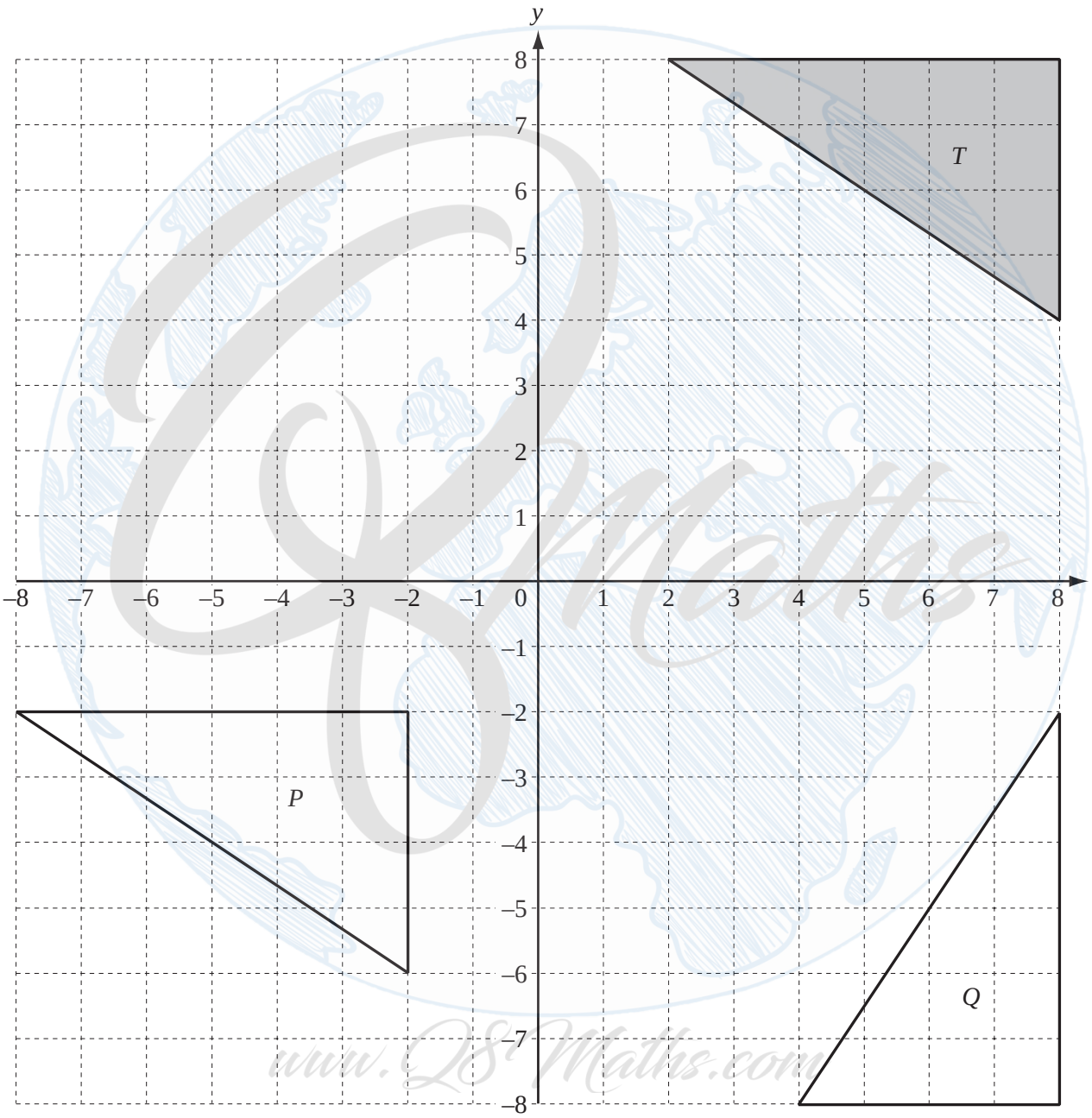
Transformations

3



(a) On the grid, draw the enlargement of the triangle T, centre (0, 0), scale factor $\frac{1}{2}$. [2]

(b) The matrix $\begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}$ represents a transformation.

(i) Calculate the matrix product $\begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}\begin{pmatrix} 8 & 8 & 2 \\ 4 & 8 & 8 \end{pmatrix}$.

Answer(b)(i) [2]

(ii) On the grid, draw the image of the triangle T under this transformation. [2]

(iii) Describe fully this **single** transformation.

Answer(b)(iii) ..... [2]

(c) Describe fully the **single** transformation which maps

(i) triangle T onto triangle P,

Answer(c)(i) ..... [2]

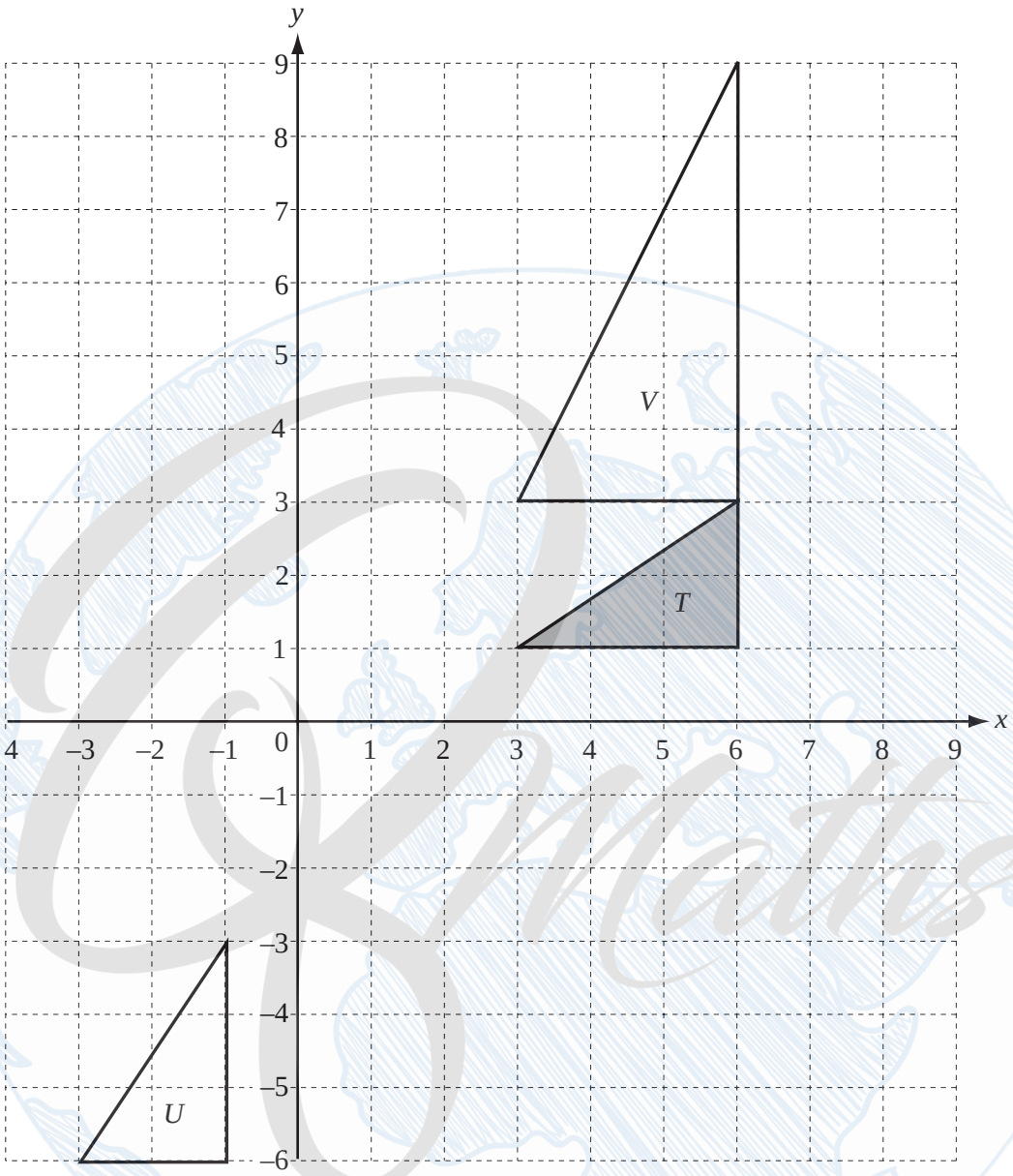
(ii) triangle T onto triangle Q.

Answer(c)(ii) ..... [3]

(d) Find the 2 by 2 matrix which represents the transformation in **part (c)(ii)**.

Answer(d) $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

4



(a) On the grid, draw

(i) the translation of triangle T by the vector $\begin{pmatrix} 7 \\ 3 \end{pmatrix}$, [2]

(ii) the rotation of triangle T about (0, 0), through 90° clockwise. [2]

(b) Describe fully the **single** transformation that maps

(i) triangle T onto triangle U,

Answer(b)(i) ..... [2]

(ii) triangle T onto triangle V

Answer(b)(ii) ..... [3]

(c) Find the 2 by 2 matrix which represents the transformation that maps

(i) triangle T onto triangle U,

Answer(c)(i) $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

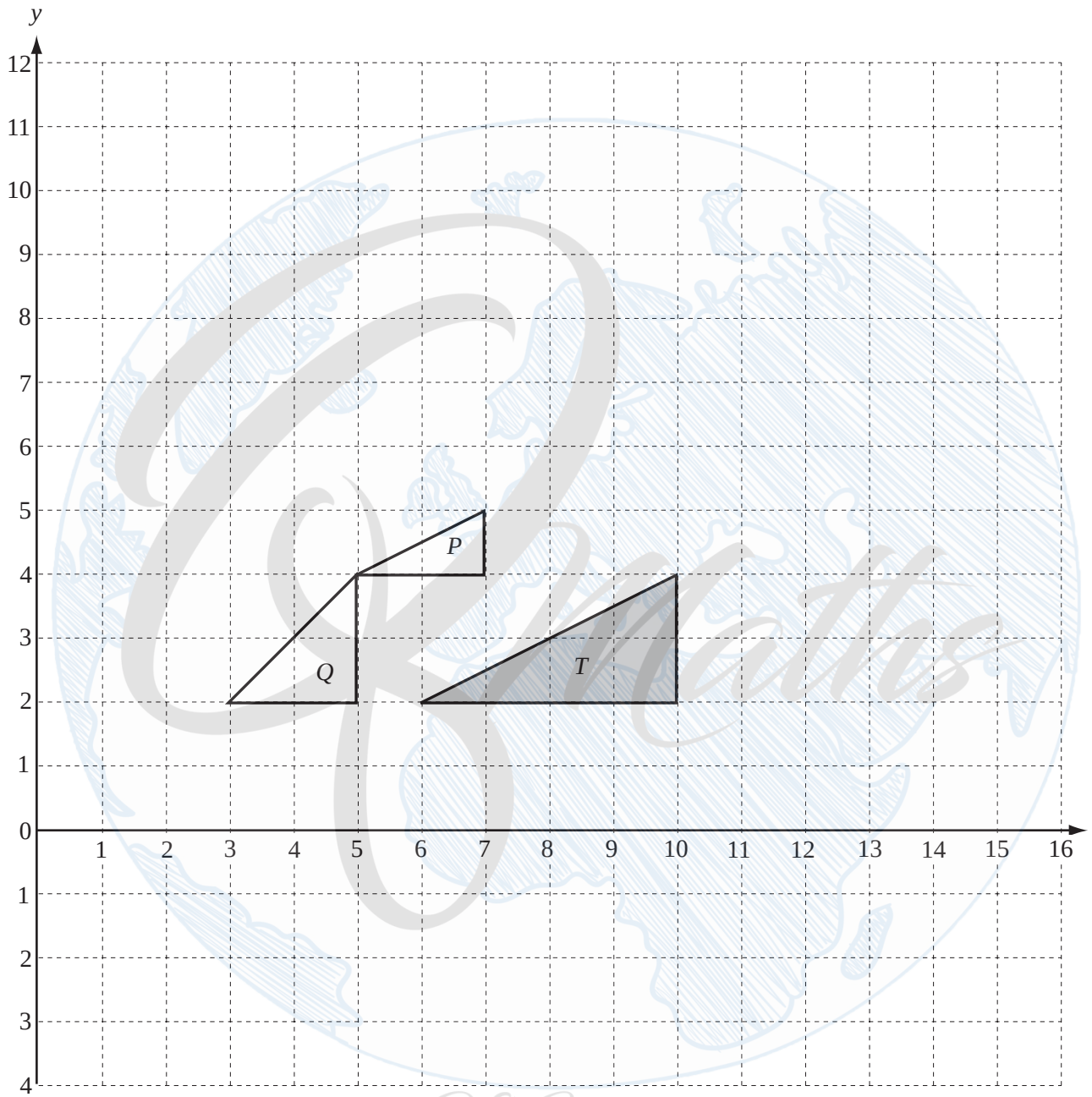
(ii) triangle T onto triangle V,

Answer(c)(ii) $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

(iii) triangle V onto triangle T.

Answer(c)(iii) $\begin{pmatrix} & \\ & \end{pmatrix}$ [1]

4



(a) Draw the reflection of triangle T in the line $y = 6$.

Label the image A. [2]

(b) Draw the translation of triangle T by the vector $\begin{pmatrix} 4 \\ 6 \end{pmatrix}$.

Label the image B. [2]

(c) Describe fully the **single** transformation which maps triangle *B* onto triangle *T*.

Answer(c) ..... [2]

(d) **(i)** Describe fully the **single** transformation which maps triangle *T* onto triangle *P*.

Answer(d)(i) ..... [3]

(ii) Complete the following statement.

Area of triangle *P* = ... × Area of triangle *T* [1]

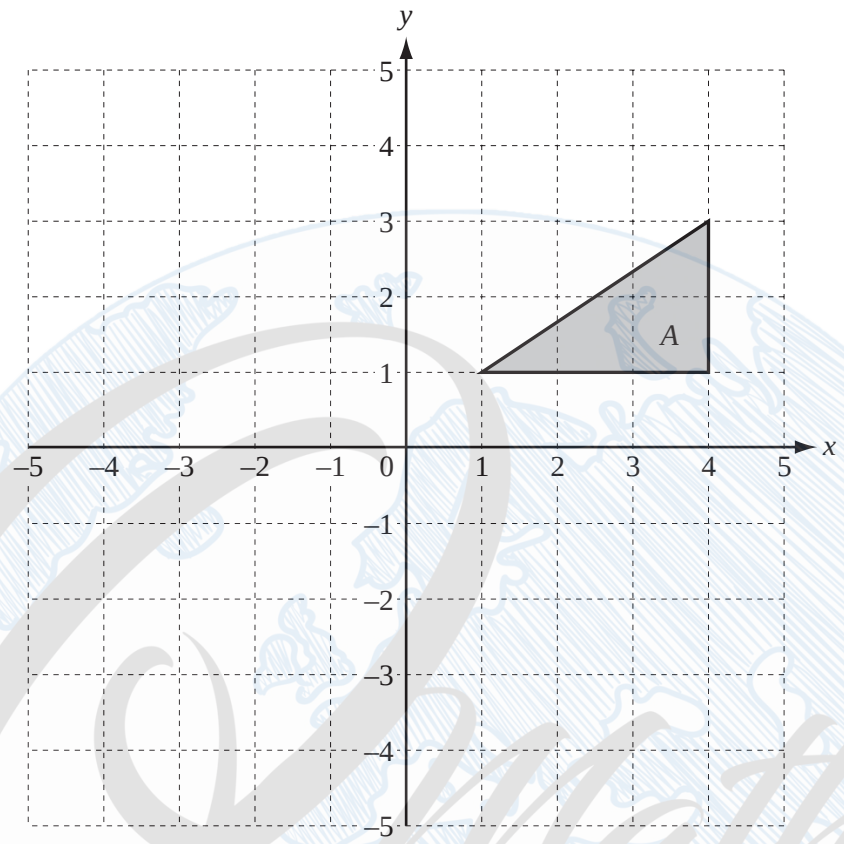
(e) **(i)** Describe fully the **single** transformation which maps triangle *T* onto triangle *Q*.

Answer(e)(i) ..... [3]

(ii) Find the 2 by 2 matrix which represents the transformation mapping triangle *T* onto triangle *Q*.

Answer(e)(ii) $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

2 (a)



(i) Draw the image when triangle A is reflected in the line $y = 0$.
Label the image B. [2]

(ii) Draw the image when triangle A is rotated through 90° anticlockwise about the origin.
Label the image C. [2]

(iii) Describe fully the **single** transformation which maps triangle B onto triangle C.

Answer(a)(iii) ..... [2]

(b) Rotation through 90° anticlockwise about the origin is represented by the matrix $\mathbf{M} = \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$.

