1 Here are two vectors.

$$\overrightarrow{AB} = \begin{pmatrix} 5 \\ 3 \end{pmatrix} \qquad \overrightarrow{CB} = \begin{pmatrix} -2 \\ 4 \end{pmatrix}$$

Find, as a column vector, $\overrightarrow{AC}$

....

(Total for Question 1 is 2 marks)

2 Here are two vectors.

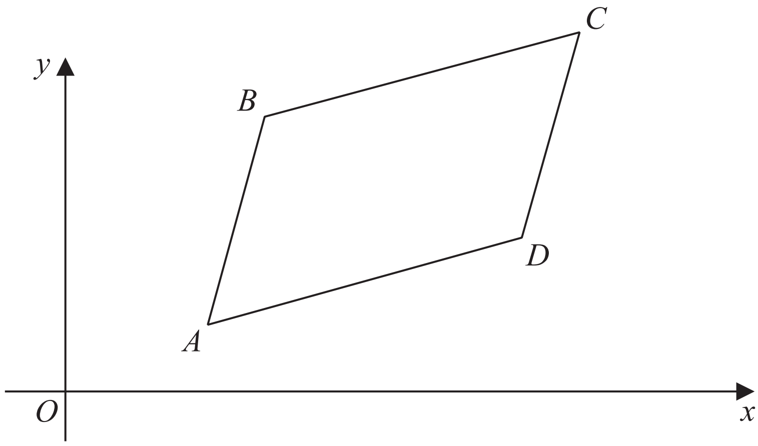
$$\overrightarrow{AB} = \begin{pmatrix} 6 \\ -9 \end{pmatrix} \qquad \overrightarrow{CB} = \begin{pmatrix} 1 \\ 3 \end{pmatrix}$$

Find the magnitude of $\overrightarrow{AC}$.

....

(Total for Question 2 is 3 marks)

3 The diagram shows parallelogram *ABCD*.



$\overrightarrow{AB} = \begin{pmatrix} 2 \\ 7 \end{pmatrix}$ $\quad \overrightarrow{AC} = \begin{pmatrix} 10 \\ 11 \end{pmatrix}$

The point *B* has coordinates (5, 8)

(a) Work out the coordinates of the point *C*.

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

(3)

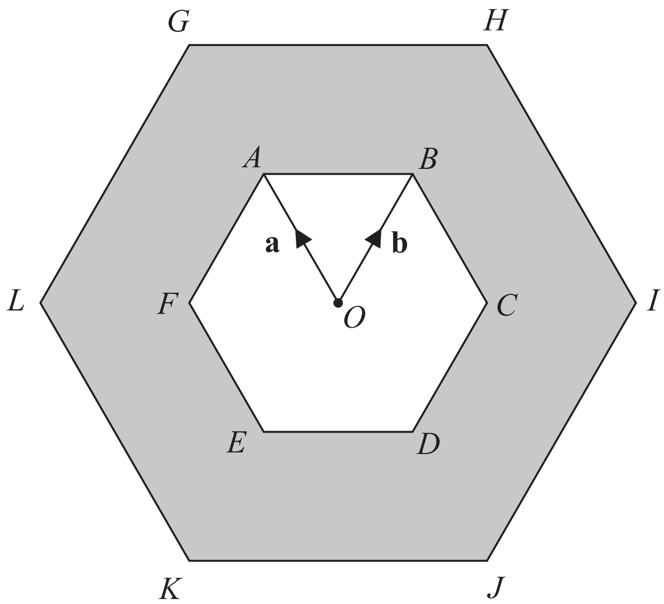
The point *E* has coordinates (63, 211)

(b) Use a vector method to prove that *ABE* is a straight line.

(2)

(Total for Question 3 is 5 marks)

4 *ABCDEF* and *GHIJKL* are regular hexagons each with centre *O*.



GHIJKL is an enlargement of *ABCDEF*, with centre *O* and scale factor 2

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

(a) Write the following vectors, in terms of **a** and **b**.
Simplify your answers.

