GCSE MATHEMATICS

Higher tier

Geometry and measures

Topic test – Vectors

v1.0

Name _____

Materials

For this paper you must have:
- Mathematical instruments
- A calculator.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 38.

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

For Teacher's Use	
Pages	Mark
2 - 3	
4 - 5	
6 - 7	
8 - 9	
10 - 11	
TOTAL	

1 $\mathbf{a} = \begin{pmatrix} -3 \\ 5 \end{pmatrix}$ $\mathbf{b} = \begin{pmatrix} -2 \\ 3 \end{pmatrix}$

Work out $\mathbf{b} - \mathbf{a}$

[2 marks]

Answer $\begin{pmatrix} \_\_ \\ \_\_ \end{pmatrix}$

2 $\mathbf{a} = \begin{pmatrix} 2 \\ -10 \end{pmatrix}$ $\mathbf{b} = \begin{pmatrix} 6 \\ -2 \end{pmatrix}$ $\mathbf{c} = \begin{pmatrix} 4 \\ 1 \end{pmatrix}$

2 (a) Work out $\mathbf{a} + \mathbf{b} + \mathbf{c}$

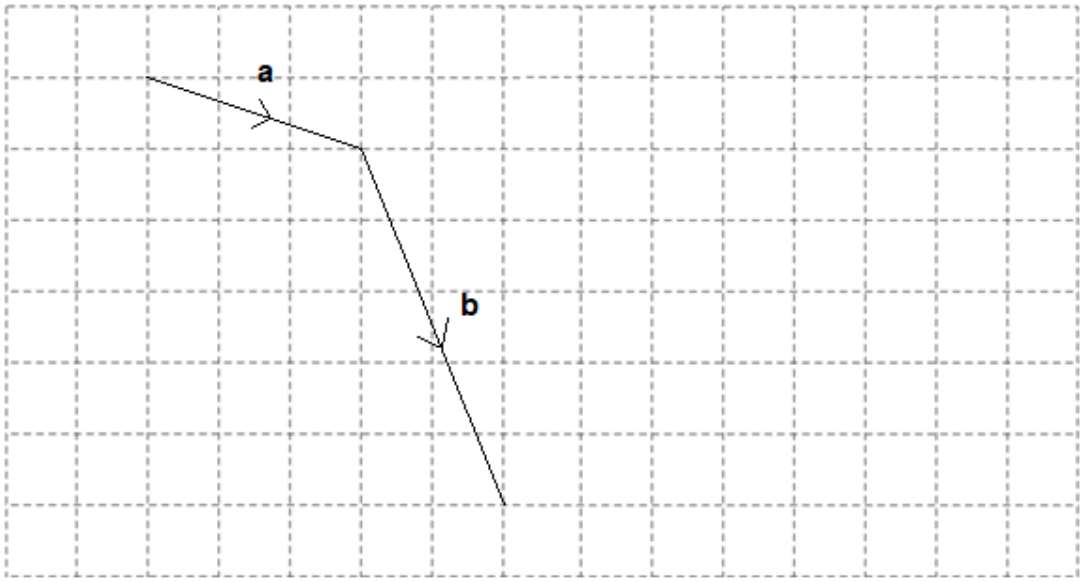
[2 marks]

Answer $\begin{pmatrix} \_\_ \\ \_\_ \end{pmatrix}$

2 (b) Show that $\mathbf{a} + \mathbf{4c}$ is parallel to $\mathbf{b}$.

[2 marks]