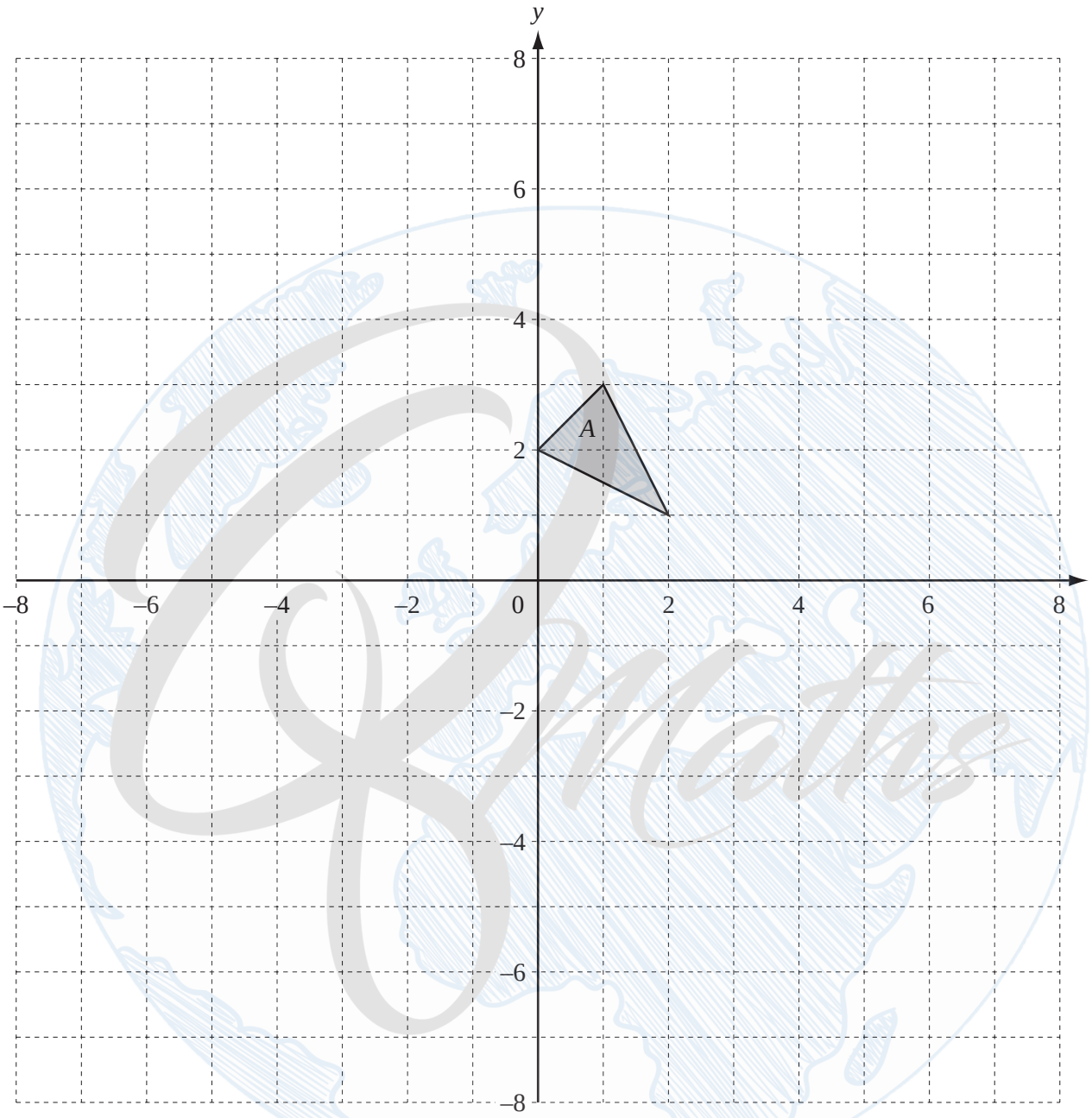
(i) Find $\mathbf{M}^{-1}$, the inverse of matrix $\mathbf{M}$.

Answer(b)(i) $\mathbf{M}^{-1} =$ $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

(ii) Describe fully the **single** transformation represented by the matrix $\mathbf{M}^{-1}$.

Answer(b)(ii) ..... [2]

8 (a)



Draw the images of the following transformations on the grid above.

(i) Translation of triangle A by the vector $\begin{pmatrix} 3 \\ -7 \end{pmatrix}$. Label the image B. [2]

(ii) Reflection of triangle A in the line $x = 3$. Label the image C. [2]

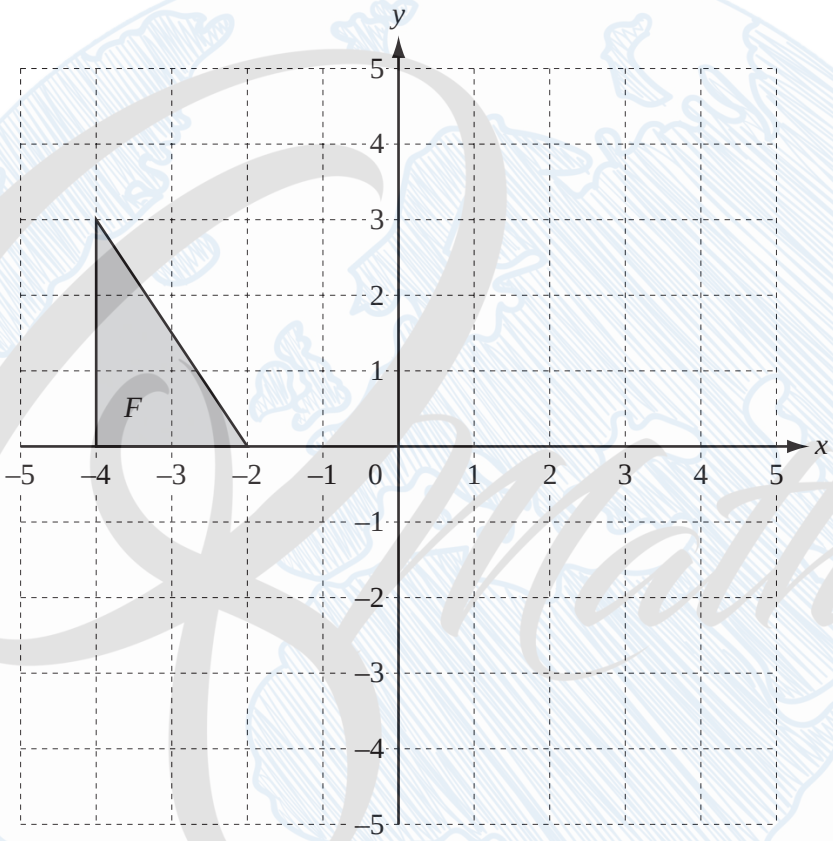
(iii) Rotation of triangle A through 90° anticlockwise around the point (0, 0). Label the image D. [2]

(iv) Enlargement of triangle A by scale factor –4, with centre (0, 1). Label the image E. [2]

(b) The area of triangle E is $k \times$ area of triangle A.
Write down the value of k.

Answer(b) $k =$ ..... [1]

(c)



(i) Draw the image of triangle F under the transformation represented by the matrix $\mathbf{M} = \begin{pmatrix} 1 & 3 \\ 0 & 1 \end{pmatrix}$. [3]

(ii) Describe fully this single transformation.

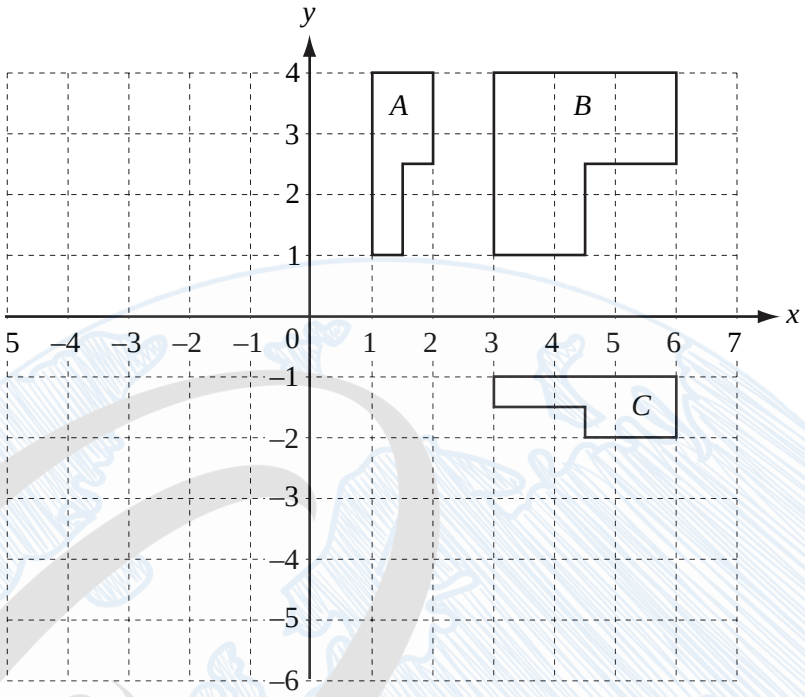
Answer(c)(ii) .....

..... [3]

(iii) Find $\mathbf{M}^{-1}$, the inverse of the matrix $\mathbf{M}$.

Answer(c)(iii) $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

5



(a) On the grid above, draw the image of

(i) shape A after translation by the vector $\begin{pmatrix} 3 \\ 2 \end{pmatrix}$, [2]

(ii) shape A after reflection in the line $x = 1$. [2]

(b) Describe fully the **single** transformation which maps

(i) shape A onto shape B,

Answer(b)(i) ..... [3]

(ii) shape A onto shape C.

Answer(b)(ii) ..... [3]

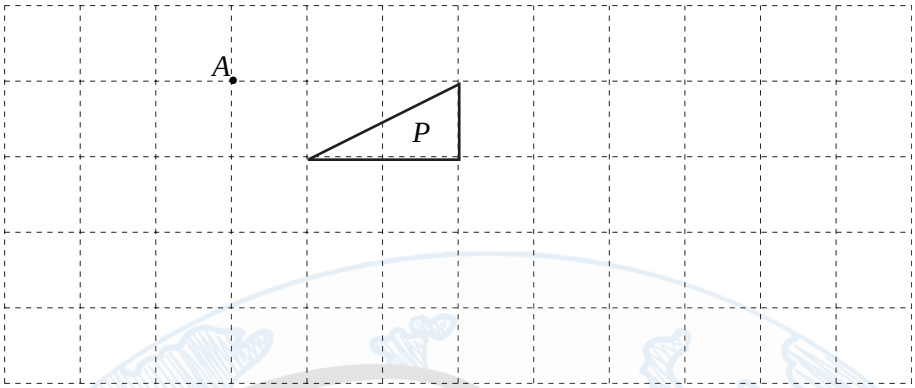
(c) Find the matrix representing the transformation which maps shape A onto shape B.

Answer(c) $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

(d) Describe fully the **single** transformation represented by the matrix $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$

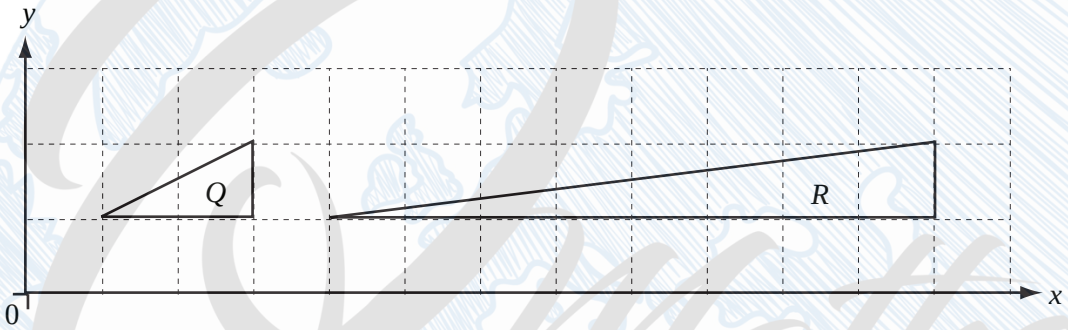
Answer(d) ..... [3]

8 **(a)**



Draw the enlargement of triangle P with centre A and scale factor 2. [2]

(b)



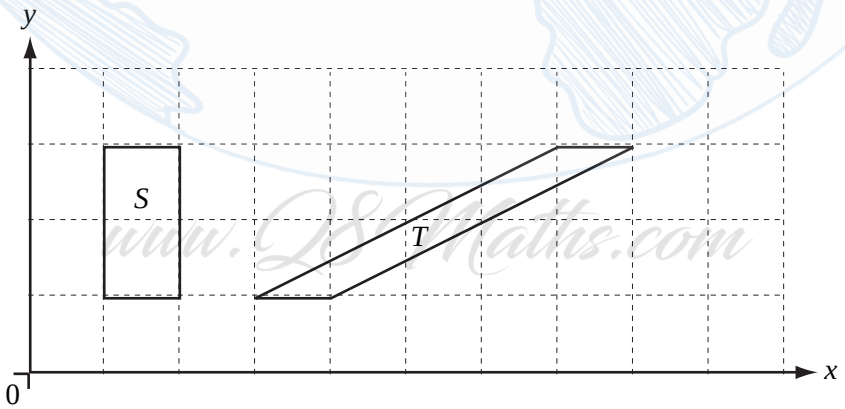
(i) Describe fully the **single** transformation which maps shape Q onto shape R.

Answer(b)(i) ..... [3]

(ii) Find the matrix which represents this transformation.

Answer(b)(ii) $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

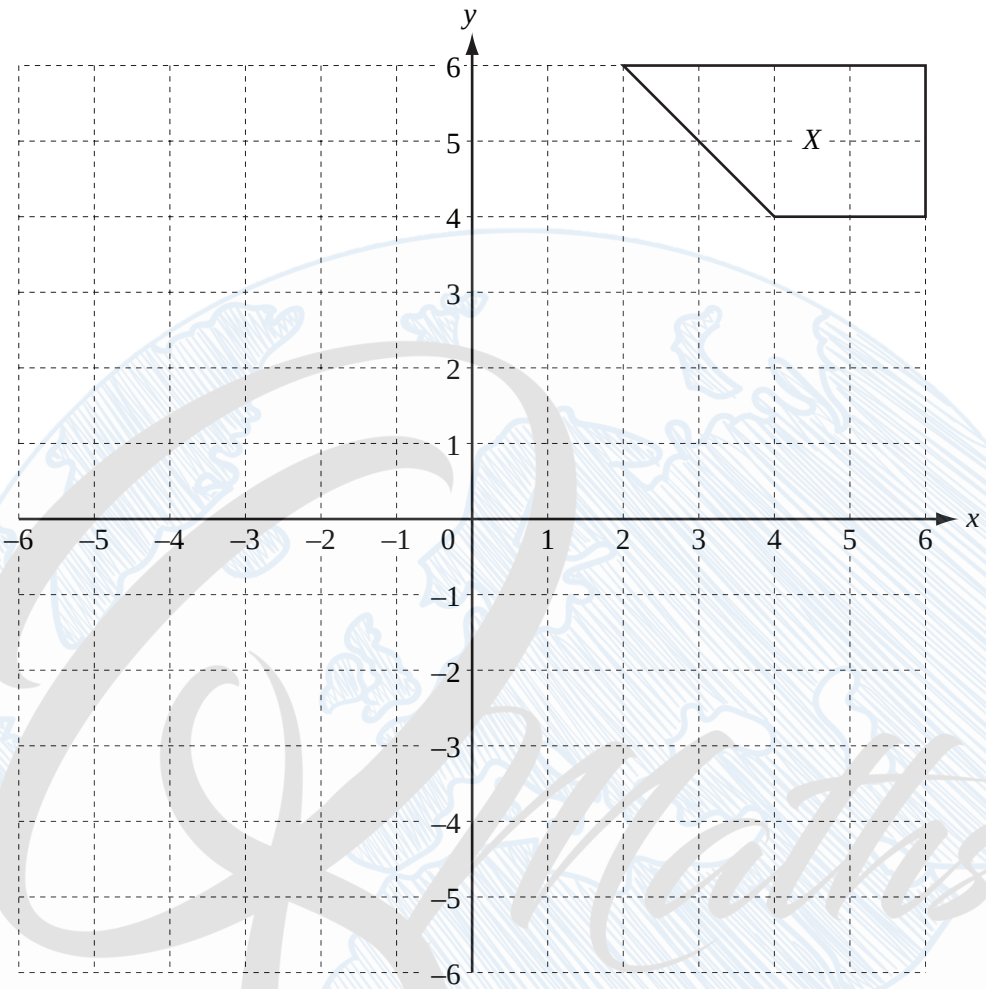
(c)



Describe fully the **single** transformation which maps shape S onto shape T.

Answer(c) ..... [3]

2



(a) **(i)** Draw the reflection of shape *X* in the *x*-axis. Label the image *Y*. [2]

(ii) Draw the rotation of **shape *Y***, 90° clockwise about (0, 0). Label the image *Z*. [2]

(iii) Describe fully the **single** transformation that maps shape *Z* onto shape *X*.

Answer(a)(iii) ..... [2]

(b) **(i)** Draw the enlargement of shape *X*, centre (0, 0), scale factor $\frac{1}{2}$. [2]

(ii) Find the matrix which represents an enlargement, centre (0, 0), scale factor $\frac{1}{2}$.

