Vectors and transformations – 2020 IGCSE 0580

1. Nov/2020/Paper_11/No.10

Work out.

(a) $\begin{pmatrix} 2 \\ -3 \end{pmatrix} + \begin{pmatrix} 5 \\ -1 \end{pmatrix}$

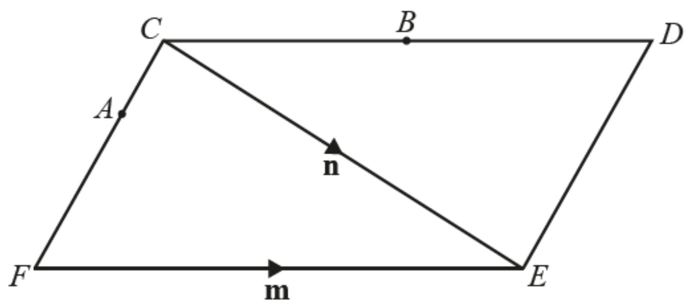
$\begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [1]

(b) $4\begin{pmatrix} 2 \\ -5 \end{pmatrix}$

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

2. Nov/2020/Paper_21/No.23

(a)



NOT TO SCALE

The diagram shows a parallelogram *CDEF*.
$\overrightarrow{FE} = \mathbf{m}$ and $\overrightarrow{CE} = \mathbf{n}$.
B is the midpoint of *CD*.
$FA = 2AC$

Find an expression, in terms of **m** and **n**, for $\overrightarrow{AB}$.
Give your answer in its simplest form.

$\overrightarrow{AB}$ = ... [3]

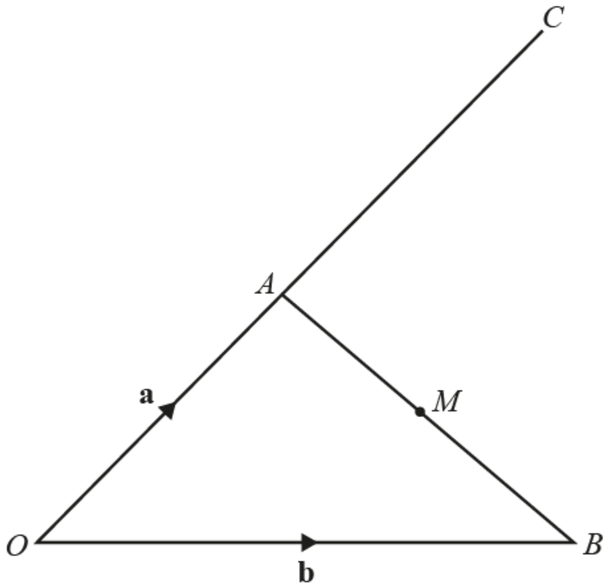
(b) $\overrightarrow{GH} = \frac{5}{6}(2\mathbf{p} + \mathbf{q})$ $\overrightarrow{JK} = \frac{5}{18}(2\mathbf{p} + \mathbf{q})$

Write down **two** facts about vectors $\overrightarrow{GH}$ and $\overrightarrow{JK}$.

....

.... [2]

3. Nov/2020/Paper_22/No.22



NOT TO SCALE

The diagram shows a triangle OAB and a straight line OAC.
$OA : OC = 2 : 5$ and M is the midpoint of AB.
$\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$.

Find, in terms of **a** and **b**, in its simplest form

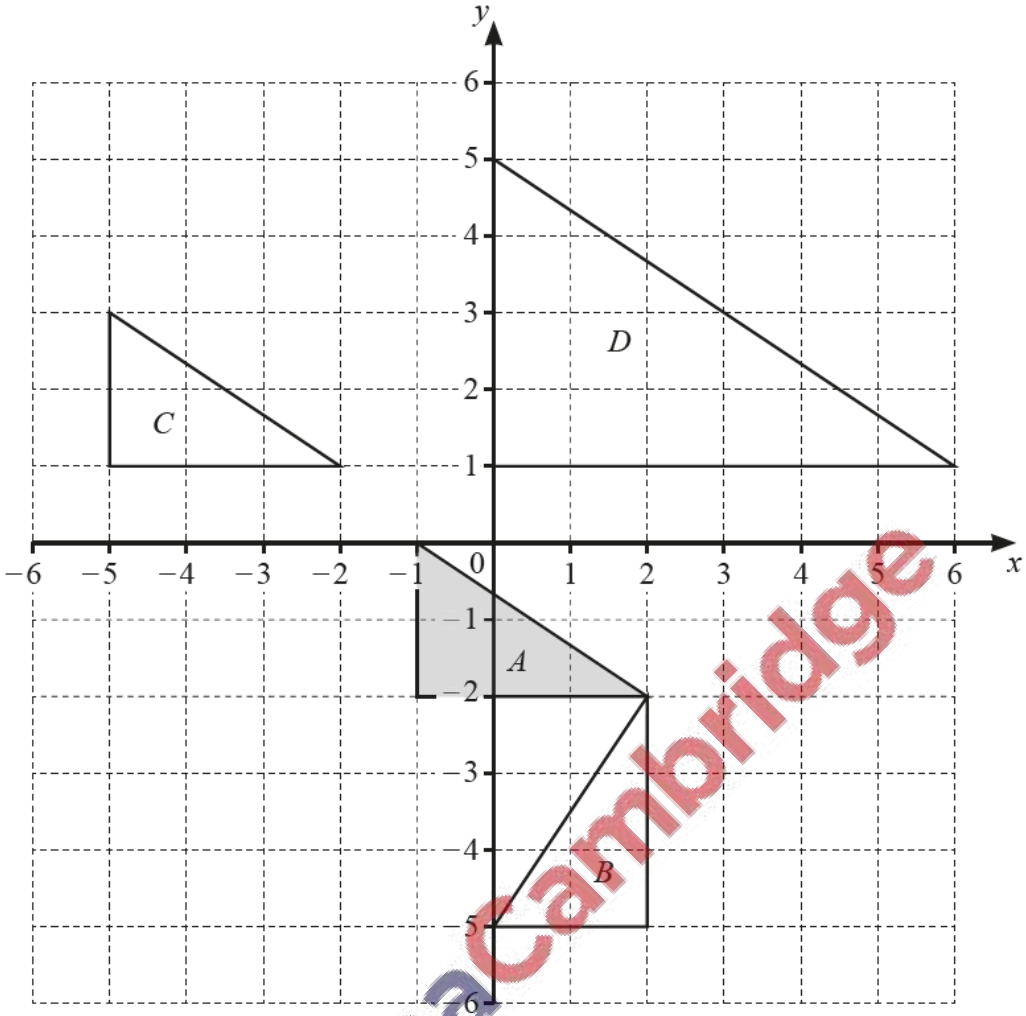
(a) $\overrightarrow{AB}$,

$\overrightarrow{AB} =$ .... [1]

(b) $\overrightarrow{MC}$.

$\overrightarrow{MC} =$ .... [3]

4. Nov/2020/Paper_31/No.8



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

(i) triangle A onto triangle B,

....

.... [3]

(ii) triangle A onto triangle C,

....

.... [2]

