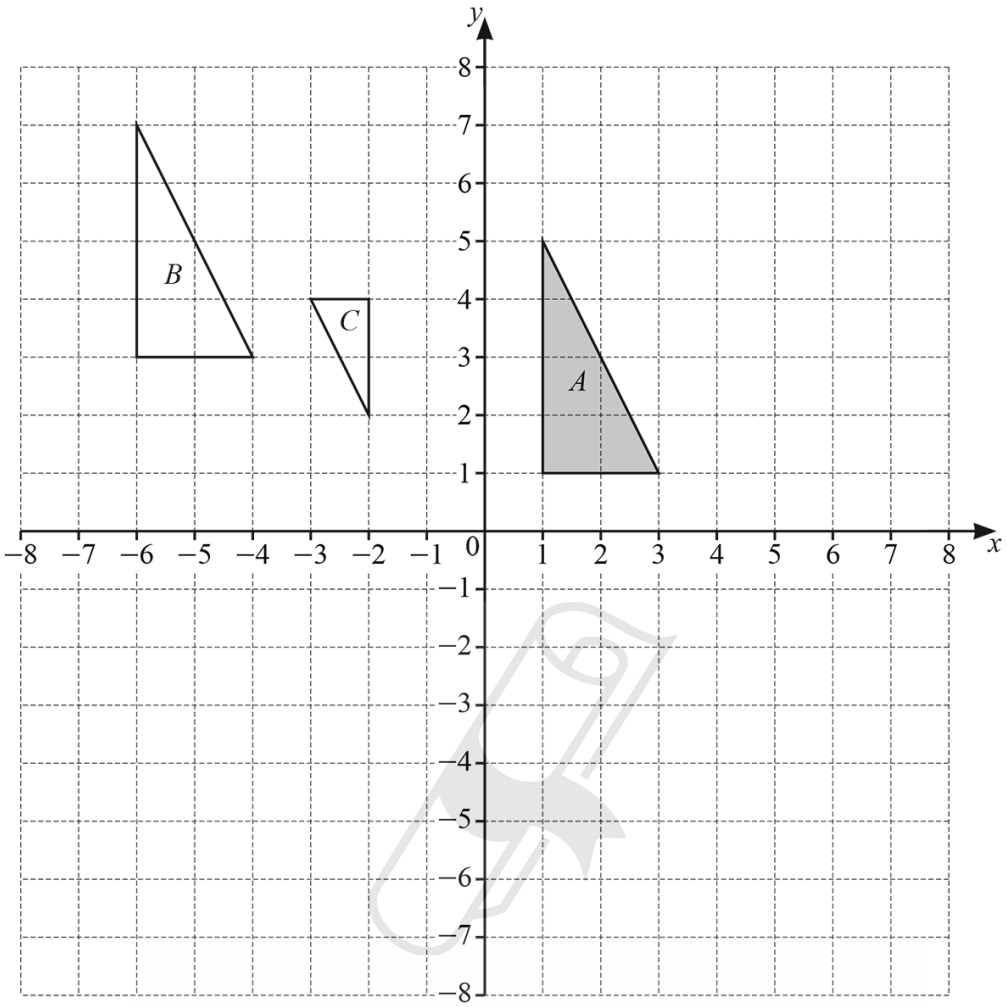
Chapter 6

Vectors and transformations

01. 0607_m24_qp_42 Q: 3



(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) (i) Rotate triangle A through 90° clockwise about $(-1, -1)$. Label the image D. [2]

(ii) Reflect triangle D in the line $x = -1$. Label the image E. [2]

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

.....

..... [2]

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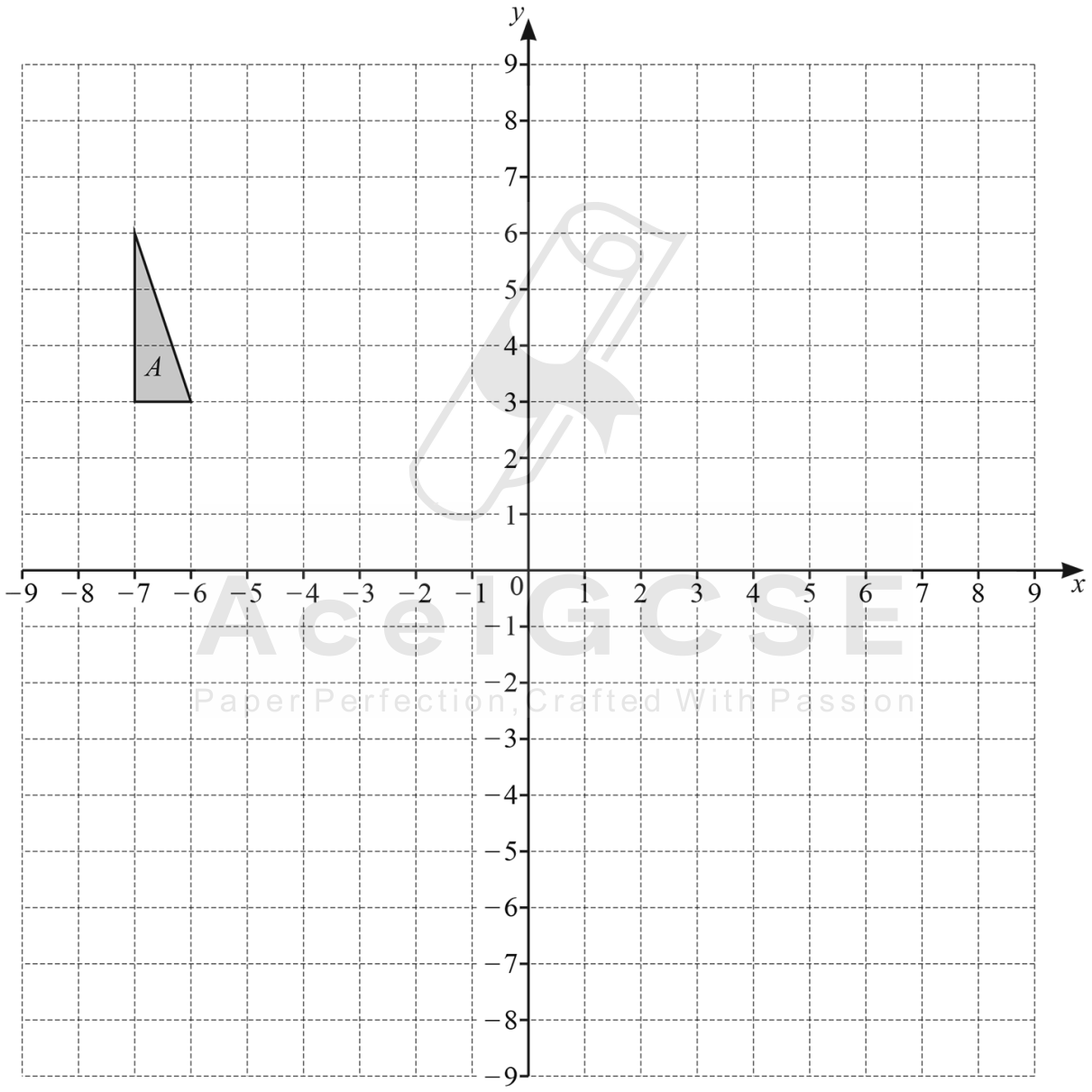
02. 0607_s24_qp_41 Q: 3



(a) Translate triangle A with vector $\begin{pmatrix} 2 \\ -6 \end{pmatrix}$. Label the image B. [2]

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

.....

..... [2]

(c) Rotate triangle A through 90° clockwise about (0, 0). Label the image C. [2]

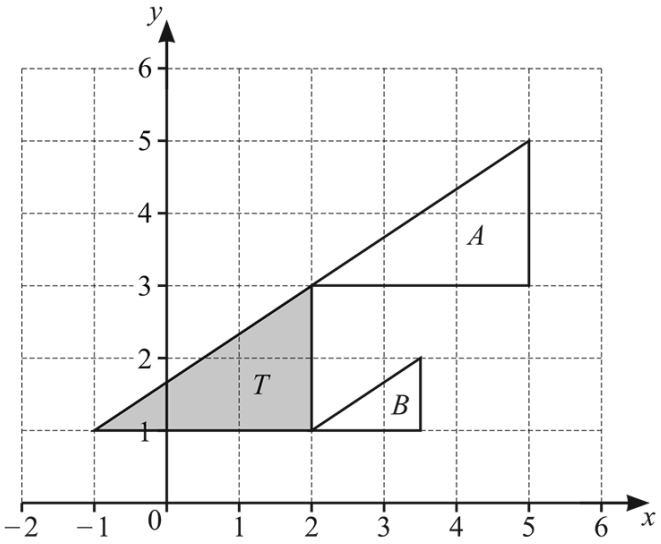
(d) Reflect triangle A in the line $y = x$. Label the image D. [2]

(e) Describe fully the **single** transformation that maps triangle C onto triangle B.

.....

..... [3]

(a)



Describe fully the **single** transformation that maps

(i) triangle T onto triangle A

.....

..... [2]

(ii) triangle T onto triangle B.

.....

..... [3]

(b) P is the point $(-3, 2)$.

The vector from P to Q is $\begin{pmatrix} 5 \\ -7 \end{pmatrix}$.

(i) Find the coordinates of Q.

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

(ii) Find the magnitude of the vector $\begin{pmatrix} 5 \\ -7 \end{pmatrix}$.

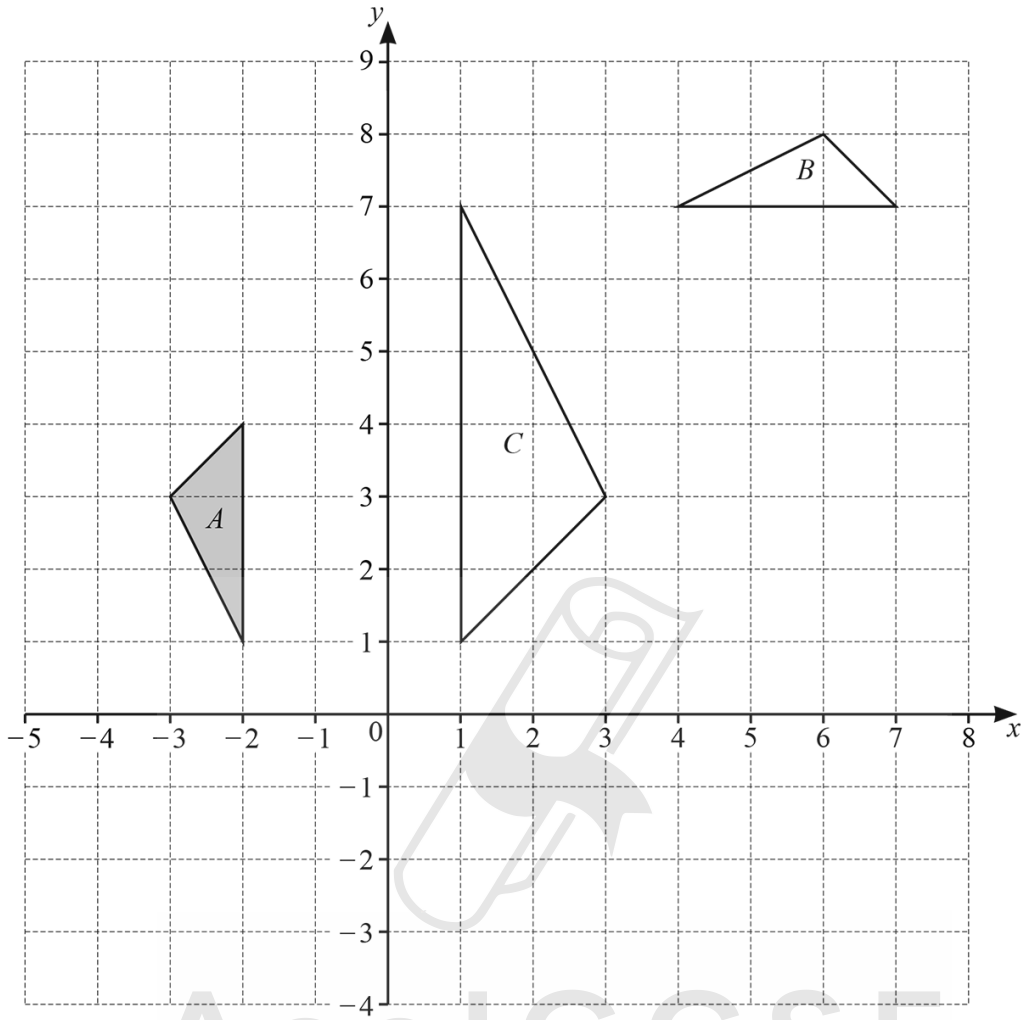
..... [2]

(c) Find the equation of the line that passes through the points $(-3, -1)$ and $(1, 11)$.
Give your answer in the form $y = mx + c$.

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

04. 0607_s24_qp_43 Q: 6

(a)



(i) Reflect triangle A in the line $y = x$. [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) Write down the inverse of each of these transformations.

(i) Translation with the vector $\begin{pmatrix} -3 \\ 4 \end{pmatrix}$

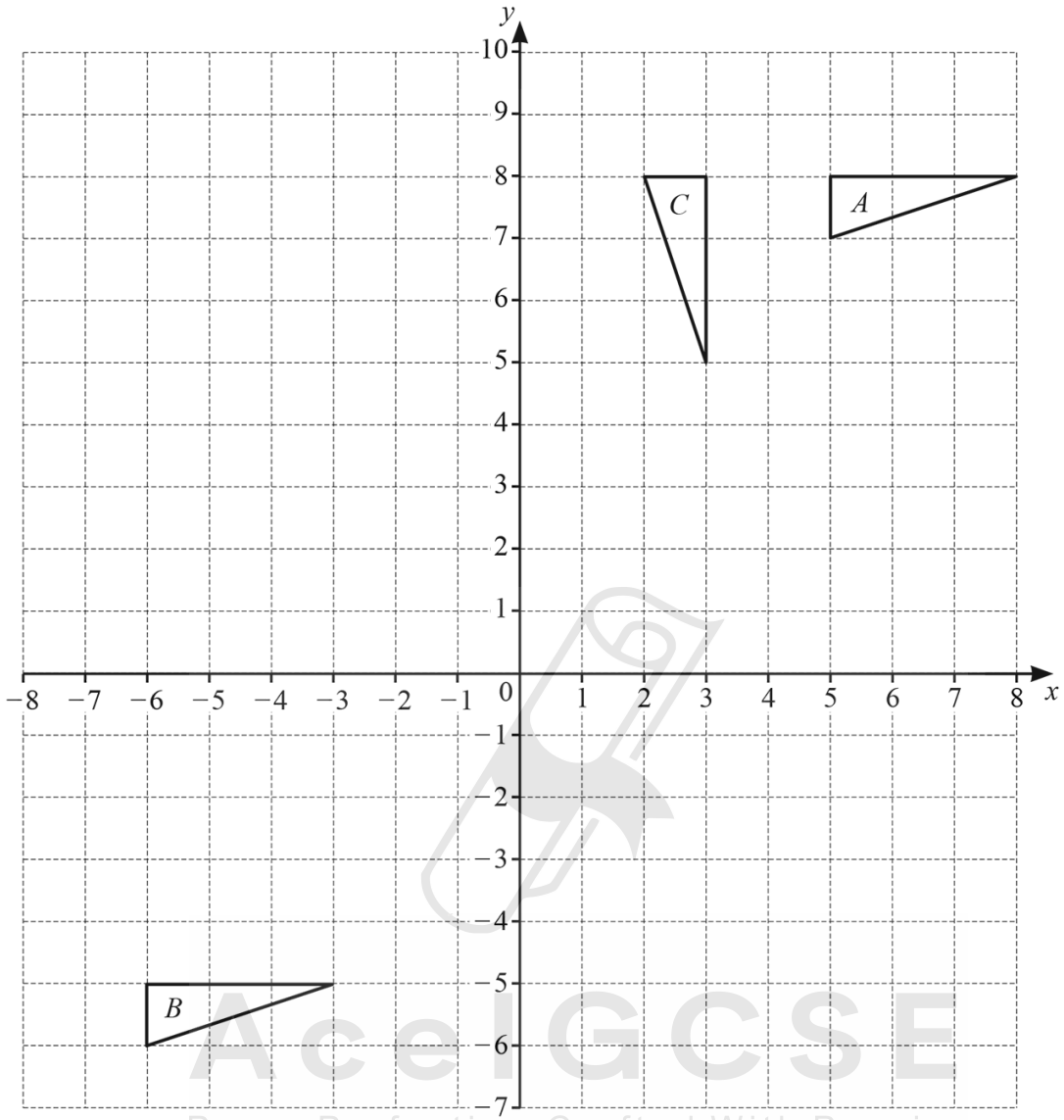
.....

..... [2]

(ii) Stretch with the line $y = 1$ invariant and stretch factor 3

.....

..... [3]



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

.....

..... [2]

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

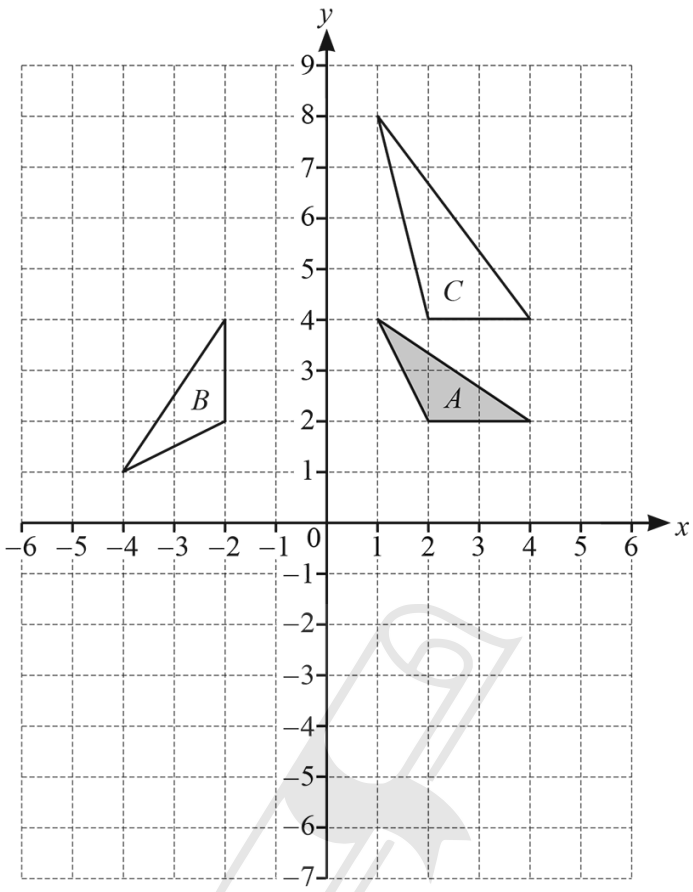
.....

..... [3]

(c) Reflect **triangle *B*** in the line $y = 1$. Label the image *D*. [2]

(d) Enlarge **triangle *B*** scale factor 2, centre $(-6, -6)$. Label the image *E*. [2]

06. 0607_s23_qp_42 Q: 3



(a) Reflect triangle A in the line $y = -1$. [2]

(b) Translate triangle A by the vector $\begin{pmatrix} -5 \\ 3 \end{pmatrix}$. [2]

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

.....

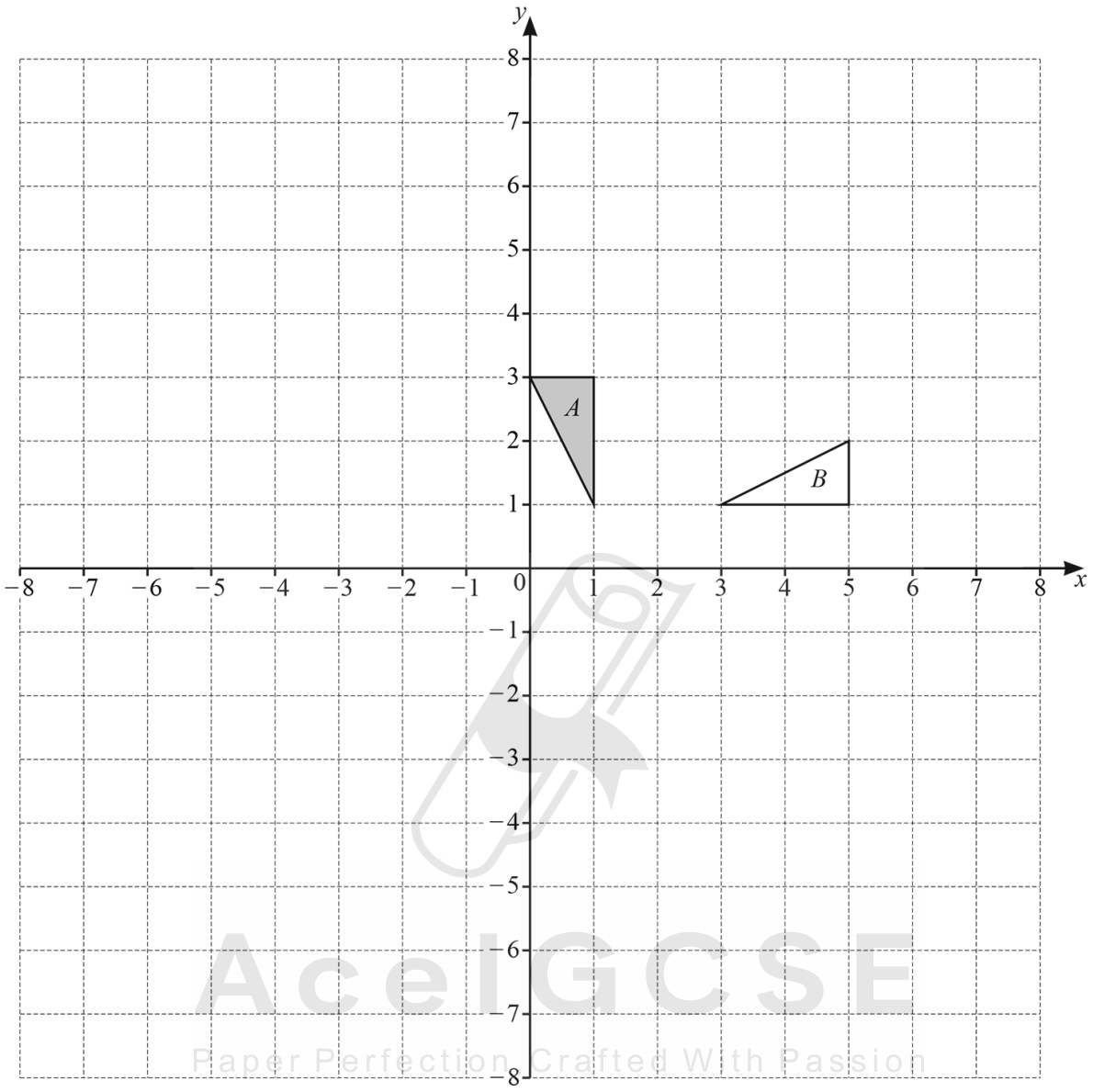
..... [3]

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

.....

..... [3]

07. 0607_s23_qp_43 Q: 1



(a) Translate triangle A by $\begin{pmatrix} -6 \\ 4 \end{pmatrix}$. Label the image C. [2]

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

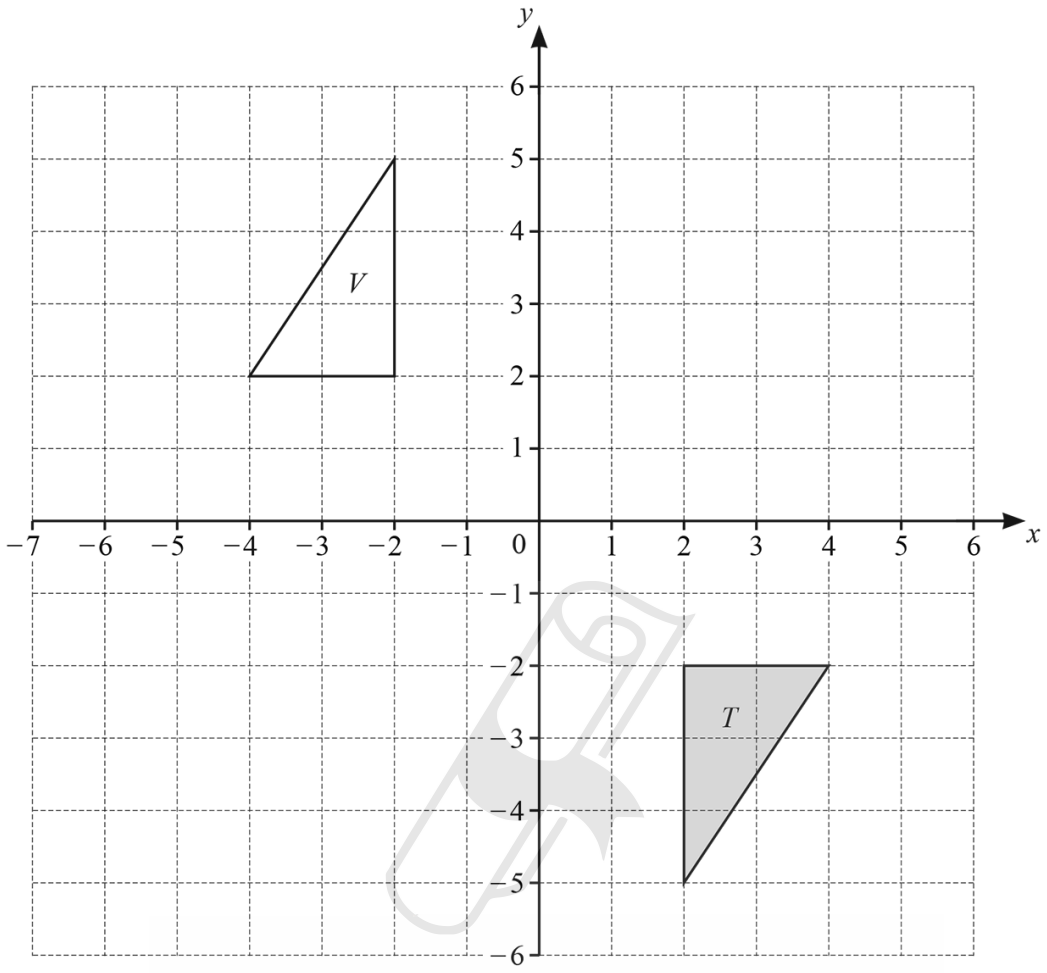
.....

..... [3]

(c) Reflect triangle A in the line $x = -2$. Label the image D. [2]

(d) Enlarge triangle A by scale factor -1, centre (0, 0). Label the image E. [2]

08. 0607_w23_qp_42 Q: 1



(a) Reflect triangle T in the line $x = -1$. Label the image A. [2]

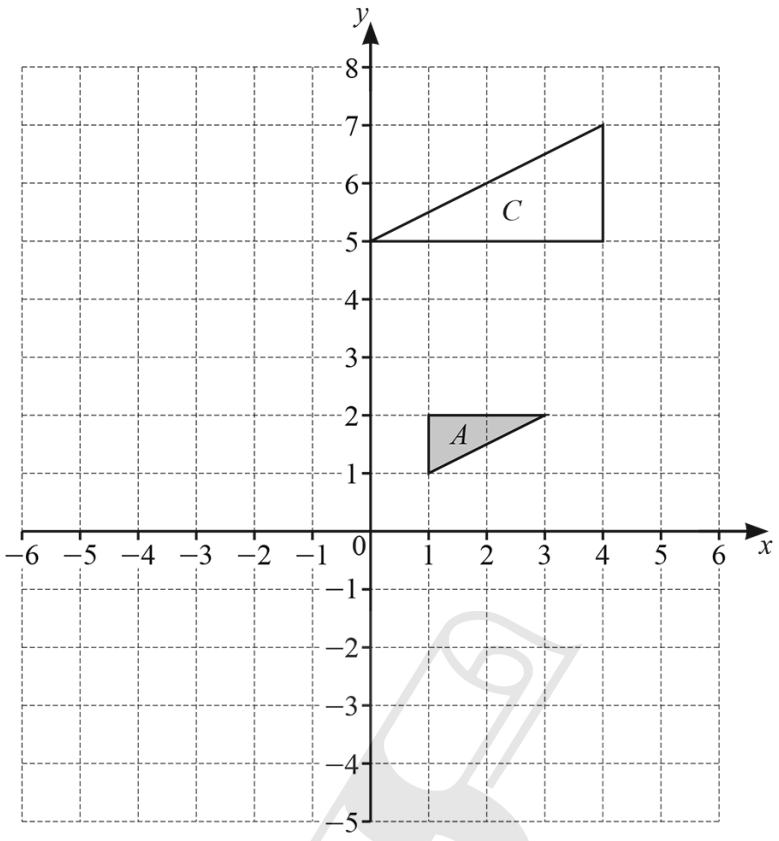
(b) Translate triangle T using the vector $\begin{pmatrix} 1 \\ 4 \end{pmatrix}$. Label the image B. [2]

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

.....

..... [3]

(d) Stretch **triangle V** with factor $\frac{1}{2}$ and invariant line $x = 2$. Label the image C. [2]



(a) Translate triangle A by the vector $\begin{pmatrix} -5 \\ 2 \end{pmatrix}$. Label the image B. [2]

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

.....

..... [3]

(c) **(i)** Triangle D is the image of triangle A after a reflection in the line $y = -1$ followed by a rotation, 90° clockwise, about the point $(1, -1)$.

Draw and label triangle D. [4]

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

.....

..... [2]

10. 0607_w20_qp_42 Q: 12

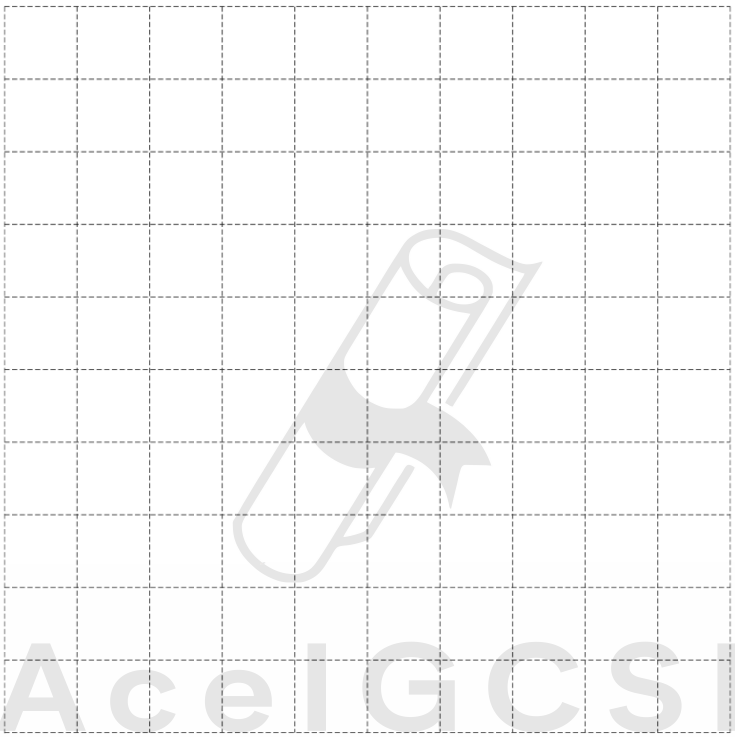
(a) The vector $\mathbf{a} = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$ and the vector $\mathbf{b} = \begin{pmatrix} 2 \\ -1 \end{pmatrix}$.

On the grid, draw and label these vectors.

(i) $2\mathbf{a}$ [1]

(ii) $-\mathbf{b}$ [1]

(iii) $\mathbf{a} - 2\mathbf{b}$ [2]



(b) $p\begin{pmatrix}2\\3\end{pmatrix}+q\begin{pmatrix}-1\\4\end{pmatrix}=\begin{pmatrix}10\\-7\end{pmatrix}$

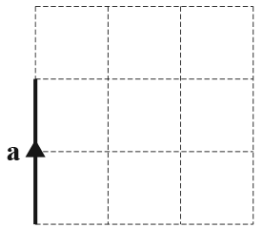
By solving a pair of simultaneous equations, find the value of p and the value of q.
Show all your working.

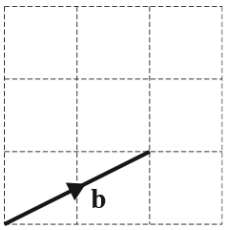
p = ...

q = ... [4]

11. 0607_s19_qp_41 Q: 7

The vectors **a** and **b** are shown on the grids.



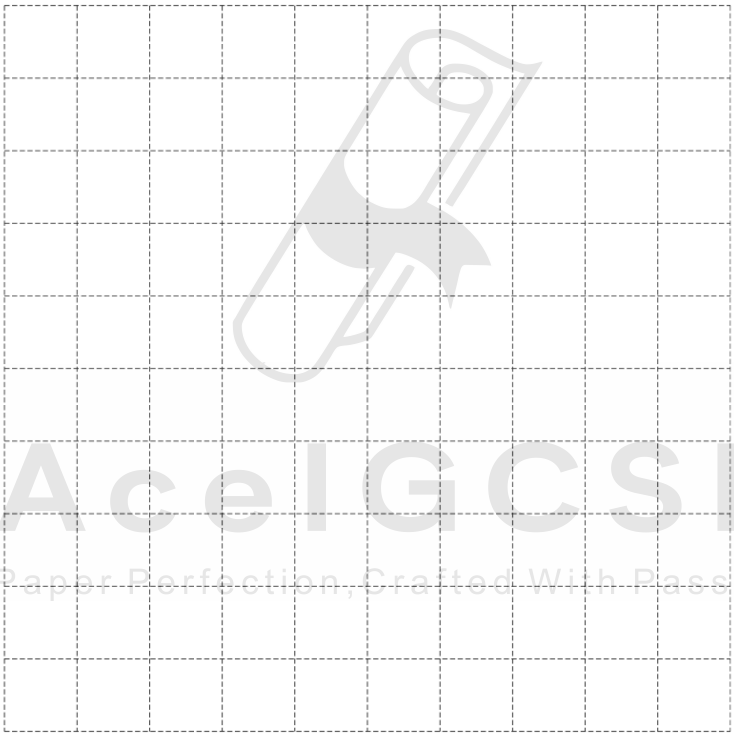


(a) On the grid below, draw and label the following three vectors.

