

13 Here are two vectors.

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

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

(Total for Question 13 is 2 marks)



14 Here are two vectors.

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

Find the magnitude of \overrightarrow{AC} .

(Total for Question 14 is 3 marks)



DO NOT WRITE IN THIS AREA**16** 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.

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

(Total for Question 16 is 2 marks)**DO NOT WRITE IN THIS AREA**

P 7 2 4 4 4 A 0 1 7 3 2

17 Here are two vectors.

$$\overrightarrow{FG} = \begin{pmatrix} -5 \\ 2 \end{pmatrix} \quad \overrightarrow{HG} = \begin{pmatrix} 4 \\ 14 \end{pmatrix}$$

Calculate the magnitude of the vector \overrightarrow{HF}

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(Total for Question 17 is 3 marks)



14 $ABCDEF$ and $GHIJKL$ are regular hexagons each with centre O .

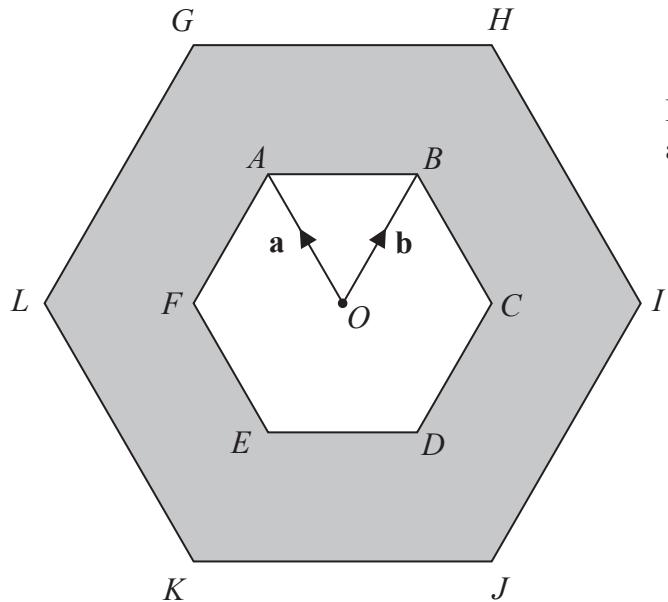


Diagram **NOT**
accurately drawn

$GHIJKL$ 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 \mathbf{a} and \mathbf{b} .

Simplify your answers.

(i) \overrightarrow{AB}

.....
(1)

(ii) \overrightarrow{KI}

.....
(2)

(iii) \overrightarrow{LD}

.....
(2)

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The triangle OAB has an area of 5 cm^2

(b) Calculate the area of the shaded region.

..... cm^2

(3)

(Total for Question 14 is 8 marks)



P 6 5 9 1 5 R A 0 1 5 2 4

19 The diagram shows a triangle ABC where A , B and C represent the positions of three towns.

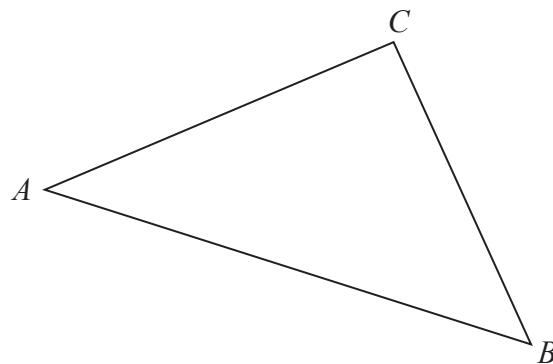


Diagram NOT
accurately drawn

$$\overrightarrow{AB} = \begin{pmatrix} 7 \\ -2 \end{pmatrix} \quad \overrightarrow{BC} = \begin{pmatrix} -3 \\ 5 \end{pmatrix}$$

Pru travels directly from A to B and then directly from B to C

Yang travels directly from A to C

Given that the values for \overrightarrow{AB} and \overrightarrow{BC} are in kilometres,

work out how much further Pru travels than Yang travels.

Give your answer in km, correct to one decimal place.

