# Vectors: exam questions

10 questions · 27 marks · mark schemes at the end

Name _____ Date _____ Score / 27

- Calculators are allowed on both 4MA1 Higher papers (1H and 2H). Show your working: most marks are for method.
- Mark schemes start after the questions. M marks are for a correct method, A marks for an accurate answer that follows a correct method, and B marks for a correct result on its own.
- Online, with more practice: igcsemathrevision.com/igcse-frontend/4ma1/exam-questions/vectors

**1.** **2 marks**

$\mathbf{a} = \begin{pmatrix} 3 \\ -2 \end{pmatrix}$ and $\mathbf{b} = \begin{pmatrix} -1 \\ 4 \end{pmatrix}$.

Work out $2\mathbf{a} + 3\mathbf{b}$ as a column vector.

**2.** **2 marks**

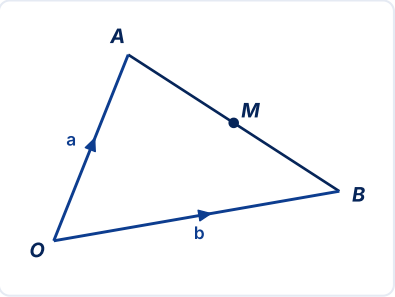
$\mathbf{a} = \begin{pmatrix} 5 \\ -12 \end{pmatrix}$.

Work out $|\mathbf{a}|$.

**3.** **2 marks**

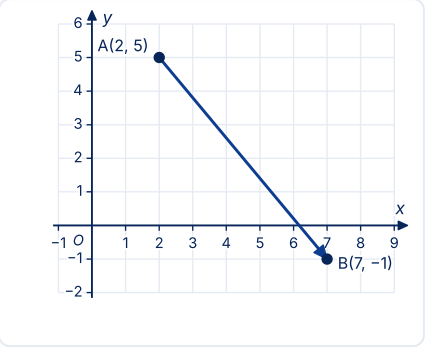
$\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$. $M$ is the midpoint of $AB$.

Find $\overrightarrow{OM}$ in terms of $\mathbf{a}$ and $\mathbf{b}$. Simplify your answer.




**4.** **3 marks**

$A$ is the point $(2, 5)$ and $B$ is the point $(7, -1)$.




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

(b) Work out $\left|\overrightarrow{AB}\right|$. Give your answer correct to 3 significant figures. **(2)**

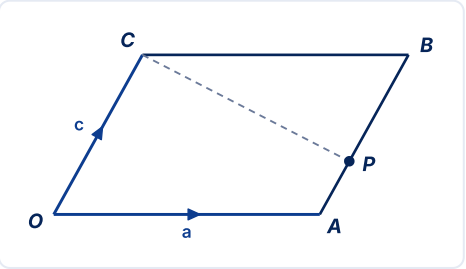
**5.** **2 marks**

$\mathbf{p} = \begin{pmatrix} 2 \\ -3 \end{pmatrix}$ and $\mathbf{q} = \begin{pmatrix} k \\ 9 \end{pmatrix}$. The vectors $\mathbf{p}$ and $\mathbf{q}$ are parallel.

Find the value of $k$.

**6.** 4 marks

$OABC$ is a parallelogram with $\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OC} = \mathbf{c}$. $P$ is the point on $AB$ with $AP : PB = 1 : 2$.




(a) Find $\overrightarrow{OP}$ in terms of $\mathbf{a}$ and $\mathbf{c}$. **(2)**

(b) Find $\overrightarrow{CP}$ in terms of $\mathbf{a}$ and $\mathbf{c}$. **(2)**

**7.** 3 marks

$\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$. $C$ is the point with $\overrightarrow{OC} = 3\mathbf{b} - 2\mathbf{a}$.

Show that $A$, $B$ and $C$ lie on a straight line.

**8.** 3 marks

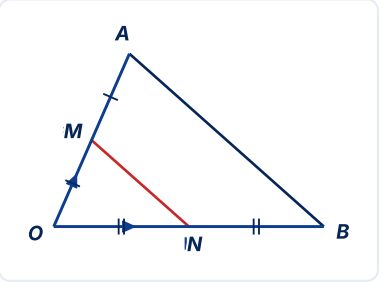
$\overrightarrow{OA} = \begin{pmatrix} 2 \\ 6 \end{pmatrix}$ and $\overrightarrow{OB} = \begin{pmatrix} 10 \\ 2 \end{pmatrix}$. $P$ is the point on $AB$ with $AP : PB = 3 : 1$.

Find the coordinates of $P$.

