Vectors and transformations – 2023 Nov IGCSE 0580

1. Nov/2023/Paper_0580/13/No.10

$$\mathbf{a} = \begin{pmatrix} 4 \\ 9 \end{pmatrix} \qquad \mathbf{b} = \begin{pmatrix} -6 \\ 1 \end{pmatrix} \qquad \mathbf{c} = \begin{pmatrix} 13 \\ -2 \end{pmatrix}$$

Work out.

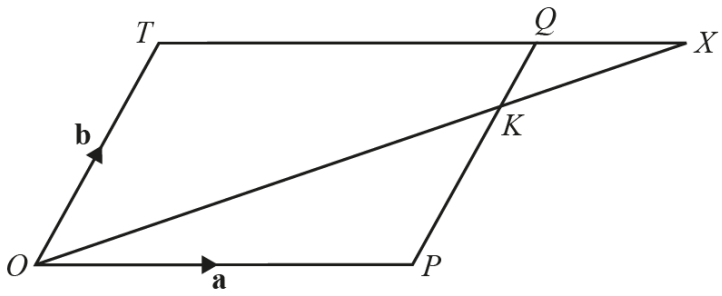
(a) $\mathbf{a} + \mathbf{b}$

( ) [1]

(b) $3\mathbf{c}$

( ) [1]

2. Nov/2023/Paper_0580/22/No.26



NOT TO SCALE

The diagram shows a parallelogram $OPQT$.
The position vector of P is **a** and the position vector of T is **b**.

K is on PQ so that $PK : KQ = 3 : 1$.
The lines OK and TQ are extended to meet at X.

Find the position vector of X in terms of **a** and **b**.
Give your answer in its simplest form.

..... [3]

3. Nov/2023/Paper_0580/23/No.10

$\overrightarrow{AB} = \begin{pmatrix} 7 \\ -3 \end{pmatrix}$

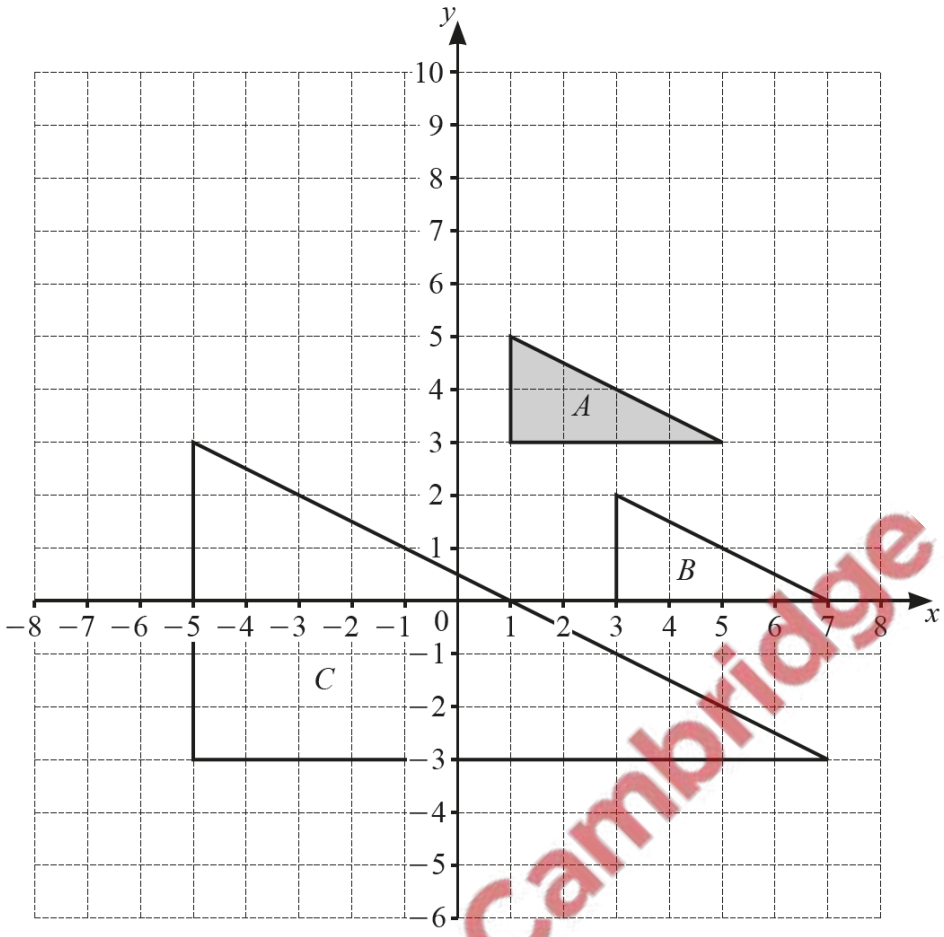
(a) Find $3\overrightarrow{AB}$.