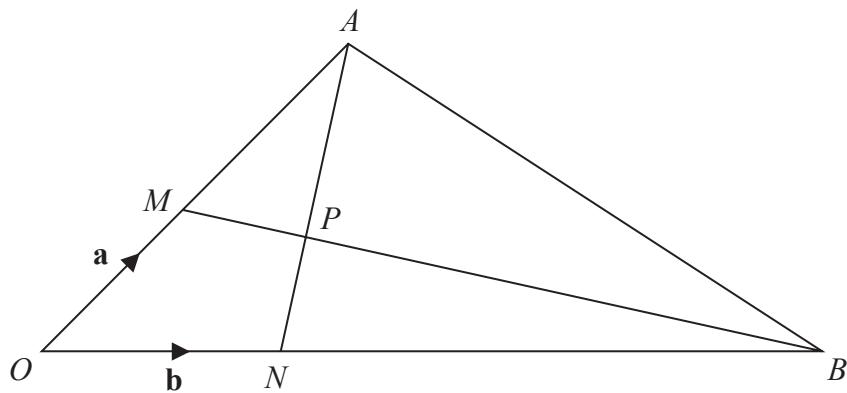
..... km

(Total for Question 19 is 5 marks)



P 7 2 7 9 2 A 0 1 9 2 8

19

Diagram NOT
accurately drawn OMA, ONB, MPB and NPA are straight lines. M is the midpoint of OA $ON:NB = 1:5$

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

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

(1)

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

$$AP:PN = \dots$$

(4)

(Total for Question 19 is 5 marks)

20



P 7 2 7 9 0 A 0 2 0 2 8

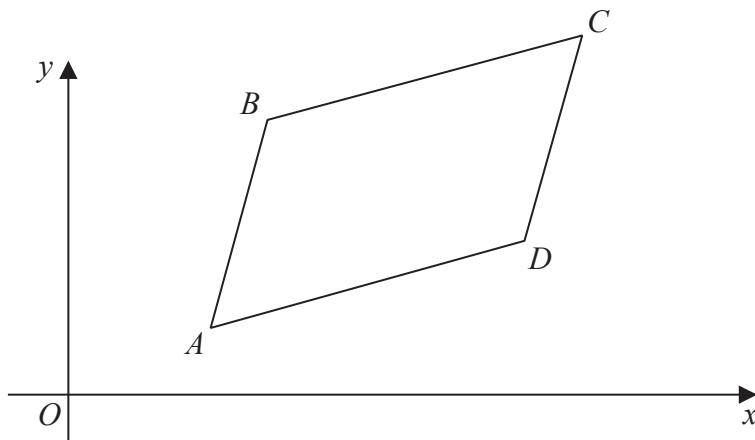


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17 The diagram shows parallelogram $ABCD$.



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

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 17 is 5 marks)



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19 OAB is a triangle.

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

The point C lies on OA such that $OC : CA = 1 : 2$

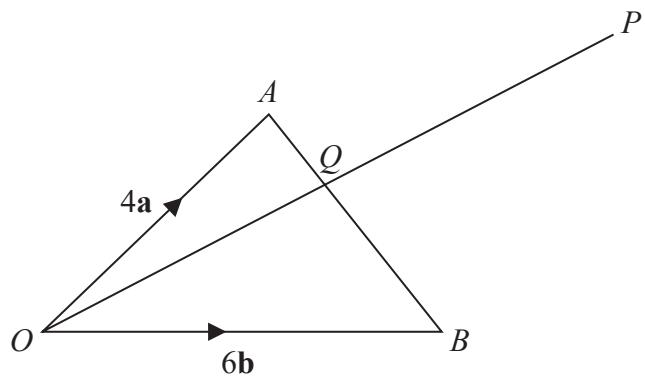
The point D lies on OB such that $OD : DB = 1 : 2$

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

(Total for Question 19 is 3 marks)



21

Diagram NOT
accurately drawn

OAB is a triangle.

