

Vectors

Please write clearly in block capitals

Forename:

Surname:

Materials

For this paper you must have:

- mathematical instruments



You **can** use a calculator.

Instructions

- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer all questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

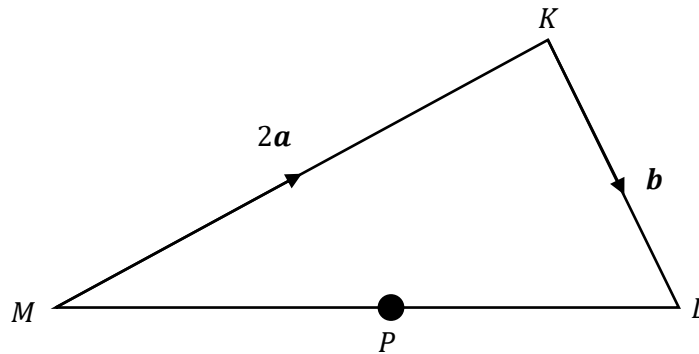
Information

- The marks for questions are shown in brackets.
- You may ask for graph paper, tracing paper and more answer paper. These must be tagged securely to this answer book.

Advice

- In all calculations, show clearly how you work out your answer.

- 1 KLM is a scalene triangle.



Not drawn accurately

Point P is half way along \overline{ML} .

$$\overline{MK} = 2\mathbf{a}, \quad \overline{KL} = \mathbf{b}.$$

- 1(a) Write the vector \overline{ML} in terms of \mathbf{a} and \mathbf{b} .

[1 mark]

Answer _____

- 1(b) Find \overline{MP} in terms of \mathbf{a} and \mathbf{b} .

[1 mark]

Answer _____

- 1(c) A new point N is to the right of L .

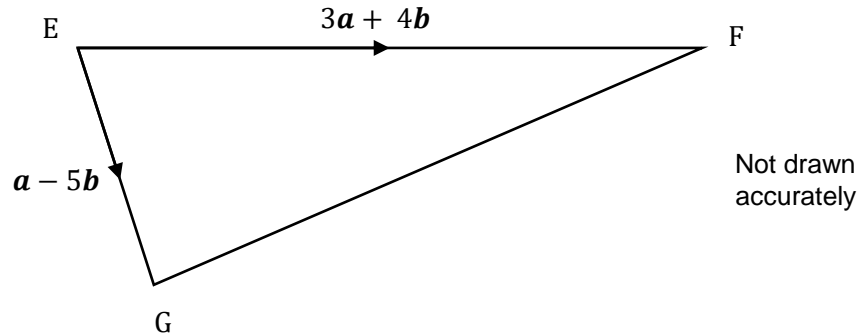
\overline{MN} is 4 times the length of \overline{MP} .

Write \overline{MN} in terms of \mathbf{a} and \mathbf{b} .

[1 mark]

Answer _____

2 EFG is a scalene triangle.



$$\vec{EG} = a - 5b, \quad \vec{EF} = 3a + 4b.$$

\vec{GH} , not shown, is 3 times the length of and parallel to \vec{GF} .

Find \vec{GH} in terms of a and b .

[3 marks]

Answer _____



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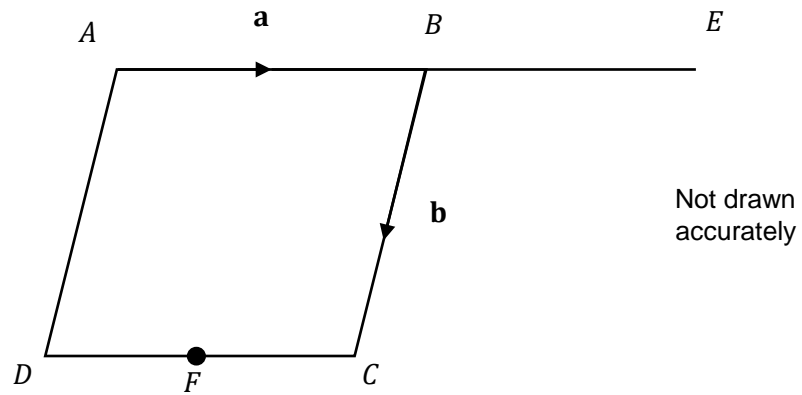
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Turn over ►

- 3 $ABCD$ is a rhombus. Opposite sides are parallel.



