Write your name, centre number and candidate number in the boxes below.

Surname	Other names

Centre number | | | | | |

Candidate number | | | | |

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Vector geometry

Time allowed: 1 hour 5 minutes

Subject code **0580**

Mathematics

Questions from Paper 1, Paper 2 and Paper 4

You must have: a ruler marked in centimetres and millimetres, a protractor, compasses, a pen, an HB pencil and an eraser.
You may use a calculator.

Total marks

/ 54

Instructions

- Answer every question in the space provided on this paper.
- Write in black or dark blue ink. Pencil may be used for diagrams and graphs.
- Fill in your name, centre number and candidate number above.
- Show your working: a correct method can earn marks even if the answer is wrong.
- Unless a question says otherwise, give answers that are not exact to 3 significant figures, and angles in degrees to 1 decimal place.

Information

- This paper has 10 questions worth 54 marks in total.
- The marks for each question or part are shown in brackets, for example [3].

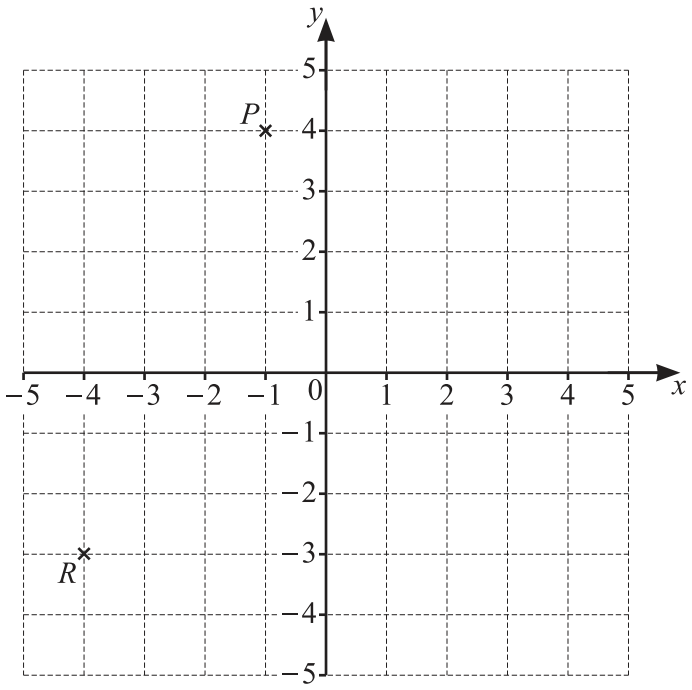
Advice

- Read every question through once before you write anything.
- Use the marks in brackets to judge how long to spend on each part.
- If you finish early, go back and check your working.

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Print at 100% (Actual size) so diagrams keep their real measurements.

1 The grid shows point P and point R.



(a) Write down the coordinates of point P.

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

(b) $\overrightarrow{PQ} = \begin{pmatrix} 3 \\ -2 \end{pmatrix}$

Mark point Q on the grid. [1]

(c) Find $\overrightarrow{QR}$.

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

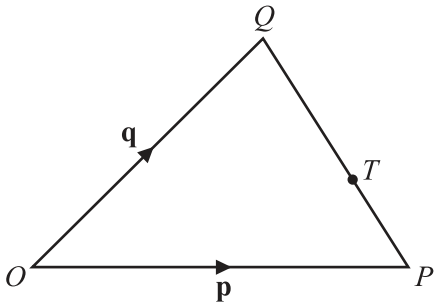
(d) Complete this statement.

$\overrightarrow{PQ} + \overrightarrow{QR} =$ ..... [1]

(a) Coordinates (b) Vectors as diagrams (c) Position and displacement vectors (d) Position and displacement vectors Click for more variations