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

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

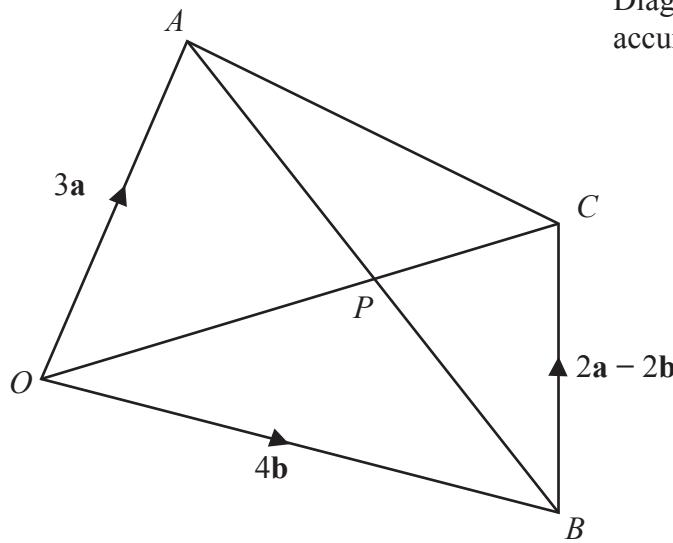
Using a vector method, find the ratio $AQ:QB$

$$AQ:QB = \dots$$

(Total for Question 21 is 5 marks)



P 6 8 7 9 8 R A 0 2 1 2 4

Diagram NOT
accurately drawn

$OACB$ is a quadrilateral.

$$\overrightarrow{OA} = 3\mathbf{a} \quad \overrightarrow{OB} = 4\mathbf{b} \quad \overrightarrow{BC} = 2\mathbf{a} - 2\mathbf{b}$$

(a) (i) Find the vector \overrightarrow{OC} in terms of \mathbf{a} and \mathbf{b}
Simplify your answer.

$$\overrightarrow{OC} = \dots \quad (1)$$

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

$$\overrightarrow{AB} = \dots \quad (1)$$



The point P lies on AB and on OC

(b) Using a vector method, find the ratio $AP : PB$
Show your working clearly.

.....
(3)

(Total for Question 22 is 5 marks)



P 7 3 4 6 9 A 0 2 1 2 4

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22 $ABCDEF$ is a regular hexagon.

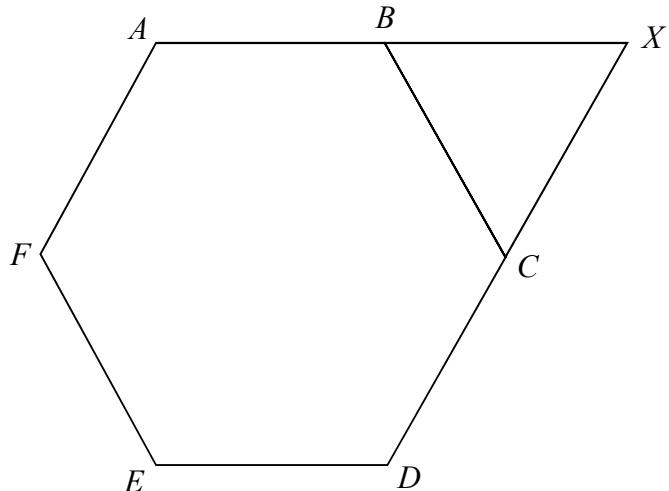


Diagram **NOT**
accurately drawn

ABX and DCX are straight lines.

$$\overrightarrow{AB} = \mathbf{a} \quad \overrightarrow{BC} = \mathbf{b}$$

Find \overrightarrow{EX} in terms of \mathbf{a} and \mathbf{b} .

Give your answer in its simplest form.

