Write your name here

Surname	Other names

In the style of:

Edexcel GCSE

Centre Number	Candidate Number

Mathematics A

Vectors

Higher Tier

Past Paper Style Questions Arranged by Topic	Paper Reference **1MA0/1H**

You must have: Ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB pencil, eraser. Tracing paper may be used.

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided *– there may be more space than you need.*
- **Calculators must not be used.**

Information

- The total mark for this paper is 100
- The marks for **each** question are shown in brackets *– use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed.

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over

1.

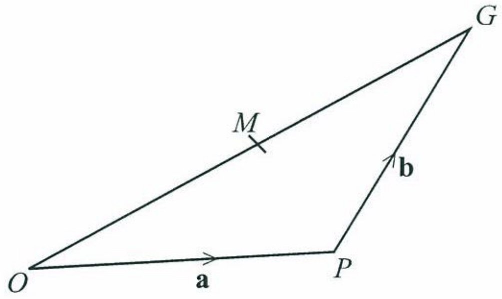


Diagram **NOT** accurately drawn

OGP is a triangle.

M is the midpoint of OG.

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

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

(a) Express $\overrightarrow{OM}$ in terms of **a** and **b**.

$$\overrightarrow{OM} = \frac{1}{2}(\overrightarrow{OG}) = \frac{1}{2}(a + b)$$

$\overrightarrow{OM} =$ $\frac{1}{2}(a+b)$

(2)

(b) Express $\overrightarrow{PM}$ in terms of **a** and **b**

Give your answer in its simplest form.

$$\overrightarrow{PM} = \overrightarrow{PO} + \overrightarrow{OM}$$

N.B: $\overrightarrow{PO} = -\overrightarrow{OP}$

$$= -a + \frac{1}{2}(a+b)$$

$$= \frac{1}{2}b - \frac{1}{2}a$$

$$= \frac{1}{2}(b - a)$$

$\overrightarrow{PM} =$ $\frac{1}{2}(b-a)$

(2)

(Total 4 marks)

2.

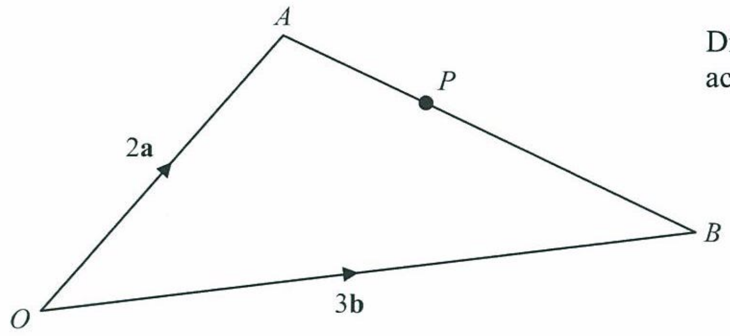


Diagram **NOT** accurately drawn

OAB is a triangle.

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

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

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

$\overrightarrow{AB} = \overrightarrow{AO} + \overrightarrow{OB}$

$= -2a + 3b$

$\overrightarrow{AB} =$ 3b − 2a

(1)

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

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

$\overrightarrow{OP} = \overrightarrow{OA} + \overrightarrow{AP}$

$= 2a + \frac{2}{5}(\overrightarrow{AB})$

$= 2a + \frac{2}{5}(3b - 2a)$

$= 2a + \frac{6}{5}b - \frac{4}{5}a$

$= \frac{6}{5}a + \frac{6}{5}b$

$= \frac{6}{5}(a+b)$, which is a scalar multiple of the vector $a+b$

(3)

Note: Two vectors are parallel if one is just a scalar multiple of the other.

(Total 4 marks)

3.

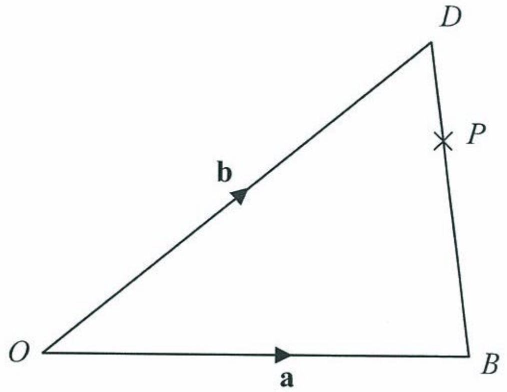


Diagram **NOT** accurately drawn

ODB is a triangle.