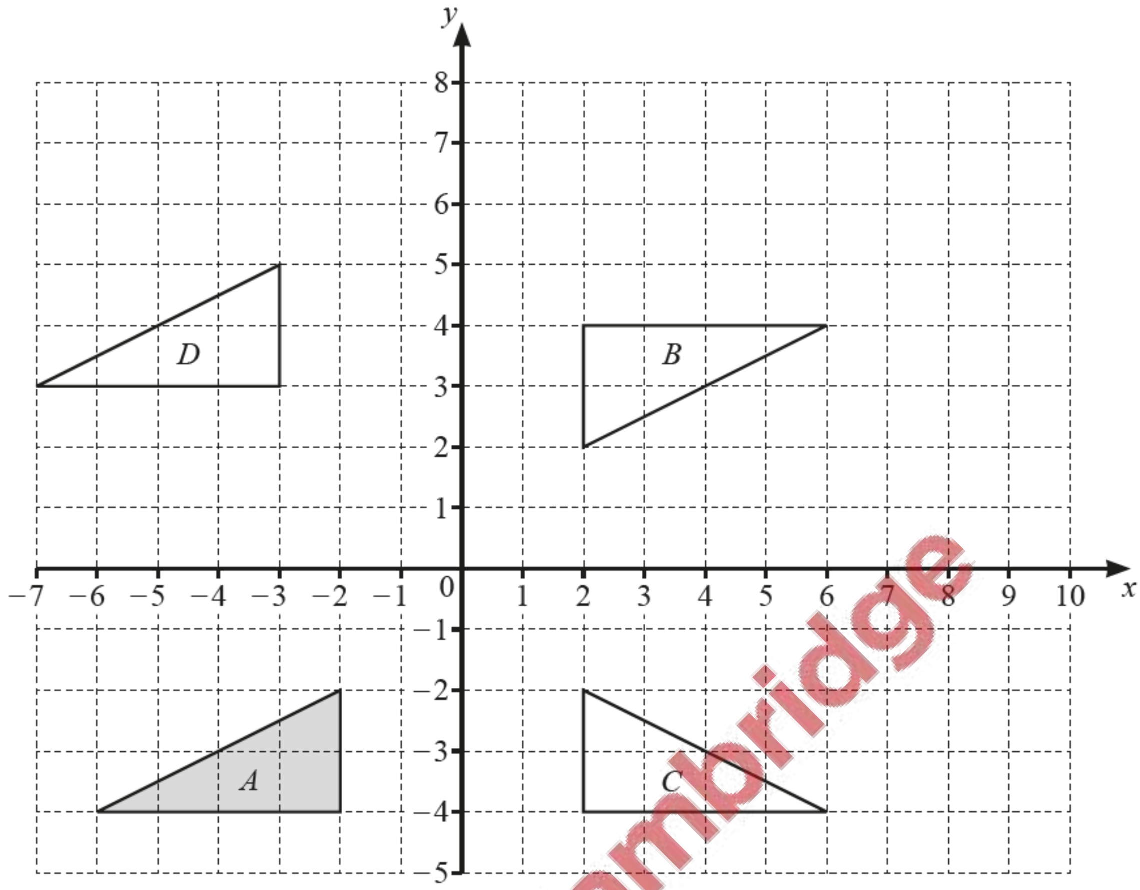
(iii) triangle A onto triangle D.

....

.... [3]

(b) On the grid, draw the image of triangle A after a reflection in the line $x = -2$. [2]

5. Nov/2020/Paper_32/No.7



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

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

....

.... [3]

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

....

.... [2]

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

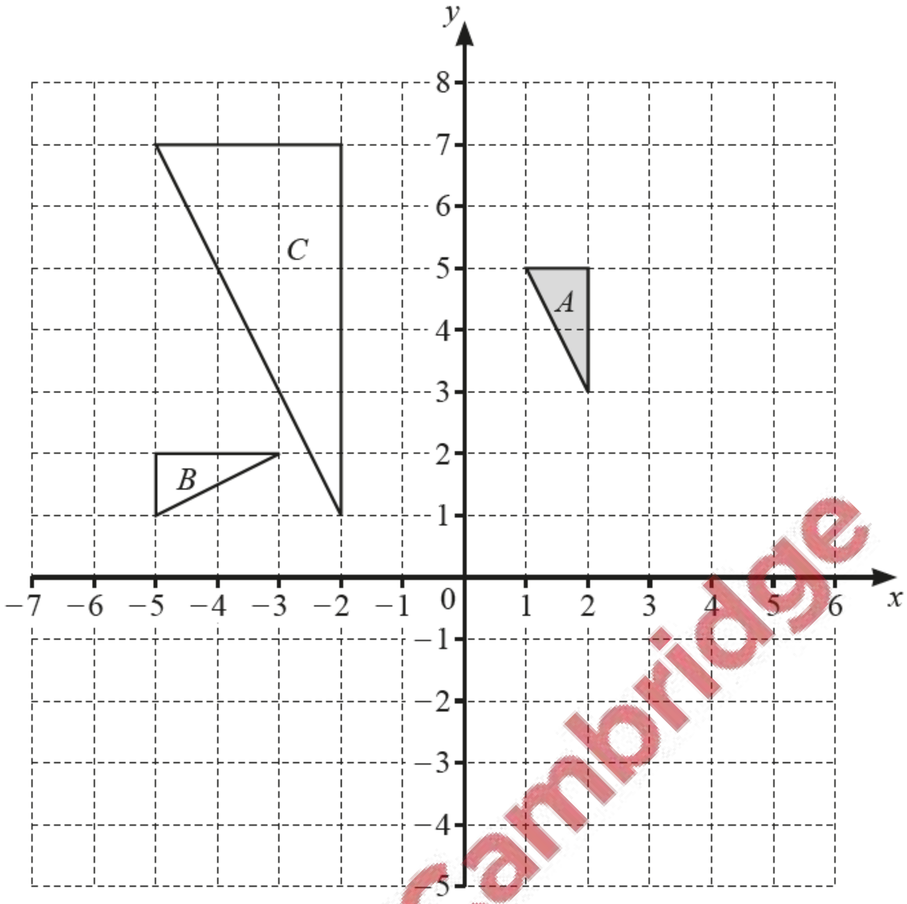
....

.... [2]

(b) On the grid, enlarge triangle *A* by scale factor 0.5, centre (4, 0). [2]

6. Nov/2020/Paper_33/No.6

(a)



(i) On the grid, draw the image of

(a) triangle A after a translation by the vector $\begin{pmatrix} 3 \\ -7 \end{pmatrix}$, [2]

(b) triangle A after a reflection in the line $x = 3$. [2]

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

....

.... [3]

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

....

.... [3]

(b) $\mathbf{a} = \begin{pmatrix} 3 \\ -2 \end{pmatrix}$ $\mathbf{b} = \begin{pmatrix} 5 \\ 7 \end{pmatrix}$ $\mathbf{c} = \begin{pmatrix} -1 \\ 4 \end{pmatrix}$

Work out.

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

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

(ii) $\mathbf{b} - 2\mathbf{c}$

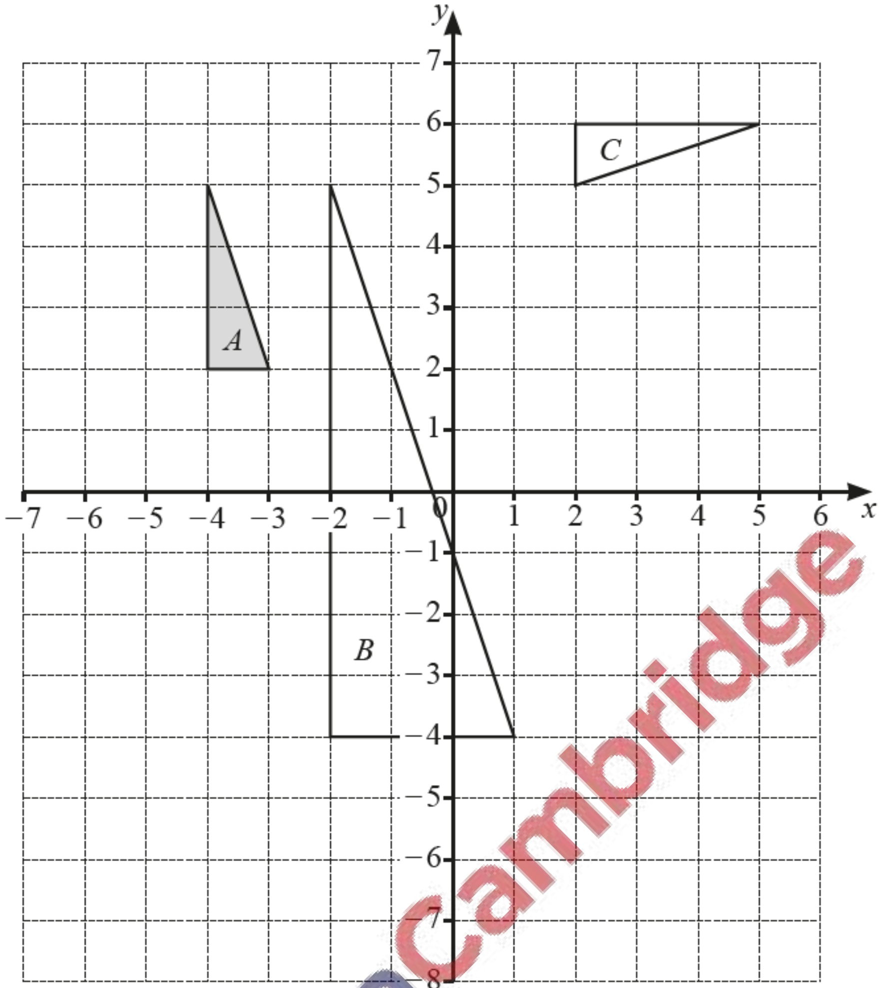
$\begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [2]

(c) Point P has coordinates $(6, -2)$ and $\overrightarrow{PQ} = \begin{pmatrix} -4 \\ 5 \end{pmatrix}$.