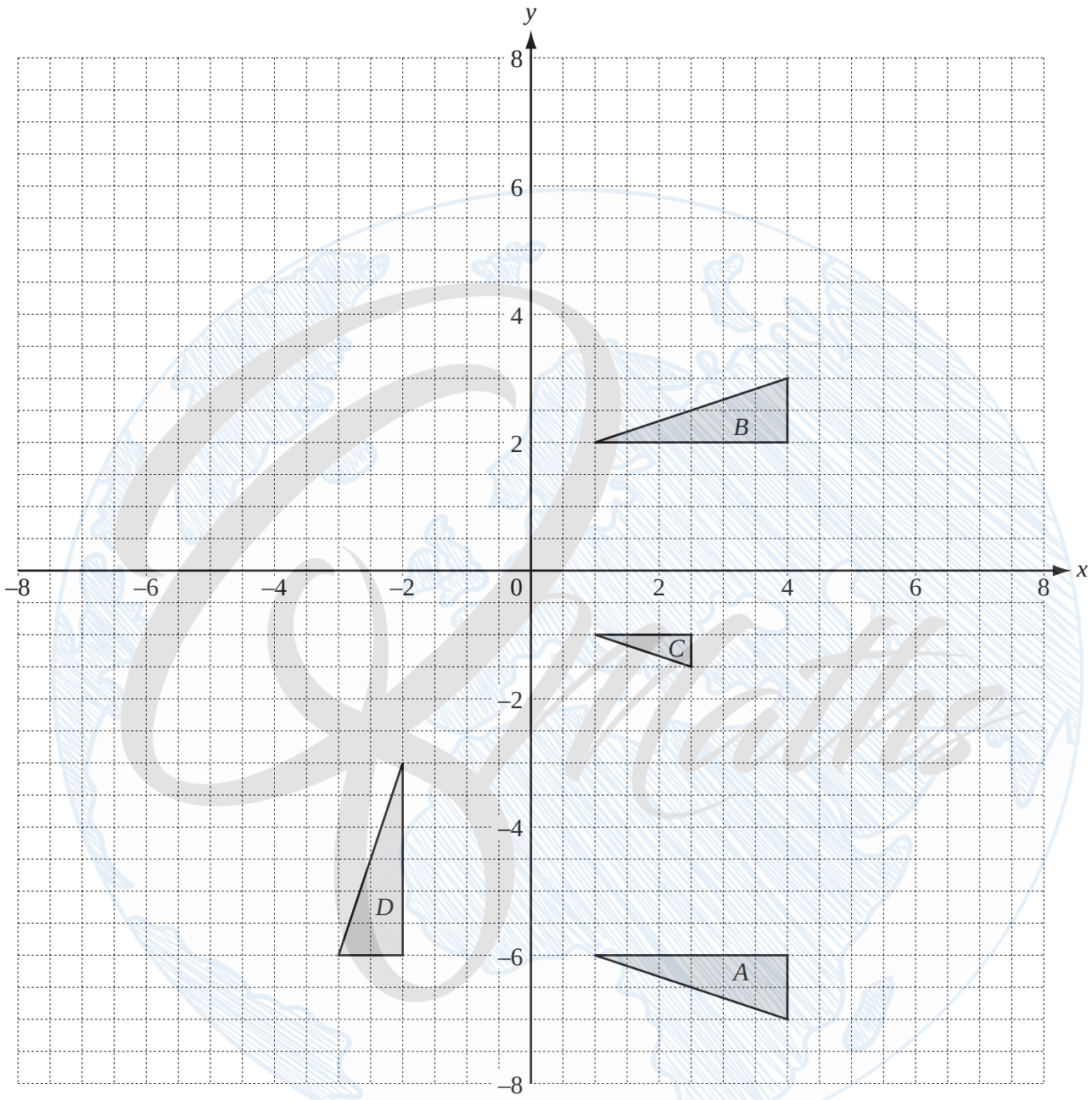
Answer(b)(ii) $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

(c) **(i)** Draw the shear of **shape *X*** with the *x*-axis invariant and shear factor –1. [2]

(ii) Find the matrix which represents a shear with the *x*-axis invariant and shear factor –1.

Answer(c)(ii) $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

7



(a) Describe fully the **single** transformation which maps

(i) triangle *A* onto triangle *B*,

Answer(a)(i) ..... [2]

(ii) triangle *A* onto triangle *C*,

Answer(a)(ii) ..... [3]

(iii) triangle *A* onto triangle *D*.

Answer(a)(iii) [3]

(b) Draw the image of

(i) triangle B after a translation of $\begin{pmatrix} -5 \\ 2 \end{pmatrix}$, [2]

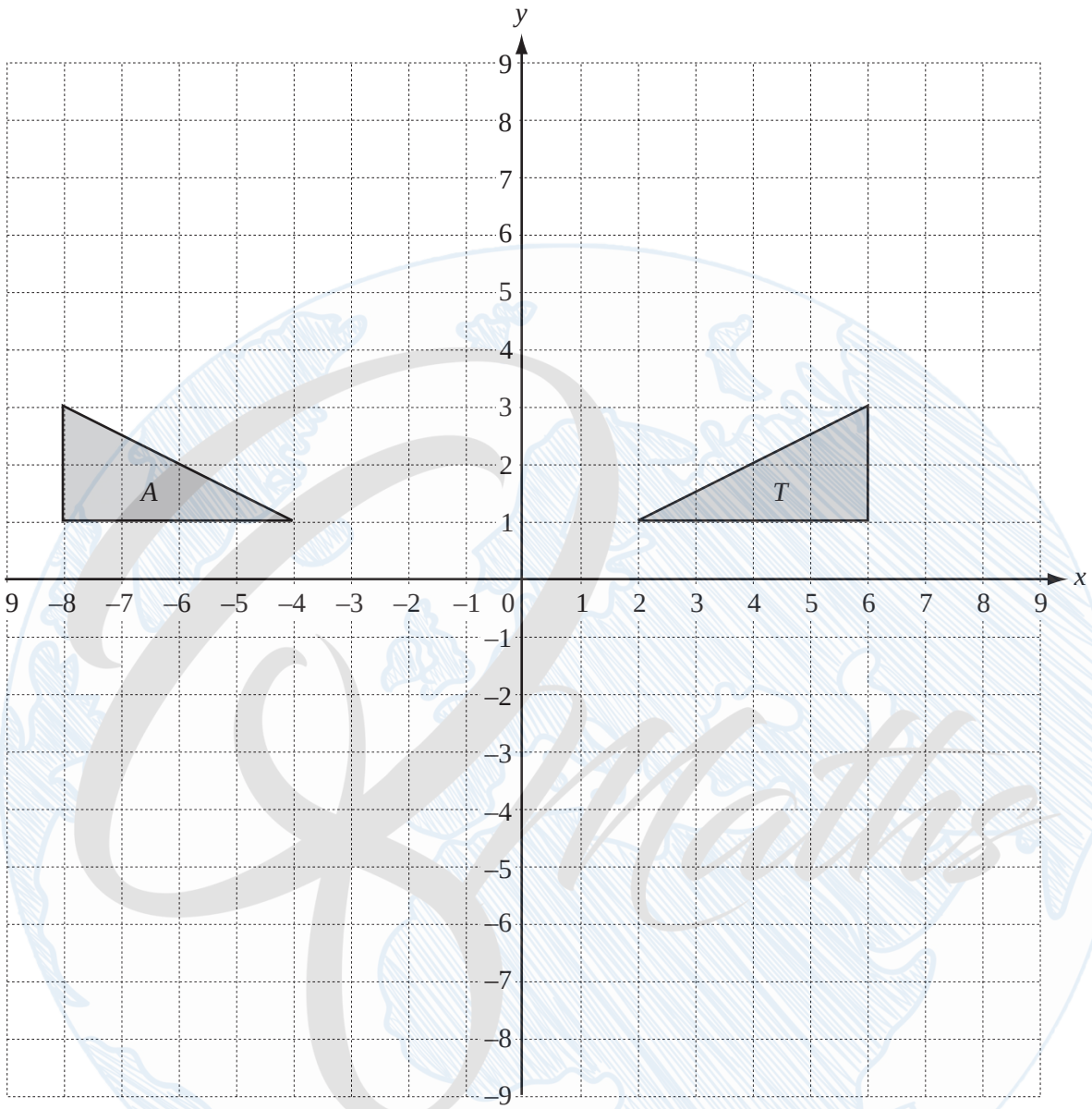
(ii) triangle B after a transformation by the matrix $\begin{pmatrix} 1 & 0 \\ 0 & 2 \end{pmatrix}$. [3]

(c) Describe fully the **single** transformation represented by the matrix $\begin{pmatrix} 1 & 0 \\ 0 & 2 \end{pmatrix}$.

Answer(c) .....

..... [3]

3



Triangles T and A are drawn on the grid above.

(a) Describe fully the **single** transformation that maps triangle T onto triangle A.

Answer(a) ..... [2]

(b) **(i)** Draw the image of triangle T after a rotation of 90° anticlockwise about the point (0,0).

Label the image B. [2]

(ii) Draw the image of triangle T after a reflection in the line $x + y = 0$.

Label the image C. [2]

(iii) Draw the image of triangle T after an enlargement with centre (4, 5) and scale factor 1.5.

Label the image D. [2]

(c) **(i)** Triangle T has its vertices at co-ordinates (2, 1), (6, 1) and (6, 3).

Transform triangle T by the matrix $\begin{pmatrix} 1 & 0 \\ 1 & 1 \end{pmatrix}$.

Draw this image on the grid and label it E.

[3]

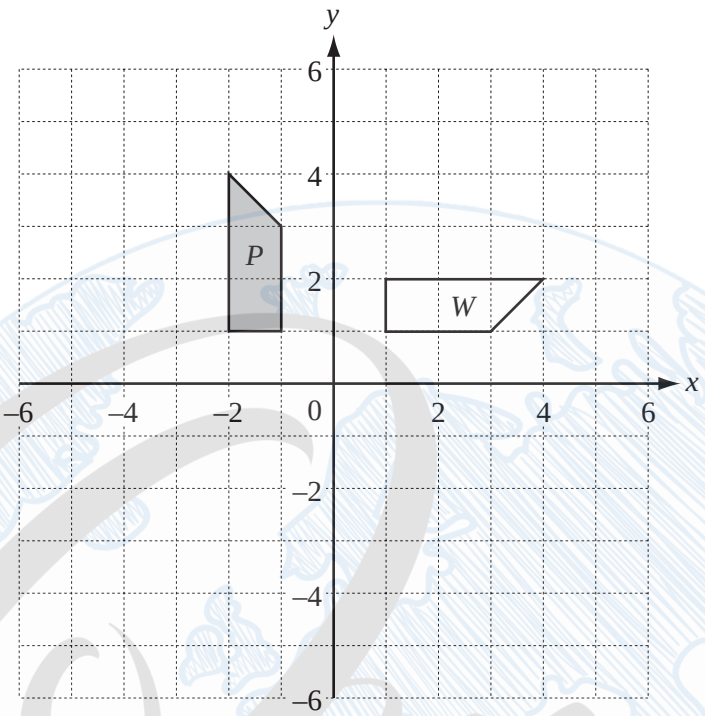
(ii) Describe fully the **single** transformation represented by the matrix $\begin{pmatrix} 1 & 0 \\ 1 & 1 \end{pmatrix}$.

Answer(c)(ii) ..... [3]

(d) Write down the matrix that transforms triangle B onto triangle T.

Answer(d) $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

4



(a) Draw the reflection of shape P in the line $y = x$. [2]

(b) Draw the translation of shape P by the vector $\begin{pmatrix} -2 \\ 1 \end{pmatrix}$. [2]

(c) **(i)** Describe fully the **single** transformation that maps shape P onto shape W.

Answer(c)(i) ..... [3]

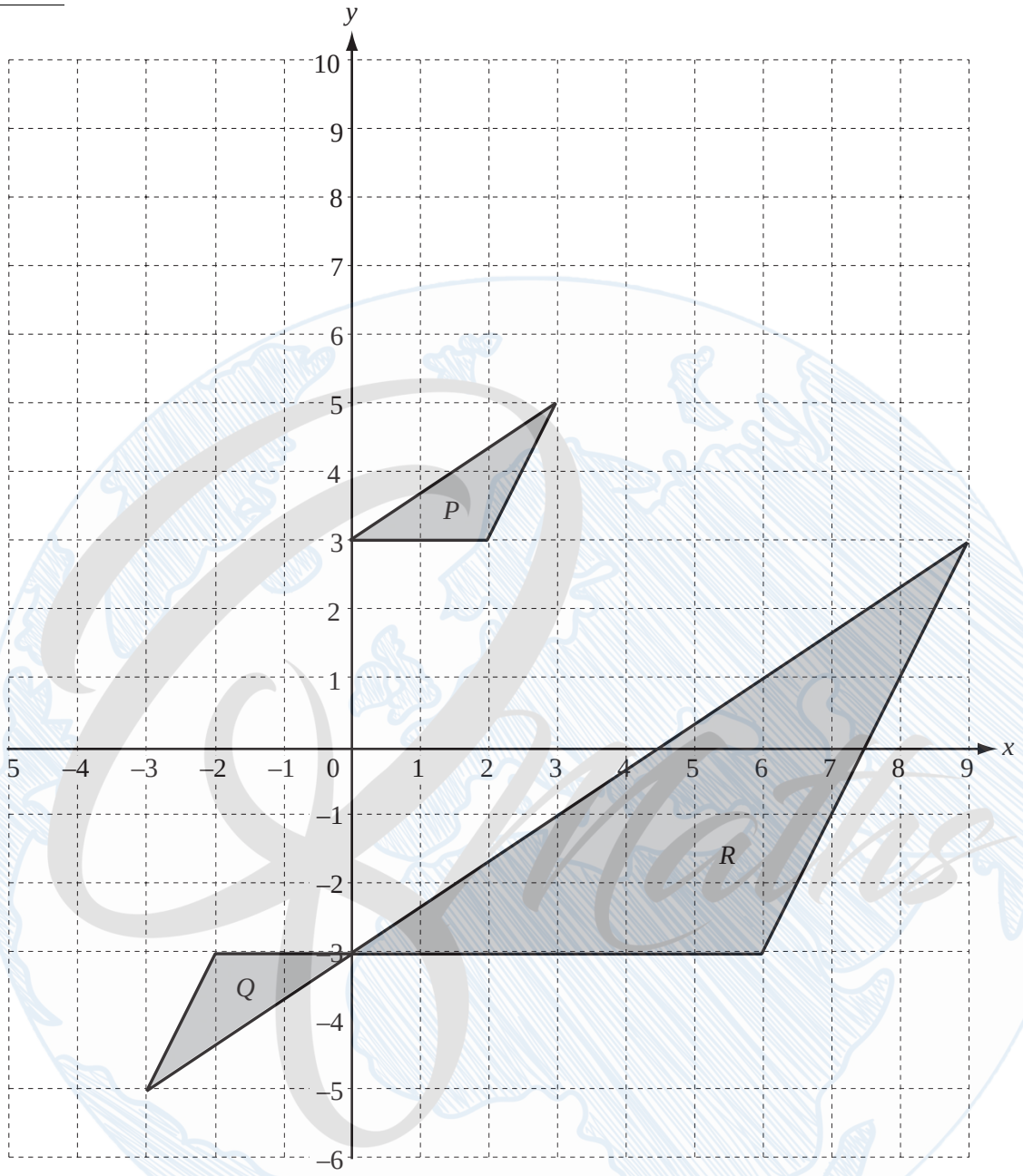
(ii) Find the 2 by 2 matrix which represents this transformation.

Answer(c)(ii) $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

(d) Describe fully the **single** transformation represented by the matrix $\begin{pmatrix} 1 & 0 \\ 0 & 2 \end{pmatrix}$.

Answer(d) ..... [3]

7



(a) Describe fully

(i) the **single** transformation which maps **triangle *P*** onto triangle Q,

Answer(a)(i) ..... [3]

(ii) the **single** transformation which maps **triangle *Q*** onto triangle R,

Answer(a)(ii) ..... [3]

(iii) the **single** transformation which maps **triangle *R*** onto triangle P.

Answer(a)(iii) ..... [3]

(b) On the grid, draw the image of

(i) **triangle *P*** after translation by $\begin{pmatrix} -4 \\ -5 \end{pmatrix}$, [2]

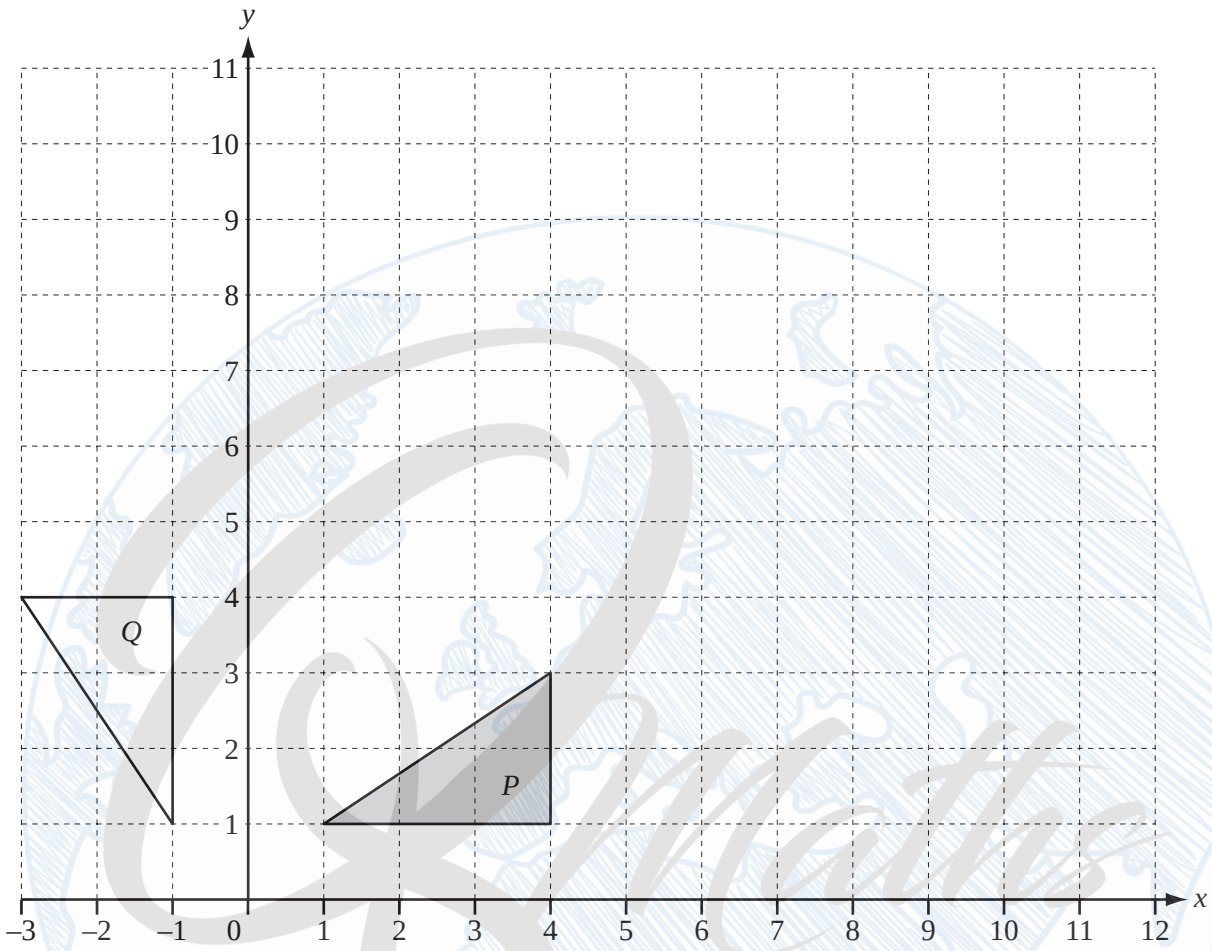
(ii) **triangle *P*** after reflection in the line $x = -1$. [2]

(c) **(i)** On the grid, draw the image of **triangle *P*** after a stretch, scale factor 2 and the y-axis as the invariant line. [2]

(ii) Find the matrix which represents this stretch.