$\begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [1]

(b) Find $\left|\overrightarrow{AB}\right|$.

$\left|\overrightarrow{AB}\right| =$ ..... [2]

4. Nov/2023/Paper_0580/31/No.6



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

.....

..... [2]

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

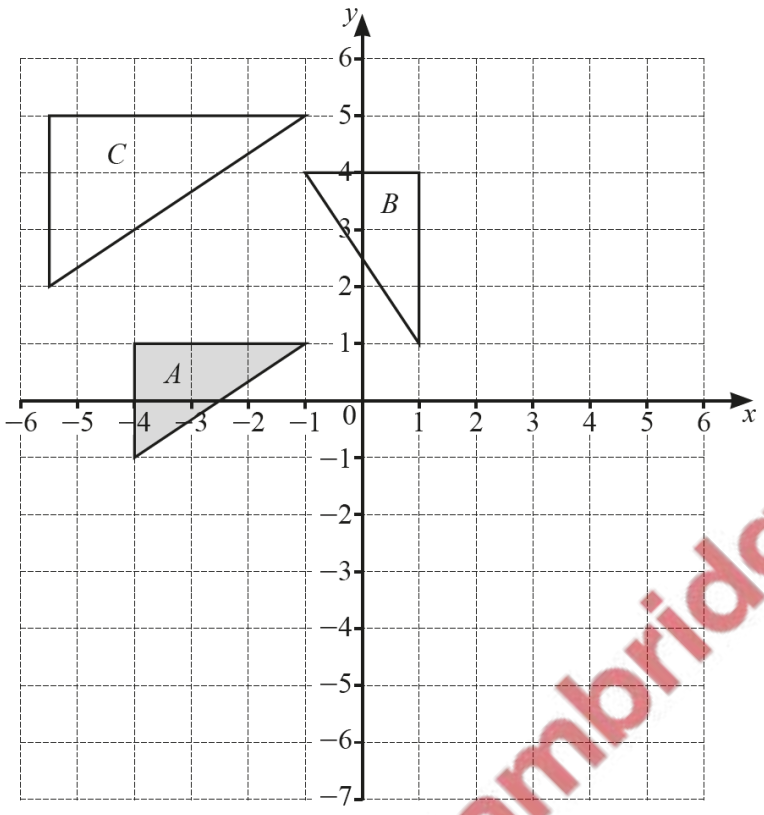
.....

..... [3]

(c) On the grid, draw the image of triangle A after a reflection in the line $y = 6$. [2]

5. Nov/2023/Paper_0580/32/No.9

Triangles A, B and C are shown on the grid.



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

.....

..... [3]

