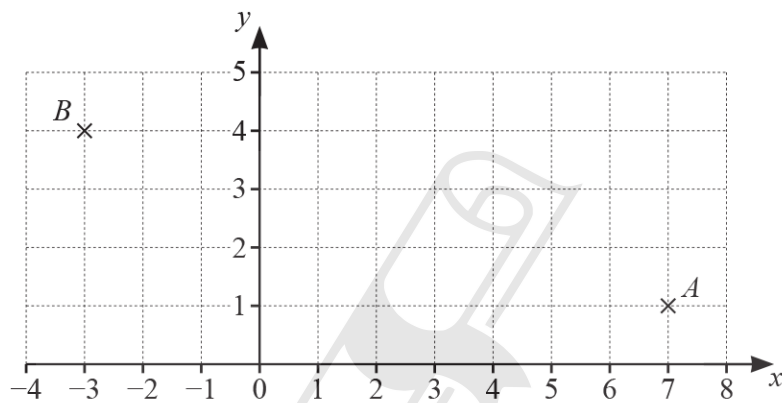


Chapter 7

Vectors and transformations

01. 0580_m24_qp_22 Q: 6



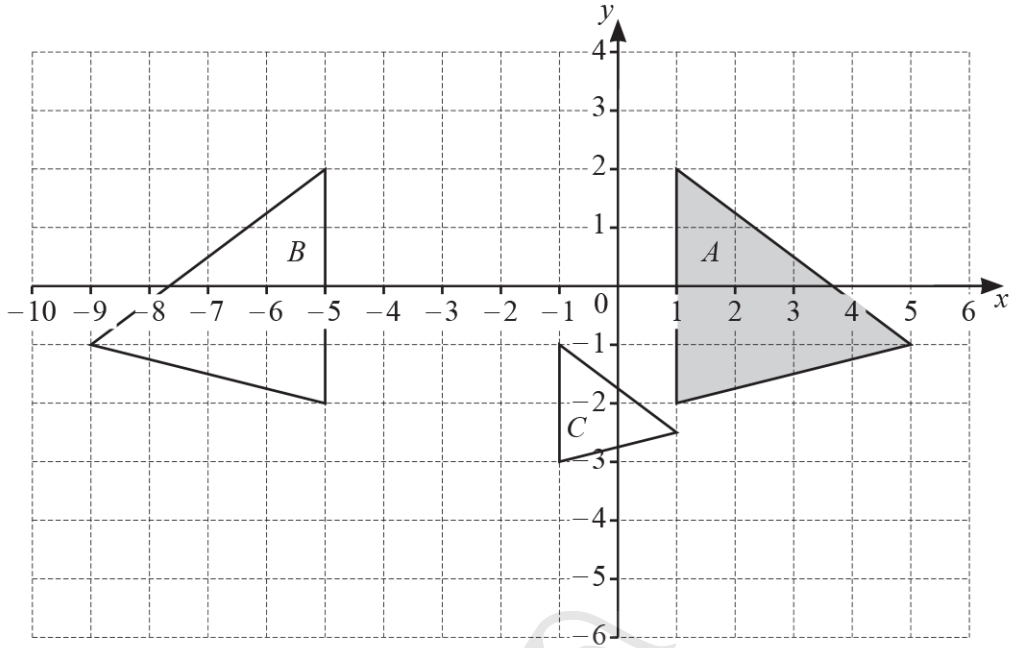
Write \vec{AB} as a column vector.

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

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02. 0580_m24_qp_22 Q: 15



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

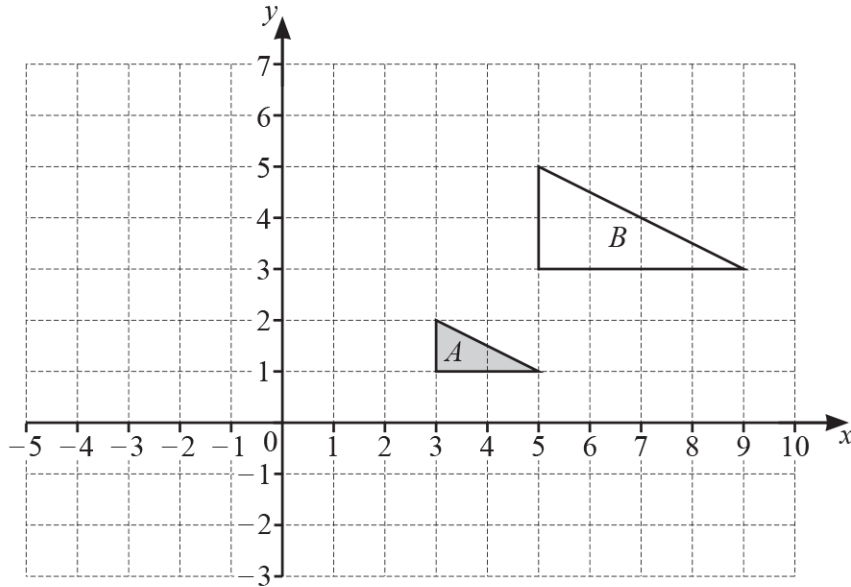
(i) triangle *A* onto triangle *B*

.....
 [2]

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

.....
 [3]

(b) Draw the image of triangle *A* after a rotation, 90° clockwise, about $(1, 3)$. [2]

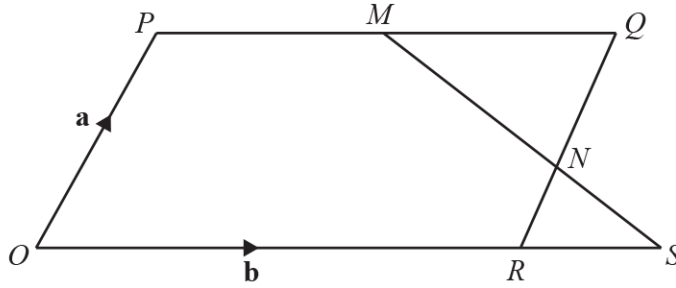


(a) Describe fully the **single** transformation that maps triangle *A* onto triangle *B*.

.....
..... [3]

(b) On the grid, draw the image of triangle *A* after a translation by the vector $\begin{pmatrix} -4 \\ 3 \end{pmatrix}$. [2]

04. 0580_s24_qp_22 Q: 24



NOT TO SCALE

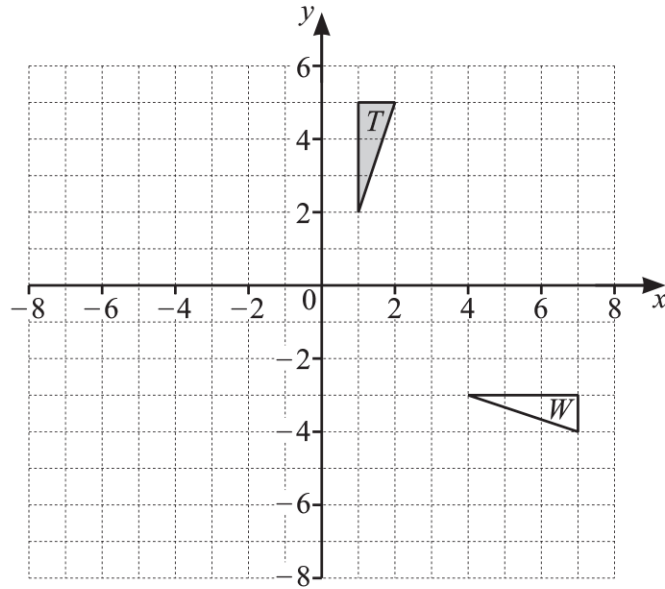
O is the origin and $OPQR$ is a parallelogram.
 M is the midpoint of PQ and N divides QR in the ratio $2 : 1$.
 $\vec{OP} = \mathbf{a}$ and $\vec{OR} = \mathbf{b}$.

- (a) Find \vec{MN} .
 Give your answer in terms of \mathbf{a} and/or \mathbf{b} and in its simplest form.

$\vec{MN} = \dots\dots\dots$ [2]

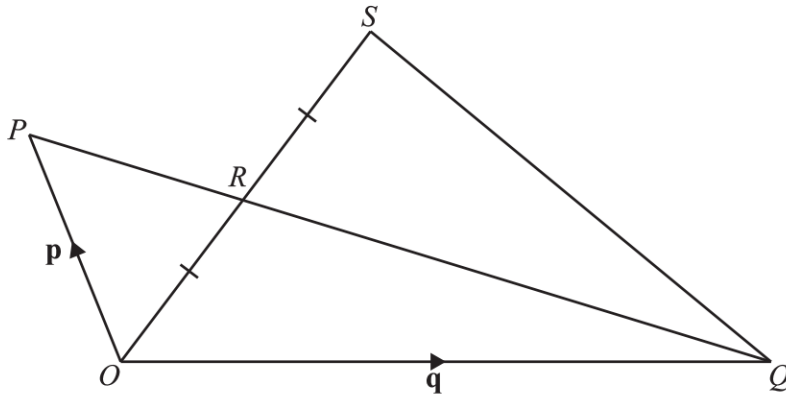
- (b) The lines MN and OR are extended to meet at S .
 Find the position vector of S .
 Give your answer in terms of \mathbf{a} and/or \mathbf{b} and in its simplest form.

$\dots\dots\dots$ [3]



- (a) Describe fully the **single** transformation that maps triangle T onto triangle W .
-
- [3]
- (b) Draw the enlargement of triangle T with scale factor -2 and centre of enlargement $(-1, 1)$. [2]
-

06. 0580_s24_qp_23 Q: 26



NOT TO SCALE

In the diagram, O is the origin.

$\vec{OP} = \mathbf{p}$ and $\vec{OQ} = \mathbf{q}$.

R is the point of intersection of PQ and OS , with $PR : RQ = 1 : 2$ and $OR = RS$.

Find the position vector of S in terms of \mathbf{p} and \mathbf{q} .

Give your answer in its simplest form.

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[4]

07. 0580_m23_qp_22 Q: 2

$$\mathbf{v} = \begin{pmatrix} -1 \\ 3 \end{pmatrix} \quad \mathbf{y} = \begin{pmatrix} 2 \\ 5 \end{pmatrix}$$

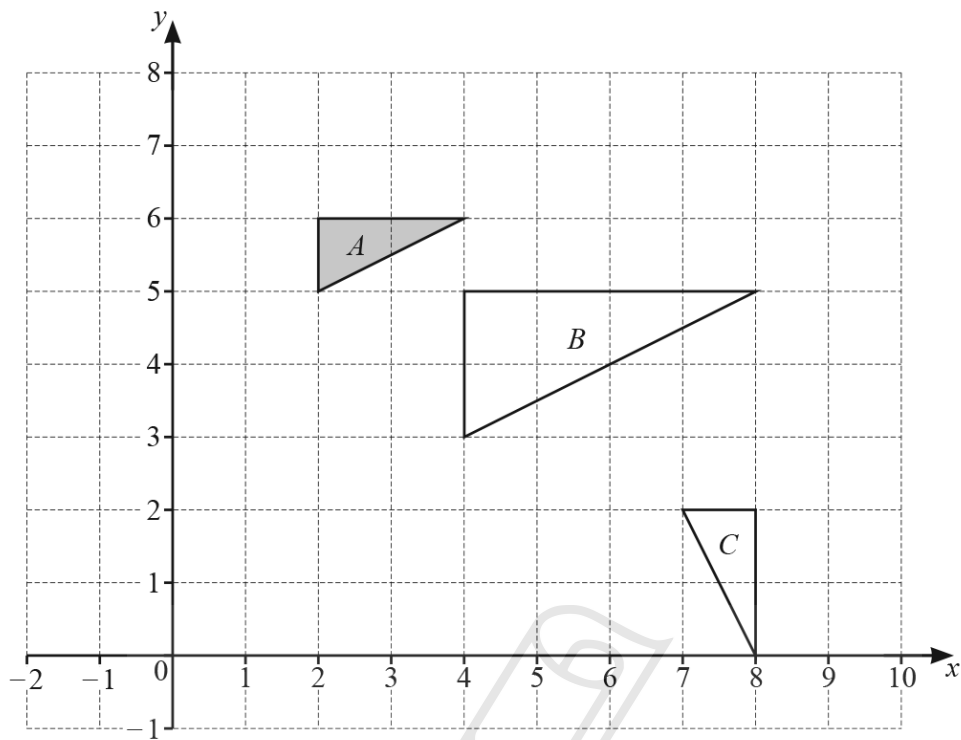
Find

(a) $\mathbf{v} - \mathbf{y}$

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

(b) $2\mathbf{v}$.

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



Describe the **single** transformation that maps

- (a) triangle *A* onto triangle *B*

..... [3]

- (b) triangle *A* onto triangle *C*.