\overrightarrow{BE} is an extension of \overrightarrow{AB} , such that $AB : BE = 4 : 3$

The point F is halfway along \overline{CD}

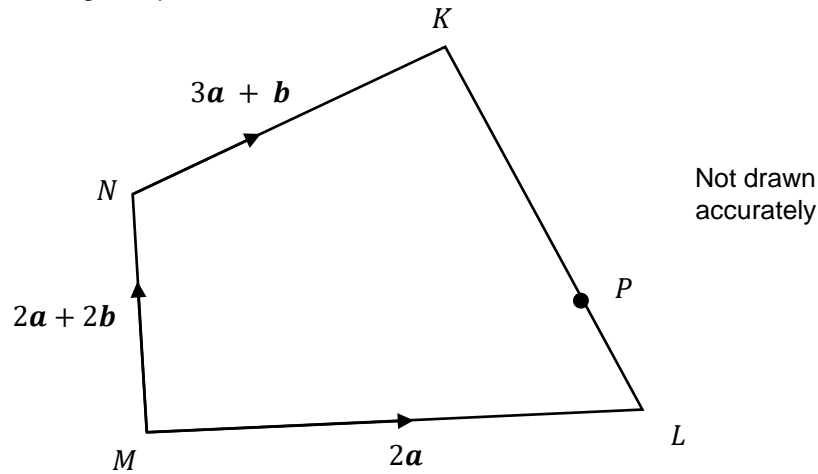
Find \overrightarrow{FE} in terms of \mathbf{a} and \mathbf{b} .

[3 marks]

Answer _____

Turn over for next question

- 4 $KLMN$ is an irregular quadrilateral.



$$\overrightarrow{ML} = 2\mathbf{a}, \quad \overrightarrow{MN} = 2\mathbf{a} + 2\mathbf{b}, \quad \overrightarrow{NK} = 3\mathbf{a} + \mathbf{b}.$$

Point P is positioned such that $LP : PK = 1 : 2$

- 4(a) Find the vector \overrightarrow{LK} in terms of \mathbf{a} and \mathbf{b} .

[2 marks]

Answer _____

- 4(b) Show that $\overrightarrow{MP} = \overrightarrow{NK}$.

[4 marks]

Answer _____

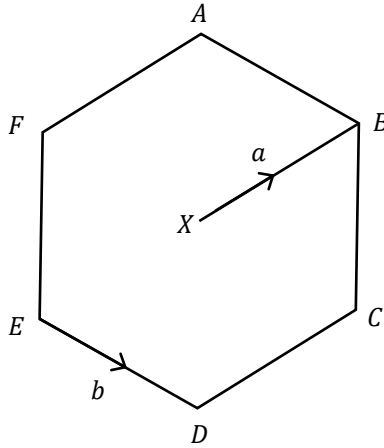
Turn over for next question

5 The diagram below shows a regular hexagon $ABCDEF$.

X is the point at the center of the hexagon.

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

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



Not drawn
accurately

Write down the following vectors in terms of \mathbf{a} and \mathbf{b} .