Answer(c)(ii) $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

3



(a) Draw the translation of triangle P by $\begin{pmatrix} 5 \\ 3 \end{pmatrix}$. [2]

(b) Draw the reflection of triangle P in the line $x = 6$. [2]

(c) **(i)** Describe fully the **single** transformation that maps triangle P onto triangle Q.

Answer(c)(i) ..... [3]

(ii) Find the 2 by 2 matrix which represents the transformation in **part(c)(i)**.

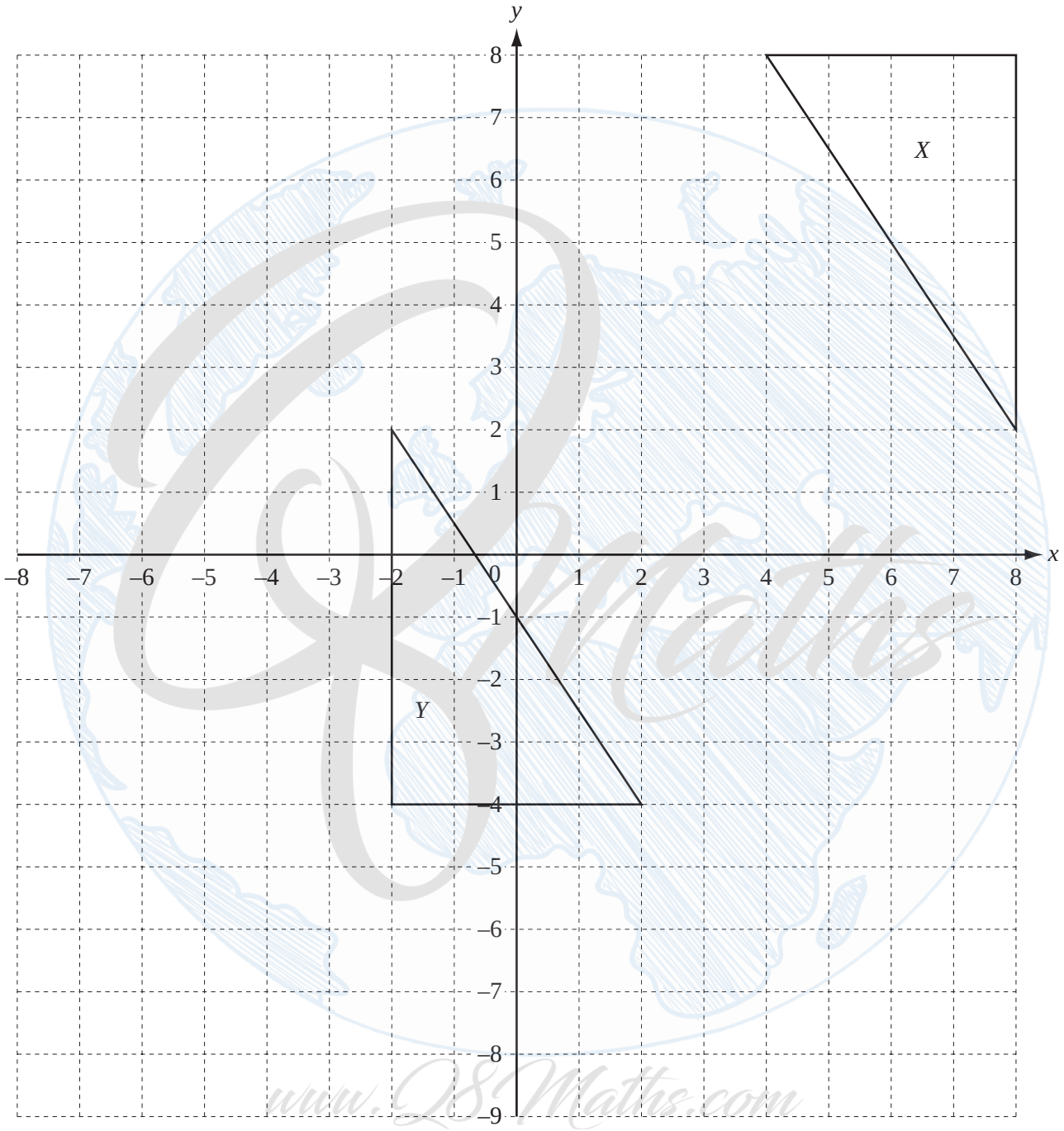
Answer(c)(ii) $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

(d) **(i)** Draw the stretch of triangle P with scale factor 3 and the x-axis as the invariant line. [2]

(ii) Find the 2 by 2 matrix which represents a stretch, scale factor 3 and x-axis invariant.

Answer(d)(ii) $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

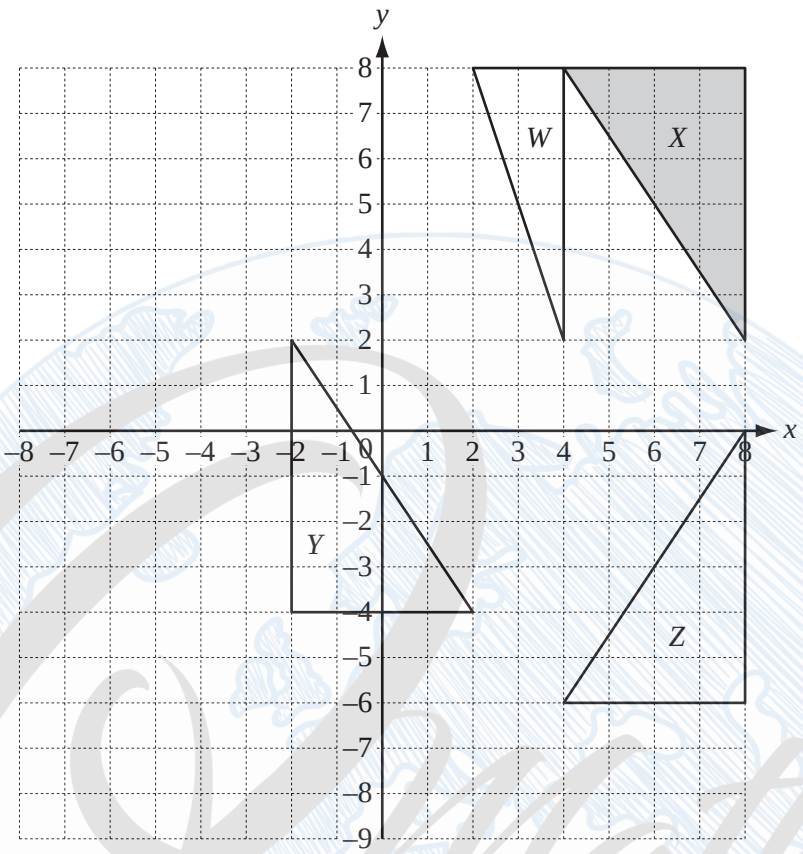
2 (a)



(i) Draw the translation of triangle X by the vector $\begin{pmatrix} -11 \\ -1 \end{pmatrix}$. [2]

(ii) Draw the enlargement of triangle Y with centre $(-6, -4)$ and scale factor $\frac{1}{2}$. [2]

(b)



Describe fully the **single** transformation that maps

(i) triangle X onto triangle Z,

Answer(b)(i) ..... [2]

(ii) triangle X onto triangle Y,

Answer(b)(ii) ..... [3]

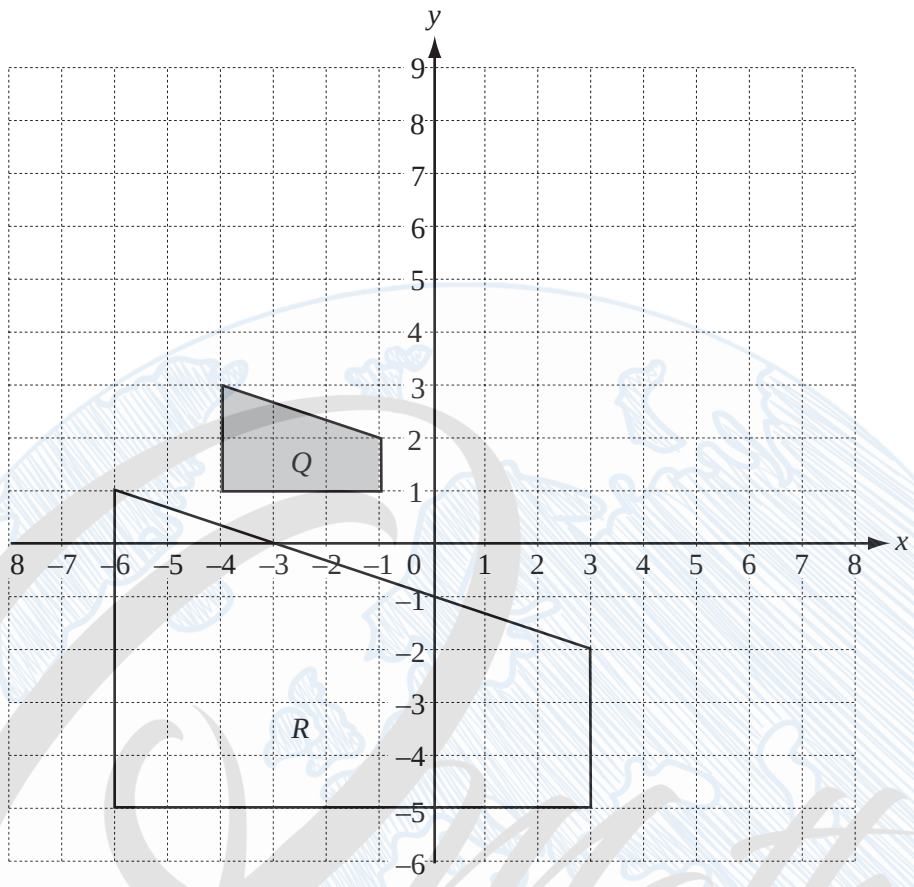
(iii) triangle X onto triangle W.

Answer(b)(iii) ..... [3]

(c) Find the matrix that represents the transformation in **part (b)(iii)**.

Answer(c) $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

4



(a) Describe fully the **single** transformation that maps shape Q onto shape R

Answer(a) ..... [3]

(b) **(i)** Draw the image when shape Q is translated by the vector $\begin{pmatrix} 5 \\ 4 \end{pmatrix}$. [2]

(ii) Draw the image when shape Q is reflected in the line $x = 2$. [2]

(iii) Draw the image when shape Q is stretched, factor 3, x-axis invariant. [2]

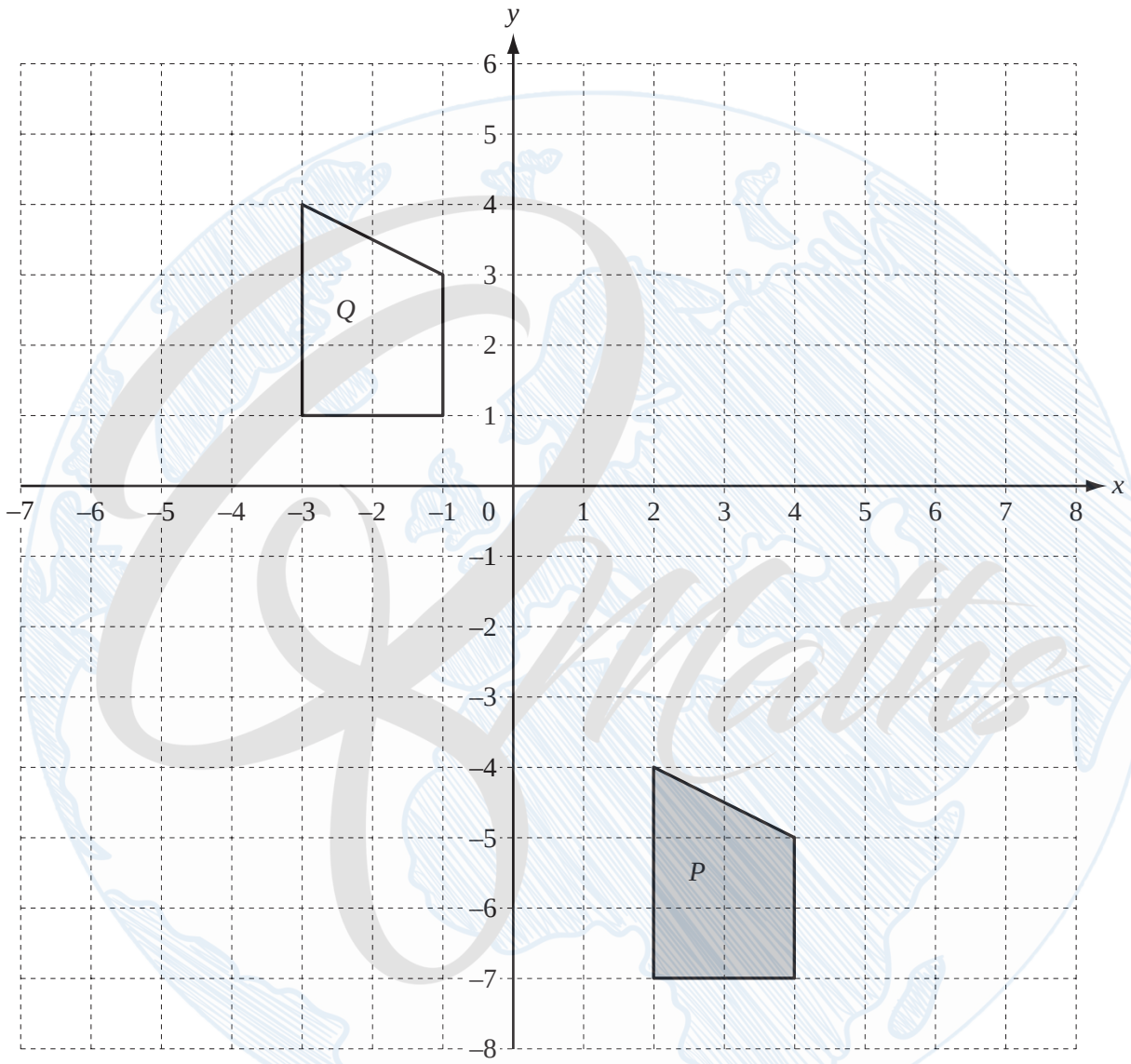
(iv) Find the 2×2 matrix that represents a stretch of factor 3, x-axis invariant.

Answer(b)(iv) $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

(c) Describe fully the **single** transformation represented by the matrix $\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$

Answer(c) ..... [2]

2 (a)



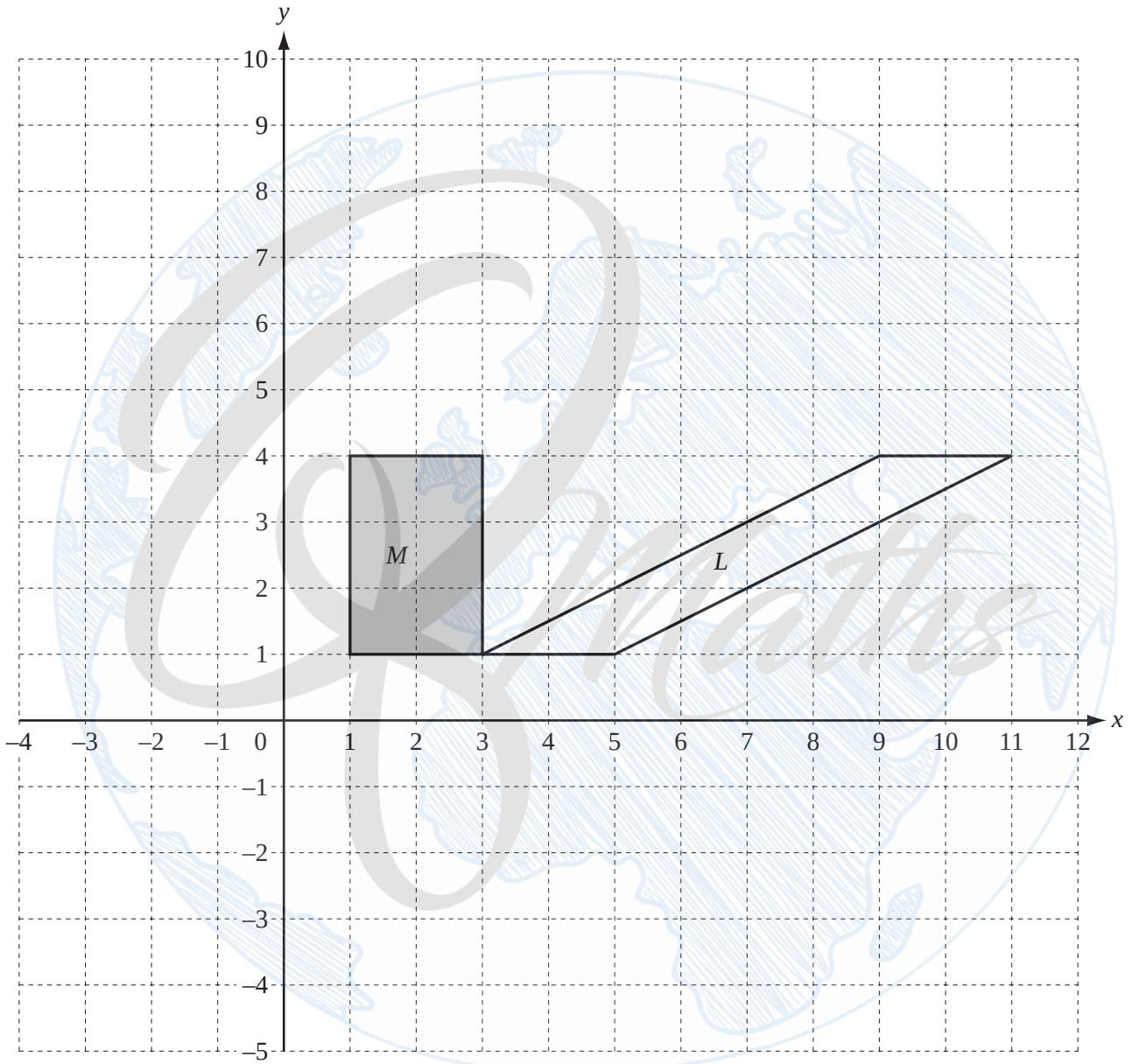
(i) Describe fully the **single** transformation which maps shape *P* onto shape *Q*.

