

Vectors

Mark Scheme

Level	GCSE
Subject	Maths
Exam Board	Edexcel GCSE
Topic	Vectors
Grade Level	Grade 7
Booklet	Mark Scheme

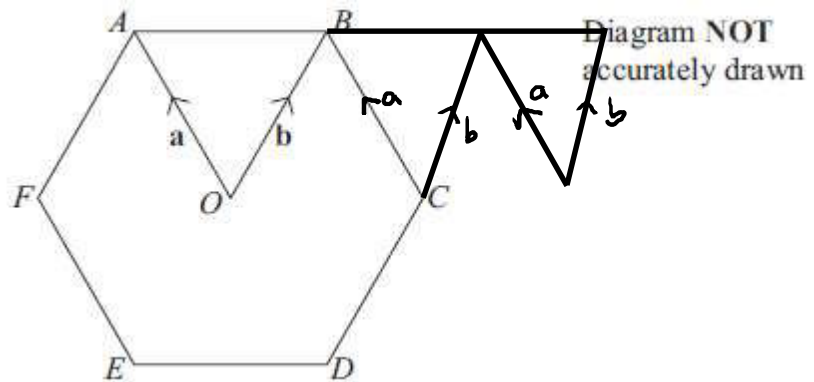
Time Allowed: 39 minutes

Score: /32

Percentage: /100

Grade Boundaries:

1.



$ABCDEF$ is a regular hexagon, with centre O .

$$\overrightarrow{OA} = \mathbf{a}, \overrightarrow{OB} = \mathbf{b}.$$

(a) Write the vector \overrightarrow{AB} in terms of \mathbf{a} and \mathbf{b} .

$$\underline{-a + b} \quad (1)$$

The line AB is extended to the point K so that $AB : BK = 1 : 2$

(b) Write the vector \overrightarrow{CK} in terms of \mathbf{a} and \mathbf{b} .
Give your answer in its simplest form.

$$b - a + b$$

$$\underline{2b - a} \quad (3)$$

(4 marks)

2.

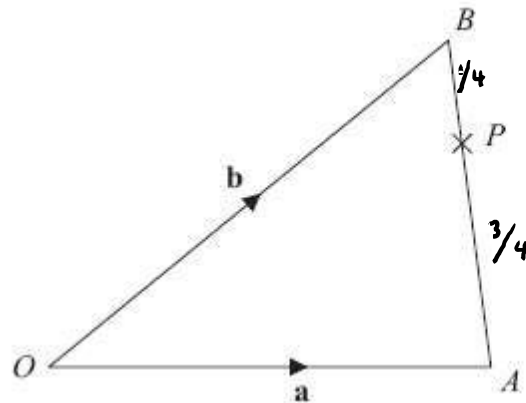


Diagram **NOT**
accurately drawn

OAB is a triangle.

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

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

(a) Find \vec{AB} in terms of \mathbf{a} and \mathbf{b} .

$$\underline{\underline{-a + b}} \quad (1)$$

P is the point on AB such that $AP : PB = 3 : 1$

(b) Find \vec{OP} in terms of \mathbf{a} and \mathbf{b} .

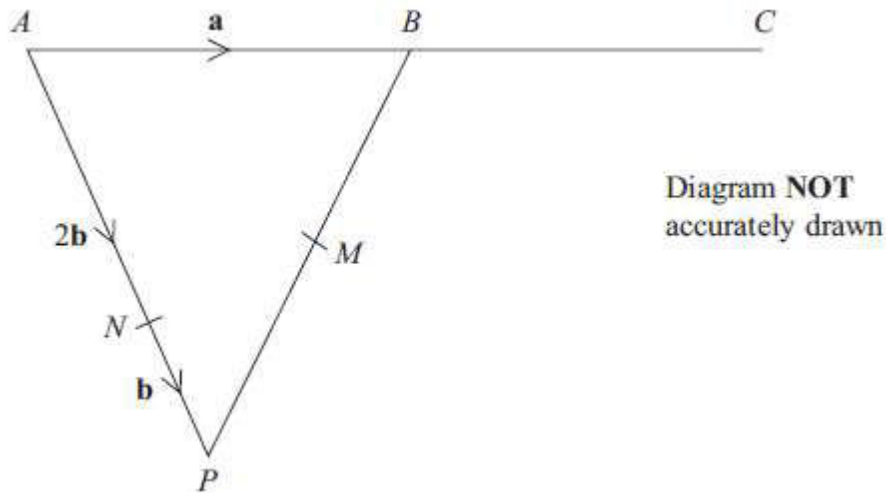
Give your answer in its simplest form.

$$\begin{aligned} \vec{OP} &= \vec{OA} + \frac{3}{4}(\vec{AB}) \\ &= a + \frac{3}{4}(-a + b) \\ &= a - \frac{3}{4}a + \frac{3}{4}b \\ &= \frac{1}{4}a + \frac{3}{4}b \end{aligned}$$

$$\underline{\underline{\frac{1}{4}a + \frac{3}{4}b}} \quad (3)$$

(4 marks)

3.



