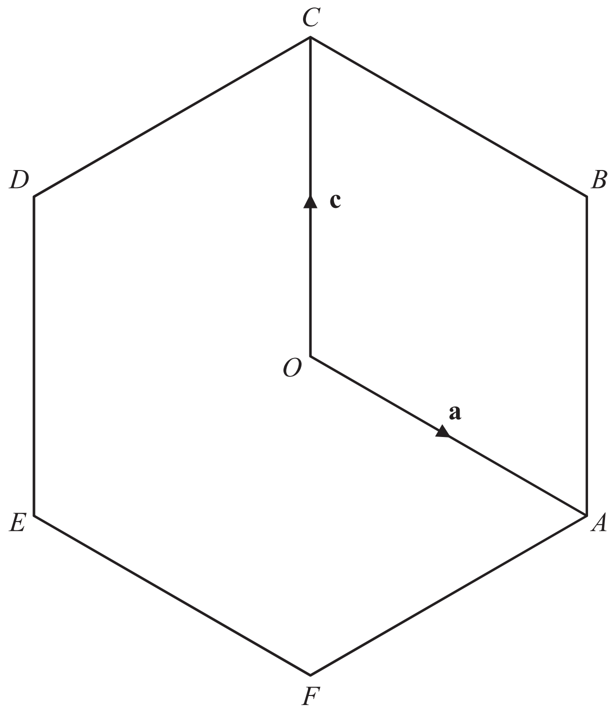
EXAM PAPERS PRACTICE

Vectors

Question Paper



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

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

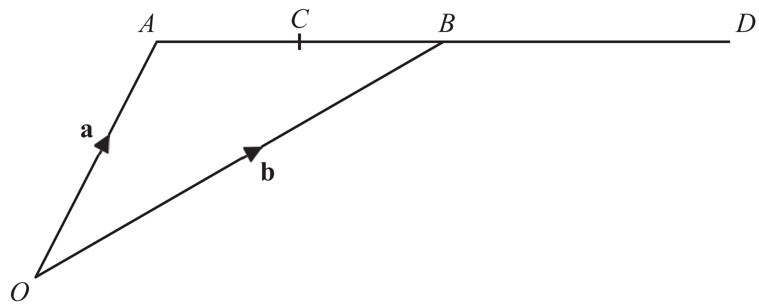
Find, in terms of **a** and **c**, in their simplest form

(a) $\overrightarrow{BE}$, [2]

(b) $\overrightarrow{DB}$, [2]

(c) the position vector of E. [2]

Question 2

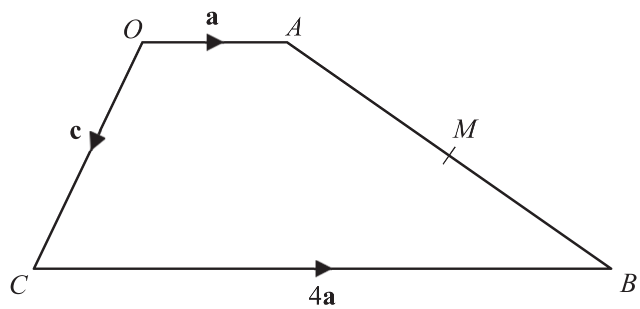


A and B have position vectors $\mathbf{a}$ and $\mathbf{b}$ relative to the origin O.
C is the midpoint of AB and B is the midpoint of AD.

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

(a) the position vector of C, [2]

(b) the vector $\overrightarrow{CD}$. [2]



O is the origin, $\overrightarrow{OA} = \mathbf{a}$, $\overrightarrow{OC} = \mathbf{c}$ and $\overrightarrow{CB} = 4\mathbf{a}$.
M is the midpoint of AB.