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2



NOT TO SCALE

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

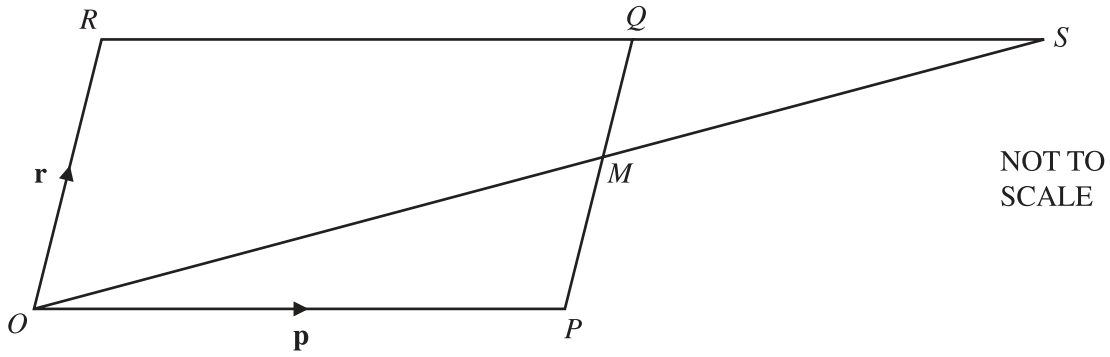
Find the position vector of T.
Give your answer in terms of **p** and **q**, in its simplest form.

..... [2]

Position and displacement vectors Click for more variations

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3



$OPQR$ 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) $\overrightarrow{OM}$,

Answer(a)(i) $\overrightarrow{OM} =$ ..... [1]

(ii) the position vector of S.

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

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

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

(a)(i) Position and displacement vectors | (a)(ii) Finding vector paths | (b) Finding vector paths

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

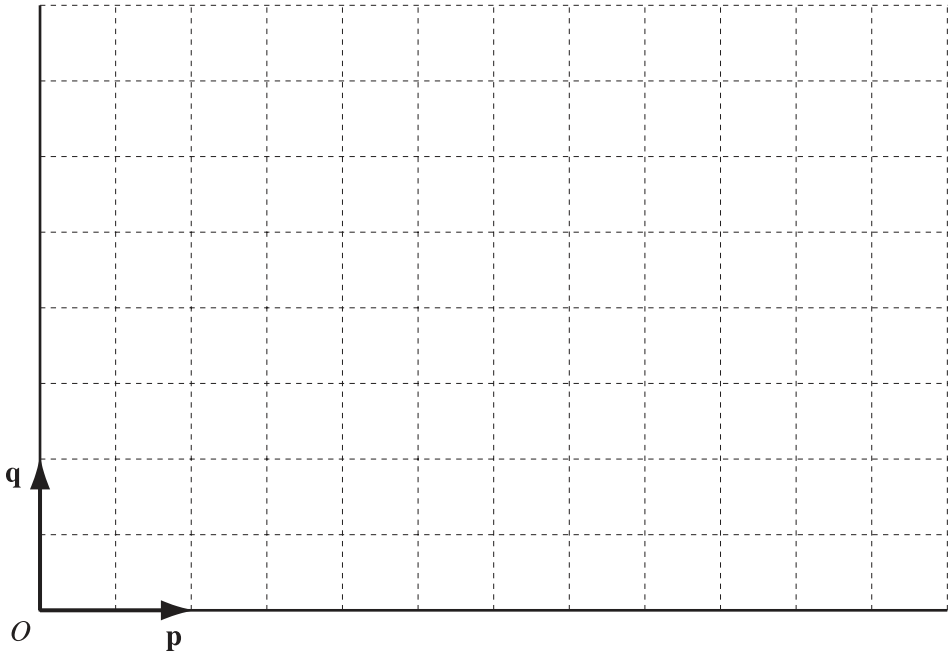
(a) Complete the table below for the given values of t.
Write each vector in its simplest form.
One result has been done for you.

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

[3]

(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]

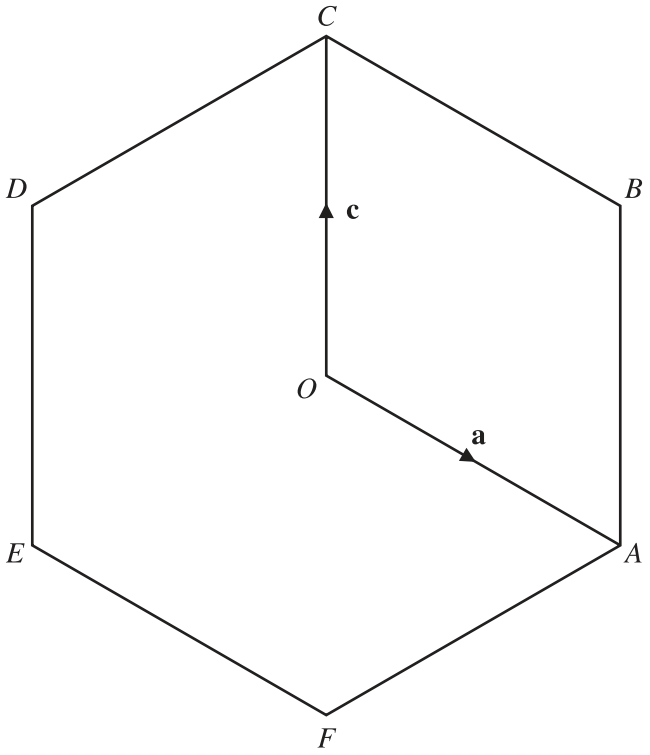
(ii) What can you say about these four points?