(i) $\overrightarrow{AB}$

....
(1)

(ii) $\overrightarrow{KI}$

....
(2)

(iii) $\overrightarrow{LD}$

....
(2)

The triangle OAB has an area of $5\,\text{cm}^2$

(b) Calculate the area of the shaded region.

.... cm^2

(3)

(Total for Question 4 is 8 marks)

5

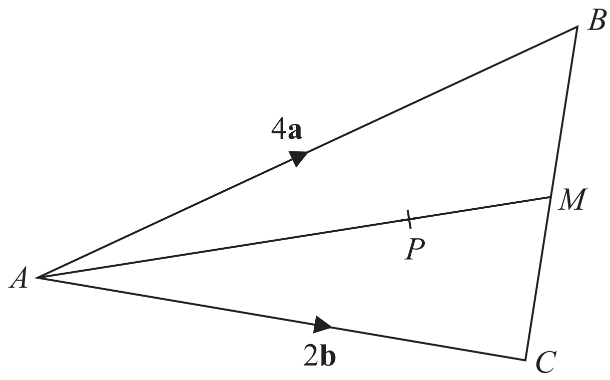


Diagram **NOT** accurately drawn

ABC is a triangle.
The midpoint of *BC* is *M*.
P is a point on *AM*.

$\overrightarrow{AB} = 4\mathbf{a}$

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

$\overrightarrow{AP} = \frac{3}{2}\mathbf{a} + \frac{3}{4}\mathbf{b}$

Find the ratio $AP:PM$

....

(Total for Question 5 is 3 marks)

6 OAB is a triangle.

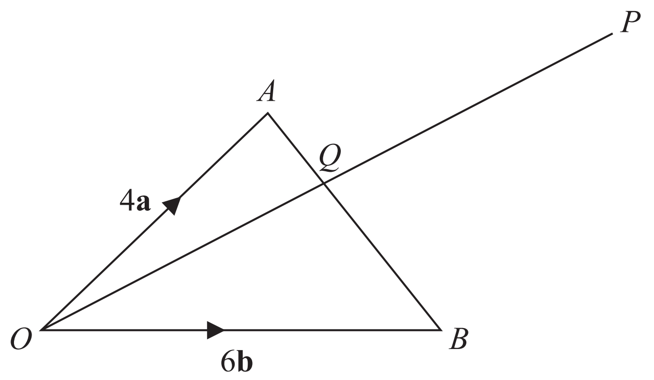
$\overrightarrow{OA} = \mathbf{a}$ $\qquad$ $\overrightarrow{OB} = \mathbf{b}$

The point C lies on OA such that $OC : CA = 1 : 2$
The point D lies on OB such that $OD : DB = 1 : 2$

Using a vector method, prove that $ABDC$ is a trapezium.

(Total for Question 6 is 3 marks)

7



OAB is a triangle.
Q is the point on AB such that OQP is a straight line.

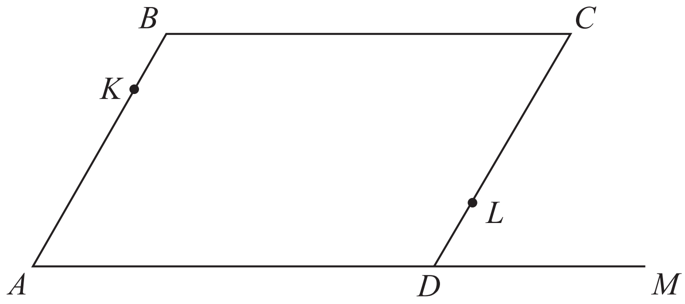
$\overrightarrow{OA} = 4\mathbf{a}$ $\qquad$ $\overrightarrow{OB} = 6\mathbf{b}$ $\qquad$ $\overrightarrow{AP} = 2\mathbf{a} + 8\mathbf{b}$

Using a vector method, find the ratio $AQ:QB$

$AQ:QB =$ ....

(Total for Question 7 is 5 marks)

8 *ABCD* is a parallelogram and *ADM* is a straight line.



$\overrightarrow{AB} = \mathbf{a} \quad \overrightarrow{BC} = \mathbf{b} \quad \overrightarrow{DM} = \frac{1}{2}\mathbf{b}$

K is the point on *AB* such that $AK : AB = \lambda : 1$
L is the point on *CD* such that $CL : CD = \mu : 1$
KLM is a straight line.

