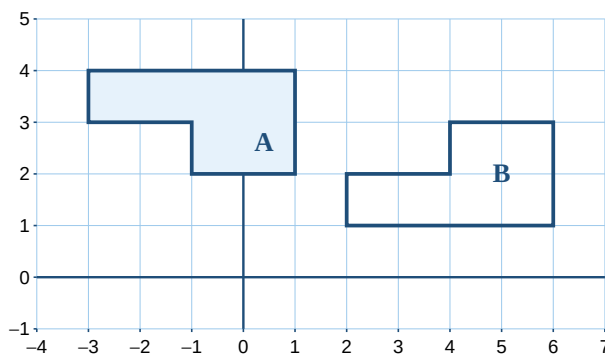


The shape has been turned through a quarter turn anticlockwise about the origin

Rotation, 90° anticlockwise,
centre $O (0, 0)$

2 / 2

- 36 A reflection in the x-axis followed by the translation shown maps shape A onto shape B. Find the values of p and q.



Translation $\begin{bmatrix} p \\ q \end{bmatrix}$

Reflect A in the x-axis to get $(1, -2)$, $(-1, -2)$, $(-1, -3)$, $(-3, -3)$, $(-3, -4)$, $(1, -4)$
Compare this image with B: it moves 5 right and 5 up, so $p = 5$ and $q = 5$

$p = 5, q = 5$

2 / 2

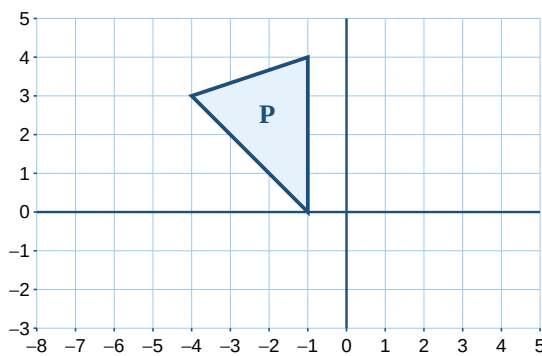
- 37 Shape A is reflected in the line $x = -2$.
 The image is then reflected in the line $x = 4$.
 Describe fully the single transformation that is equivalent to these two reflections.

The shape moves twice the distance between the mirror lines, in the direction from the first line to the second

Translation by 12 right, the column vector (top 12, bottom 0)

2 / 2

- 38 (a) Rotate shape P 90° clockwise about O. Label the image A.
 (b) Translate shape P by the vector shown. Label the image B.



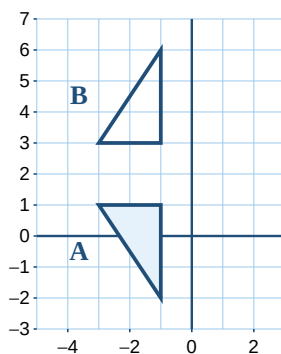
Vector $\begin{bmatrix} -3 \\ -2 \end{bmatrix}$

*A: rotate each vertex 90° clockwise about O
 B: add -3 to every x-coordinate and -2 to every y-coordinate*

A: (4, 1), (0, 1), (3, 4); B: (-4, 2), (-4, -2), (-7, 1)

2 / 2

- 39 A reflection in the x-axis followed by the translation shown maps shape A onto shape B. Find the values of p and q.



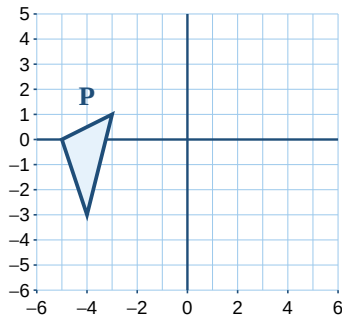
Translation $\begin{bmatrix} p \\ q \end{bmatrix}$

*Reflect A in the x-axis to get (-3, -1), (-1, -1), (-1, 2)
 Compare this image with B: it moves 4 up, so $p = 0$ and $q = 4$*

$p = 0, q = 4$

3 / 3

- 40 (a) Reflect shape P in the y-axis. Label the image A.
 (b) Rotate shape P 90° anticlockwise about O. Label the image B.
 (c) Translate shape P by the vector shown. Label the image C.



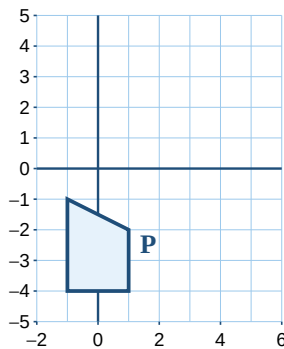
Vector $\begin{bmatrix} 4 \\ 3 \end{bmatrix}$

*A: reflect each vertex in the y-axis
 B: rotate each vertex 90° anticlockwise about O
 C: add 4 to every x-coordinate and 3 to every y-coordinate*

A: (3, 1), (4, -3), (5, 0); B: (-1, -3), (3, -4), (0, -5); C: (1, 4), (0, 0), (-1, 3)

3 / 3

- 41 (a) Rotate shape P 90° anticlockwise about O. Label the image A.
 (b) Reflect shape P in the x-axis. Label the image B.