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

(a) Position and displacement vectors (b)(i) Position and displacement vectors
(b)(ii) Position and displacement vectors Click for more variations

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5



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) $\overrightarrow{BE}$,

Answer(a) $\overrightarrow{BE}$ = ... [2]

(b) $\overrightarrow{DB}$,

Answer(b) $\overrightarrow{DB}$ = ... [2]

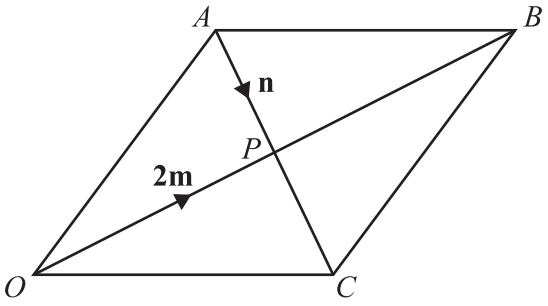
(c) the position vector of E.

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

(a) Finding vector paths (b) Finding vector paths (c) Finding vector paths Click for more variations

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6



NOT TO SCALE

$OABC$ is a rhombus and O is the origin.
The diagonals of the rhombus intersect at P.
$\overrightarrow{OP} = 2\,\mathbf{m}$ and $\overrightarrow{AP} = \mathbf{n}$.

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

(i) $\overrightarrow{OA}$

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

(ii) $\overrightarrow{OC}$.

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

(b) D is the point such that $\overrightarrow{AD} = 10\mathbf{m} - 3\mathbf{n}$.

Show that $OADC$ is a trapezium.

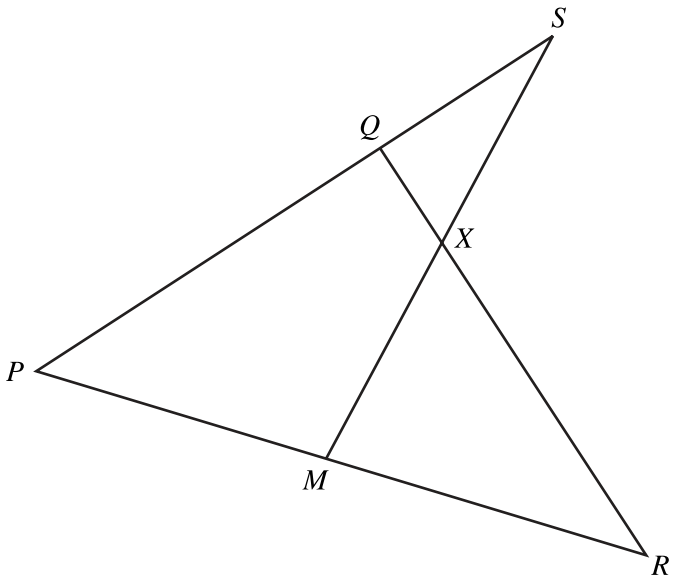
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[3]

(a)(i) Position and displacement vectors (a)(ii) Position and displacement vectors (b) Problem solving with vectors

Click for more variations

7



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) $\overrightarrow{RQ}$,

Answer(a)(i) $\overrightarrow{RQ}$ = ... [1]

(ii) $\overrightarrow{MS}$.