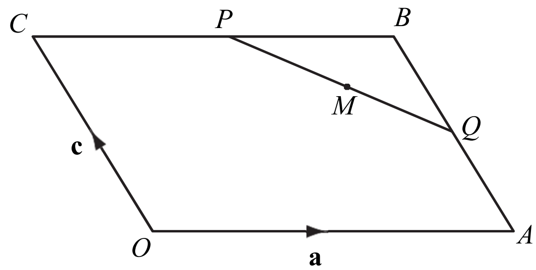
(a) Find, in terms of **a** and **c**, in their simplest form

(i) the vector $\overrightarrow{AB}$, [2]

(ii) the position vector of M. [2]

(b) Mark the point D on the diagram where $\overrightarrow{OD} = 3\mathbf{a} + \mathbf{c}$. [2]

Question 4



NOT TO SCALE

O is the origin and $OABC$ is a parallelogram.
$CP = PB$ and $AQ = QB$.

$\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OC} = \mathbf{c}$.
Find in terms of a and c, in their simplest form,

(a) $\overrightarrow{PQ}$, [2]

(b) the position vector of M, where M is the midpoint of PQ. [2]

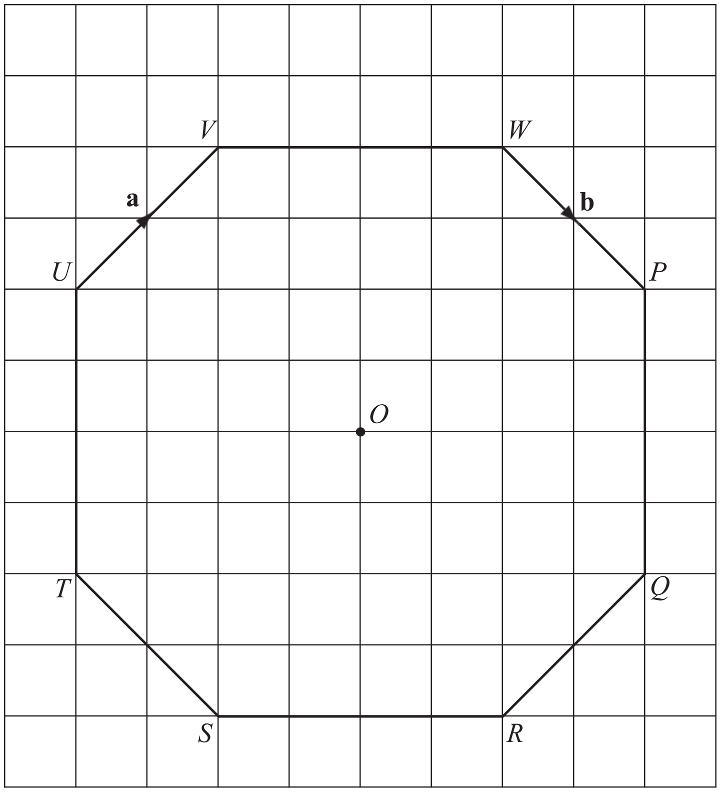
Question 5

$\overrightarrow{AB} = \mathbf{a} + t\mathbf{b}$ and $\overrightarrow{CD} = \mathbf{a} + (3t - 5)\mathbf{b}$ where t is a number.

Find the value of t when $\overrightarrow{AB} = \overrightarrow{CD}$.

[2]

Question 6



The origin O is the centre of the octagon $PQRSTUVW$.
$\overrightarrow{UV} = \mathbf{a}$ and $\overrightarrow{WP} = \mathbf{b}$.

(a) Write down in terms of $\mathbf{a}$ and $\mathbf{b}$

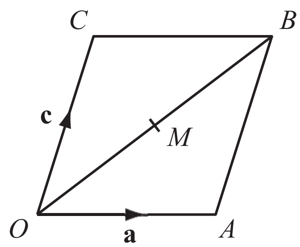
(i) $\overrightarrow{VW}$, [1]

(ii) $\overrightarrow{TU}$, [1]

(iii) $\overrightarrow{TP}$, [2]

(iv) the position vector of the point P. [1]

(b) In the diagram, 1 centimetre represents 1 unit.
Write down the value of $|\mathbf{a} - \mathbf{b}|$. [1]



$OABC$ is a parallelogram. $\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OC} = \mathbf{c}$.
M is the mid-point of OB.
Find $\overrightarrow{MA}$ in terms of $\mathbf{a}$ and $\mathbf{c}$.