$2\mathbf{b}$

$2\mathbf{a} + \mathbf{b}$

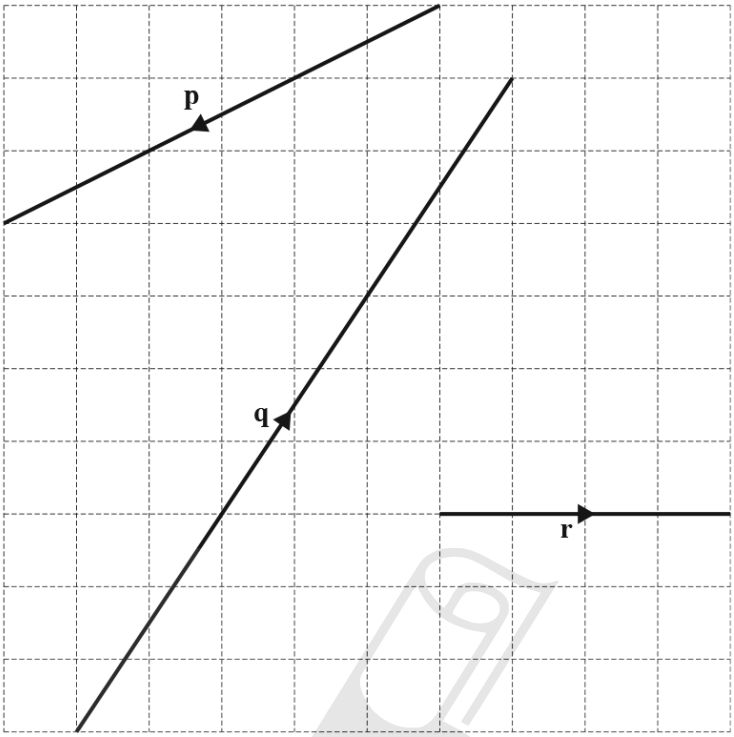
$\mathbf{a} - 2\mathbf{b}$



[3]

(b) Vectors **p**, **q**, and **r** are drawn on this grid.

Write each of the vectors in terms of **a** and/or **b**.



p = ...

q = ...

r = ... [3]

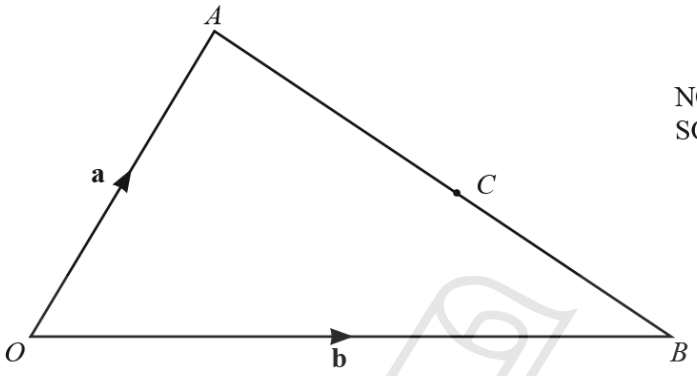
12. 0607_w19_qp_43 Q: 6

(a) P is the point $(3, 5)$ and Q is the point $(7, -2)$.
Q is the midpoint of PR.

Find the co-ordinates of the point R.

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

(b)



NOT TO SCALE

$\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$.
C divides AB in the ratio 4 : 3.

Find these vectors, in terms of **a** and **b**, in their simplest form.

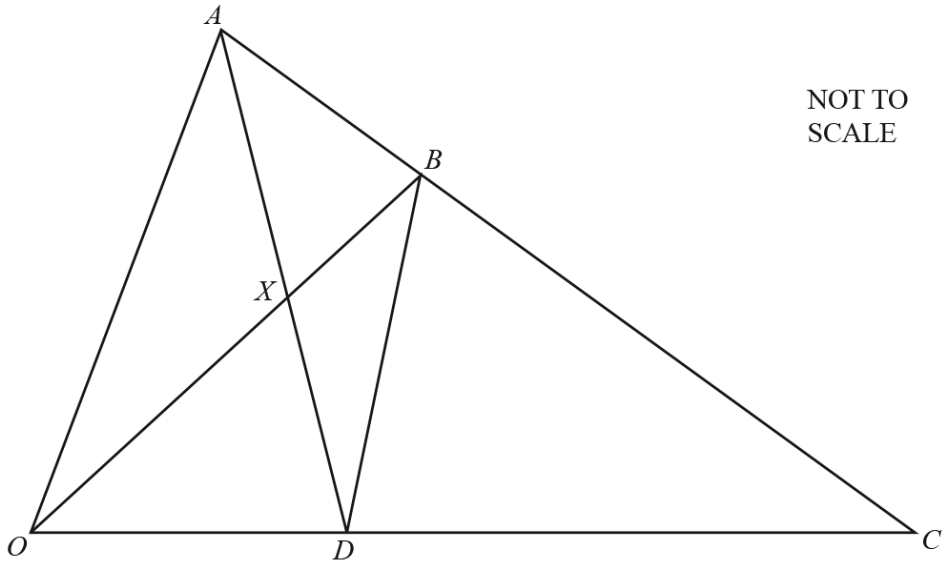
(i) $\overrightarrow{AB}$

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

(ii) $\overrightarrow{OC}$

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

13. 0607_w18_qp_41 Q: 10



NOT TO SCALE

OAC is a triangle with $AB : BC = 1 : 2$ and $OD : DC = 1 : 2$.

The lines OB and AD intersect at X.

$\overrightarrow{OA} = 6\mathbf{a}$ and $\overrightarrow{OC} = 6\mathbf{c}$.

(a) Find an expression, in terms of **a** and/or **c**, for

(i) $\overrightarrow{AC}$,

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

(ii) $\overrightarrow{BC}$,

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

(iii) $\overrightarrow{BD}$, giving your answer in its simplest form.

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

(b) Use your answer to **part (a)(iii)** to explain why OA and BD are parallel.

..... [1]

(c) Explain why triangle OAX and triangle BDX are similar.

.....

..... [2]

(d) Find an expression, in terms of **a** and **c**, for

(i) $\overrightarrow{AD}$,

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

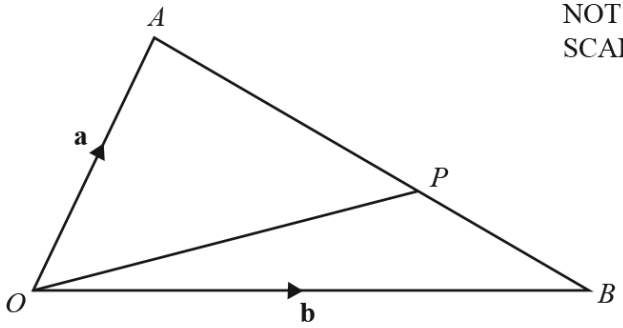
(ii) $\overrightarrow{XD}$, giving your answer in its simplest form.

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

(e) Find the ratio area AXO : area BXD.

..... : ..... [2]

14. 0607_w18_qp_42 Q: 13



The point P divides AB in the ratio 3 : 2.

$\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$.

(a) Write each of these vectors in terms of **a** and/or **b**, giving each answer in its simplest form.

(i) $\overrightarrow{AB}$

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

(ii) $\overrightarrow{OP}$

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

(b) The point Q is such that $\overrightarrow{OQ} = \frac{5}{3}\overrightarrow{OP}$.

(i) Write $\overrightarrow{BQ}$, in terms of **a** and/or **b**, in its simplest form.

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

(ii) Use your answer to **part (b)(i)** to explain why OA and BQ are parallel.

..... [1]

15. 0607_w18_qp_43 Q: 3

(a) $\mathbf{p} = \begin{pmatrix} 2 \\ -1 \end{pmatrix}$ $\mathbf{q} = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$

Find

(i) $\mathbf{q} - \mathbf{p}$,

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

(ii) $2\mathbf{p}$,

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

(iii) $|2\mathbf{p}|$.

..... [2]

(b) A is the point (0, 2) and B is the point (2, 7).

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

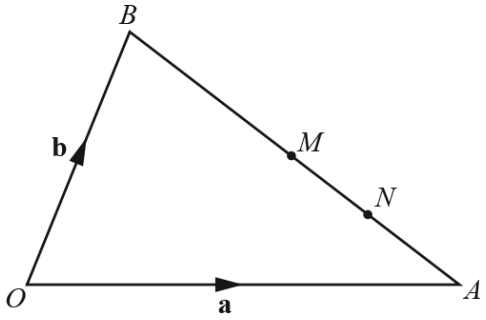
$\begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [2]

(ii) $\overrightarrow{BC} = 2\overrightarrow{AB}$

Find the co-ordinates of C.

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

16. 0607_s17_qp_43 Q: 11



NOT TO SCALE

In the diagram, $\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$.
M is the midpoint of AB and N is the midpoint of AM.

(a) Find each of these vectors in terms of **a** and **b**.
Give each vector in its simplest form.

(i) $\overrightarrow{AB}$

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

(ii) $\overrightarrow{AN}$

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

(iii) $\overrightarrow{ON}$

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

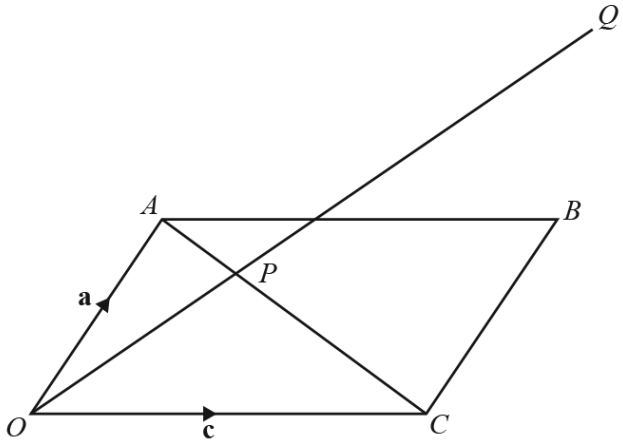
(b) O is the point (0, 0).

$\overrightarrow{OA} = \begin{pmatrix} 8 \\ 0 \end{pmatrix}$ and $\overrightarrow{OB} = \begin{pmatrix} 2 \\ 6 \end{pmatrix}$.

Find the co-ordinates of N.

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

17. 0607_w17_qp_41 Q: 13



NOT TO SCALE

$OABC$ is a parallelogram and OPQ is a straight line.
P divides AC in the ratio 1 : 2.
P divides OQ in the ratio 1 : 2.

$\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OC} = \mathbf{c}$.

(a) Find these vectors in terms of **a** and/or **c**.
Give each answer in its simplest form.

(i) $\overrightarrow{AC}$

..... [1]

(ii) $\overrightarrow{OP}$

..... [2]

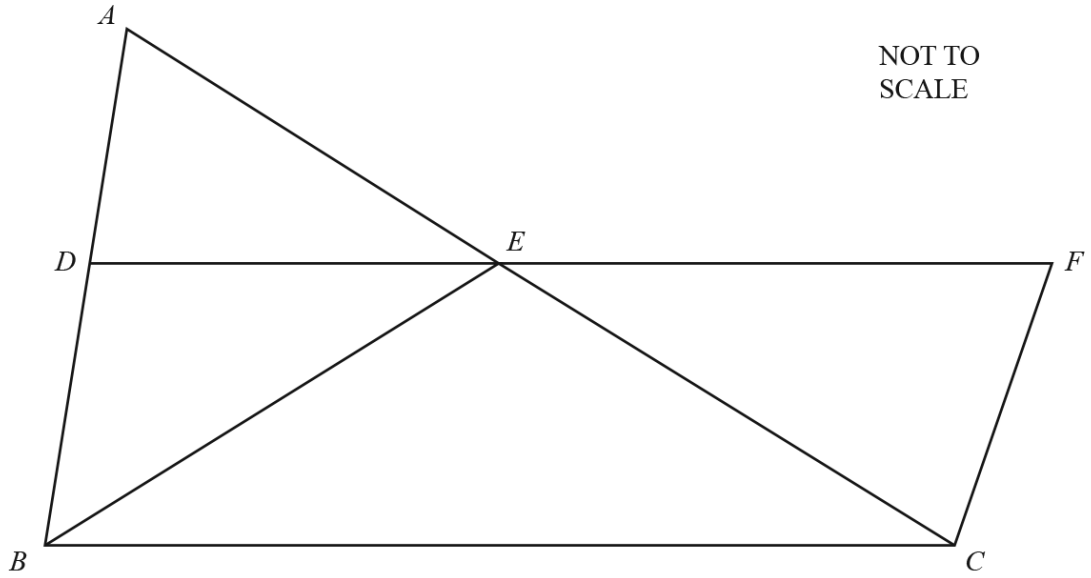
(iii) $\overrightarrow{CQ}$

..... [2]

(b) Use your answer to **part(a)(iii)** to complete the statement.

The points C, B and Q are ..... [1]

18. 0607_w17_qp_43 Q: 5



ABC is a triangle and $BCFD$ is a parallelogram.

$AD = \frac{1}{3}AB$ and $AE = \frac{1}{3}AC$.

$\overrightarrow{AB} = 6\mathbf{p}$ and $\overrightarrow{AC} = 6\mathbf{q}$.

(a) Find an expression, in terms of **p** and/or **q**, for

(i) $\overrightarrow{BC}$,

..... [1]

(ii) $\overrightarrow{DE}$,

..... [2]

(iii) $\overrightarrow{FC}$,

..... [1]

(iv) $\overrightarrow{BE}$.

..... [2]

(b) The area of triangle ADE is 24 units^2.

(i) Find the area of triangle ABC.

..... units^2 [2]

(ii) Find the area of triangle EFC.

..... units^2 [3]

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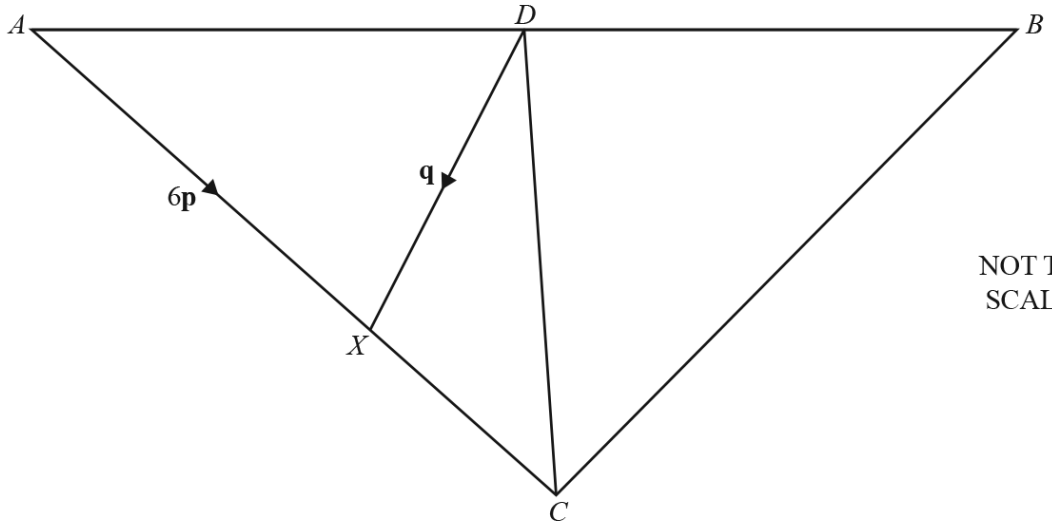
19. 0607_s16_qp_43 Q: 8



NOT TO SCALE

ABC is a triangle.

$AX = \frac{2}{3}AC$ and $AD = \frac{1}{2}AB$.

$\overrightarrow{AX} = 6\mathbf{p}$ and $\overrightarrow{DX} = \mathbf{q}$.

Find an expression, in terms of **p** and **q**, for

(a) $\overrightarrow{AD}$,

..... [2]

(b) $\overrightarrow{DC}$,

..... [2]

(c) $\overrightarrow{CB}$.

..... [3]

20. 0607_w21_qp_42 Q: 6

(a) (i) Work out $\begin{pmatrix}3\\5\end{pmatrix}-2\begin{pmatrix}-1\\-2\end{pmatrix}$.

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

(ii) A is the point (3, 5) and C is the point (4, 3).

Find the column vector that maps the point A onto the point C.

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

(iii) D is the point (1, 3) and the vector from D to E is $\begin{pmatrix}3\\2\end{pmatrix}$.

Find the coordinates of E.

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

(iv) Find the magnitude of the vector $\begin{pmatrix}-3\\-4\end{pmatrix}$.

..... [2]

(b) (i) P is the point $(-1, 6)$ and Q is the point $(3, 4)$.

Find the equation of the perpendicular bisector of the line PQ.

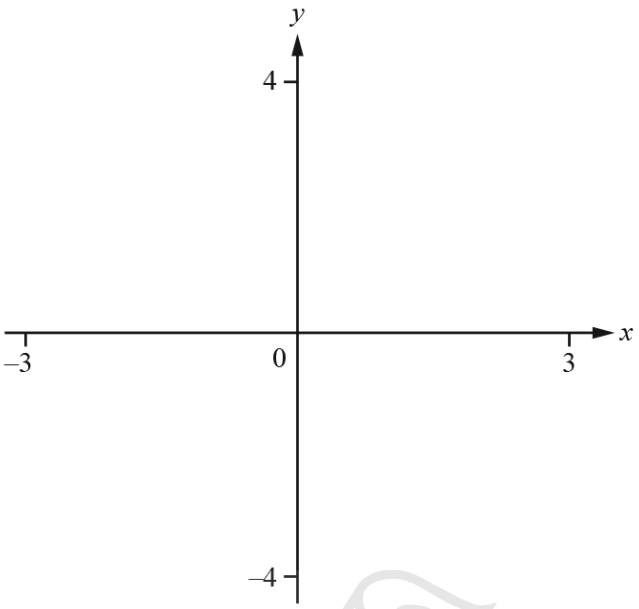
..... [5]

(ii) Find the coordinates of the point where the perpendicular bisector in **part(b)(i)** crosses the x-axis.

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

21. 0607_w18_qp_43 Q: 4

(a)



$f(x) = x + \frac{1}{2x}$, $x \neq 0$

(i) On the diagram, sketch the graph of $y = f(x)$ for values of x between -3 and 3. [3]

(ii) Find the co-ordinates of the local minimum point.

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

(iii) Find the range of $f(x)$ for $x > 0$.

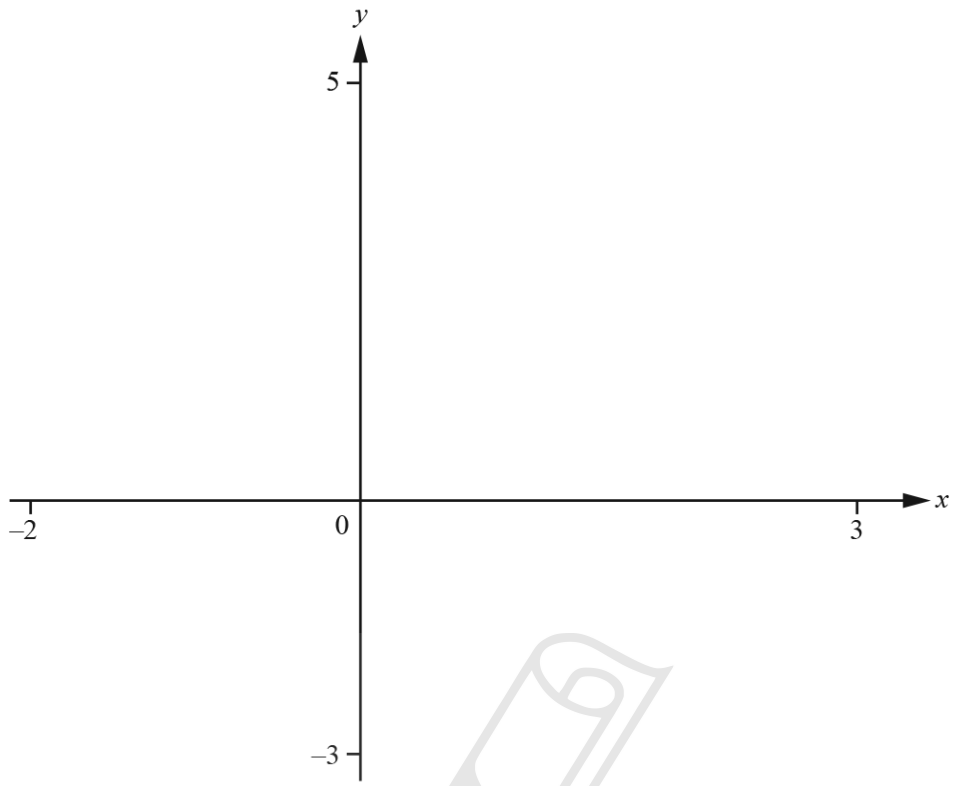
..... [1]

(iv) Write down the equations of the two asymptotes to the graph of $y = f(x)$.

.....

..... [2]

(b)



(i) On the diagram, sketch the graph of

(a) $y = 2^x - 3$ for $-2 \leqslant x \leqslant 3$, [2]

(b) $y = 6\log x$ for $x > 0$. [2]

(ii) Solve the inequality $6\log x > 2^x - 3$.

..... [2]

22. 0607_s17_qp_42 Q: 4

$\mathbf{p} = \begin{pmatrix} -3 \\ 2 \end{pmatrix}$ and $\mathbf{q} = \begin{pmatrix} 4 \\ 3 \end{pmatrix}$

(a) Find

(i) the column vector $\frac{1}{2}\mathbf{p}$,

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

(ii) the column vector $\mathbf{q} - 2\mathbf{p}$,

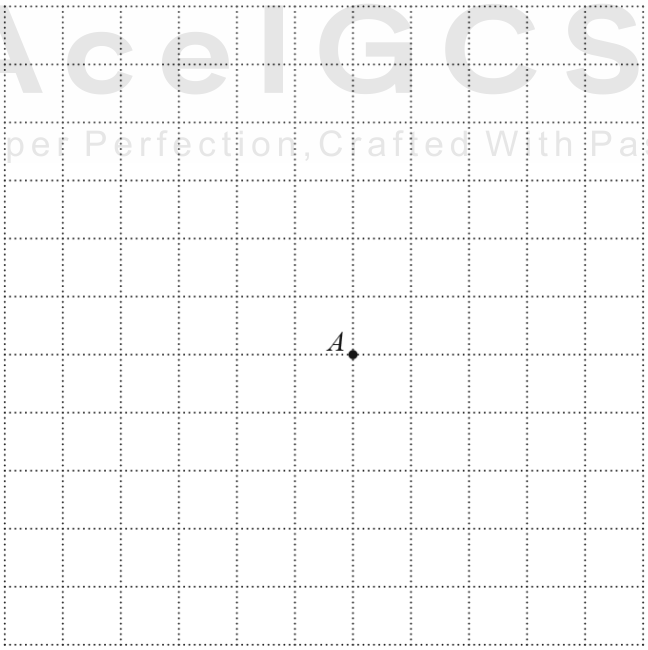
$\begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [2]

(iii) $|\mathbf{p}|$, leaving your answer in surd form.

..... [2]

(b) $\overrightarrow{AB} = \mathbf{p} + \mathbf{q}$

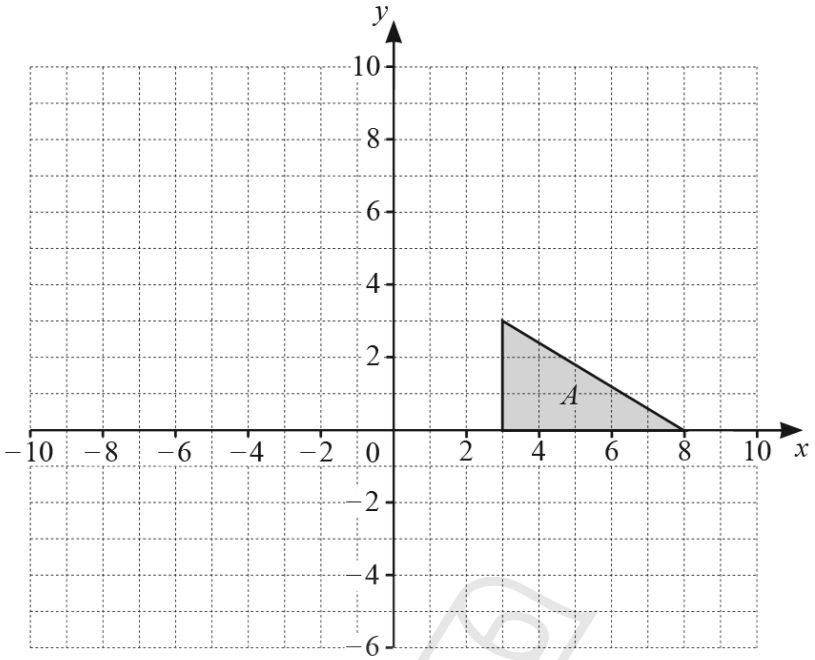
Mark and label point B on the grid.



[2]

23. 0607_m21_qp_42 Q: 1

(a)



(i) Rotate triangle A through 90° anticlockwise about (0, 0). Label the image B. [2]

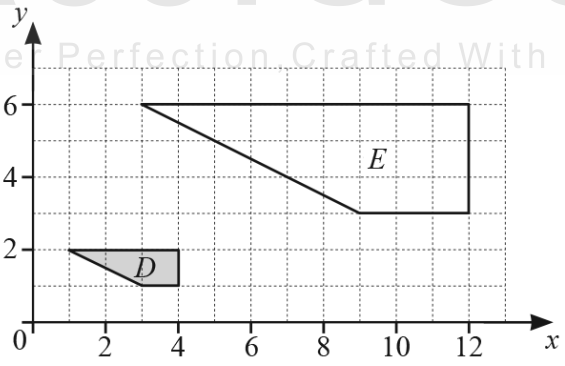
(ii) Reflect triangle A in the y-axis. Label the image C. [1]

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

.....

..... [2]

(b)

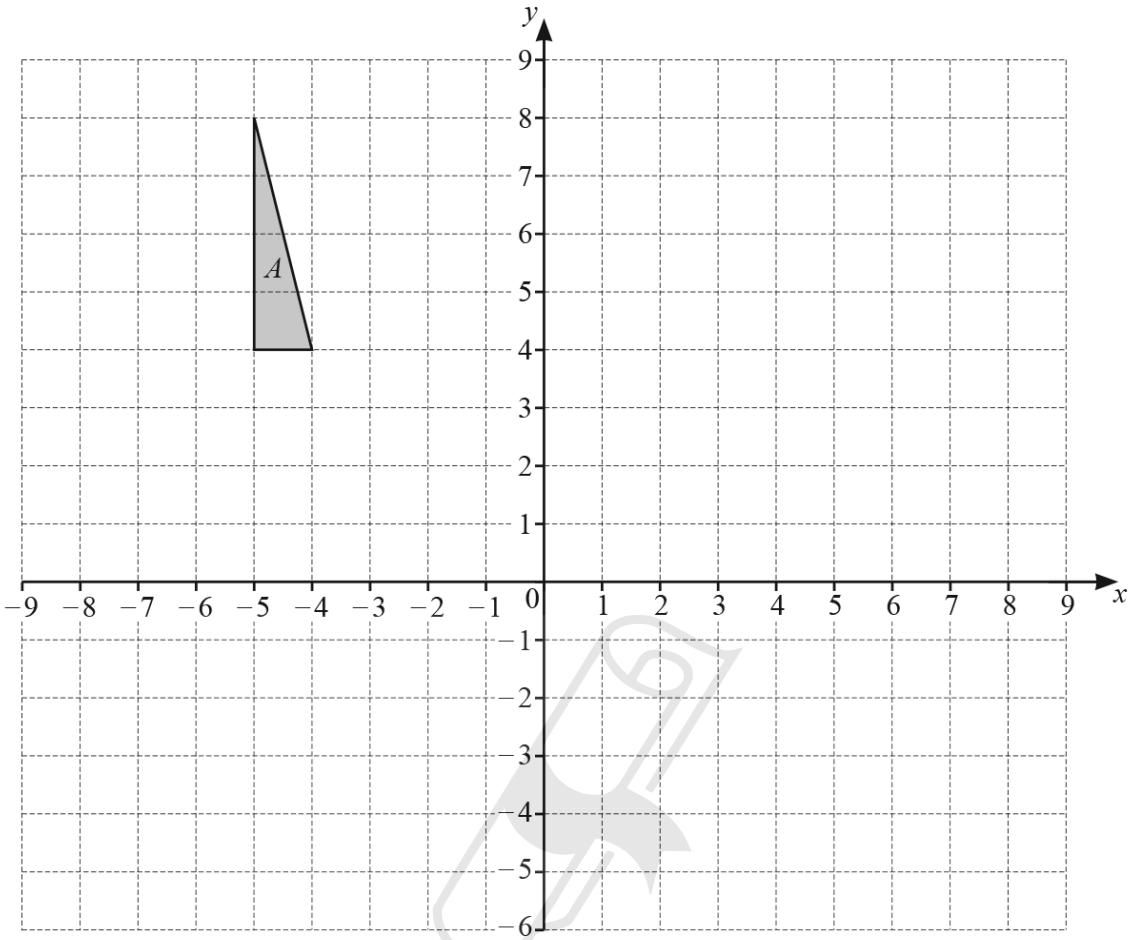


Describe fully the **single** transformation that maps trapezium D onto trapezium E.

.....

..... [3]

24. 0607_s21_qp_41 Q: 2



(a) Translate triangle A with vector $\begin{pmatrix}-3\\-5\end{pmatrix}$. Label the image B. [2]

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

.....

..... [2]

(c) Rotate triangle A through 90° clockwise about (0, 0). Label the image C. [2]

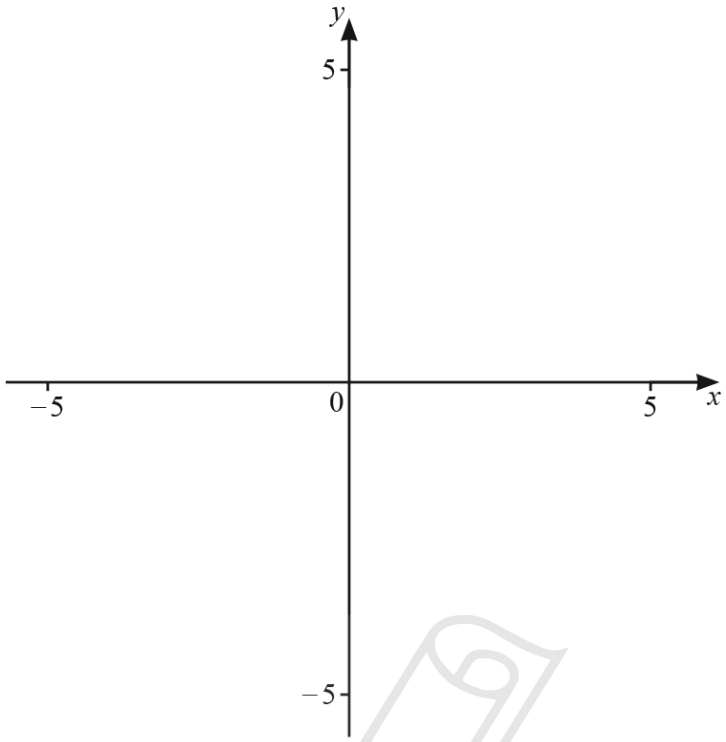
(d) Reflect triangle A in the line $y = x$. Label the image D. [2]

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

.....

..... [2]

25. 0607_s21_qp_43 Q: 1



$f(x) = x - \frac{4}{x}$

(a) On the diagram, sketch the graph of $y = f(x)$ for values of x between -5 and 5. [2]

(b) Find the zeros of $f(x)$.

$x =$ ..... or $x =$ ..... [2]

(c) Solve the equation $f(x) = 2$.

$x =$ ..... or $x =$ ..... [2]

(d) $g(x) = f(x + 2)$

(i) On the same diagram, sketch the graph of $y = g(x)$ for values of x between -5 and 5. [2]

(ii) Describe fully the **single** transformation that maps the graph of $y = f(x)$ onto the graph of $y = g(x)$.

.....

..... [2]

26. 0607_w21_qp_41 Q: 2

(a) In **part (a)** enlargements and stretches have scale factors greater than 1.

(i) A transformation maps triangle A onto triangle B.
Triangle A is congruent to triangle B.

Tick all the possible transformations it could be.

Transformation	Tick (✓)
Rotation	
Reflection	
Translation	
Enlargement	
Stretch	

[1]

(ii) A transformation maps triangle C onto triangle D.
The angles of triangle C are the same as the corresponding angles of triangle D.

Tick all the possible transformations it could be.