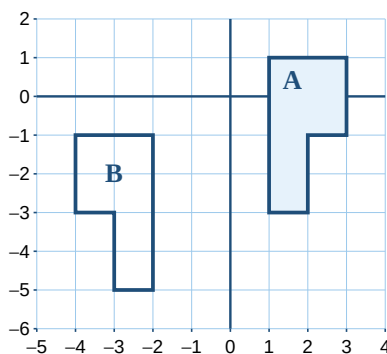


*A: rotate each vertex 90° anticlockwise about O
 B: reflect each vertex in the x-axis*

A: (1, -1), (4, -1), (4, 1), (2, 1); B: (-1, 1), (-1, 4), (1, 4), (1, 2)

3 / 3

- 42 A reflection in the y-axis followed by the translation shown maps shape A onto shape B. Find the values of p and q.



Translation $\begin{bmatrix} p \\ q \end{bmatrix}$

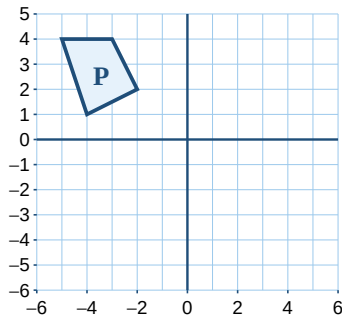
Reflect A in the y-axis to get (-3, 1), (-3, -1), (-2, -1), (-2, -3), (-1, -3), (-1, 1)

Compare this image with B: it moves 1 left and 2 down, so $p = -1$ and $q = -2$

$p = -1, q = -2$

3 / 3

- 43 (a) Translate shape P by the vector shown. Label the image A.
 (b) Rotate shape P 90° anticlockwise about O. Label the image B.
 (c) Reflect shape P in the y-axis. Label the image C.



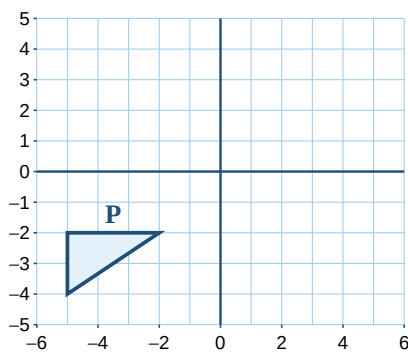
Vector $\begin{bmatrix} 5 \\ -5 \end{bmatrix}$

A: add 5 to every x-coordinate
and -5 to every y-coordinate
B: rotate each vertex 90°
anticlockwise about O
C: reflect each vertex in the
y-axis

A: (0, -1), (1, -4), (3, -3), (2, -1);
B: (-4, -5), (-1, -4), (-2, -2), (-4, -3);
C: (5, 4), (4, 1), (2, 2), (3, 4)

3 / 3

- 44 (a) Reflect shape P in the y-axis. Label the image A.
 (b) Rotate shape P 180° about O. Label the image B.

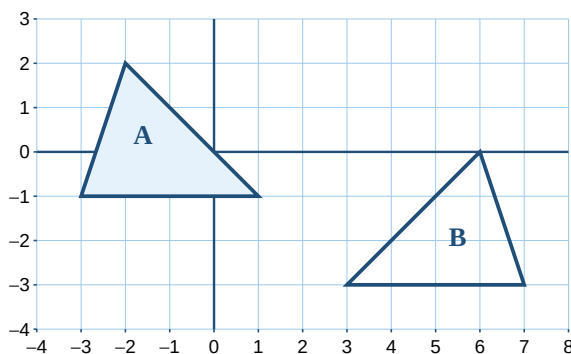


A: reflect each vertex in the y-axis
B: rotate each vertex 180° about O

A: (5, -2), (2, -2), (5, -4); B:
(5, 2), (2, 2), (5, 4)

3 / 3

- 45 A reflection in the y-axis followed by the translation shown maps shape A onto shape B. Find the values of p and q.



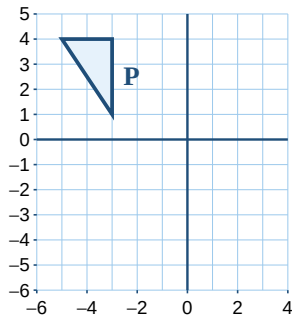
Translation $\begin{bmatrix} p \\ q \end{bmatrix}$

Reflect A in the
y-axis to get (3,
-1), (-1, -1),
(2, 2)
Compare this
image with B: it
moves 4 right
and 2 down, so
 $p = 4$ and $q =$
 -2

$p = 4, q = -2$

3 / 3

- 46 (a) Rotate shape P 90° anticlockwise about O. Label the image A.
 (b) Reflect shape P in $x = -2$. Label the image B.
 (c) Translate shape P by the vector shown. Label the image C.