(Total for Question 22 is 4 marks)



P 5 9 0 2 2 A 0 2 5 2 8

22 The diagram shows triangle OAB

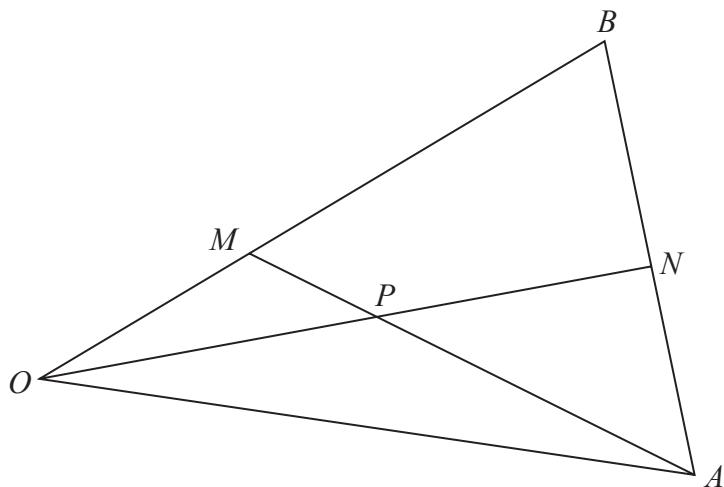


Diagram NOT
accurately drawn

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

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.

$$\overrightarrow{OP} = \dots$$

(Total for Question 22 is 5 marks)



22 The diagram shows triangle OAB with OA extended to E

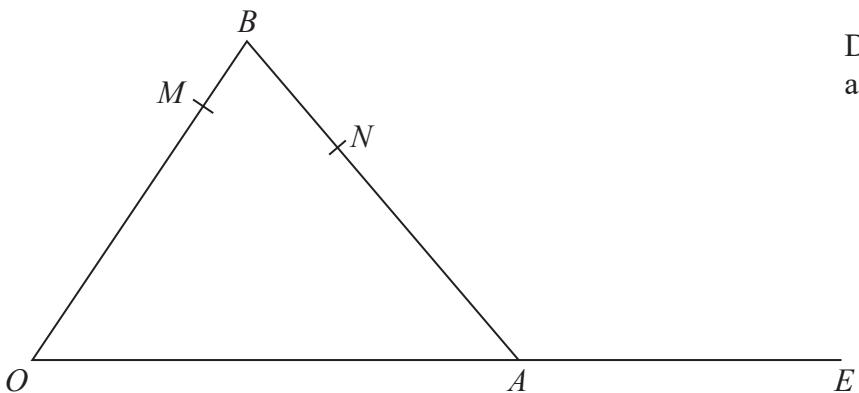


Diagram **NOT**
accurately drawn

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

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.

$$\overrightarrow{ON} = \dots \quad (2)$$



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(b) Use a vector method to show that MNE is a straight line.

(3)

(Total for Question 22 is 5 marks)



P 7 2 4 3 8 A 0 2 5 2 8

23 OAB is a triangle.

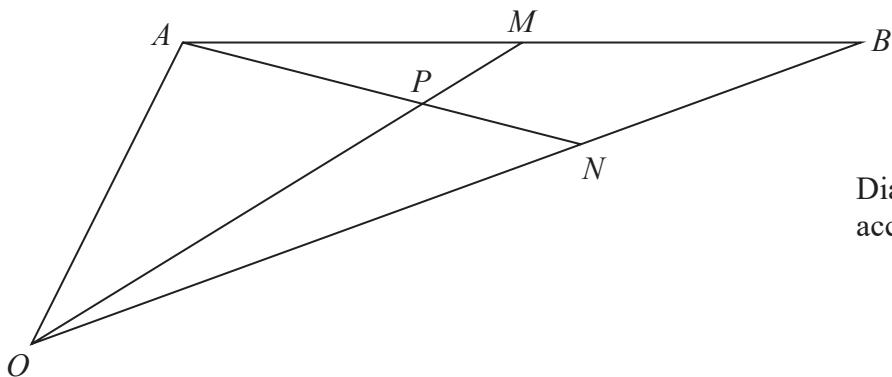


Diagram NOT
accurately drawn

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

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.