3 Vectors **a** and **b** are drawn on a grid.



Write down the column vector that represents $\mathbf{a} + \mathbf{b}$

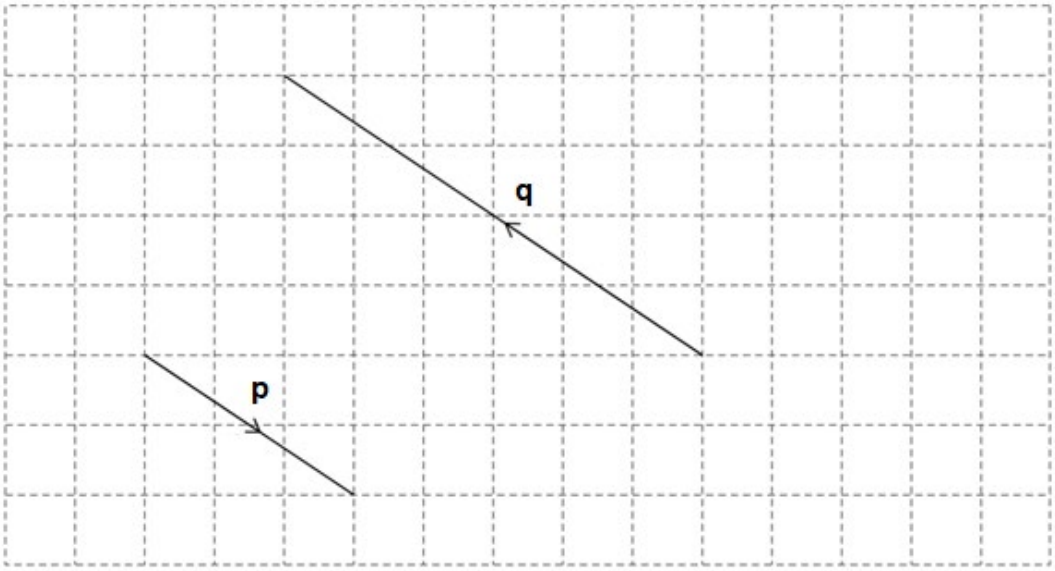
[2 marks]

Answer $\begin{pmatrix} \_\_ \\ \_\_ \end{pmatrix}$

Turn over for the next question

8

4 (a) Vectors **p** and **q** are drawn on a grid.

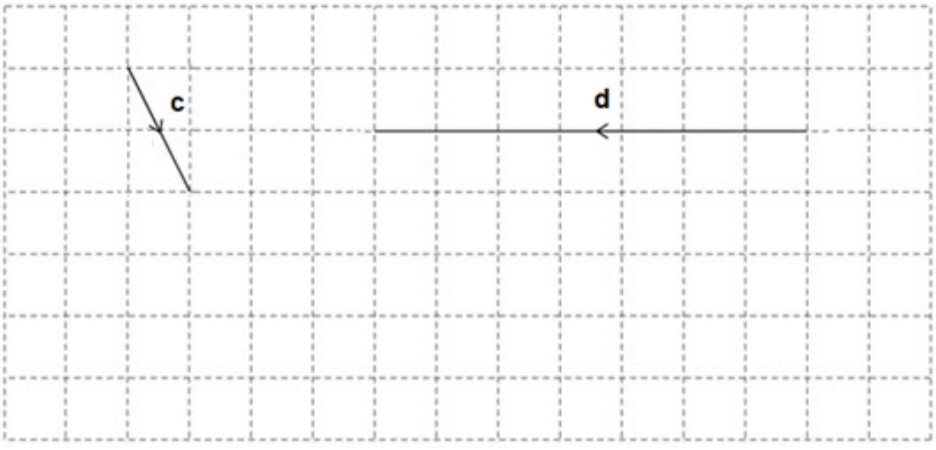


Write **p** in terms of **q**.

[1 mark]

p = _____

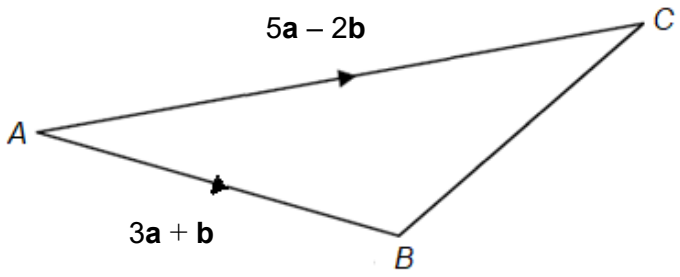
4 (b) Vectors **c** and **d** are drawn on a grid.