[2]

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

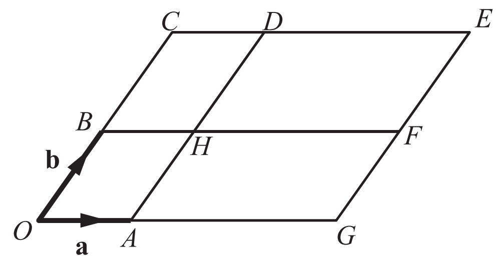
Find the co-ordinates of the point E. [1]

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

Work out the value of t, where t is negative. [2]

Question 9

The diagram shows a parallelogram *OCEG*.



NOT TO SCALE

O is the origin, $\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$.
BHF and *AHD* are straight lines parallel to the sides of the parallelogram.

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

(a) Write the vector $\overrightarrow{HE}$ in terms of **a** and **b**. [1]

(b) Complete this statement. [1]

$\mathbf{a} + 2\mathbf{b}$ is the position vector of point ....

(c) Write down two vectors that can be written as $3\mathbf{a} - \mathbf{b}$. [2]

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

Find

(i) $5\overrightarrow{GH}$, [1]

(ii) $\overrightarrow{HG}$. [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. [1]

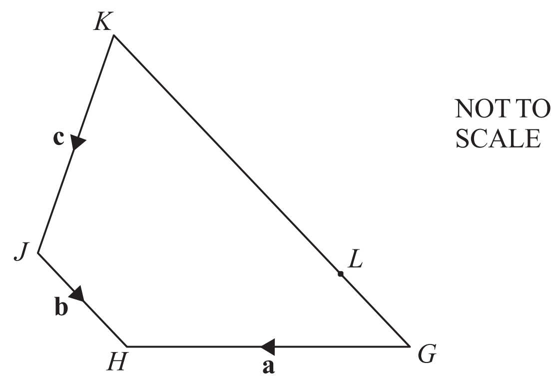
Question 11

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

(a) Find $\overrightarrow{CA}$. [2]

(b) Work out $|\overrightarrow{BA}|$. [2]

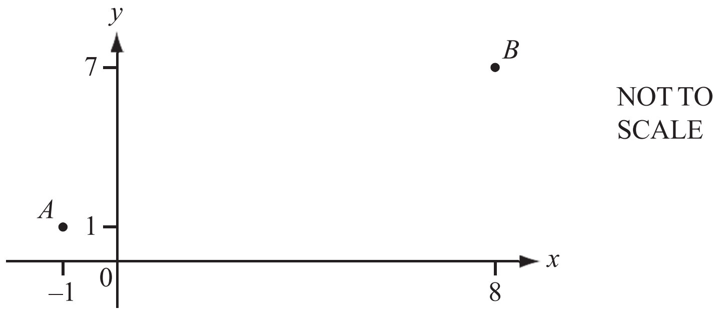
Question 12



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

Find an expression, in terms of **a**, **b** and **c**, for $\overrightarrow{GL}$. [2]

Question 13



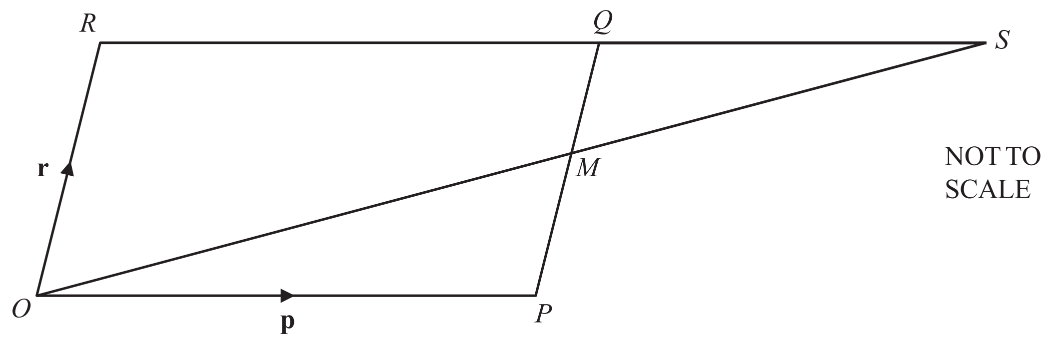
A is the point (–1, 1) and B is the point (8, 7).