$\overrightarrow{OB} = \mathbf{a}$
$\overrightarrow{OD} = \mathbf{b}$

(a) Find $\overrightarrow{BD}$ in terms of **a** and **b**.

$\overrightarrow{BD} = \overrightarrow{BO} + \overrightarrow{OD} = -a + b$

$b - a$

(1)

P is the point on *DB* such that $DP : PB = \cancel{3} : \cancel{1}$ $1 : 3$

(b) Find $\overrightarrow{OP}$ in terms of **a** and **b**.
Give your answer in its simplest form.

$\overrightarrow{OP} = \overrightarrow{OB} + \overrightarrow{BP}$

$= \overrightarrow{OB} + \frac{3}{4}(\overrightarrow{BD})$

$= a + \frac{3}{4}(b - a)$

$= a + \frac{3}{4}b - \frac{3}{4}a$

$= \frac{1}{4}a + \frac{3}{4}b$

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

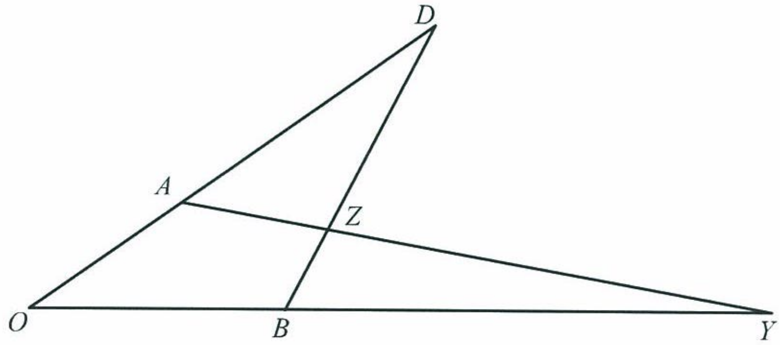
$\frac{1}{4}(a+3b)$

(3)

(Total 4 marks)

4.

Diagram **NOT** accurately drawn



In the diagram,

$\overrightarrow{OA} = 4\mathbf{a}$ and $\overrightarrow{OB} = 4\mathbf{b}$

*OA*D, *OBY* and *BZD* are all straight lines

$AD = 2OA$ and $BZ : ZD = 1:3$

(a) Find, in terms of **a** and **b**, the vectors which represent

(4)

(i) $\overrightarrow{BD}$

$\overrightarrow{BD} = \overrightarrow{BO} + \overrightarrow{OD} = -4b + 4a + 8a$

$= 12a - 4b = 4(3a - b)$

$4(3a - b)$

(ii) $\overrightarrow{AZ}$

$\overrightarrow{AZ} = \overrightarrow{AO} + \overrightarrow{OB} + \overrightarrow{BZ}$

$= -4a + 4b + \frac{1}{4}(4)(3a - b)$

$= -4a + 4b + 3a - b = 3b - a$

$3b - a$

Given that $\overrightarrow{BY} = 8\mathbf{b}$

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

(3)

$\overrightarrow{AY} = \overrightarrow{AO} + \overrightarrow{OY} = -4a + 4b + 8b$

$= 12b - 4a = 4(3b - a) \equiv 4(\overrightarrow{AZ})$

$\therefore$ Since $\overrightarrow{AY}$ is a scalar multiple of $\overrightarrow{AZ}$,

AZY is a straight line.

(Total 7 marks)

5.

