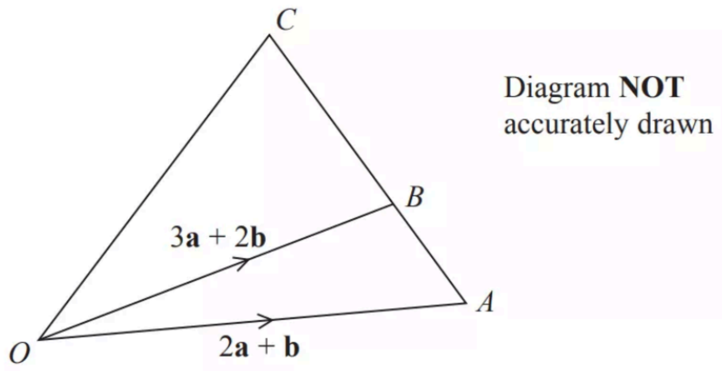
IGCSE
Top Tips
(hard questions)

Vector conclusion:

Vector: Hard Questions:

Type 1:



ABC is a straight line.

$AB : BC = 2 : 5$

$\overrightarrow{OA} = 2\mathbf{a} + \mathbf{b}$

$\overrightarrow{OB} = 3\mathbf{a} + 2\mathbf{b}$

Express $\overrightarrow{OC}$ in terms of **a** and **b**.
Give your answer in its simplest form.

Practice type 1:

OACB is a parallelogram.

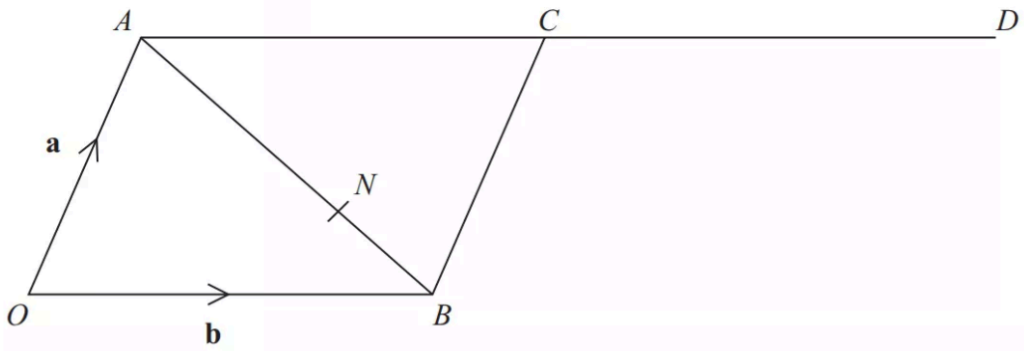
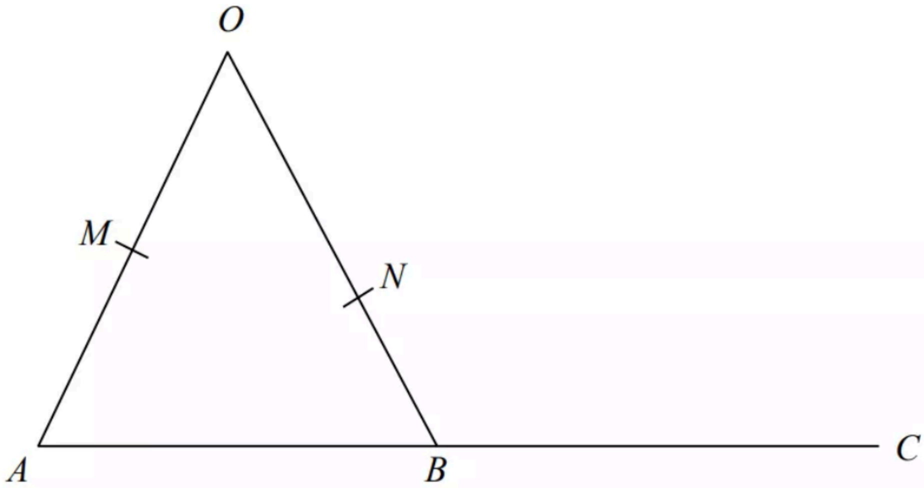


Diagram **NOT** accurately drawn

$\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$
D is the point such that $\overrightarrow{AC} = \overrightarrow{CD}$
The point *N* divides *AB* in the ratio 2 : 1

(a) Write an expression for $\overrightarrow{ON}$ in terms of **a** and **b**.