Vector $\begin{bmatrix} 6 \\ -3 \end{bmatrix}$

A: rotate each vertex 90° anticlockwise about O

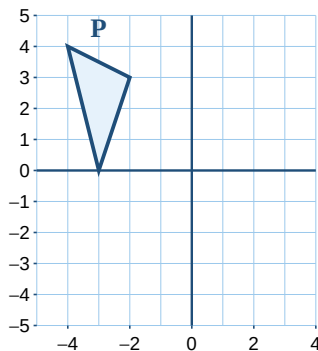
B: reflect each vertex in $x = -2$

C: add 6 to every x-coordinate and -3 to every y-coordinate

A: $(-4, -5), (-4, -3), (-1, -3)$; B: $(1, 4), (-1, 4), (-1, 1)$;
 C: $(1, 1), (3, 1), (3, -2)$

3 / 3

- 47 (a) Translate shape P by the vector shown. Label the image A.
 (b) Rotate shape P 90° anticlockwise about O. Label the image B.



Vector $\begin{bmatrix} 5 \\ -4 \end{bmatrix}$

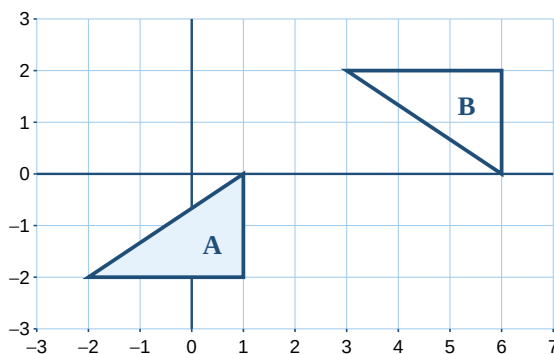
A: add 5 to every x-coordinate and -4 to every y-coordinate

B: rotate each vertex 90° anticlockwise about O

A: $(1, 0), (2, -4), (3, -1)$; B: $(-4, -4), (0, -3), (-3, -2)$

3 / 3

- 48 A reflection in the x-axis followed by the translation shown maps shape A onto shape B. Find the values of p and q.



Translation $\begin{bmatrix} p \\ q \end{bmatrix}$

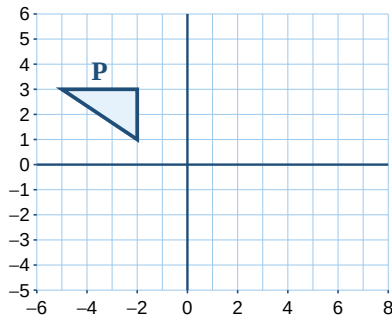
Reflect A in the x-axis to get $(1, 0), (1, 2), (-2, 2)$

Compare this image with B: it moves 5 right, so $p = 5$ and $q = 0$

$p = 5, q = 0$

3 / 3

- 49 (a) Translate shape P by the vector shown. Label the image A.
 (b) Rotate shape P 90° clockwise about O. Label the image B.
 (c) Reflect shape P in $x = 1$. Label the image C.



Vector $\begin{bmatrix} 1 \\ -5 \end{bmatrix}$

A: add 1 to every x-coordinate and -5 to every y-coordinate

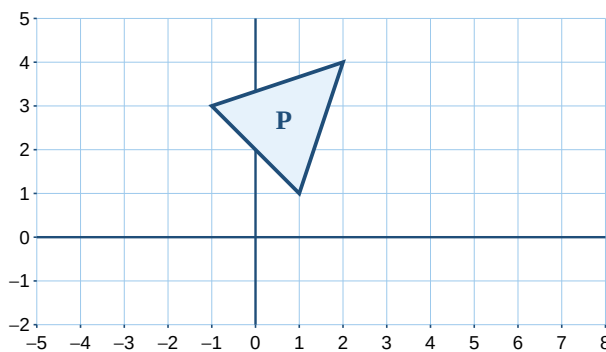
B: rotate each vertex 90° clockwise about O

C: reflect each vertex in $x = 1$

A: $(-1, -2)$, $(-4, -2)$, $(-1, -4)$; B: $(3, 2)$, $(3, 5)$, $(1, 2)$; C: $(4, 3)$, $(7, 3)$, $(4, 1)$

3 / 3

- 50 (a) Reflect shape P in $x = 3$. Label the image A.
 (b) Rotate shape P 90° anticlockwise about O. Label the image B.



A: reflect each vertex in $x = 3$

B: rotate each vertex 90° anticlockwise about O

A: $(4, 4)$, $(7, 3)$, $(5, 1)$; B: $(-4, 2)$, $(-3, -1)$, $(-1, 1)$

3 / 3