1

OAN, *OMB*, *APB* and *MPN* are straight lines.

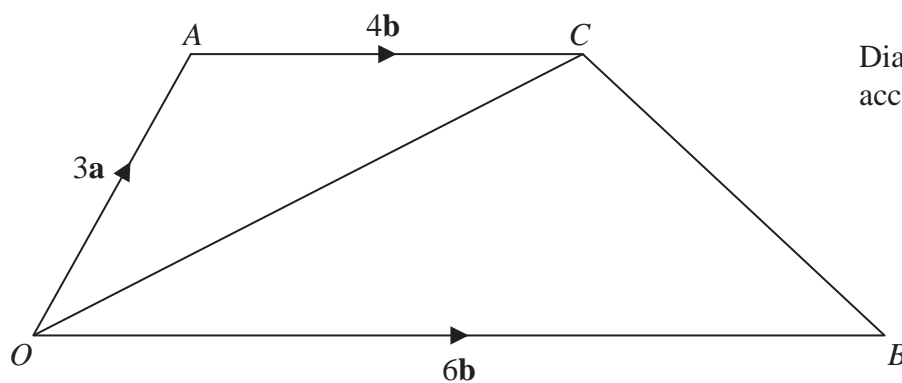$OA : AN = 1 : 4$

$OM : MB = 1 : 1$

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

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

(Total for Question 1 is 5 marks)

2 The diagram shows trapezium *OACB*.

Diagram **NOT**
accurately drawn

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

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 2 is 5 marks)

3
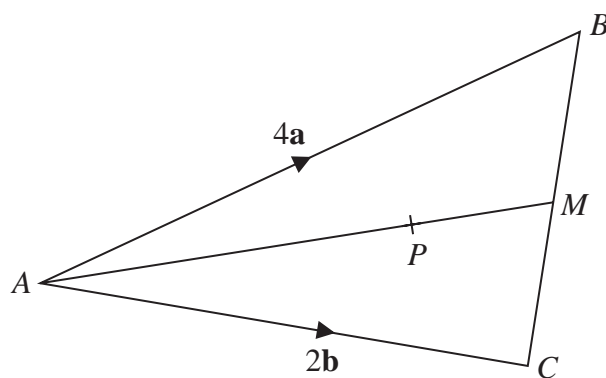
Diagram **NOT** accurately drawn

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 3 is 3 marks)

4 *OACB* is a trapezium.
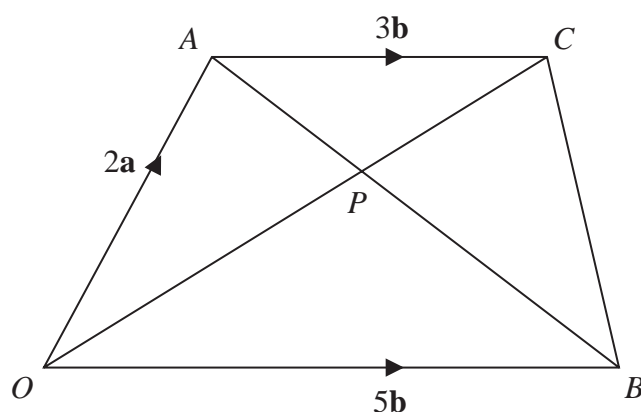
Diagram **NOT**
accurately drawn

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

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.

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

(Total for Question 4 is 5 marks)