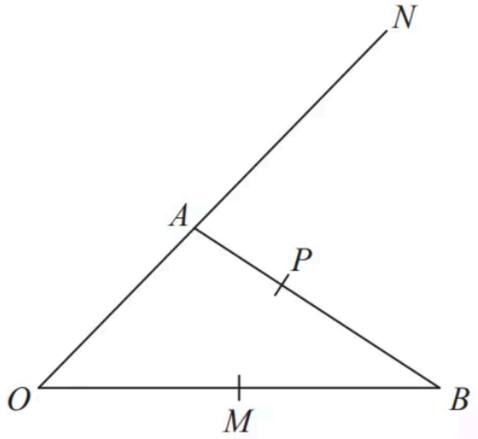
Type 2:



OMA, ONB and *ABC* are straight lines.
M is the midpoint of *OA*.
B is the midpoint of *AC*.
$\overrightarrow{OA} = 6\mathbf{a}$ $\overrightarrow{OB} = 6\mathbf{b}$ $\overrightarrow{ON} = k\mathbf{b}$ where k is a scalar quantity.

Given that *MNC* is a straight line, find the value of k.

Practice type 2:



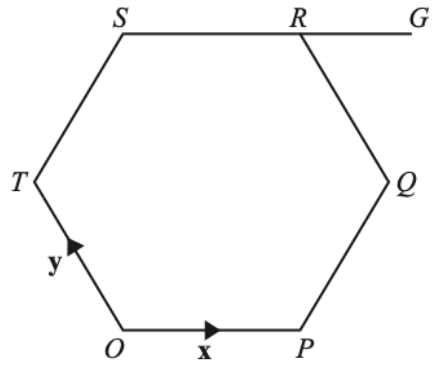
OAN, OMB and APB are straight lines.
$AN = 2OA$.
M is the midpoint of OB.

$\overrightarrow{OA} = \mathbf{a}$ $\quad$ $\overrightarrow{OB} = \mathbf{b}$

$\overrightarrow{AP} = k\overrightarrow{AB}$ where k is a scalar quantity.

Given that MPN is a straight line, find the value of k.

Type 3: Regular hexagon



NOT TO SCALE

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

$\overrightarrow{OP} = \mathbf{x}$ and $\overrightarrow{OT} = \mathbf{y}$.

(a) Write down, in terms of **x** and/or **y**, in its simplest form,

(i) $\overrightarrow{QR}$,

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

(ii) $\overrightarrow{PQ}$,

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

(iii) the position vector of *S*.

.... [2]

(b) The line *SR* is extended to *G* so that *SR* : *RG* = 2 : 1.

Find $\overrightarrow{GQ}$, in terms of **x** and **y**, in its simplest form.

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

(c) *M* is the midpoint of *OP*.

(i) Find $\overrightarrow{MG}$, in terms of **x** and **y**, in its simplest form.

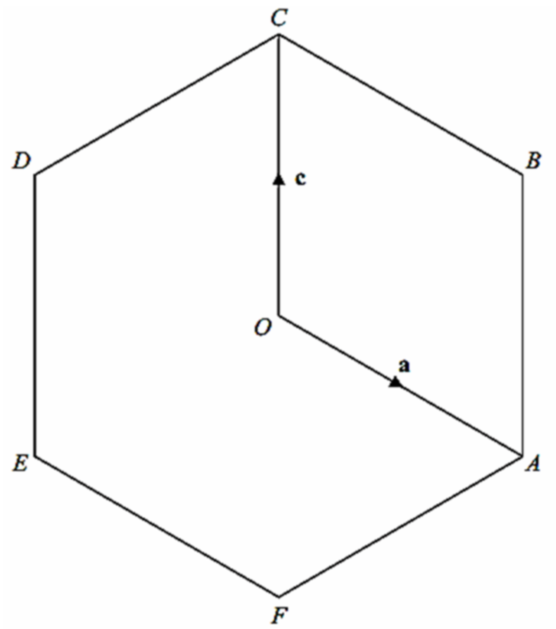
$\overrightarrow{MG} =$ .... [2]

(ii) *H* is a point on *TQ* such that *TH* : *HQ* = 3 : 1.

Use vectors to show that *H* lies on *MG*.