Find the coordinates of point Q.

(.................... , ...) [1]

7. Nov/2020/Paper_41/No.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.

....

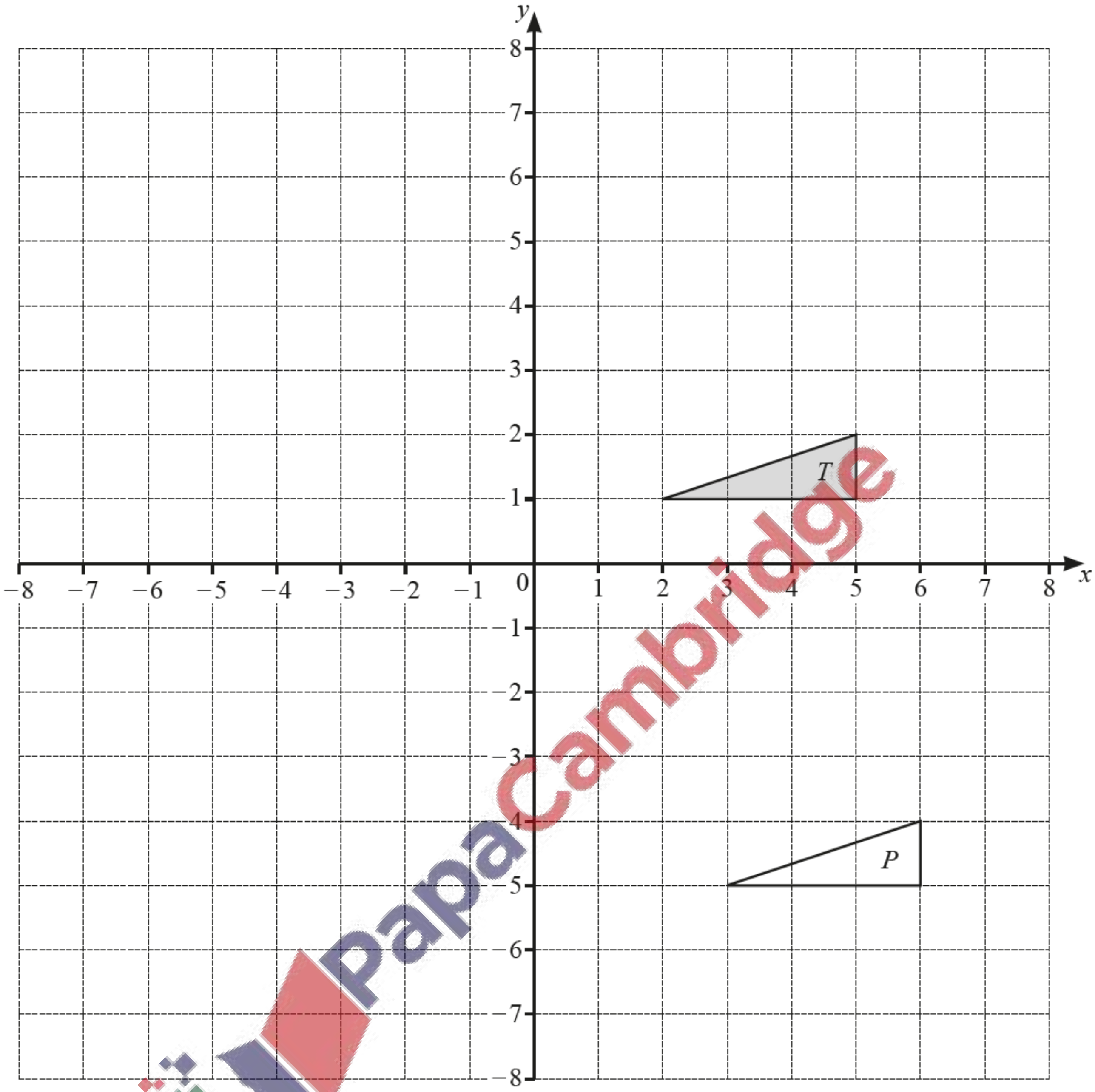
.... [3]

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

....

.... [3]

8. Nov/2020/Paper_42/No.2



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

....

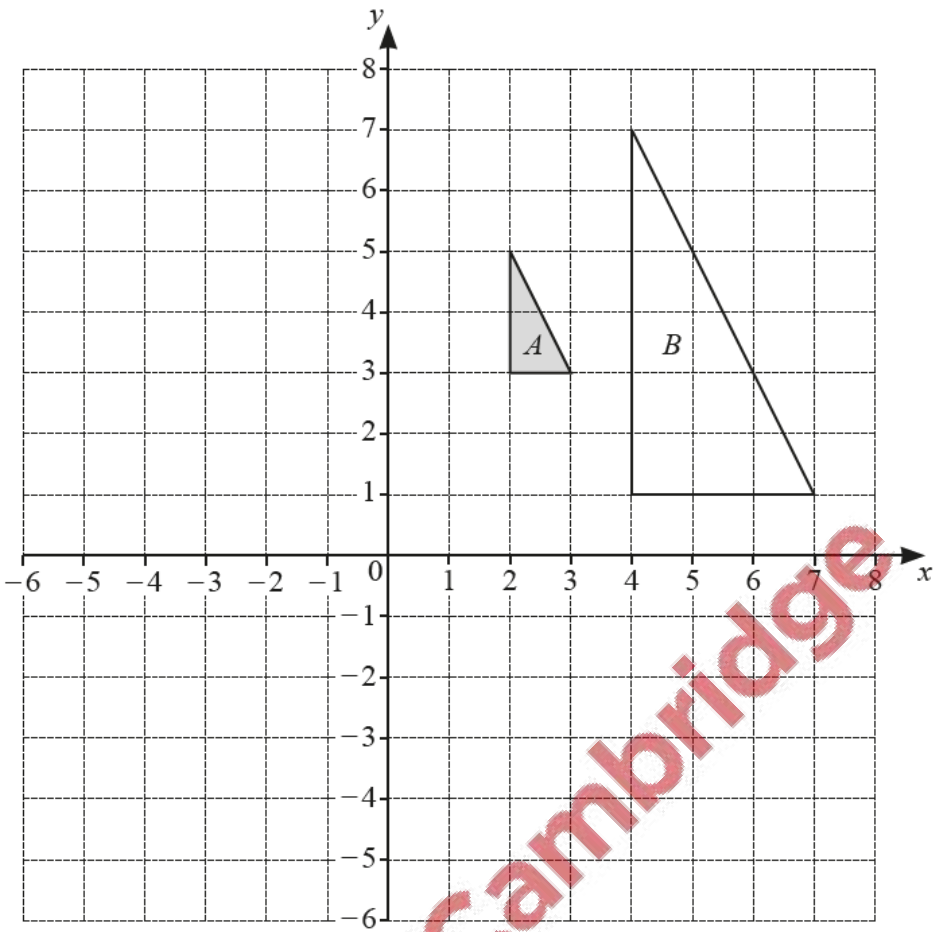
.... [2]

(b) **(i)** Reflect triangle T in the line $x = 1$. [2]

(ii) Rotate triangle T through 90° anticlockwise about (6, 0). [2]

(iii) Enlarge triangle T by a scale factor of -2, centre (1, 0). [2]

9. Nov/2020/Paper_43/No.2



(a) On the grid, draw the image of

(i) triangle A after a rotation of 90° anticlockwise about (0, 0), [2]

(ii) triangle A after a translation by the vector $\begin{pmatrix} 3 \\ -5 \end{pmatrix}$. [2]

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

....