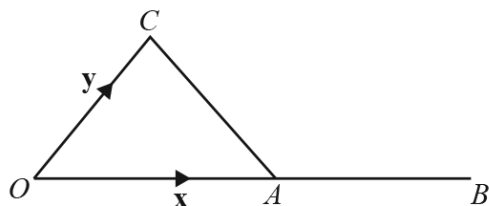
..... [3]

09. 0580_s23_qp_21 Q: 16

- (a) Find the magnitude of the vector $\begin{pmatrix} -4 \\ 5 \end{pmatrix}$.

..... [2]

- (b)



NOT TO SCALE

The diagram shows a triangle OAC .
 A is the midpoint of the straight line OB .
 $\vec{OA} = x$ and $\vec{OC} = y$.

Find \vec{CB} in terms of x and y .

$\vec{CB} = \dots\dots\dots$ [1]

F is the point $(1, -4)$, $\vec{FG} = \begin{pmatrix} 8 \\ -3 \end{pmatrix}$ and $\vec{GH} = \begin{pmatrix} -12 \\ 35 \end{pmatrix}$.

Find

(a) $3\vec{FG}$

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

(b) $\vec{FG} + \vec{GH}$

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

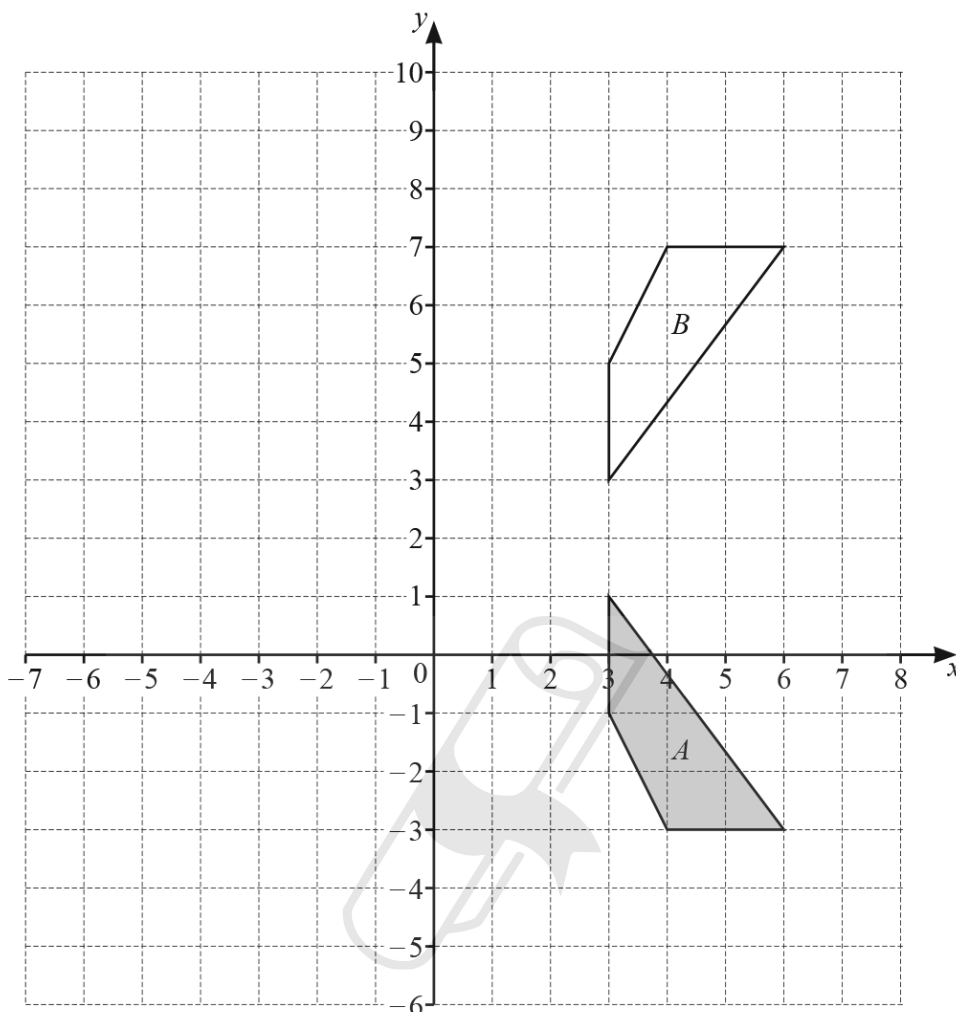
(c) the coordinates of the point G

(.....,) [1]

(d) the magnitude of vector \vec{GH} .



11. 0580_s23_qp_22 Q: 10



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

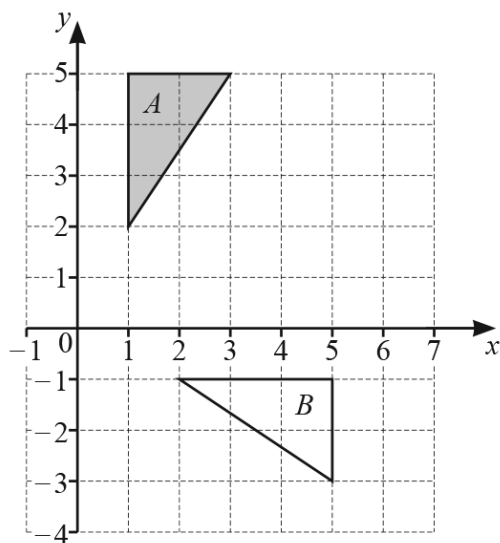
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..... [2]

- (b) Rotate shape *A* 90° clockwise about the point $(-1, 2)$. [2]

- (c) Enlarge shape *A* by scale factor -2 , centre $(2, 0)$. [2]

12. 0580_s23_qp_23 Q: 8



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

.....
..... [3]

13. 0580_s23_qp_23 Q: 12

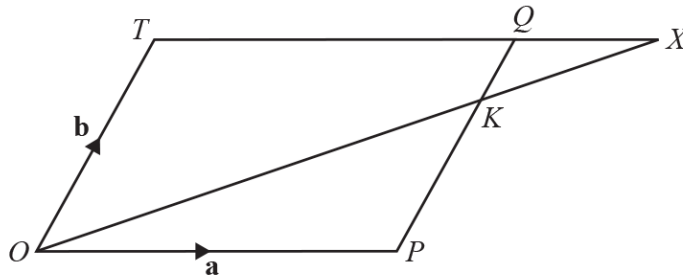
The position vector of A is $\begin{pmatrix} 5 \\ 3 \end{pmatrix}$ and $\vec{BA} = \begin{pmatrix} 4 \\ 8 \end{pmatrix}$.

Show that $|\vec{OB}| = 5.1$, correct to 1 decimal place.

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[3]

14. 0580_w23_qp_22 Q: 26



NOT TO
SCALE

The diagram shows a parallelogram $OPQT$.
The position vector of P is \mathbf{a} and the position vector of T is \mathbf{b} .

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

Find the position vector of X in terms of \mathbf{a} and \mathbf{b} .
Give your answer in its simplest form.



15. 0580_w23_qp_23 Q: 10

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

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

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

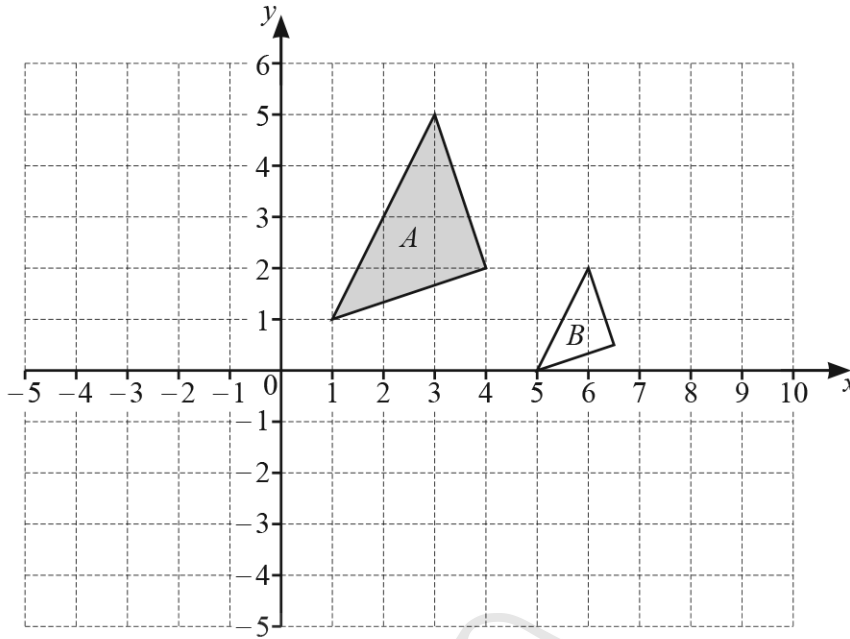
(b) Find $|\vec{AB}|$.

$$|\vec{AB}| = \dots\dots\dots [2]$$



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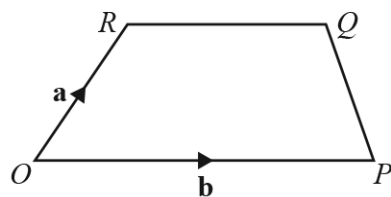
16. 0580_m22_qp_22 Q: 8



- (a) On the grid, draw the image of
- (i) triangle A after a reflection in the y -axis, [1]
 - (ii) triangle A after a translation by the vector $\begin{pmatrix} -3 \\ -4 \end{pmatrix}$. [2]
- (b) Describe fully the **single** transformation that maps triangle A onto triangle B .

.....

..... [3]



NOT TO SCALE

The diagram shows a trapezium $OPQR$.

O is the origin, $\vec{OR} = \mathbf{a}$ and $\vec{OP} = \mathbf{b}$.

$$|\vec{RQ}| = \frac{3}{5}|\vec{OP}|$$

(a) Find \vec{PQ} in terms of \mathbf{a} and \mathbf{b} in its simplest form.

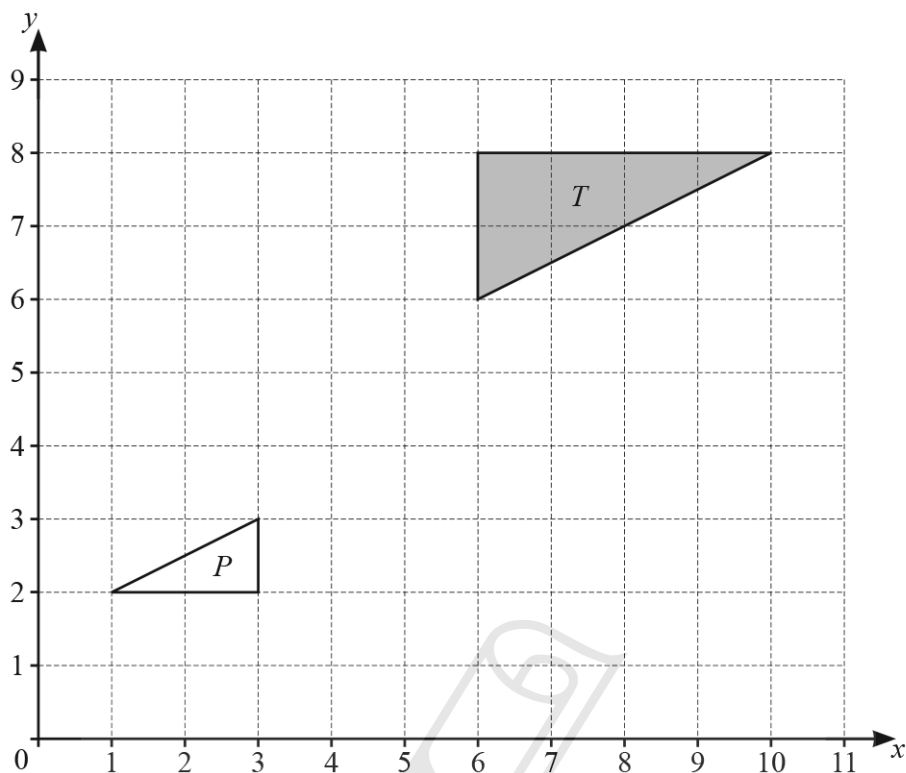
$\vec{PQ} = \dots\dots\dots$ [2]

(b) When PQ and OR are extended, they intersect at W .

Find the position vector of W .