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(Total for Question 23 is 6 marks)



23 $ABCD$ is a trapezium.

$$\vec{DC} = 3\vec{AB}$$

$$\vec{DA} = \begin{pmatrix} -2 \\ 3 \end{pmatrix} \quad \vec{DB} = \begin{pmatrix} -1 \\ 7 \end{pmatrix}$$

Find the exact magnitude of \vec{BC}

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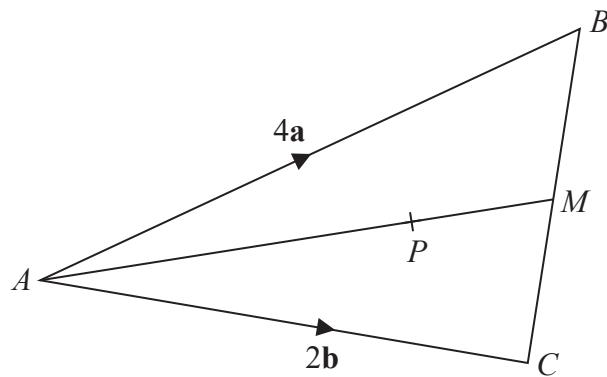
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(Total for Question 23 is 5 marks)



23

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 23 is 3 marks)



23 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 $\overrightarrow{OB} = 2\overrightarrow{BE}$

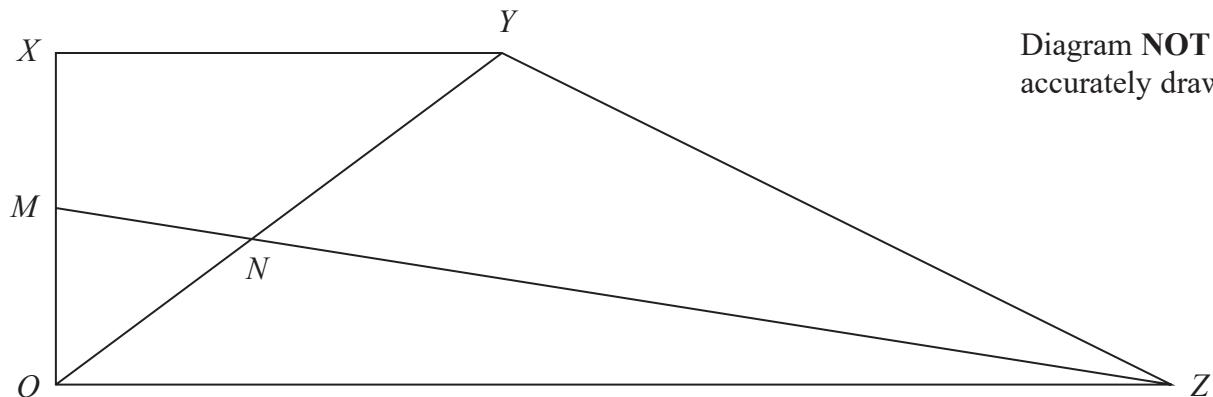
Using a vector method, prove that the points C , D and E lie on the same straight line.

(Total for Question 23 is 5 marks)



P 5 9 0 1 4 A 0 2 3 2 4

24 $OXYZ$ 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

$$\lambda = \dots$$

(Total for Question 24 is 5 marks)



24 $OAED$ is a quadrilateral.