On the grid above, draw a vector representing **c** – **d**

[2 marks]

5 Here is triangle *ABC*.



Not drawn accurately

$\overrightarrow{AB} = 3\mathbf{a} + \mathbf{b}$

$\overrightarrow{AC} = 5\mathbf{a} - 2\mathbf{b}$

5 (a) Find the vector $\overrightarrow{BC}$

[2 marks]

Answer _____

5 (b) $\overrightarrow{PQ} = 4\overrightarrow{BC}$

Work out the vector $\overrightarrow{PQ}$

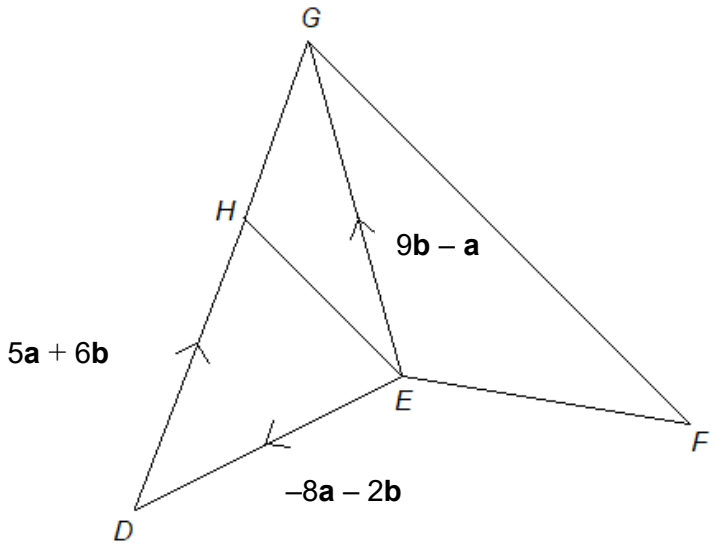
[1 mark]

Answer _____

6

6 Five points are connected by vectors.

$\overrightarrow{FG} = 2\overrightarrow{EH}$



Not drawn accurately

Work out $\overrightarrow{FE}$ in terms of **a** and **b**.

[4 marks]

Answer _____

7 PQR is a straight line.

$PQ : QR = 5 : 1$

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

Not drawn accurately

Write down, in terms of **a**, the vector $\overrightarrow{RQ}$

[1 mark]

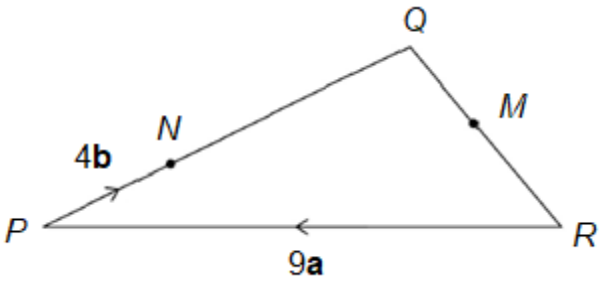
Answer _____

8 In triangle PQR

M is the midpoint of QR

$PN : NQ = 2 : 5$

Not drawn accurately



$\overrightarrow{RP} = 9\mathbf{a}$

$\overrightarrow{PN} = 4\mathbf{b}$

Work out $\overrightarrow{QM}$ in terms of **a** and **b**.

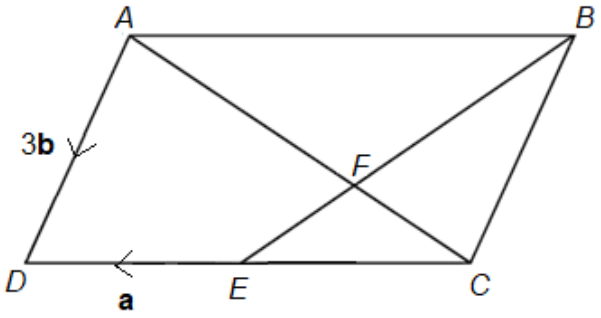
Give your answer in its simplest form.

[3 marks]

Answer _____

8

9 ABCD is a parallelogram.



Not drawn accurately

AFC is a straight line with $AF : FC = 2 : 1$.

E is the midpoint of the straight line *DC*.