5(a)

$$\overrightarrow{BC}$$

[1 mark]

5(b)

$$\overrightarrow{BE}$$

[1 mark]

5(c)

$$\overrightarrow{AE}$$

[1 mark]

5(d)

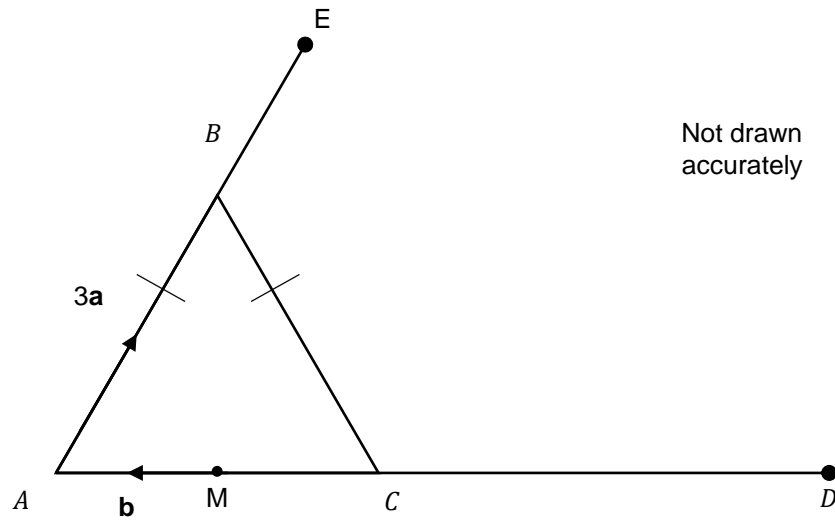
$$\overrightarrow{FB}$$

[1 mark]

Turn over for next question

Turn over ►

6 ABC is an isosceles triangle.



Point M is halfway along the triangle base, AC .

Point D is positioned such that AC and AD are collinear.

Point E is positioned such that AB and AE are collinear.

$AB:BE = 3:2$

$\vec{MA} = \mathbf{b}$, $\vec{AB} = 3\mathbf{a}$, $\vec{AD} = 2\vec{AC}$.

Find \vec{DE} in terms of \mathbf{a} and \mathbf{b} .

[4 marks]

Answer _____

Turn over for next question.

Turn over ►

7 On the diagram below:

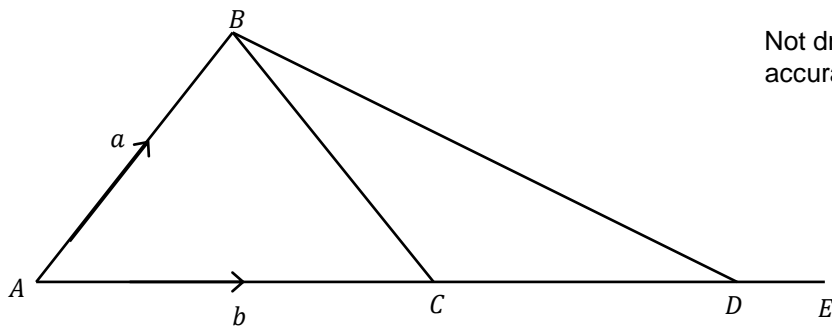
AE is a straight line

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

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

$$AC = CE$$

$$DE = \frac{1}{4}CE$$



Not drawn accurately

Find expressions for the vectors below in terms of \mathbf{a} and \mathbf{b} .

7(a) \overrightarrow{BC}

[1 mark]

Answer _____

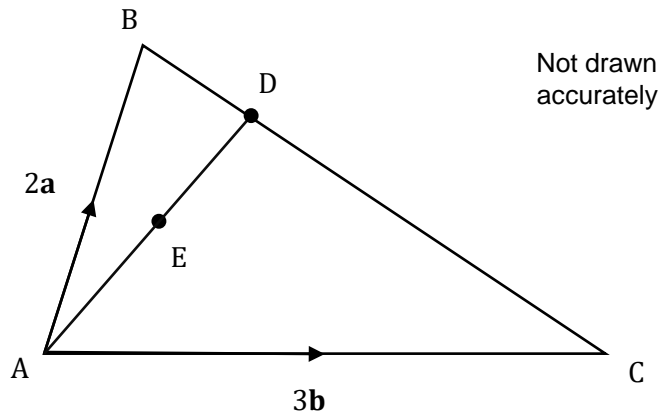
7(b) \overrightarrow{DB}

[4 marks]

Answer _____

Turn over for next question

- 8 ABC is a scalene triangle.



$$\vec{AC} = 3\mathbf{b}, \quad \vec{AB} = 2\mathbf{a}.$$

Point D is positioned such that $BD:DC = 1:3$

Point E is positioned such that $AE:ED = 1:1$

Find \vec{AE} in terms of \mathbf{a} and \mathbf{b} .