Given that $\lambda : \mu = 1 : 2$

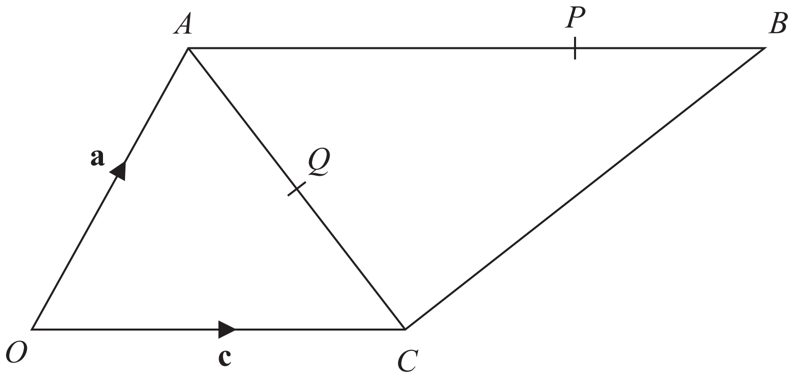
use a vector method to find the value of λ and the value of μ

$\lambda =$ ....

$\mu =$ ....

(Total for Question 8 is 5 marks)

9



$\overrightarrow{OA} = \mathbf{a}$ $\quad$ $\overrightarrow{OC} = \mathbf{c}$ $\quad$ $\overrightarrow{AB} = 2\mathbf{c}$

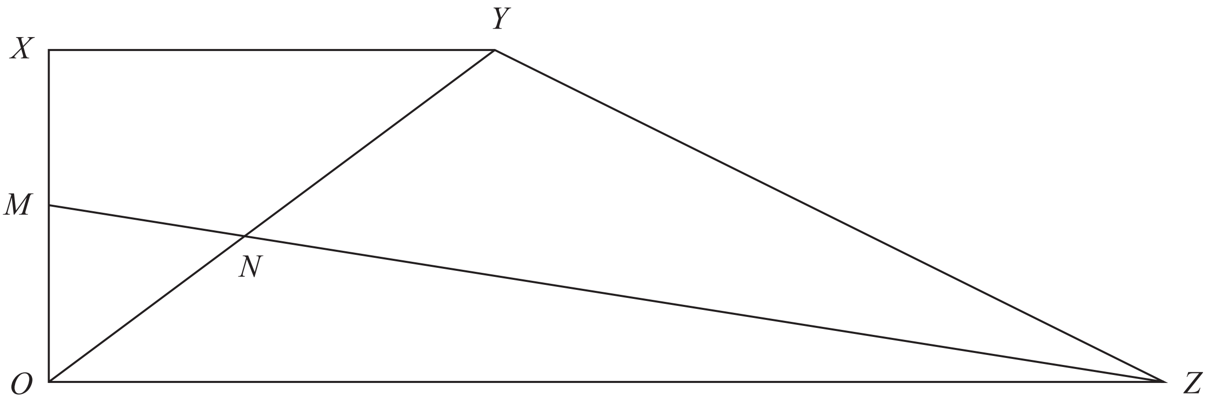
P is the point on AB such that $AP : PB = 3 : 1$
Q is the point on AC such that OQP is a straight line.

Use a vector method to find $AQ : QC$
Show your working clearly.

$AQ : QC =$ ....

(Total for Question 9 is 5 marks)

10 *OXYZ* is a trapezium.



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

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

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

M is the midpoint of *OX*
N is the point such that *MNZ* and *ONY* are straight lines.

