

Vectors

Introduction to Column Vectors / Representing Vectors as Diagrams / Magnitude of a Vector / Position & Displacement Vectors / Finding Vector Paths / Problem Solving with Vectors

Medium (7 questions)	/26
Hard (5 questions)	/24
Very Hard (4 questions)	/21
Total Marks	/71

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Medium Questions

1 $\vec{VW} = \begin{pmatrix} 10 \\ -24 \end{pmatrix}$
Find $|\vec{VW}|$.

(2 marks)

2 $\vec{AB} = \begin{pmatrix} 6 \\ -1 \end{pmatrix}$ $\vec{BC} = \begin{pmatrix} -2 \\ 5 \end{pmatrix}$ $\vec{DC} = \begin{pmatrix} 2 \\ -3 \end{pmatrix}$

Find

i) $\vec{AC}$,

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

ii) $\vec{BD}$,

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

iii) $|\vec{BC}|$.

[2]

(6 marks)

3 $\mathbf{p} = \begin{pmatrix} 4 \\ 5 \end{pmatrix}$ $\mathbf{q} = \begin{pmatrix} -2 \\ 7 \end{pmatrix}$

i) Find $2\mathbf{p} + \mathbf{q}$.

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

ii) Find $|\mathbf{p}|$.

[2]

(4 marks)

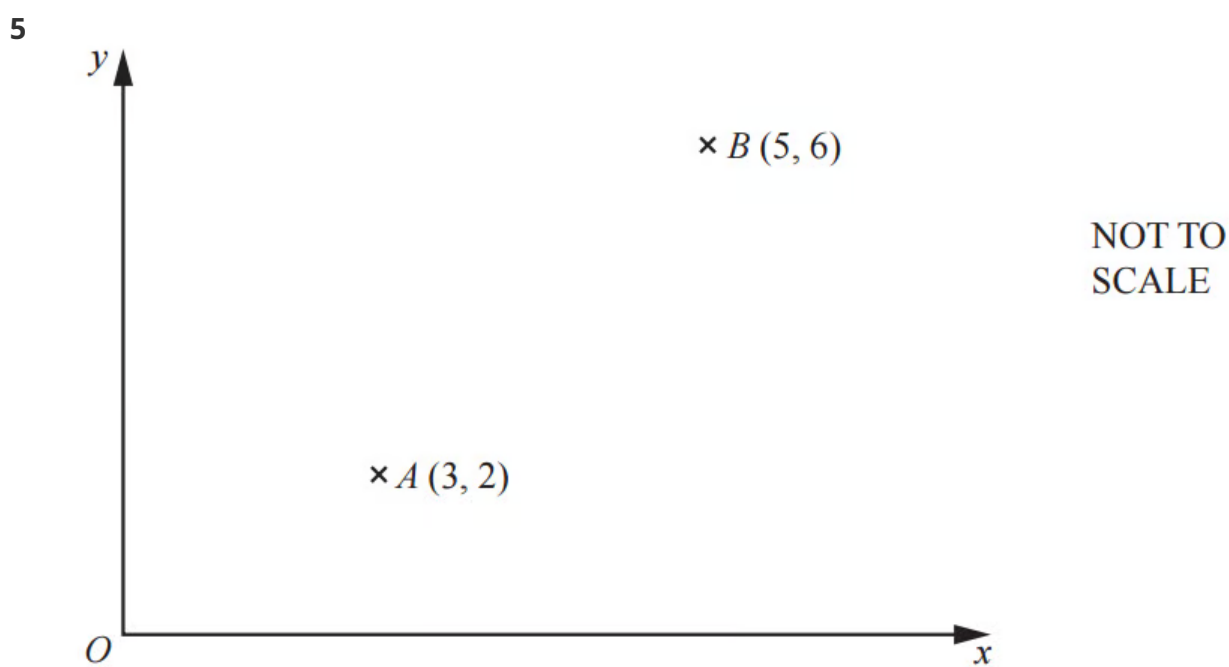
4 $\mathbf{a} = \begin{pmatrix} -3 \\ 2 \end{pmatrix}$ $\mathbf{b} = \begin{pmatrix} 5 \\ 4 \end{pmatrix}$ $\mathbf{c} = \begin{pmatrix} 14 \\ 9 \end{pmatrix}$

i) Find $3\mathbf{a} - 2\mathbf{b}$.