(a) Write $\overrightarrow{AB}$ as a column vector. [1]

(b) Find $|\overrightarrow{AB}|$. [2]

(c) $\overrightarrow{AC} = 2\overrightarrow{AB}$. [1]

Write down the co-ordinates of C.



OPQR is a parallelogram, with *O* the origin.
M is the midpoint of *PQ*.
OM and *RQ* are extended to meet at *S*.
$\overrightarrow{OP} = \mathbf{p}$ and $\overrightarrow{OR} = \mathbf{r}$.

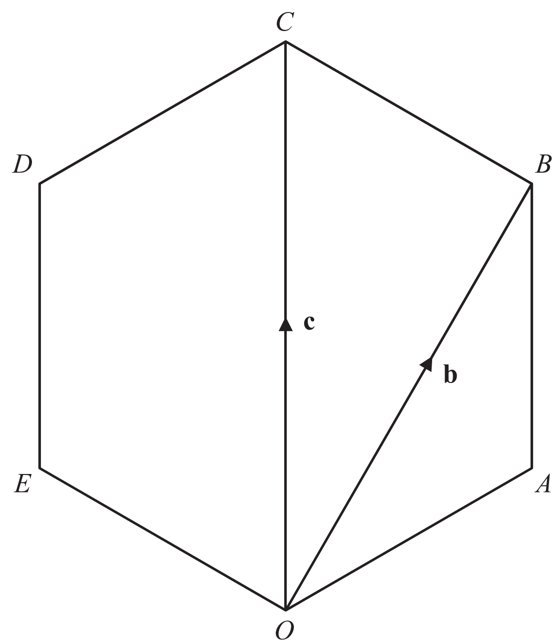
(a) Find, in terms of **p** and **r**, in its simplest form,

(i) $\overrightarrow{OM}$, [1]

(ii) the position vector of *S*. [1]

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

Question 15



OABCDE is a regular polygon.

(a) Write down the geometrical name for this polygon. [1]

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

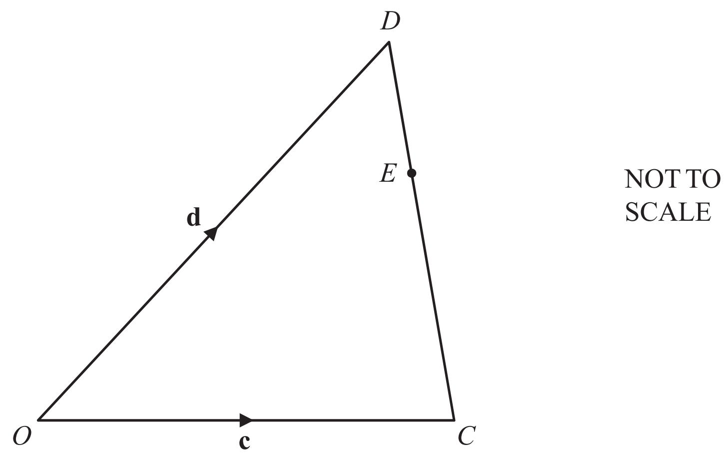
Find, in terms of **b** and **c**, in their simplest form,

(i) $\overrightarrow{BC}$, [1]

(ii) $\overrightarrow{OA}$, [2]

(iii) the position vector of E. [1]

Question 16

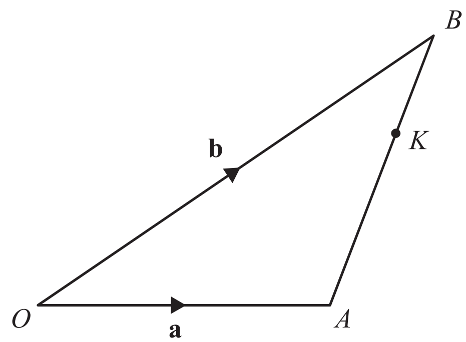


In the diagram, O is the origin.
$\overrightarrow{OC}$ = c and $\overrightarrow{OD}$ = d.
E is on CD so that $CE = 2ED$.