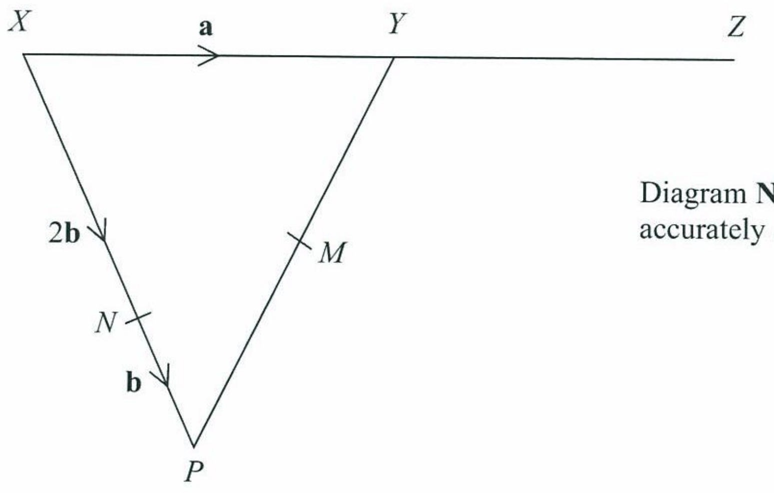


Diagram **NOT** accurately drawn

XYP is a triangle
N is a point on AP

$$\overrightarrow{XY} = \mathbf{a} \qquad \overrightarrow{XN} = 2\mathbf{b} \qquad \overrightarrow{NP} = \mathbf{b}$$

(a) Find the vector $\overrightarrow{PX}$, in terms of **a** and **b**.

$\overrightarrow{PX} = \overrightarrow{PN} + \overrightarrow{NX} = -b - 2b = -3b$

$-3b$

(1)

Y is the midpoint of XZ
M is the midpoint of PY

(b) Show that NMZ is a straight line.

$\overrightarrow{NM} = \overrightarrow{NP} + \overrightarrow{PM}$
$= b + \frac{1}{2}(\overrightarrow{PY})$
$= b + \frac{1}{2}(a - 3b)$
$= b + \frac{1}{2}a - \frac{3b}{2}$
$= \frac{1}{2}a - \frac{1}{2}b$
$= \frac{1}{2}(a - b)$

$\overrightarrow{NZ} = \overrightarrow{NX} + \overrightarrow{XZ}$
$= -2b + 2a$
$= 2(a - b)$
$\equiv 4(\overrightarrow{NM})$

$\therefore$ NMZ is a straight line.

(4)

(Total 5 marks)

6.

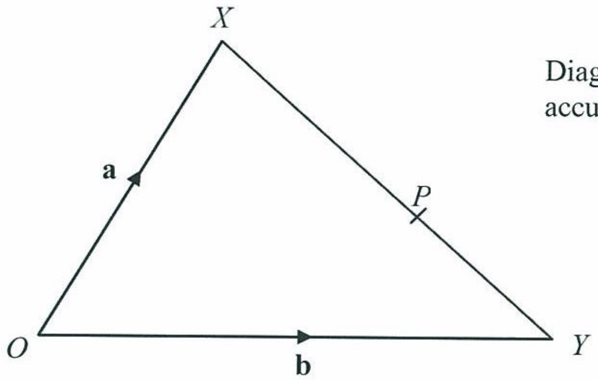


Diagram **NOT** accurately drawn

OXY is a triangle.

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

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

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

$\overrightarrow{XY} = -a + b$

$\overrightarrow{XY} =$ $b - a$

(1)

P is the point on XY such that $XP : PY = 3 : 2$

(b) Show that $\overrightarrow{OP} = \frac{1}{5}(2\mathrm{a} + 3\mathrm{b})$

$\overrightarrow{OP} = \overrightarrow{OX} + \overrightarrow{XP} = a + \frac{3}{5}(b - a)$

$= a + \frac{3}{5}b - \frac{3}{5}a$

$= \frac{2}{5}a + \frac{3}{5}b$

$= \frac{1}{5}(2a + 3b)$

(3)

(Total 4 marks)

7.

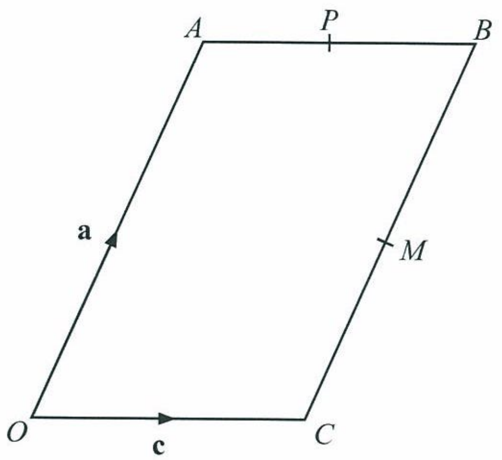


Diagram **NOT** accurately drawn

OABC is a parallelogram.
M is the midpoint of *CB*.
P is the midpoint of *AB*.