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

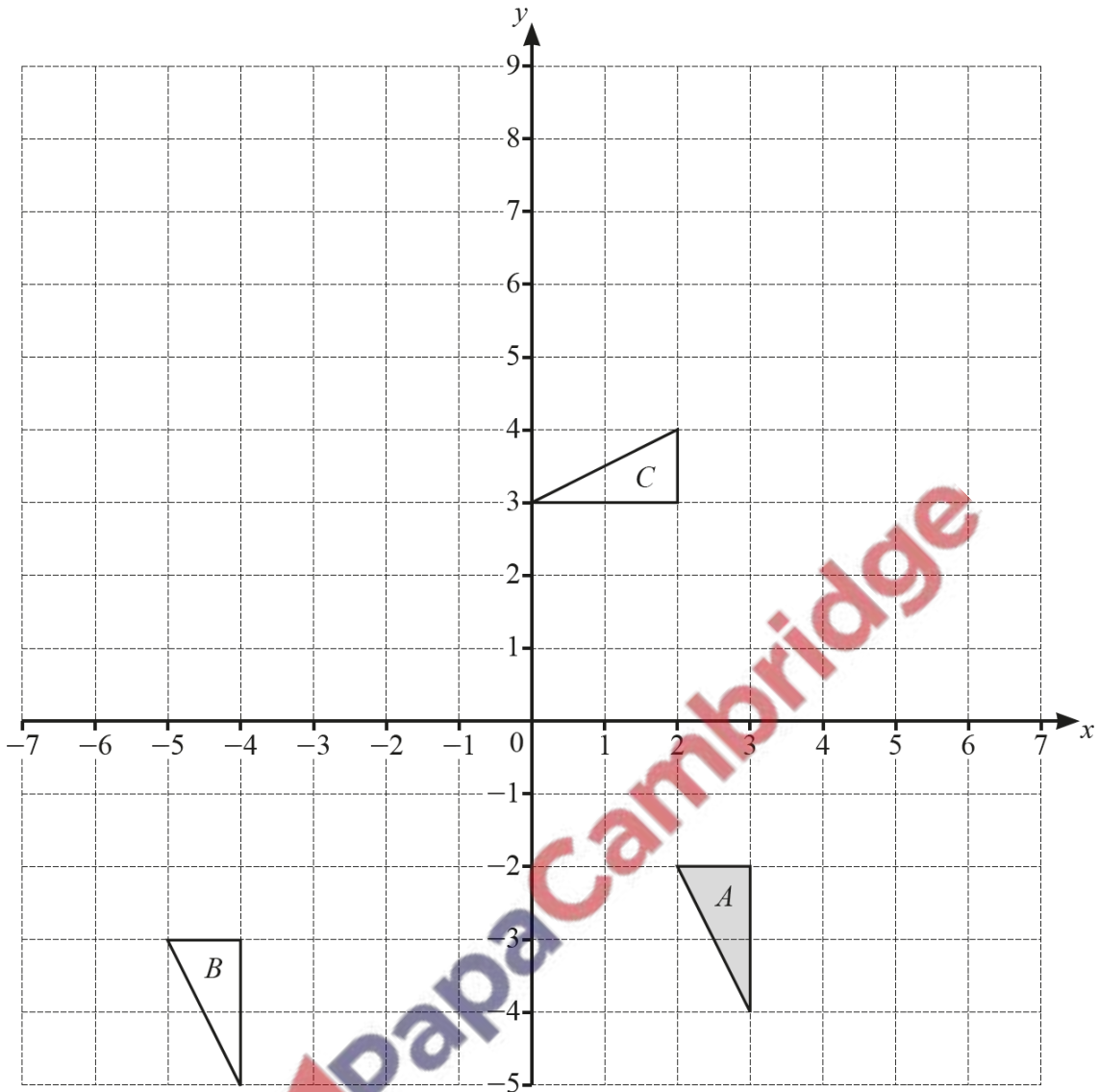
.....

..... [3]

(c) On the grid, translate triangle A by the vector $\begin{pmatrix} 6 \\ -4 \end{pmatrix}$. [2]

(d) On the grid, reflect triangle A in the line $y = -2$. [2]

6. Nov/2023/Paper_0580/41/No.1



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

(i) shape A onto shape B

.....

..... [2]

(ii) shape A onto shape C.

.....

..... [3]

(b) On the grid, draw the image of

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

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

7. Nov/2023/Paper_0580/41/No.10

(a) ABC is a triangle.

B is the point $(1, -10)$, A is the point $(4, 14)$ and $\overrightarrow{CA} = \begin{pmatrix} -11 \\ 8 \end{pmatrix}$.

(i) Find the coordinates of C.