Transformation	Tick (✓)
Rotation	
Reflection	
Translation	
Enlargement	
Stretch	

[1]

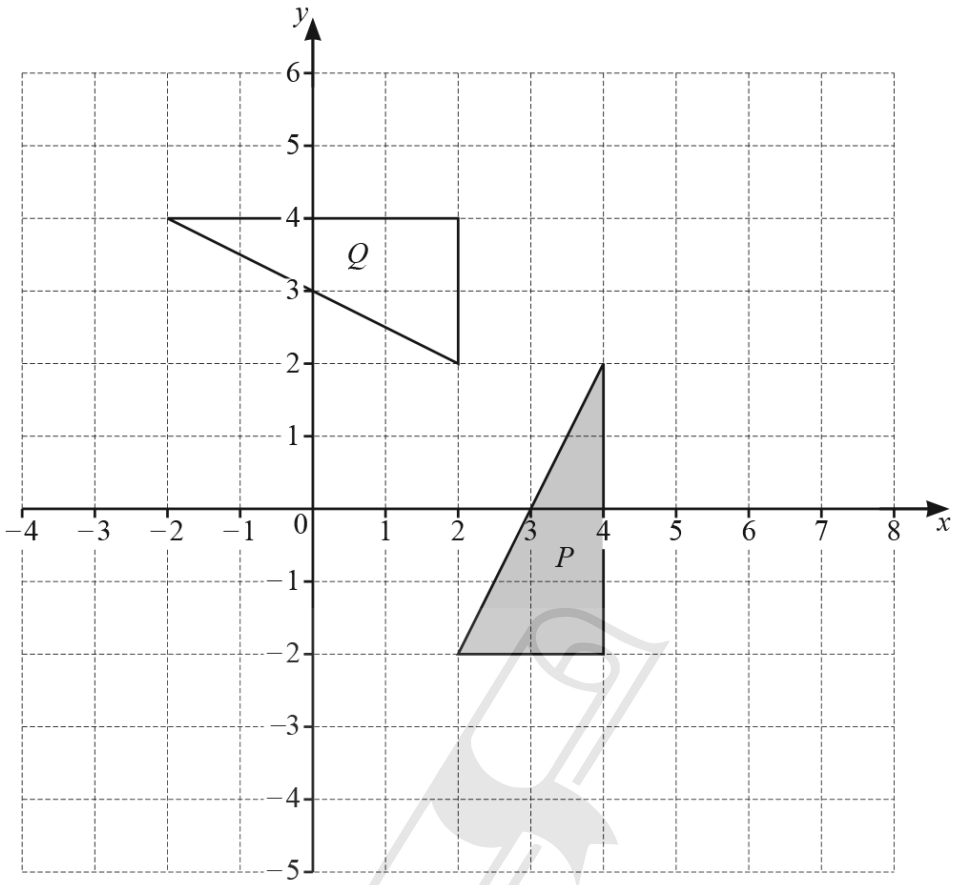
(iii) A transformation maps triangle E onto triangle F.
Triangle F has a larger area than triangle E.

Tick all the possible transformations it could be.

Transformation	Tick (✓)
Rotation	
Reflection	
Translation	
Enlargement	
Stretch	

[1]

(b)



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

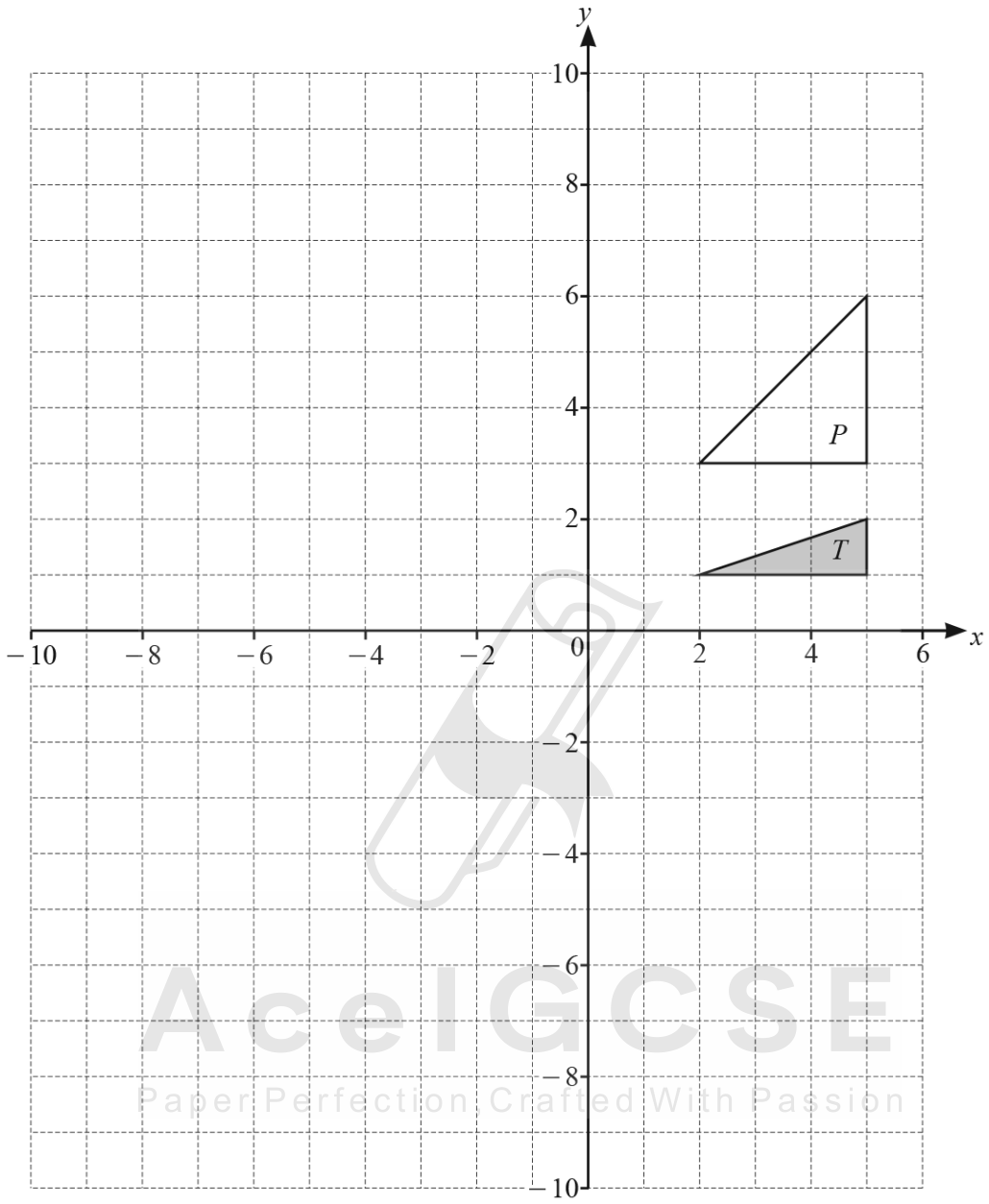
.....

..... [3]

(ii) Stretch triangle P with the x-axis invariant and scale factor 2. [2]

27. 0607_w21_qp_42 Q: 5

(a)



(i) Reflect shape T in the y-axis. [1]

(ii) Translate shape T by the vector $\begin{pmatrix} -10 \\ 5 \end{pmatrix}$. [2]

(iii) Rotate shape T through 90° clockwise about the point (2, 0). [2]

(iv) Enlarge shape T with scale factor -2 and centre (0, 0). [2]

(v) Describe fully the **single** transformation that maps shape T onto shape P.

.....

..... [3]

(b) $f(x) = x^2$

(i) The graph of $y = f(x)$ is mapped onto the graph of $y = g(x)$ by a translation with vector $\begin{pmatrix} 0 \\ 2 \end{pmatrix}$.

Find $g(x)$ in terms of x.

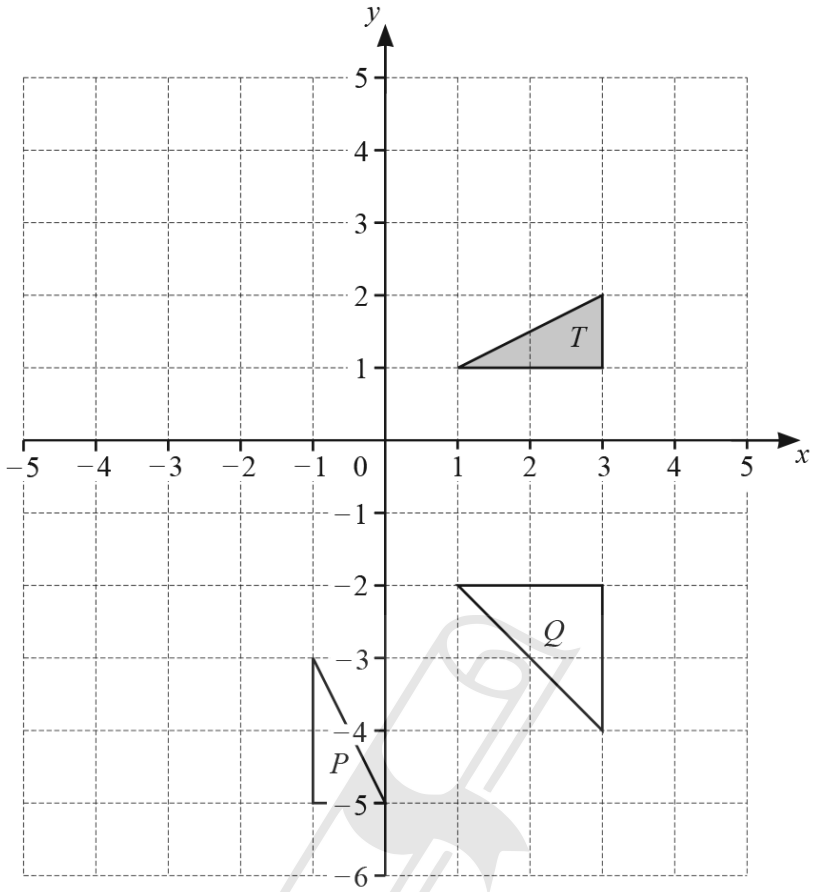
$g(x) =$ ..... [1]

(ii) The graph of $y = f(x)$ is mapped onto the graph of $y = h(x)$ by a stretch with factor 2 and the x-axis invariant.

Find $h(x)$ in terms of x.

$h(x) =$ ..... [1]

28. 0607_s20_qp_41 Q: 1



(a) **(i)** Reflect shape T in the y-axis. [1]

(ii) Translate shape T by the vector $\begin{pmatrix} -5 \\ 3 \end{pmatrix}$. [2]

(iii) Enlarge shape T by scale factor 2, centre (2, 0). [2]

(b) Describe fully the **single** transformation that maps shape T onto

(i) shape P,

.....

..... [3]

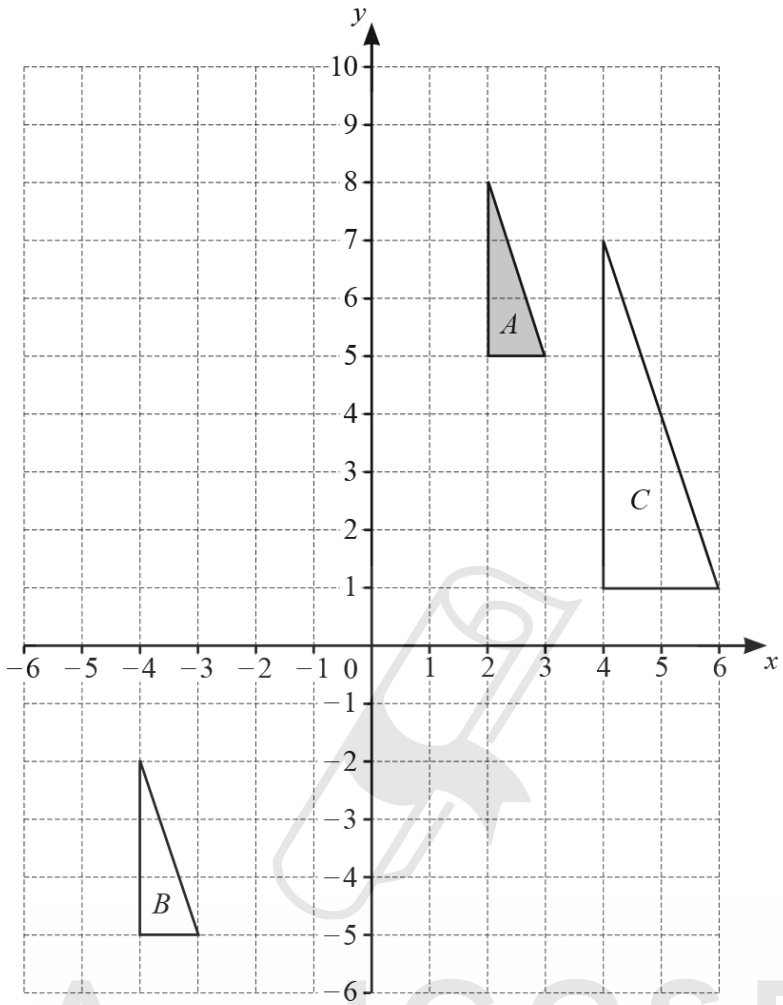
(ii) shape Q.

.....

..... [3]

29. 0607_s20_qp_42 Q: 2

(a)



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

.....

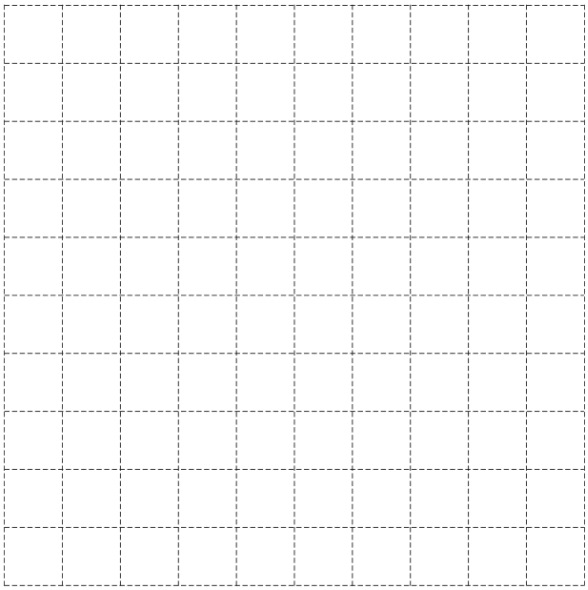
..... [2]

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

.....

..... [3]

(b) You may use the grid to help you in answering this question.



The transformation P is a rotation of 90° clockwise about the origin.
The transformation Q is a reflection in the line $y = -x$.

(i) Find the image of the point $(5, -2)$ under the transformation P.

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

(ii) Find the image of the point $(5, -2)$ under the transformation Q.

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

(iii) Describe fully the **single** transformation equivalent to P followed by Q.

.....

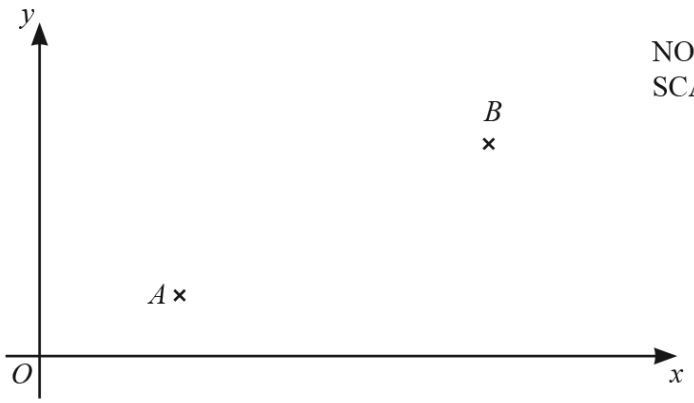
..... [2]

(iv) Describe fully the **single** transformation equivalent to Q followed by P.

.....

..... [2]

30. 0607_w20_qp_42 Q: 7



A is the point (3, 2) and B is the point (9, 5).

(a) Find the length AB.

$AB =$ ..... [3]

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

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

(c) C is the point (8, 2).

Find the equation of the line perpendicular to AB which passes through C.
Give your answer in the form $y = mx + c$.

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

(d) Find the coordinates of the point where the line in **part (c)** intersects AB.

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

(e) D is the reflection of C in the line AB.

(i) Find the coordinates of D.

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

(ii) What is the special name of quadrilateral $ACBD$?

..... [1]

(f) Find the area of the quadrilateral $ACBD$.

..... [3]

31. 0607_w20_qp_43 Q: 9

$\mathbf{p} = \begin{pmatrix} -1 \\ 3 \end{pmatrix}$ $\mathbf{q} = \begin{pmatrix} 2 \\ -1 \end{pmatrix}$

A is the point (3, 4).

(a) Find $\mathbf{p} - \mathbf{q}$.

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

(b) A is translated onto H by the vector $\mathbf{p}$.

Find the coordinates of H.

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

(c) J is translated onto A by the vector $\mathbf{q}$.

Find the coordinates of J.

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

(d) Find the coordinates of the mid-point of HJ.

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

(e) Find the length of HJ.

$HJ =$ ..... [3]

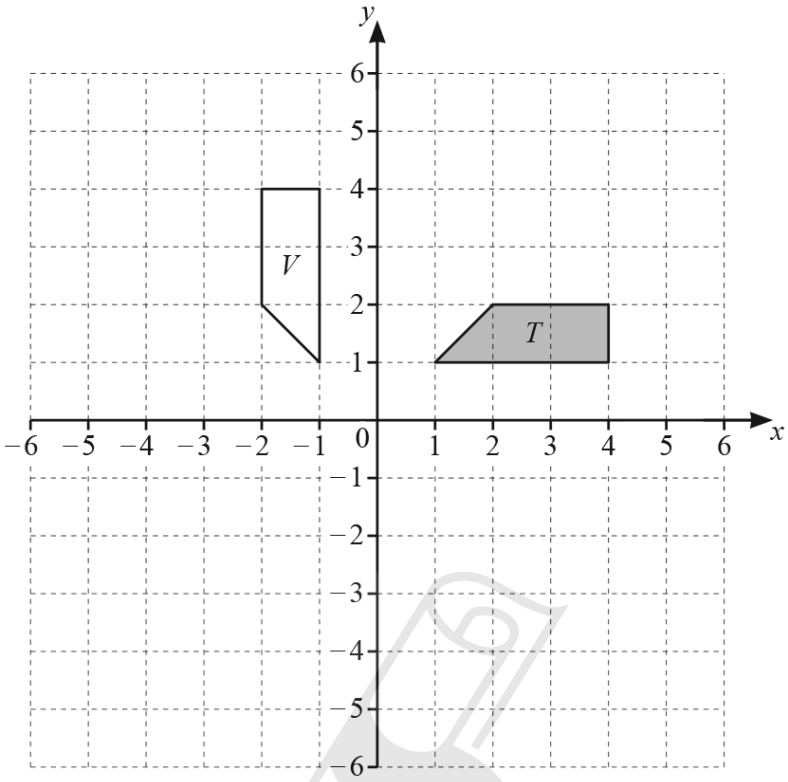
(f) A line L, parallel to the vector $\mathbf{q}$, has gradient $-\frac{1}{2}$.

Find the equation of the line perpendicular to the line L that passes through the point A.

..... [3]

32. 0607_w20_qp_43 Q: 10

(a)



(i) Describe fully the **single** transformation that maps shape T onto shape V.

.....

..... [3]

(ii) Reflect shape T in the line $y = -2$. [2]

(iii) Stretch shape T by a factor of 2 with the x-axis invariant. [2]

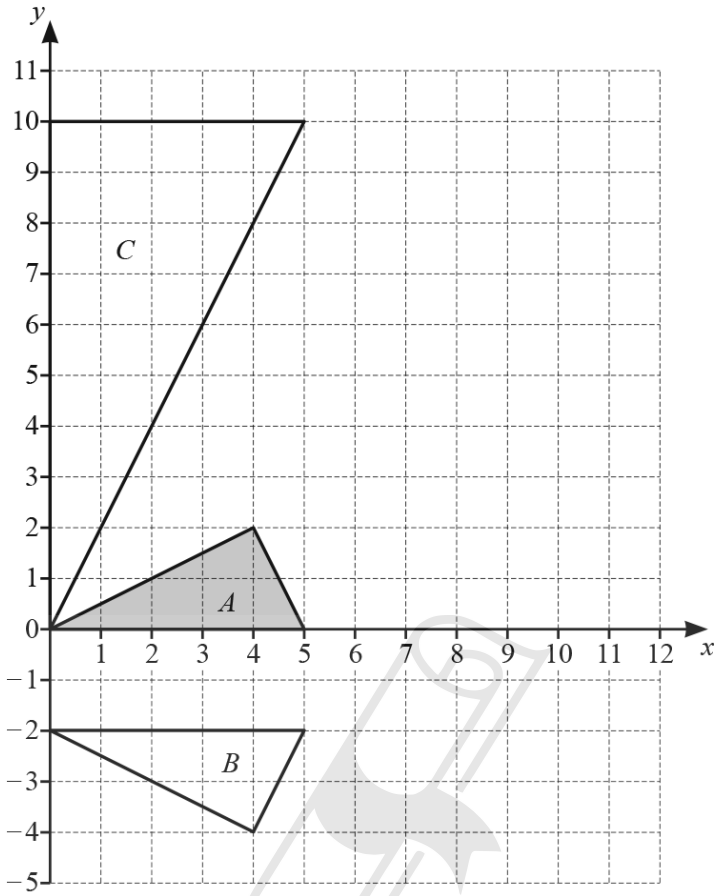
(b) $f(x) = \log(x)$ $g(x) = \log(x^3)$

Describe fully the **single** transformation that maps the graph of $y = f(x)$ onto the graph of $y = g(x)$.

.....

..... [3]

33. 0607_s19_qp_41 Q: 2



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

..... [2]

(b) Translate triangle A by the vector $\begin{pmatrix} 6 \\ -3 \end{pmatrix}$. [2]

(c) Triangle A can be mapped onto triangle C by a rotation followed by an enlargement.

(i) Use trigonometry to calculate the angle of rotation.

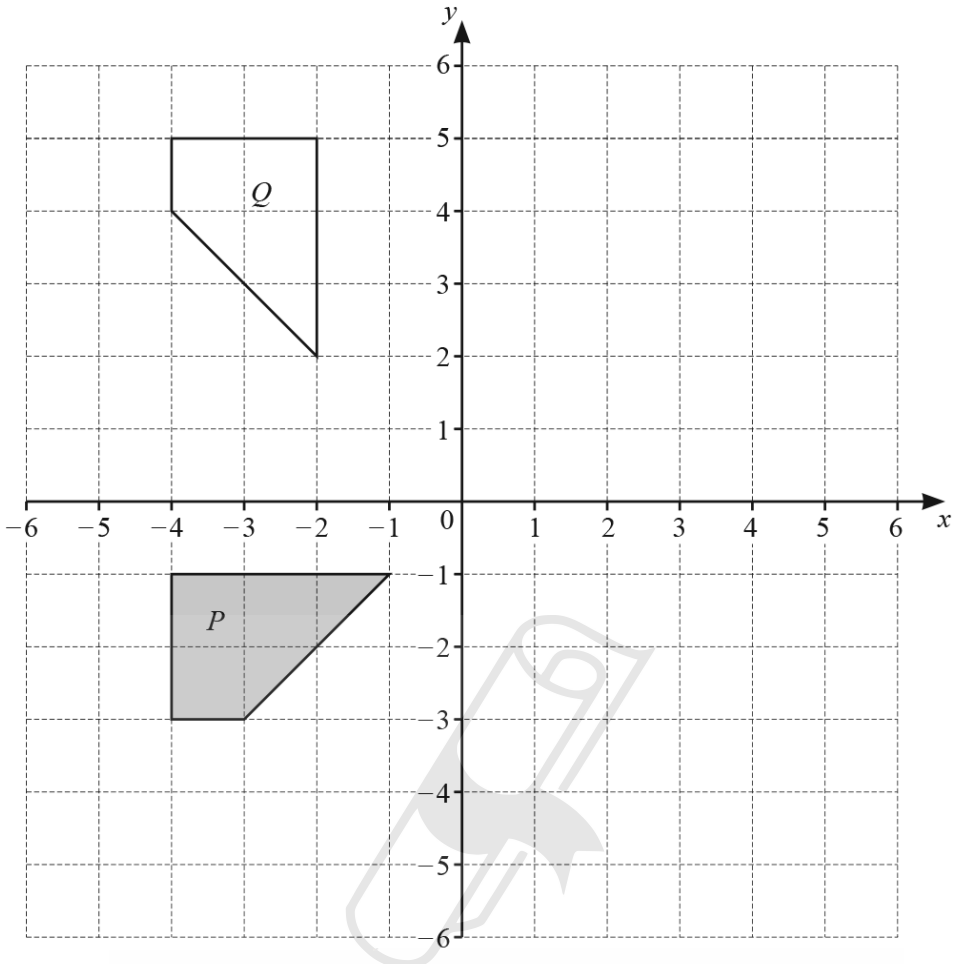
..... [3]

(ii) The scale factor of the enlargement is $\sqrt{a}$ where a is an integer.

Find the value of a.

$a =$ ..... [3]

34. 0607_s19_qp_42 Q: 6



(a) Reflect shape P in the y-axis. [1]

(b) Translate shape P by the vector $\begin{pmatrix} 6 \\ -3 \end{pmatrix}$. [2]

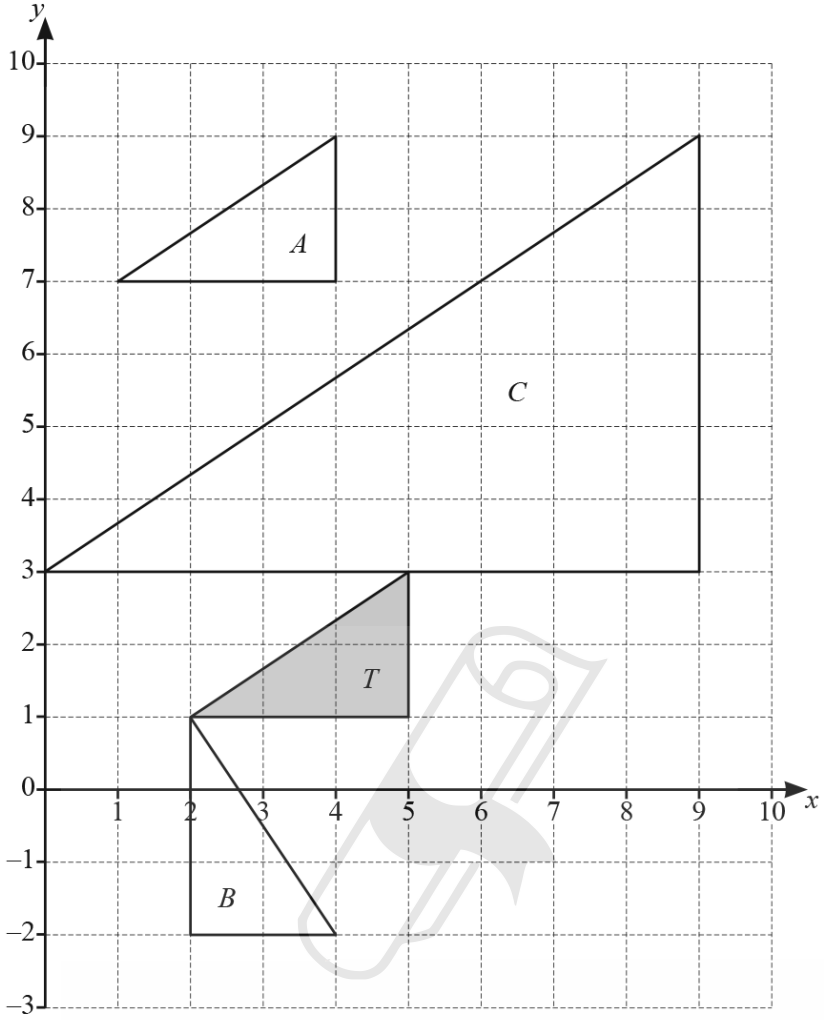
(c) Describe fully the **single** transformation that maps shape P onto shape Q.

.....

..... [3]

(d) Stretch shape P with stretch factor 2 and the x-axis invariant. [2]

35. 0607_w19_qp_41 Q: 4



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

(i) triangle A,

.....

..... [2]

(ii) triangle B,

.....

..... [3]

(iii) triangle C.

.....

..... [3]

(b) Stretch triangle T by a factor of 2 with the y–axis invariant. [2]

36. 0607_w19_qp_41 Q: 11

$f(x) = 3\sin(3x°)$

(a) On the diagram, sketch the graph of $y = f(x)$ for $0 \leqslant x \leqslant 180$. [2]

(b) Write down the amplitude and the period of $f(x)$.

Amplitude = ...

Period = ... [2]

(c) Solve the inequality $f(x) < -1.5$ for $0 \leqslant x \leqslant 180$.

..... [2]

(d) $g(x) = 3\sin(x°)$

(i) On the same diagram, sketch the graph of $y = g(x)$ for $0 \leqslant x \leqslant 180$. [1]

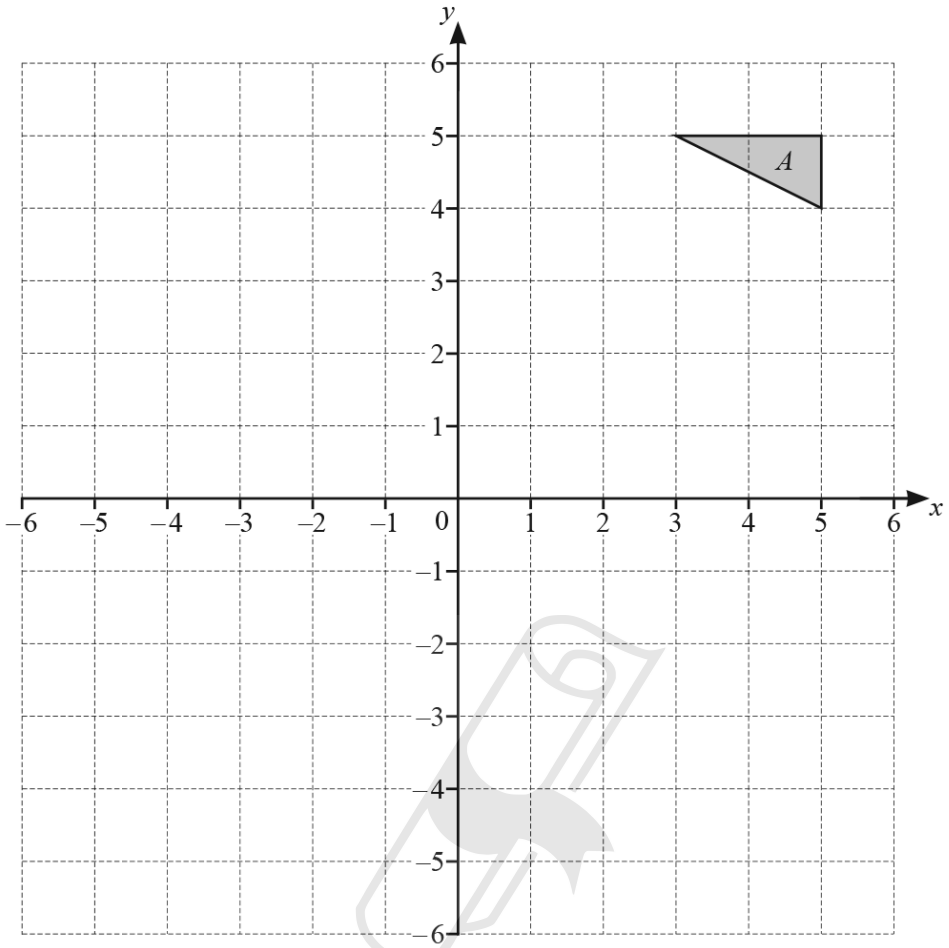
(ii) On the diagram, shade the regions where $f(x) \geqslant g(x)$. [1]

(iii) Describe fully the **single** transformation that maps the graph of $y = g(x)$ onto the graph of $y = f(x)$.

.....

..... [3]

37. 0607_w19_qp_42 Q: 1



(a) Reflect triangle A in the x-axis. Label the image B. [1]

(b) Translate triangle A by the vector $\begin{pmatrix} 0 \\ -3 \end{pmatrix}$. Label the image C. [1]

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

.....

..... [2]

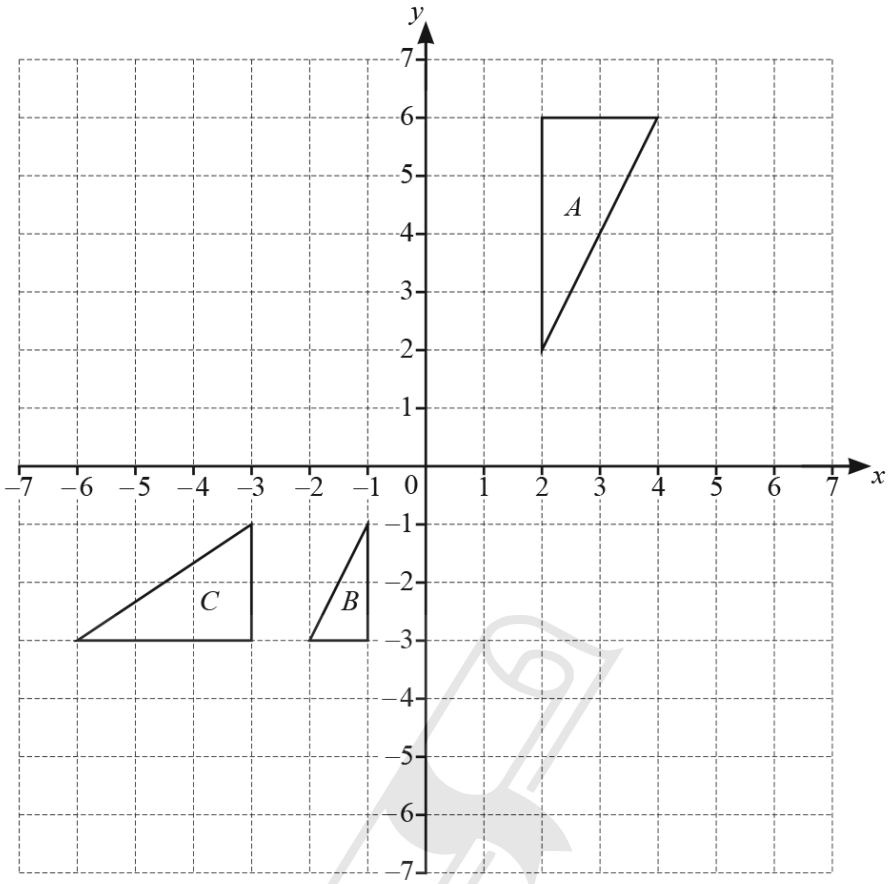
(d) Rotate triangle A through 90° anti-clockwise, about the origin. Label the image D. [2]

(e) Describe fully the **single** transformation that maps triangle B onto triangle D.