Answer(a)(i) ..... [2]

(ii) On the grid above, draw the image of shape *P* after reflection in the line $y = -1$. [2]

(iii) On the grid above, draw the image of shape *P* under the transformation represented by the matrix $\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$. [3]

(b)

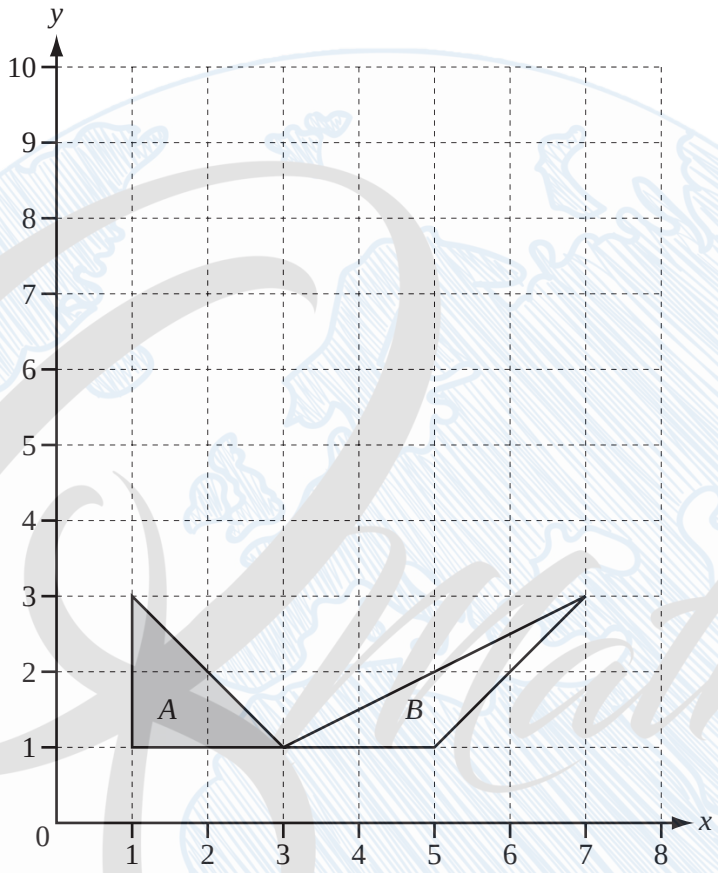


(i) Describe fully the **single** transformation which maps shape *M* onto shape *L*.

Answer(b)(i) ..... [3]

(ii) On the grid above, draw the image of shape *M* after enlargement by scale factor 2, centre (5, 0). [2]

7



(a) **(i)** Draw the image of shape *A* after a stretch, factor 3, *x*-axis invariant. [2]

(ii) Write down the matrix representing a stretch, factor 3, *x*-axis invariant.

Answer(a)(ii) ( ) [2]

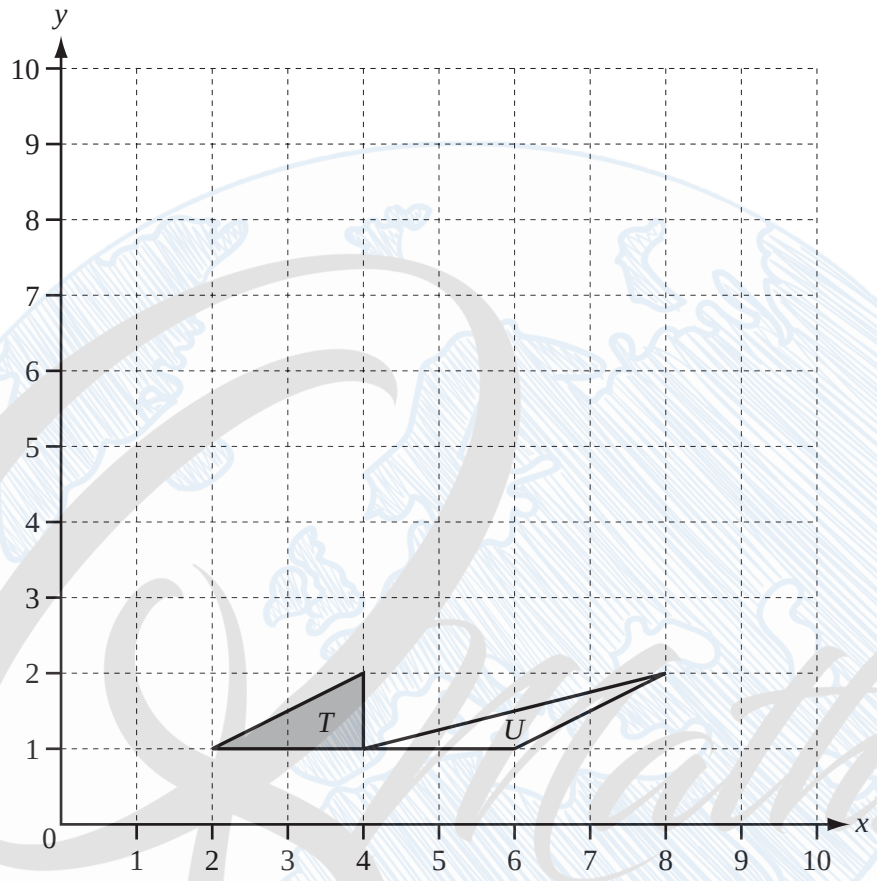
(b) **(i)** Describe fully the **single** transformation which maps shape *A* onto shape *B*.

Answer(b)(i) ..... [3]

(ii) Write down the matrix representing the transformation which maps shape *A* onto shape *B*.

Answer(b)(ii) ( ) [2]

5 (a)



(i) Draw the reflection of triangle T in the line $y = 5$. [2]

(ii) Draw the rotation of triangle T about the point (4, 2) through 180°. [2]

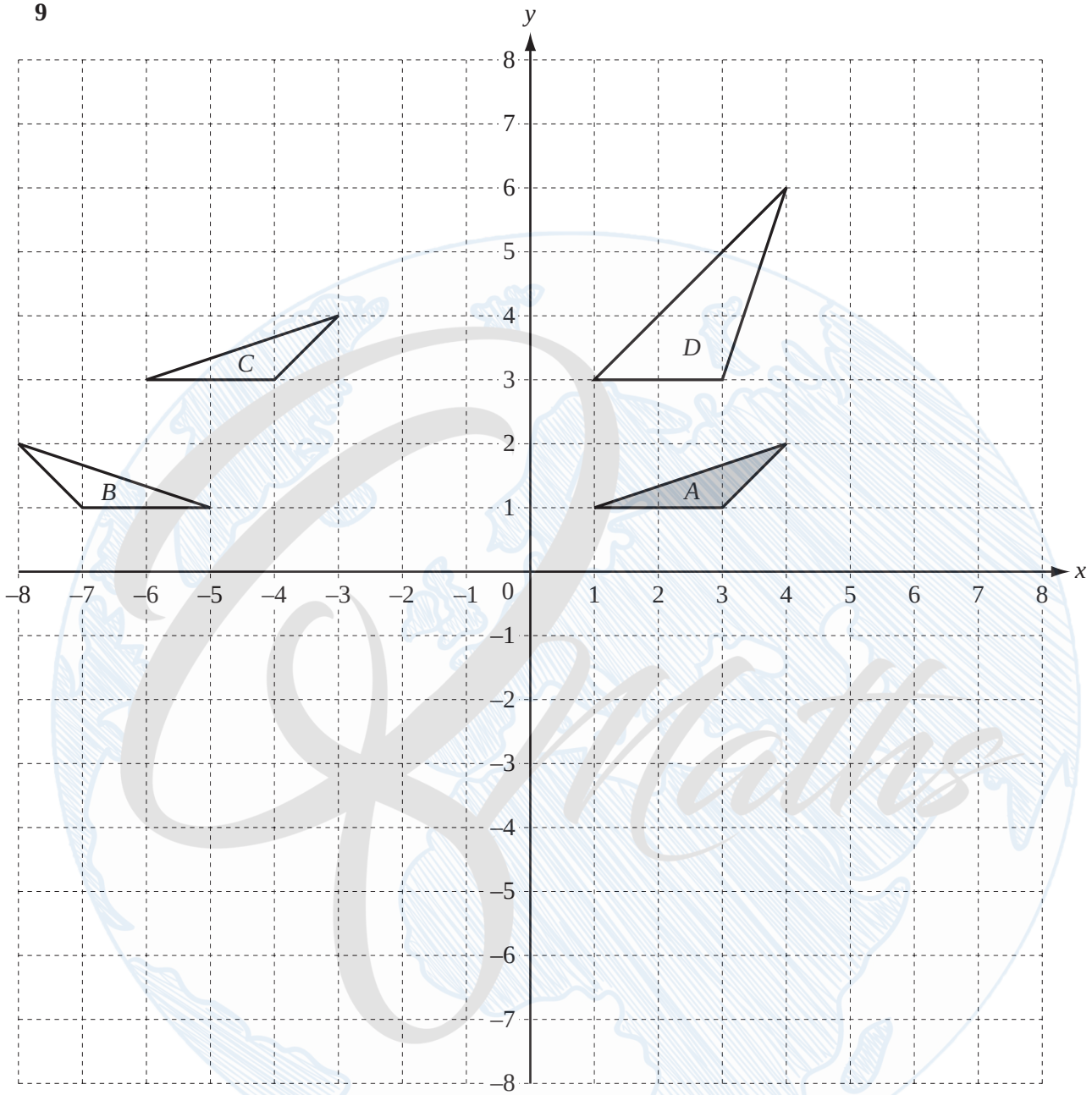
(iii) Describe fully the **single** transformation that maps triangle T onto triangle U.

Answer(a)(iii) ..... [3]

(iv) Find the 2 × 2 matrix which represents the transformation in **part (a)(iii)**.

Answer(a)(iv) $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

9



(a) Describe fully the **single** transformation that maps triangle *A* onto

(i) triangle *B*,

Answer(a)(i) ..... [2]

(ii) triangle *C*,

Answer(a)(ii) ..... [2]

(iii) triangle *D*.

Answer(a)(iii) ..... [3]

(b) On the grid, draw

(i) the rotation of triangle A about (6, 0) through 90° clockwise, [2]

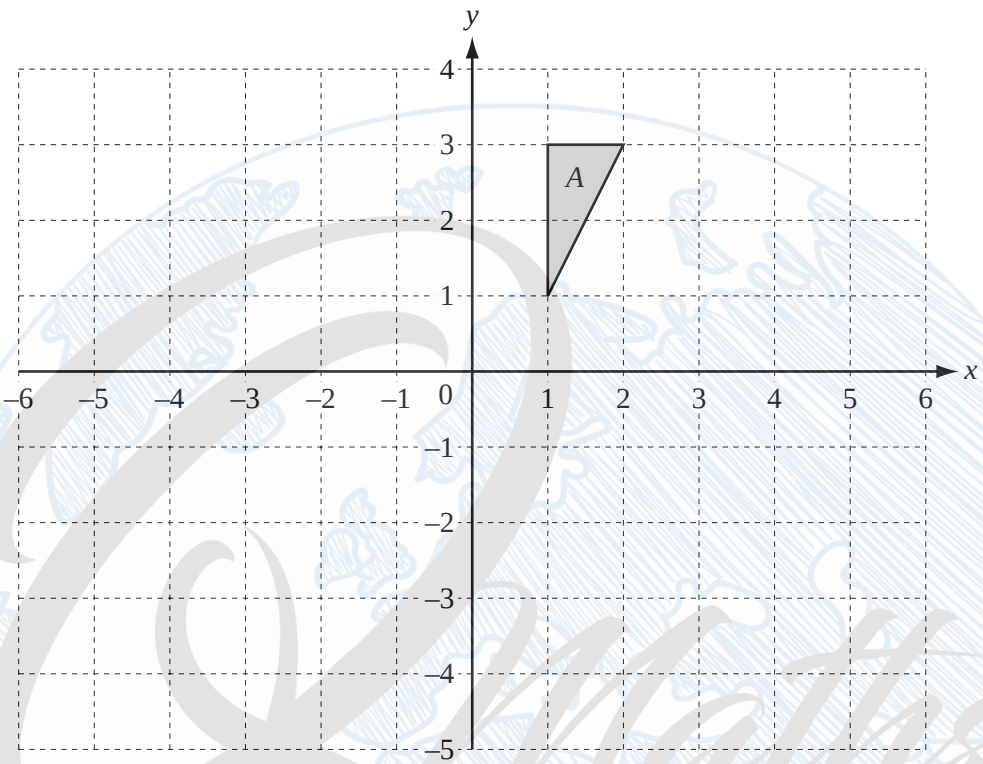
(ii) the enlargement of triangle A by scale factor –2 with centre (0, –1), [2]

(iii) the shear of triangle A by shear factor –2 with the y-axis invariant. [2]

(c) Find the matrix that represents the transformation in **part (b)(iii)**.

Answer(c) $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

7



(a) On the grid,

(i) draw the image of shape *A* after a translation by the vector $\begin{pmatrix} -5 \\ -4 \end{pmatrix}$, [2]

(ii) draw the image of shape *A* after a rotation through 90° clockwise about the origin. [2]

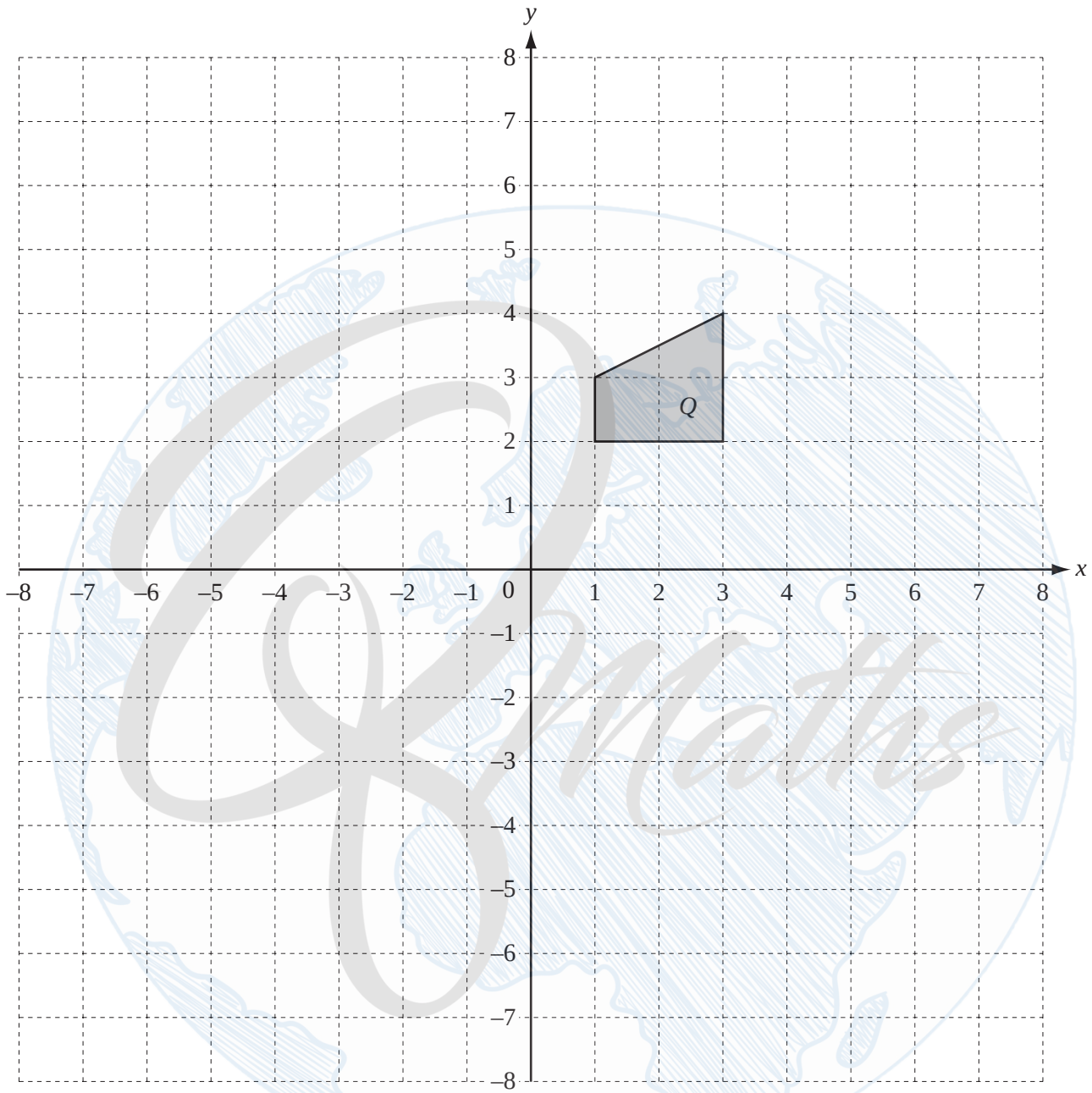
(b) **(i)** On the grid, draw the image of shape *A* after the transformation represented by the matrix $\begin{pmatrix} 2 & 0 \\ 0 & 1 \end{pmatrix}$. [3]

(ii) Describe fully the **single** transformation represented by the matrix $\begin{pmatrix} 2 & 0 \\ 0 & 1 \end{pmatrix}$.