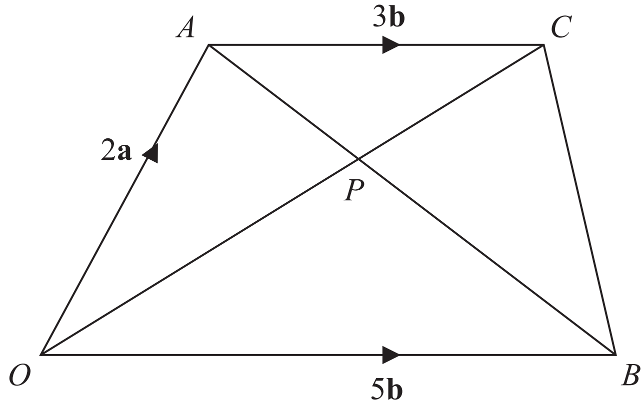
Given that $ON : OY = \lambda : 1$

use a vector method to find the value of λ

$\lambda =$ ....

(Total for Question 10 is 5 marks)

11 *OACB* is a trapezium.



$\overrightarrow{OA} = 2\mathbf{a}$ $\quad \overrightarrow{OB} = 5\mathbf{b}$ $\quad \overrightarrow{AC} = 3\mathbf{b}$

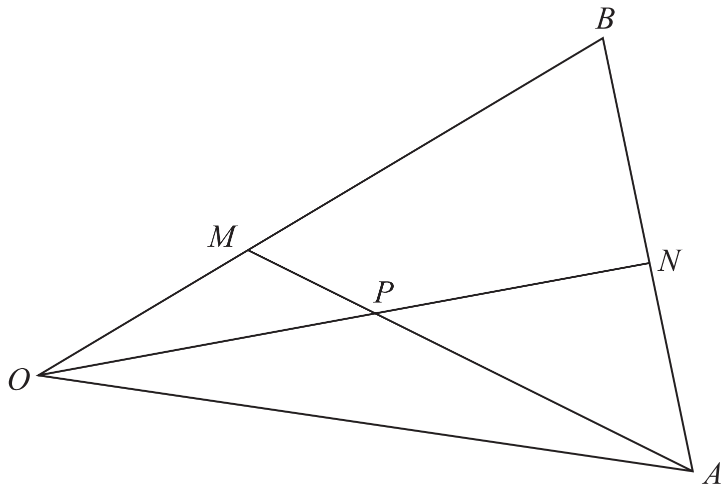
The diagonals, *OC* and *AB*, of the trapezium intersect at the point *P*.

Find and simplify an expression, in terms of **a** and **b**, for $\overrightarrow{OP}$
Show your working clearly.

$\overrightarrow{OP} =$ ....

(Total for Question 11 is 5 marks)

12 The diagram shows triangle OAB



$\overrightarrow{OA} = 8\mathbf{a}$ $\qquad$ $\overrightarrow{OB} = 6\mathbf{b}$

M is the point on OB such that $OM : MB = 1 : 2$
N is the midpoint of AB
P is the point of intersection of ON and AM

Using a vector method, find $\overrightarrow{OP}$ as a simplified expression in terms of $\mathbf{a}$ and $\mathbf{b}$
Show your working clearly.

$\overrightarrow{OP}$ = ...

(Total for Question 12 is 5 marks)

13 *OAB* is a triangle.

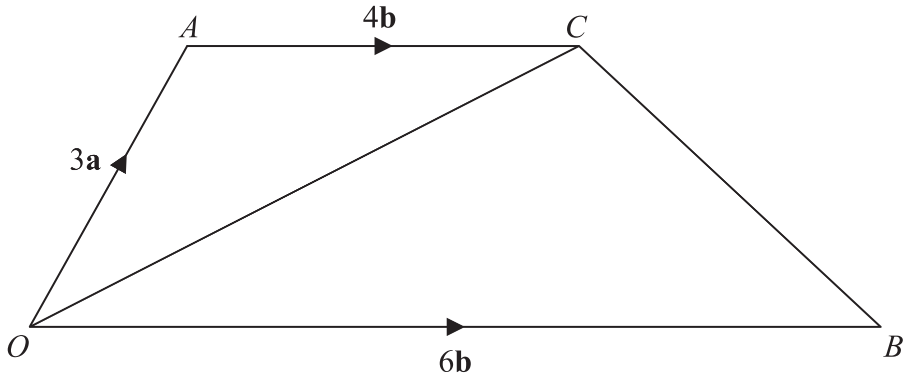
$\overrightarrow{OA} = \mathbf{a}$ $\quad$ $\overrightarrow{OB} = \mathbf{b}$

C is the midpoint of OA.
D is the point on AB such that $AD : DB = 3 : 1$
E is the point such that $\overrightarrow{OB} = 2\overrightarrow{BE}$

Using a vector method, prove that the points C, D and E lie on the same straight line.