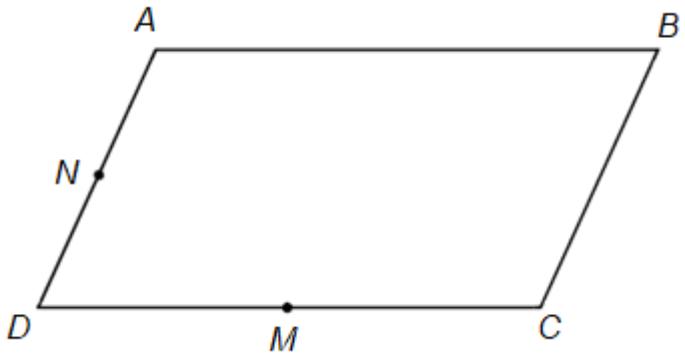
$\overrightarrow{AD} = 3\mathbf{b}$ $\overrightarrow{ED} = \mathbf{a}$

Work out $\overrightarrow{EF}$ in terms of **a** and **b**.

[4 marks]

Answer _____

10 ABCD is a parallelogram.



Not drawn accurately

M is the midpoint of *DC*.

N is the midpoint of *AD*.

$\overrightarrow{AB} = 2\mathbf{a}$ $\overrightarrow{BC} = 3\mathbf{b}$

Show that $\overrightarrow{NM}$ is parallel to $\overrightarrow{AC}$

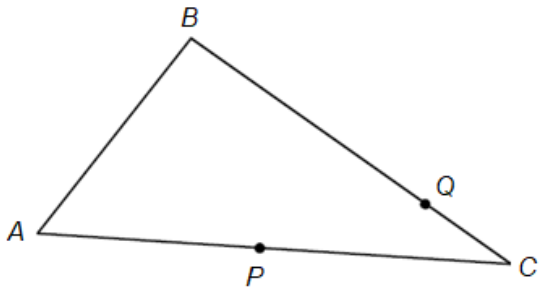
[3 marks]

Answer _____

Turn over for the next question

7

11 ABC is a triangle.



Not drawn accurately

P is the midpoint of *AC*.

Q is a point on *BC* where *BQ* : *QC* = 3 : 1.

$\overrightarrow{BA} = 6\mathbf{a}$ $\overrightarrow{BC} = 8\mathbf{b}$

11 (a) Work out $\overrightarrow{PQ}$ in terms of **a** and **b**.

Give your answer in its simplest form.

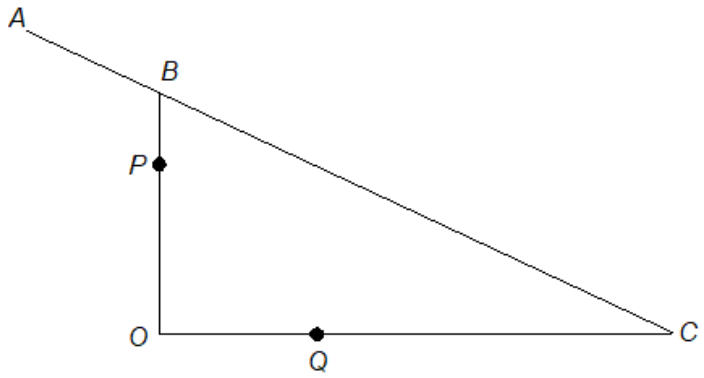
[3 marks]

Answer _____

11 (b) Use your answer to part **(a)** to explain why $\overrightarrow{PQ}$ is not parallel to $\overrightarrow{AB}$

[1 mark]

12 *ABC, BPO* and *OQC* are straight lines.



Not drawn accurately

Q is the point on *OC* such that *OQ* : *QC* = 1 : 2

The ratio of the line *AB* : *BC* is 1 : 3

$\overrightarrow{OC} = 15\mathbf{a}$ $\overrightarrow{OB} = 12\mathbf{b}$ $\overrightarrow{AB} = 5\mathbf{a} - 4\mathbf{b}$ $\overrightarrow{PB} = k\mathbf{b}$ where k is a constant

Given that APQ is a straight line, find the value of k.

You must show your working.

[5 marks]

Answer _____

END OF QUESTIONS

9