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

ii) Find $|\mathbf{a}|$.

(4 marks)



i) Find the column vector $\vec{AB}$.

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

ii) Find $|\vec{AB}|$.

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

(3 marks)

6 $\vec{OA} = \begin{pmatrix} 4 \\ 3 \end{pmatrix}$ $\vec{AB} = \begin{pmatrix} 8 \\ -7 \end{pmatrix}$ $\vec{AC} = \begin{pmatrix} -3 \\ 6 \end{pmatrix}$

Find

i) $|\vec{OB}|$,

$|\vec{OB}| = \dots\dots\dots$ [3]

ii) $\vec{BC}$.

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

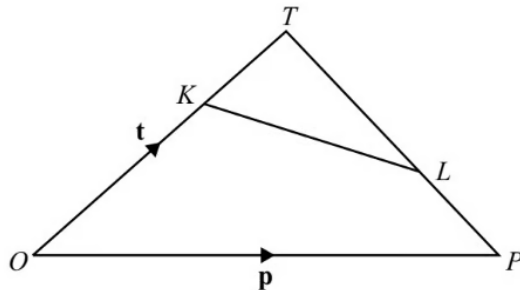
(5 marks)

7 Find the magnitude of the vector $\begin{pmatrix} -1 \\ 7 \end{pmatrix}$.

(2 marks)

Hard Questions

1 (a) The diagram shows triangle OPT .



NOT TO
SCALE

In the diagram $\vec{OT} = \mathbf{t}$ and $\vec{OP} = \mathbf{p}$. $OK : KT = 2 : 1$ and $TL : LP = 2 : 1$.

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

i) $\vec{PL}$

[2]

ii) $\vec{KL}$

[2]

(4 marks)

(b) KL is extended to the point M .

$$\vec{KM} = -\frac{2}{3}\mathbf{t} + \frac{4}{3}\mathbf{p}.$$

Show that M lies on OP extended.

(2 marks)

2 P is the point $(16, 9)$ and Q is the point $(22, 24)$.

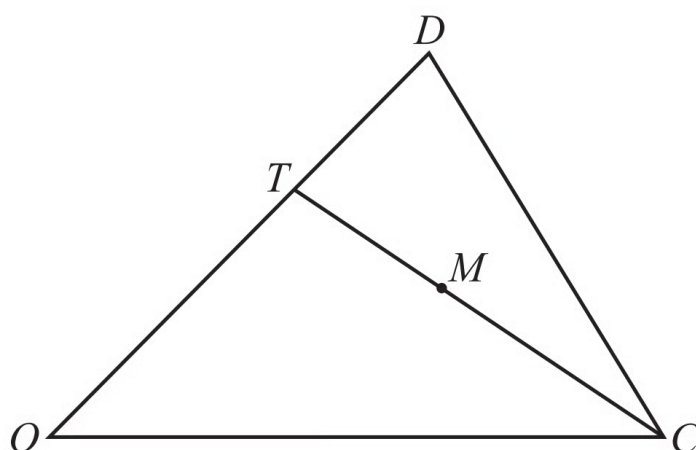
N is the point on PQ such that $PN = 2NQ$.

Find the co-ordinates of N .

(..... ,)

(4 marks)

3



NOT TO
SCALE

In the diagram, O is the origin, $OT = 2TD$ and M is the midpoint of TC .

$\vec{OC} = \mathbf{c}$ and $\vec{OD} = \mathbf{d}$.

Find the position vector of M .

Give your answer in terms of $\mathbf{c}$ and $\mathbf{d}$ in its simplest form.

(3 marks)

4 $\mathbf{a} = \begin{pmatrix} -3 \\ 2 \end{pmatrix}$ $\mathbf{b} = \begin{pmatrix} 5 \\ 4 \end{pmatrix}$ $\mathbf{c} = \begin{pmatrix} 14 \\ 9 \end{pmatrix}$

$m\mathbf{a} + n\mathbf{b} = \mathbf{c}$

Write down two simultaneous equations and solve them to find the value of m and the value of n . Show all your working.