.... [3]

10. Nov/2020/Paper_43/No.8

(a) $\overrightarrow{AB} = \begin{pmatrix} 6 \\ -1 \end{pmatrix}$ $\overrightarrow{BC} = \begin{pmatrix} -2 \\ 5 \end{pmatrix}$ $\overrightarrow{DC} = \begin{pmatrix} 2 \\ -3 \end{pmatrix}$

Find

(i) $\overrightarrow{AC}$,

$\overrightarrow{AC} = \begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [2]

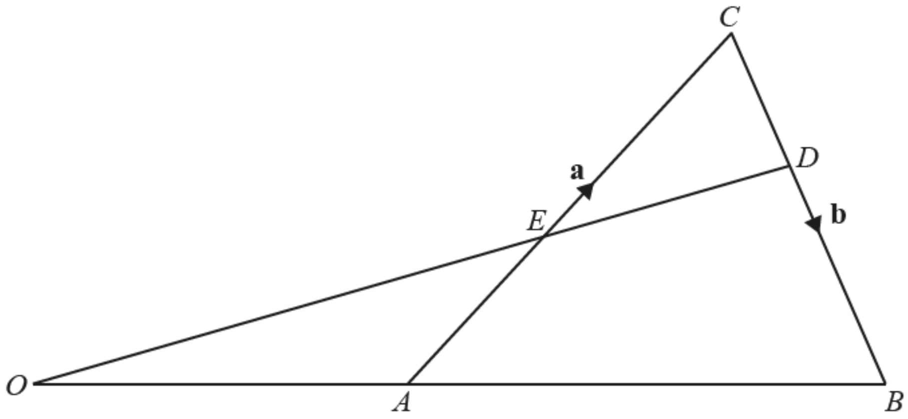
(ii) $\overrightarrow{BD}$,

$\overrightarrow{BD} = \begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [2]

(iii) $|\overrightarrow{BC}|$.

.... [2]

(b)



NOT TO SCALE

In the diagram, OAB and OED are straight lines.
O is the origin, A is the midpoint of OB and E is the midpoint of AC.
$\overrightarrow{AC} = \mathbf{a}$ and $\overrightarrow{CB} = \mathbf{b}$.

Find, in terms of $\mathbf{a}$ and $\mathbf{b}$, in its simplest form

(i) $\overrightarrow{AB}$,

$\overrightarrow{AB} =$ .... [1]

(ii) $\overrightarrow{OE}$,

$\overrightarrow{OE} =$ .... [2]

(iii) the position vector of D.

.... [3]

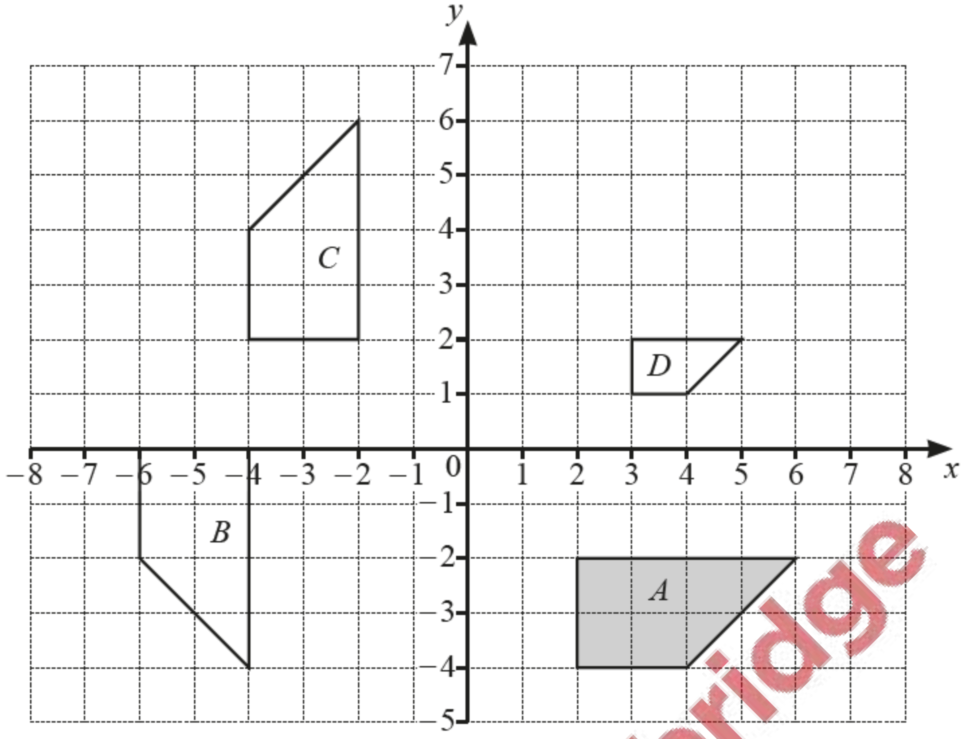
11. March/2020/Paper_12/No.10

Point A has coordinates (6, 4) and point B has coordinates (2, 7).

Write $\overrightarrow{AB}$ as a column vector.

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

12. March/2020/Paper_22/No.11



Describe fully the **single** transformation that maps

(a) shape A onto shape B,

....

.... [3]

(b) shape A onto shape C,

....

.... [2]

(c) shape A onto shape D.

....

.... [3]

13. March/2020/Paper_22/No.21

$\overrightarrow{XY} = 3\mathbf{a} + 2\mathbf{b}$ and $\overrightarrow{ZY} = 6\mathbf{a} + 4\mathbf{b}$.

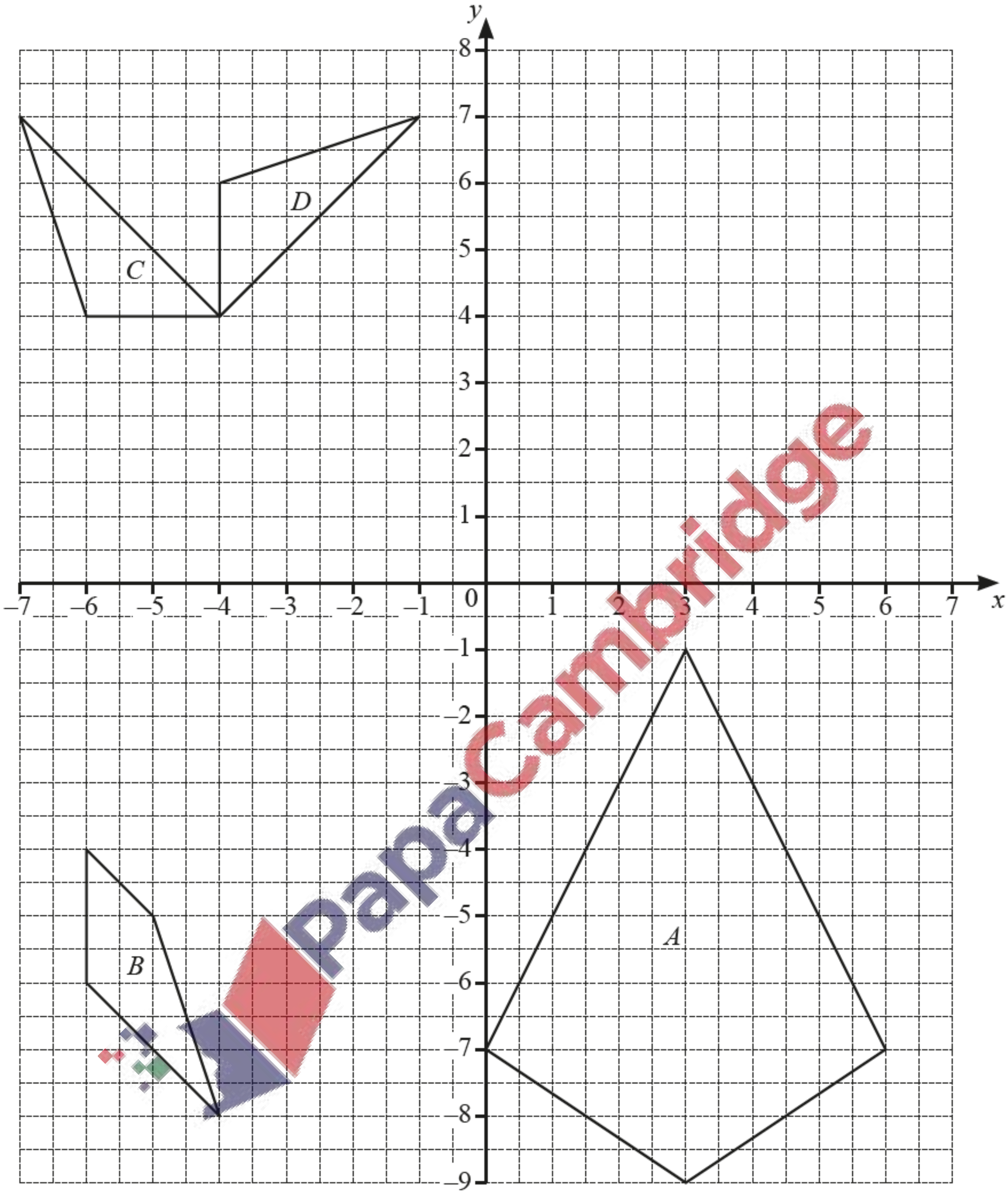
Write down two statements about the relationship between the points X, Y and Z.