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

$\overrightarrow{OC} = \mathbf{c}$

(a) Find, in terms of **a** and/or **c**, the vectors

(i) $\overrightarrow{MB}$,

$\overrightarrow{MB} = \frac{1}{2}a$

$\frac{1}{2}a$ ....

(ii) $\overrightarrow{MP}$.

$\overrightarrow{MP} = \overrightarrow{MB} + \overrightarrow{BP}$

$= \frac{1}{2}a + \frac{1}{2}(-c) = \frac{1}{2}(a-c)$

$\frac{1}{2}(a-c)$ ....

(2)

(b) Show that *CA* is parallel to *MP*.

$\overrightarrow{CA} = \overrightarrow{CO} + \overrightarrow{OA}$

$= a - c$

$\equiv \frac{1}{2}(\overrightarrow{MP})$

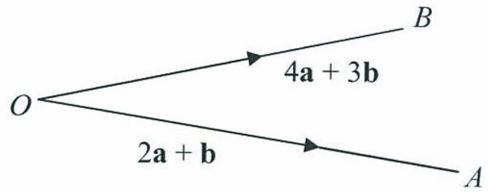
$\therefore$ CA is parallel to MP.

(2)

(Total 4 marks)

8.

Diagram **NOT** accurately drawn



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

$\overrightarrow{OB} = 4\mathbf{a} + 3\mathbf{b}$

(a) Express the vector $\overrightarrow{AB}$ in terms of **a** and **b**

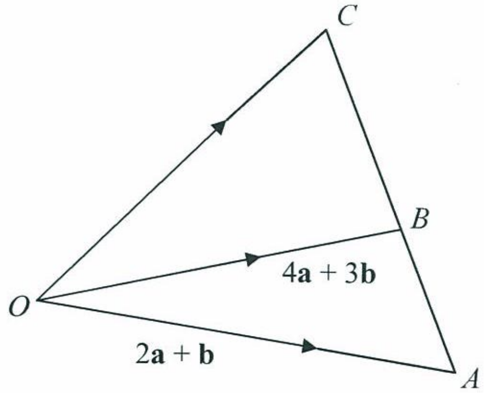
Give your answer in its simplest form.

$$\overrightarrow{AB} = \overrightarrow{AO} + \overrightarrow{OB}$$
$$= -(2a+b) + 4a+3b$$
$$= -2a - b + 4a + 3b$$
$$= 2b + 2a$$
$$= 2(b+a)$$

$2(a+b)$ ....

(2)

Diagram **NOT** accurately drawn



ABC is a straight line.
~~CB~~ : ~~YZ~~ = 2 : 3
AB : BC

(b) Express the vector $\overrightarrow{OC}$ in terms of **a** and **b**

Give your answer in its simplest form.

$$\overrightarrow{OC} = \overrightarrow{OB} + \overrightarrow{BC} = \overrightarrow{OB} + \frac{3}{2}(\overrightarrow{AB})$$

$$= 4a + 3b + \frac{3}{2}(2)(a+b)$$

$$= 7a + 6b$$

$7a + 6b$ ....

(3)

OR

$$\overrightarrow{OC} = \overrightarrow{OA} + \overrightarrow{AC}$$

$$= \overrightarrow{OA} + \frac{5}{2}(\overrightarrow{AB})$$

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

$$= 2a + b + 5(a+b)$$

$$= 7a + 6b$$

(Total 5 marks)

9.