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

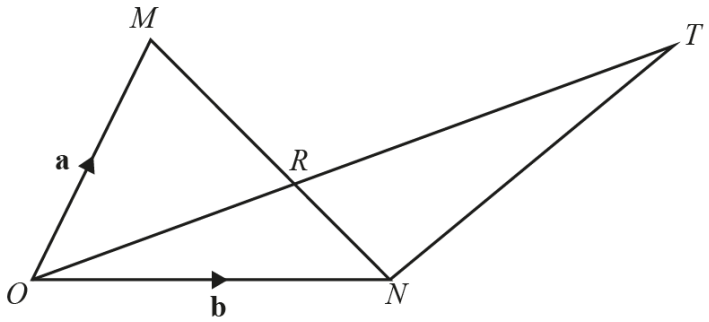
(ii) Find $\overrightarrow{BA}$.

$\overrightarrow{BA} = \begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [1]

(iii) Find $|\overrightarrow{CA}|$.

..... [2]

(b)



NOT TO SCALE

OMN is a triangle.
$\overrightarrow{OM} = \mathbf{a}$ and $\overrightarrow{ON} = \mathbf{b}$.
R is a point on MN such that $MR : RN = 3 : 2$.
ORT is a straight line.

(i) Show that $\overrightarrow{OR} = \frac{2}{5}\mathbf{a} + \frac{3}{5}\mathbf{b}$.

[3]

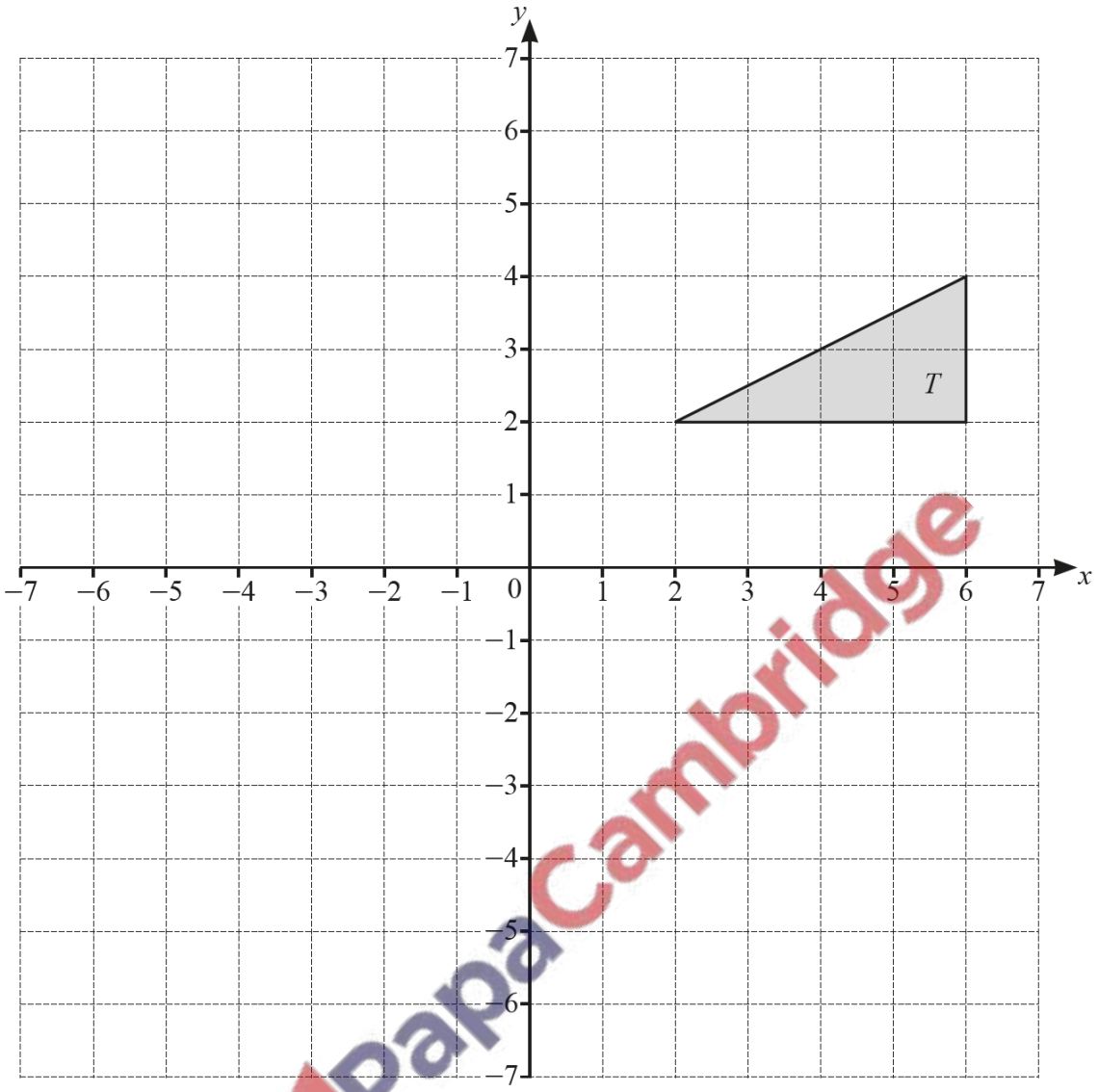
(ii) **(a)** $\overrightarrow{NT} = 4\mathbf{a} + k\mathbf{b}$ and $\overrightarrow{OT} = c\overrightarrow{OR}$.