5 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, $\overrightarrow{AC}$

....
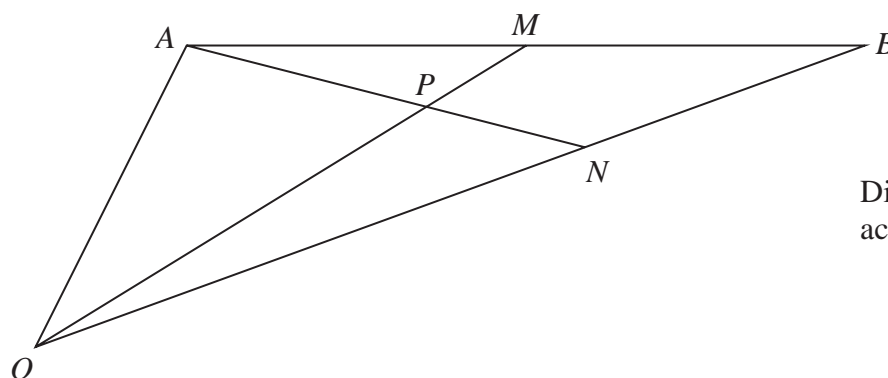
(Total for Question 5 is 2 marks)

6 *OAB* is a triangle.

Diagram **NOT**
accurately drawn

$\overrightarrow{OA} = 2\mathbf{a}$ 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 6 is 6 marks)

7 *ABCD* is a parallelogram and *ADM* is a straight line.
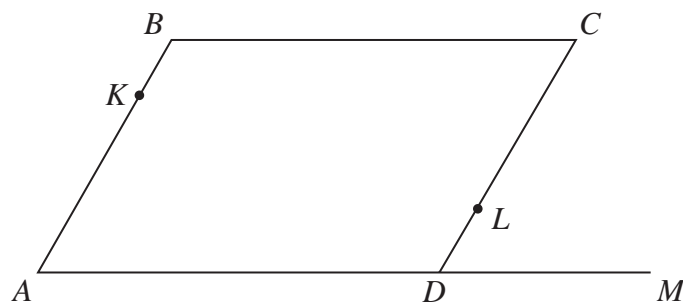
Diagram **NOT**
accurately drawn

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

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 = $ ....

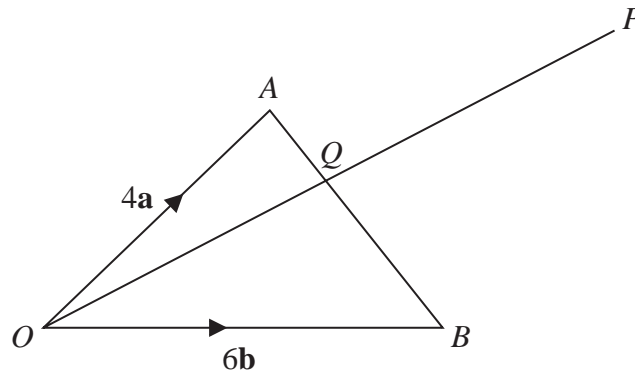**(Total for Question 7 is 5 marks)**

8

Diagram **NOT** accurately drawn

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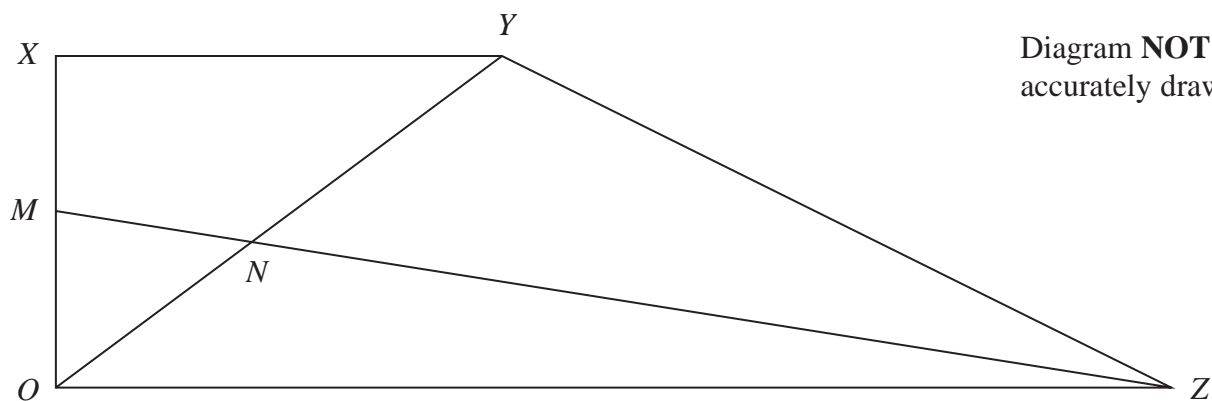*Q* is the point on *AB* such that *OQP* is a straight line.