Answer(b)(ii) .....

..... [3]

4



(a) Draw the reflection of shape Q in the line $x = -1$. [2]

(b) **(i)** Draw the enlargement of shape Q, centre (0, 0), scale factor -2 . [2]

(ii) Find the 2×2 matrix that represents an enlargement, centre (0, 0), scale factor -2 .

Answer(b)(ii) ( ) [2]

(c) **(i)** Draw the stretch of shape Q, factor 2, x-axis invariant. [2]

(ii) Find the 2×2 matrix that represents a stretch, factor 2, x-axis invariant.

Answer(c)(ii) $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

(iii) Find the inverse of the matrix in **part (c)(ii)**.

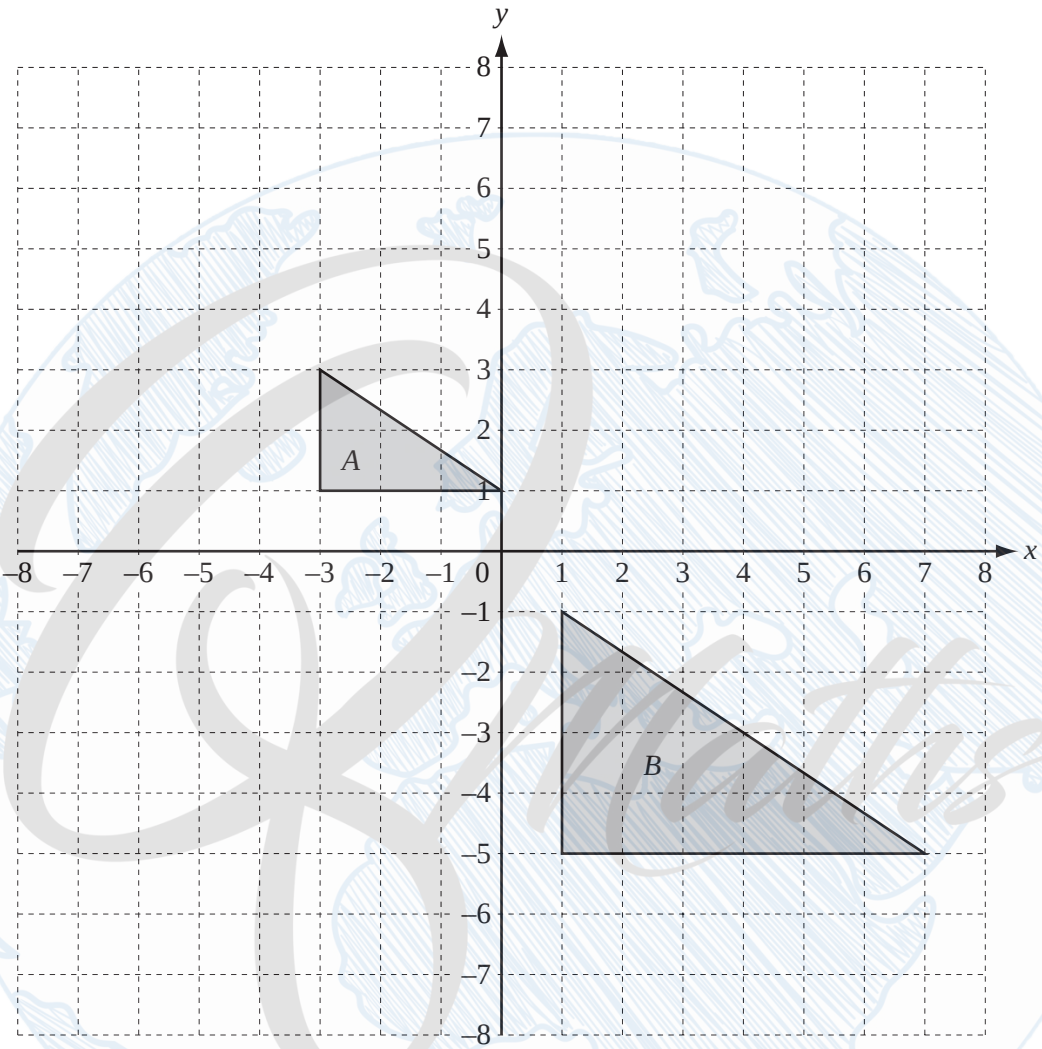
Answer(c)(iii) $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

(iv) Describe fully the **single** transformation represented by the matrix in **part (c)(iii)**.

Answer(c)(iv) .....

..... [3]

3



(a) Draw the image when triangle *A* is reflected in the line $x = 0$. [1]

(b) Draw the image when triangle *A* is rotated through 90° anticlockwise about (–4, 0). [2]

(c) **(i)** Describe fully the **single** transformation that maps triangle *A* onto triangle *B*.

Answer(c)(i) .....

..... [3]

(ii) Complete the following statement.

Area of triangle *A* : Area of triangle *B* = ... : ..... [2]

(d) Write down the matrix that represents a stretch, factor 4 with the y-axis invariant.

Answer(d) $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

(e) **(i)** On the grid, draw the image of triangle A after the transformation represented by the matrix $\begin{pmatrix} 1 & 0 \\ 2 & 1 \end{pmatrix}$.

[3]

(ii) Describe fully this **single** transformation.

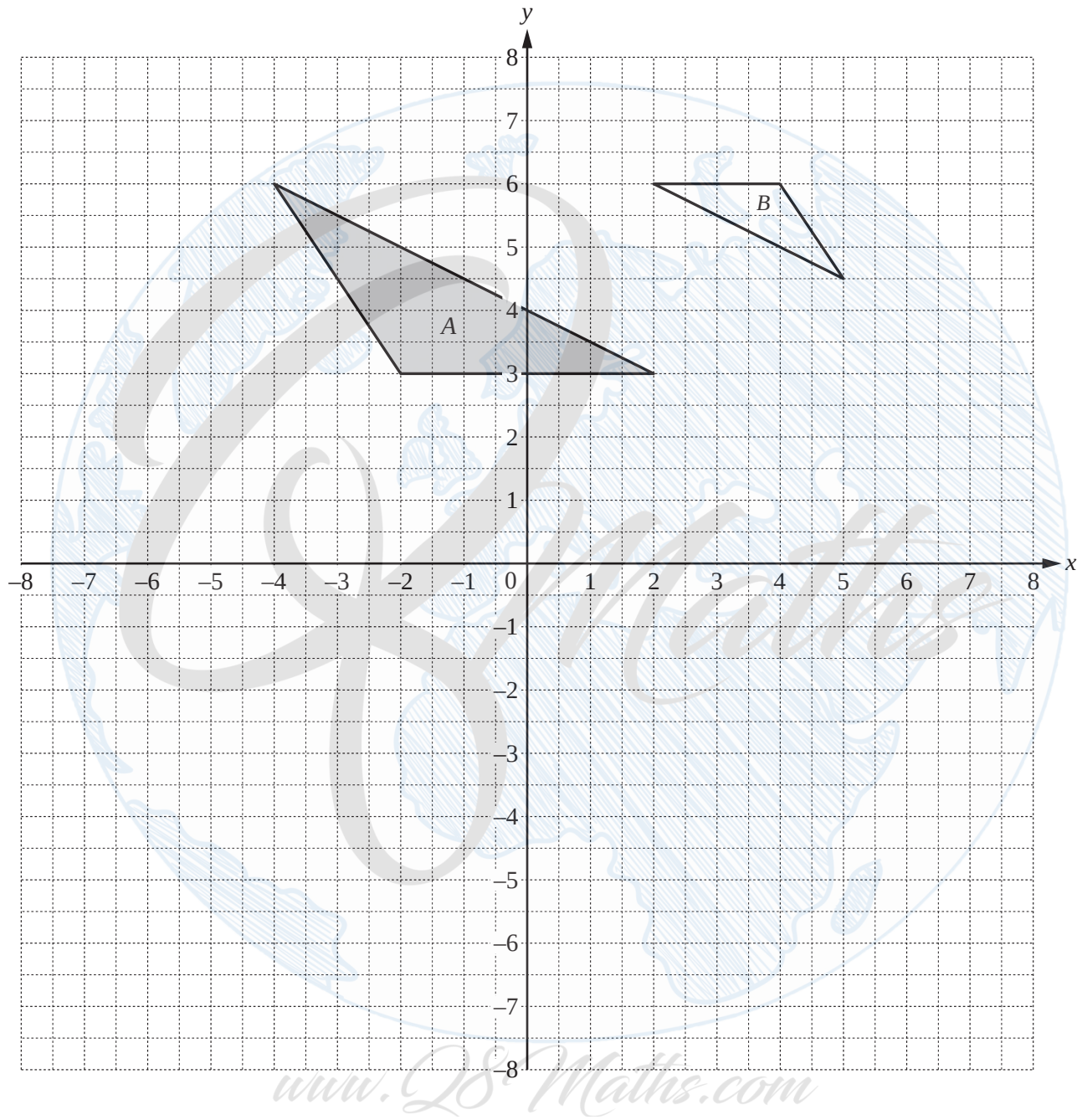
Answer(e)(ii) .....

..... [3]

(iii) Find the inverse of the matrix $\begin{pmatrix} 1 & 0 \\ 2 & 1 \end{pmatrix}$.

Answer(e)(iii) $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

4



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

Answer(a) .....

..... [3]

(b) On the grid, draw the image of

(i) triangle A after a reflection in the line $x = -3$, [2]

(ii) triangle A after a rotation about the origin through 270° anticlockwise, [2]

(iii) triangle A after a translation by the vector $\begin{pmatrix} -1 \\ -5 \end{pmatrix}$. [2]

(c) **M** is the matrix that represents the transformation in **part (b)(ii)**.

(i) Find **M**.

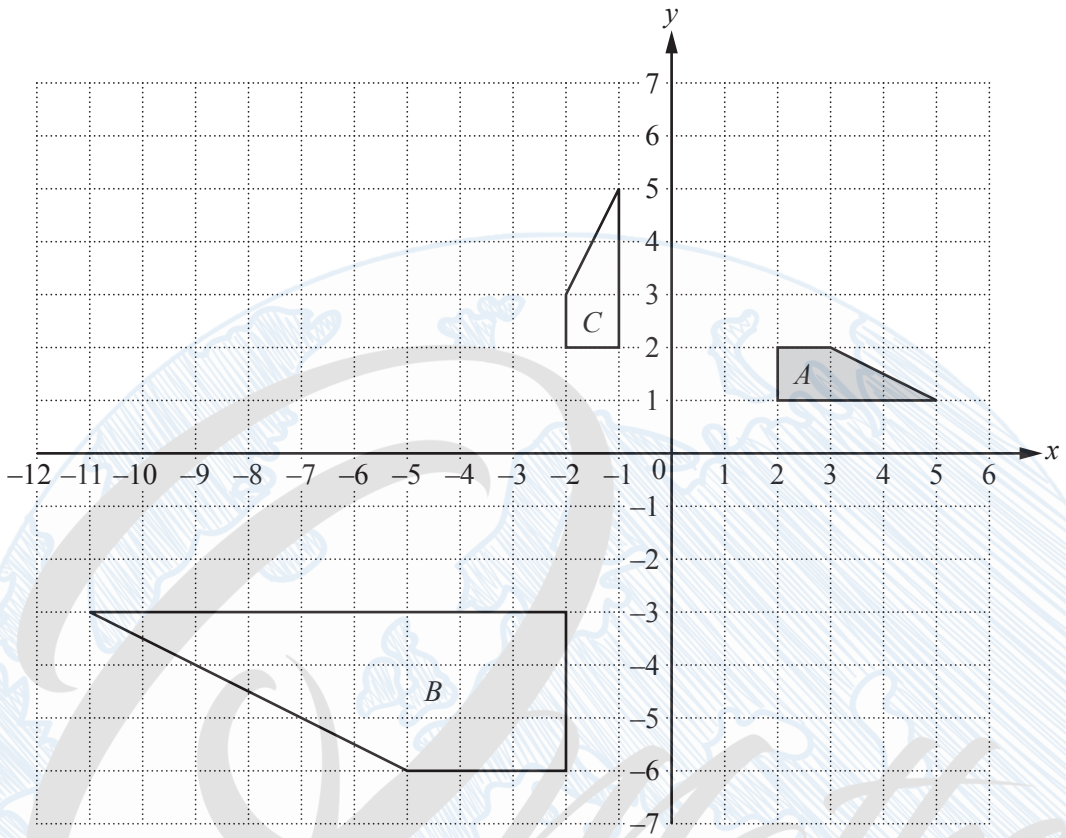
Answer(c)(i) **M** = $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

(ii) Describe fully the **single** transformation represented by $\mathbf{M}^{-1}$, the inverse of **M**.

Answer(c)(ii) .....

..... [2]

3



(a) Draw the image of

(i) shape A after a translation by $\begin{pmatrix} -1 \\ 3 \end{pmatrix}$, [2]

(ii) shape A after a rotation through 180° about the point (0, 0), [2]

(iii) shape A after the transformation represented by the matrix $\begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$. [3]

(b) Describe fully the **single** transformation that maps shape A onto shape B.

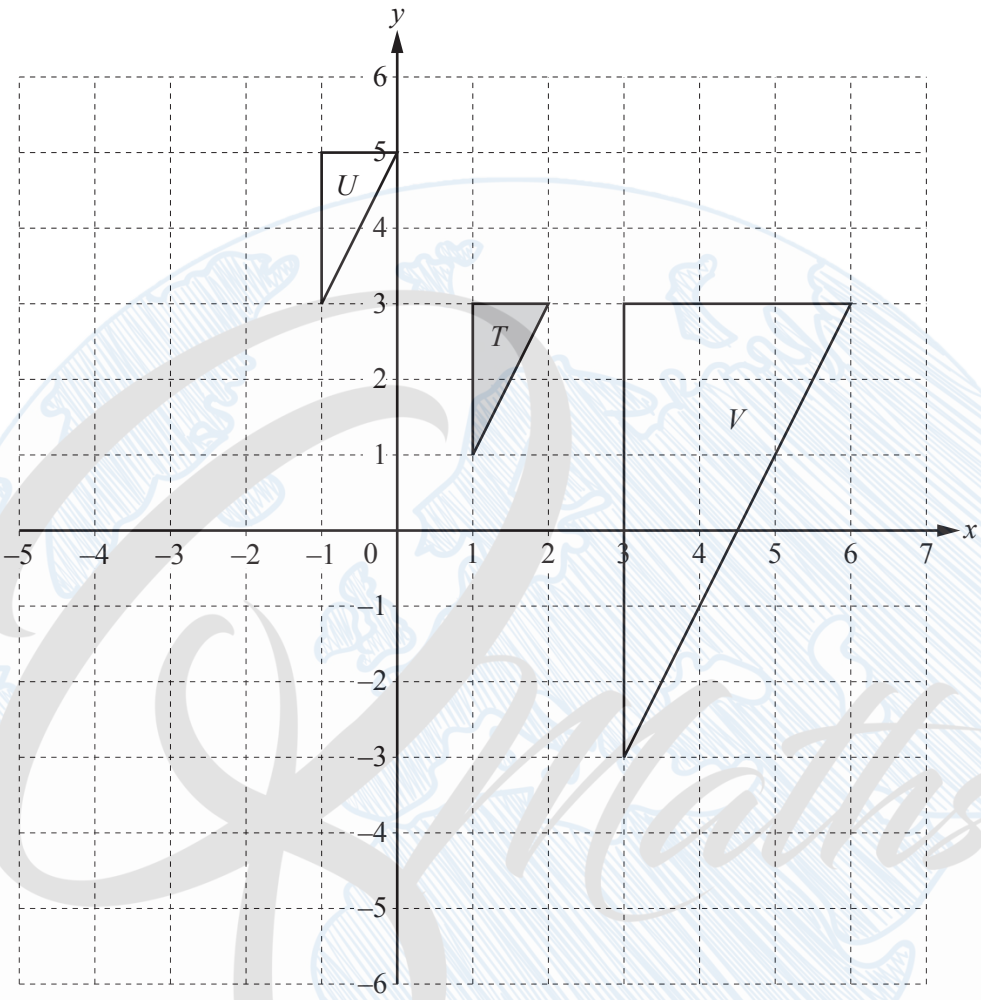
Answer(b) .....

..... [3]

(c) Find the matrix which represents the transformation that maps shape A onto shape C.

Answer(c) $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

1



(a) On the grid, draw the image of

(i) triangle T after a reflection in the line $x = -1$, [2]

(ii) triangle T after a rotation through 180° about (0, 0). [2]

(b) Describe fully the **single** transformation that maps

(i) triangle T onto triangle U,

Answer(b)(i) .....

