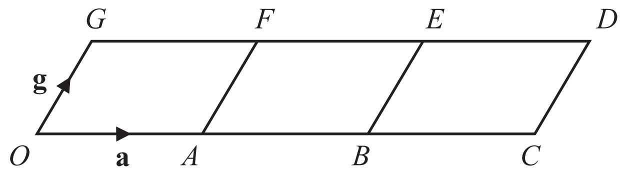
Vectors 1 IGCSE

1)



The diagram is made from three identical parallelograms.

O is the origin. $\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OG} = \mathbf{g}$.

Write down in terms of **a** and **g**

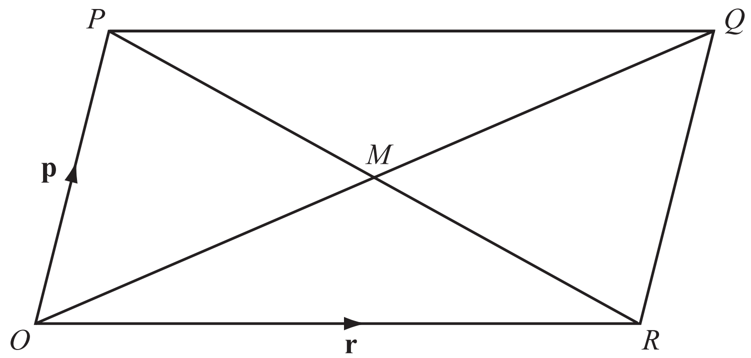
(a) $\overrightarrow{GB}$,

Answer(a) [1]

(b) the position vector of the centre of the parallelogram *BCDE*.

Answer(b) [1]

2)



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

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

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

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

Answer(a)(i) [1]

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

Answer(a)(ii) [1]

(b) On the diagram, mark with a cross (x) and label with the letter *S* the point with position vector $\frac{1}{2}\mathbf{p} + \frac{3}{4}\mathbf{r}$. [2]

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The position vector **r** is given by **r** = 2**p** + *t*(**p** + **q**).

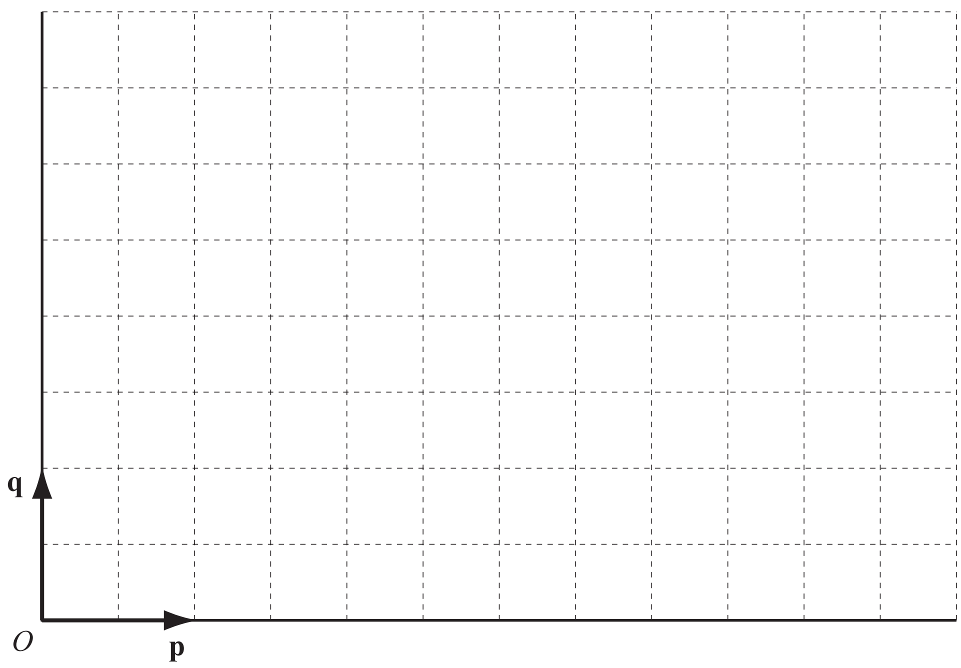
(a) Complete the table below for the given values of *t*.
Write each vector in its simplest form.
One result has been done for you.

t	0	1	2	3
r			4**p** + 2**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]

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4)

(a) $\mathbf{p} = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$ and $\mathbf{q} = \begin{pmatrix} 6 \\ 3 \end{pmatrix}$.