**9.** 3 marks

$OAB$ is a triangle with $\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$. $M$ is the midpoint of $OA$ and $N$ is the midpoint of $OB$.

Show that $MN$ is parallel to $AB$ and half its length.




**10.** 3 marks

$$m\begin{pmatrix}2\\1\end{pmatrix} + n\begin{pmatrix}1\\3\end{pmatrix} = \begin{pmatrix}7\\11\end{pmatrix}$$

Find the values of $m$ and $n$.

## Answers and worked solutions

### Question 1 — 2 marks

**M1** $\begin{pmatrix}6\\-4\end{pmatrix}+\begin{pmatrix}-3\\12\end{pmatrix}$

**A1** $\begin{pmatrix}3\\8\end{pmatrix}$

**Answer:** $\begin{pmatrix}3\\8\end{pmatrix}$

### Question 2 — 2 marks

**M1** $\sqrt{5^2+(-12)^2}$

**A1** 13

**Answer:** 13

### Question 3 — 2 marks

**M1** $\overrightarrow{AB}=\mathbf{b}-\mathbf{a}$, so $\overrightarrow{OM}=\mathbf{a}+\frac{1}{2}(\mathbf{b}-\mathbf{a})$

**A1** $\frac{1}{2}(\mathbf{a}+\mathbf{b})$

**Answer:** $\frac{1}{2}(\mathbf{a}+\mathbf{b})$

### Question 4 — 3 marks

**(a)**

**B1** $\begin{pmatrix}5\\-6\end{pmatrix}$

**(b)**

**M1** $\sqrt{5^2+6^2}=\sqrt{61}$

**A1** 7.81

**Answer:** (a) $\begin{pmatrix}5\\-6\end{pmatrix}$; (b) 7.81

### Question 5 — 2 marks

**M1** $\mathbf{q}=-3\mathbf{p}$

**A1** $k=-6$

**Answer:** $k=-6$

### Question 6 — 4 marks

**(a)**

**M1** $\overrightarrow{AB}=\mathbf{c}$, so $\overrightarrow{AP}=\frac{1}{3}\mathbf{c}$

**A1** $\mathbf{a}+\frac{1}{3}\mathbf{c}$

**(b)**

**M1** $-\mathbf{c}+\mathbf{a}+\frac{1}{3}\mathbf{c}$

**A1** $\mathbf{a}-\frac{2}{3}\mathbf{c}$

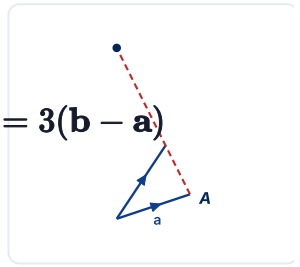
**Answer:** (a) $\mathbf{a}+\frac{1}{3}\mathbf{c}$; (b) $\mathbf{a}-\frac{2}{3}\mathbf{c}$

### Question 7 — 3 marks

**M1** $\overrightarrow{AB}=\mathbf{b}-\mathbf{a}$

**M1** $\overrightarrow{AC}=3\mathbf{b}-2\mathbf{a}-\mathbf{a}=3(\mathbf{b}-\mathbf{a})$

**A1** $\overrightarrow{AC}=3\overrightarrow{AB}$, so the lines are parallel and share the point $A$




**Answer:** shown

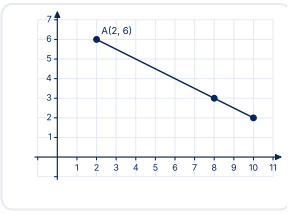
### Question 8 — 3 marks

**M1** $\overrightarrow{AB}=\begin{pmatrix}8\\-4\end{pmatrix}$

**M1** $\begin{pmatrix}2\\6\end{pmatrix}+\frac{3}{4}\begin{pmatrix}8\\-4\end{pmatrix}$

**A1** $(8,3)$

**Answer:** $(8,3)$




### Question 9 — 3 marks

**M1** $\overrightarrow{MN}=-\frac{1}{2}\mathbf{a}+\frac{1}{2}\mathbf{b}$

**M1** $\overrightarrow{MN}=\frac{1}{2}(\mathbf{b}-\mathbf{a})$

**A1** $\overrightarrow{AB}=\mathbf{b}-\mathbf{a}$, so $\overrightarrow{MN}=\frac{1}{2}\overrightarrow{AB}$

**Answer:** shown

### Question 10 — 3 marks

**M1** $2m+n=7$ and $m+3n=11$

**A1** $m=2$

**A1** $n=3$

**Answer:** $m=2$, $n=3$

Online, with every solution: igcsemathrevision.com/igcse-frontend/4ma1/exam-questions/vectors
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