$m = \dots\dots\dots$

$n = \dots\dots\dots$

(5 marks)

5 (a)

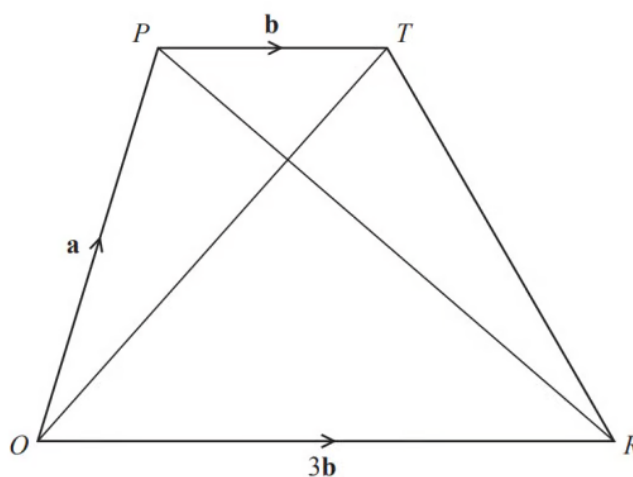


Diagram **NOT**
accurately drawn

$OPTR$ is a trapezium.

$$\vec{OP} = \mathbf{a}$$

$$\vec{PT} = \mathbf{b}$$

$$\vec{OR} = 3\mathbf{b}$$

i) Find $\vec{OT}$ in terms of $\mathbf{a}$ and $\mathbf{b}$

[1]

ii) Find $\vec{PR}$ in terms of $\mathbf{a}$ and $\mathbf{b}$. Give your answer in its simplest form.

[1]

(2 marks)

(b) S is the point on PR such that $PS : SR = 1 : 3$

Find $\vec{OS}$ in terms of $\mathbf{a}$ and $\mathbf{b}$.

Give your answer in its simplest form.

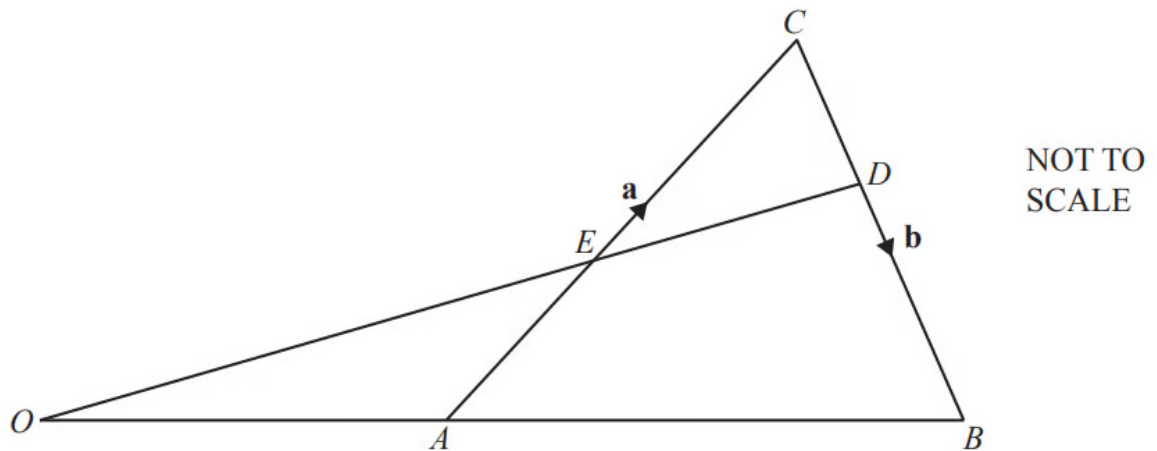
(2 marks)

(c) What does your answer to part (b) tell you about the position of point S ?

(2 marks)

Very Hard Questions

1



In the diagram, OAB and OED are straight lines.

O is the origin, A is the midpoint of OB and E is the midpoint of AC . $\vec{AC} = \mathbf{a}$ and $\vec{CB} = \mathbf{b}$.