$\dots\dots\dots$ [2]

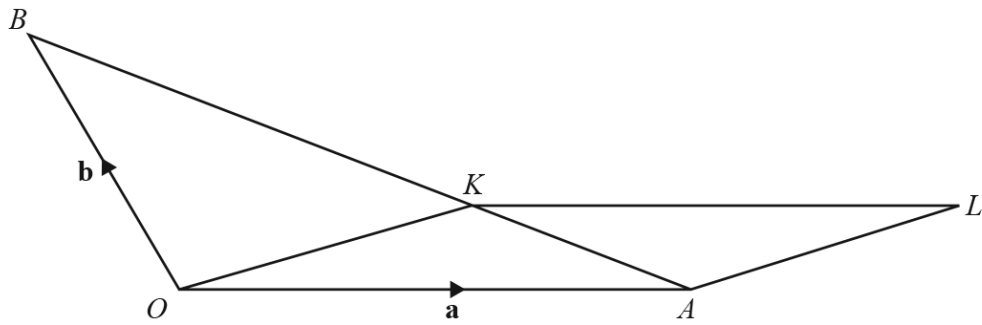
18. 0580_s22_qp_21 Q: 16



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

.....

..... [3]



NOT TO
SCALE

The diagram shows a triangle OAB and a parallelogram $OALK$.
The position vector of A is \mathbf{a} and the position vector of B is \mathbf{b} .
 K is a point on AB so that $AK : KB = 1 : 2$.

Find the position vector of L , in terms of \mathbf{a} and \mathbf{b} .
Give your answer in its simplest form.

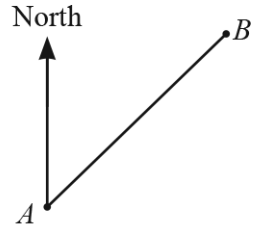


..... [4]

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20. 0580_s22_qp_22 Q: 10



NOT TO SCALE

The bearing of B from A is 059° .

Work out the bearing of A from B .

..... [2]

$$\mathbf{p} = \begin{pmatrix} 2 \\ 8 \end{pmatrix}$$

$$\mathbf{q} = \begin{pmatrix} -1 \\ 4 \end{pmatrix}$$

(a) Find

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

(ii) $6\mathbf{p}$.

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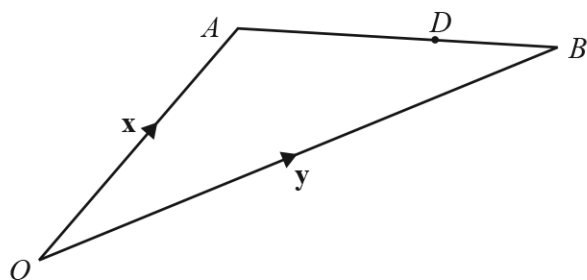
$\left(\quad \right)$ [1]

$\left(\quad \right)$ [1]

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

..... [2]

21. 0580_s22_qp_22 Q: 22



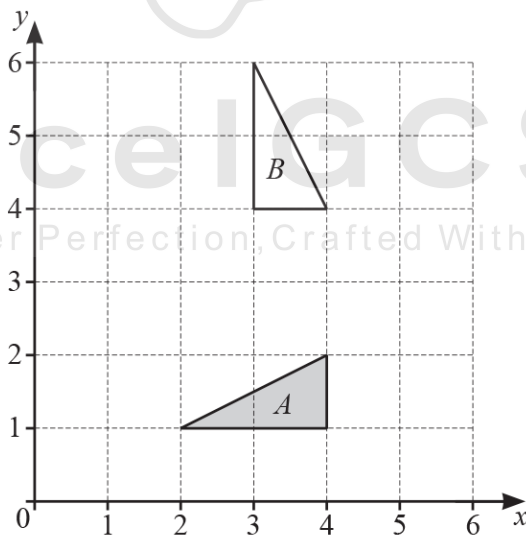
NOT TO SCALE

$\vec{OA} = \mathbf{x}$, $\vec{OB} = \mathbf{y}$ and $\vec{OD} = \frac{3}{7}\mathbf{x} + \frac{4}{7}\mathbf{y}$.

Calculate the ratio $AD : DB$.

..... : [2]

22. 0580_w22_qp_21 Q: 14



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

.....
 [3]

23. 0580_s21_qp_21 Q: 5

Work out.

(a) $\begin{pmatrix} 6 \\ -5 \end{pmatrix} + \begin{pmatrix} 8 \\ -1 \end{pmatrix}$

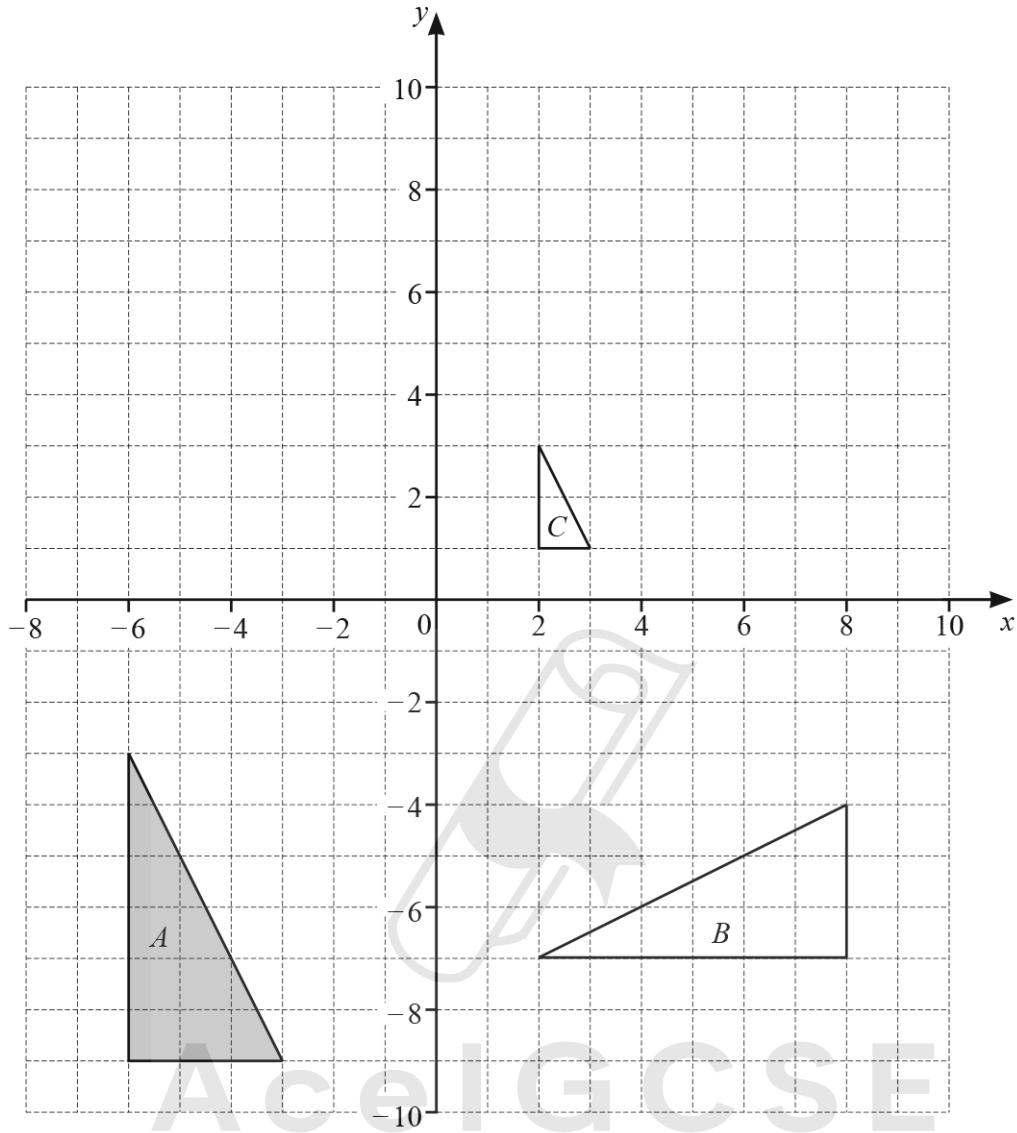
$\begin{pmatrix} \\ \end{pmatrix}$ [1]

(b) $3\begin{pmatrix} -4 \\ 7 \end{pmatrix}$

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



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

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

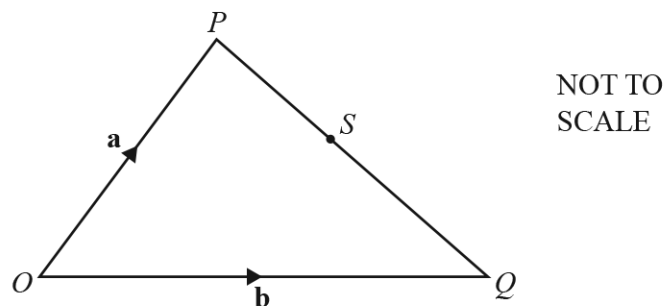
.....
 [3]

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

.....
 [3]

(b) Draw the image of triangle *A* after a translation by the vector $\begin{pmatrix} 2 \\ 10 \end{pmatrix}$. [2]

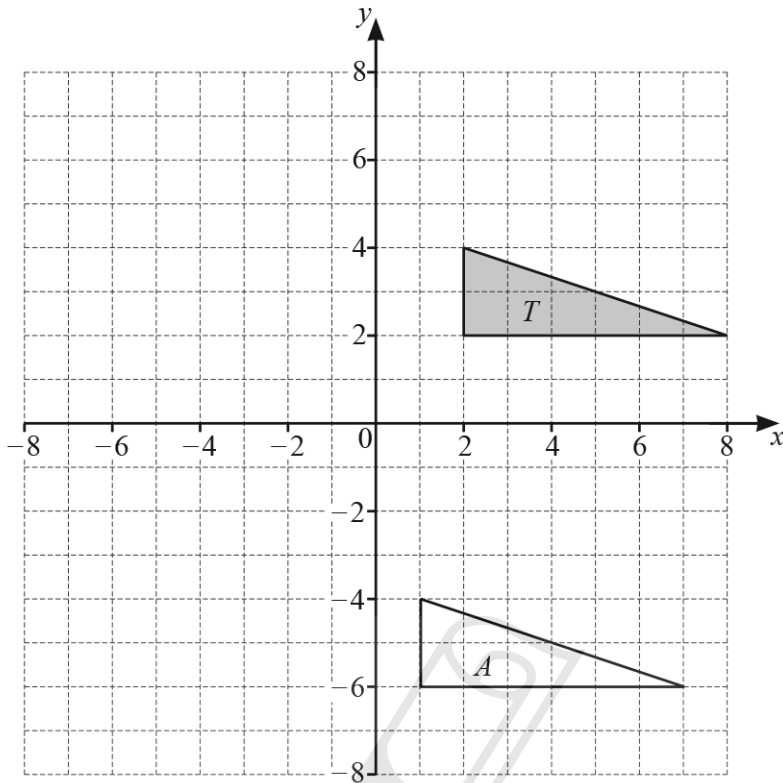
25. 0580_s21_qp_21 Q: 18



S is a point on PQ such that $PS : SQ = 4 : 5$.

Find \vec{OS} , in terms of \mathbf{a} and \mathbf{b} , in its simplest form.

$\vec{OS} = \dots\dots\dots$ [2]



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

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

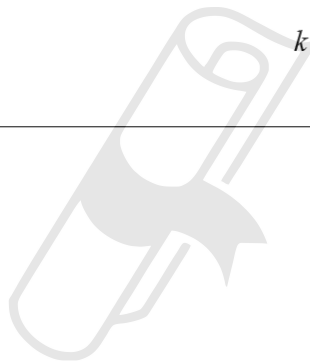
(b) Draw the image of triangle *T* after an enlargement, scale factor $-\frac{1}{2}$, centre $(0, 0)$. [2]

27. 0580_s21_qp_23 Q: 14

The magnitude of the vector $\begin{pmatrix} 20 \\ k \end{pmatrix}$ is 29.

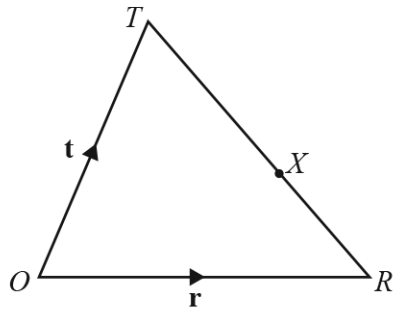
Find the value of k .

$k = \dots\dots\dots$ [3]



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28. 0580_w21_qp_23 Q: 26



NOT TO
SCALE

ORT is a triangle.

X is a point on TR so that $TX : XR = 3 : 2$.

O is the origin, $\overrightarrow{OR} = \mathbf{r}$ and $\overrightarrow{OT} = \mathbf{t}$.

Find the position vector of X .

Give your answer in terms of \mathbf{r} and \mathbf{t} in its simplest form.



..... [3]

29. 0580_m20_QP_22 Q: 3

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

Write \overrightarrow{AB} as a column vector.