(Total for Question 13 is 5 marks)

14 The diagram shows trapezium *OACB*.



$\overrightarrow{OA} = 3\mathbf{a}$ $\overrightarrow{OB} = 6\mathbf{b}$ $\overrightarrow{AC} = 4\mathbf{b}$

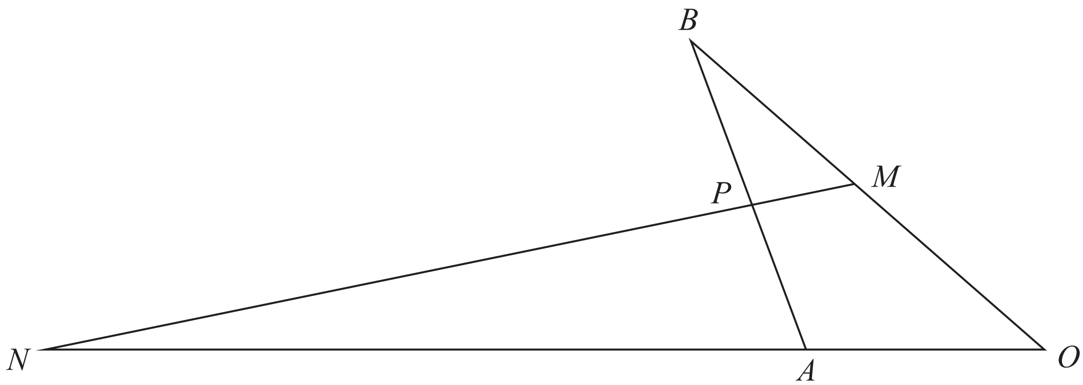
N is the point on *OC* such that *ANB* is a straight line.

Find $\overrightarrow{ON}$ as a simplified expression in terms of **a** and **b**.

....

(Total for Question 14 is 5 marks)

15



OAN, OMB, APB and MPN are straight lines.

$OA : AN = 1 : 4$

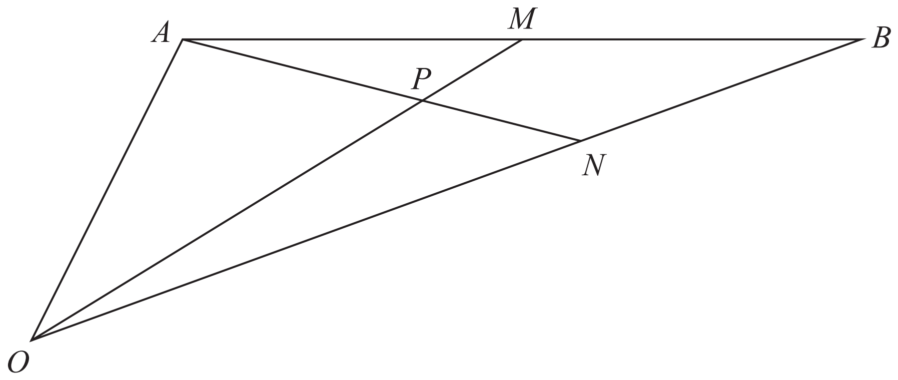
$OM : MB = 1 : 1$

$\overrightarrow{OA} = 2\mathbf{a}$ $\quad \overrightarrow{OB} = 2\mathbf{b}$

By using a vector method, find the ratio $AP : PB$
Give your answer in its simplest form.

(Total for Question 15 is 5 marks)

16 *OAB* is a triangle.



$\overrightarrow{OA} = 2\mathbf{a}$ and $\overrightarrow{OB} = 2\mathbf{b}$

M is the midpoint of *AB*.
N is the point on *OB* such that $ON : NB = 2 : 1$

P is the point on *AN* such that *OPM* is a straight line.

Use a vector method to find $OP : PM$
Show your working clearly.

(Total for Question 16 is 6 marks)