1 ....

2 .... [2]

14. March/2020/Paper_32/No.6

(a)



(i) On the grid, draw the image of

(a) shape A after an enlargement with scale factor $\frac{1}{2}$, centre $(3, -5)$, [2]

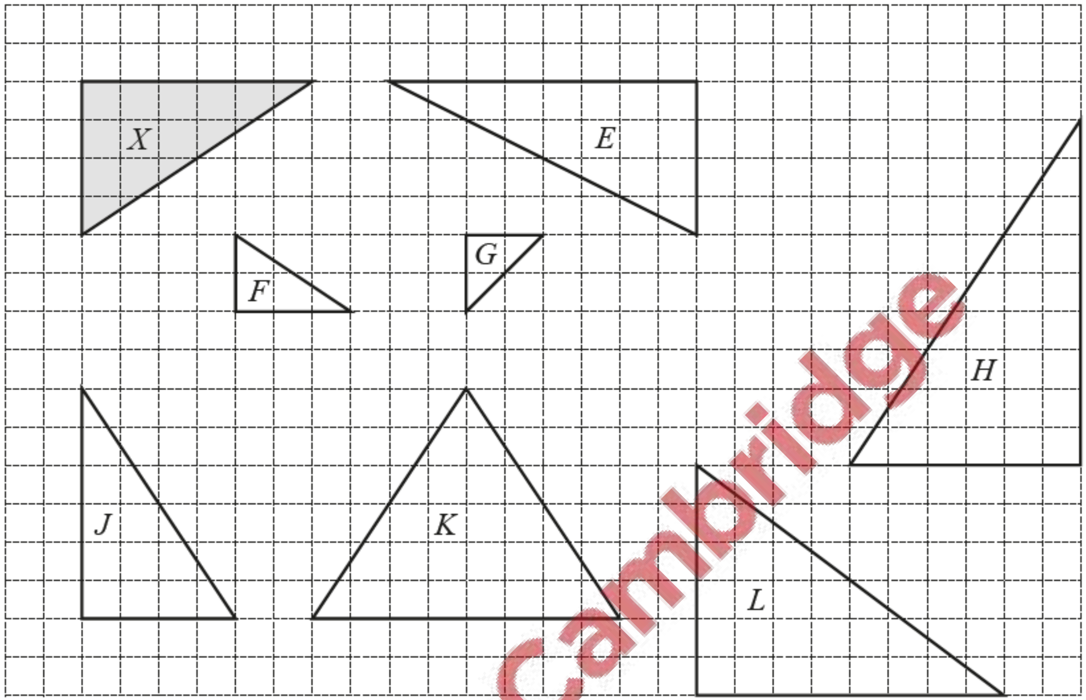
(b) shape B after a reflection in the line $y = -3$. [2]

(ii) Describe fully the **single** transformation that maps triangle C onto triangle D.

....

.... [3]

(b)



For the triangles shown on the grid, write down the letter of each triangle that is

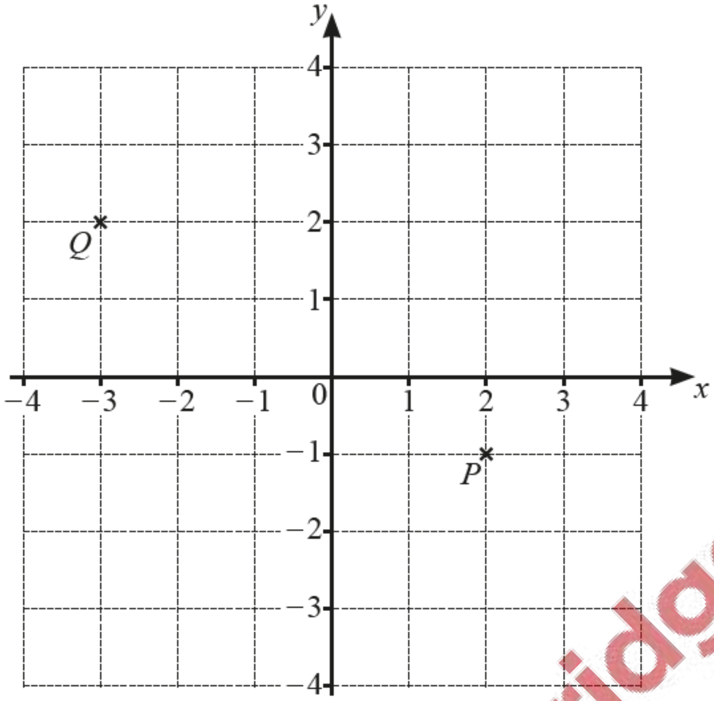
(i) congruent to triangle X,

.... [1]

(ii) similar to triangle X.

.... [2]

15. June/2020/Paper_11/No.9



(a) Write $\overrightarrow{PQ}$ as a column vector.

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

(b) Write $3\overrightarrow{PQ}$ as a single vector.

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

16. June/2020/Paper_13/No.7

(a) Write down the mathematical name of a quadrilateral that has

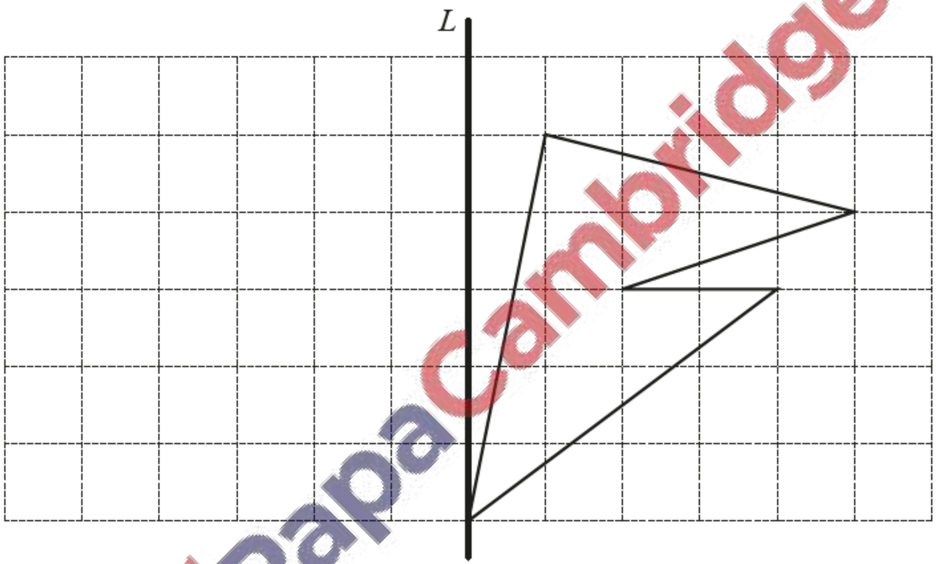
- rotational symmetry of order 1

and

- only one line of symmetry.

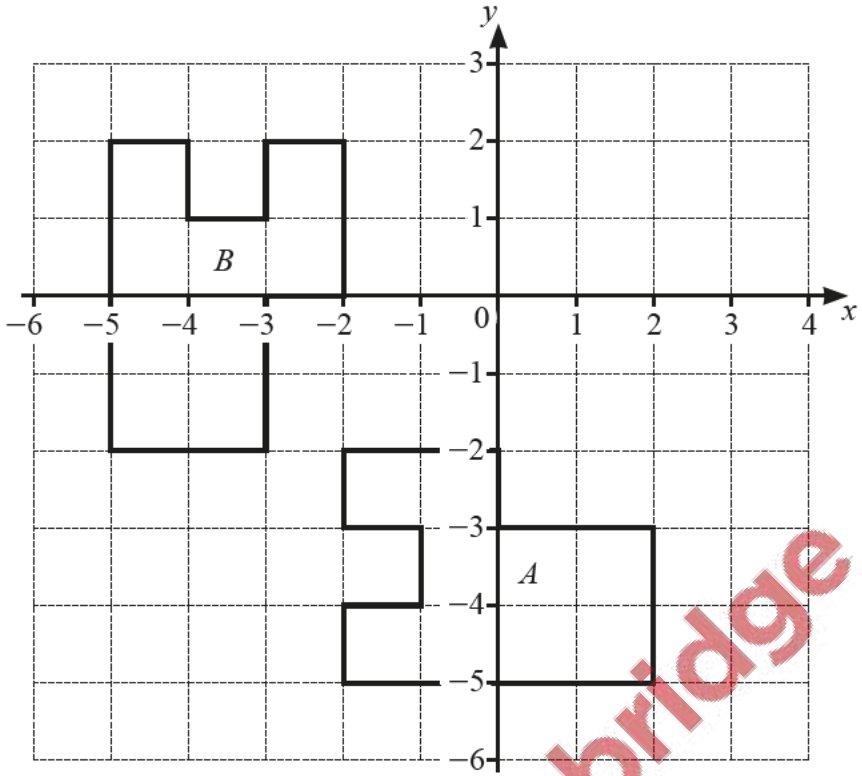
.... [1]

(b) Reflect the shape in line L.