Find the value of k and the value of c.

$k =$ ..... $c =$ ..... [4]

(b) Find $\overrightarrow{MT}$.

8. Nov/2023/Paper_0580/42/No.1



(a) **(i)** Translate triangle T by the vector $\begin{pmatrix} -7 \\ 1 \end{pmatrix}$. Label the image K. [2]

(ii) Describe fully the **single** transformation that maps triangle K onto triangle T.

.....

..... [1]

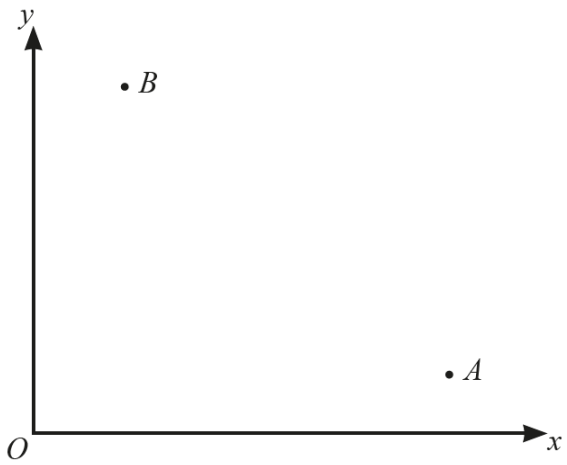
(b) Reflect triangle T in the line $y = 4$. [2]

(c) Rotate triangle T through 90° clockwise about (0, 0). [2]

(d) **(i)** Enlarge triangle T by scale factor $-\frac{1}{2}$, centre (0, 0). Label the image P. [2]

(ii) Describe fully the **single** transformation that maps triangle P onto triangle T.

9. Nov/2023/Paper_0580/42/No.12



NOT TO SCALE

O is the origin (0, 0), A is the point (8, 1) and B is the point (2, 5).

(a) Write as column vectors.

(i) $\overrightarrow{OB}$

$\overrightarrow{OB} = \begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [1]

(ii) $\overrightarrow{AB}$

$\overrightarrow{AB} = \begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [1]

(b) Find the equation of the line AB.
Give your answer in the form $y = mx + c$.

$y =$ ..... [3]

(c) Find the equation of the perpendicular bisector of AB.
Give your answer in the form $y = mx + c$.