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

30. 0580_m20_QP_22 Q: 21

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

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

1

2 [2]

31. 0580_s20_QP_21 Q: 17

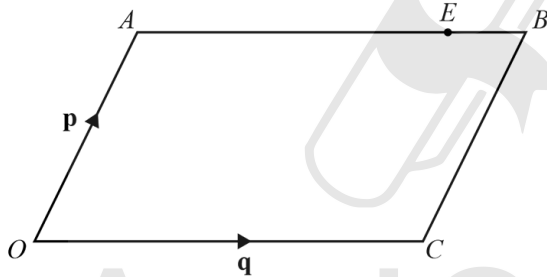
- (a) (i) $\mathbf{m} = \begin{pmatrix} 5 \\ 7 \end{pmatrix}$
Find $3\mathbf{m}$.

$$\left(\quad \right) [1]$$

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

Find $|\overrightarrow{VW}|$.

(b)



NOT TO SCALE

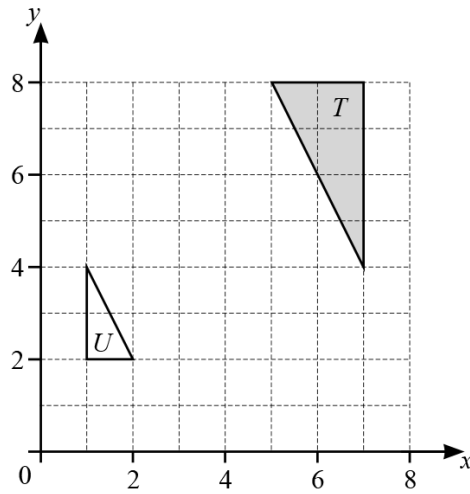
$OACB$ is a parallelogram.

$\overrightarrow{OA} = \mathbf{p}$ and $\overrightarrow{OC} = \mathbf{q}$.

E is the point on AB such that $AE : EB = 3 : 1$.

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

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

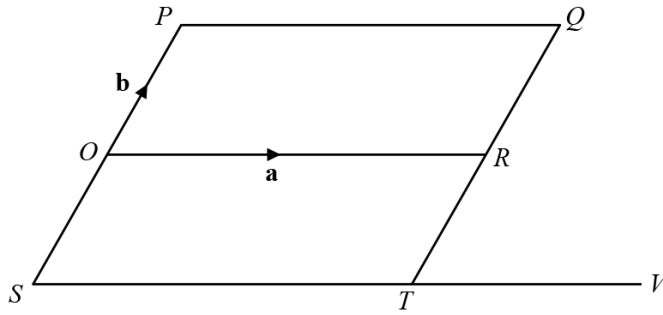


Describe fully the **single** transformation that maps triangle T onto triangle U .

.....

..... [3]

33. 0580_s20_QP_23 Q: 21



NOT TO SCALE

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

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

(i) the position vector of T ,

..... [2]

(ii) \vec{RV} .

Ace | GCSE $\vec{RV} =$ [1]

(b) Show that PT is parallel to RV .

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[2]

34. 0580_w20_qp_21 Q: 9

(a) Ahmed increases 40 by 300%.

From this list, put a ring around the correct calculation.

40×1.300

40×3

40×400

40×4

40×300

[1]

(b) Ahmed finds the magnitude of the vector $\begin{pmatrix} 2 \\ -3 \end{pmatrix}$.

From this list, put a ring around the correct calculation.

$\sqrt{2^2 + -3^2}$

$2^2 - 3^2$

$\sqrt{2^2 - 3^2}$

$2^2 + (-3)^2$

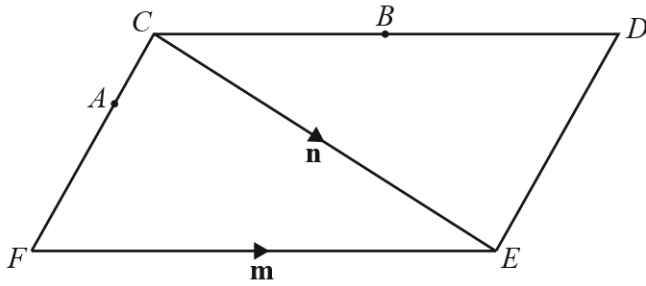
$\sqrt{2^2 + (-3)^2}$

[1]



35. 0580_w20_qp_21 Q: 23

(a)



NOT TO SCALE

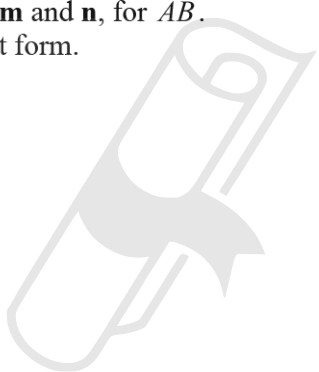
The diagram shows a parallelogram $CDEF$.

$\overrightarrow{FE} = \mathbf{m}$ and $\overrightarrow{CE} = \mathbf{n}$.

B is the midpoint of CD .

$FA = 2AC$

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

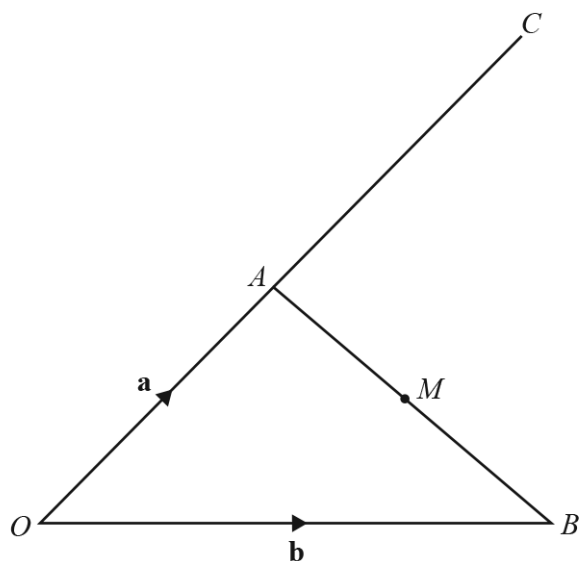


AcelGCSE $\overrightarrow{AB} = \dots\dots\dots$ [3]

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

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

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



NOT TO
SCALE

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

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

(a) \vec{AB} ,

$\vec{AB} = \dots\dots\dots$ [1]

(b) \vec{MC} .

$\vec{MC} = \dots\dots\dots$ [3]

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37. 0580_m19_QP_22 Q: 8

O is the origin, $\vec{OA} = 2\mathbf{x} + 3\mathbf{y}$ and $\vec{BA} = \mathbf{x} - 4\mathbf{y}$.

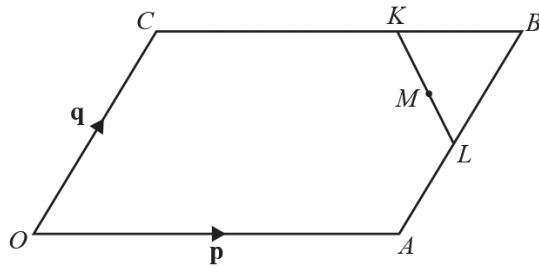
Find the position vector of B , in terms of \mathbf{x} and \mathbf{y} , in its simplest form.

..... [2]



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38. 0580_s19_QP_21 Q: 25



NOT TO SCALE

$OACB$ is a parallelogram and O is the origin.

$CK = 2KB$ and $AL = LB$.

M is the midpoint of KL .

$\vec{OA} = \mathbf{p}$ and $\vec{OC} = \mathbf{q}$.

Find, in terms of \mathbf{p} and \mathbf{q} , giving your answer in its simplest form

(a) \vec{KL} ,

$\vec{KL} = \dots\dots\dots$ [2]

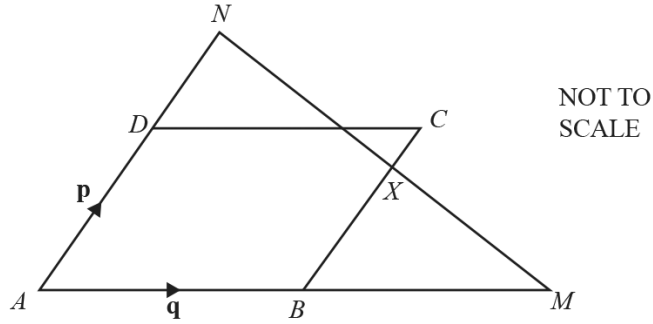
(b) the position vector of M .



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Paper Perfection, Crafted With Passion..... [2]

39. 0580_s19_QP_22 Q: 23



$ABCD$ is a parallelogram with $\vec{AB} = \mathbf{q}$ and $\vec{AD} = \mathbf{p}$.
 ABM is a straight line with $AB : BM = 1 : 1$.
 ADN is a straight line with $AD : DN = 3 : 2$.

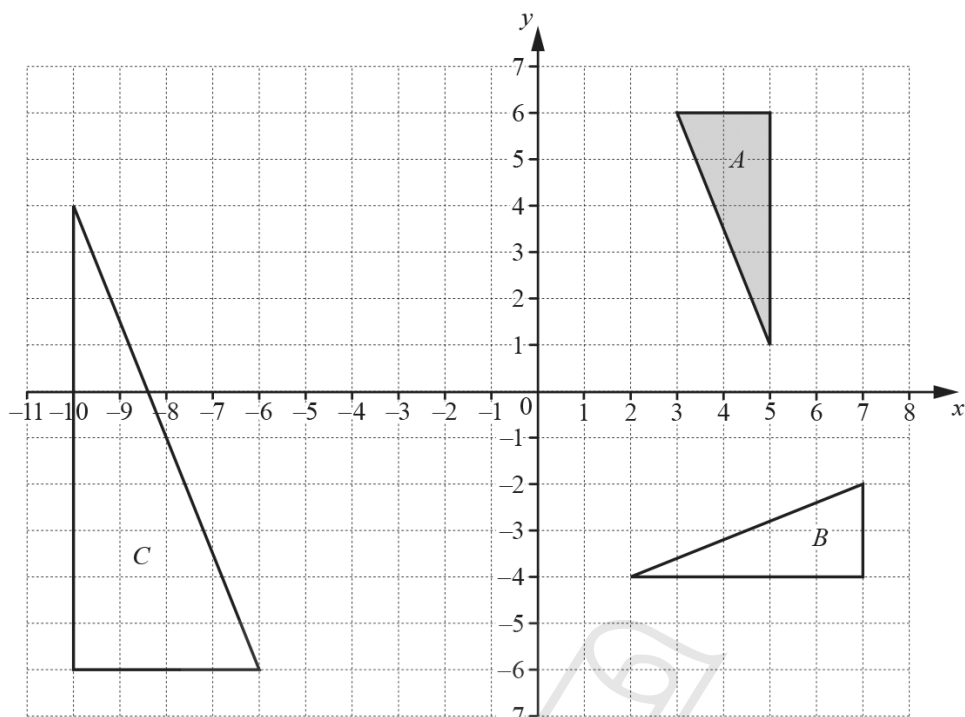
(a) Write \vec{MN} , in terms of \mathbf{p} and \mathbf{q} , in its simplest form.

$\vec{MN} = \dots\dots\dots$ [2]

(b) The straight line NM cuts BC at X .
 X is the midpoint of MN .
 $\vec{BX} = k\mathbf{p}$

Find the value of k .

$k = \dots\dots\dots$ [2]



Describe fully the **single** transformation that maps

- (a) triangle *A* onto triangle *B*,

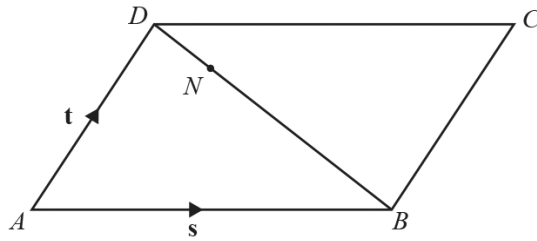
.....
 [3]

- (b) triangle *A* onto triangle *C*.

.....
 [3]

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41. 0580_s19_QP_23 Q: 22



NOT TO SCALE

$ABCD$ is a parallelogram.

N is the point on \overline{BD} such that $BN : ND = 4 : 1$.

$\overline{AB} = \mathbf{s}$ and $\overline{AD} = \mathbf{t}$.