APB is a triangle.
 N is a point on AP .

$$\overrightarrow{AB} = \mathbf{a}$$

$$\overrightarrow{AN} = 2\mathbf{b}$$

$$\overrightarrow{NP} = \mathbf{b}$$

(a) Find the vector \overrightarrow{PB} , in terms of \mathbf{a} and \mathbf{b} .

$$-3\mathbf{b} + \mathbf{a}$$

(1)

B is the midpoint of AC .
 M is the midpoint of PB .

*(b) Show that NMC is a straight line.

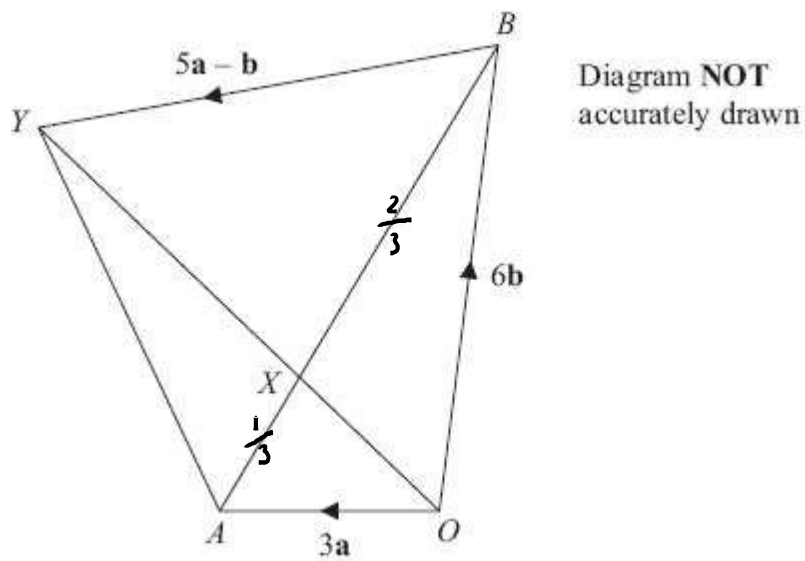
$$\begin{aligned}\overrightarrow{NM} &= \mathbf{b} + \frac{1}{2}(-3\mathbf{b} + \mathbf{a}) \\ &= \mathbf{b} - \frac{3}{2}\mathbf{b} + \frac{1}{2}\mathbf{a} \\ &= -\frac{1}{2}\mathbf{b} + \frac{1}{2}\mathbf{a} \\ \overrightarrow{NC} &= -2\mathbf{b} + 2\mathbf{a}\end{aligned}$$

$$\begin{aligned}\overrightarrow{NM} &= \frac{1}{2}(-\mathbf{b} + \mathbf{a}) \\ \overrightarrow{NC} &= 2(-\mathbf{b} + \mathbf{a})\end{aligned}$$

The lines are parallel and both go through N . NMC is therefore a straight line

(5 marks)

4.



$OAYB$ is a quadrilateral.

$$\overrightarrow{OA} = 3\mathbf{a}$$

$$\overrightarrow{OB} = 6\mathbf{b}$$

(a) Express \overrightarrow{AB} in terms of \mathbf{a} and \mathbf{b} .

$$\overrightarrow{AB} = -3\mathbf{a} + 6\mathbf{b}$$

$$-3\mathbf{a} + 6\mathbf{b}$$

(1)

X is the point on AB such that $AX : XB = 1 : 2$

and $\overrightarrow{BY} = 5\mathbf{a} - \mathbf{b}$

* (b) Prove that $\overrightarrow{OX} = \frac{2}{5} \overrightarrow{OY}$

$$\begin{aligned} \overrightarrow{OX} &= 3\mathbf{a} + \frac{1}{3}(-3\mathbf{a} + 6\mathbf{b}) \\ &= 3\mathbf{a} - \mathbf{a} + 2\mathbf{b} \\ &= 2\mathbf{a} + 2\mathbf{b} \end{aligned}$$

$$2\mathbf{a} + 2\mathbf{b} = \frac{2}{5}(5\mathbf{a} + 5\mathbf{b})$$

$$\begin{aligned} \overrightarrow{OY} &= 6\mathbf{b} + 5\mathbf{a} - \mathbf{b} \\ &= 5\mathbf{a} + 5\mathbf{b} \end{aligned}$$

(4)

(5 marks)

5.