Find, in terms of c and d, in their simplest forms,

(a) $\overrightarrow{DE}$, [2]

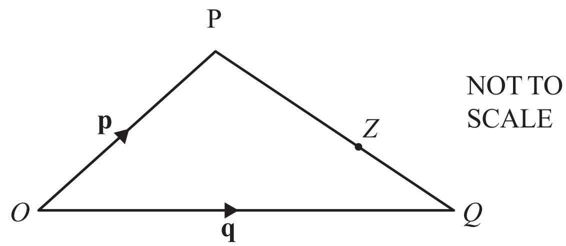
(b) the position vector of E. [2]



NOT TO SCALE

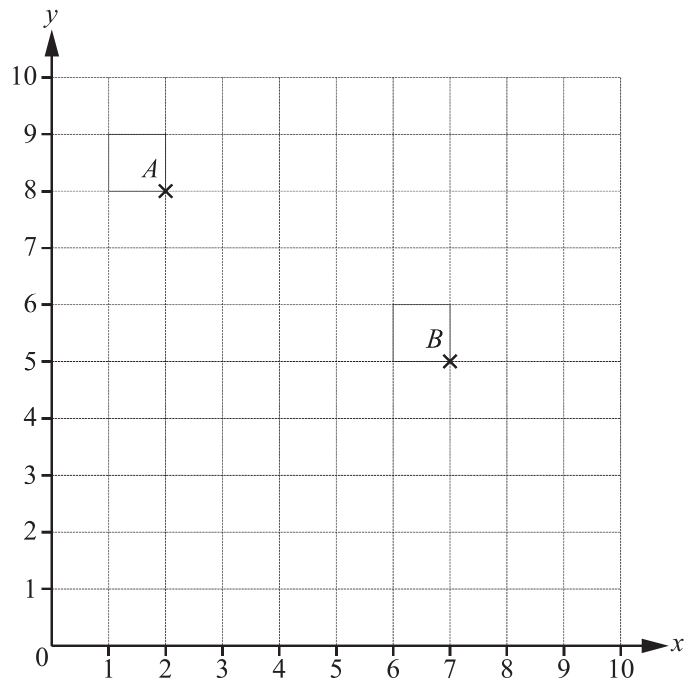
O is the origin and K is the point on AB so that $AK : KB = 2 : 1$.
$\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$.

Find the position vector of K.
Give your answer in terms of **a** and **b** in its simplest form. [3]



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

Work out, in terms of **p** and **q**, the position vector of Z.
Give your answer in its simplest form. [3]



Points A and B are marked on the grid.

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

(a) On the grid, plot the point C. [1]

(b) Write $\overrightarrow{AC}$ as a column vector. [1]

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

[2]

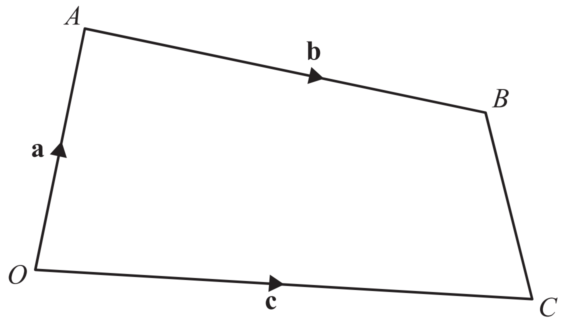
Write down a possible column vector for $\overrightarrow{DE}$.