.....

..... [2]

38. 0607_w19_qp_43 Q: 5



(a) Reflect triangle A in the line $y = 1$. [2]

(b) Rotate triangle B through 90° clockwise about (1, 0). [3]

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

.....

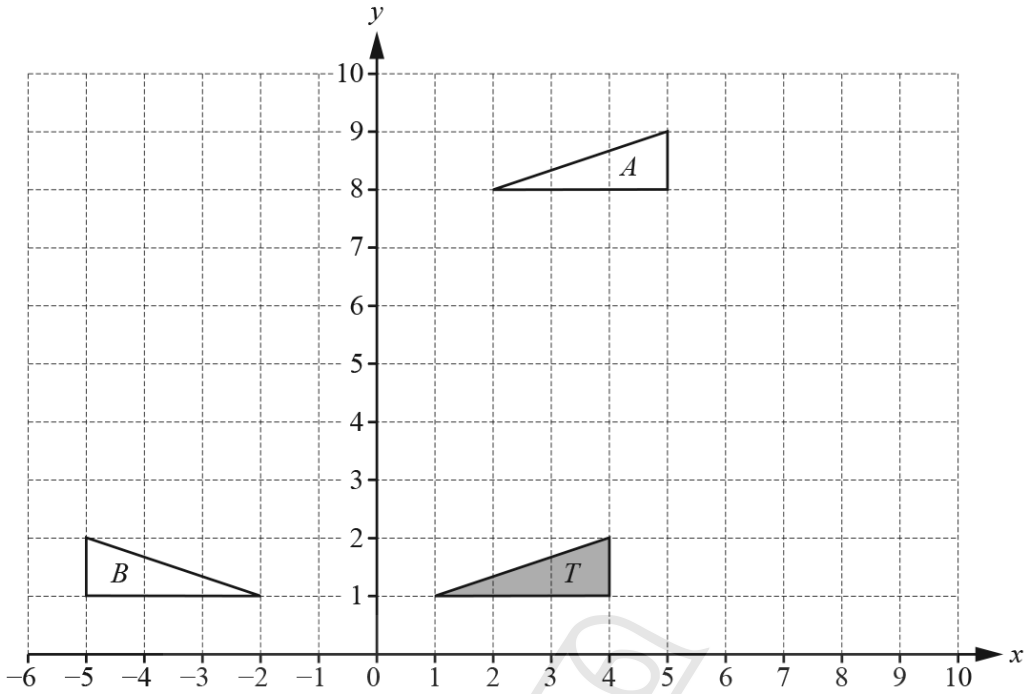
..... [3]

(d) Describe fully the **single** transformation that maps triangle B onto triangle C.

.....

..... [3]

39. 0607_s18_qp_41 Q: 1



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

(i) triangle T onto triangle A,

.....

..... [2]

(ii) triangle T onto triangle B.

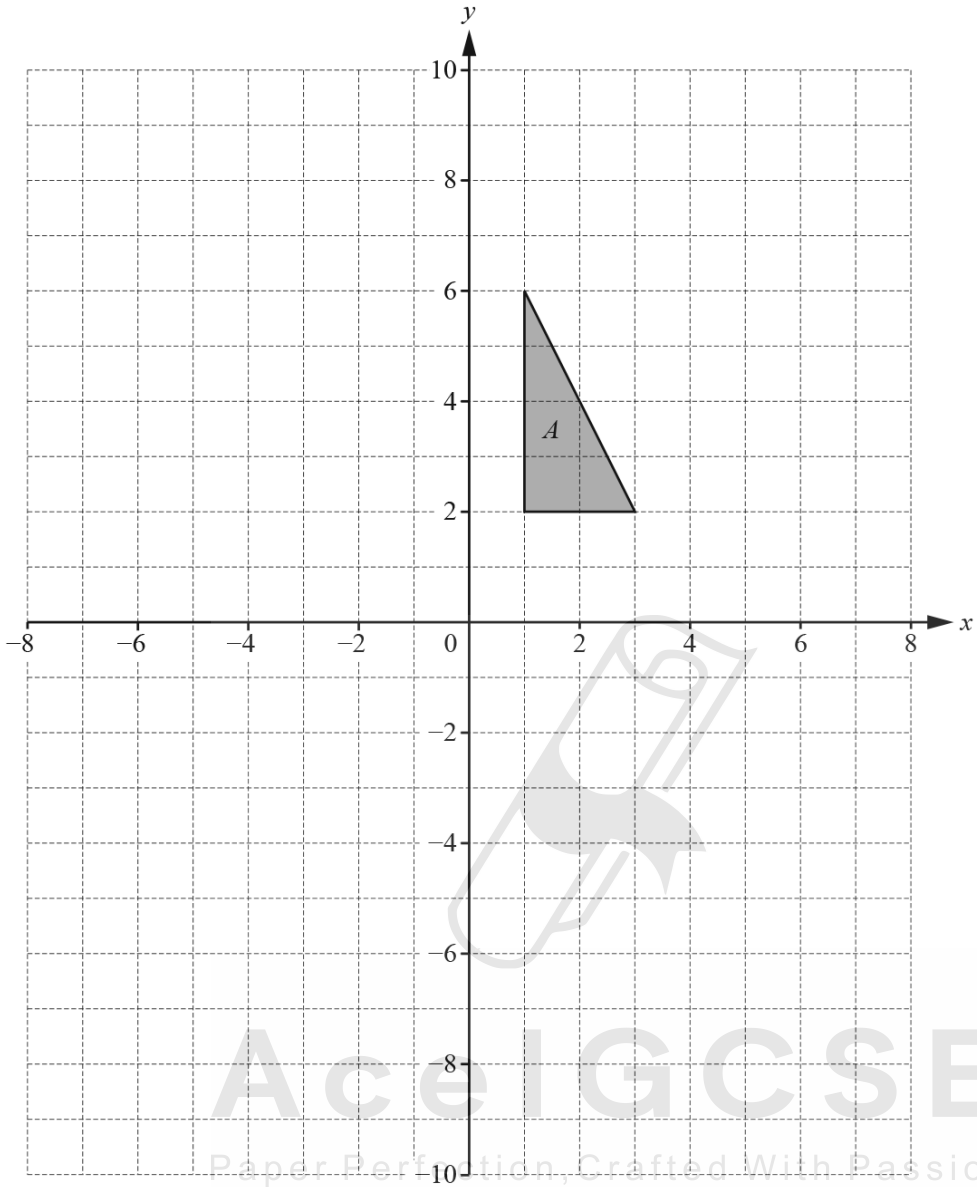
.....

..... [2]

(b) Enlarge triangle T with centre (5, 0) and scale factor 2. [2]

(c) Stretch triangle T with the y-axis invariant and factor 2. [2]

40. 0607_s18_qp_42 Q: 6



(a) Translate triangle A with vector $\begin{pmatrix} -7 \\ -3 \end{pmatrix}$. Label the image B. [2]

(b) Rotate triangle A through 90° anti-clockwise about $(-1, 2)$. Label the image C. [2]

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

.....

..... [3]

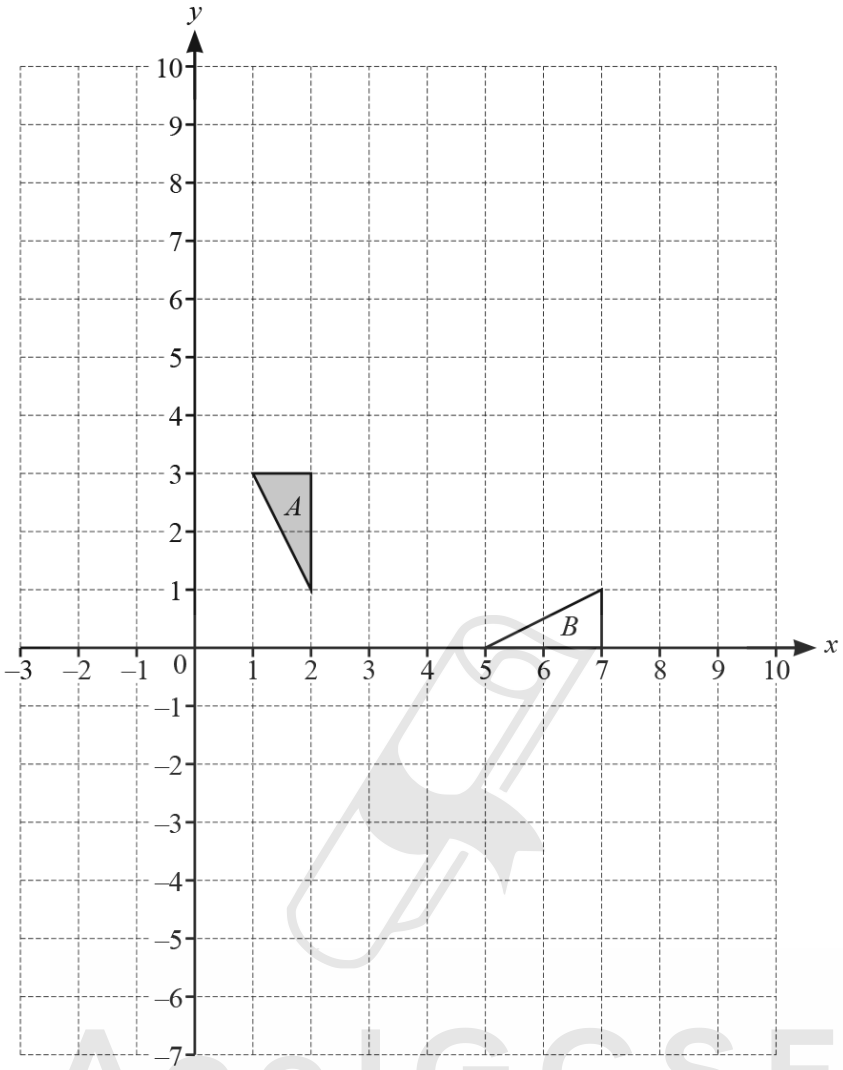
(d) Enlarge triangle A scale factor -2 with centre $(3, 1)$. Label the image D. [2]

(e) Describe fully the **single** transformation that maps triangle D onto triangle A.

.....

..... [2]

41. 0607_s18_qp_43 Q: 3



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

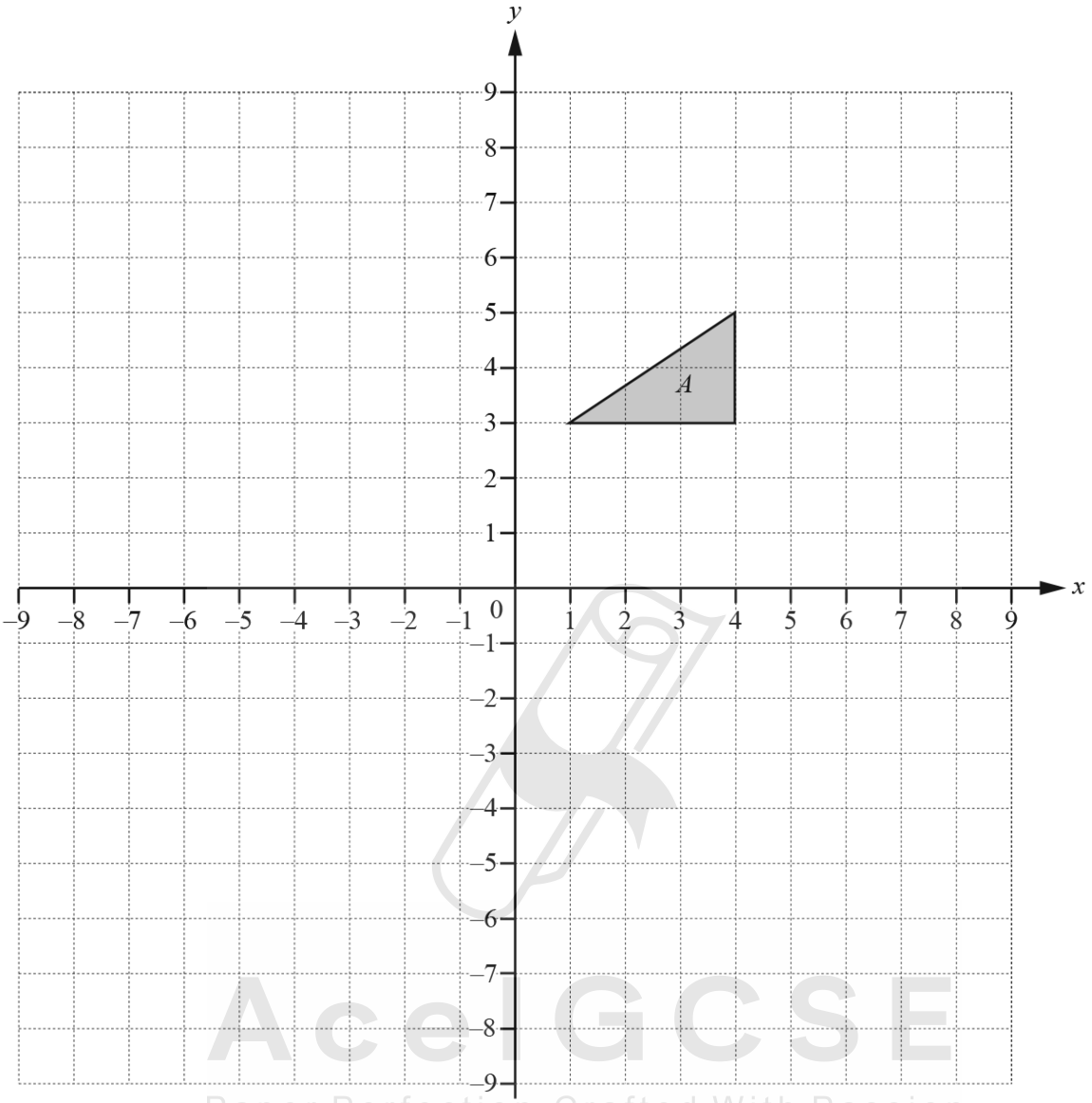
(b) Draw the image of triangle B after a stretch, factor 3 and the x-axis invariant. [2]

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

.....

..... [3]

42. 0607_w18_qp_41 Q: 6



(a) Reflect triangle A in the line $x = -2$. Label the image B. [2]

(b) Rotate triangle A through 180° about $(-2, -1)$. Label the image C. [2]

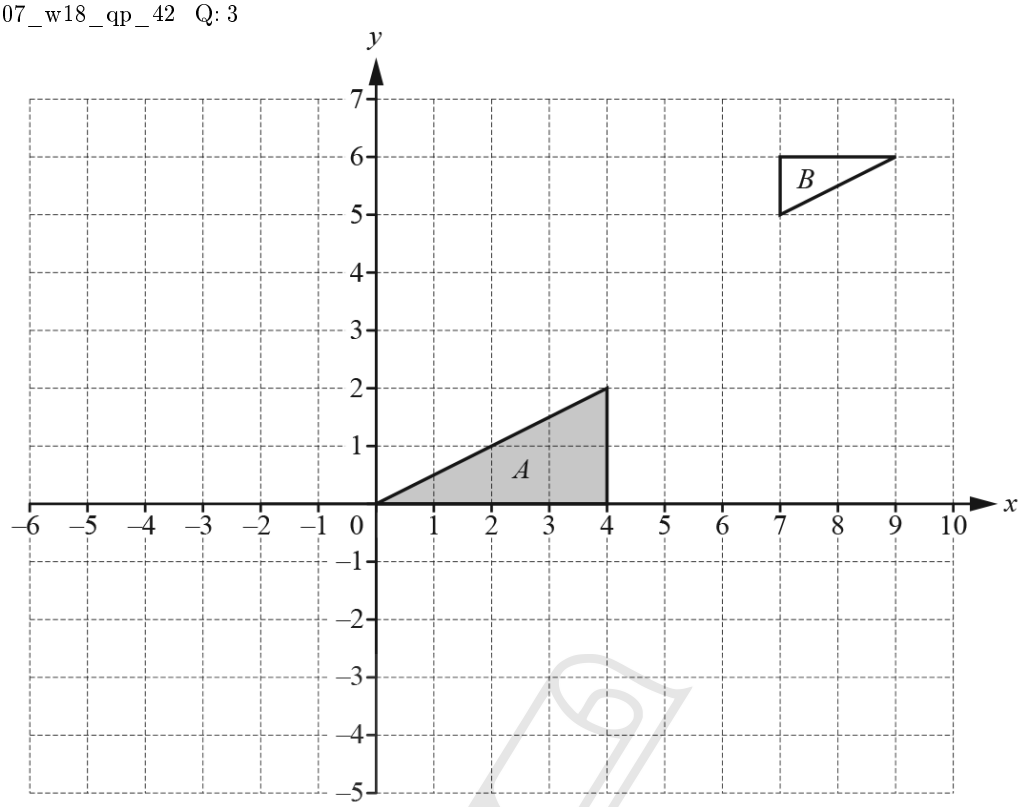
(c) Describe fully the **single** transformation that maps triangle C onto triangle B.

.....

..... [2]

(d) Enlarge triangle A with centre of enlargement $(1, 2)$ and scale factor 2. Label the image D. [2]

43. 0607_w18_qp_42 Q: 3



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

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

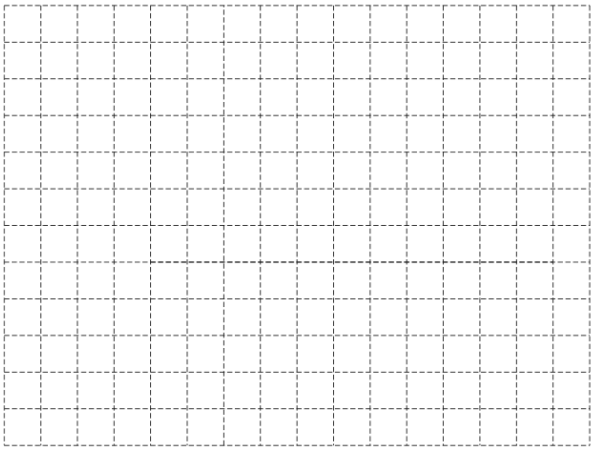
.....

..... [3]

(c) Describe fully the **single** transformation that is equivalent to a reflection in $y = -x$ followed by a reflection in the y-axis.
You may use the grid below to help you.

.....

..... [3]



44. 0607_w18_qp_42 Q: 14

A is the point (1, 9) and B is the point (7, 1).

(a) Find the length of AB.

..... [3]

(b) Find the co-ordinates of the midpoint of AB.

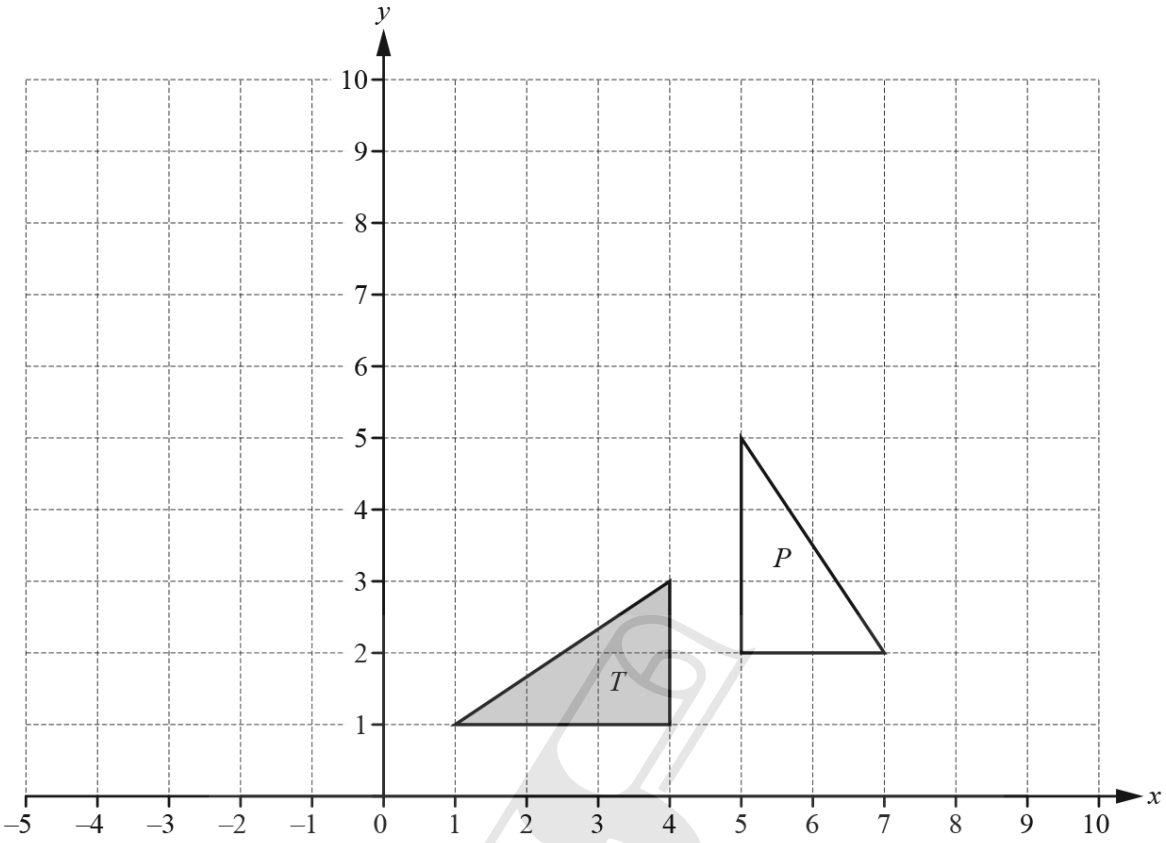
(..... , ...) [2]

(c) B is the reflection of A in the line L.

Find the equation of the line L.

..... [4]

45. 0607_w18_qp_43 Q: 2



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

.....

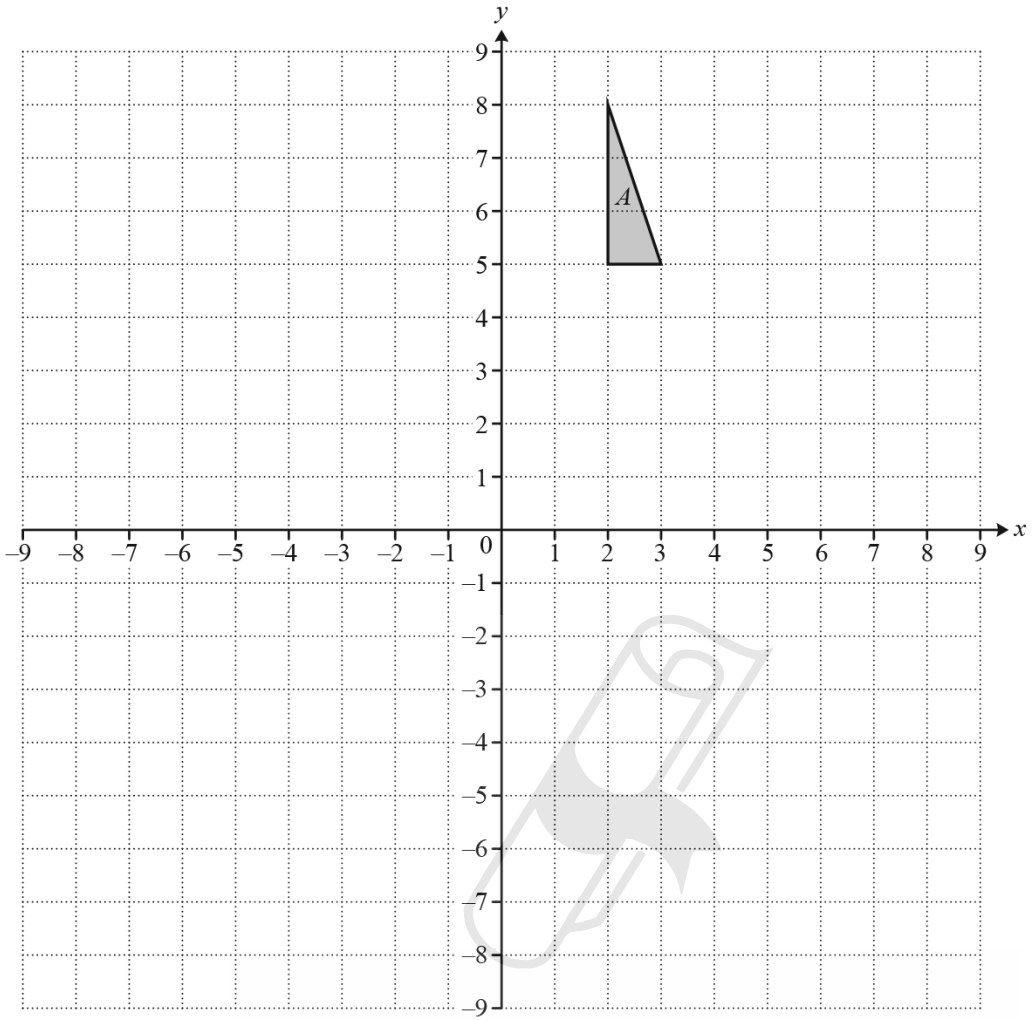
..... [3]

(b) Reflect triangle T in the y-axis. [1]

(c) Translate triangle T by the vector $\begin{pmatrix}5\\6\end{pmatrix}$. [2]

(d) Stretch triangle T, stretch factor 3 and x-axis invariant. [2]

46. 0607_s17_qp_41 Q: 4



(a) Translate triangle A with vector $\begin{pmatrix} 0 \\ -4 \end{pmatrix}$. Label the image B. [2]

(b) Rotate triangle A through 90° anticlockwise about (0, 0). Label the image C. [2]

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

.....

..... [2]

(d) Reflect triangle A in the line $y = -x$. Label the image D. [3]

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

.....

..... [2]

47. 0607_s17_qp_42 Q: 2

(a) **(i)** Reflection in the line $y = x$ maps triangle A onto triangle B.

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

.....

..... [1]

(ii) Enlargement, with centre (2, 1) and scale factor 4, maps triangle C onto triangle D.

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

.....

..... [2]

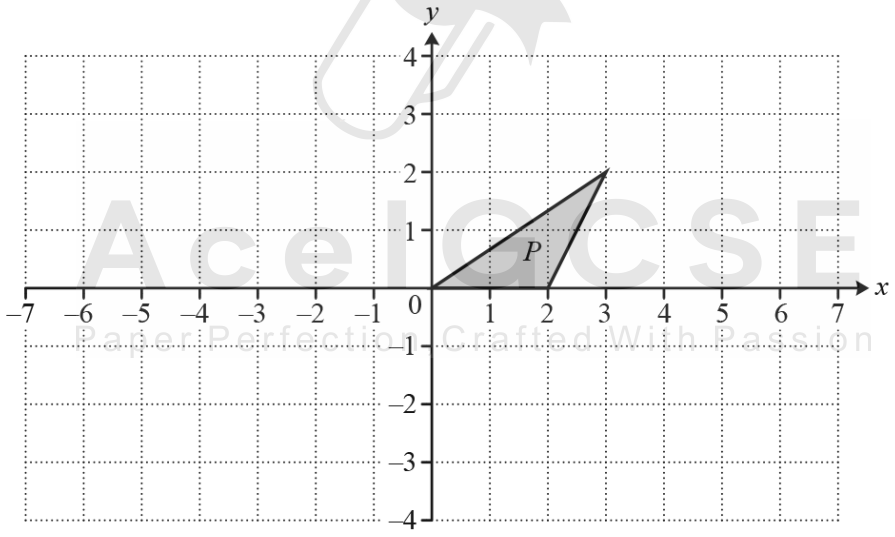
(iii) Translation by the vector $\begin{pmatrix} -3 \\ 5 \end{pmatrix}$ maps triangle E onto triangle F.

Describe fully the **single** transformation that maps triangle F onto triangle E.

.....

..... [2]

(b)



(i) Rotate triangle P through 90° anticlockwise about (0, 0).
Label the image Q. [2]

(ii) Stretch triangle P with stretch factor 2 and the y-axis invariant.
Label the image R. [2]

48. 0607_s17_qp_42 Q: 12

$f(x) = 4x + 2$ $g(x) = 5 - 2x$ $h(x) = x^2 - 3$

(a) Find $g(-3)$.

..... [1]

(b) Find $f(h(2))$.

..... [2]

(c) Find x when $f(x) = -10$.

$x =$ ..... [2]

(d) Write down the range of $h(x)$.

..... [1]

(e) Find $f^{-1}(x)$.

$f^{-1}(x) =$ ..... [2]

(f) $k(x) = 10 - 4x$

Describe fully the **single** transformation that maps the graph of $y = g(x)$ onto the graph of $y = k(x)$.

.....

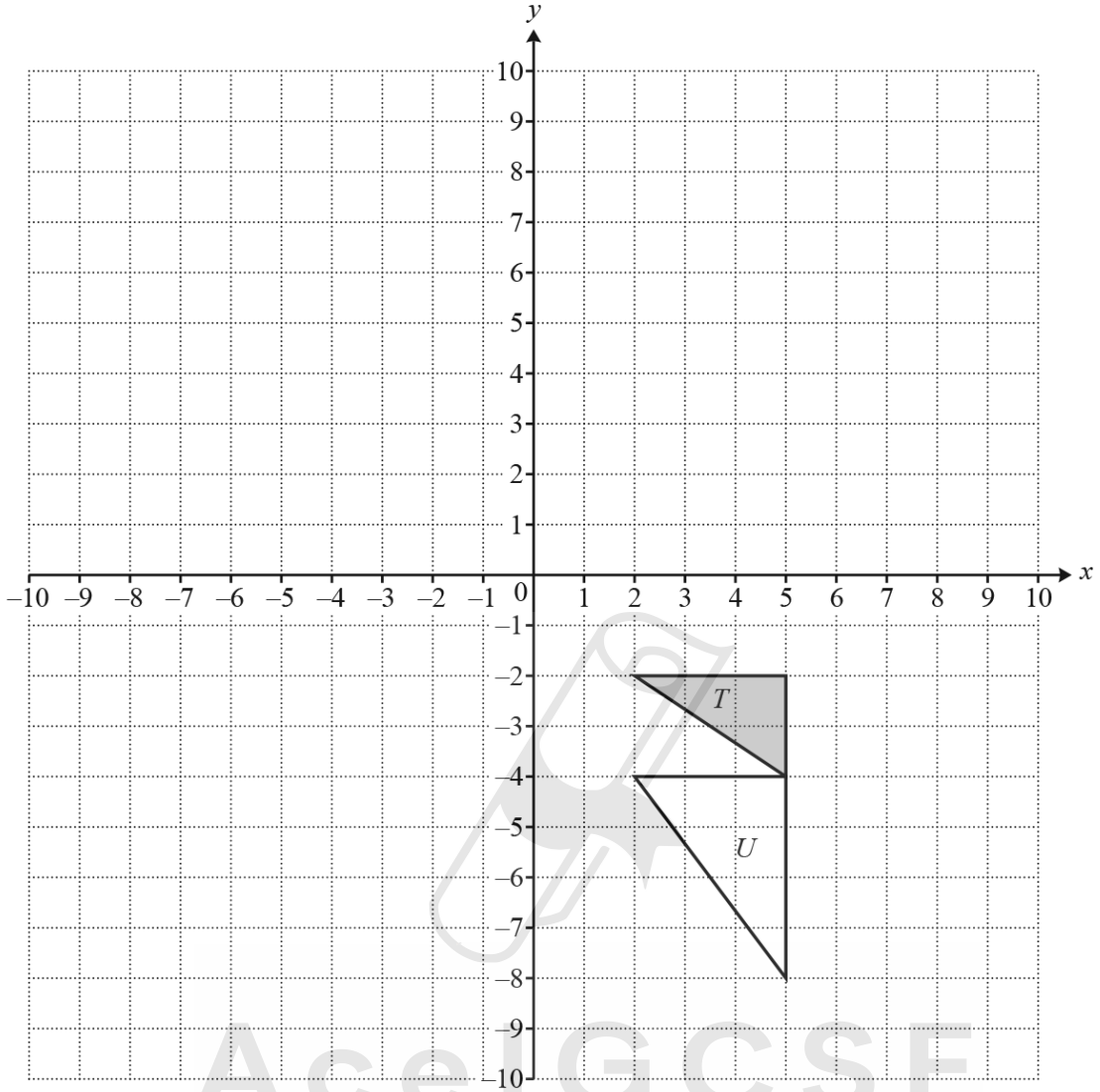
..... [3]

(g) The graph of $y = h(x)$ is translated by the vector $\begin{pmatrix} 2 \\ 0 \end{pmatrix}$.

Find the equation of the graph of the image.
Write your answer in the form $y = ax^2 + bx + c$.