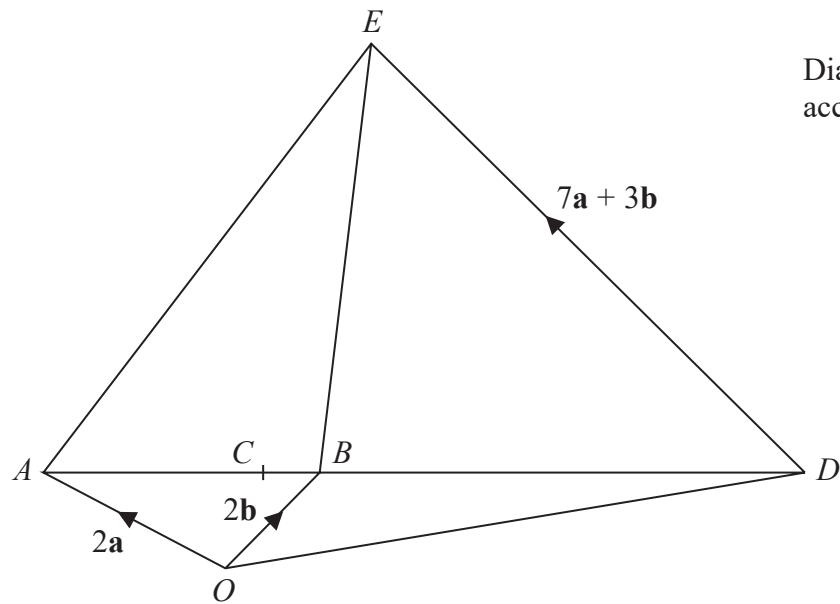


Diagram NOT
accurately drawn

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

$$AB : BD = 1 : 2$$

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

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

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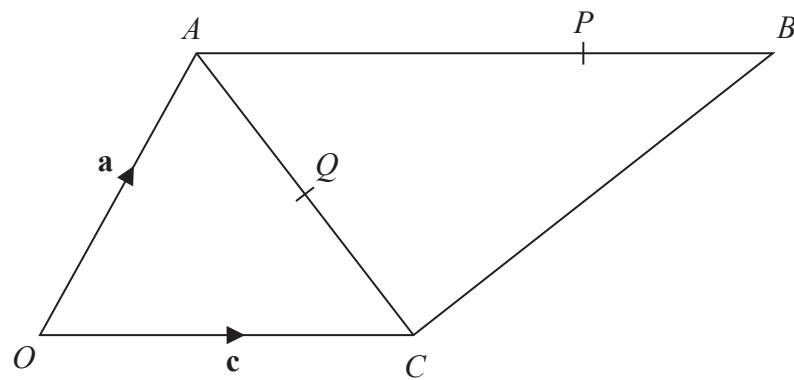
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(Total for Question 24 is 5 marks)



24

Diagram NOT
accurately drawn

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

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.

$$AQ : QC = \dots$$

(Total for Question 24 is 5 marks)



P 6 0 2 6 0 A 0 2 3 2 4

25 $ABCD$ is a parallelogram and ADM is a straight line.

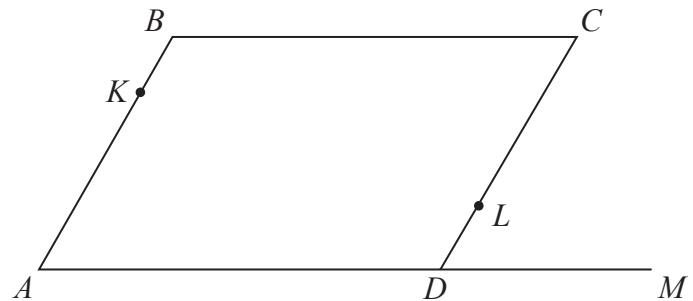


Diagram **NOT**
accurately drawn

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

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

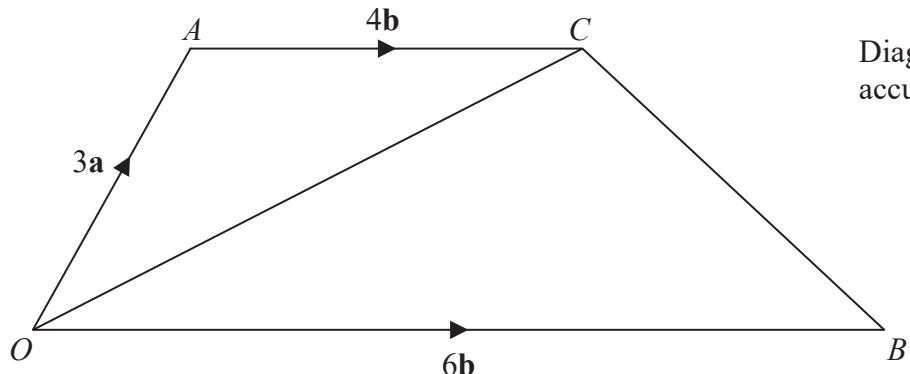
$$\lambda = \dots$$

$$\mu = \dots$$

(Total for Question 25 is 5 marks)



26 The diagram shows trapezium $OACB$.



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

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

Find \vec{ON} as a simplified expression in terms of \mathbf{a} and \mathbf{b} .