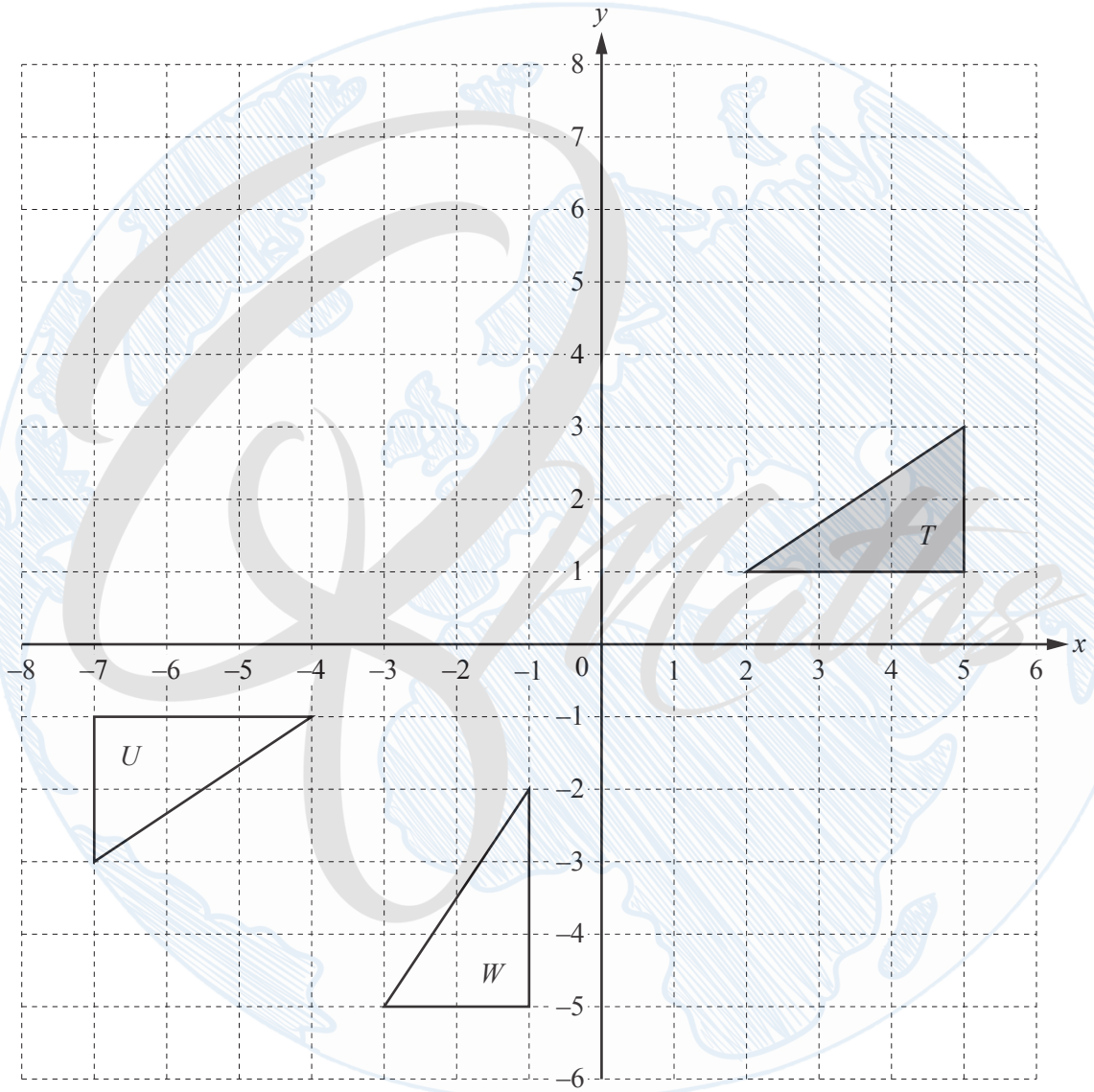
..... [2]

(ii) triangle T onto triangle V.

Answer(b)(ii) .....

..... [3]

2



(a) On the grid, draw the image of

(i) triangle T after a translation by the vector $\begin{pmatrix} -4 \\ 4 \end{pmatrix}$, [2]

(ii) triangle T after a reflection in the line $y = -1$. [2]

(b) Describe fully the **single** transformation that maps triangle T onto triangle U.

Answer(b) .....

..... [3]

(c) **(i)** Describe fully the **single** transformation that maps triangle T onto triangle W.

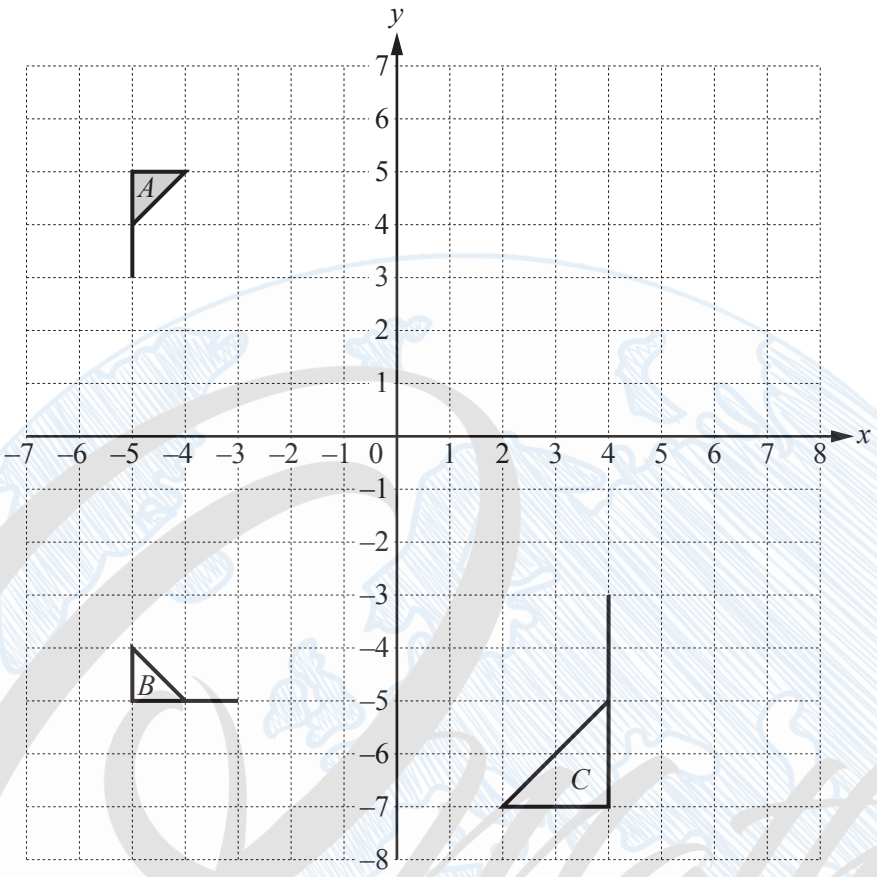
Answer(c)(i) .....

..... [2]

(ii) Find the 2×2 matrix that represents the transformation in **part (c)(i)**.

Answer(c)(ii) $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

7



(a) Describe fully the **single** transformation that maps

(i) flag *A* onto flag *B*,

Answer(a)(i) .....

..... [3]

(ii) flag *A* onto flag *C*.

Answer(a)(ii) .....

..... [3]

(b) Draw the image of flag *A* after a translation by the vector $\begin{pmatrix} 2 \\ 1 \end{pmatrix}$. [2]

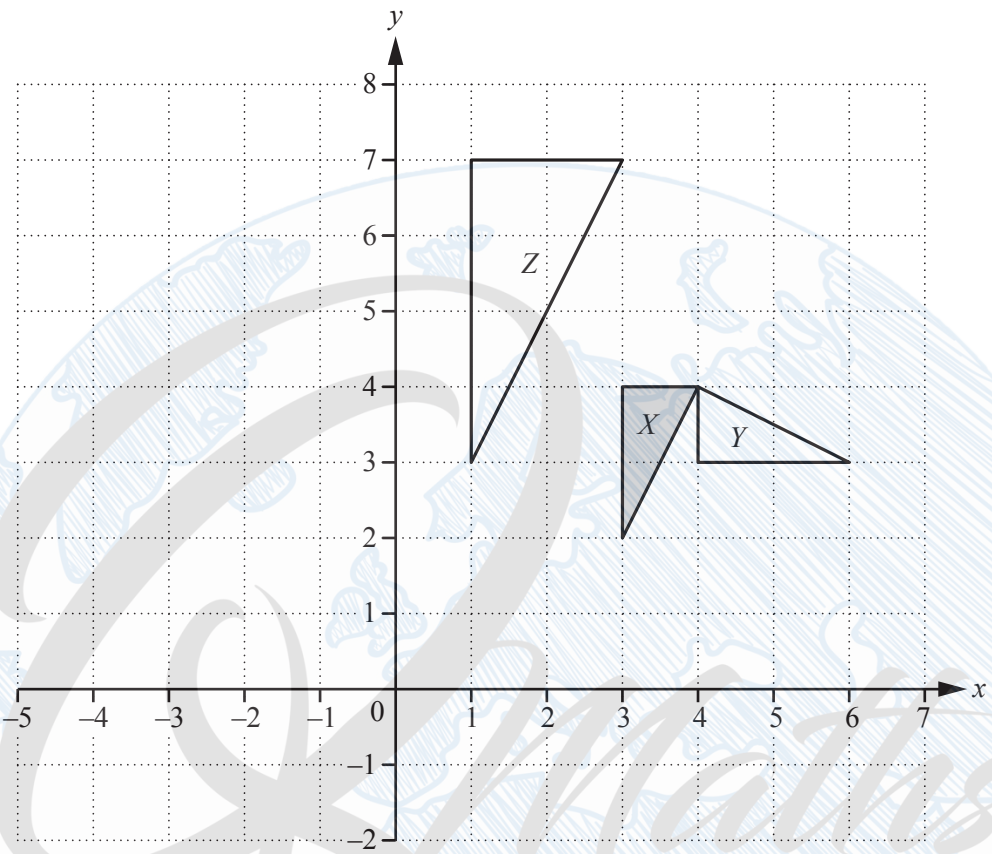
(c) Draw the image of flag *A* after a reflection in the line $x = 1$. [2]

(d) Describe fully the **single** transformation represented by the matrix $\begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$.

Answer(d) .....

..... [2]

6



(a) Describe fully the **single** transformation that maps

(i) triangle X onto triangle Y,

.....

..... [3]

(ii) triangle X onto triangle Z.

.....

..... [3]

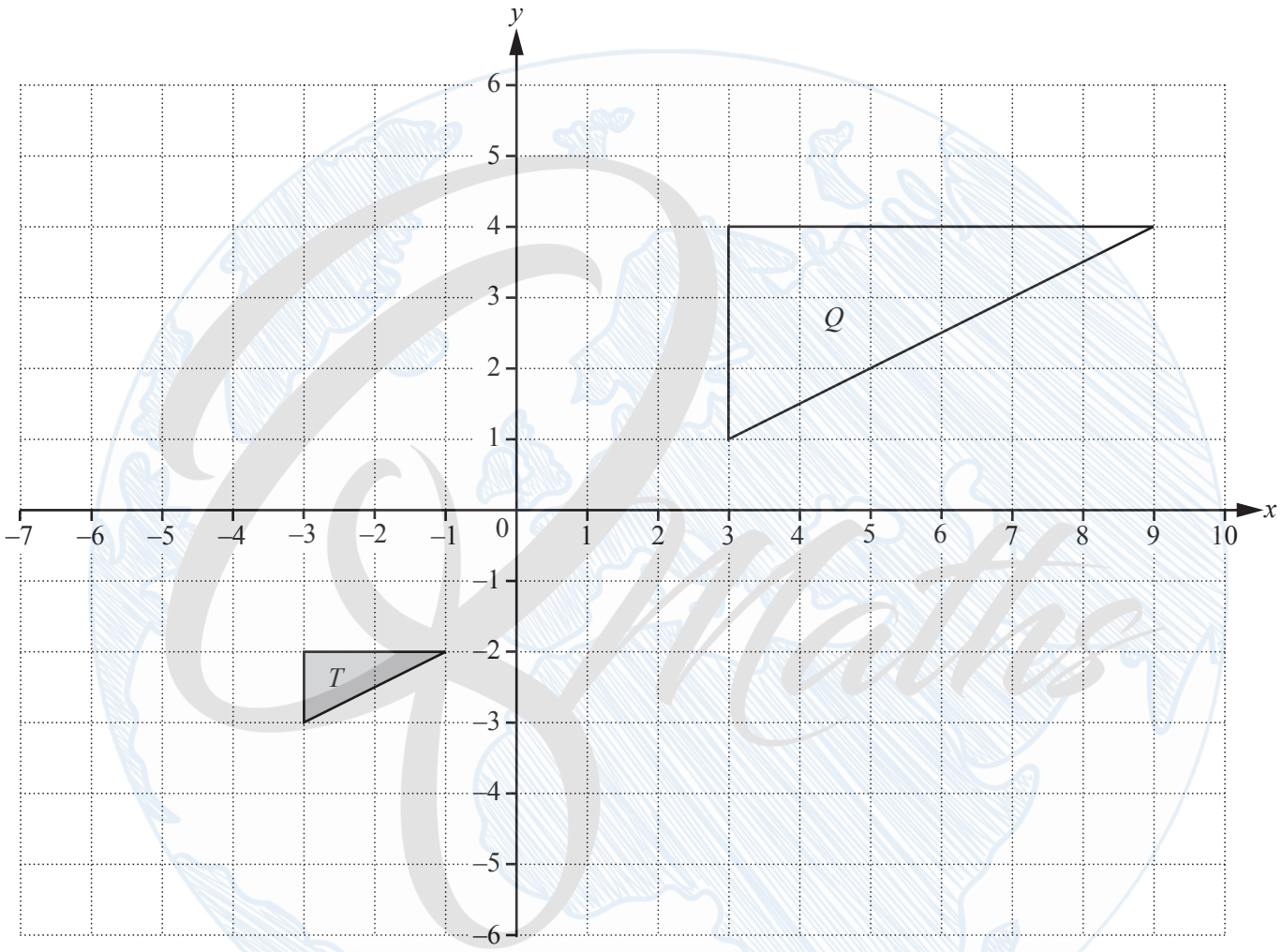
(b) **(i)** Draw the image of triangle X after a translation by the vector $\begin{pmatrix} -5 \\ 3 \end{pmatrix}$.

Label this triangle P. [2]

(ii) Draw the reflection of triangle P in the line $y = 3$. [2]

(c) Draw the image of triangle X after the transformation represented by the matrix $\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$. [3]

2 (a)



(i) Draw the image of triangle T after a translation by the vector $\begin{pmatrix} 5 \\ -2 \end{pmatrix}$. [2]

(ii) Draw the image of triangle T after a reflection in the line $y = 1$. [2]

(iii) Describe fully the **single** transformation that maps triangle T onto triangle Q.

.....

..... [3]

(b) $\mathbf{M} = \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$ $\mathbf{N} = \begin{pmatrix} 4 & 3 \\ 1 & k \end{pmatrix}$ $\mathbf{P} = \begin{pmatrix} 1 & 3 \\ 0 & 6 \end{pmatrix}$

(i) Work out $\mathbf{M} + \mathbf{P}$.

( ) [1]

(ii) Work out $\mathbf{PM}$.

( ) [2]

(iii) $|\mathbf{M}| = |\mathbf{N}|$

Find the value of k.

$k =$ ..... [3]

(c) **(i)** Describe fully the **single** transformation represented by the matrix $\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$.

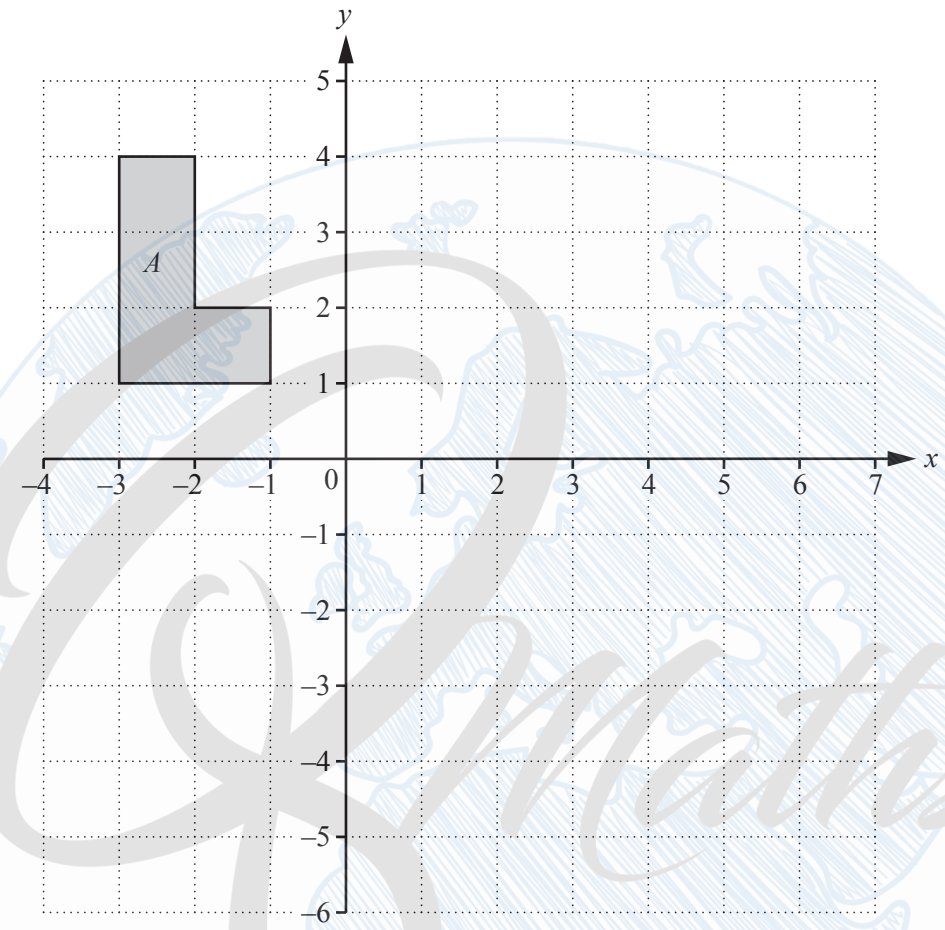
.....

..... [3]

(ii) Find the matrix which represents a reflection in the line $y = x$.