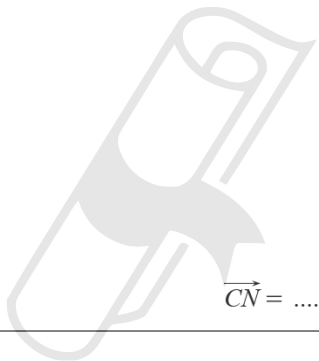
Find, in terms of \mathbf{s} and \mathbf{t} , an expression in its simplest form for

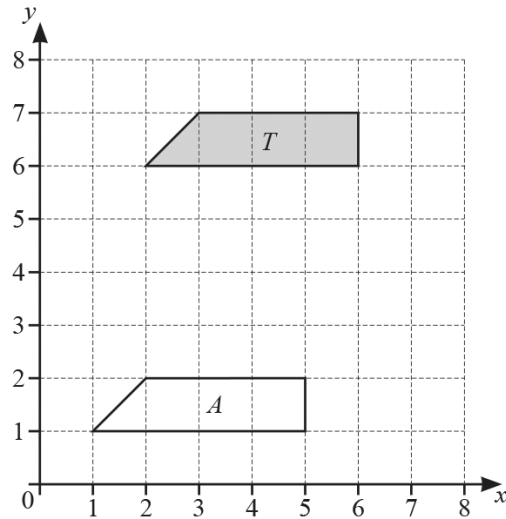
(a) \overrightarrow{BD} ,

$\overrightarrow{BD} = \dots\dots\dots [1]$

(b) \overrightarrow{CN} .

$\overrightarrow{CN} = \dots\dots\dots [3]$



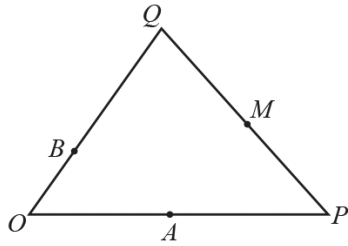


(a) Describe fully the **single** transformation that maps shape T onto shape A .

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

(b) On the grid, reflect shape T in the line $y = x$. [2]

43. 0580_w19_QP_21 Q: 25



NOT TO
SCALE

O is the origin, $\vec{OP} = 2\vec{OA}$, $\vec{OQ} = 3\vec{OB}$ and $\vec{PM} = \vec{MQ}$.

$\vec{OP} = \mathbf{p}$ and $\vec{OQ} = \mathbf{q}$.

Find, in terms of \mathbf{p} and \mathbf{q} , in its simplest form

(a) \vec{BA} ,

$\vec{BA} = \dots\dots\dots$ [2]

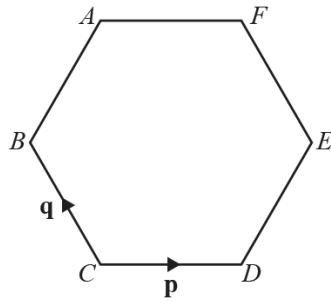
(b) the position vector of M .

$\dots\dots\dots$ [2]

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44. 0580_m18_QP_22 Q: 7



The diagram shows a regular hexagon $ABCDEF$.

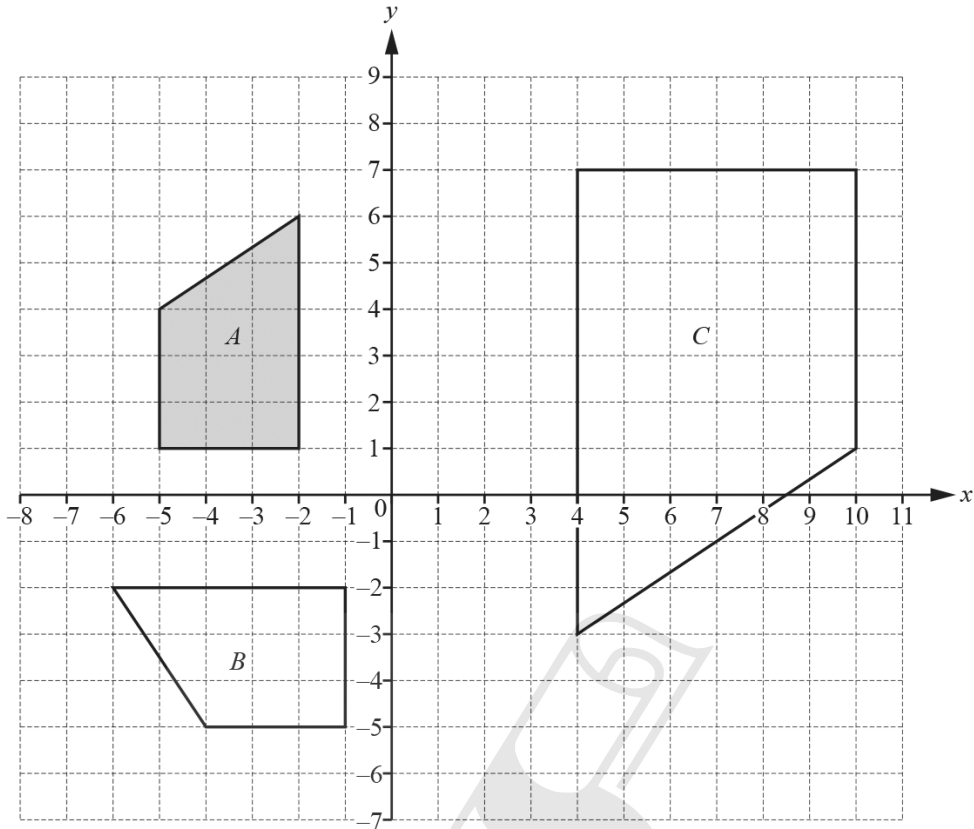
$\vec{CD} = \mathbf{p}$ and $\vec{CB} = \mathbf{q}$.

Find \vec{CA} , in terms of \mathbf{p} and \mathbf{q} , giving your answer in its simplest form.

$\vec{CA} = \dots\dots\dots [2]$

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45. 0580_m18_QP_22 Q: 20



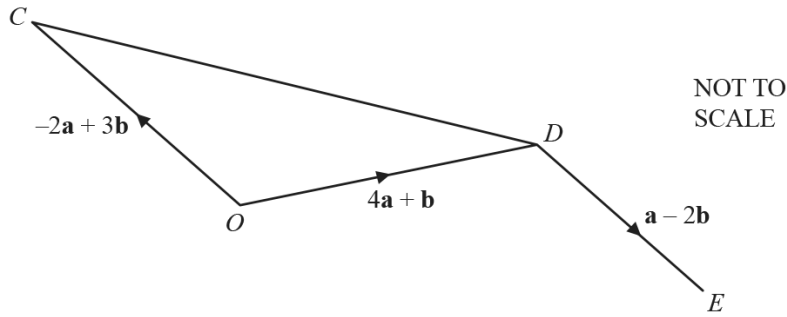
Describe fully the **single** transformation that maps

- (a) shape *A* onto shape *B*,

.....
 [3]

- (b) shape *A* onto shape *C*.

.....
 [3]



In the diagram, O is the origin, $\vec{OC} = -2\mathbf{a} + 3\mathbf{b}$ and $\vec{OD} = 4\mathbf{a} + \mathbf{b}$.

(a) Find \vec{CD} , in terms of \mathbf{a} and \mathbf{b} , in its simplest form.

$\vec{CD} = \dots\dots\dots$ [2]

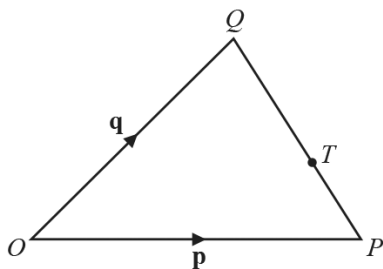
(b) $\vec{DE} = \mathbf{a} - 2\mathbf{b}$

Find the position vector of E , in terms of \mathbf{a} and \mathbf{b} , in its simplest form.

Ace | GCSE [2]

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47. 0580_s18_QP_23 Q: 14



NOT TO
SCALE

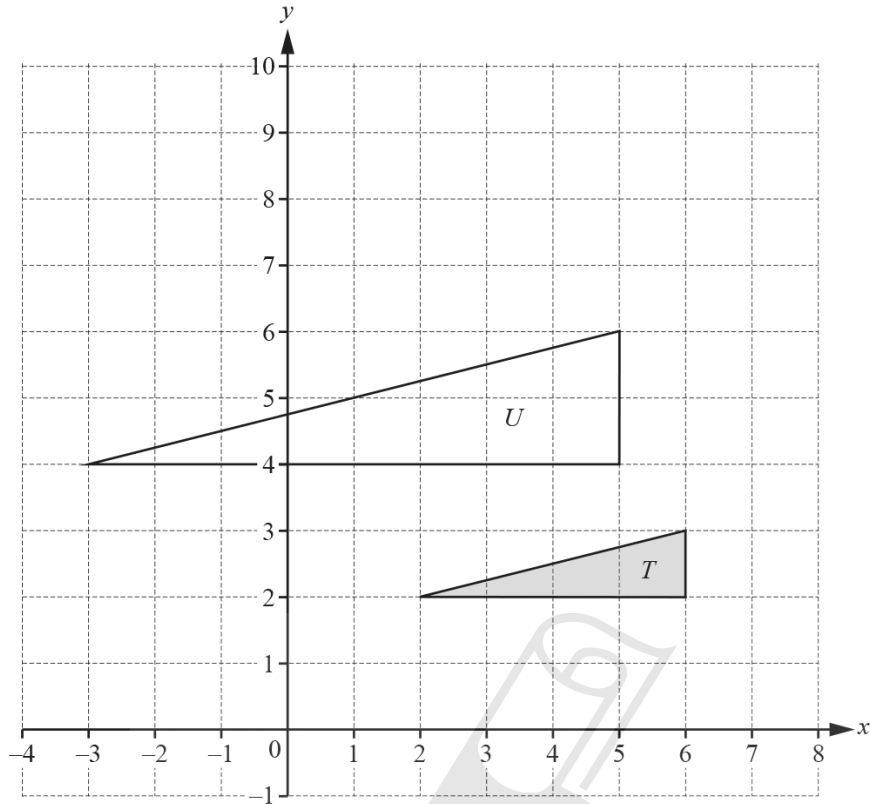
O is the origin, $\overrightarrow{OP} = \mathbf{p}$ and $\overrightarrow{OQ} = \mathbf{q}$.
 $QT : TP = 2 : 1$

Find the position vector of T .
Give your answer in terms of \mathbf{p} and \mathbf{q} , in its simplest form.

..... [2]



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

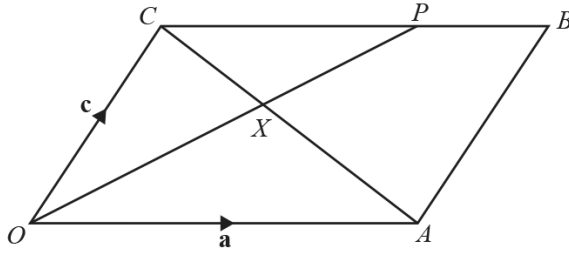
.....

..... [3]

- (b) On the grid, draw the image of triangle *T* after a rotation through 90° clockwise about the point $(7, 3)$. [3]

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49. 0580_w18_QP_23 Q: 26



NOT TO SCALE

In the diagram, $OACB$ is a parallelogram.
 OP and CA intersect at X and $CP : PB = 2 : 1$.
 $\vec{OA} = \mathbf{a}$ and $\vec{OC} = \mathbf{c}$.

(a) Find \vec{OP} , in terms of \mathbf{a} and \mathbf{c} , in its simplest form.

$\vec{OP} = \dots\dots\dots [2]$

(b) $CX : XA = 2 : 3$

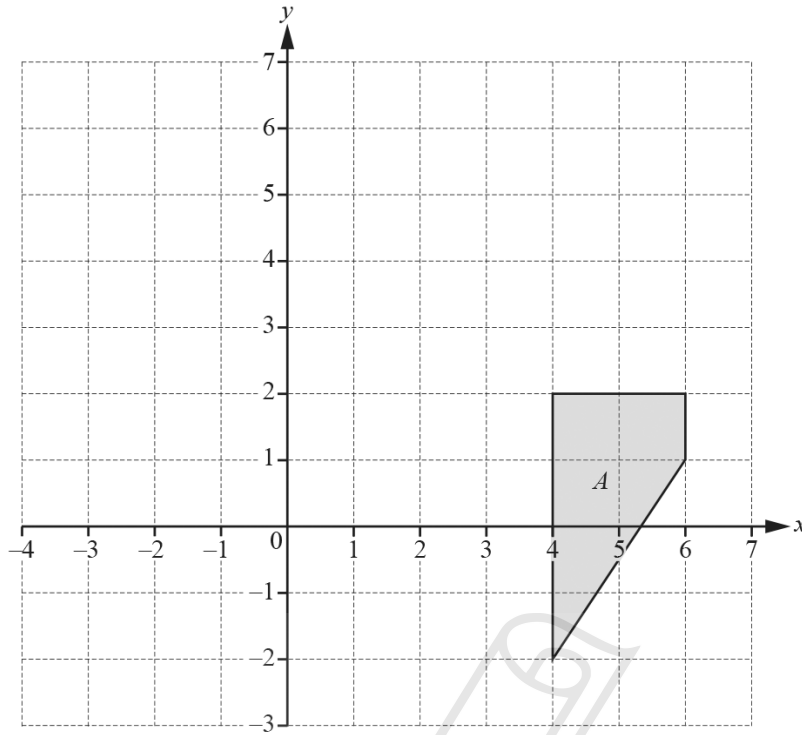
(i) Find \vec{OX} , in terms of \mathbf{a} and \mathbf{c} , in its simplest form.

