1 *A* is the point with coordinates (2, 3).

$$\overrightarrow{AB} = \begin{pmatrix} 5 \\ -4 \end{pmatrix}.$$

Find the coordinates of *B*.

(................., ...)

(Total 2 marks)

2

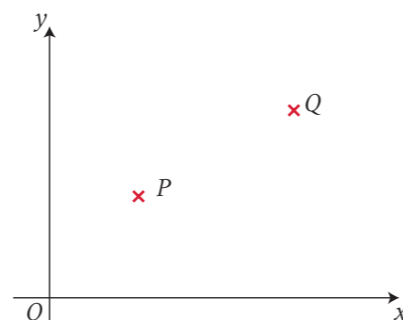Diagram **NOT** accurately drawn

The diagram is a sketch.

P is the point (2, 3)

Q is the point (6, 6)

a Write down the vector $\overrightarrow{PQ}$

Write your answer as a column vector $\begin{pmatrix} x \\ y \end{pmatrix}$

$\begin{pmatrix} \ \end{pmatrix}$ ....

(2)

PQRS is a parallelogram.

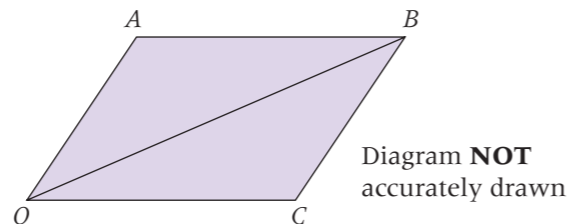$$\overrightarrow{PR} = \begin{pmatrix} 4 \\ 7 \end{pmatrix}$$

b Find the vector $\overrightarrow{QS}$

Write your answer as a column vector $\begin{pmatrix} x \\ y \end{pmatrix}$

$$\begin{pmatrix} \ \\ \ \end{pmatrix}$$ ....

(2)

(Total 4 marks)

3 *OABC* is a parallelogram.

$$\overrightarrow{OA} = \begin{pmatrix} 1 \\ 2 \end{pmatrix}, \ \overrightarrow{OC} = \begin{pmatrix} 4 \\ 0 \end{pmatrix}$$

Diagram **NOT** accurately drawn

a Find the vector $\overrightarrow{OB}$ as a column vector.

$$\begin{pmatrix} \ \\ \ \end{pmatrix}$$ .... (1)

X is the point on *OB* such that $OX = kOB$, where $0 < k < 1$

b Find, in terms of *k*, the vectors

i $\overrightarrow{OX}$,

....

ii $\overrightarrow{AX}$,

....

iii $\overrightarrow{XC}$.

.... (3)

c Find the value of *k* for which $\overrightarrow{AX} = \overrightarrow{XC}$.

.... (2)

d Use your answer to part **c** to show that the diagonals of the parallelogram *OABC* bisect one another.

....
....
.... (2)

(Total 8 marks)

4 *PQR* is a triangle.

M and *N* are the midpoints of *PQ* and *PR* respectively.
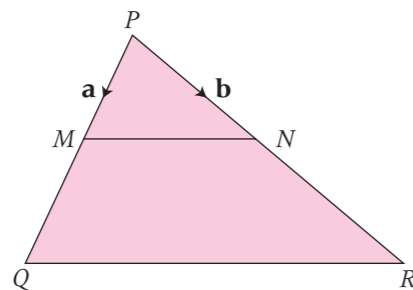
Diagram **NOT** accurately drawn

$\overrightarrow{PM} = \mathbf{a}$ $\overrightarrow{PN} = \mathbf{b}$.

a Find, in terms of **a** and/or **b**,

i $\overrightarrow{MN}$

....

ii $\overrightarrow{PQ}$

....

iii $\overrightarrow{QR}$

....

(3)

b Use your answers to **a i** and **iii** to write down two geometrical facts about the lines *MN* and *QR*.

. . . .

. . . .

(2)

(Total 5 marks)

5
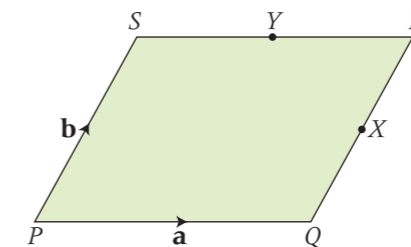
PQRS is a parallelogram.

X is the midpoint of *QR* and *Y* is the midpoint of *SR*.
$\overrightarrow{PQ} = \mathbf{a}$ and $\overrightarrow{PS} = \mathbf{b}$.

a Write down, in terms of **a** and **b**, expressions for

i $\overrightarrow{PX}$

....

ii $\overrightarrow{PY}$

....

iii $\overrightarrow{QS}$

....