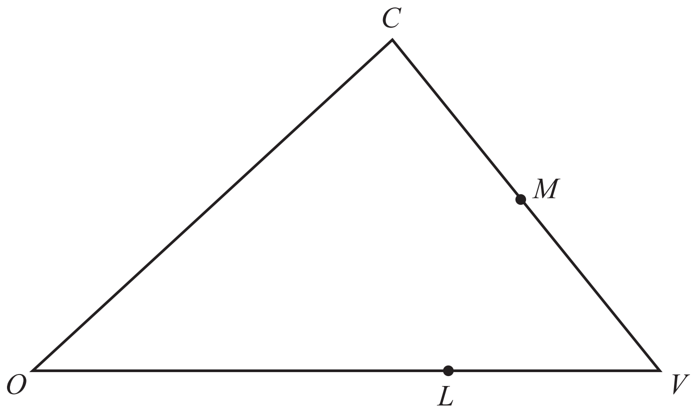
(i) Find, as a single column vector, $\mathbf{p} + 2\mathbf{q}$.

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

(ii) Calculate the value of $|\,\mathbf{p} + 2\mathbf{q}\,|$.

Answer(a)(ii) [2]

(b)



NOT TO SCALE

In the diagram, $CM = MV$ and $OL = 2LV$.
O is the origin. $\overrightarrow{OC} = \mathbf{c}$ and $\overrightarrow{OV} = \mathbf{v}$.

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

(i) $\overrightarrow{CM}$,

Answer(b)(i) [2]

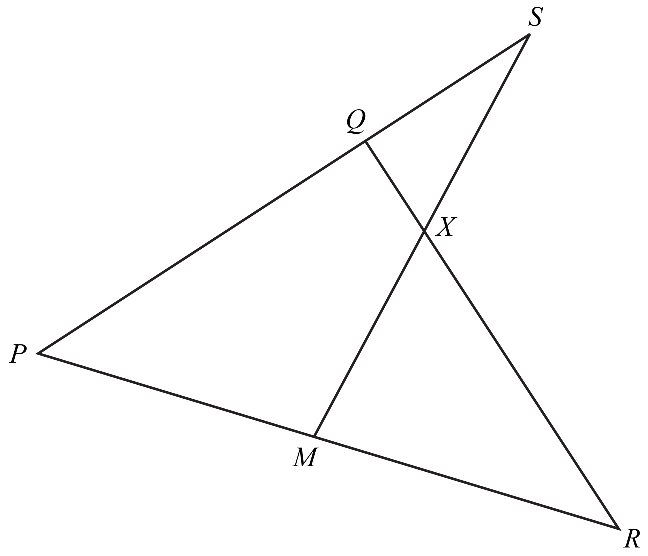
(ii) the position vector of M,

Answer(b)(ii) [2]

(iii) $\overrightarrow{ML}$.

Answer(b)(iii) [2]

5)



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) $\overrightarrow{MS}$.

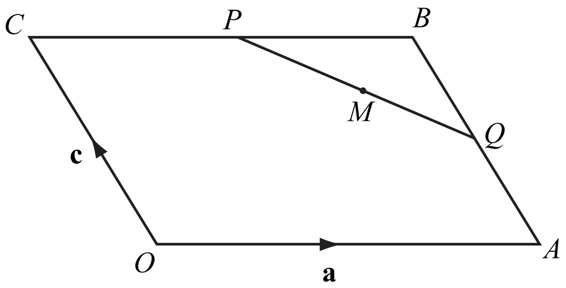
Answer(a)(ii) $\overrightarrow{MS} =$ [1]

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

Answer (b)

[3]

6)