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

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

Answer (b)

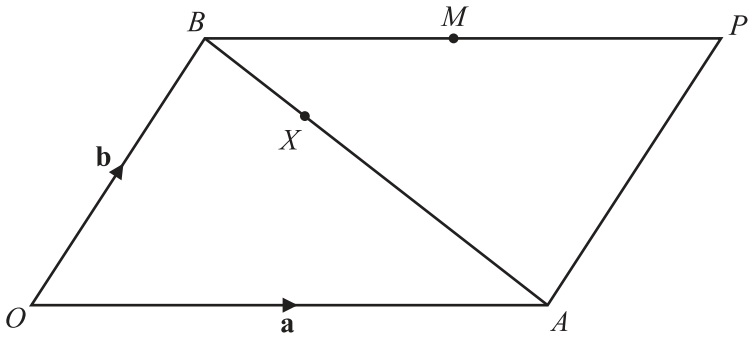
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[3]

(a)(i) Position and displacement vectors (a)(ii) Finding vector paths (b) Problem solving with vectors

Click for more variations

8



NOT TO SCALE

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

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

(i) $\overrightarrow{BA}$,

Answer(a)(i) $\overrightarrow{BA}$ = ... [1]

(ii) the position vector of *M*.

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

(a)(i) Position and displacement vectors (a)(ii) Position and displacement vectors (b) Problem solving with vectors

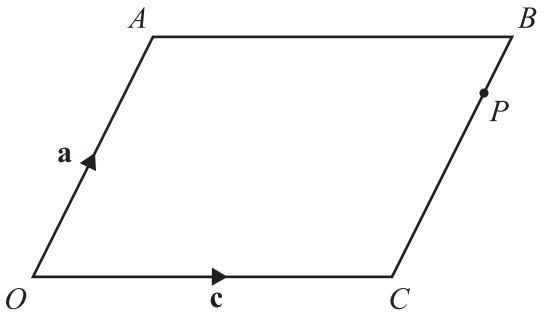
Click for more variations

9 **(a)** $\left|\begin{pmatrix} 9m \\ 40m \end{pmatrix}\right| = \frac{205}{2}$

Find the two possible values of m.

$m =$ ..... or ..... [3]

(b)



NOT TO SCALE

$OABC$ is a parallelogram.
$\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OC} = \mathbf{c}$.
P is the point on CB such that $CP : PB = 3 : 1$.

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

(a) $\overrightarrow{AC}$,

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

(b) $\overrightarrow{CP}$,

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

(c) $\overrightarrow{OP}$.

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

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(ii) OP and AB are extended to meet at Q.

Find the position vector of Q.

..... [2]

(a) Magnitude of a vector (b)(i)(a) Position and displacement vectors (b)(i)(b) Finding vector paths (b)(i)(c) Finding vector paths (b)(ii) Problem solving with vectors Click for more variations

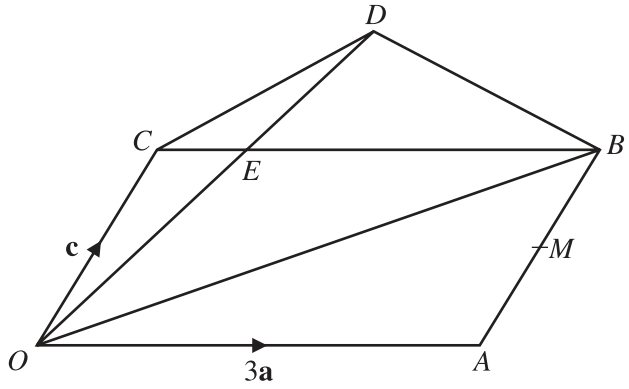
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10 **(a)** P is the point (2, 5) and $\overrightarrow{PQ} = \begin{pmatrix} 3 \\ -2 \end{pmatrix}$.

Write down the co-ordinates of Q.

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

(b)



NOT TO SCALE

O is the origin and $OABC$ is a parallelogram.
M is the midpoint of AB.

$\overrightarrow{OC} = \mathbf{c}$, $\overrightarrow{OA} = 3\mathbf{a}$ and $CE = \frac{1}{3}CB$.

OED is a straight line with $OE : ED = 2 : 1$.

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

(i) $\overrightarrow{OB}$,

Answer(b)(i) $\overrightarrow{OB}$ = ... [1]

(ii) the position vector of M,

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

(iii) $\overrightarrow{OE}$,

Answer(b)(iii) $\overrightarrow{OE}$ = ... [1]

(iv) $\overrightarrow{CD}$.

Answer(b)(iv) $\overrightarrow{CD}$ = ... [2]

(c) Write down two facts about the lines CD and OB.

Answer (c) .....

..... [2]

(a) Position and displacement vectors | (b)(i) Finding vector paths | (b)(ii) Position and displacement vectors | (b)(iii) Finding vector paths | (b)(iv) Finding vector paths | (c) Problem solving with vectors

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