Question 20

Work out

$$2\begin{pmatrix}3\\5\end{pmatrix}-\begin{pmatrix}1\\2\end{pmatrix}$$

[1]



NOT TO SCALE

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

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

(a) $\overrightarrow{CB}$, [1]

(b) the position vector of Q, [2]

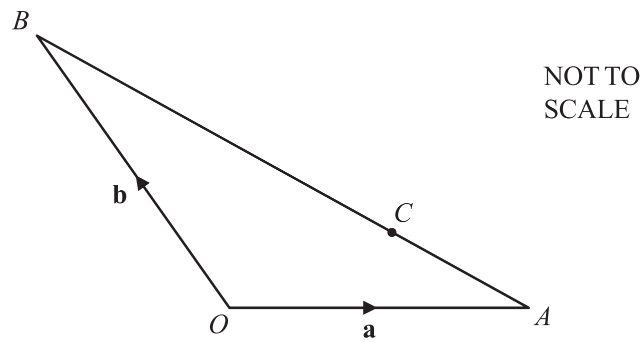
(c) $\overrightarrow{PQ}$. [2]

Question 22

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

Find $|\overrightarrow{AB}|$. [2]

Question 23

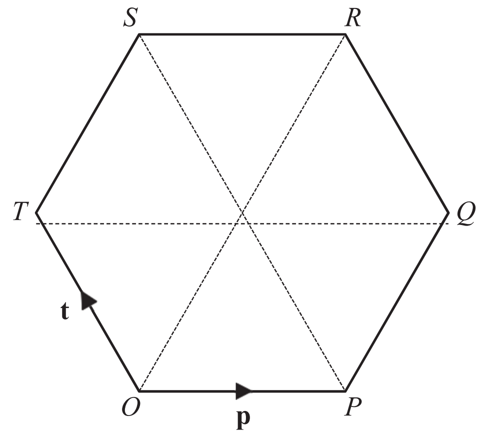


In the diagram, O is the origin, $\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$.
C is on the line AB so that $AC : CB = 1 : 2$.

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

(a) $\overrightarrow{AC}$, [2]

(b) the position vector of C. [2]



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

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

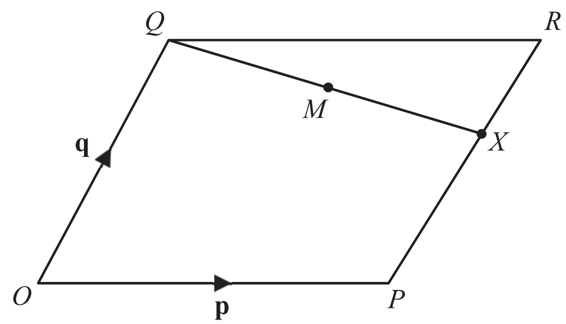
Find, in terms of **p** and **t**, in their simplest forms,

(a) $\overrightarrow{PT}$, [1]

(b) $\overrightarrow{PR}$, [2]

(c) the position vector of R. [2]