[2]

Practice type 3:



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]

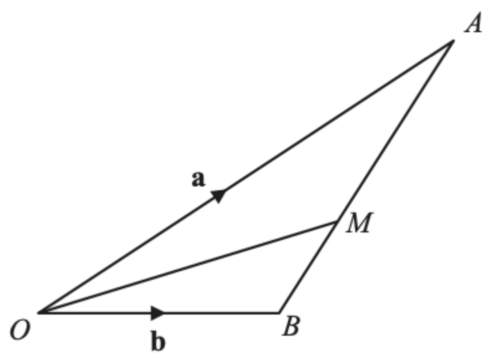
Practice Questions: 1

(a) $\mathbf{m} = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$ $\mathbf{n} = \begin{pmatrix} -2 \\ 3 \end{pmatrix}$

(i) Work out $2\mathbf{m} - 3\mathbf{n}$. [2]

(ii) Calculate $|2\mathbf{m} - 3\mathbf{n}|$. [2]

(b) (i)



NOT TO SCALE

In the diagram, O is the origin, $\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$.
The point M lies on AB such that $AM : MB = 3 : 2$.

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

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

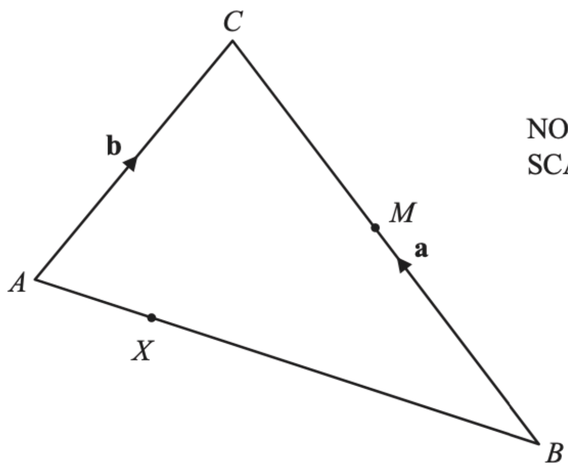
(b) $\overrightarrow{AM}$, [1]

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

(ii) OM is extended to the point C.
The position vector of C is $\mathbf{a} + k\mathbf{b}$.

Find the value of k. [1]

2



$\overrightarrow{BC} = \mathbf{a}$ and $\overrightarrow{AC} = \mathbf{b}$.

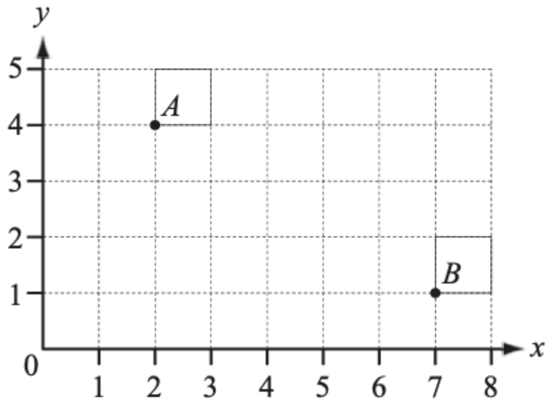
(a) Find $\overrightarrow{AB}$ in terms of **a** and **b**. [1]

(b) M is the midpoint of BC.
X divides AB in the ratio $1:4$.

Find $\overrightarrow{XM}$ in terms of **a** and **b**.
Show all your working and write your answer in its simplest form. [4]

3

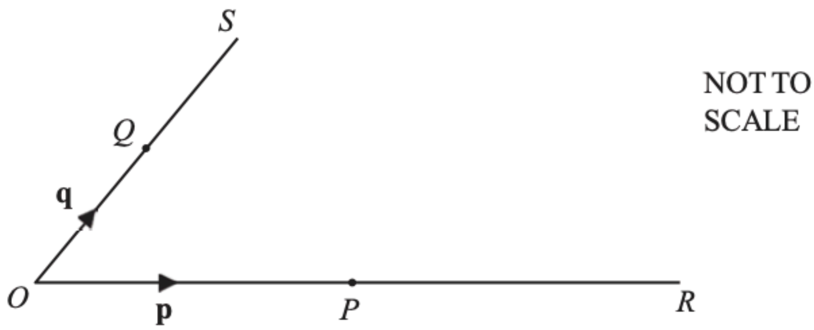
(a)



(i) Write down the position vector of$A$. [1]