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

49. 0607_s17_qp_43 Q: 1



(a) Translate triangle T by the vector $\begin{pmatrix} -2 \\ 7 \end{pmatrix}$. [2]

(b) **(i)** Reflect triangle T in the x-axis. Label the image P. [1]

(ii) Reflect triangle T in the line $x = -1$. Label the image Q. [1]

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

.....

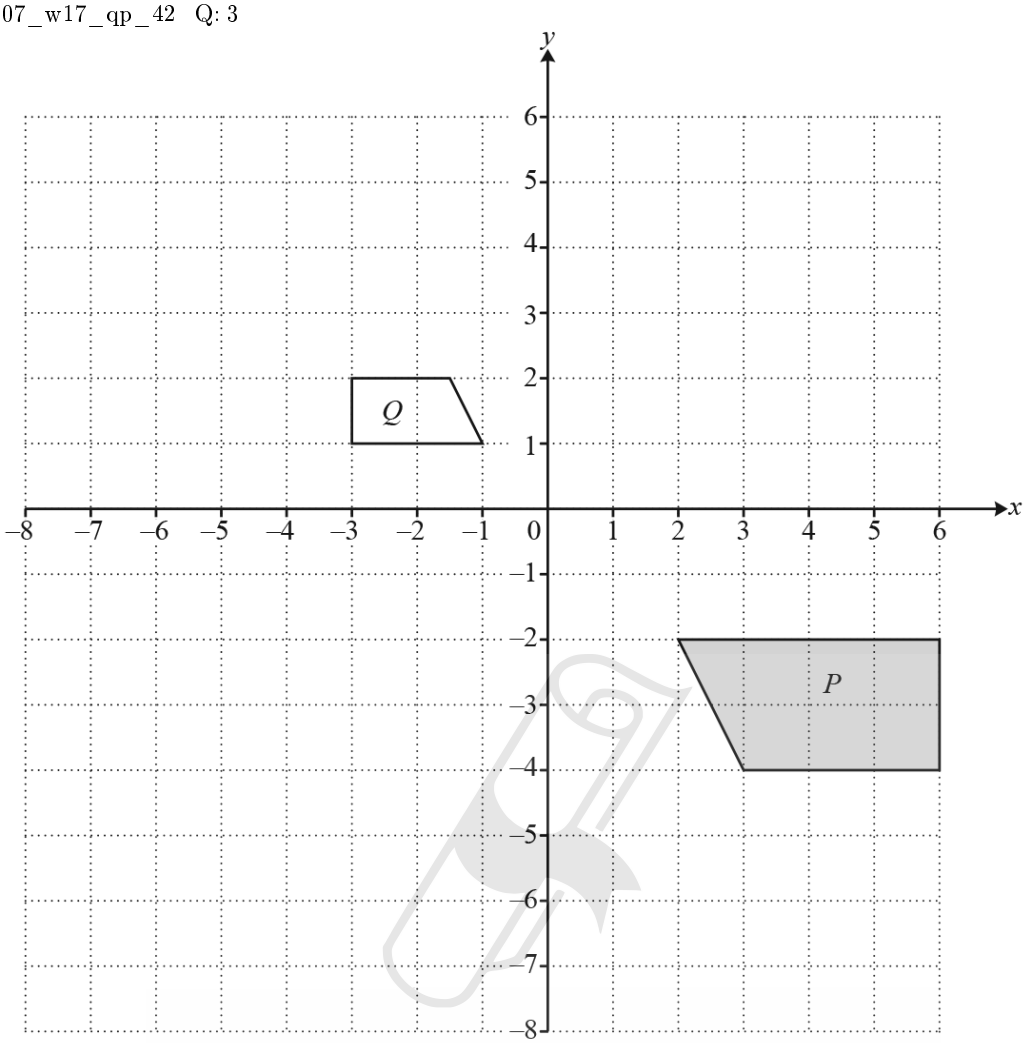
..... [3]

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

.....

..... [3]

50. 0607_w17_qp_42 Q: 3



(a) **(i)** Reflect shape P in the line $y = 1$.
Label the image A. [2]

(ii) Rotate shape P through 90° clockwise about $(-1, 1)$.
Label the image B. [2]

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

.....

..... [2]

(b) Describe fully the **single** transformation that maps shape P onto shape Q.

.....

..... [3]

(c) Stretch shape P with the x-axis invariant and factor 2. [2]

51. 0607_w17_qp_42 Q: 11

$f(x) = 2x + 1$ $g(x) = x^2 + 1$ $h(x) = \log x$

(a) **(i)** Find the value of f(4.5).

..... [1]

(ii) Find the value of h(f(4.5)).

..... [1]

(b) Find $f^{-1}(x)$.

$f^{-1}(x) =$ ..... [2]

(c) Find g(f(x)) in the form $ax^2 + bx + c$.

..... [3]

(d) $p(x) = x^2 - 1$

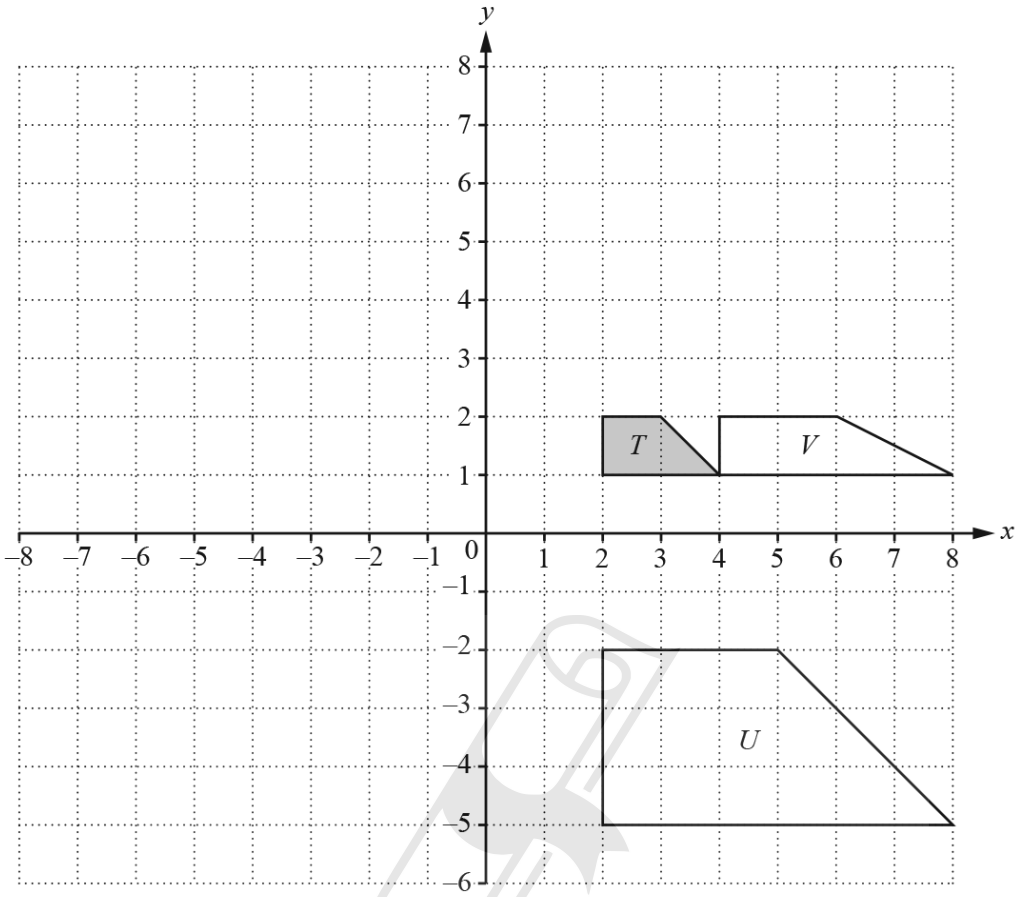
Find the **single** transformation that maps the graph of $y = g(x)$ onto the graph of $y = p(x)$.

..... [2]

(e) Solve the equation $h^{-1}(x) = 1000$.

$x =$ ..... [1]

52. 0607_s16_qp_42 Q: 1



(a) Translate shape T by the vector $\begin{pmatrix} 3 \\ 4 \end{pmatrix}$. [2]

(b) Reflect shape T in the line $y = -x$. [2]

(c) Rotate shape T by 90° anticlockwise about (–2, 1). [3]

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

(i) shape T onto shape U,

.....

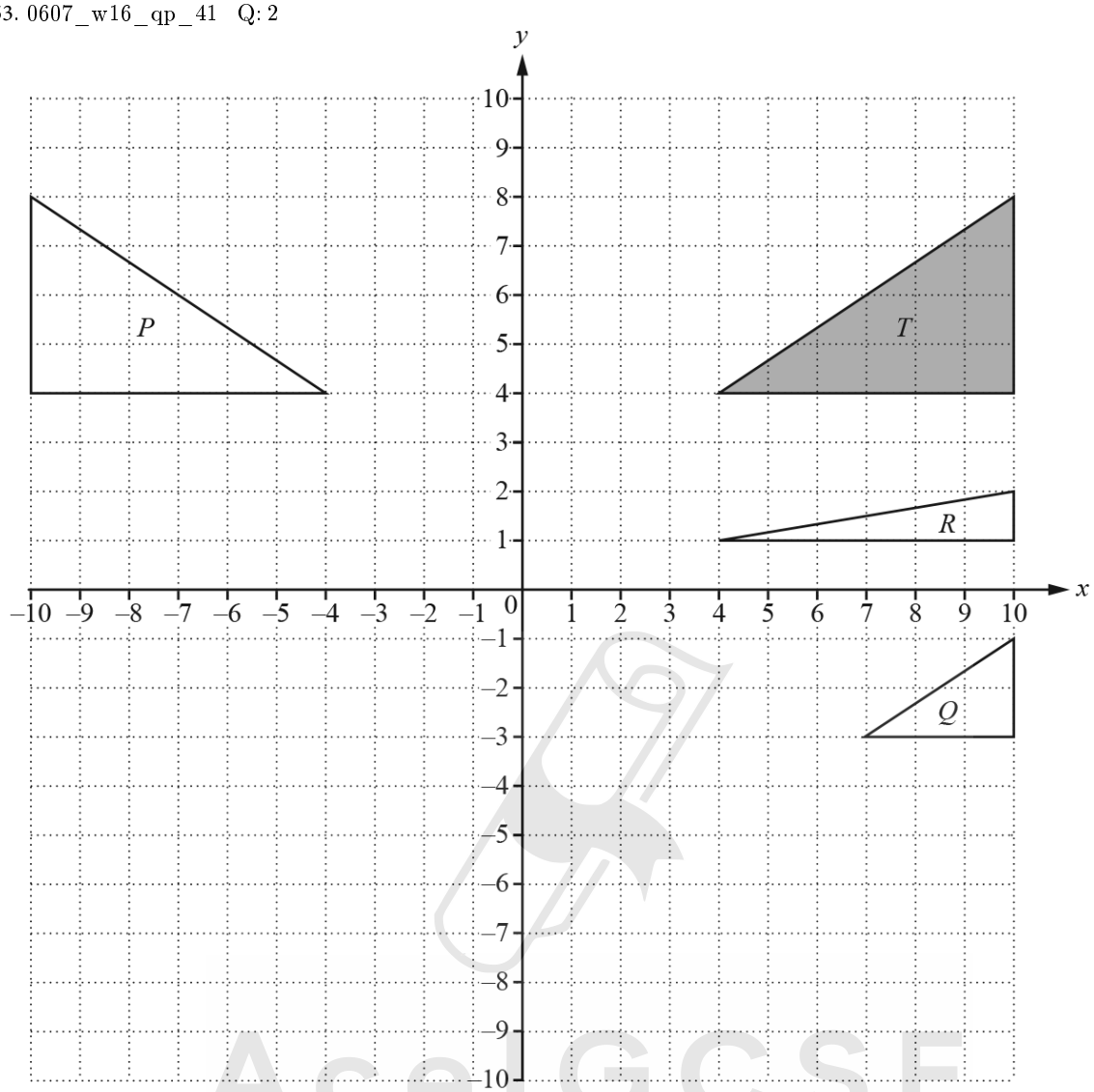
..... [3]

(ii) shape T onto shape V.

.....

..... [3]

53. 0607_w16_qp_41 Q: 2



(a) $\mathbf{u} = \begin{pmatrix} -3 \\ -2 \end{pmatrix}$ and $\mathbf{v} = \begin{pmatrix} -5 \\ -3 \end{pmatrix}$

(i) Find $\mathbf{u} + \mathbf{v}$.

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

(ii) Draw the image of triangle T under the translation by the vector $\mathbf{u} + \mathbf{v}$. [2]

(iii) Calculate $|\mathbf{u} + \mathbf{v}|$.

..... [2]

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

(i) triangle T onto triangle P,

.....

..... [2]

(ii) triangle T onto triangle Q,

.....

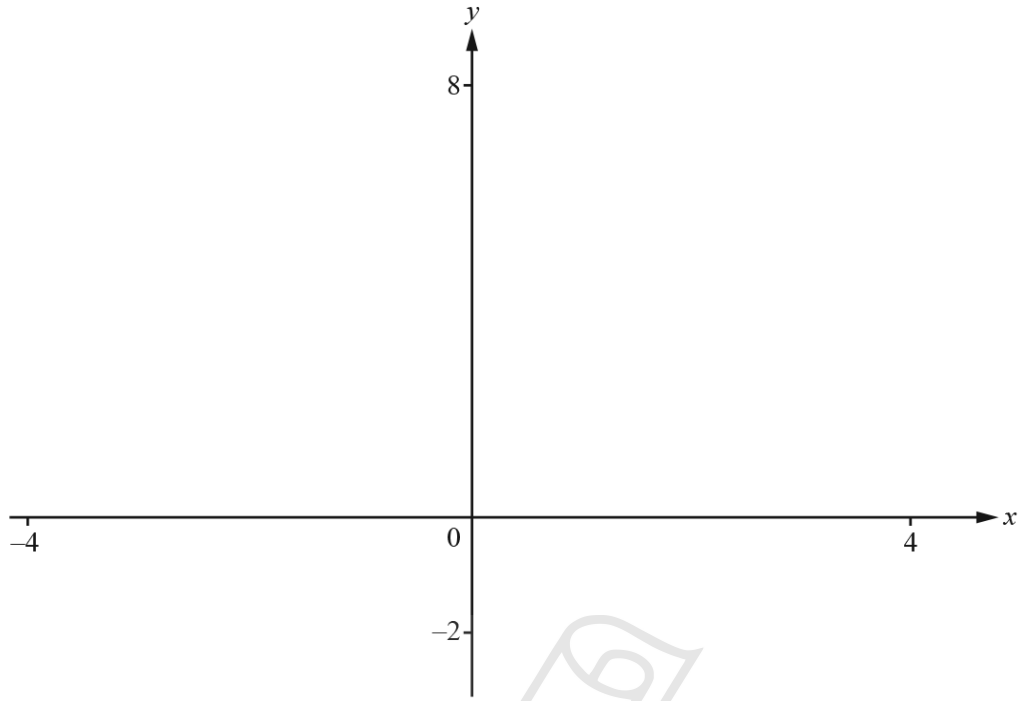
..... [3]

(iii) triangle T onto triangle R.

.....

..... [3]

54. 0607_w16_qp_41 Q: 8



$$f(x) = x + \frac{1}{x} + 3$$

(a) On the diagram, sketch the graph of $y = f(x)$ for values of x between -4 and 4. [2]

(b) Find the zeros of $f(x)$.

..... [2]

(c) Solve the inequality $f(x) < 0$.

..... [3]

(d) The asymptotes of the graph are $x = a$ and $y = x + b$, where a and b are integers.

Find the value of a and the value of b.

$a =$ .....

$b =$ ..... [2]

(e) $g(x) = x + \frac{1}{x}$

Describe fully the **single** transformation that maps the graph of $y = f(x)$ onto the graph of $y = g(x)$.

.....

..... [2]

55. 0607_w16_qp_42 Q: 6

Describe fully the single transformation that is the **inverse** of

(a) a reflection in the line $y = x$,

.....

..... [2]

(b) a rotation of 90° clockwise, centre (2, 3),

.....

..... [2]

(c) a translation with vector $\begin{pmatrix} 4 \\ -3 \end{pmatrix}$,

.....

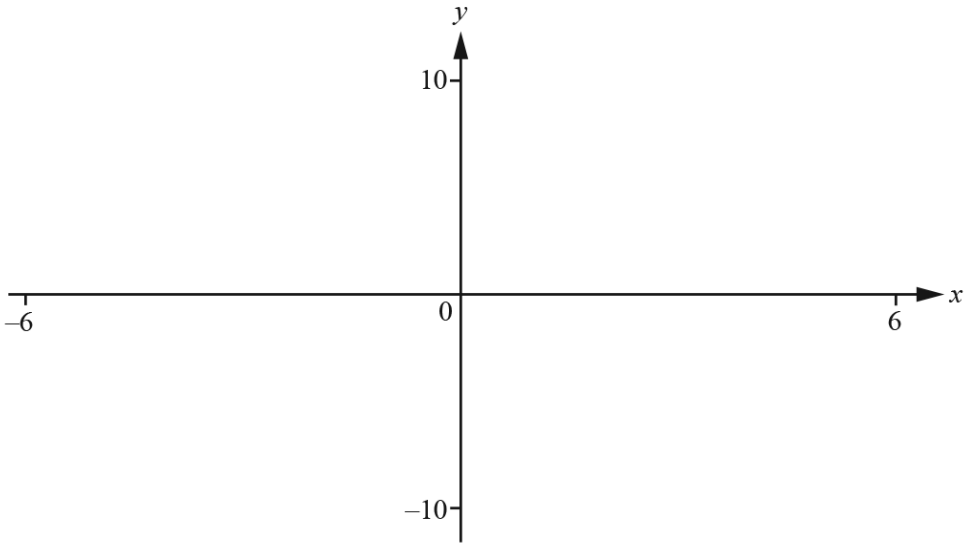
..... [2]

(d) an enlargement scale factor 3, centre (0, 0).

.....

..... [2]

56. 0607_w16_qp_42 Q: 10



$$f(x) = 3 - \frac{6}{(x-2)}$$

(a) On the diagram, sketch the graph of $y = f(x)$ for values of x between -6 and 6. [3]

(b) Write down the equations of the asymptotes of the graph of $y = f(x)$.

..... and .....[2]

(c) Solve the equation $f(x) = -x$.

..... [2]

(d) Solve the inequality $f(x) + x < 0$.

..... [3]

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

(i) $y = 3 - \frac{6}{x}$ onto $y = 3 - \frac{6}{(x-2)}$,

.....

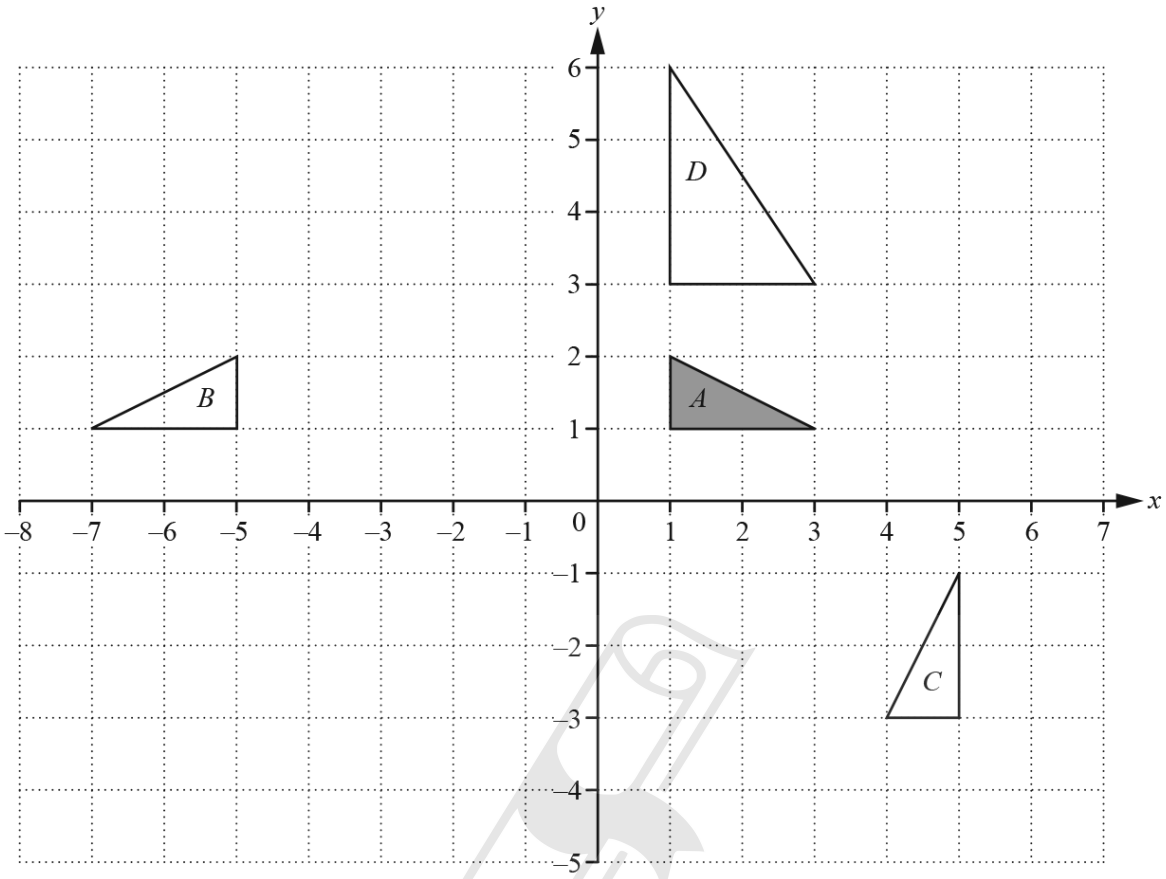
..... [2]

(ii) $y = -\frac{6}{(x-2)}$ onto $y = 3 - \frac{6}{(x-2)}$.

.....

..... [2]

57. 0607_w16_qp_43 Q: 3



Describe fully the **single** transformation that maps

(a) triangle A onto triangle B,

.....

..... [2]

(b) triangle A onto triangle C,

.....

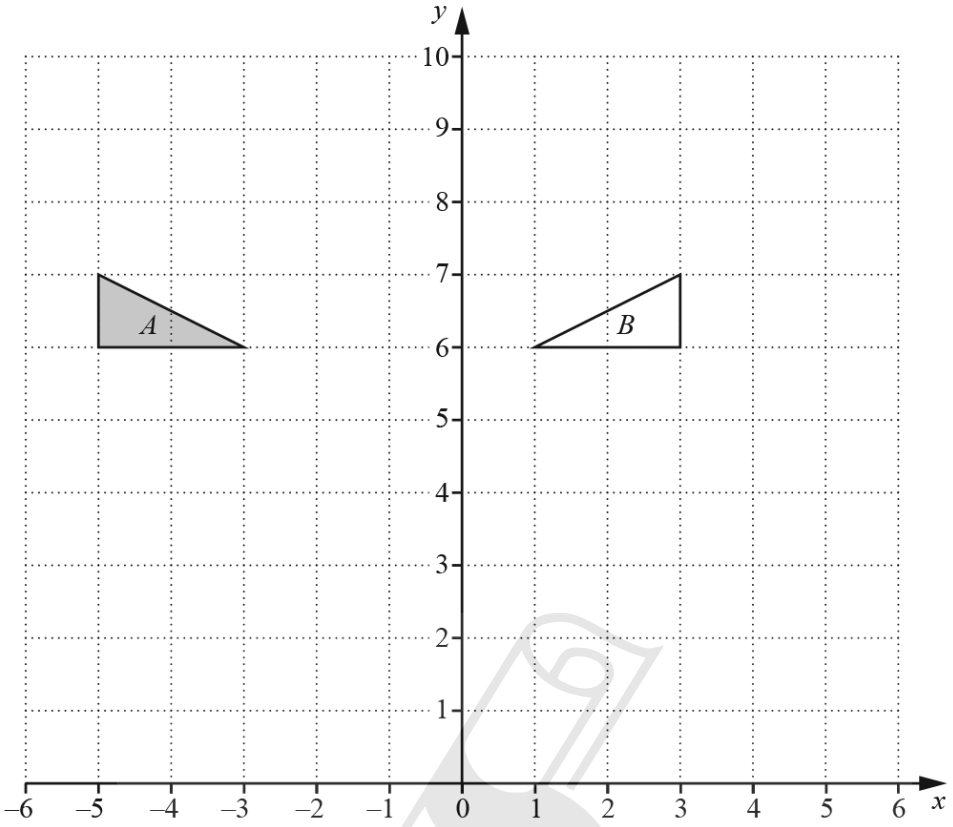
..... [3]

(c) triangle A onto triangle D.

.....

..... [3]

58. 0607_s15_qp_41 Q: 4



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

Answer(a) .....

..... [2]

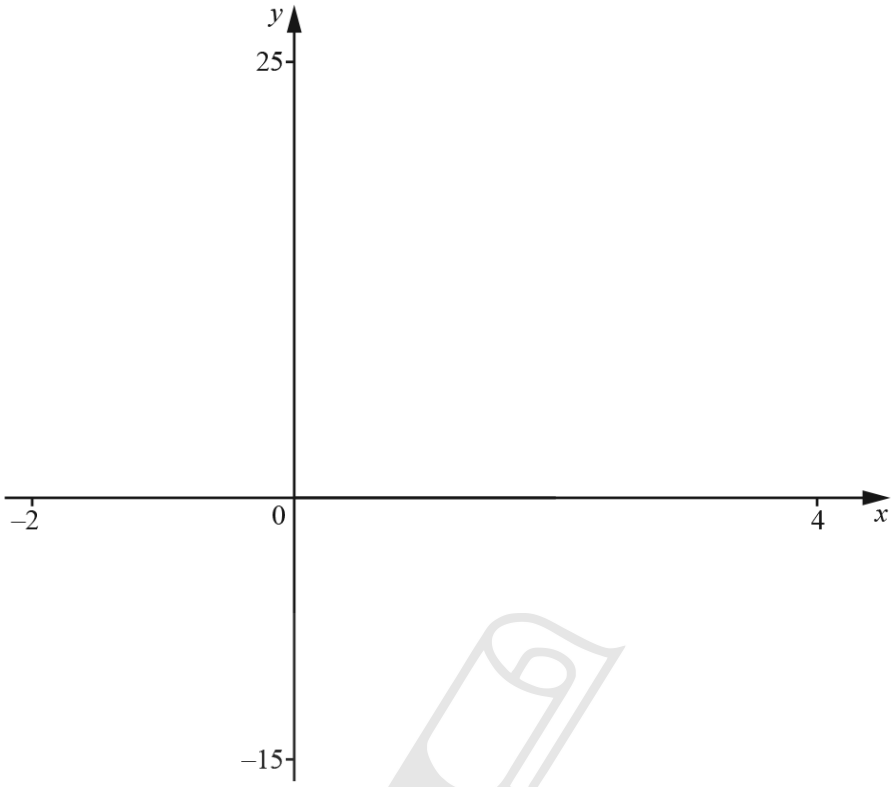
(b) Rotate **triangle *B*** through 90° clockwise, centre (–1, 6). Draw this triangle and label it *C*. [3]

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

Answer(c) .....

..... [2]

59. 0607_s15_qp_42 Q: 4



$f(x) = x^3 - 3x^2 + 6$

(a) On the diagram, sketch the graph of $y = f(x)$ for $-2 \leqslant x \leqslant 4$. [2]

(b) Find the co-ordinates of the local maximum point and the local minimum point.

Answer(b) Maximum (..... , ...)

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

(c) Find the range of values of k for which the equation $f(x) = k$ has 3 different solutions.

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

(d) Describe fully the symmetry of the graph of $y = f(x)$.

Answer(d) .....

..... [3]

(e) The graph of $y = g(x)$ is the translation of the graph of $y = f(x)$ with vector $\begin{pmatrix} 0 \\ -2 \end{pmatrix}$.

Write down and simplify $g(x)$.

Answer(e) $g(x) =$ ..... [1]

60. 0607_w15_qp_41 Q: 2

(a) $\mathbf{p} = \begin{pmatrix} 2 \\ 3 \end{pmatrix}$ $\mathbf{q} = \begin{pmatrix} 14 \\ 8 \end{pmatrix}$

(i) Find $2\mathbf{p} + 3\mathbf{q}$.

Answer(a)(i) $\begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [2]

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

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

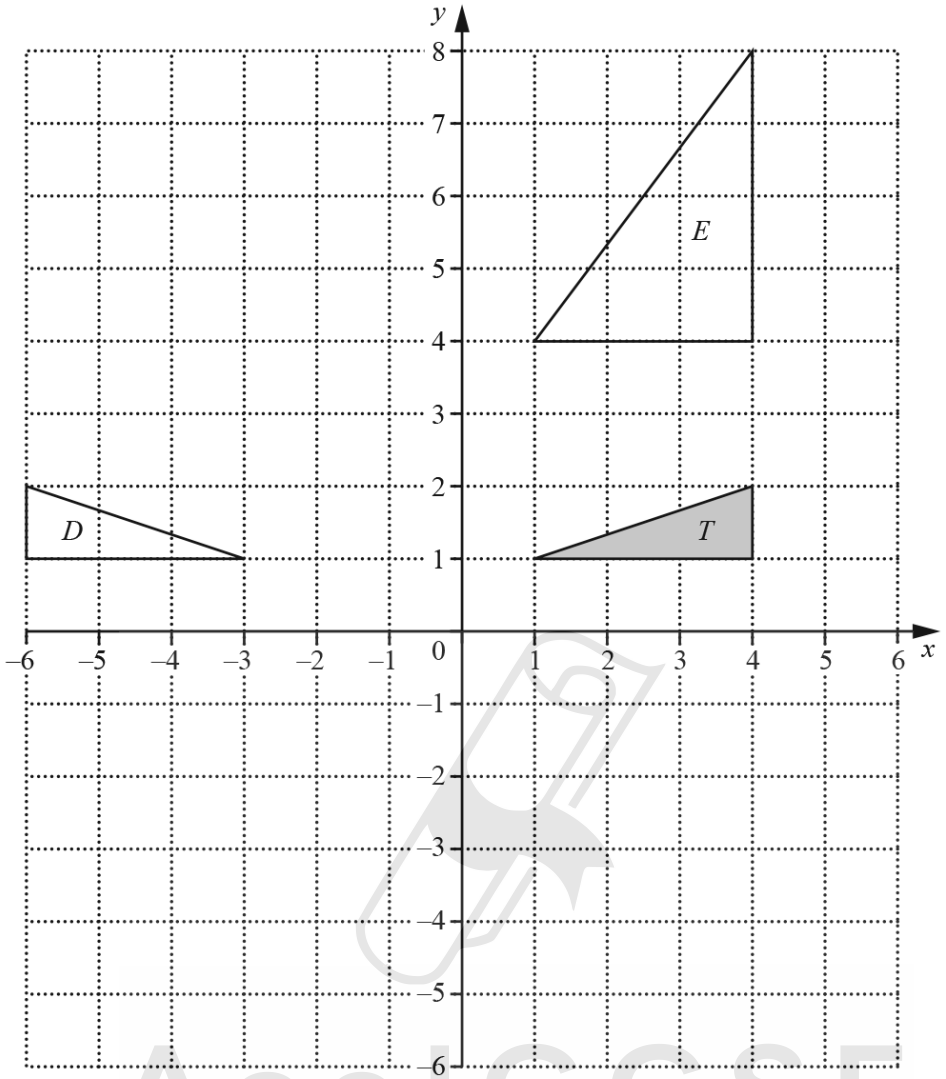
(b) The graph of $y = f(x)$ is mapped onto the graph of $y = f(x + 2)$ by a translation with vector $\begin{pmatrix} u \\ v \end{pmatrix}$.

Find the value of u and the value of v.

Answer(b) $u =$ .....

$v =$ ..... [2]

(c)



(i) Draw the image of triangle T under a rotation of 90° clockwise about the point $(-1, -1)$. [3]

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

.....