$\vec{OX} = \dots\dots\dots [2]$

(ii) Find $OX : XP$.

$OX : XP = \dots\dots\dots : \dots\dots\dots [2]$





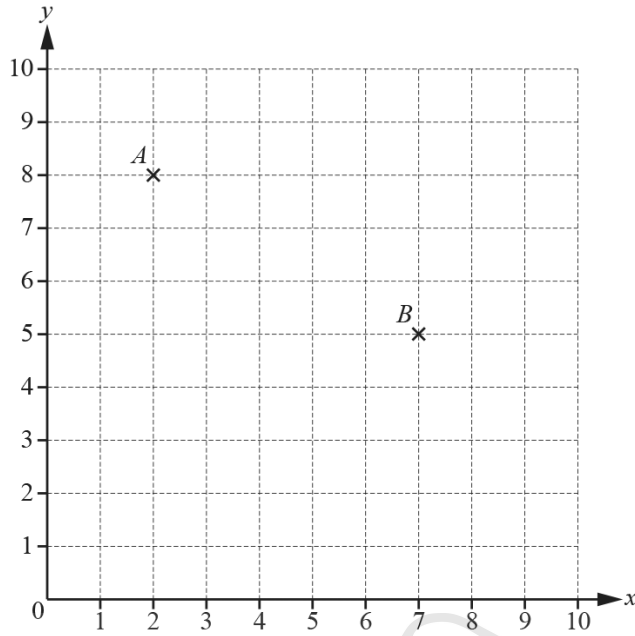
$T(X)$ is the image of the shape X after translation by the vector $\begin{pmatrix} -1 \\ 3 \end{pmatrix}$.

$M(Y)$ is the image of the shape Y after reflection in the line $x = 2$.

On the grid, draw $MT(A)$, the image of shape A after the transformation MT .

[3]

51. 0580_m17_QP_22 Q: 14



Points A and B are marked on the grid.

$$\vec{BC} = \begin{pmatrix} -4 \\ 0 \end{pmatrix}$$

(a) On the grid, plot the point C .

[1]

(b) Write \vec{AC} as a column vector.

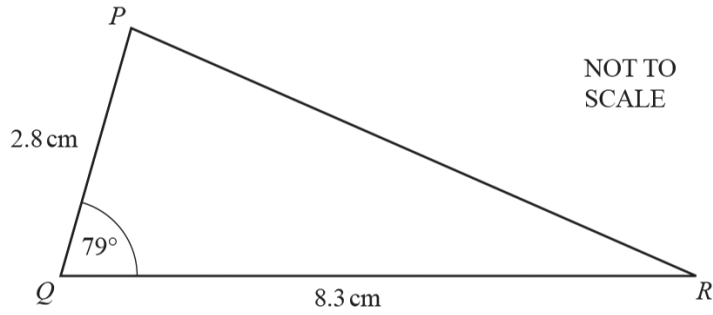
$\begin{pmatrix} \\ \end{pmatrix}$ [1]

(c) \vec{DE} is a vector that is perpendicular to \vec{BC} .
The magnitude of \vec{DE} is equal to the magnitude of \vec{BC} .

Write down a possible column vector for \vec{DE} .

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

52. 0580_m17_QP_22 Q: 19

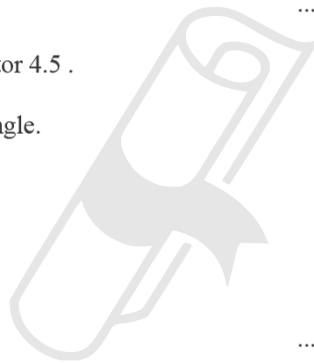


(a) Calculate the area of triangle PQR .

..... cm^2 [2]

(b) Triangle PQR is enlarged by scale factor 4.5 .

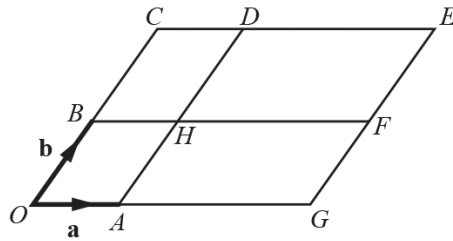
Calculate the area of the enlarged triangle.



..... cm^2 [2]

53. 0580_s17_QP_21 Q: 18

The diagram shows a parallelogram $OCEG$.



NOT TO
SCALE

O is the origin, $\vec{OA} = \mathbf{a}$ and $\vec{OB} = \mathbf{b}$.

BHF and AHD are straight lines parallel to the sides of the parallelogram.

$\vec{OG} = 3\vec{OA}$ and $\vec{OC} = 2\vec{OB}$.

(a) Write the vector \vec{HE} in terms of \mathbf{a} and \mathbf{b} .

$\vec{HE} = \dots\dots\dots$ [1]

(b) Complete this statement.

$\mathbf{a} + 2\mathbf{b}$ is the position vector of point $\dots\dots\dots$ [1]

(c) Write down two vectors that can be written as $3\mathbf{a} - \mathbf{b}$.

$\dots\dots\dots$ and $\dots\dots\dots$ [2]

54. 0580_s17_QP_23 Q: 9

(a) $\vec{GH} = \begin{pmatrix} 6 \\ -4 \end{pmatrix}$

Find

(i) $5\vec{GH}$,

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

(ii) \vec{HG} .

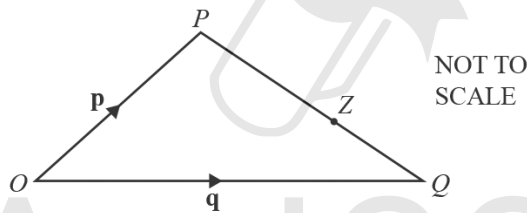
$\begin{pmatrix} \\ \end{pmatrix}$ [1]

(b) $\begin{pmatrix} 6 \\ 7 \end{pmatrix} + \begin{pmatrix} 2 \\ y \end{pmatrix} = \begin{pmatrix} 8 \\ 3 \end{pmatrix}$

Find the value of y .

$y = \dots\dots\dots$ [1]

55. 0580_s17_QP_23 Q: 17



O is the origin, $\vec{OP} = \mathbf{p}$ and $\vec{OQ} = \mathbf{q}$.
 Z is a point on PQ such that $PZ : ZQ = 5 : 2$.

Work out, in terms of \mathbf{p} and \mathbf{q} , the position vector of Z .
 Give your answer in its simplest form.

$\dots\dots\dots$ [3]

56. 0580_w17_QP_21 Q: 14

(a) D is the point $(2, -5)$ and $\overrightarrow{DE} = \begin{pmatrix} 7 \\ 1 \end{pmatrix}$.

Find the co-ordinates of the point E .

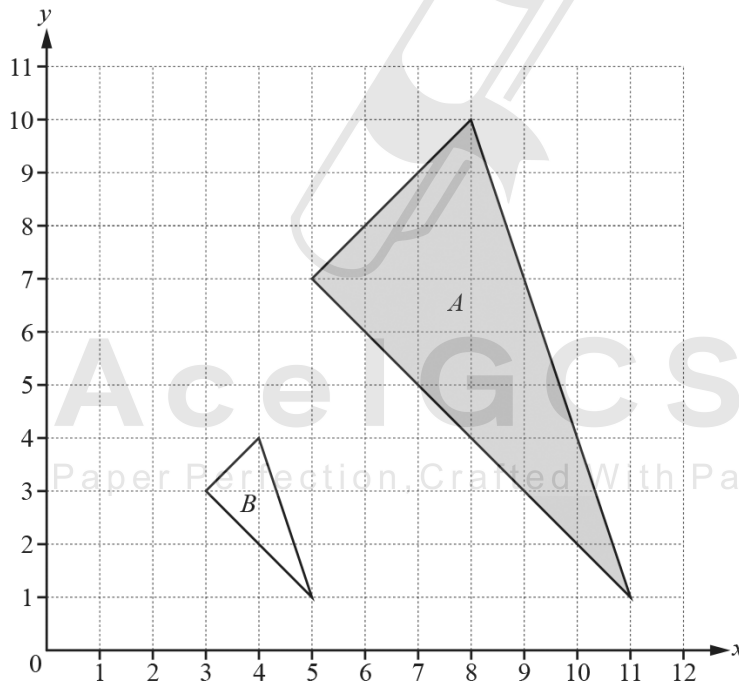
(..... ,) [1]

(b) $\mathbf{v} = \begin{pmatrix} t \\ 12 \end{pmatrix}$ and $|\mathbf{v}| = 13$.

Work out the value of t , where t is negative.

$t = \dots\dots\dots$ [2]

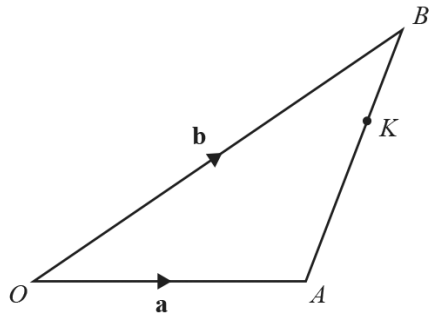
57. 0580_w17_QP_21 Q: 16



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

.....
 [3]

58. 0580_w17_QP_22 Q: 21



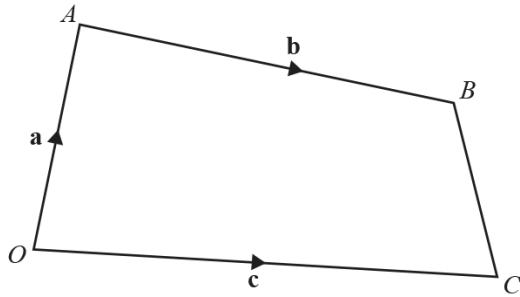
NOT TO
SCALE

O is the origin and K is the point on AB so that $AK : KB = 2 : 1$.
 $\vec{OA} = \mathbf{a}$ and $\vec{OB} = \mathbf{b}$.

Find the position vector of K .
Give your answer in terms of \mathbf{a} and \mathbf{b} in its simplest form.

..... [3]

59. 0580_s16_QP_22 Q: 24



NOT TO SCALE

In the diagram, O is the origin, $\vec{OA} = \mathbf{a}$, $\vec{OC} = \mathbf{c}$ and $\vec{AB} = \mathbf{b}$.
 P is on the line AB so that $AP : PB = 2 : 1$.
 Q is the midpoint of BC .

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

(a) \vec{CB} ,

$\vec{CB} = \dots\dots\dots$ [1]

(b) the position vector of Q ,

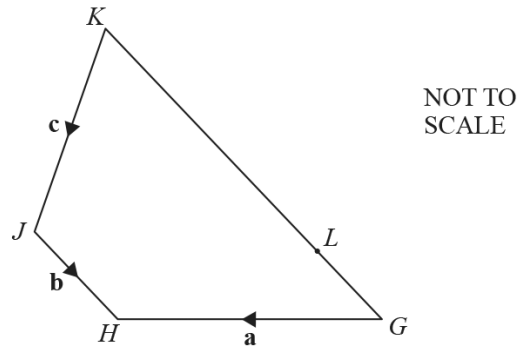
$\dots\dots\dots$ [2]

(c) \vec{PQ} .

$\vec{PQ} = \dots\dots\dots$ [2]

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60. 0580_s16_QP_23 Q: 9



$GHJK$ is a quadrilateral.
 $\vec{GH} = \mathbf{a}$, $\vec{JH} = \mathbf{b}$ and $\vec{KJ} = \mathbf{c}$.
 L lies on GK so that $LK = 3GL$.

Find an expression, in terms of \mathbf{a} , \mathbf{b} and \mathbf{c} , for \vec{GL} .

$\vec{GL} = \dots\dots\dots$ [2]

61. 0580_w16_QP_22 Q: 16

$\vec{BC} = \begin{pmatrix} 2 \\ 3 \end{pmatrix}$ $\vec{BA} = \begin{pmatrix} -5 \\ 6 \end{pmatrix}$

(a) Find \vec{CA} .

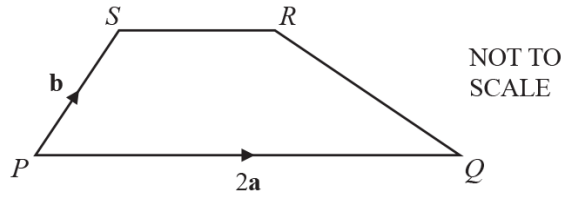
$\vec{CA} = \begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [2]

(b) Work out $|\vec{BA}|$.