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) $\overrightarrow{PQ}$,

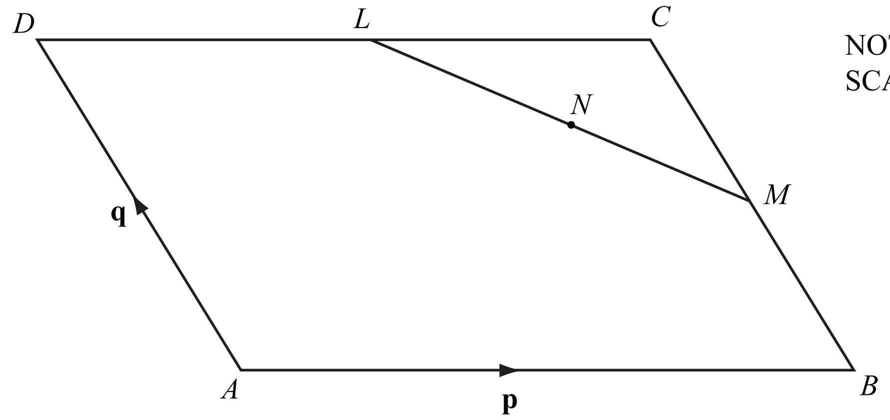
Answer(a) $\overrightarrow{PQ} =$ [2]

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

Answer(b) [2]

7)

(a)



NOT TO SCALE

ABCD is a parallelogram.
L is the midpoint of *DC*, *M* is the midpoint of *BC* and *N* is the midpoint of *LM*.
$\overrightarrow{AB} = \mathbf{p}$ and $\overrightarrow{AD} = \mathbf{q}$.

(i) Find the following in terms of **p** and **q**, in their simplest form.

(a) $\overrightarrow{AC}$

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

(b) $\overrightarrow{LM}$

Answer(a)(i)(b) $\overrightarrow{LM}$= [2]

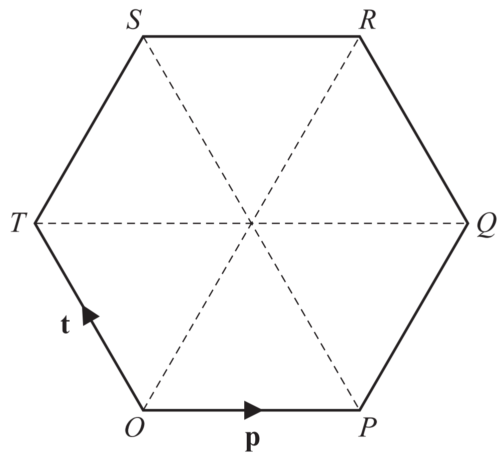
(c) $\overrightarrow{AN}$

Answer(a)(i)(c) $\overrightarrow{AN}$= [2]

(ii) Explain why your answer for $\overrightarrow{AN}$ shows that the point *N* lies on the line *AC*.

Answer(a)(ii) [1]

8)



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) $\overrightarrow{PT}$,

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

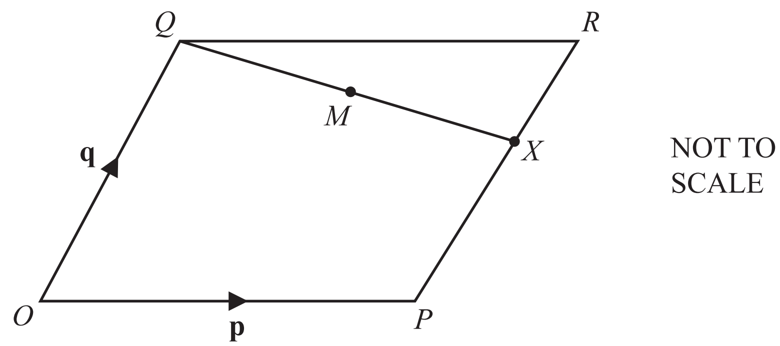
(b) $\overrightarrow{PR}$,

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

(c) the position vector of *R*.

Answer(c) [2]

9)



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) $\overrightarrow{QX}$,

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

(b) the position vector of *M*, the midpoint of *QX*.

Answer(b) [2]

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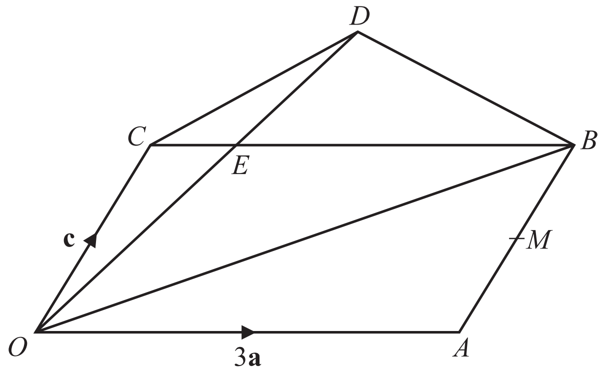
10)

(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]