Question 25



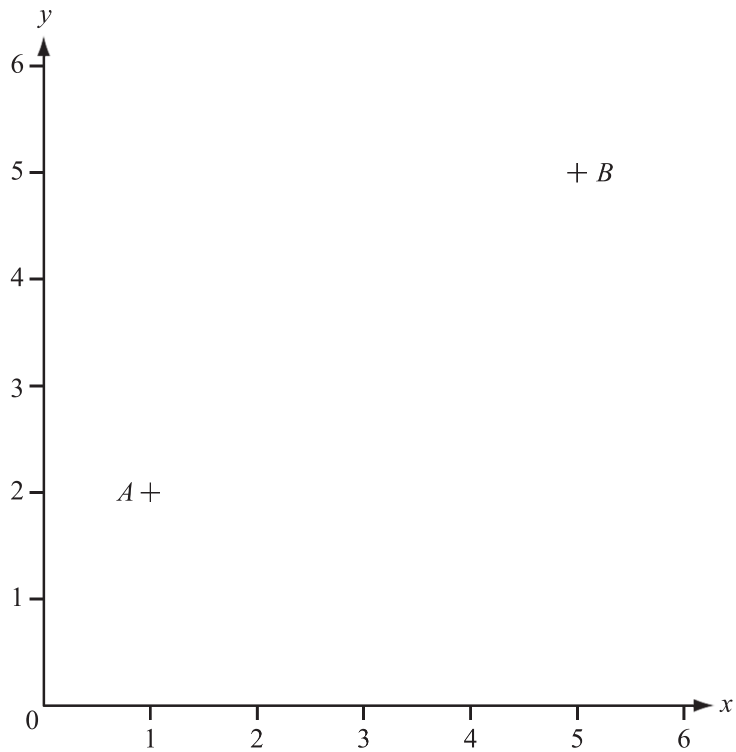
NOT TO SCALE

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

Find, in terms of p and q, in their simplest forms

(a) ,$\overrightarrow{QX}$ [2]

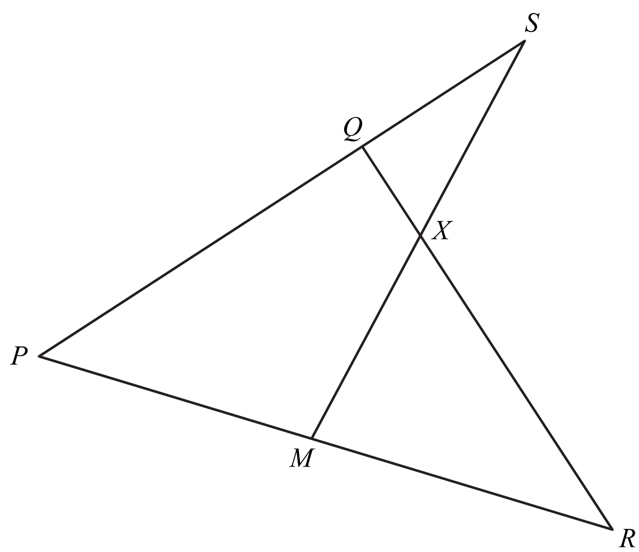
(b) the position vector of M, the midpoint of QX. [2]



The points $A(1, 2)$ and $B(5, 5)$ are shown on the diagram .

(a) Work out the co-ordinates of the midpoint of AB. [1]

(b) Write down the column vector $\overrightarrow{AB}$. [1]



NOT TO SCALE

In the diagram, PQS, PMR, MXS and QXR are straight lines.

$PQ = 2\,QS$.
M is the midpoint of PR.
$QX : XR = 1 : 3$.

$\overrightarrow{PQ} = \mathbf{q}$ and $\overrightarrow{PR} = \mathbf{r}$.

(a) Find, in terms of q and r,

(i) $\overrightarrow{RQ}$, [1]

(ii) $\overrightarrow{MS}$. [1]

(b) By finding $\overrightarrow{MX}$, show that X is the midpoint of MS. [3]

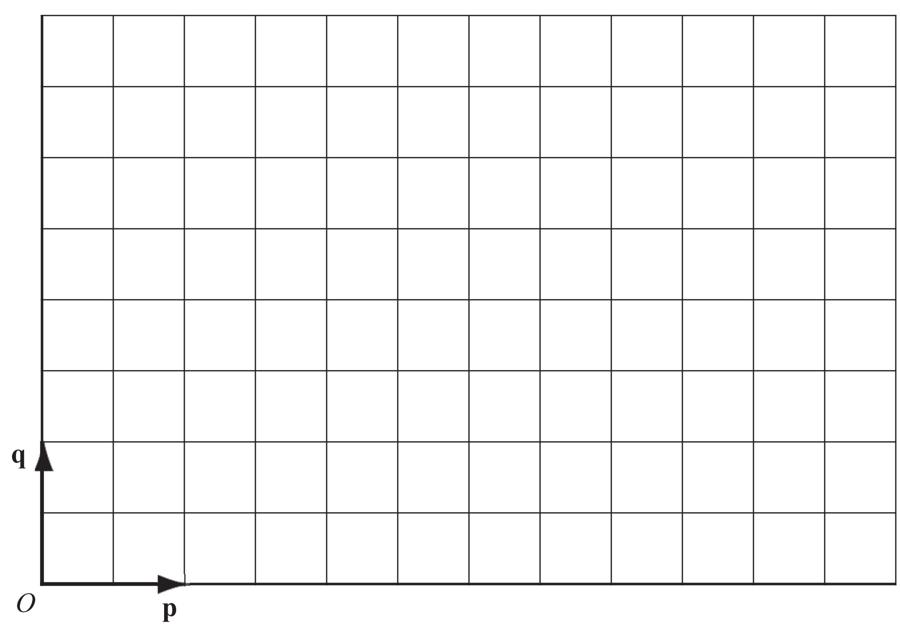
The position vector r is given by $\mathbf{r} = 2\mathbf{p} + t(\mathbf{p} + \mathbf{q})$.