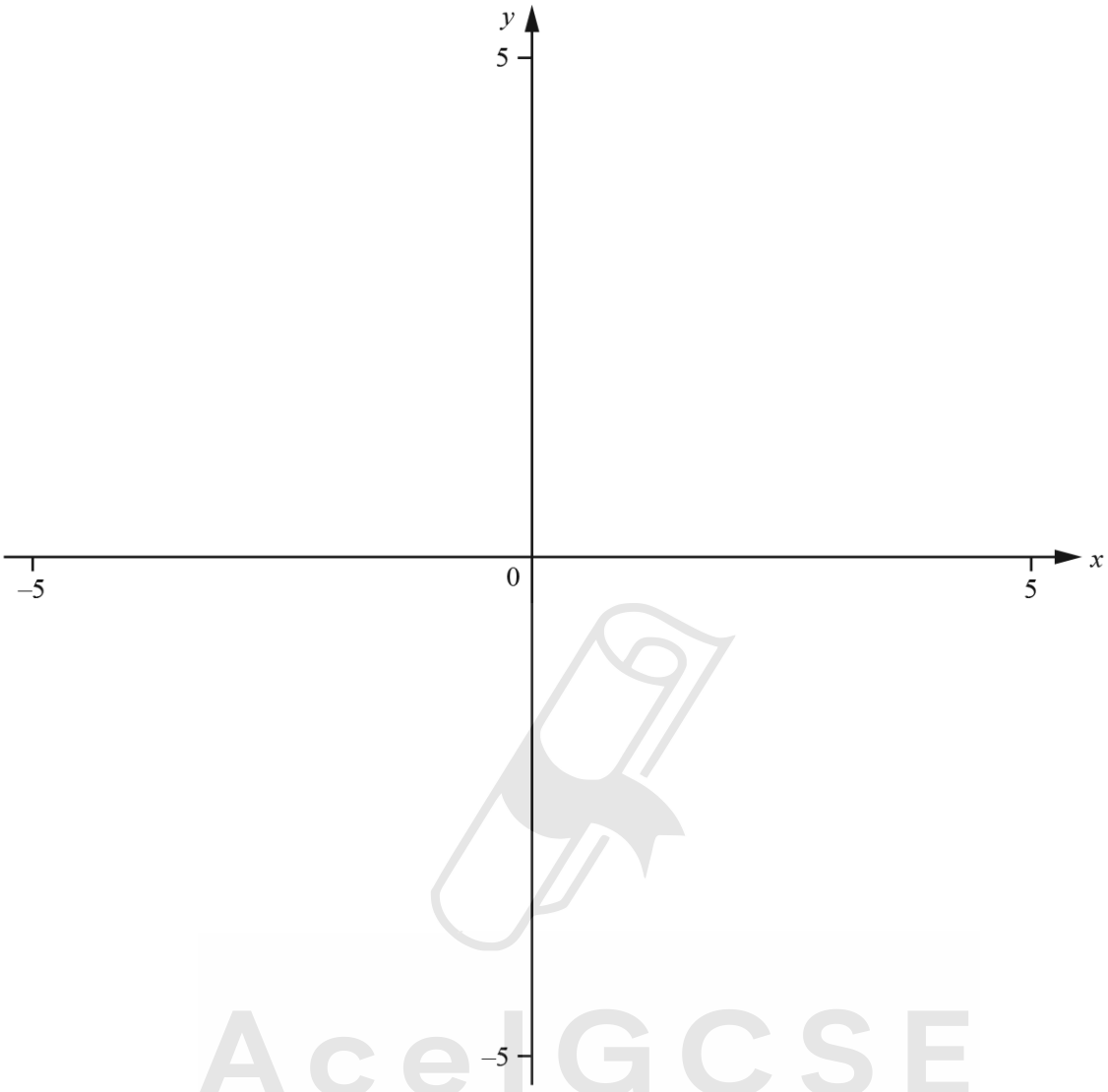
..... [2]

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

.....

..... [3]

61. 0607_w15_qp_41 Q: 3



$$f(x) = 1 - \frac{2}{x}, \quad x \neq 0$$

(a) On the diagram, sketch the graph of $y = f(x)$, for values between $x = -5$ and $x = 5$. [2]

(b) Solve the inequality $f(x) < 0$.

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

(c) Find $f^{-1}(x)$.

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

(d) On the diagram, sketch the graph of $y = f^{-1}(x)$, for values between $x = -5$ and $x = 5$. [2]

(e) Describe fully the **single** transformation that maps the graph of $y = f(x)$ onto the graph of $y = f^{-1}(x)$.

.....

..... [2]

62. 0607_w15_qp_42 Q: 4

The transformation P is a reflection in the x-axis.
The transformation Q is a rotation of 90° clockwise about the origin.

(a) Write down the transformation that is

(i) the inverse of P,

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

..... [1]

(ii) the inverse of Q.

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

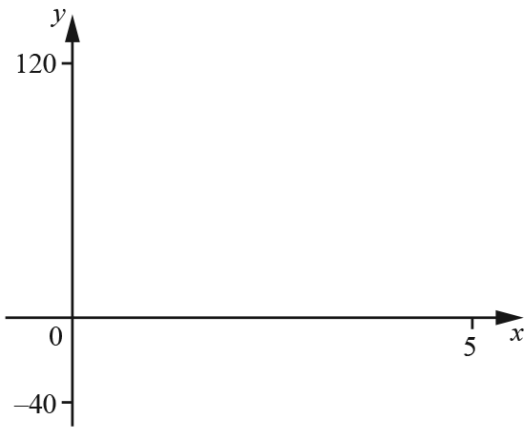
..... [2]

(b) Describe fully the **single** transformation equivalent to P followed by Q.

Answer(*b*) .....

..... [2]

63. 0607_w15_qp_42 Q: 13



$$f(x) = \frac{100}{2^x} - 10$$

(a) **(i)** On the diagram, sketch the graph of $y = f(x)$, for $0 \leqslant x \leqslant 5$. [2]

(ii) Write down the x co-ordinate of the point where the graph crosses the x-axis.

Answer(a)(ii) ..... [1]

(iii) Write down the range of $f(x)$.

Answer(a)(iii) ..... [1]

(b) Solve the equation.

$$\frac{100}{2^x} - 10 = 20$$

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

(c) Describe fully the **single** transformation that maps the graph of $y = \frac{100}{2^x}$ onto the graph of $y = \frac{100}{2^x} - 10$.

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

64. 0607_w15_qp_43 Q: 11

$f(x) = x^2 - 16$ $\quad g(x) = \frac{2}{x+1}, x \neq -1$ $\quad h(x) = 2^x$

(a) Find h(3).

Answer(a) ..... [1]

(b) Find the range of g(x) for the domain {0, 1}.

Answer(b) ..... [1]

(c) f($x - 2$) can be written as $(x + a)(x + b)$.
Find the value of a and the value of b.

Answer(c) a = ...

b = ... [4]

(d) Find the inverse of

(i) g(x),

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

(ii) h(x).

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

(e) Describe fully the **single** transformation that maps the graph of $y = f(x)$ onto the graph of $y = 2x^2 - 32$.

.....

..... [2]

65. 0607_s20_qp_43 Q: 5

(a) (i) A reflection in the line $y = 3$ maps triangle A onto triangle B.

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

.....

..... [1]

(ii) A translation using the vector $\begin{pmatrix} 5 \\ -4 \end{pmatrix}$ maps triangle C onto triangle D.

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

.....

..... [2]

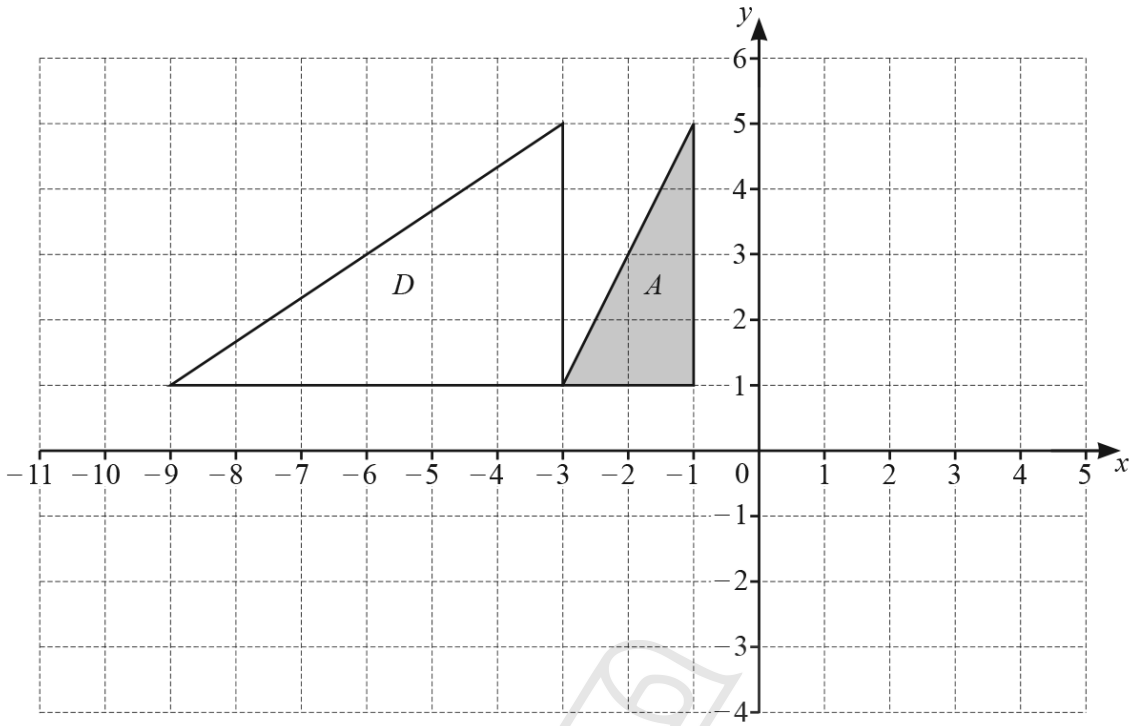
(iii) An enlargement, centre $(2, -1)$, scale factor 3, maps triangle G onto triangle H.

Describe fully the **single** transformation that maps triangle H onto triangle G.

.....

..... [2]

(b)



(i) Rotate triangle A through 90° anticlockwise, centre $(-1, 0)$.
Label the image B. [2]

(ii) Enlarge triangle A with scale factor $-\frac{1}{2}$, centre $(1, 3)$.
Label the image C. [2]

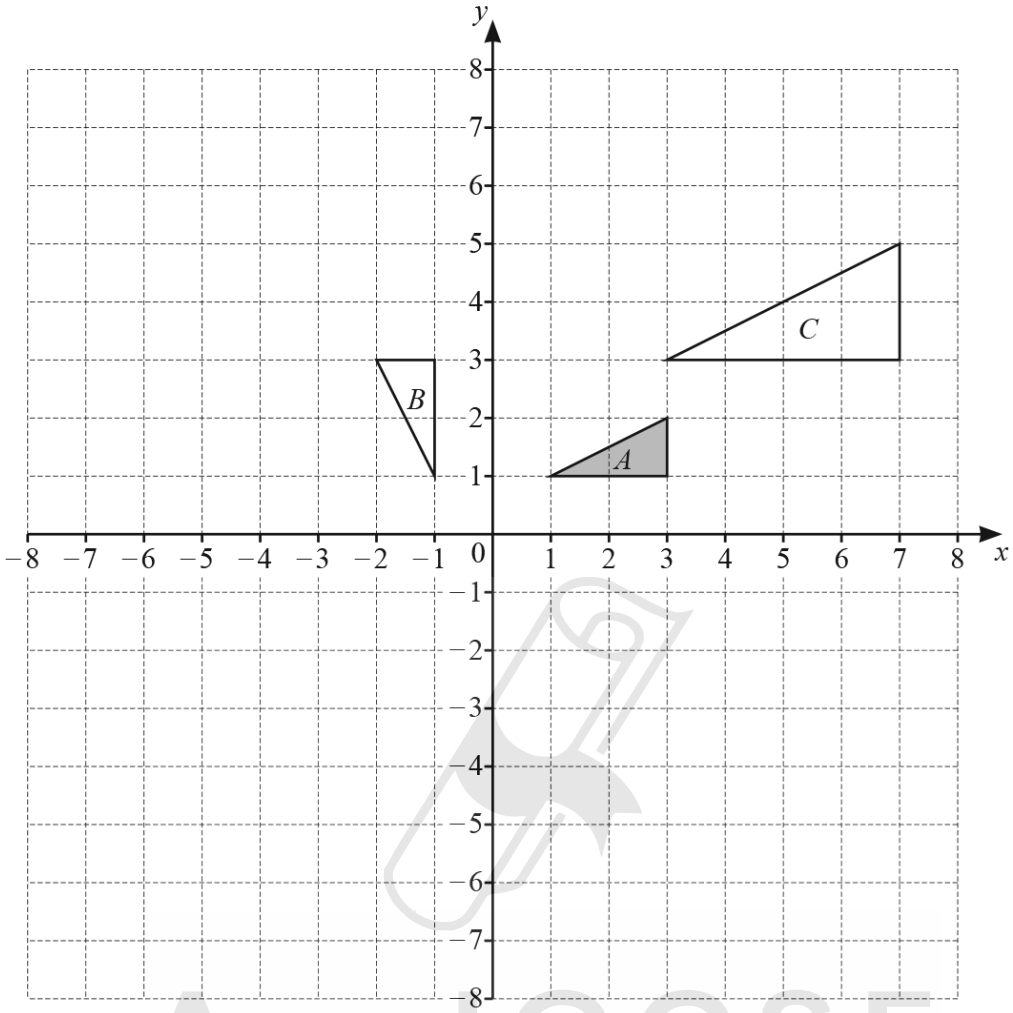
(iii) Describe fully the **single** transformation that maps triangle A onto triangle D.

.....

..... [3]

66. 0607_w20_qp_41 Q: 4

(a)



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

.....

..... [3]

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

.....

..... [3]

(iii) On the grid, draw the stretch of triangle A, scale factor 2, y-axis invariant. [2]

(b) Describe fully the **single** transformation that is the **inverse** of

(i) a reflection in $y = 2$,

.....

..... [1]

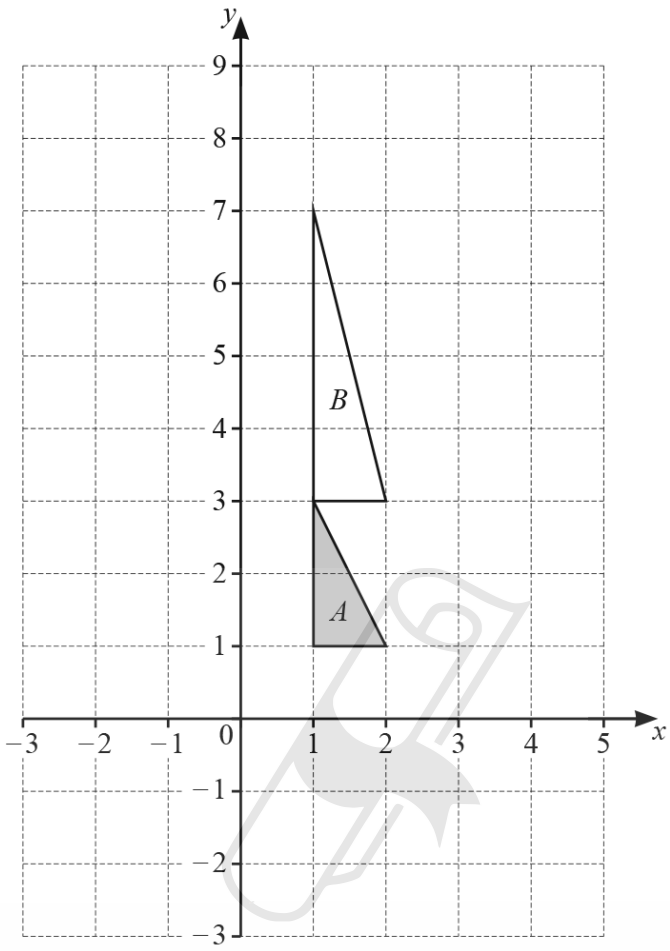
(ii) a translation with vector $\begin{pmatrix} -5 \\ 2 \end{pmatrix}$.

.....

..... [2]

67. 0607_s21_qp_42 Q: 2

(a)



(i) Rotate triangle A 90° anticlockwise about $(-1, 2)$. [2]

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

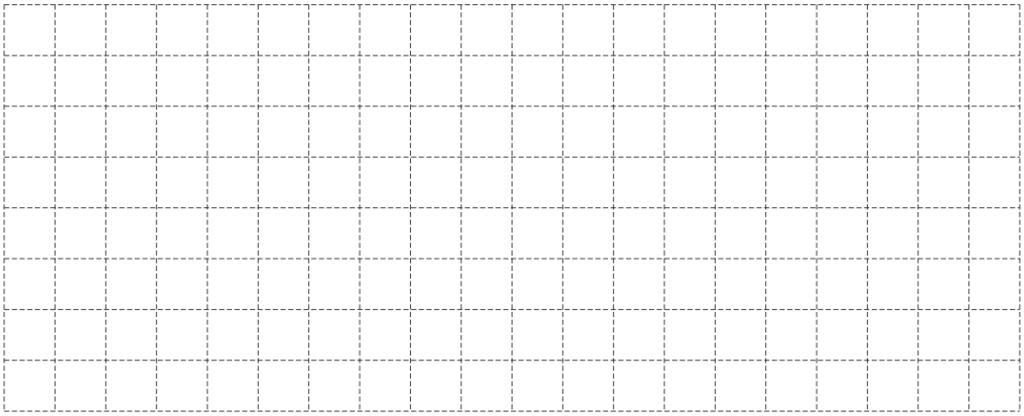
.....

..... [3]

(b) Describe fully the **single** transformation that is equivalent to

reflection in $x = 3$ followed by reflection in $x = 7$.

You may use the grid below to help you.

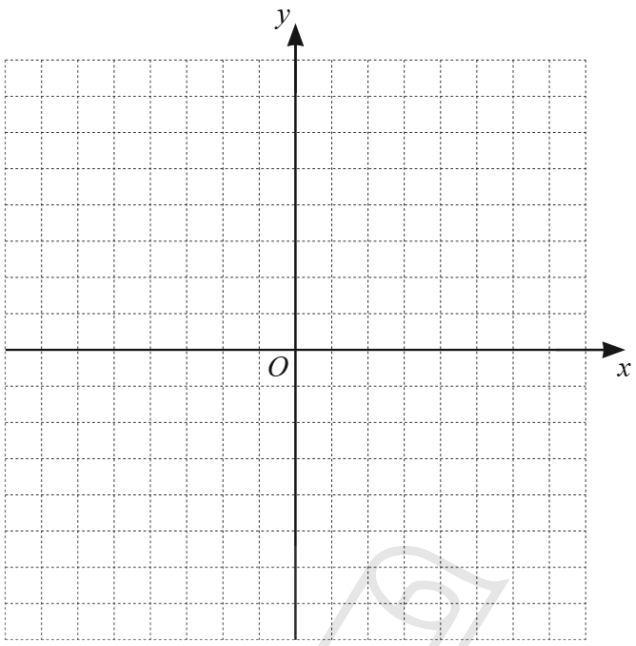


.....

..... [2]

68. 0607_w21_qp_43 Q: 2

You may use this grid to help you answer this question.



Transformation P is a rotation of 180° about the origin.

Transformation Q is a reflection in the line $y = x$.

(a) Find the coordinates of the image of the point (5, 2) under transformation P.

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

(b) Find the coordinates of the image of the point (5, 2) under transformation Q.

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

(c) Find the coordinates of the image of the point (x, y) under transformation P followed by transformation Q.

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

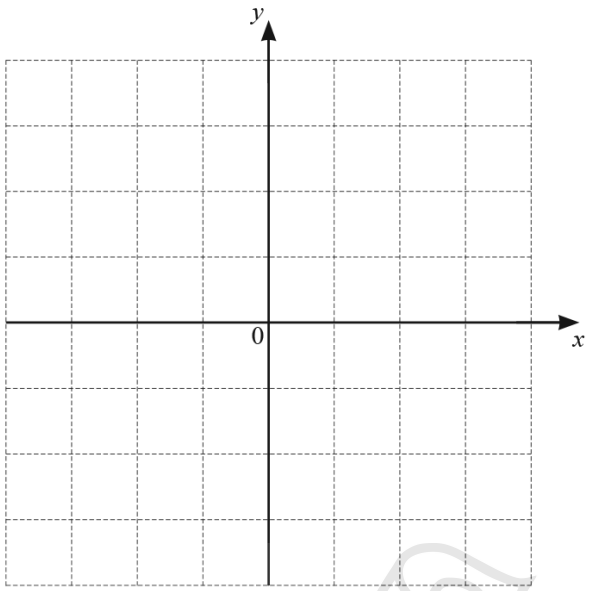
(d) Describe fully the **single** transformation that is equivalent to transformation Q followed by transformation P.

.....

..... [2]

69. 0607_s19_qp_43 Q: 6

You may use this grid to help you answer this question.



The transformation P is a reflection in the line $y = x$.

The transformation Q is a rotation of 180° about the origin.

The transformation R is a stretch, scale factor 2 with x-axis invariant.

The transformation S is a stretch, scale factor 2 with y-axis invariant.

(a) **(i)** Find the co-ordinates of the image of the point (5, 1) under the transformation P.

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

(ii) Find the co-ordinates of the image of the point (x, y) under the transformation P followed by the transformation Q.

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

(iii) Describe fully the **single** transformation equivalent to P followed by Q.

.....

..... [2]

(b) Describe fully the **single** transformation equivalent to R followed by S.

.....

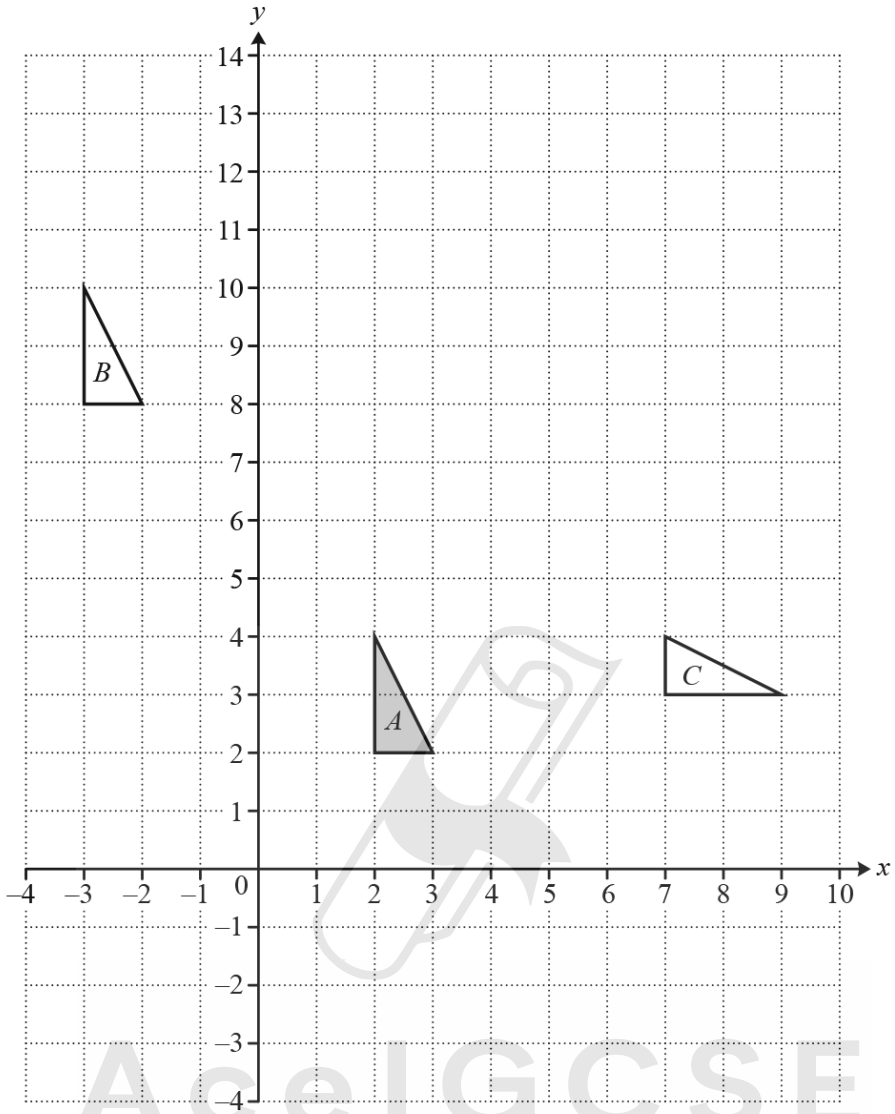
..... [3]

(c) Describe fully the **single** transformation equivalent to the inverse of R.

.....

..... [2]

70. 0607_w17_qp_41 Q: 6



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

.....

..... [2]

(b) On the grid, draw the image of triangle A after a stretch with scale factor 3 and invariant line the x-axis. [2]

(c) Triangle A can be mapped onto triangle C by a rotation followed by a reflection.

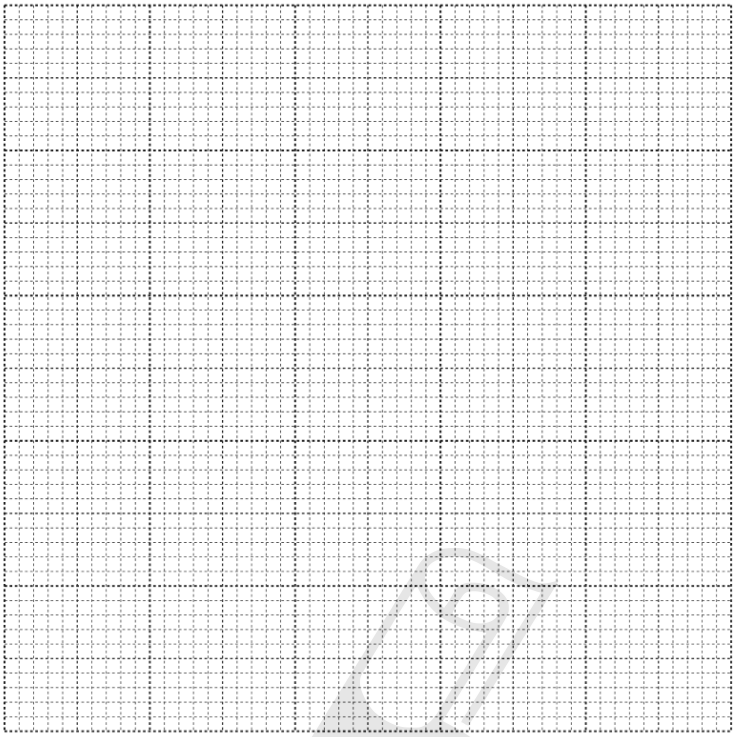
Complete the following to **fully** describe the two transformations.

Rotation .....

Reflection ..... [3]

71. 0607_w17_qp_43 Q: 8

You may use the grid to help you in answering this question.



The transformation P is a rotation through 90° anti-clockwise about the origin.
The transformation Q is a reflection in the line $y = -x$.

(a) Find the image of the point (5, 1) under the transformation P.

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

(b) Find the image of the point (5, 1) under the transformation Q.

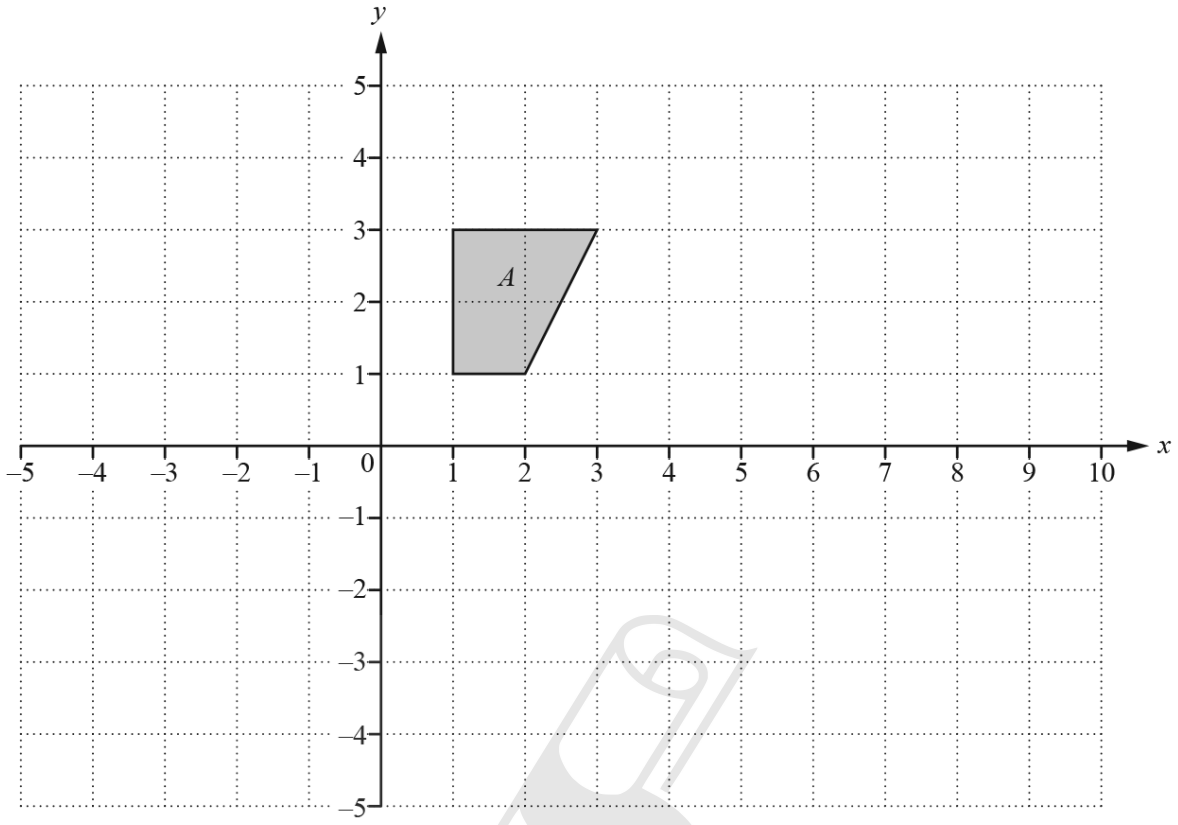
(..... , ...) [2]

(c) Describe fully the **single** transformation equivalent to the transformation P followed by the transformation Q.

.....

..... [2]

72. 0607_s16_qp_41 Q: 3



(a) **(i)** Draw the image of quadrilateral A after it has been reflected in the y-axis and then rotated through 90° anti-clockwise about the origin. [3]

(ii) Describe fully the **single** transformation equivalent to reflection in the y-axis followed by rotation 90° anti-clockwise about the origin.

.....

..... [2]

(b) **(i)** Draw the image of quadrilateral A after a stretch, factor 3 with the y-axis invariant. Label the image B. [2]

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

.....

..... [2]

73. 0607_s16_qp_43 Q: 9

The transformation **AB** means transformation **B** followed by transformation **A**.

(a) The transformation **P** is a rotation through 90° clockwise about the origin.
The transformation **Q** is a rotation through 180° about the origin.
The transformation **R** is a rotation through 270° clockwise about the origin.
The transformation **S** is a reflection in the y-axis.
The transformation **T** is a reflection in the x-axis.

Write down the letter of the **single** transformation, **P**, **Q**, **R**, **S** or **T**, that is equivalent to each of the transformations **QR**, **PQR**, **ST**, **SQ**, **PTP** and **TPP**.

QR = ...

PQR = ...

ST = ...

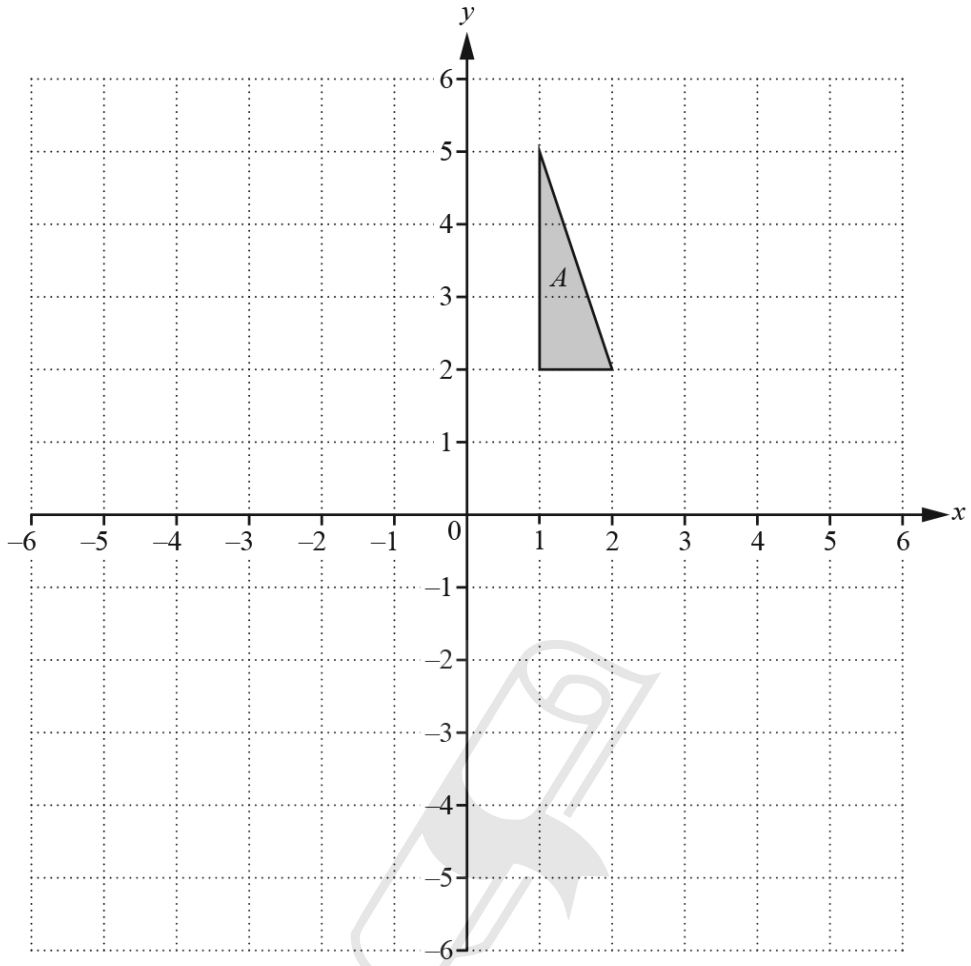
SQ = ...

PTP = ...

TPP = ...

[6]

(b)



(i) Draw the image of triangle A after a reflection in the line $y = x$.
Label this image B.

[2]

(ii) Draw the image of **triangle** $\boldsymbol{B}$ after a reflection in the x-axis.
Label this image C.