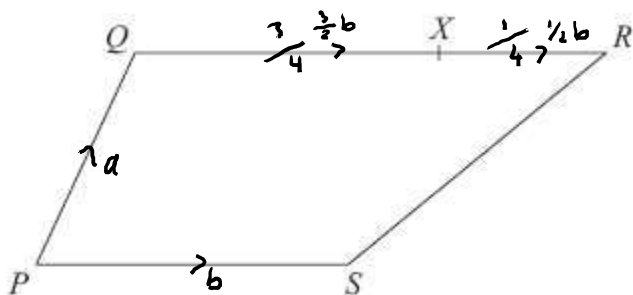


Diagram **NOT**
accurately drawn

$PQRS$ is a trapezium.

PS is parallel to QR .

$QR = 2PS$

$$\overrightarrow{PQ} = \mathbf{a} \quad \overrightarrow{PS} = \mathbf{b}$$

X is the point on QR such that $QX : XR = 3 : 1$

Express in terms of \mathbf{a} and \mathbf{b} .

(i) \overrightarrow{PR}

(2)

$$a + 2b$$

(ii) \overrightarrow{SX}

(3)

$$-b + a + \frac{3}{2}b$$

$$a + \frac{1}{2}b$$

$$a + \frac{1}{2}b$$

(5 marks)

6.

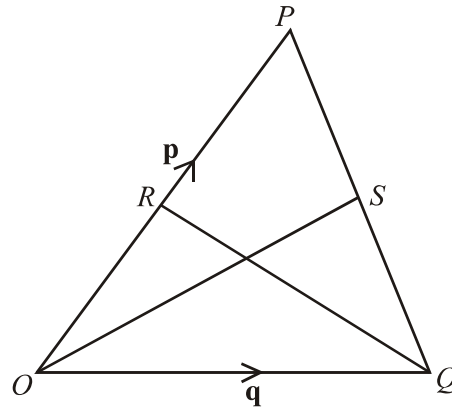


Diagram **NOT**
accurately drawn

OPQ is a triangle.

R is the midpoint of OP .

S is the midpoint of PQ .

$\vec{OP} = p$ and $\vec{OQ} = q$

(i) Find \vec{OS} in terms of p and q .

$$\vec{QP} = -q + p$$

$$\vec{QS} = q + \frac{1}{2}(-q + p)$$

$$\vec{OS} = \frac{1}{2}q + \frac{1}{2}p$$

(ii) Show that RS is parallel to OQ .

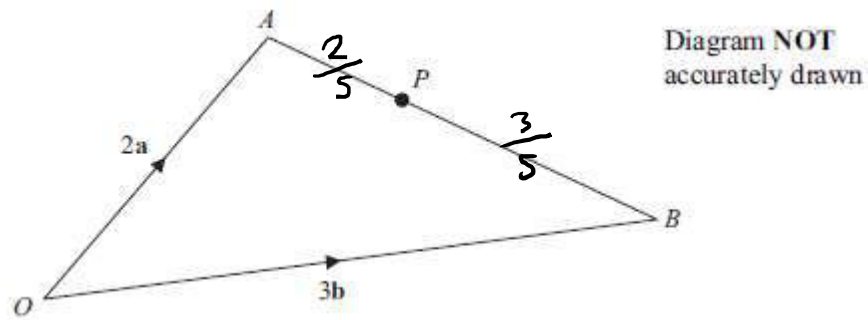
$$\begin{aligned} \vec{RS} &= -\frac{1}{2}p + \frac{1}{2}q + \frac{1}{2}p & (\vec{RO} + \vec{OS}) \\ &= \frac{1}{2}q \end{aligned}$$

$$\vec{OQ} = q$$

$$2\vec{RS} = \vec{OQ} \quad \therefore \text{they are parallel}$$

(5 marks)

6.



OAB is a triangle.

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

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

(a) Find AB in terms of \mathbf{a} and \mathbf{b} .

$$\vec{AB} = \frac{-2\mathbf{a} + 3\mathbf{b}}{\dots\dots\dots} \quad (1)$$

P is the point on AB such that $AP : PB = 2 : 3$

(b) Show that \vec{OP} is parallel to the vector $\mathbf{a} + \mathbf{b}$.

$$\begin{aligned} \vec{OP} &= \vec{OA} + \vec{AP} \\ &= 2\mathbf{a} + \frac{2}{5}(-2\mathbf{a} + 3\mathbf{b}) \\ &= 2\mathbf{a} - \frac{4}{5}\mathbf{a} + \frac{6}{5}\mathbf{b} \\ &= \frac{6}{5}\mathbf{a} + \frac{6}{5}\mathbf{b} \\ &= \frac{6}{5}(\mathbf{a} + \mathbf{b}) \end{aligned}$$

(3)

(4 marks)