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

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

AQ : *QB* = ...

(Total for Question 8 is 5 marks)

9 *OXYZ* is a trapezium.

Diagram **NOT** accurately drawn

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

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

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

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

Given that *ON* : *OY* = λ : 1

use a vector method to find the value of λ

λ = ...

(Total for Question 9 is 5 marks)
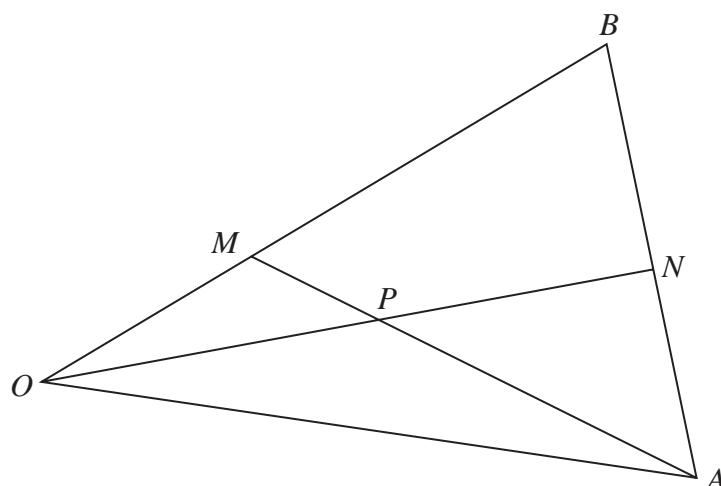
10 The diagram shows triangle *OAB*

Diagram **NOT** accurately drawn

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

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 **a** and **b**
Show your working clearly.

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

(Total for Question 10 is 5 marks)

11 The diagram shows triangle OAB with OA extended to E
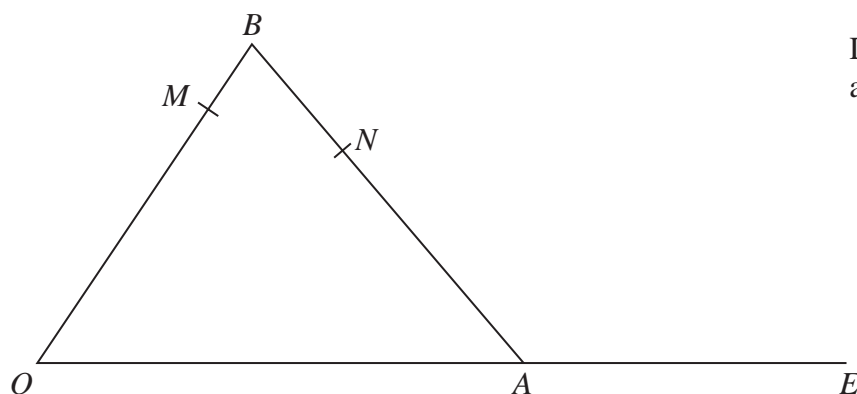
Diagram **NOT** accurately drawn

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

M is the point on OB such that $OM:MB = 4:1$
N is the point on AB such that $AN:NB = 3:2$
$OA:AE = 5:3$

(a) Find an expression for $\overrightarrow{ON}$ in terms of $\mathbf{a}$ and $\mathbf{b}$
Give your answer in its simplest form.

$\overrightarrow{ON}$ = ...

(2)

(Total for Question 11 is 2 marks)

12 Here are two vectors.

$$\overrightarrow{BA} = \begin{pmatrix} -5 \\ 4 \end{pmatrix} \quad \overrightarrow{BC} = \begin{pmatrix} 9 \\ 1 \end{pmatrix}$$

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

$$\overrightarrow{AC} = \begin{pmatrix} \cdots \\ \cdots \end{pmatrix}$$

(Total for Question 12 is 2 marks)

13 *OAED* is a quadrilateral.