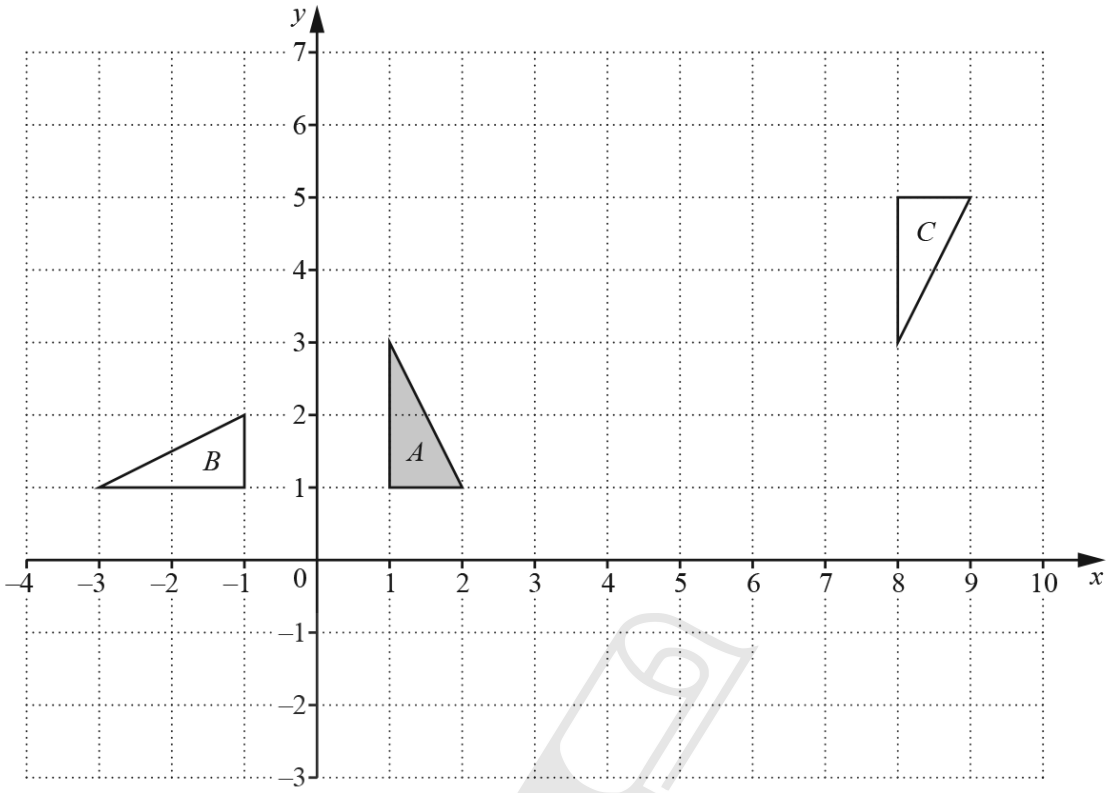
[1]

(iii) Describe fully the **single** transformation that maps **triangle** $\boldsymbol{C}$ onto **triangle** $\boldsymbol{A}$.

.....

..... [3]

74. 0607_s15_qp_42 Q: 2



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

Answer(a) .....

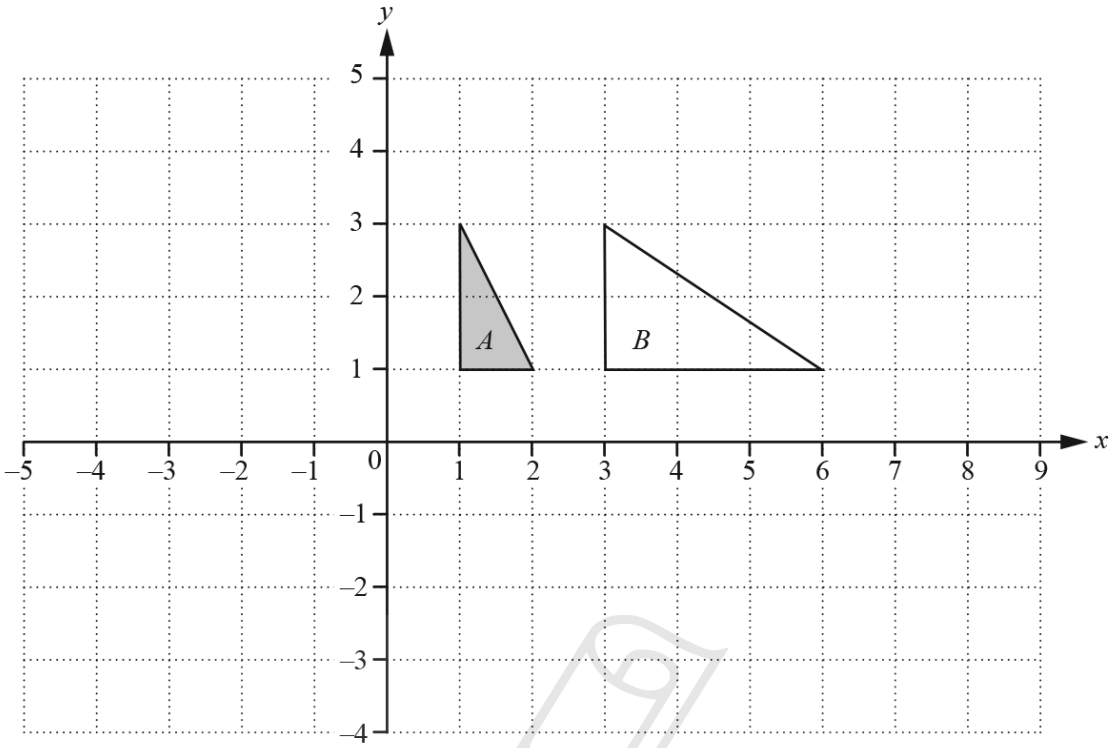
..... [3]

(b) Complete the statement.

Triangle A can be mapped onto triangle C by a translation with vector $\begin{pmatrix} \\ \end{pmatrix}$ followed by a reflection in the line ..... . [2]

(c) Stretch triangle A with the x-axis invariant and stretch factor 2. [2]

75. 0607_s15_qp_43 Q: 2



(a) **(i)** Rotate triangle A through 90° anticlockwise about the origin.
Label the image C. [2]

(ii) Reflect triangle C in the x-axis.
Label the image D. [2]

(iii) Describe fully the **single** transformation that is equivalent to a rotation through 90° anticlockwise about the origin followed by a reflection in the x-axis.

Answer(a)(iii) .....

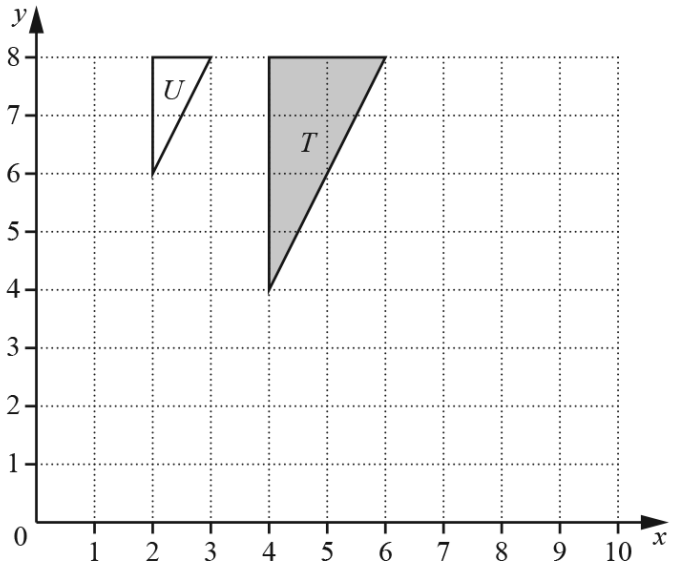
..... [2]

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

Answer(b) .....

..... [3]

76. 0607_w15_qp_43 Q: 5



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

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

..... [3]

(ii) Describe fully the inverse of the transformation in **part(a)(i)**.

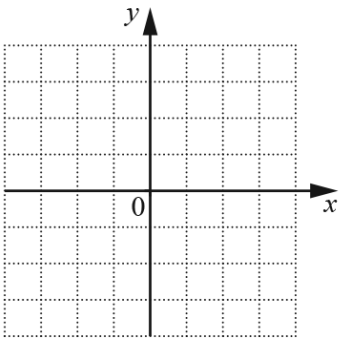
Answer(a)(ii) .....

..... [2]

(b) **(i)** Draw the image of triangle T under a reflection in the line $y = x$. [2]

(ii) Draw the image of triangle T under a rotation of 90° anti-clockwise about the point (6, 8). [2]

(c) Describe fully the **single** transformation equivalent to a rotation 90° clockwise about (0, 0) followed by a reflection in the line $y = -x$.
You may use the grid to help you.



Answer(c) .....

..... [3]

01. 0607_m24_ms_42 Q: 3

Question	Answer	Marks	Partial Marks
(a)	Translation $\begin{pmatrix}-7\\2\end{pmatrix}$	2	**B1** for each
(b)	Enlargement [sf] $-\frac{1}{2}$ [centre] (–1, 3)	3	**B1** for each
(c)(i)	Triangle at (1, –3), (5, –3), (1, –5)	2	**B1** for rotation 90° anticlockwise about (–1, –1) or for rotation 90° clockwise about wrong centre
(c)(ii)	Triangle at (–3, –3), (–7, –3), (–3, –5)	2	**FT** *their* (c)(i) **B1** for reflection in $x = k$ or $y = -1$
(c)(iii)	Reflection $y = -x - 2$ oe	2	**B1** for each

02. 0607_s24_ms_41 Q: 3

Question	Answer	Marks	Partial Marks
(a)	Correct triangle (–5, 0), (–5, –3), (–4, –3)	2	**B1** for translation $\begin{pmatrix}2\\k\end{pmatrix}$ or $\begin{pmatrix}k\\-6\end{pmatrix}$

Question	Answer	Marks	Partial Marks
(b)	Translation $\begin{pmatrix}-2\\6\end{pmatrix}$	2	**B1** for each
(c)	Correct triangle (3, 6), (3, 7), (6, 7)	2	**B1** for correct rotation, incorrect centre or for correct rotation 90 anticlockwise
(d)	Correct triangle (3, –6), (3, –7), (6, –7)	2	**B1** for correct size and orientation, wrong position or reflection in $y = -x$
(e)	Rotation 90 anticlockwise oe [Centre] (4, –2)	3	**B1** for each

03. 0607_s24_ms_42 Q: 8

Question	Answer	Marks	Partial Marks
(a)(i)	Translation $\begin{pmatrix}3\\2\end{pmatrix}$	2	**B1** for each
(a)(ii)	Enlargement (or reduction) [scale factor] $\frac{1}{2}$ oe [centre] (5, 1)	3	**B1** for each
(b)(i)	(2, –5)	1	
(b)(ii)	8.6[0] or 8.602...	2	**M1** for $5^2 + (-7)^2$ or $5^2 + 7^2$ or better
(c)	[y=] $3x + 8$	3	**M1** for $\frac{11 - -1}{1 - -3}$ (m) oe **M1** for substituting (–3, –1) or (1, 11) into $y = (\textit{their } m)x + c$ oe

04. 0607_s24_ms_43 Q: 6

Question	Answer	Marks	Partial Marks
(a)(i)	Triangle at (1, –2), (4, –2) , (3, –3)	2	**B1** for reflection in $y = -x$ or correct size and orientation
(a)(ii)	Rotation 90° clockwise oe [centre] (4, 1)	3	**B1** for each
(a)(iii)	Enlargement [Scale factor] –2 [centre] (–1, 3)	3	**B1** for each
(b)(i)	Translation $\begin{pmatrix}3\\-4\end{pmatrix}$	2	**B1** for each
(b)(ii)	Stretch $y = 1$ [invariant] factor $\frac{1}{3}$	3	**B1** for each

05. 0607_m23_ms_42 Q: 2

Question	Answer	Marks	Partial Marks
(a)	Translation $\begin{pmatrix}-11\\-13\end{pmatrix}$	2	**B1** for each
(b)	Rotation 90 clockwise oe [Centre] (4, 9)	3	**B1** for each
(c)	Correct triangle (–6, 8) (–6, 7) (–3, 7)	2	**B1** for correct reflection in $y = k$,
(d)	Correct triangle (–6, –6) (–6, –4) (0, –4)	2	**B1** for correct SF enlargement, incorrect position

06. 0607_s23_ms_42 Q: 3

Question	Answer	Marks	Partial Marks
(a)	Triangle at (1, –6), (2, –4), (4, –4)	2	**B1** for reflection in $x = -1$ or $y = k$
(b)	Triangle at (–4, 7), (–3, 5), (– 1, 5)	2	**B1** for translation $\begin{pmatrix}-5\\k\end{pmatrix}$ or $\begin{pmatrix}k\\3\end{pmatrix}$

Question	Answer	Marks	Partial Marks
(c)	Rotation 90° [anticlockwise] oe [Centre] origin or (0, 0)	3	**B1** for each
(d)	Stretch [Factor] 2 x-axis (or $y = 0$) invariant	3	**B1** for each

07. 0607_s23_ms_43 Q: 1

Question	Answer	Marks	Partial Marks
(a)	Correct triangle (–5, 5) (–5, 7) (–6, 7)	2	**B1** for translation by $\begin{pmatrix}-6\\k\end{pmatrix}$ or $\begin{pmatrix}k\\4\end{pmatrix}$
(b)	Rotation 90 clockwise oe Centre (2, 0)	3	**B1** for each
(c)	Correct triangle (–5, 1) (–5, 3) (–4, 3)	2	**B1** for correct reflection in $x = k$ or in $y = -2$
(d)	Correct triangle (–1, –1) (0, –3) (–1, –3)	2	**B1** for correct enlargement, incorrect centre

08. 0607_w23_ms_42 Q: 1

Question	Answer	Marks	Partial Marks
(a)	triangle (–6, –2) (–4, –2) (–4, –5)	2	**B1** for reflection in $y = -1$ or reflection in $x = k$
(b)	triangle (3, 2) (5, 2) (3, −1)	2	**B1** for translation $\begin{pmatrix}1\\k\end{pmatrix}$ or $\begin{pmatrix}k\\4\end{pmatrix}$
(c)	rotation 180° [centre] (0, 0) oe OR enlargement [centre] (0, 0) oe [sf] –1	3	**B1** for each
(d)	triangle (−1, 2) (0, 5) (0, 2)	2	**B1** for correct shape but translated horizontally from correct position.

09. 0607_w23_ms_43 Q: 3

Question	Answer	Marks	Partial Marks
(a)	Triangle at (–4, 4), (–2, 4), (–4, 3)	2	**B1** for translation through $\begin{pmatrix}-5\\k\end{pmatrix}$ or $\begin{pmatrix}k\\2\end{pmatrix}$
(b)	Enlargement [Scale Factor] –2 [Centre] (2, 3)	3	**B1** for each
(c)(i)	Triangle at (–2, –1), (–1, –1), (–2, –3)	4	**B2** for triangle at (1, –3), (1, –4), (3, –4) or **B1** for reflection in $y = k$ or $x = -1$ **dep B1** for rotation of *their* first image 90° clockwise or anticlockwise about (1, –1) or rotation 90° clockwise about wrong centre. If 0 scored, **SC1** for correct triangle translated
(c)(ii)	Reflection $y = -x$ oe	2	**B1** for each

10. 0607_w20_ms_42 Q: 12

Question	Answer	Marks	Partial Marks
(a)(i)	Vector $\begin{pmatrix}6\\4\end{pmatrix}$ drawn	**1**	
(a)(ii)	Vector $\begin{pmatrix}-2\\1\end{pmatrix}$ drawn	**1**	
(a)(iii)	Vector $\begin{pmatrix}-1\\4\end{pmatrix}$ drawn	**2**	**B1** for vector $\begin{pmatrix}-1\\k\end{pmatrix}$ or vector $\begin{pmatrix}k\\4\end{pmatrix}$ drawn or $\begin{pmatrix}-1\\4\end{pmatrix}$ seen

Question	Answer	Marks	Partial Marks
(b)	$2p - q = 10$ $3p + 4q = -7$	**B1**	
	Equalising coefficients and adding or subtracting appropriately, or expression for one variable in terms of the other and correctly substituted, or rearranged equations seen and sketch of both lines intersecting.	**M1**	
	$p = 3$, $q = -4$	**A2**	**A1** for each If **M0 A0** scored, **SC1** for $p = 3$, $q = -4$ with no working or their answers satisfying one equation

11. 0607_s19_ms_41 Q: 7

Question	Answer	Marks	Partial Marks
(a)	Vector $\begin{pmatrix}4\\2\end{pmatrix}$ drawn Vector $\begin{pmatrix}2\\5\end{pmatrix}$ drawn Vector $\begin{pmatrix}-4\\0\end{pmatrix}$ drawn	**3**	**B1** for each with arrows If 0 scored **SC1** for all three without arrows or all incorrect arrows
(b)	[**p** =] –3**b** oe [**q** =] 3**a** + 3**b** oe [**r** =] 2**b** – **a** oe	**3**	**B1** for each

12. 0607_w19_ms_43 Q: 6

Question	Answer	Marks	Partial Marks
(a)	(11, –9)	**2**	**B1** for each co-ordinate
(b)(i)	–**a** + **b**	**1**	
(b)(ii)	$\frac{3}{7}$**a** + $\frac{4}{7}$ **b** or $\frac{1}{7}$(3**a** + 4**b**)	**3**	**B2** for unsimplified or **B1** for $\overrightarrow{OA}$ + $\frac{4}{7}$ $\overrightarrow{AB}$ oe or a correct route

13. 0607_w18_ms_41 Q: 10

Question	Answer	Marks	Partial Marks
(a)(i)	$-6\mathbf{a} + 6\mathbf{c}$ oe	1	
(a)(ii)	$\frac{2}{3}(-6\mathbf{a} + 6\mathbf{c})$ oe	1	**FT** *their* **(a)(i)** if a vector
(a)(iii)	$-4\mathbf{a}$	2	**M1** for *their* **(a)(ii)** $+\frac{2}{3}\overrightarrow{CO}$ or correct unsimplified route
(b)	Both multiples of **a** oe	1	Depends on **(a)(iii)** being a multiple of **a**
(c)	AngleOAX = angle BDX Angle OXA = angle BXD	2	Two correct statements **B1** for one correct statement
(d)(i)	$-6\mathbf{a} + 2\mathbf{c}$ oe	2	**B1** for a correct route eg $\overrightarrow{AO} + \overrightarrow{OD}$ or for $-6\mathbf{a} + k\mathbf{c}$ or for $k\mathbf{a} + 2\mathbf{c}$, $k \neq 0$
(d)(ii)	$\frac{1}{5}(-12\mathbf{a} + 4\mathbf{c})$ oe	2	**M1** for $3\overrightarrow{XD} = 2(-6a + 2c - \overrightarrow{XD})$ or $\frac{2}{5}$(*their* **(d)(i)**)
(e)	9 : 4 oe	2	**B1** for 3 : 2 oe soi or for 1.5^2 or $\left(\frac{2}{3}\right)^2$ seen

14. 0607_w18_ms_42 Q: 13

Question	Answer	Marks	Partial Marks
(a)(i)	$-\mathbf{a} + \mathbf{b}$	1	
(a)(ii)	$\frac{2}{5}\mathbf{a} + \frac{3}{5}\mathbf{b}$	2	**B1** for unsimplified seen or **M1** for $\mathbf{a} + \frac{3}{5}\overrightarrow{AB}$ oe or $\mathbf{b} + \frac{2}{5}\overrightarrow{BA}$ oe
(b)(i)	$\frac{2}{3}\mathbf{a}$	2	**B1** for unsimplified seen or **M1** for $-\mathbf{b} + \frac{5}{3}$*their* **(a)(ii)**
(b)(ii)	$\overrightarrow{BQ}$ is a multiple of **a** oe	1	**Dep** on **(b)(i)** = $k\mathbf{a}$, $k \neq 1$

15. 0607_w18_ms_43 Q: 3

Question	Answer	Marks	Partial Marks
(a)(i)	$\begin{pmatrix}1\\3\end{pmatrix}$	**1**	
(a)(ii)	$\begin{pmatrix}4\\-2\end{pmatrix}$	**1**	
(a)(iii)	4.47 or 4.472…	**2**	**FT** *their* **(ii)** **M1** for $(\textit{their } 4)^2 + (\textit{their } -2)^2$
(b)(i)	$\begin{pmatrix}2\\5\end{pmatrix}$	**2**	**B1** for $\begin{pmatrix}2\\k\end{pmatrix}$ or $\begin{pmatrix}k\\5\end{pmatrix}$ If 0 scored, **SC1** for $\begin{pmatrix}2\\5\end{pmatrix}$
(b)(ii)	$(6, 17)$	**2**	**B1** for $(6, k)$ or $(k, 17)$

16. 0607_s17_ms_43 Q: 11

Question	Answer	Marks	Part Marks
(a)(i)	$-\mathbf{a} + \mathbf{b}$ oe	**1**	
(a)(ii)	$-\frac{1}{4}\mathbf{a} + \frac{1}{4}\mathbf{b}$ oe	**1**	**FT** *their* (i)
(a)(iii)	$\frac{3}{4}\mathbf{a} + \frac{1}{4}\mathbf{b}$ oe	**2**	**B1** for correct unsimplified answer or a correct route
(b)	(6.5, 1.5)	**3**	**FT** *their* (a)(iii) **B2** for $\begin{pmatrix}6.5\\1.5\end{pmatrix}$ or **M1** for $\frac{3}{4}\times\begin{pmatrix}8\\0\end{pmatrix}+\frac{1}{4}\times\begin{pmatrix}2\\6\end{pmatrix}$ OR **B2** for (5, 3) at M or $[\overrightarrow{OM} =]\ \begin{pmatrix}5\\3\end{pmatrix}$ or **B1** for $(k, 3)$ or $(5, k)$ at M or $[\overrightarrow{OM} =]\ \begin{pmatrix}k\\3\end{pmatrix}$ or $\begin{pmatrix}5\\k\end{pmatrix}$

17. 0607_w17_ms_41 Q: 13

Question	Answer	Marks	Partial Marks
(a)(i)	**c** – **a** oe	1	
(a)(ii)	$\frac{2}{3}\mathbf{a} + \frac{1}{3}\mathbf{c}$ or $\frac{1}{3}(2\mathbf{a} + \mathbf{c})$	2	**B1** for correct unsimplified or correct route e.g. $\mathbf{c} + \frac{2}{3}\overrightarrow{CA}$ or $\mathbf{a} + \frac{1}{3}$ *their* (i)
(a)(iii)	2**a**	2	**B1** for correct unsimplified or correct route e.g. –**c** + 3 × *their* (ii)
(b)	Collinear oe	1	

18. 0607_w17_ms_43 Q: 5

Question	Answer	Marks	Partial Marks
(a)(i)	–6**p** + 6**q** oe	1	
(a)(ii)	–2**p** + 2**q** oe	2	**FT** *their* (a)(i) ÷ 3 provided in form a**p** +b**q** **B1** for –2**p** + *k***q** or for *k***p** + 2**q** **M1** for $\overrightarrow{AD} = 2\mathbf{p}$ oe or $\overrightarrow{AE} = 2\mathbf{q}$ or correct route
(a)(iii)	4**p** cao	1	
(a)(iv)	–6**p** +2**q** oe	2	**B1** for –6**p** + *k***q** or for *k***p** + 2**q** **M1** for a correct route
(b)(i)	216	2	**M1** for $\left(\frac{1}{3}\right)^2$ or 3^2 oe soi
(b)(ii)	96	3	**M2** for $\left(\frac{1}{2}\right)^2$ or 2^2 oe soi or **M1** for triangle *EFC* is similar to triangle *EDA* soi

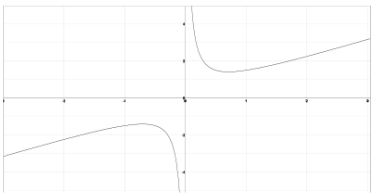
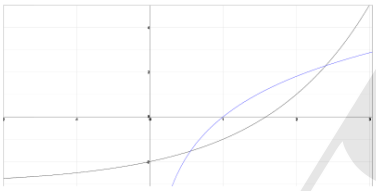
19. 0607_s16_ms_43 Q: 8

Question	Answer	Mark	Part Marks
(a)	6**p** – **q**	2	**B1** for $\overrightarrow{XD} = -\mathbf{q}$ or **M1** for $\overrightarrow{AD} = \overrightarrow{AX} + \overrightarrow{XD}$ oe
(b)	3**p** + **q** oe	2	**M1** for $\overrightarrow{AC} = 9\mathbf{p}$ or $\overrightarrow{XC} = 3\mathbf{p}$ or correct route
(c)	3**p** – 2**q** oe	3	**M1** for $\overrightarrow{BD}$ = *their* (a) **M1** for $\overrightarrow{CB} = \overrightarrow{CD} + \overrightarrow{DB}$ oe

20. 0607_w21_ms_42 Q: 6

Question	Answer	Marks	Partial Marks
(a)(i)	$\begin{pmatrix}5\\9\end{pmatrix}$	**2**	**B1** for $\begin{pmatrix}5\\k\end{pmatrix}$ or $\begin{pmatrix}k\\9\end{pmatrix}$ or **M1** for $\begin{pmatrix}3\\5\end{pmatrix}-\begin{pmatrix}-2\\-4\end{pmatrix}$ or $\begin{pmatrix}3\\5\end{pmatrix}+\begin{pmatrix}2\\4\end{pmatrix}$
(a)(ii)	$\begin{pmatrix}1\\-2\end{pmatrix}$	**2**	**B1** for $\begin{pmatrix}1\\k\end{pmatrix}$ or $\begin{pmatrix}k\\-2\end{pmatrix}$ If 0 scored **SC1** for answer $\begin{pmatrix}-1\\2\end{pmatrix}$
(a)(iii)	(4, 5)	**1**	
(a)(iv)	5	**2**	**M1** for $(-3)^2+(-4)^2$ oe
(b)(i)	$y=2x+3$ oe	**5**	**B4** for answer $2x+3$ OR **M1** for grad = $\frac{6-4}{-1-3}$ oe or better **M1** for perp grad = $\frac{-1}{\textit{their}\text{ gradient}}$ **B1** for (1, 5) **M1** for substituting *their* (1, 5) into $y = (\textit{their } m)x + c$ oe
(b)(ii)	(–1.5, 0)	**2**	**FT** *their* **(b)(i)** **M1** for $y = 0$ substituted in *their* equation in **(b)(i)**

21. 0607_w18_ms_43 Q: 4

Question	Answer	Marks	Partial Marks
(a)(i)	Correct sketch 	3	**B2** for correct shaped branches but branches joined or **B1** for one branch correct shape (even if branches connected)
(a)(ii)	(0.707 or 0.7071… , 1.41 or 1.414…)	2	**B1** for (0.707 or 0.7071… , k) or for(k , 1.41 or 1.414…)
(a)(iii)	f(x) ⩾ 1.41 or 1.414….	1	**FT** *their* **(ii)**
(a)(iv)	$x = 0$ $y = x$ oe	2	**B1** for each
(b)(i)(a)	Correct sketches 	2	**B1** for increasing exponential graph with negative y-intercept.
(b)(i)(b)		2	**B1** for correct shape all to right of y-axis and x-intercept not too far from 1.
(b)(ii)	0.556 or 0.5559… < x < 2.4[0] or 2.401…	2	**B1** for both correct values seen

22. 0607_s17_ms_42 Q: 4

Question	Answer	Marks	Partial Marks
(a)(i)	$\begin{pmatrix}-1.5\\1\end{pmatrix}$ oe	1	
(a)(ii)	$\begin{pmatrix}10\\-1\end{pmatrix}$	2	**B1** for each
(a)(iii)	$\sqrt{13}$ final answer	2	**M1** for $(-3)^2 + 2^2$ oe soi by 3.61 or 3.605 to 3.606 $\sqrt{13}$ in working implies M1
(b)	Correct B clearly indicated	2	**B1** for vector $\begin{pmatrix}1\\5\end{pmatrix}$ drawn not from A or $\begin{pmatrix}1\\5\end{pmatrix}$ seen or correctly following through, from A, their incorrect vector seen. or either $\begin{pmatrix}-3\\2\end{pmatrix}$ or $\begin{pmatrix}4\\3\end{pmatrix}$ correctly drawn **only** if one starts from A.

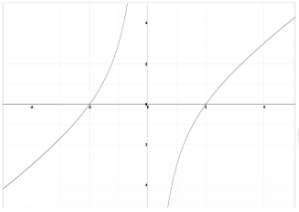
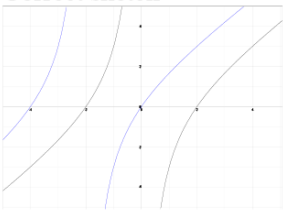
23. 0607_m21_ms_42 Q: 1

Question	Answer	Marks	Partial Marks
(a)(i)	correct triangle B (0, 3) (0, 8) (−3, 3)	2	**B1** for 90° rotation about wrong centre
(a)(ii)	correct triangle C (−3, 0) (−8, 0) (−3, 3)	1	
(a)(iii)	reflection $x + y = 0$ oe	2	**B1** for each
(b)	enlargement [scale factor] 3 [centre] (0, 0) oe	3	**B1** for each

24. 0607_s21_ms_41 Q: 2

Question	Answer	Marks	Partial Marks
(a)	Correct triangle (–8, –1) (–7, –1) (–8, 3)	2	**B1** for correct translation in y or for correct translation in x
(b)	Translation $\begin{pmatrix}3\\5\end{pmatrix}$	2	**B1** for each
(c)	Correct triangle (4, 4) (4, 5) (8, 5)	2	**M1** for correct rotation, wrong centre or for rotation anticlockwise 90°, about O
(d)	Correct triangle (4, –4) (4, –5) (8, –5)	2	**M1** for correct orientation, incorrect position or for reflection in $y = -x$
(e)	Reflection $y = 0$ oe	2	**B1** for each

25. 0607_s21_ms_43 Q: 1

Question	Answer	Marks	Partial Marks
(a)	Correct sketch 	2	**B1** for each branch or **B1** for correct but branches joined
(b)	–2, 2	2	**B1** for each
(c)	–1.24 or –1.236... 3.24 or 3.236...	2	**B1** for each
(d)(i)	Correct sketch 	2	**B1** for each branch or **B1 FT** *their* f(x) translated in x direction
(d)(ii)	Translation $\begin{pmatrix}-2\\0\end{pmatrix}$	2	**B1** for each

Question	Answer	Marks	Partial Marks
(a)(i)	Rotation ✓ Reflection ✓ Translation ✓ Enlargement Stretch	1	
(a)(ii)	Rotation ✓ Reflection ✓ Translation ✓ Enlargement ✓ Stretch	1	
(a)(iii)	Rotation Reflection Translation Enlargement ✓ Stretch ✓	1	

Question	Answer	Marks	Partial Marks
(b)(i)	Rotation 90 [anticlockwise] oe (0, 0) oe	3	**B1** for each
(b)(ii)	Triangle with vertices at (2, –4), (4, –4), (4, 4)	2	**B1** for stretch, factor 2, y-axis invariant, or stretch, factor 2, $y = c$ invariant

27. 0607_w21_ms_42 Q: 5

Question	Answer	Marks	Partial Marks
(a)(i)	Image at (–2, 1), (–5, 1), (–5, 2)	1	
(a)(ii)	Image at (–8, 6), (–5, 6) (–5, 7)	2	**B1** for translation $\begin{pmatrix}-10\\k\end{pmatrix}$ or $\begin{pmatrix}k\\5\end{pmatrix}$
(a)(iii)	Image at (3, 0), (3, –3), (4, –3)	2	**B1** for rotation 90° anticlockwise about (2, 0) or rotation 90° clockwise but incorrect centre.
(a)(iv)	Image at (–4, –2), (–10 –2), (–10, –4)	2	**B1** for enlargement factor –2 correct orientation but incorrect position
(a)(v)	Stretch [factor] 3 *x*-axis oe invariant	3	**B1** for each
(b)(i)	$x^2 + 2$	1	
(b)(ii)	$2x^2$	1	

28. 0607_s20_ms_41 Q: 1

Question	Answer	Marks	Partial Marks
(a)(i)	Image at (–1, 1), (–3, 1), (–3, 2)	1	
(a)(ii)	Image at (–4, 4), (–2, 4), (–2, 5)	2	**B1** for translation $\begin{pmatrix}-5\\k\end{pmatrix}$ or $\begin{pmatrix}k\\3\end{pmatrix}$
(a)(iii)	Image at (0, 2), (4, 2), (4, 4)	2	**B1** for enlargement factor 2, different centre
(b)(i)	Rotation (–2, 0) 90° clockwise oe	3	**B1** for each
(b)(ii)	Stretch –2 *x*-axis oe invariant	3	**B1** for each

29. 0607_s20_ms_42 Q: 2

Question	Answer	Marks	Partial Marks
(a)(i)	Translation $\begin{pmatrix} -6 \\ -10 \end{pmatrix}$	**2**	**B1** for each
(a)(ii)	Enlargement SF 2 Centre (0, 9)	**3**	**B1** for each
(b)(i)	(–2, –5)	**1**	
(b)(ii)	(2, –5)	**1**	
(b)(iii)	Reflection *x*-axis oe	**2**	**B1** for each
(b)(iv)	Reflection *y*-axis oe	**2**	**B1** for each

30. 0607_w20_ms_42 Q: 7

Question	Answer	Marks	Partial Marks
(a)	6.71 or 6.708...	**3**	**M2** for $(9 - 3)^2 + (5 - 2)^2$ soi or **M1** for 9 – 3 and 5 – 2 soi
(b)	[*y* =] 0.5*x* + 0.5 oe	**3**	**M1** for gradient = $\frac{5-2}{9-3}$ oe **M1** for substituting (3, 2) or (9, 5) into *their* $y = mx + c$ oe
(c)	[*y* =] –2*x* + 18	**3**	**M1** for gradient = –1 ÷ *their* 0.5 **M1** for substituting (8, 2) into *their* $y = mx + c$ oe
(d)	(7, 4)	**2**	**B1** for each coordinate or **M1** for *their* **(b)** = *their* **(c)**
(e)(i)	(6, 6)	**2**	**B1** for each coordinate
(e)(ii)	Kite	**1**	