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(Total for Question 26 is 5 marks)



26 $OACB$ is a trapezium.

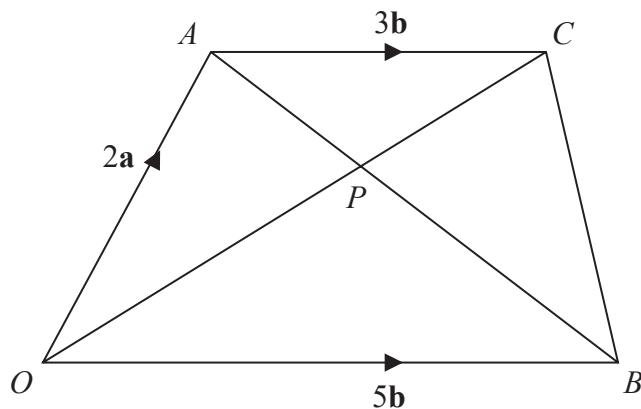


Diagram **NOT**
accurately drawn

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

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

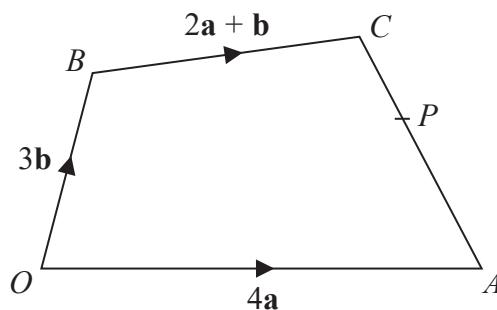
Find and simplify an expression, in terms of \mathbf{a} and \mathbf{b} , for \overrightarrow{OP}
Show your working clearly.

$$\overrightarrow{OP} = \dots$$

(Total for Question 26 is 5 marks)



24

Diagram NOT
accurately drawn

The diagram shows a quadrilateral $OACB$ in which

$$\overrightarrow{OA} = 4\mathbf{a} \quad \overrightarrow{OB} = 3\mathbf{b} \quad \overrightarrow{BC} = 2\mathbf{a} + \mathbf{b}$$

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

$$\overrightarrow{AC} = \dots \quad (2)$$

The point P lies on AC such that $AP:PC = 3:2$

The point Q is such that OPQ and BCQ are straight lines.

(b) Using a vector method, find \overrightarrow{OQ} in terms of \mathbf{a} and \mathbf{b}
Give your answer in its simplest form.
Show your working clearly.

$$\overrightarrow{OQ} = \dots \quad (4)$$

(Total for Question 24 is 6 marks)



24 OAB is a triangle.

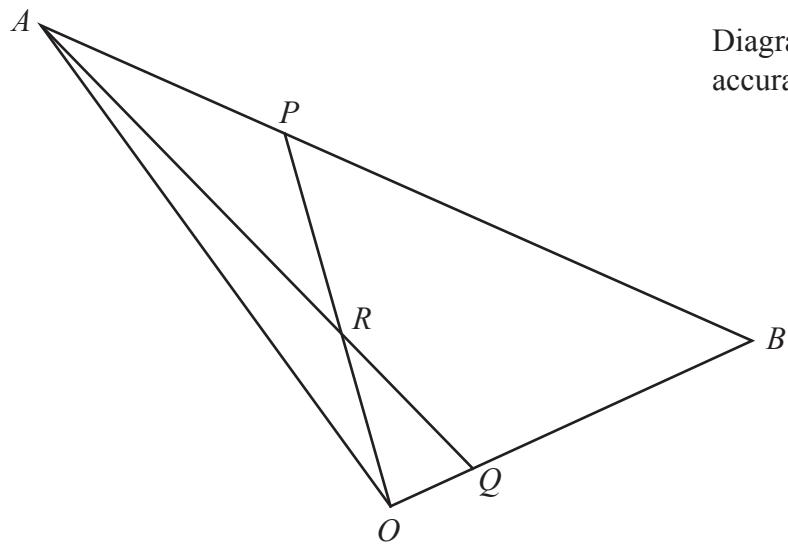


Diagram NOT
accurately drawn

$$\overrightarrow{OA} = 10\mathbf{a} \quad \overrightarrow{OB} = 10\mathbf{b}$$

ARQ and ORP are straight lines.