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

i) $\vec{AB}$,

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

ii) $\vec{OE}$,

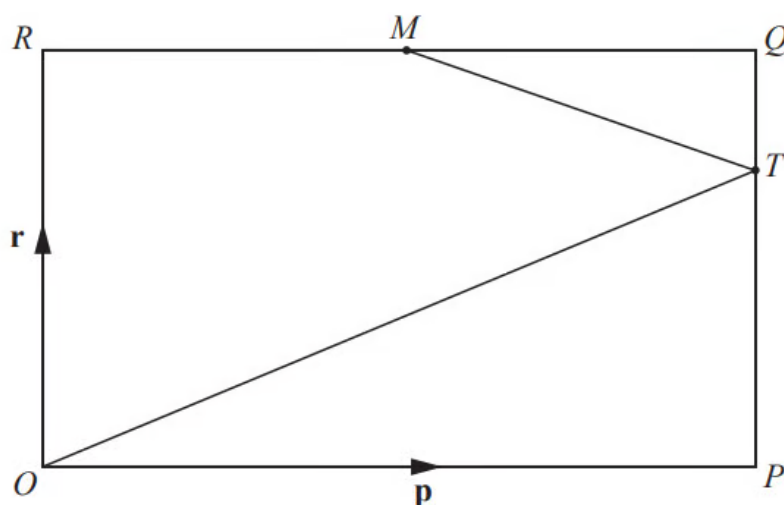
$$\vec{OE} = \dots\dots\dots [2]$$

iii) the position vector of D .

[3]

(6 marks)

2 (a)



NOT TO
SCALE

$OPQR$ is a rectangle and O is the origin.
 M is the midpoint of RQ and $PT:TQ = 2:1$.
 $\vec{OP} = \mathbf{p}$ and $\vec{OR} = \mathbf{r}$.

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

i) $\vec{MQ}$,

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

ii) $\vec{MT}$,

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

iii) $\vec{OT}$,

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

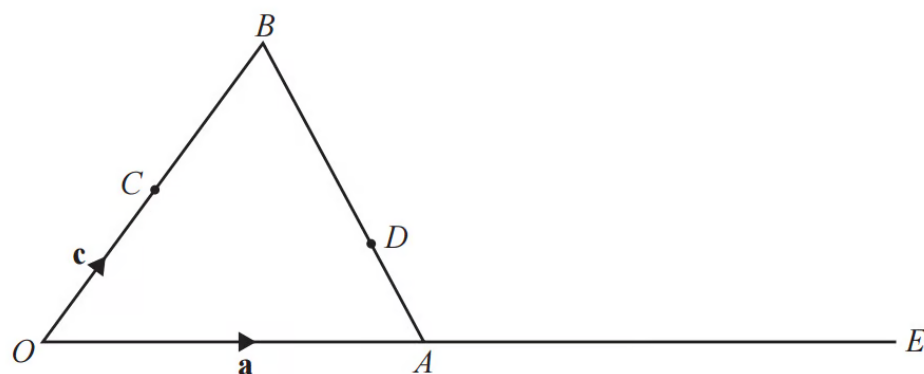
(3 marks)

(b) RQ and OT are extended and meet at U .

Find the position vector of U in terms of $\mathbf{p}$ and $\mathbf{r}$.
Give your answer in its simplest form.

(2 marks)

3 (a)



NOT TO
SCALE

OAB is a triangle and C is the mid-point of OB .

D is on AB such that $AD : DB = 3 : 5$.

OAE is a straight line such that $OA : AE = 2 : 3$.

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

Find the following vectors, in terms of $\mathbf{a}$ and $\mathbf{c}$, in their simplest form

i) $\vec{AB}$,

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

ii) $\vec{AD}$,

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

iii) $\vec{CE}$,

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

iv) $\vec{CD}$.

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

(5 marks)

(b) $\vec{CE} = k\vec{CD}$

Find the value of k .

$k = \dots\dots\dots$

(1 mark)

4

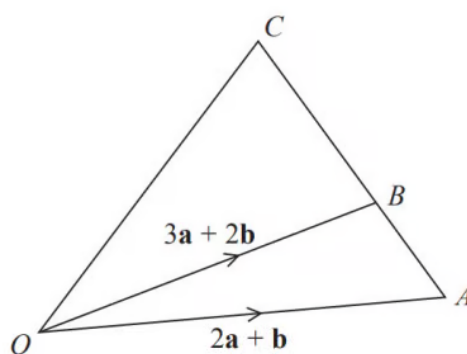


Diagram **NOT**
accurately drawn

ABC is a straight line.

$AB : BC = 2 : 5$

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

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

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

(4 marks)