Question	Answer	Marks	Partial Marks
(f)	15 or 14.99 to 15.01	**3**	**M2** for $\frac{(8-3)\times(5-2)}{2}\times 2$ OR **M1** for ((*their* 6) – 8)^2 + ((*their* 6) – 2)^2 **M1** for 0.5 × *their* (a) × *their CD* OR **M2** for 24 – 6 – 2 × 1.5 oe or better or **M1** for $6\times4-0.5\times3\times4-2\times0.5\times1\times3$

31. 0607_w20_ms_43 Q: 9

Question	Answer	Marks	Partial Marks
(a)	$\begin{pmatrix}-3\\4\end{pmatrix}$	**1**	
(b)	(2, 7)	**1**	
(c)	(1, 5)	**1**	
(d)	(1.5, 6)	**1**	**FT** *their* **(b)** and **(c)**.
(e)	2.24 or 2.236...	**3**	**FT** *their* **(b)** and **(c)**. **M2** for (*their* 2 – *their* 1)^2 + (*their* 7 – *their* 5)^2 oe or **M1** for (*their* 2 – *their* 1) and (*their* 7 – *their* 5) seen
(f)	$y = 2x - 2$ oe	**3**	**M1** for gradient = $\frac{-1}{\frac{1}{2}}$ oe soi 2 **M1** for substituting (3, 4) in $y =$ *their* $m\,x + c$ Answer $2x - 2$ implies M1 M1

32. 0607_w20_ms_43 Q: 10

Question	Answer	Marks	Partial Marks
(a)(i)	Rotation 90 [anticlockwise] oe (0, 0) oe	3	**B1** for each
(a)(ii)	Image at (1, –5), (2, –6), (4, –6), (4, –5)	2	**B1** for reflection in $y = k$
(a)(iii)	Image at (1, 2), (2, 4), (4, 2), (4, 4)	2	**B1** for other stretch, factor 2, $y = k$ invariant or y-axis invariant
(b)	Stretch [factor] 3 x-axis oe invariant	3	**B1** for each If 0 scored **M1** for $[g(x)] = 3\log x$

33. 0607_s19_ms_41 Q: 2

Question	Answer	Marks	Partial Marks
(a)	Reflection $y = -1$	2	**B1** for each
(b)	Triangle at (6, –3), (11, –3), (10, –1)	2	**B1** for translation $\begin{pmatrix} k \\ -3 \end{pmatrix}$ or $\begin{pmatrix} 6 \\ k \end{pmatrix}$
(c)(i)	63.4 or 63.43 to 63.44	3	**B2** for $\tan[\theta] = \frac{4}{2}$ oe or **B1** for correct angle clearly identified and no other angle seen.
(c)(ii)	5	3	**M2** for $\frac{\sqrt{125}}{5}$ or $\frac{10}{\sqrt{20}}$ or $\frac{5}{\sqrt{5}}$ or **M1** for $\sqrt{10^2+5^2}$ or $\sqrt{4^2+2^2}$ or $\sqrt{1^2+2^2}$ or $\sqrt{125}$ or $\sqrt{20}$ or $\sqrt{5}$

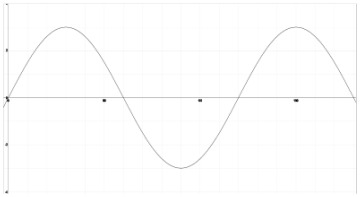
34. 0607_s19_ms_42 Q: 6

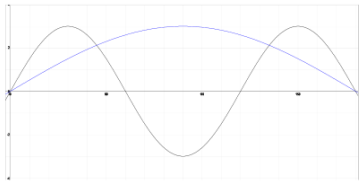
Question	Answer	Marks	Partial Marks
(a)	Correct reflection at (1, –1), (4, –1), (4, –3), (3, –3)	1	
(b)	Correct translation at (5, –4), (2, –4), (2, –6), (3, –6)	2	**B1** for translation $\begin{pmatrix}6\\k\end{pmatrix}$ or $\begin{pmatrix}k\\-3\end{pmatrix}$
(c)	Rotation 90[°] clockwise oe (0, 1)	3	**B1** for each
(d)	Correct stretch at (–1, –2), (–4, –2), (–4, –6), (–3, –6)	2	**B1** for stretch factor 2 displaced vertically

35. 0607_w19_ms_41 Q: 4

Question	Answer	Marks	Partial Marks
(a)(i)	Translation $\begin{pmatrix}-1\\6\end{pmatrix}$	2	**B1** for each
(a)(ii)	Rotation [centre] (2, 1) 90 clockwise oe	3	**B1** for each
(a)(iii)	Enlargement [centre] (3, 0) [factor] 3	3	**B1** for each
(b)	Correct stretch at (4, 1) (10, 1), (10, 3)	2	**B1** for stretch factor 2 with x-axis invariant or for stretch with $x = k$ invariant with stretch factor 2

36. 0607_w19_ms_41 Q: 11

Question	Answer	Marks	Partial Marks
(a)	Correct sketch 	2	**B1** for sine graph with incorrect amplitude and/or incorrect period, passing through (0, 0).
(b)	3 120	2	**B1** for each
(c)	$70 < x < 110$	2	**B1** for 70 and 110 seen

Question	Answer	Marks	Partial Marks
(d)(i)	Correct sketch 	1	
(d)(ii)	Two areas shaded, which are below graph of $y = f(x)$ and above graph of $y = g(x)$	1	
(d)(iii)	Stretch [factor] $\frac{1}{3}$ invariant line y-axis oe	3	**B1** for each

37. 0607_w19_ms_42 Q: 1

Question	Answer	Marks	Partial Marks
(a)	Correct triangle with vertices (3, –5), (5, –5), (5, –4)	1	
(b)	Correct triangle with vertices (3, 2), (5, 2), (5, 1)	1	
(c)	Reflection $y = -1.5$ oe	2	**B1** for each
(d)	Correct triangle with vertices (–5, 3), (–5, 5), (–4, 5)	2	**B1** for correct rotation with incorrect centre of rotation. or **B1** for clockwise rotation with correct centre of rotation.
(e)	Reflection $y = x$ oe	2	**B1** for each

38. 0607_w19_ms_43 Q: 5

Question	Answer	Marks	Partial Marks
(a)	Triangle at (2, 0), (2, –4), (4, –4)	**2**	**B1** for reflection in $y = k$ or $x = 1$
(b)	Triangle at (0, 2), (–2, 2), (–2, 3)	**3**	**B2** for Rotation 90° anti-clockwise about (1, 0) or **B1** for Rotation 90° clockwise about any centre.
(c)	Enlargement [Scale factor] $-\frac{1}{2}$ oe [Centre] (0, 0) oe	**3**	**B1** for each
(d)	Stretch [Stretch factor] 3 Invariant [line] y-axis oe	**3**	**B1** for each

39. 0607_s18_ms_41 Q: 1

Question	Answer	Marks	Partial Marks
(a)(i)	Translation $\begin{pmatrix}1\\7\end{pmatrix}$	**2**	**B1** for each
(a)(ii)	Reflection $x = -\frac{1}{2}$ oe	**2**	**B1** for each
(b)	Triangle drawn at (3, 2), (3, 4), (–3, 2)	**2**	**B1** for enlargement factor 2 with wrong centre, or correct centre with wrong positive factor (not 1)
(c)	Triangle drawn at (2, 1), (8, 1), (8, 2)	**2**	**B1** for stretch factor 2 with x-axis invariant. or stretch factor 2 translated horizontally

40. 0607_s18_ms_42 Q: 6

Question	Answer	Marks	Partial Marks
(a)	Correct triangle. (–6, –1), (–4, –1), (–6, 3)	**2**	**B1** for $\begin{pmatrix}-7\\k\end{pmatrix}$ or $\begin{pmatrix}k\\-3\end{pmatrix}$

Question	Answer	Marks	Partial Marks
(b)	Correct triangle. (–1, 4), (–1, 6), (–5, 4)	**2**	**B1** for correct rotation about any centre or for correct centre but 90° clockwise
(c)	Rotation 90° clockwise oe [Centre] (–6, 4)	**3**	**B1** for each
(d)	Correct triangle. (3, –1), (7, –1), (7, –9)	**2**	**B1** for correct enlargement with wrong centre
(e)	Enlargement [centre] (3, 1) [SF] –0.5	**2**	**B1** for each

41. 0607_s18_ms_43 Q: 3

Question	Answer	Marks	Partial Marks
(a)	Triangle at (4, –4), (5, –4), (5, –6)	**2**	**B1** for translation $\begin{pmatrix}3\\k\end{pmatrix}$ or $\begin{pmatrix}k\\-1\end{pmatrix}$
(b)	Triangle at (5, 0), (7, 0), (7, 3)	**2**	**B1** for any stretch in with x-axis invariant or correct stretch translated vertically
(c)	Rotation 90° clockwise oe (3, –1)	**3**	**B1** for each

42. 0607_w18_ms_41 Q: 6

Question	Answer	Marks	Partial Marks
(a)	Vertices (–5, 3) (–8, 3) (–8, 5)	**2**	**B1** for reflection in $x = k$, $k \neq -2$ or **B1** for reflection in $y = -2$
(b)	Vertices (–5, –5) (–8, –5) (–8, –7)	**2**	**B1** for correct rotation with incorrect centre of rotation.
(c)	Reflection $y = -1$ cao	**2**	**B1** for each
(d)	Vertices (1, 4) (7, 4) (7, 8)	**2**	**M1** for enlargement SF2 different centre or for enlargement different SF, correct centre

43. 0607_w18_ms_42 Q: 3

Question	Answer	Marks	Partial Marks
(a)	Triangle at (–5, 3), (–1, 3), (–1, 5)	**2**	**B1** translation $\begin{pmatrix}-5\\k\end{pmatrix}$ or $\begin{pmatrix}k\\3\end{pmatrix}$
(b)	Enlargement [Scale factor] $-\frac{1}{2}$ [Centre] (6, 4)	**3**	**B1** for each
(c)	Rotation 90° clockwise oe (0, 0)	**3**	**B1** for each

44. 0607_w18_ms_42 Q: 14

Question	Answer	Marks	Partial Marks
(a)	10	**3**	**M2** for $\sqrt{6^2 + 8^2}$ or **B1** for 6 and 8 seen nfww
(b)	(4, 5)	**2**	**B1** for each co-ordinate
(c)	$y = \frac{3}{4}x + 2$ oe	**4**	Must be 3 term equation **B2** for gradient = $\frac{3}{4}$ or **B1** for gradient of $AB = -\frac{4}{3}$ **M1** for substituting *their* **(b)** into $y = (\textit{their } m)\,x + c$ oe

45. 0607_w18_ms_43 Q: 2

Question	Answer	Marks	Partial Marks
(a)	Rotation 90° clockwise oe (5, 1)	**3**	**B1**for each
(b)	Correct reflection (– 1, 1), (– 4, 1), (– 4, 3)	**1**	
(c)	Correct translation (6, 7), (9, 7), (9, 9)	**2**	**B1** for translation $\begin{pmatrix}5\\k\end{pmatrix}$ or $\begin{pmatrix}k\\6\end{pmatrix}$
(d)	Correct stretch (1, 3), (4, 3), (4, 9)	**2**	**B1** for stretch factor 3 displaced vertically or stretch with x-axis invariant but other factor.

46. 0607_s17_ms_41 Q: 4

Question	Answer	Marks	Partial Marks
(a)	Correct triangle (2, 1) (3, 1) (2, 4)	2	**B1** for translation $\begin{pmatrix} k \\ -4 \end{pmatrix}$ or $\begin{pmatrix} 0 \\ k \end{pmatrix}$
(b)	Correct triangle (–5, 2) (–5, 3) (–8, 2)	2	**B1** for correct rotation, incorrect centre or for rotation 90° clockwise, correct centre
(c)	Rotation [Centre] (0, 0) 90° clockwise oe	2	**B1** for each
(d)	Correct triangle (–5, –2) (–5, –3) (–8, –2)	3	**B1** for $y = -x$ soi **M1** for correct shape, incorrect location
(e)	Reflection x-axis oe	2	**B1** for each

47. 0607_s17_ms_42 Q: 2

Question	Answer	Marks	Partial Marks
(a)(i)	Reflection, $y = x$	1	
(a)(ii)	Enlargement [with centre] (2, 1) [scale factor] $\frac{1}{4}$ oe	2	**B1** for each
(a)(iii)	Translation $\begin{pmatrix} 3 \\ -5 \end{pmatrix}$	2	**B1** for each
(b)(i)	Correct triangle (0, 0), (0, 2), (–2, 3)	2	**SC1** for rotation 90° clockwise about (0, 0) or rotation 90° anti-clockwise about different centre
(b)(ii)	Correct triangle (0, 0), (4, 0), (6, 2)	2	**SC1** for stretch with s.f. = 2, x-axis invariant or stretch with y-axis invariant with different scale factor.

48. 0607_s17_ms_42 Q: 12

Question	Answer	Marks	Partial Marks
(a)	11	**1**	
(b)	6	**2**	**B1** for h(2) = 1 soi or $4(x^2 - 3) + 2$ or better
(c)	–3	**2**	**M1** for $4x = -10 - 2$
(d)	h(x) ⩾ –3	**1**	Allow $y \geqslant -3$
(e)	$\frac{x-2}{4}$ oe final answer	**2**	**M1** for $y - 2 = 4x$ or $x = 4y + 2$ or $\frac{y}{4} = x + \frac{2}{4}$
(f)	Stretch x-axis invariant [Scale factor] 2 OR Reflection $y = -2.70 + 6.75$ OR Rotation (2.5, 0) 167 (167.47) or 12.5 (12.53) clockwise	**3** **M1** **A2** **M1** **A1** **A1**	**B1** for each
(g)	[y =] $x^2 - 4x + 1$	**3**	**M2** for $y = (x - 2)^2 - 3$ or **M1** for $x - 2$ seen in a quadratic If 0 scored, **SC1** for $y = x^2 + 4x + 1$

49. 0607_s17_ms_43 Q: 1

Question	Answer	Marks	Part Marks
(a)	Image at (0, 5), (3, 5), (3, 3)	**2**	**SC1** for translation $\begin{pmatrix}-2\\k\end{pmatrix}$ or $\begin{pmatrix}k\\7\end{pmatrix}$
(b)(i)	Image at (2, 2), (5, 2), (5, 4)	**1**	
(b)(ii)	Image at (– 4, – 2), (– 7, – 2), (– 7, – 4)	**1**	
(b)(iii)	Rotation 180 [centre] (– 1 , 0)	**3**	**B1** for each
(c)	Stretch [factor]2 x-axis oe invariant	**3**	**B1** for each

50. 0607_w17_ms_42 Q: 3

Question	Answer	Marks	Partial Marks
(a)(i)	Image at (2, 4), (3, 6), (6, 6), (6, 4)	**2**	**SC1** for reflection in other horizontal line or in the line $x = 1$
(a)(ii)	Image at (– 4, – 2), (– 6, – 3), (– 6, – 6), (– 4, – 6)	**2**	**SC1** for correct orientation but wrong centre
(a)(iii)	Reflection $y = -x$ oe	**2**	**B1** for each
(b)	Enlargement [centre] (0, 0) oe [factor] – 0.5 oe	**3**	**B1** for each
(c)	Image at (2, – 4), (6, – 4), (6, – 8), (3, – 8)	**2**	**SC1** for stretch with x-axis invariant with other factor or stretch with $y = k$ invariant with stretch factor 2

51. 0607_w17_ms_42 Q: 11

Question	Answer	Marks	Partial Marks
(a)(i)	10	**1**	
(a)(ii)	1	**1**	
(b)	$\frac{x-1}{2}$ oe	**2**	**M1** for $y - 1 = 2x$ or $x = 2y + 1$ or $\frac{y}{2} = x + \frac{1}{2}$
(c)	$4x^2 + 4x + 2$ final answer	**3**	**M1** for $(2x+1)^2 + 1$ **B1** for $[(2x+1)^2 =]\ 4x^2 + 2x + 2x + 1$ oe
(d)	Translation $\begin{pmatrix} 0 \\ -2 \end{pmatrix}$	**2**	**B1** for each
(e)	3	**1**	

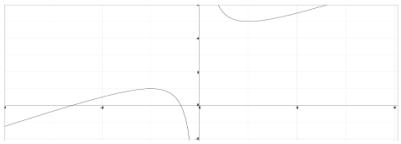
52. 0607_s16_ms_42 Q: 1

Question	Answer	Mark	Part Marks
(a)	Image at (5, 5), (7, 5), (6, 6), (5, 6)	**2**	If 0 scored **SC1** for translation $\begin{pmatrix}3\\k\end{pmatrix}$ or $\begin{pmatrix}k\\4\end{pmatrix}$
(b)	Image at (–1, –2), (–1, –4), (–2, –3), (–2, –2)	**2**	If 0 scored **SC1** for reflection in line $y = x$
(c)	Image at (–2, 5), (–2, 7), (–3, 5), (–3, 6)	**3**	If 0 scored **SC2** for 90° clockwise about (–2, 1) or **SC1** for 90° anticlockwise about other centre
(d) (i)	Enlargement [scale factor] 3 [centre] (2, 4)	**B1** **B1** **B1**	If combined transformations, all three marks lost
(ii)	Stretch [factor] 2 *y*-axis oe invariant	**B1** **B1** **B1**	If combined transformations, all three marks lost

53. 0607_w16_ms_41 Q: 2

Qu.	Answer	Mark	Part Marks
(a) (i)	$\begin{pmatrix}-8\\-5\end{pmatrix}$	**1**	
(ii)	Image at (–4, –1), (2, –1), (2, 3)	**2FT**	**SC1FT** for translation $\begin{pmatrix}-8\\k\end{pmatrix}$ or $\begin{pmatrix}k\\-5\end{pmatrix}$
(iii)	9.43 or 9.433 to 9.434	**2**	**M1** for $(their(-8))^2 + (their(-5))^2$ oe
(b) (i)	Reflection *y*-axis oe	**1** **1**	
(ii)	Enlargement 0.5 oe (10, –10)	**1** **1** **1**	
(iii)	Stretch [factor] 0.25 oe *x*-axis oe invariant	**1** **1** **1**	

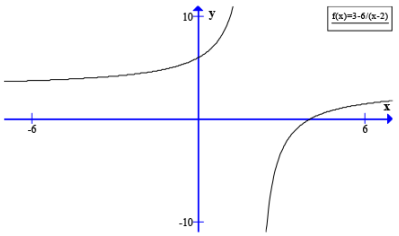
54. 0607_w16_ms_41 Q: 8

Qu.	Answer	Mark	Part Marks
(a)	Correct sketch 	2	**B1** for one correct branch
(b)	–2.62 or –2.618… –0.382 or –0.3820 to –0.3819	1 1	If 0 scored, **M1** for correct use of quadratic formula oe
(c)	$x < -2.62$ $-0.382 < x < 0$	1FT 2FT	**FT** only if 2 negative roots in (b) **FT** only if 2 negative roots in (b) **B1** each
(d)	[a =] 0 [b =] 3	1 1	
(e)	Translation $\begin{pmatrix} 0 \\ -3 \end{pmatrix}$ oe	1 1	

55. 0607_w16_ms_42 Q: 6

Question	Answer	Mark	Part Marks
(a)	Reflection $y = x$	2	**B1** for each
(b)	Rotation, centre (2, 3) 90 [anticlockwise] or 270 clockwise	2	**B1** for each
(c)	Translation $\begin{pmatrix} -4 \\ 3 \end{pmatrix}$	2	**B1** for each
(d)	Enlargement, centre (0, 0) [SF] $\frac{1}{3}$ oe	2	Allow reduction **B1** for each

56. 0607_w16_ms_42 Q: 10

Question	Answer	Mark	Part Marks
(a)	Fully correct curve 	**3**	**B2** for both branches but with serious 'curl back' and/or overlap. or **B1** for 1 branch
(b)	$x = 2$ $y = 3$	**2**	**B1** for each
(c)	[$x =$] -4 [$x =$] 3	**2**	**B1** for each
(d)	$x < -4$ $2 < x < 3$	**1** **2**	**FT** *their* -4 from (c) **FT** *their* 2 from (b) and *their* 3 from (c) **B1** for each
(e) (i)	Translation $\begin{pmatrix} 2 \\ 0 \end{pmatrix}$	**2**	**B1** for each
(ii)	Translation $\begin{pmatrix} 0 \\ 3 \end{pmatrix}$	**2**	**B1** for each

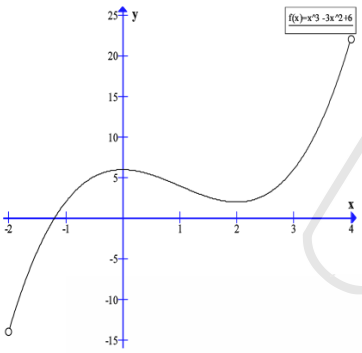
57. 0607_w16_ms_43 Q: 3

Question	Answer	Mark	Part Marks
(a)	Reflection $x = -2$	**1** **1**	In all three parts of (a) give 0 for any indication of second transformation.
(b)	Rotation 90° [anticlockwise] oe (5, 1)	**1** **1** **1**	
(c)	Stretch x-axis oe invariant [stretch factor] 3	**1** **1** **1**	

58. 0607_s15_ms_41 Q: 4

Qu.	Answer	Mark	Part Marks
(a)	Reflection $x = -1$ oe	1 1	Any combination of transformations scores 0
(b)	(–1, 4), (–1, 2), (0, 2)	3	**M2** for any rotation 90° clockwise If 0 scored, **SC2** for rotation 90° anti-clockwise about (–1, 6) or **SC1** for any rotation 90° anti-clockwise
(c)	Reflection $y = x + 7$ oe	1 1FT	Any combination of transformations scores 0 **FT** if **SC2** scored in **(b)** to $y = -x + 5$

59. 0607_s15_ms_42 Q: 4

Qu.	Answer	Mark	Part Marks
(a)	Good curve with x intercept reasonably placed and maximum reasonably placed on y-axis and minimum in 1st quadrant  	2	**B1** for basic cubic shape (max before min)
(b)	(0, 6) (2, 2)	1 1	**SC1** if answers reversed
(c)	$2 < k < 6$	2FT	**FT** *their* y values from **(b)** **SC1** for $2 \leqslant k \leqslant 6$ or for $2 < k < n$ or $n < k < 6$ or for $2 < k \leqslant 6$ or $n \leqslant k < 6$ or for $2 < x < 6$
(d)	Rotational [Order] 2 [About] (1, 4)	1 1 1	
(e)	$x^3 - 3x^2 + 4$ or $(x-2)(x-2)(x+1)$	1	

60. 0607_w15_ms_41 Q: 2

Question	Answer	Mark	Part Marks
(a) (i)	$\begin{pmatrix}46\\30\end{pmatrix}$	2	**B1** each component **SC1** for $\left(\frac{46}{30}\right)$
(ii)	13	3	**M2** for $\sqrt{12^2+5^2}$ or **M1** 14 – 2 and 8 – 3 or better seen
(b)	[u =] –2 [v =] 0	1 1	
(c) (i)	Image at (1, –3), (1, –6), (2, –6)	3	**SC2** for rotation about (–1, –1) 90° anti-clockwise or **SC1** for rotation 90° clockwise with different centre
(ii)	Reflection $x = -1$	1 1	
(iii)	Stretch [factor] 4 invariant x-axis oe	1 1 1	

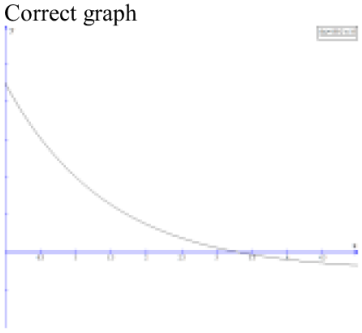
61. 0607_w15_ms_41 Q: 3

Question	Answer	Mark	Part Marks
(a),(d)		2	**M1** for inaccurate rectangular hyperbola but with correct orientation.
		2	**M1** for inaccurate rectangular hyperbola but with correct orientation.
(b)	$0 < x < 2$ oe	2	**B1** for $0 < x$ oe or $x < 2$ oe
(c)	$\frac{2}{1-x}$ oe	3	**M1** for correct and appropriate rearrangement **M1** for correct multiplication **M1** for correct changing x and y **M1** for correct division **If answer incorrect maximum possible is M2**
(e)	Reflection $y = x$	1 1	

62. 0607_w15_ms_42 Q: 4

Question	Answer	Mark	Part Marks
(a) (i)	Reflection in x-axis	1	
(ii)	Rotation 90° [anticlockwise] [about] origin oe	2	**B1** for rotation
(b)	Reflection $y = -x$	1 1	

63. 0607_w15_ms_42 Q: 13

Question	Answer	Mark	Part Marks
(a) (i)	Correct graph 	2	**M1** for graph with correct shape.
(ii)	3.32 or 3.321 to 3.322	1	
(iii)	$[f(x)] > -10$	1	Ignore $\leqslant 90$
(b)	1.74 or 1.736 to 1.737	1	
(c)	Translate	1	
	$\begin{pmatrix} 0 \\ -10 \end{pmatrix}$	1	

64. 0607_w15_ms_43 Q: 11

Question	Answer	Mark	Part Marks
(a)	8	**1**	
(b)	2, 1	**1**	
(c)	–6 and 2	**4**	**B3** for $(x-6)(x+2)$ or **SC3** for 6 and –2 or **B2** for $x^2-2x-2x+4-16$ or better or **M1** for $(x-2)^2-16$ or for $x^2+ax+bx+ab$
(d) (i)	$\frac{2-x}{x}$ oe final answer	**3**	**M1** for interchanging x and y **M1** for a correct multiplication **M1** for a correct rearrangement and a correct division **If answer incorrect maximum possible is M2**
(ii)	$\log_2 x$ or $\frac{\log x}{\log 2}$	**2**	**M1** for $\log y = x\log 2$ or $\log_2 y = x$ oe or $x = 2^y$
(e)	Stretch [factor] 2 and x-axis invariant	**1** **1**	

65. 0607_s20_ms_43 Q: 5

Question	Answer	Marks	Partial Marks
(a)(i)	Reflection in the line $y = 3$	**1**	
(a)(ii)	Translation $\begin{pmatrix} -5 \\ 4 \end{pmatrix}$	**2**	**B1** for each
(a)(iii)	Enlargement [centre] (2, –1) [scale factor] $\frac{1}{3}$	**2**	**B1** for each
(b)(i)	Triangle at (–6, 0), (–2, 0), (–2, – 2)	**2**	**B1** for rotation 90° clockwise about (–1, 0) or 90° anticlockwise about another centre
(b)(ii)	Triangle at (2, 2), (2, 4), (3, 4)	**2**	**B1** for enlargement scale factor $-\frac{1}{2}$, wrong centre or scale factor $\frac{1}{2}$, centre (1, 3)
(b)(iii)	Stretch [Stretch factor] 3 Invariant line y-axis oe	**3**	**B1** for each

66. 0607_w20_ms_41 Q: 4

Question	Answer	Marks	Partial Marks
(a)(i)	Rotation, [Centre] (0, 0) [Anticlockwise] 90 or clockwise 270	**3**	**B1** for each
(a)(ii)	Enlargement [Scale factor] 2 [Centre] (–1, –1)	**3**	**B1** for each
(a)(iii)	Correct triangle (2, 1) (6, 1) (6, 2)	**2**	**B1** for correct stretch with x-axis invariant or **B1** for correct SF in wrong position
(b)(i)	Reflect $y = 2$	**1**	
(b)(ii)	Translation $\begin{pmatrix} 5 \\ -2 \end{pmatrix}$	**2**	**B1** for each

67. 0607_s21_ms_42 Q: 2

Question	Answer	Marks	Partial Marks
(a)(i)	Triangle at (–2, 4), (0, 4), (0, 5)	**2**	**B1** for rotation 90° clockwise about (–1, 2) or rotation anticlockwise 90° about wrong centre
(a)(ii)	Stretch [Factor] 2 Invariant [line] $y = -1$ oe	**3**	**B1** for each
(b)	Translation $\begin{pmatrix} 8 \\ 0 \end{pmatrix}$	**2**	**B1** for each

68. 0607_w21_ms_43 Q: 2

Question	Answer	Marks	Partial Marks
(a)	(–5, –2)	**1**	
(b)	(2, 5)	**1**	
(c)	($-y$, $-x$)	**2**	**B1** for each. If 0 scored **SC1** for answer (–2, –5)
(d)	Reflection $y = -x$	**2**	**B1** for each

69. 0607_s19_ms_43 Q: 6

Question	Answer	Marks	Partial Marks
(a)(i)	(1, 5)	**1**	
(a)(ii)	($-y$, $-x$)	**2**	**B1** for each co-ordinate
(a)(iii)	Reflection $y = -x$	**2**	**B1** for each
(b)	Enlargement Scale factor 2 Centre (0, 0)	**3**	**B1** for each
(c)	Stretch x-axis invariant SF 0.5	**2**	**B1** for each

70. 0607_w17_ms_41 Q: 6

Question	Answer	Marks	Partial Marks
(a)	Translation $\begin{pmatrix} -5 \\ 6 \end{pmatrix}$	**2**	**B1** for each
(b)	Triangle at (2, 6), (3, 6), (2, 12)	**2**	**B1** for any stretch with x-axis invariant or stretch with scale factor 3 and $y = k$ invariant or stretch with y-axis invariant, s.f. = 3
(c)	90° [anti-clockwise] or 270° clockwise Centre $(a, a + 1)$ $x = a + 3$ OR 90° clockwise or 270° [anticlockwise] Centre $(b + 5, b)$ $y = b + 3$	**3**	**B1** for each Dep on 90° anti-clockwise or 270° clockwise Dep on previous mark If 0 scored, **SC1** for centre $(a, a + 1)$ and $x = a + 3$ OR **B1** for each Dep on 90° clockwise or 270° anti-clockwise Dep on previous mark If 0 scored, **SC1** for centre $(b + 5, b)$ and $y = b + 3$

71. 0607_w17_ms_43 Q: 8

Question	Answer	Marks	Partial Marks
(a)	(–1, 5)	**2**	**B1** for each
(b)	(–1, –5)	**2**	**B1** for each
(c)	Reflection y-axis oe	**2**	**B1** for each

72. 0607_s16_ms_41 Q: 3

Question	Answer	Mark	Part Marks
(a) (i)	Quadrilateral drawn at (–1, –1), (–1, –2), (–3, –1), (–3, –3)	3	**M2** for 3 pts correct or **M1** for correct reflection of *A* in *y*-axis
(ii)	Reflection $y = -x$ oe	1 1	
(b) (i)	Quadrilateral drawn at (3, 1), (6, 1), (3, 3), (9, 3)	2	**B1** for any stretch with *y*-axis invariant or with stretch factor 3
(ii)	Stretch, *y*-axis oe invariant (stretch factor) $\frac{1}{3}$	2	**B1** for any 2 correct

73. 0607_s16_ms_43 Q: 9

Question	Answer	Mark	Part Marks
(a)	[*QR* =] *P* [*PQR* =] *Q* [*ST* =] *Q* [*SQ* =] *T* [*PTP* =] *T* [*TPP* =] *S*	6	**B1** for each
(b) (i)	Points (2, 2) (2, 1) (5, 1)	2	**B1** for (2, 1) or (5, 1) correct
(ii)	Points (2, –2) (2, –1) (5, –1)	1FT	**FT** their *B* reflected in *x*-axis
(iii)	Rotation 90 [anticlockwise] oe [Centre] (0, 0) oe	1 1 1	

74. 0607_s15_ms_42 Q: 2

Qu.	Answer	Mark	Part Marks
(a)	Rotation [Anticlockwise] 90° oe [About] (0, 0) oe	1 1 1	Combinations of transformations – lose all 3 marks
(b)	$\begin{pmatrix} 7 \\ k \end{pmatrix}$	1	any *k*
	$y = \frac{1}{2}k + 3$	1	Must be $\frac{1}{2}$*their k* from vector
(c)	Triangle at (1, 2), (2, 2), (1, 6)	2	**SC1** for stretch s.f. 2 with $y = 1$ invariant or triangle at (2, 1), (4, 1), (2, 3) i.e. *y*-axis invariant

75. 0607_s15_ms_43 Q: 2

Qu.	Answer	Mark	Part Marks
(a) (i)	Triangle (–1, 1), (–1, 2) (–3, 1)	2	**SC1** for rotation 90° clockwise about (0, 0) or rotation 90° anticlockwise about another point
(ii)	Triangle (–1, –1), (–1, –2), (–3, –1)	2FT	**FT** *their* **(i)** or **SC1FT** for reflection in $x = 0$
(iii)	Reflection $y = -x$	1 1	
(b)	Stretch [stretch factor] 3 Invariant line $x = 0$ oe	1 1 1	

76. 0607_w15_ms_43 Q: 5

Question	Answer	Mark	Part Marks
(a) (i)	Enlargement [factor] 0.5 oe [centre] (0, 8)	1 1 1	
(ii)	Enlargement [factor] 2 and [centre] (0, 8)	1 1FT	 **FT** scale factor and centre
(b) (i)	Image at (4, 4), (8, 4), (8, 6)	2	**M1** for $y = x$ drawn
(ii)	Image at (6, 8), (6, 6), (10, 6)	2	**SC1** for 90° anti-clockwise but different centre
(c)	Reflection, x-axis oe	3	**M2** for full method seen i.e. diagram or unit vectors. or **M1** for one of transformations correctly carried out If 0 scored, **SC1** for any reflection in answer