(a) Complete the table below for the given values of t.
Write each vector in its simplest form.
One result has been done for you. [3]

t	0	1	2	3
$\mathbf{r}$			$4\mathbf{p} + 2\mathbf{q}$	

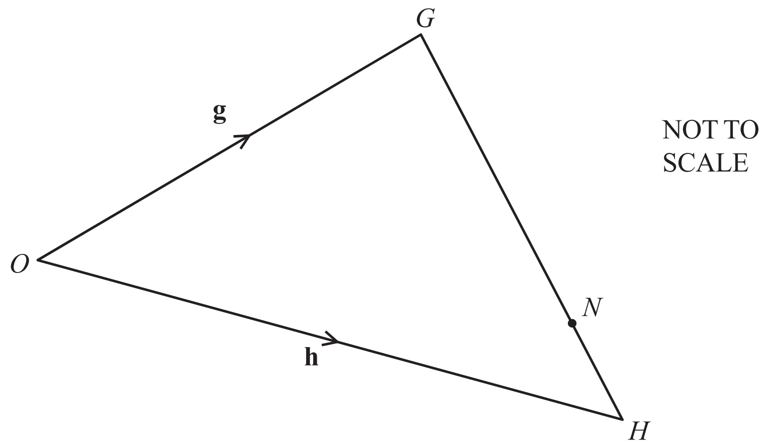
(b) O is the origin and **p** and **q** are shown on the diagram.

(i) Plot the 4 points given by the position vectors in the table. [2]



(ii) What can you say about these four points? [1]

Question 29



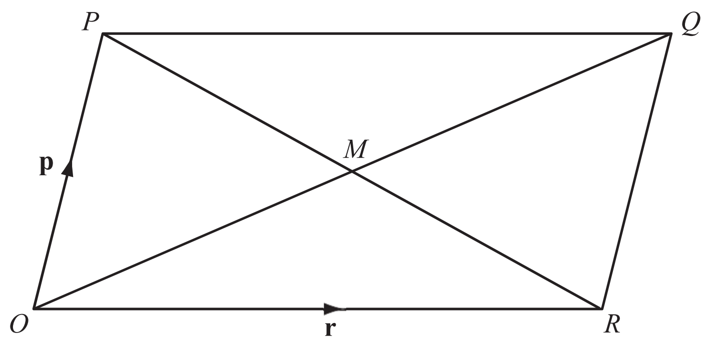
In triangle OGH, the ratio $GN : NH = 3 : 1$.

$\overrightarrow{OG} = \mathbf{g}$ and $\overrightarrow{OH} = \mathbf{h}$.

Find the following in terms of g and **h**, giving your answers in their simplest form.

(a) $\overrightarrow{HG}$ [1]

(b) $\overrightarrow{ON}$ [2]



O is the origin and $OPQR$ is a parallelogram whose diagonals intersect at M.

The vector $\overrightarrow{OP}$ is represented by $\mathbf{p}$ and the vector $\overrightarrow{OR}$ is represented by $\mathbf{r}$.

(a) Write down a single vector which is represented by

(i) $\mathbf{p} + \mathbf{r}$, [1]

(ii) $\frac{1}{2}\mathbf{p} - \frac{1}{2}\mathbf{r}$. [1]

(b) On the diagram, mark with a cross (x) and label with the letter S the point with position vector [2]

$\frac{1}{2}\mathbf{p} + \frac{3}{4}\mathbf{r}$.