$\dots\dots\dots$ [2]

62. 0580_m15_QP_22 Q: 17

(a)



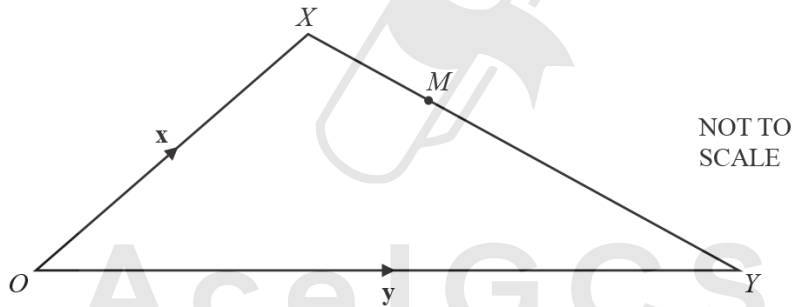
$PQRS$ is a trapezium with $PQ = 2SR$.

$\vec{PQ} = 2\mathbf{a}$ and $\vec{PS} = \mathbf{b}$.

Find \vec{QR} in terms of \mathbf{a} and \mathbf{b} in its simplest form.

Answer(a) $\vec{QR} = \dots\dots\dots$ [2]

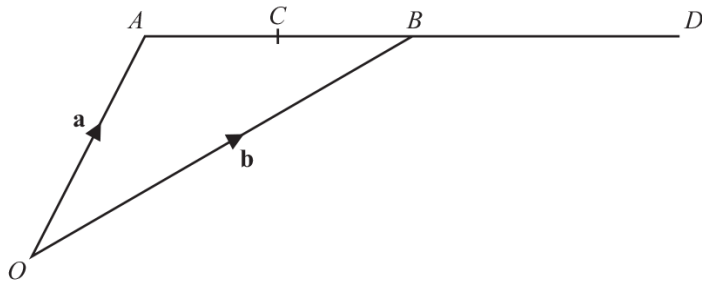
(b)



$\vec{OX} = \mathbf{x}$ and $\vec{OY} = \mathbf{y}$.

M is a point on XY such that $XM:MY = 3:5$.

Find \vec{OM} in terms of \mathbf{x} and \mathbf{y} in its simplest form.



A and B have position vectors \mathbf{a} and \mathbf{b} relative to the origin O .
 C is the midpoint of AB and B is the midpoint of AD .

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

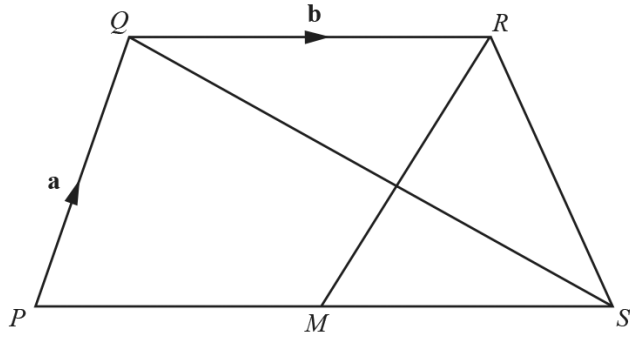
(a) the position vector of C ,

Answer(a) [2]

(b) the vector \vec{CD} .

Answer(b) [2]

64. 0580_s15_QP_21 Q: 14



NOT TO SCALE

$PQRS$ is a quadrilateral and M is the midpoint of PS .

$\vec{PQ} = \mathbf{a}$, $\vec{QR} = \mathbf{b}$ and $\vec{SQ} = \mathbf{a} - 2\mathbf{b}$.

(a) Show that $\vec{PS} = 2\mathbf{b}$.

Answer(a)

[1]

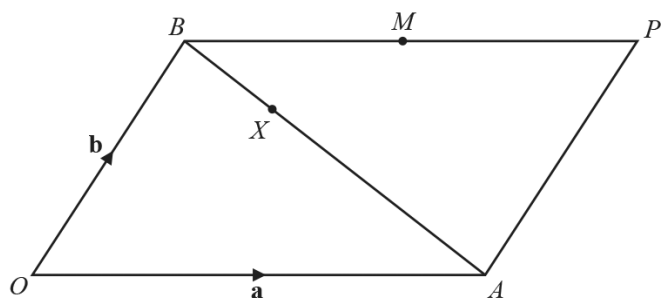
(b) Write down the mathematical name for the quadrilateral $PQRM$, giving reasons for your answer.

Answer(b) because

..... [2]

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NOT TO SCALE

$OAPB$ is a parallelogram.
 O is the origin, $\vec{OA} = \mathbf{a}$ and $\vec{OB} = \mathbf{b}$.
 M is the midpoint of BP .

(a) Find, in terms of \mathbf{a} and \mathbf{b} , giving your answer in its simplest form,

(i) \vec{BA} ,

Answer(a)(i) $\vec{BA} = \dots\dots\dots$ [1]

(ii) the position vector of M .

Answer(a)(ii) $\dots\dots\dots$ [1]

(b) X is on BA so that $BX:XA = 1:2$.

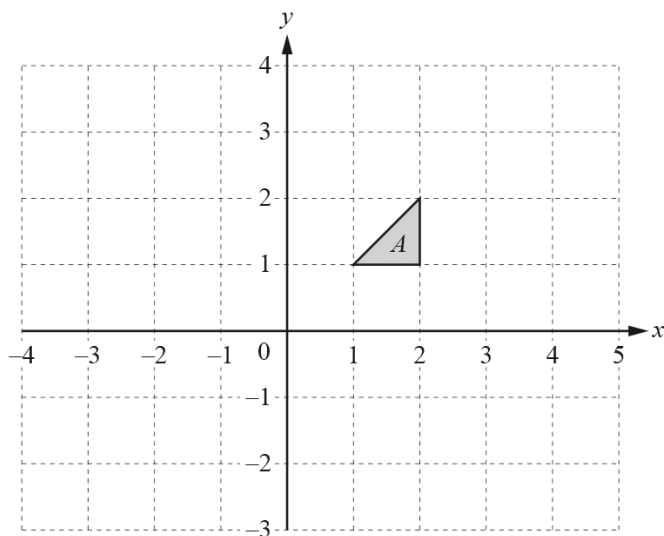
Show that X lies on OM .

Answer(b)

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[4]

66. 0580_w15_QP_21 Q: 3



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

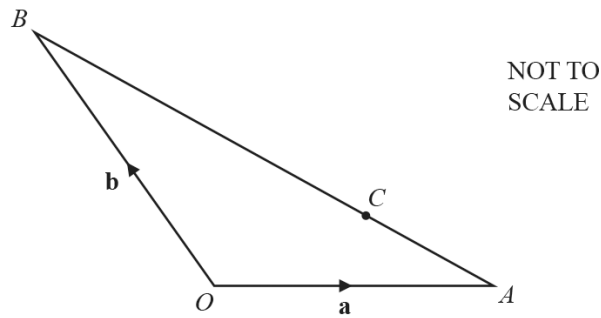
67. 0580_w15_QP_22 Q: 4

$$\vec{AB} = \begin{pmatrix} -3 \\ 5 \end{pmatrix}$$

Find $|\vec{AB}|$.

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Answer [2]
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68. 0580_w15_QP_23 Q: 23



In the diagram, O is the origin, $\vec{OA} = \mathbf{a}$ and $\vec{OB} = \mathbf{b}$.
 C is on the line AB so that $AC:CB = 1:2$.

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

(a) \vec{AC} ,

Answer(a) $\vec{AC} = \dots\dots\dots$ [2]

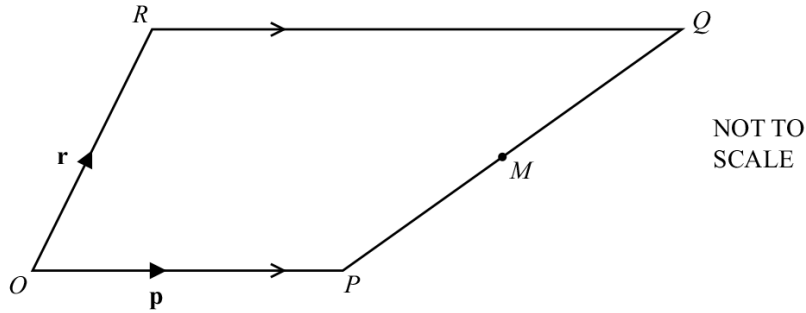
(b) the position vector of C .

Answer(b) $\dots\dots\dots$ [2]

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69. 0580_s14_QP_22 Q: 14



$OPQR$ is a trapezium with RQ parallel to OP and $RQ = 2OP$.

O is the origin, $\vec{OP} = \mathbf{p}$ and $\vec{OR} = \mathbf{r}$.

M is the midpoint of PQ .

Find, in terms of \mathbf{p} and \mathbf{r} , in its simplest form

(a) \vec{PQ} ,

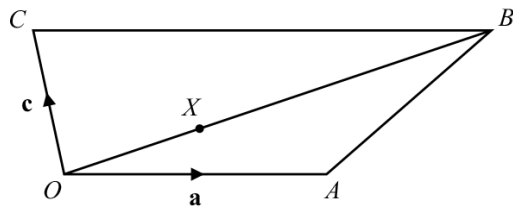
Answer(a) $\vec{PQ} = \dots\dots\dots$ [1]

(b) \vec{OM} , the position vector of M .

Answer(b) $\vec{OM} = \dots\dots\dots$ [2]

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NOT TO SCALE

The diagram shows a quadrilateral $OACB$.

$\vec{OA} = \mathbf{a}$, $\vec{OC} = \mathbf{c}$ and $\vec{CB} = 2\mathbf{a}$.

X is a point on OB such that $OX:XB = 1:2$.

(a) Find, in terms of \mathbf{a} and \mathbf{c} , in its simplest form

(i) \vec{AC} ,

Answer(a)(i) $\vec{AC} = \dots\dots\dots$ [1]

(ii) \vec{AX} .

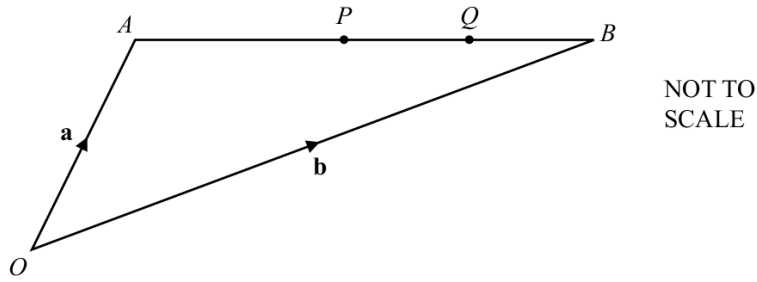
Answer(a)(ii) $\vec{AX} = \dots\dots\dots$ [3]

(b) Explain why the vectors \vec{AC} and \vec{AX} show that C, X and A lie on a straight line.

Answer(b) $\dots\dots\dots$

$\dots\dots\dots$ [2]

71. 0580_w14_QP_23 Q: 14



The diagram shows two points, P and Q , on a straight line AB .
 P is the midpoint of AB and Q is the midpoint of PB .
 O is the origin, $\vec{OA} = \mathbf{a}$ and $\vec{OB} = \mathbf{b}$.

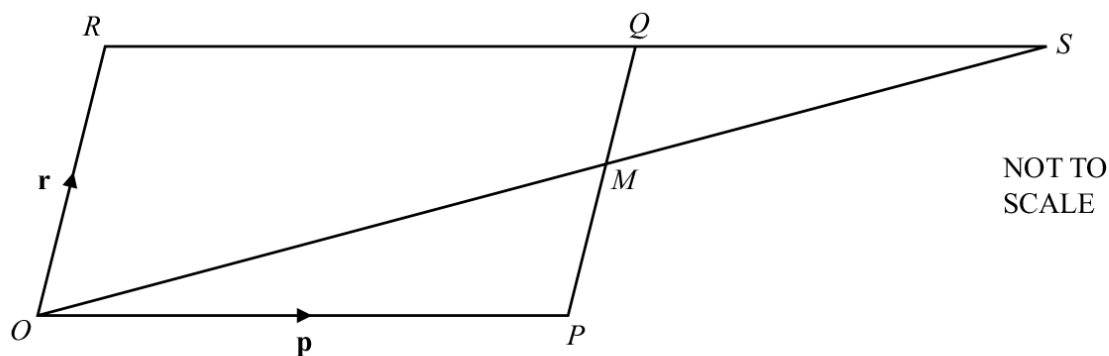
Write down, in terms of \mathbf{a} and \mathbf{b} , in its simplest form

(a) \vec{AP} ,

Answer(a) $\vec{AP} = \dots\dots\dots$ [2]

(b) the position vector of Q .

Answer(b) $\dots\dots\dots$ [2]



$OPQR$ is a parallelogram, with O the origin.

M is the midpoint of PQ .