[2]

17. June/2020/Paper_13/No.15



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

....

.... [3]

18. June/2020/Paper_21/No.17

(a) **(i)** $\mathbf{m} = \begin{pmatrix} 5 \\ 7 \end{pmatrix}$

Find $3\mathbf{m}$.

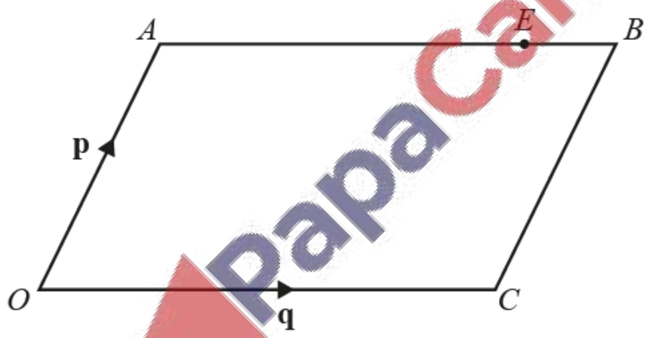
$\begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [1]

(ii) $\overrightarrow{VW} = \begin{pmatrix} 10 \\ -24 \end{pmatrix}$

Find $\left|\overrightarrow{VW}\right|$.

.... [2]

(b)



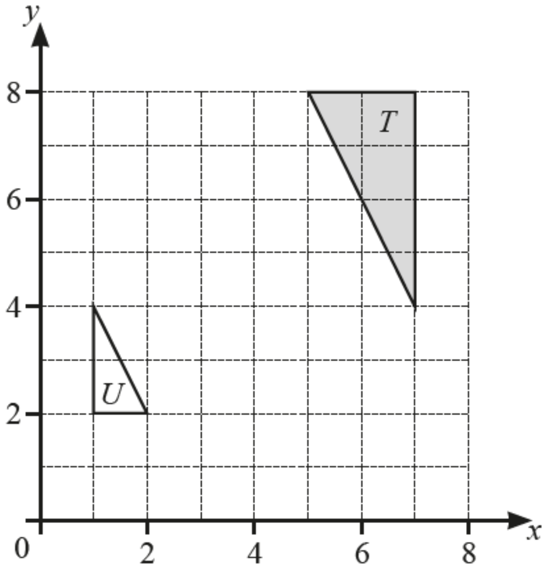
NOT TO SCALE

OABC is a parallelogram.
$\overrightarrow{OA} = \mathbf{p}$ and $\overrightarrow{OC} = \mathbf{q}$.
E is the point on *AB* such that $AE : EB = 3 : 1$.

Find $\overrightarrow{OE}$, in terms of $\mathbf{p}$ and $\mathbf{q}$, in its simplest form.

$\overrightarrow{OE} =$ .... [2]

19. June/2020/Paper_22/No.18

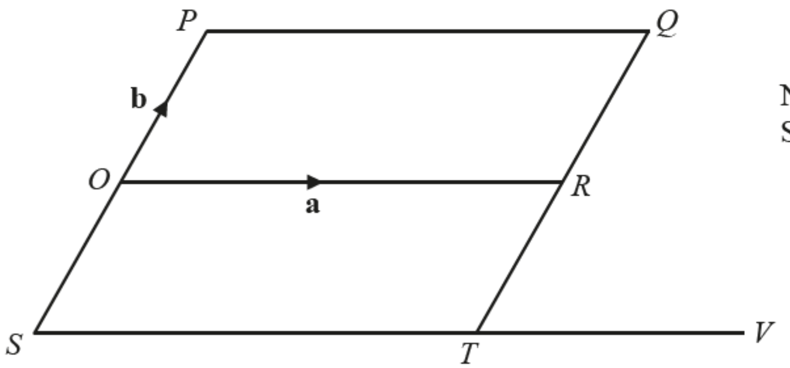


Describe fully the **single** transformation that maps triangle T onto triangle U.

....

.... [3]

20. June/2020/Paper_23/No.21



O is the origin and $OPQR$ is a parallelogram.
SOP is a straight line with $SO = OP$.
TRQ is a straight line with $TR = RQ$.
STV is a straight line and $ST : TV = 2 : 1$.
$\overrightarrow{OR} = \mathbf{a}$ and $\overrightarrow{OP} = \mathbf{b}$.

(a) Find, in terms of **a** and **b**, in its simplest form,

(i) the position vector of T,

.... [2]

(ii) $\overrightarrow{RV}$.

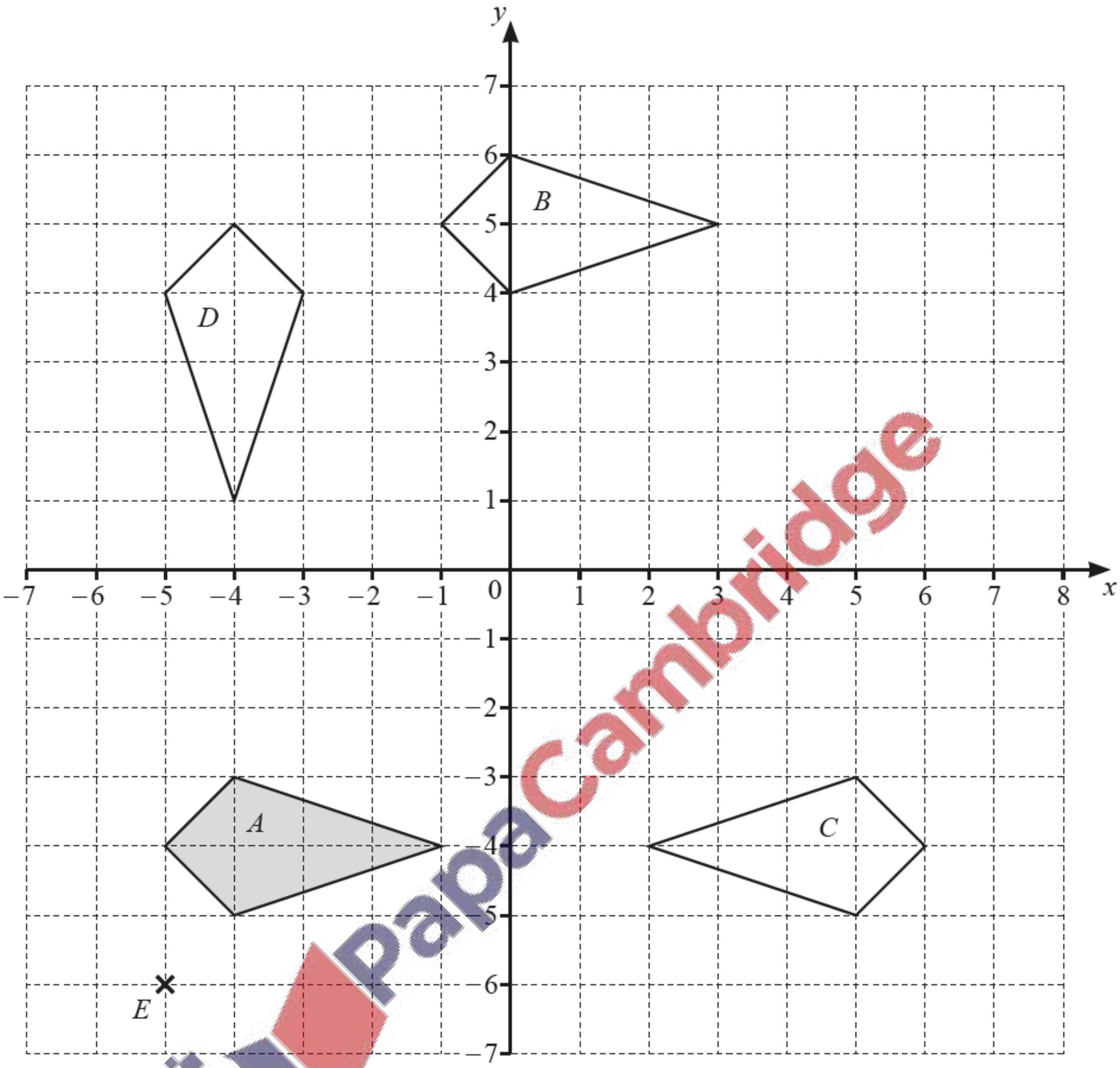
$\overrightarrow{RV}$ = ... [1]

(b) Show that PT is parallel to RV.