$$\overrightarrow{AP} = \frac{1}{4} \overrightarrow{AB} \quad \text{and} \quad \overrightarrow{OQ} = \frac{1}{5} \overrightarrow{OB}$$

Write the following vectors in terms of \mathbf{a} and \mathbf{b}
Simplify your answers.

(i) \overrightarrow{AQ}

.....
(1)

(ii) \overrightarrow{OP}

.....
(1)

(iii) \overrightarrow{OR}

.....
(4)

(Total for Question 24 is 6 marks)



25 $OPQR$ is a parallelogram.

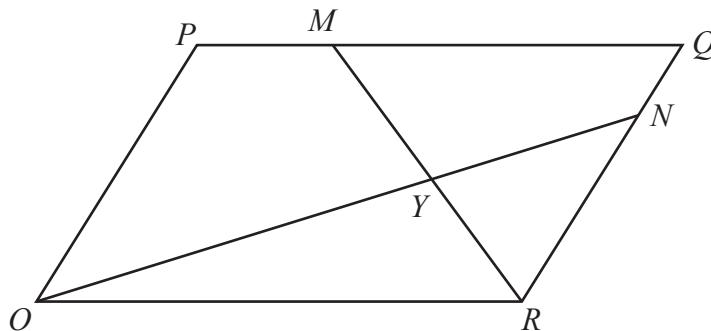


Diagram **NOT**
accurately drawn

$$\overrightarrow{OP} = 2\mathbf{a} \quad \text{and} \quad \overrightarrow{OR} = 3\mathbf{b}$$

The point M lies on PQ such that $PM = \frac{1}{4} PQ$

The point N lies on RQ such that $RN = \frac{4}{5} RQ$

(a) Find, in terms of \mathbf{a} and \mathbf{b} , giving your answers in simplest form

(i) \overrightarrow{ON}

(1)

(ii) \overrightarrow{MR}

(1)

MR and ON intersect at the point Y

Given that

$$OY = k \times ON$$

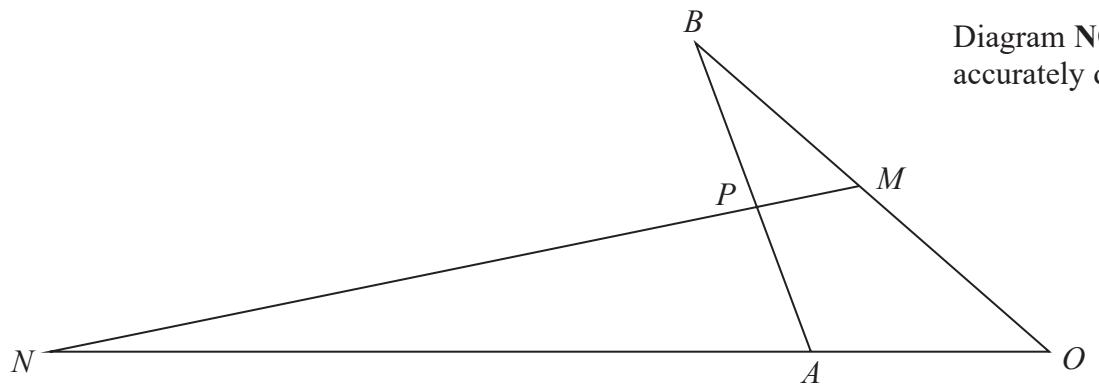
(b) use a vector method to find the value of k

$k = \dots$

(4)

(Total for Question 25 is 6 marks)



25**Diagram NOT
accurately drawn**

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.

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(Total for Question 25 is 5 marks)