E

Diagram **NOT**
accurately drawn

$7\mathbf{a} + 3\mathbf{b}$

A   *C*   *B*   *D*

$2\mathbf{b}$

$2\mathbf{a}$

O
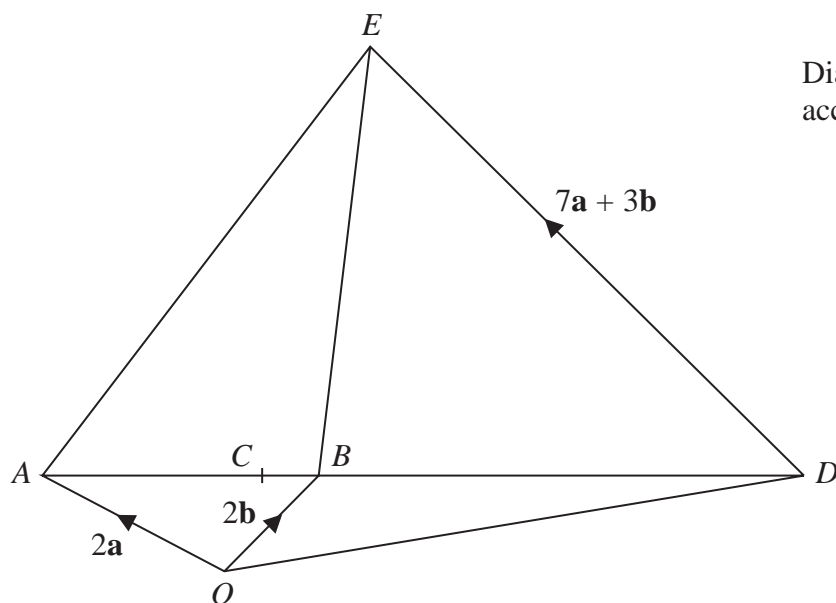
$\overrightarrow{OA} = 2\mathbf{a}$ $OB = 2\mathbf{b}$ $DE = 7\mathbf{a} + 3\mathbf{b}$

$AB:BD = 1:2$

The point *C* on *AB* is such that *OCE* is a straight line.

Use a vector method to find the ratio of *OC*:*CE*

....

(Total for Question 13 is 5 marks)

14
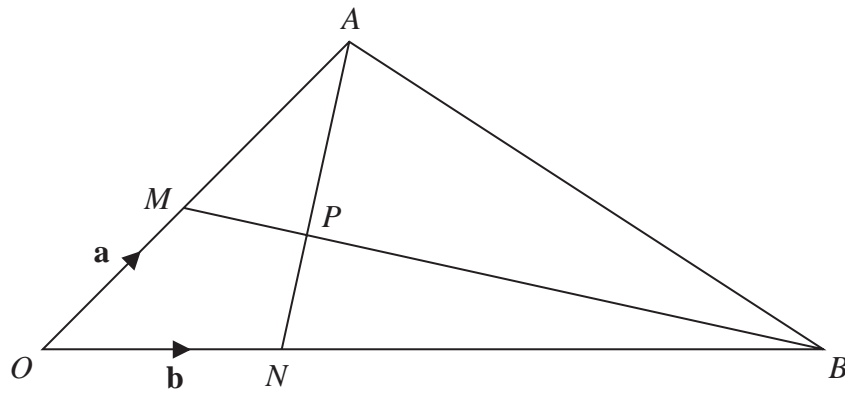
Diagram **NOT**
accurately drawn

OMA, *ONB*, *MPB* and *NPA* are straight lines.

M is the midpoint of *OA*

$ON:NB = 1:5$

$$\overrightarrow{OM} = \mathbf{a} \qquad \overrightarrow{ON} = \mathbf{b}$$

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

....

(1)

(b) Use a vector method to find the ratio *AP*:*PN*

$AP:PN =$ ....

(4)

(Total for Question 14 is 5 marks)