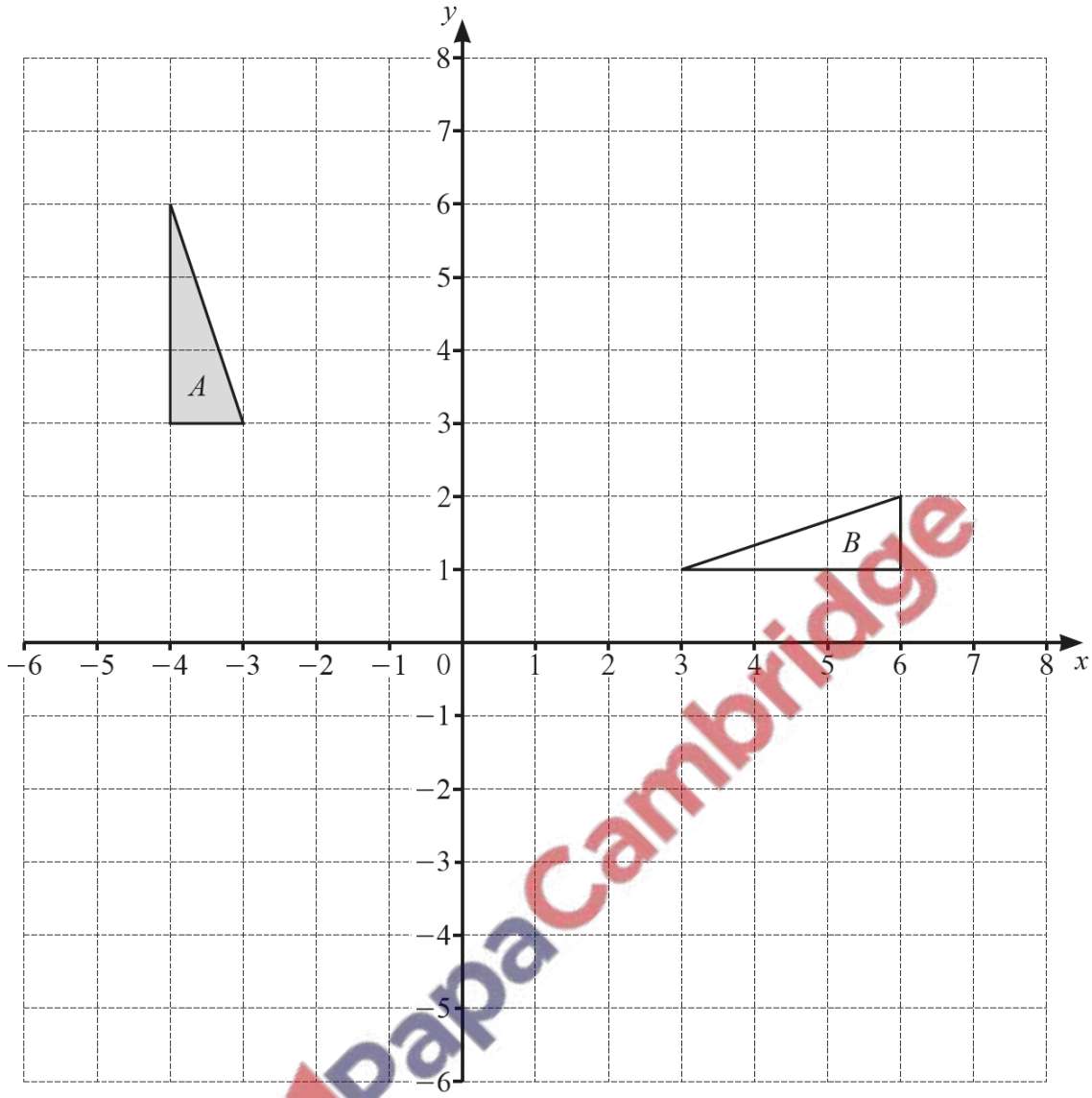
$y =$ ..... [4]

(d) The line AB meets the y-axis at P.
The perpendicular bisector of AB meets the y-axis at Q.

Find the length of PQ.

..... [2]

10. Nov/2023/Paper_0580/43/No.3



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

.....

..... [3]

(b) Draw the image of triangle A after

(i) a reflection in the line $y = 1$ [2]

(ii) a translation by the vector $\begin{pmatrix} 5 \\ -7 \end{pmatrix}$ [2]

(iii) an enlargement, scale factor 2, centre $(-4,\ 5)$. [2]