( ) [2]

3 **(a)**



On the grid, draw the image of

(i) shape A after a reflection in the line $x = 1$, [2]

(ii) shape A after an enlargement with scale factor -2, centre $(0, 1)$, [2]

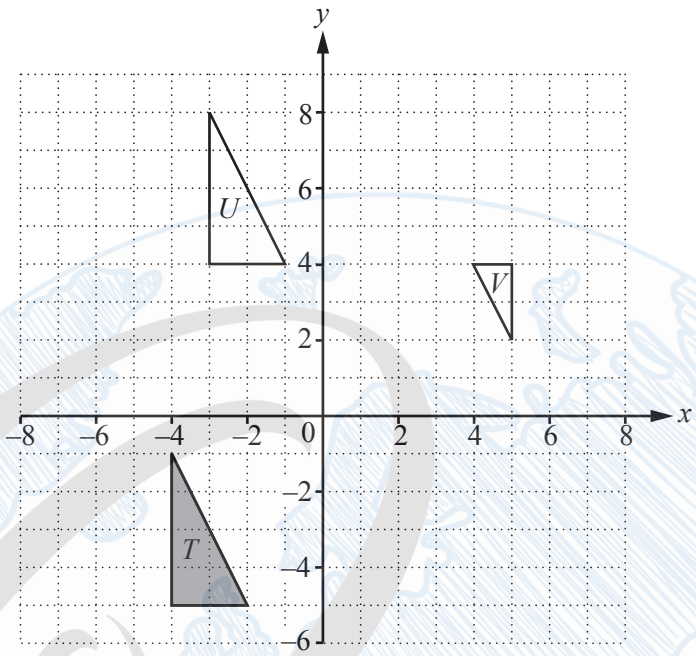
(iii) shape A after the transformation represented by the matrix $\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$. [3]

(b) Describe fully the **single** transformation represented by the matrix $\begin{pmatrix} 3 & 0 \\ 0 & 3 \end{pmatrix}$.

.....

..... [3]

6



(a) (i) Draw the image of triangle T after a reflection in the line $x = 0$. [2]

(ii) Draw the image of triangle T after a rotation through 90° clockwise about (–2, –1). [2]

(iii) Describe fully the **single** transformation that maps triangle T onto triangle U.

.....

..... [2]

(iv) Describe fully the **single** transformation that maps triangle T onto triangle V.

.....

..... [3]

(b) (i) Find the matrix that represents the transformation in **part (a)(i)**.

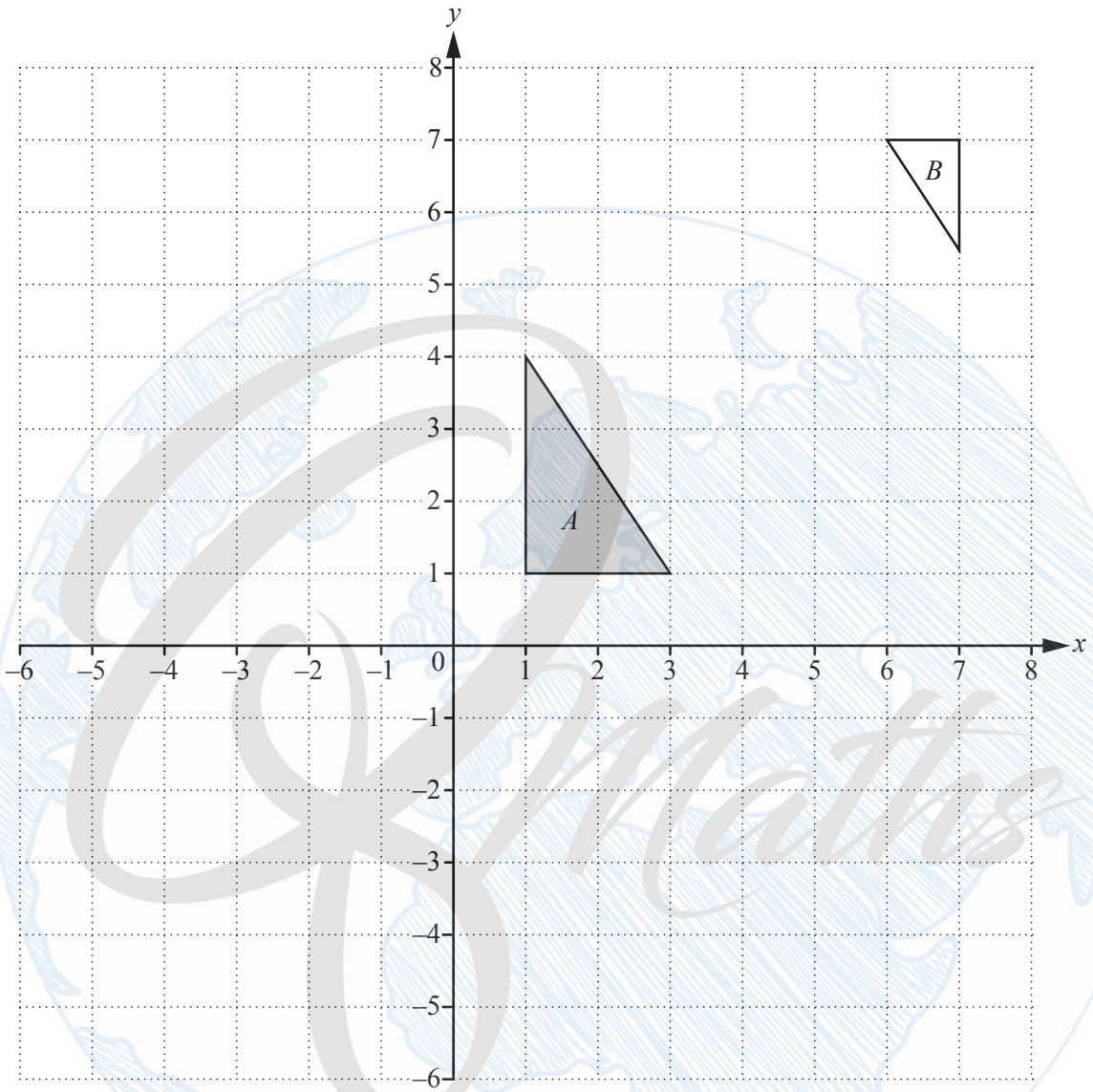
$\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

(ii) Describe fully the **single** transformation represented by the inverse of the matrix in **part (b)(i)**.

.....

..... [2]

3



(a) **(i)** Draw the image of triangle A after reflection in the line $x = 4$. [2]

(ii) Draw the image of triangle A after rotation of 90° anticlockwise about (0, 0). [2]

(iii) Draw the image of triangle A after translation by the vector $\begin{pmatrix} 1 \\ -5 \end{pmatrix}$. [2]

(b) Describe fully the **single** transformation that maps triangle A onto triangle B.

.....

..... [3]

(c) Find the matrix that represents the transformation in **part (a)(ii)**.

$\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

(d) Point P has co-ordinates (4, 1).

$\mathbf{F} = \begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}$ and $\mathbf{G} = \begin{pmatrix} 1 & 0 \\ 0 & 2 \end{pmatrix}$ represent transformations.

(i) Find $\mathbf{G}(P)$, the image of P after the transformation represented by $\mathbf{G}$.

(..... , ...) [2]

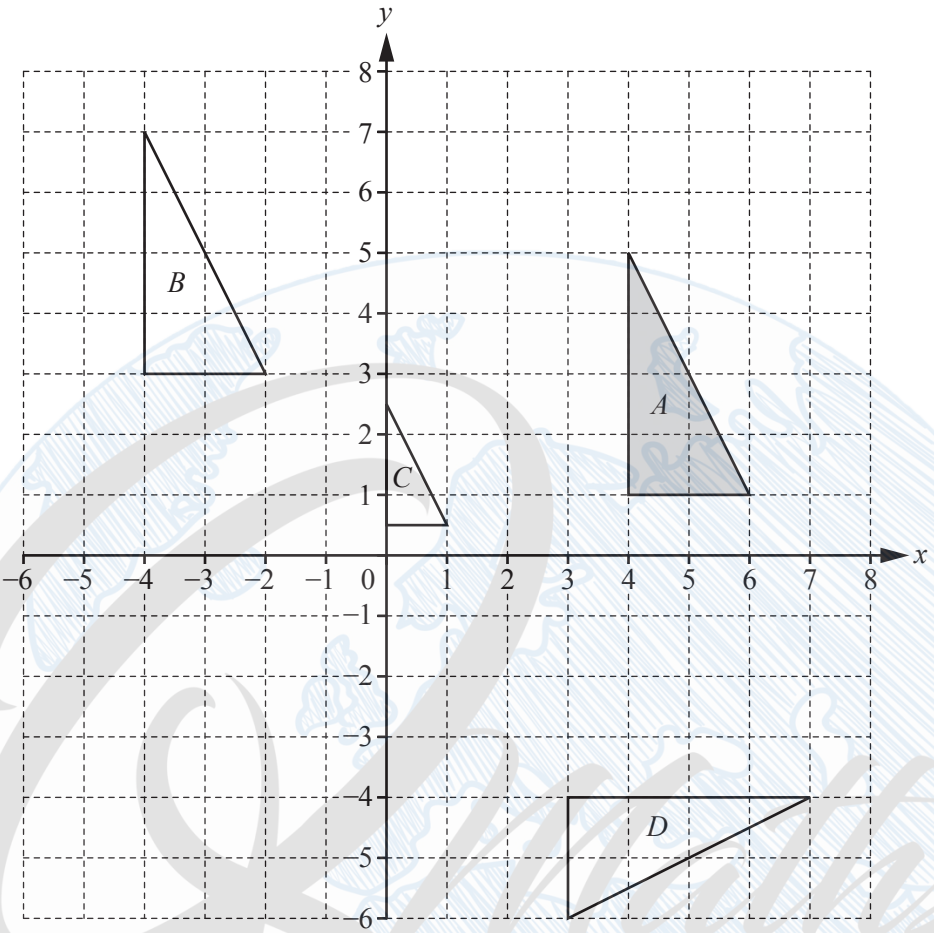
(ii) Find $\mathbf{GF}(P)$.

(..... , ...) [3]

(iii) Find the matrix $\mathbf{Q}$ such that $\mathbf{GQ}(P) = P$.

$\begin{pmatrix} & \\ & \end{pmatrix}$ [3]

4



(a) Describe fully the **single** transformation that maps

(i) triangle A onto triangle B,

.....

..... [2]

(ii) triangle A onto triangle C,

.....

..... [3]

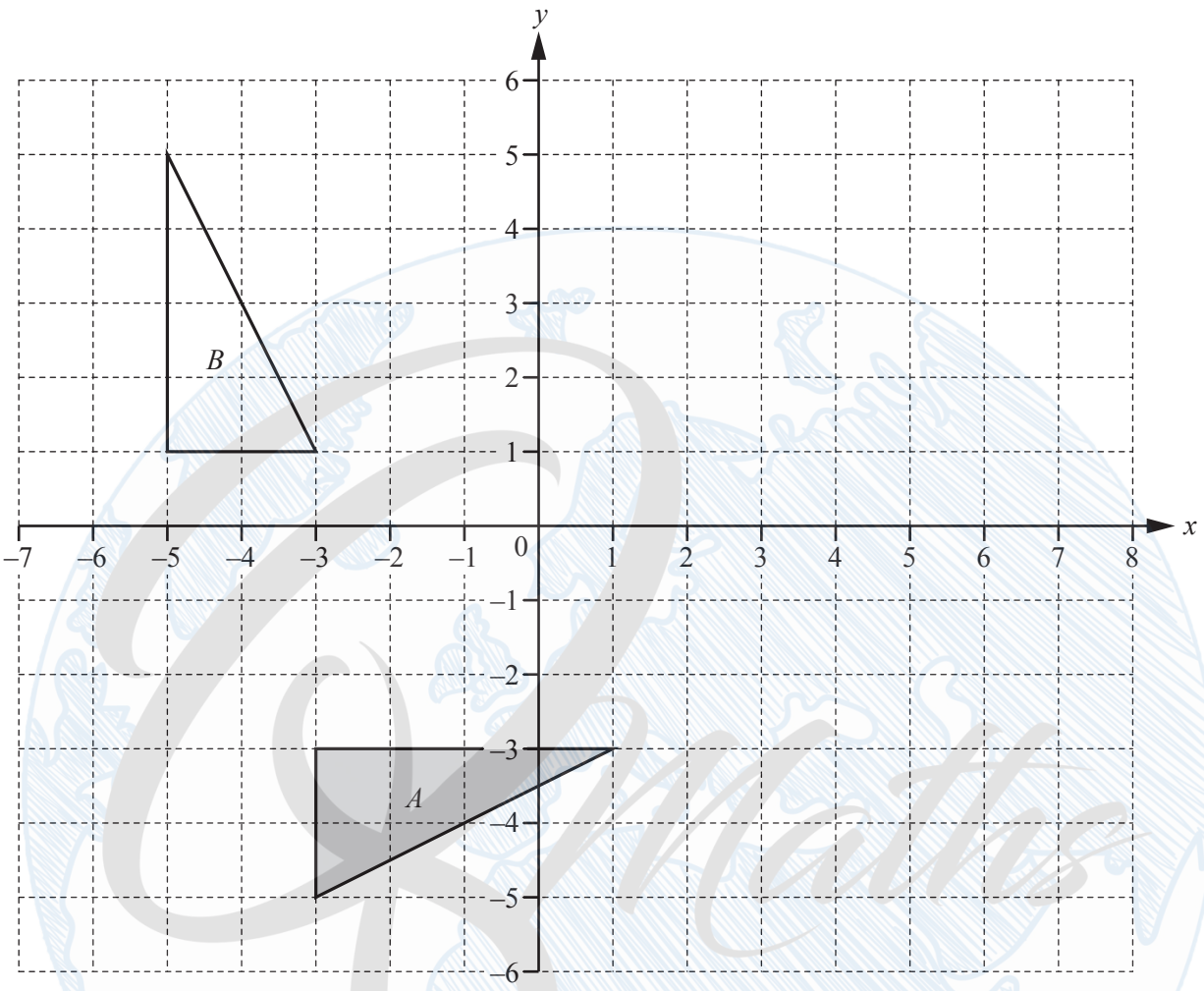
(iii) triangle A onto triangle D.

.....

..... [3]

(b) On the grid, draw the image of triangle A after an enlargement by scale factor 2, centre $(7, 3)$. [2]

3



(a) **(i)** Draw the image of triangle A after a reflection in the line $x = 2$. [2]

(ii) Draw the image of triangle A after a translation by the vector $\begin{pmatrix} -2 \\ 4 \end{pmatrix}$. [2]

(iii) Draw the image of triangle A after an enlargement by scale factor $-\frac{1}{2}$, centre (3, 1). [3]

(b) Describe fully the **single** transformation that maps triangle A onto triangle B.

.....

..... [3]

(c) Describe fully the **single** transformation represented by the matrix $\begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix}$.

.....

..... [2]

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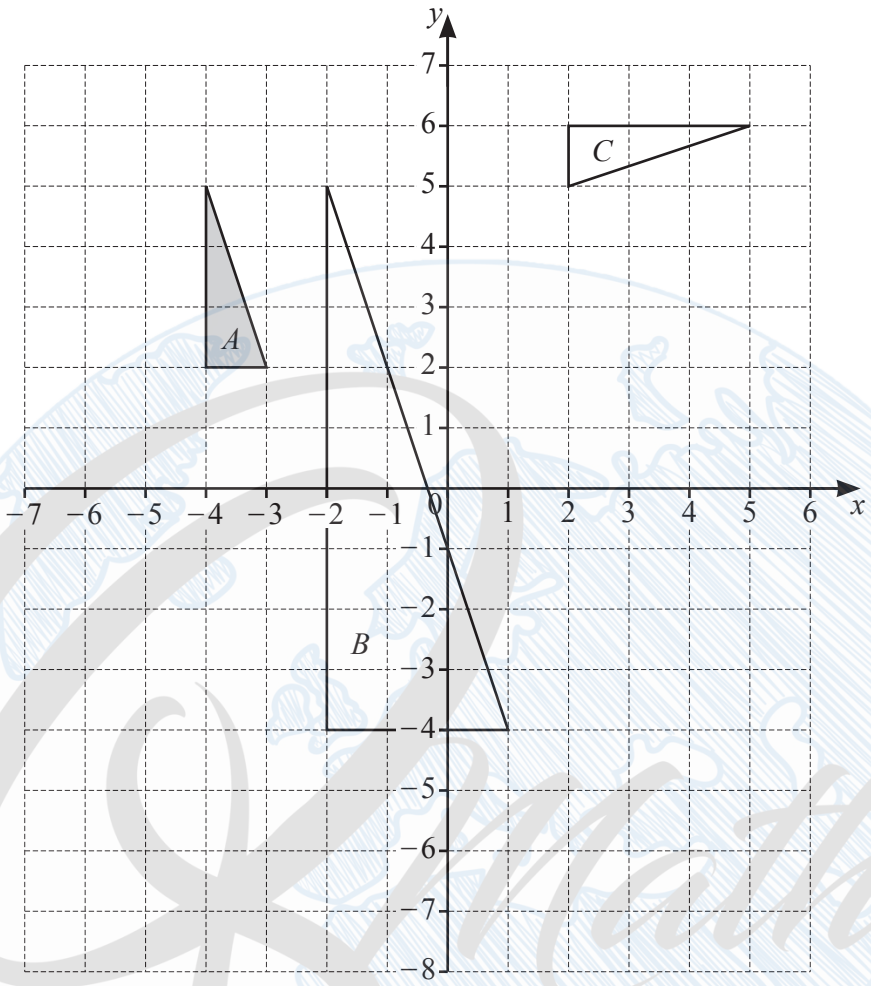
1



(a) Draw the image of shape A after a translation by the vector $\begin{pmatrix} 8 \\ -6 \end{pmatrix}$. [2]

(b) Draw the image of shape A after a reflection in the line $y = -1$. [2]

(c) Describe fully the **single** transformation that maps shape A onto shape B.

.....

..... [3]

(d) Describe fully the **single** transformation that maps shape A onto shape C.

.....

..... [3]