(3)

b Use a vector method to show that *XY* is parallel to *QS* and that $XY = \frac{1}{2}QS$.

(2)

(Total 5 marks)

6

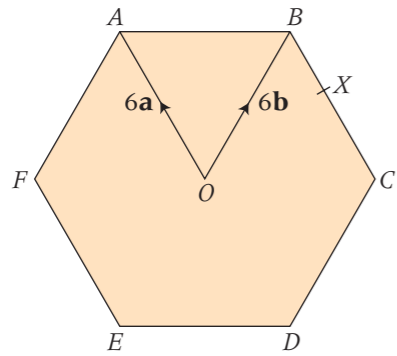Diagram **NOT** accurately drawn

The diagram shows a regular hexagon *ABCDEF* with centre *O*.

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

a Express in terms of **a** and/or **b**

  i $\overrightarrow{AB}$,

....

  ii $\overrightarrow{EF}$.

....

(2)

X is the midpoint of *BC*.

b Express $\overrightarrow{EX}$ in terms of **a** and/or **b**

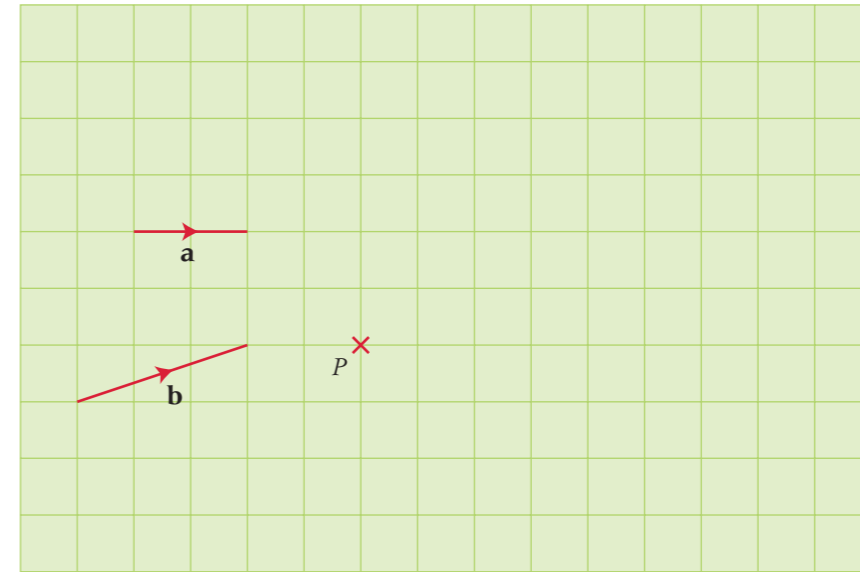...

(2)

Y is the point on *AB* extended, such that *AB* : *BY* = 3:2

c Prove that *E*, *X* and *Y* lie on the same straight line.

(3)

(Total 7 marks)

7

The diagram shows two vectors **a** and **b**.

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

On the grid above draw the vector $\overrightarrow{PQ}$.

(Total 2 marks)

8 $\mathbf{p} = \begin{pmatrix} 2 \\ 3 \end{pmatrix}$ and $\mathbf{q} = \begin{pmatrix} -1 \\ 1 \end{pmatrix}$

Write down as a column vector

  i $\mathbf{p} - \mathbf{q}$

$\begin{pmatrix} \\ \end{pmatrix}$

....

  ii $3\mathbf{p} + \mathbf{q}$

$\begin{pmatrix} \\ \end{pmatrix}$

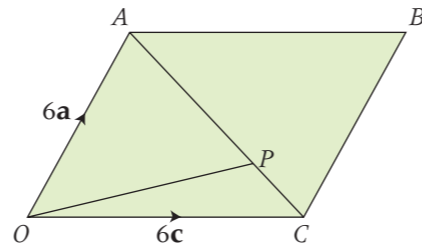...

(Total 2 marks)

9

Diagram **NOT**
accurately drawn

OABC is a parallelogram.

P is the point on *AC* such that $AP = \dfrac{2}{3}AC$.

$\overrightarrow{OA} = 6\mathbf{a}$. $\overrightarrow{OC} = 6\mathbf{c}$.

a Find the vector $\overrightarrow{OP}$.

   Give your answer in terms of **a** and **c**.

.... (3)

The midpoint of *CB* is *M*.

b Prove that *OPM* is a straight line.

(2)

(Total 5 marks)