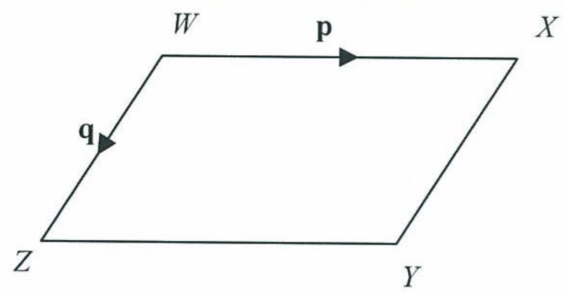


Diagram **NOT** accurately drawn

WXYZ is a parallelogram.
WX is parallel to *ZY*. *WZ* is parallel to *XY*.

$\overrightarrow{WX} = \mathbf{p}$
$\overrightarrow{AD} = \mathbf{q}$

(a) Express, in terms of **p** and **q**

(i) $\overrightarrow{WY}$ $p + q$

(i) $p + q$

(ii) $\overrightarrow{XZ}$ $\overrightarrow{XZ} = \overrightarrow{XY} + \overrightarrow{YZ}$
$= q - p$

(ii) $q - p$

(2)

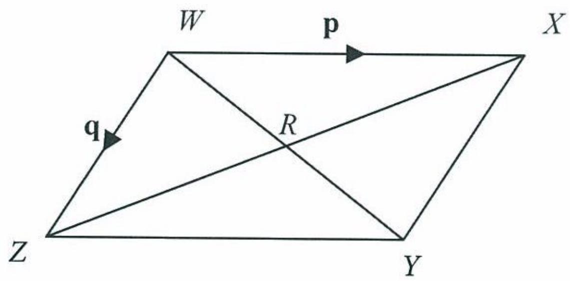


Diagram **NOT** accurately drawn

W~~X~~Y and *XZ* are diagonals of parallelogram *WXYZ*.
WY and *XZ* intersect at *R*

(b) Express $\overrightarrow{WR}$ in terms of **p** and **q**.

$\overrightarrow{WR} = \frac{1}{2}(\overrightarrow{WY}) = \frac{1}{2}(p + q)$

$\frac{1}{2}(p + q)$

(1)

(Total 3 marks)

N.B: The intersection point of the two diagonals of a parallelogram is just the midpoint of each diagonal. This can be shown by virtue of the congruency which can be demonstrated between the triangles which are formed vertically opposite the intersection point.

10.

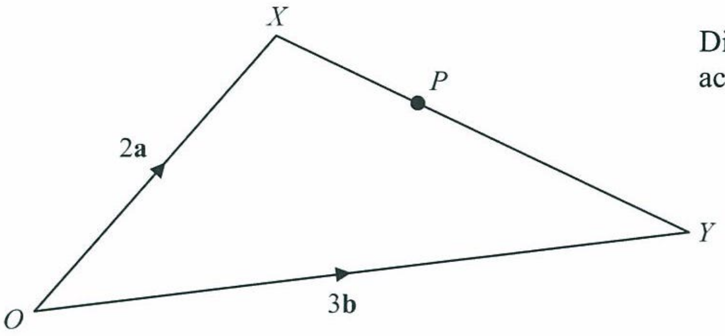


Diagram **NOT** accurately drawn

OXY is a triangle.

$\overrightarrow{OX} = 2\mathbf{a}$

$\overrightarrow{OY} = 3\mathbf{b}$

(a) Find $\overrightarrow{XY}$ in terms of **a** and **b**.

$$\overrightarrow{XY} = \overrightarrow{XO} + \overrightarrow{OY}$$
$$= -2a + 3b$$

$\overrightarrow{XY} =$ $3b - 2a$

(1)

P is the point on *XY* such that *XP* : *PY* = 2 : 3

(b) Show that $\overrightarrow{OP}$ is parallel to the vector **a** + **b**

$$\overrightarrow{OP} = \overrightarrow{OX} + \overrightarrow{XP}$$
$$= 2a + \frac{2}{5}(\overrightarrow{XY})$$
$$= 2a + \frac{2}{5}(3b - 2a)$$
$$= 2a + \frac{6}{5}b - \frac{4}{5}a$$
$$= \frac{6}{5}a + \frac{6}{5}a$$
$$= \frac{6}{5}(a + b), \text{ i.e. } k(a+b) \text{ where } k = \frac{6}{5}$$

(3)

$\therefore$ $\overrightarrow{OP}$ is parallel to the vector $a + b$.

(Total 4 marks)