[2]

21. June/2020/Paper_31/No.2

The grid shows a point E and four quadrilaterals, A, B, C and D.



(a) Write down the mathematical name of shape A.

.... [1]

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

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

....

.... [2]

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

....

.... [2]

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

....

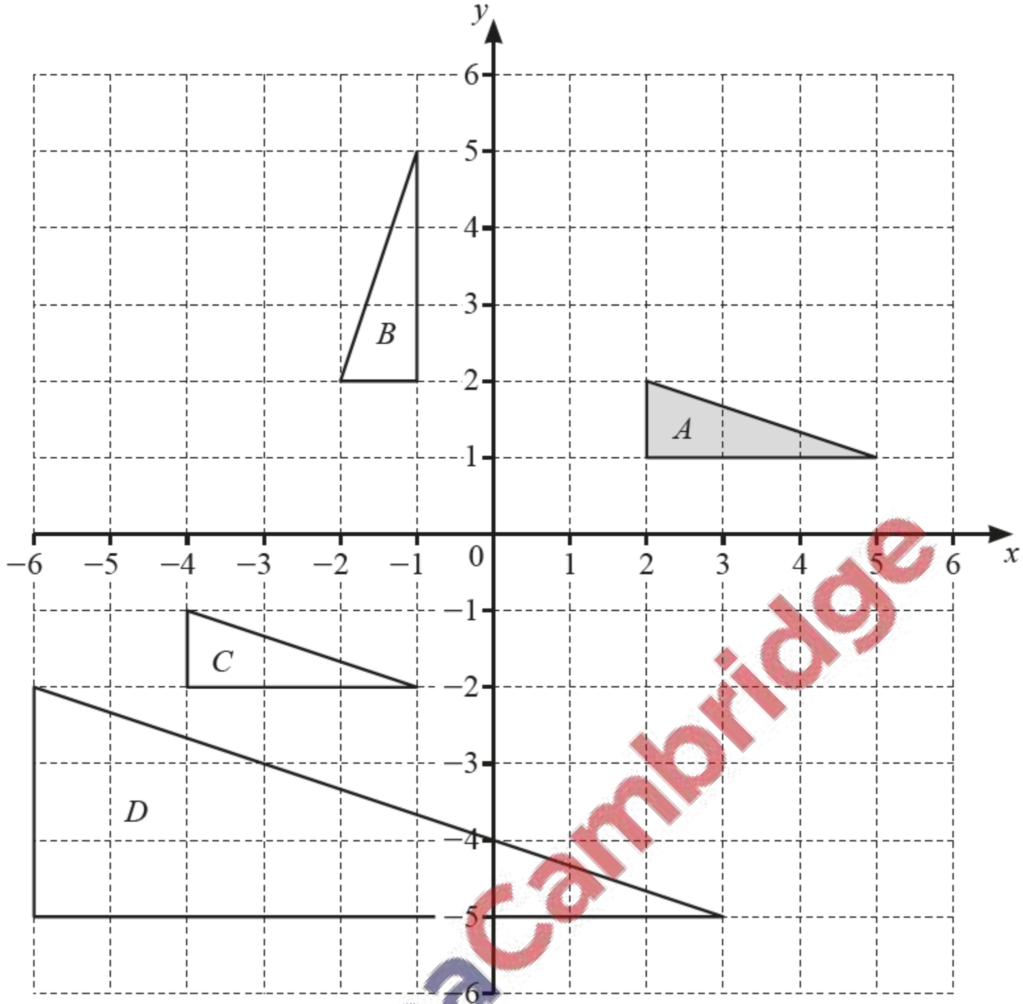
.... [3]

(c) **(i)** Write down the coordinates of the point *E*.

(................. , ...) [1]

(ii) On the grid, draw the image of shape *A* after an enlargement by scale factor 3, centre *E*. [2]

22. June/2020/Paper_32/No.8



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

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

....

.... [3]

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

....

.... [2]

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

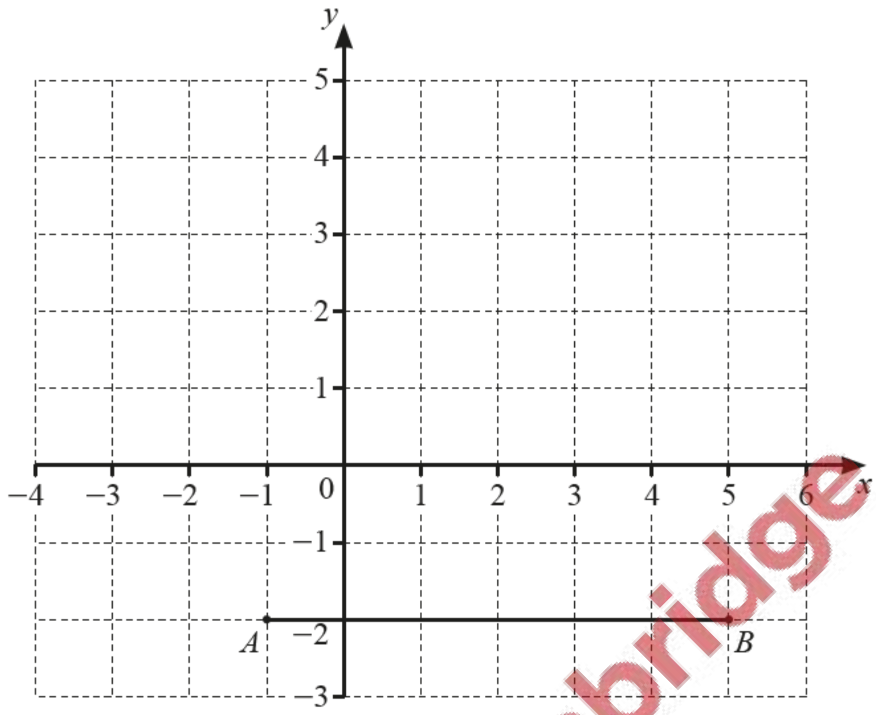
....

.... [3]

(b) On the grid, draw the image of triangle *A* after a reflection in the line $y = -1$. [2]

23. June/2020/Paper_33/No.2

The diagram shows a line AB on a 1 cm^2 grid.



(a) Write down the coordinates of point A.

(.............. , ...) [1]

(b) Write down the vector $\overrightarrow{AB}$.

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

(c) $\overrightarrow{BC} = \begin{pmatrix} -2 \\ 5 \end{pmatrix}$

Mark point C on the grid. [1]

(d) **(i)** Work out $\overrightarrow{AB} + \overrightarrow{BC}$.

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

(ii) Complete this statement.