(ii) Find $|\overrightarrow{AB}|$, the magnitude of $\overrightarrow{AB}$. [2]

(b)



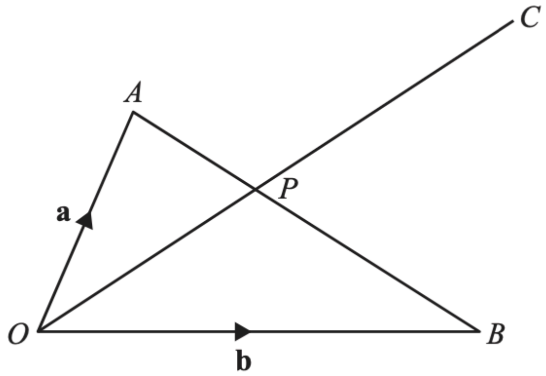
O is the origin, $\overrightarrow{OP} = \mathbf{p}$ and $\overrightarrow{OQ} = \mathbf{q}$.
OP is extended to R so that $OP = PR$.
OQ is extended to S so that $OQ = QS$.

(i) Write down $\overrightarrow{RQ}$ in terms of $\mathbf{p}$ and $\mathbf{q}$. [1]

(ii) PS and RQ intersect at M and $RM = 2MQ$.

Use vectors to find the ratio $PM : PS$, showing all your working. [4]

4



NOT TO SCALE

In the diagram, O is the origin and P lies on AB such that $AP : PB = 3 : 4$.
$\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$.

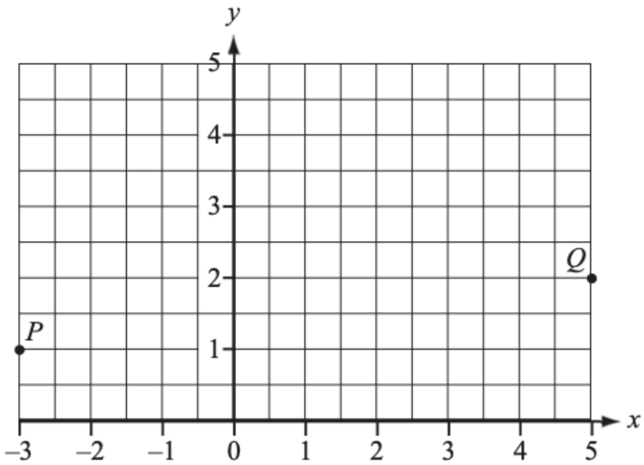
(i) Find $\overrightarrow{OP}$, in terms of $\mathbf{a}$ and $\mathbf{b}$, in its simplest form. [3]

(ii) The line OP is extended to C such that $\overrightarrow{OC} = mOP$ and $BC = k\mathbf{a}$.

Find the value of m and the value of k. [2]

5

(a)



The points P and Q have co-ordinates (–3, 1) and (5, 2).

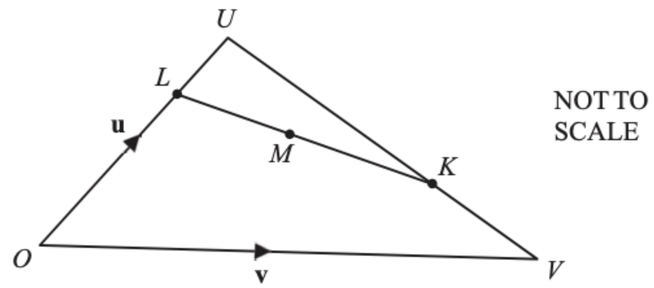
(i) Write $\overrightarrow{PQ}$ as a column vector. [1]

(ii) $\overrightarrow{QR} = 2\begin{pmatrix} -1 \\ 1 \end{pmatrix}$

Mark the point R on the grid. [1]

(iii) Write down the position vector of the point P. [1]

(b)



In the diagram, $\overrightarrow{OU} = \mathbf{u}$ and $\overrightarrow{OV} = \mathbf{v}$.

K is on UV so that $\overrightarrow{UK} = \frac{2}{3}\overrightarrow{UV}$ and L is on OU so that $\overrightarrow{OL} = \frac{3}{4}\overrightarrow{OU}$.

M is the midpoint of KL.

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

(i) $\overrightarrow{LK}$ [4]

(ii) $\overrightarrow{OM}$ [2]