[5 marks]

Answer _____

Turn over for next question

9 On the diagram below:

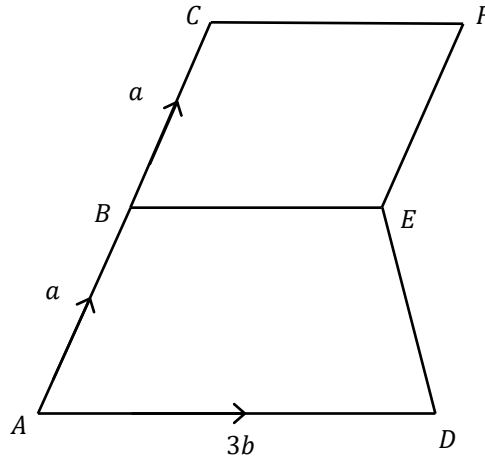
$$\overrightarrow{AB} = \overrightarrow{BC} = \mathbf{a}$$

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

AE is a straight line

$CBEF$ is a parallelogram

$$AD:BE:CF = 3:2:2$$



Not drawn
accurately

Find expressions for the vectors below in terms of \mathbf{a} and \mathbf{b} .

9(a)

$$\overrightarrow{DC}$$

[1 mark]

Answer _____

9(b)

$$\overrightarrow{FD}$$

[2 marks]

Answer _____

Question continues on next page

9(c) DE is extended upwards until it hits the line CF .

The point of intersection is X .

What is the ratio $CX:XF$?

[3 marks]

Answer _____



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Turn over ►

10 On the diagram below:

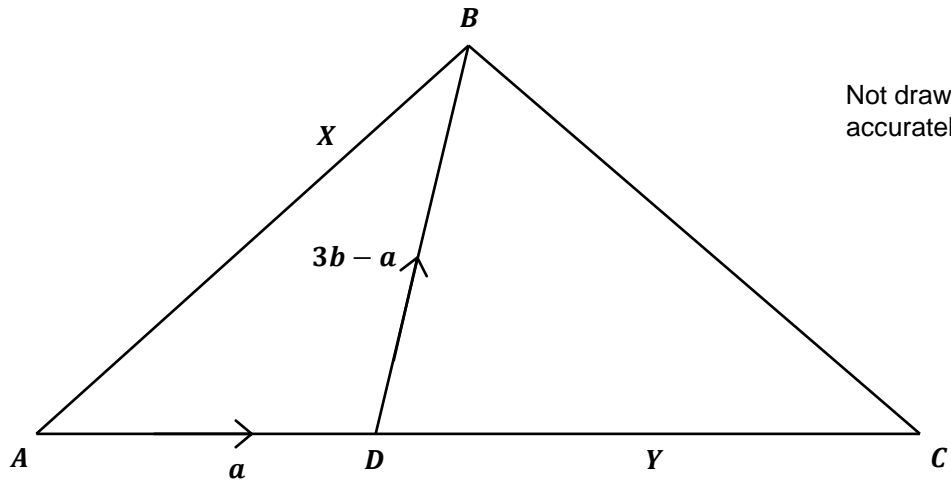
$$\overrightarrow{AD} = \mathbf{a}$$

$$\overrightarrow{DB} = 3\mathbf{b} - \mathbf{a}$$

AC and AB are straight lines

$$AD:DY:YC = 1:1:1$$

$$AX:XB = 2:1$$



Show that XY is parallel to BC .

[3 marks]

Answer _____

End of Questions