$\overrightarrow{AB} + \overrightarrow{BC} = \overrightarrow{\ldots\ldots}$ [1]

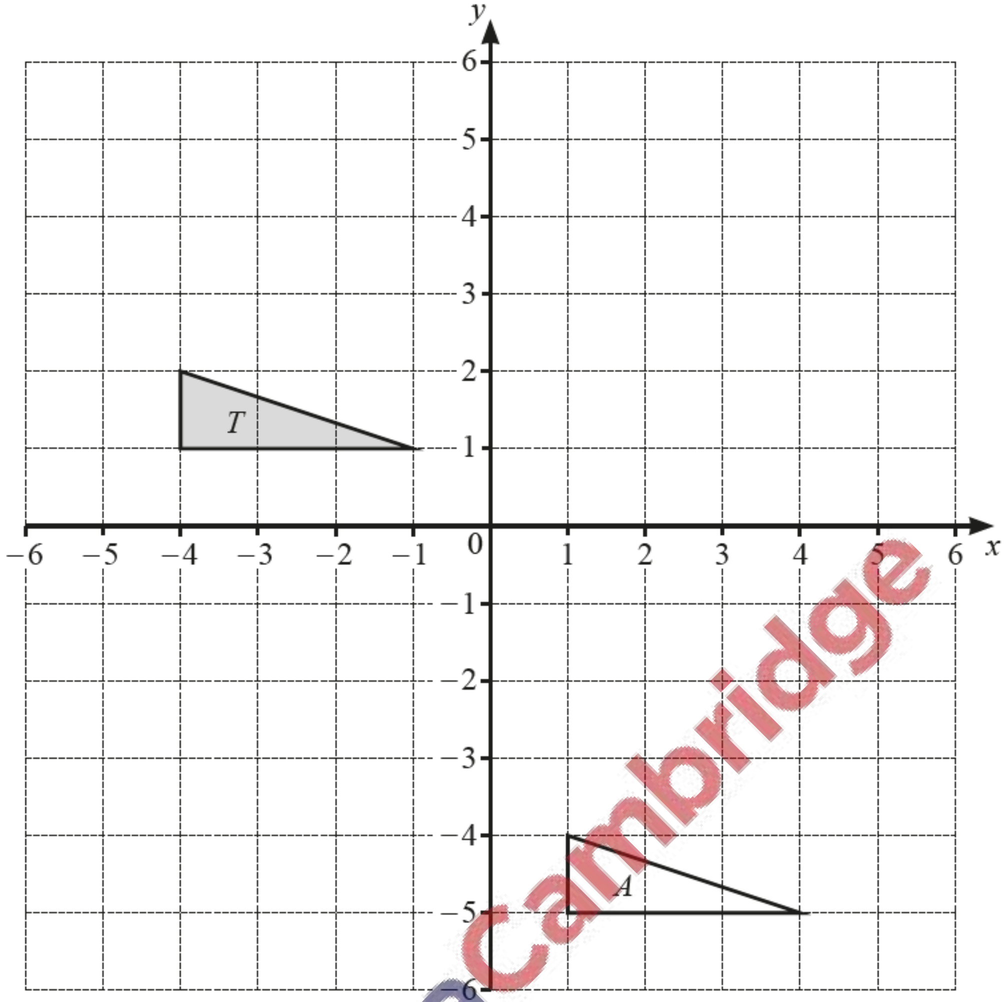
(e) *A*, *B* and *C* are three vertices of a parallelogram, *ABCD*.

(i) Mark point *D* on the diagram and draw the parallelogram *ABCD*. [1]

(ii) Work out the area of the parallelogram.
Give the units of your answer.

.... [2]

24. June/2020/Paper_41/No.4



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

(b) Draw the image of triangle T after a rotation through 90° clockwise about (0, 0). [2]

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

....

.... [2]

25. June/2020/Paper_42/No.2

(a) $\mathbf{p} = \begin{pmatrix} 4 \\ 5 \end{pmatrix}$ $\mathbf{q} = \begin{pmatrix} -2 \\ 7 \end{pmatrix}$

(i) Find $2\mathbf{p} + \mathbf{q}$.

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

(ii) Find $|\mathbf{p}|$.

.... [2]

(b) A is the point (4, 1) and $\overrightarrow{AB} = \begin{pmatrix} -3 \\ 1 \end{pmatrix}$.

Find the coordinates of B.

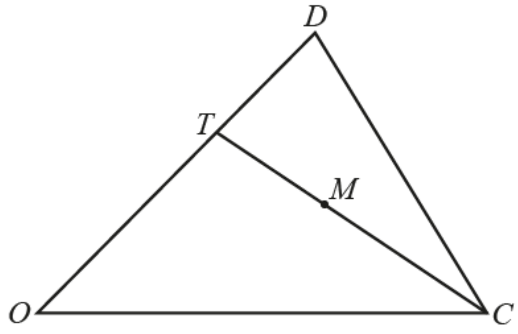
(...................... , ...) [1]

(c) The line $y = 3x - 2$ crosses the y-axis at G.

Write down the coordinates of G.

(...................... , ...) [1]

(d)



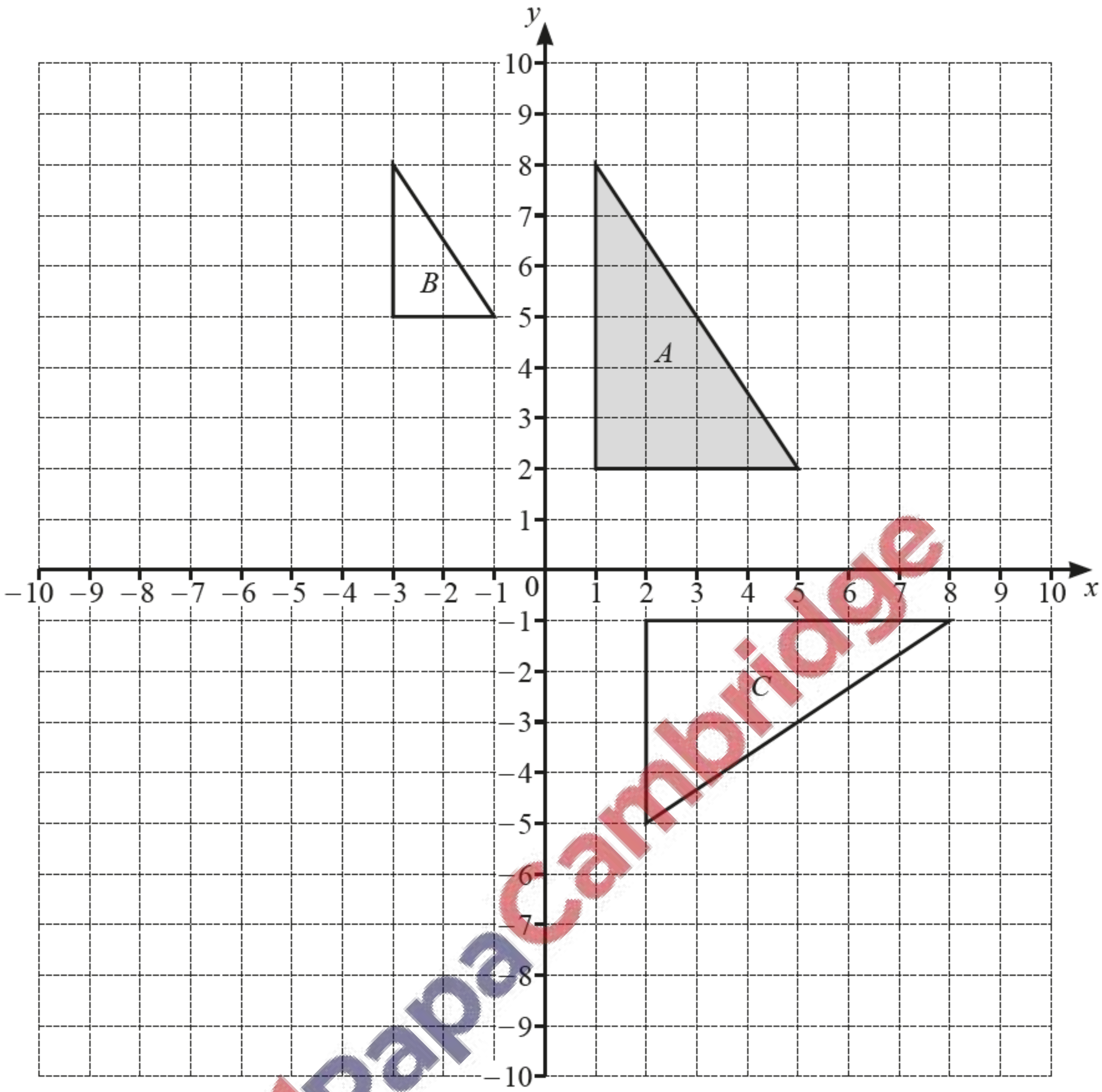
NOT TO SCALE

In the diagram, O is the origin, $OT = 2TD$ and M is the midpoint of TC.
$\overrightarrow{OC} = \mathbf{c}$ and $\overrightarrow{OD} = \mathbf{d}$.

Find the position vector of M.
Give your answer in terms of **c** and **d** in its simplest form.

.... [3]

26. June/2020/Paper_43/No.2



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

(ii) Draw the image of triangle A after a translation by the vector $\begin{pmatrix}-2\\-9\end{pmatrix}$. [2]

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

(i) triangle A onto triangle B,

....

.... [3]

(ii) triangle A onto triangle C.

....

.... [3]