OM and RQ are extended to meet at S .

$\vec{OP} = \mathbf{p}$ and $\vec{OR} = \mathbf{r}$.

(a) Find, in terms of \mathbf{p} and \mathbf{r} , in its simplest form,

(i) \vec{OM} ,

Answer(a)(i) $\vec{OM} = \dots\dots\dots$ [1]

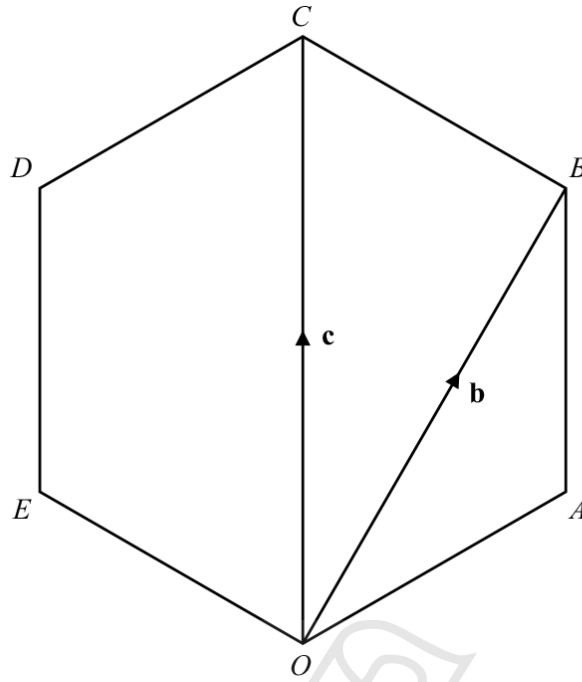
(ii) the position vector of S .

Answer(a)(ii) $\dots\dots\dots$ [1]

(b) When $\vec{PT} = -\frac{1}{2}\mathbf{p} + \mathbf{r}$, what can you write down about the position of T ?

Answer(b) $\dots\dots\dots$ [1]

73. 0580_s13_QP_23 Q: 19



OABCDE is a regular polygon.

(a) Write down the geometrical name for this polygon.

Answer(a) [1]

(b) O is the origin. $\vec{OB} = \mathbf{b}$ and $\vec{OC} = \mathbf{c}$.

Find, in terms of \mathbf{b} and \mathbf{c} , in their simplest form,

(i) \vec{BC} ,

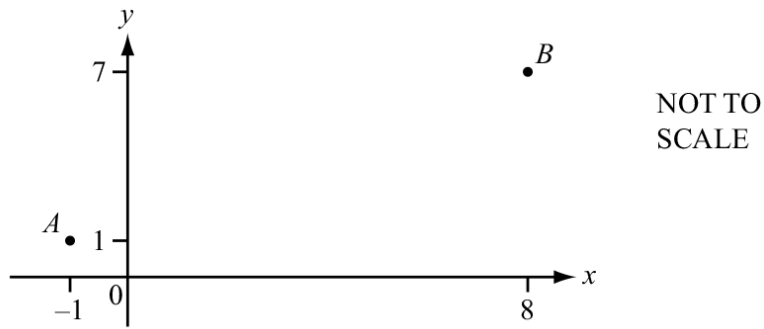
Answer(b)(i) $\vec{BC} = \dots\dots\dots$ [1]

(ii) \vec{OA} ,

Answer(b)(ii) $\vec{OA} = \dots\dots\dots$ [2]

(iii) the position vector of E.

Answer(b)(iii) [1]



A is the point $(-1, 1)$ and B is the point $(8, 7)$.

(a) Write \vec{AB} as a column vector.

Answer(a) $\vec{AB} = \begin{pmatrix} \\ \end{pmatrix}$ [1]

(b) Find $|\vec{AB}|$.

Answer(b) $|\vec{AB}| = \dots\dots\dots$ [2]

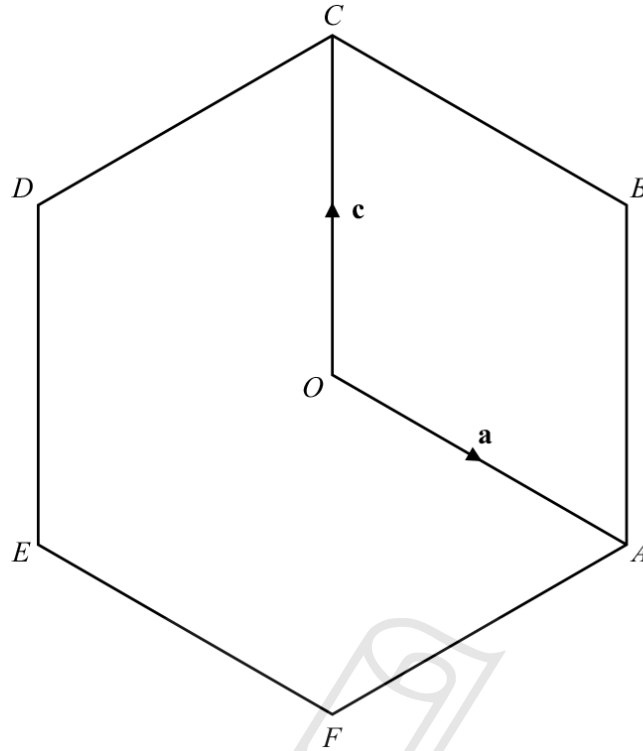
(c) $\vec{AC} = 2\vec{AB}$.

Write down the co-ordinates of C .

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Paper Perfection, Crafted With Passion, [1]

75. 0580_w13_QP_22 Q: 19



O is the origin.
 $ABCDEF$ is a regular hexagon and O is the midpoint of AD .

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

Find, in terms of \mathbf{a} and \mathbf{c} , in their simplest form

(a) \vec{BE} ,



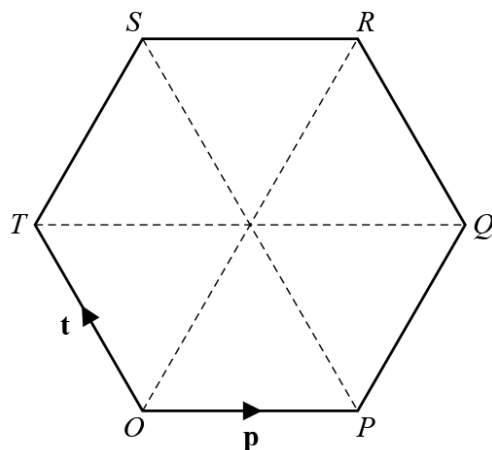
Answer(a) $\vec{BE} = \dots\dots\dots$ [2]

(b) \vec{DB} ,

Answer(b) $\vec{DB} = \dots\dots\dots$ [2]

(c) the position vector of E .

Answer(c) $\dots\dots\dots$ [2]

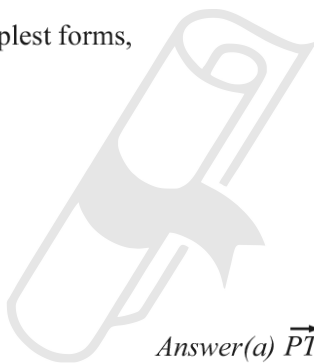


O is the origin and $OPQRST$ is a regular hexagon.

$\vec{OP} = \mathbf{p}$ and $\vec{OT} = \mathbf{t}$.

Find, in terms of \mathbf{p} and \mathbf{t} , in their simplest forms,

(a) \vec{PT} ,



Answer(a) $\vec{PT} = \dots\dots\dots$ [1]

(b) \vec{PR} ,

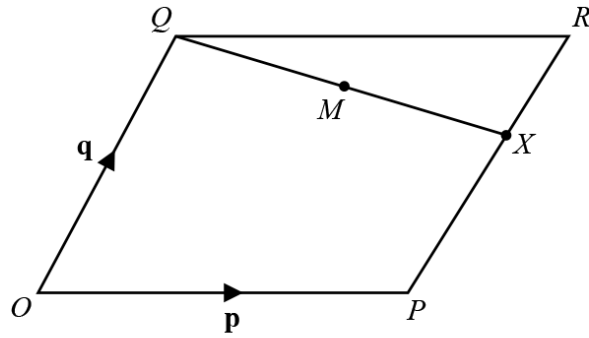
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Answer(b) $\vec{PR} = \dots\dots\dots$ [2]

(c) the position vector of R .

Answer(c) $\dots\dots\dots$ [2]

77. 0580_s12_QP_23 Q: 18



NOT TO SCALE

O is the origin and $OPRQ$ is a parallelogram.
 The position vectors of P and Q are \mathbf{p} and \mathbf{q} .
 X is on PR so that $PX = 2XR$.

Find, in terms of \mathbf{p} and \mathbf{q} , in their simplest forms

(a) \vec{QX} ,

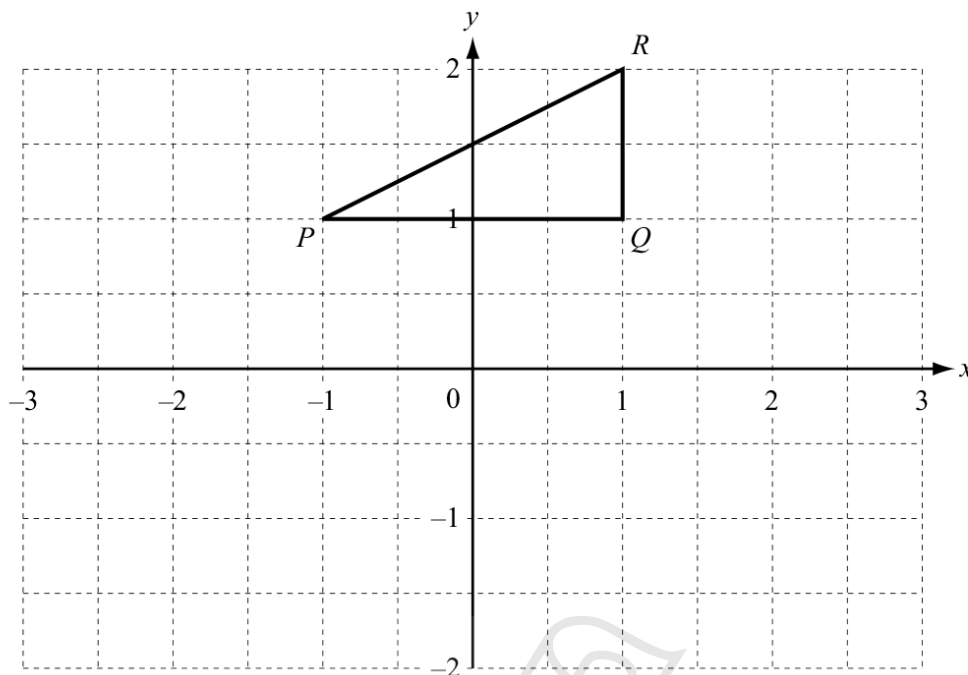


Answer(a) $\vec{QX} = \dots\dots\dots$ [2]

(b) the position vector of M , the midpoint of QR .

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Answer(b) $\dots\dots\dots$ [2]



The triangle PQR has co-ordinates $P(-1, 1)$, $Q(1, 1)$ and $R(1, 2)$.

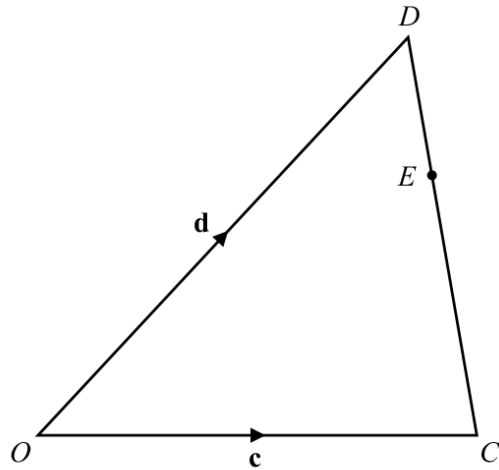
- (a) Rotate triangle PQR by 90° clockwise about $(0, 0)$.
Label your image $P'Q'R'$. [2]

- (b) Reflect **your triangle** $P'Q'R'$ in the line $y = -x$.
Label your image $P''Q''R''$. [2]

- (c) Describe fully the **single** transformation which maps triangle PQR onto triangle $P''Q''R''$.

Answer(c) [2]

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NOT TO SCALE

In the diagram, O is the origin.
 $\vec{OC} = \mathbf{c}$ and $\vec{OD} = \mathbf{d}$.
 E is on CD so that $CE = 2ED$.

Find, in terms of \mathbf{c} and \mathbf{d} , in their simplest forms,

(a) \vec{DE} ,

Answer(a) $\vec{DE} = \dots\dots\dots$ [2]

(b) the position vector of E .

Answer(b) $\dots\dots\dots$ [2]

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