1 The vector **a** and the vector **b** are shown on the grid.
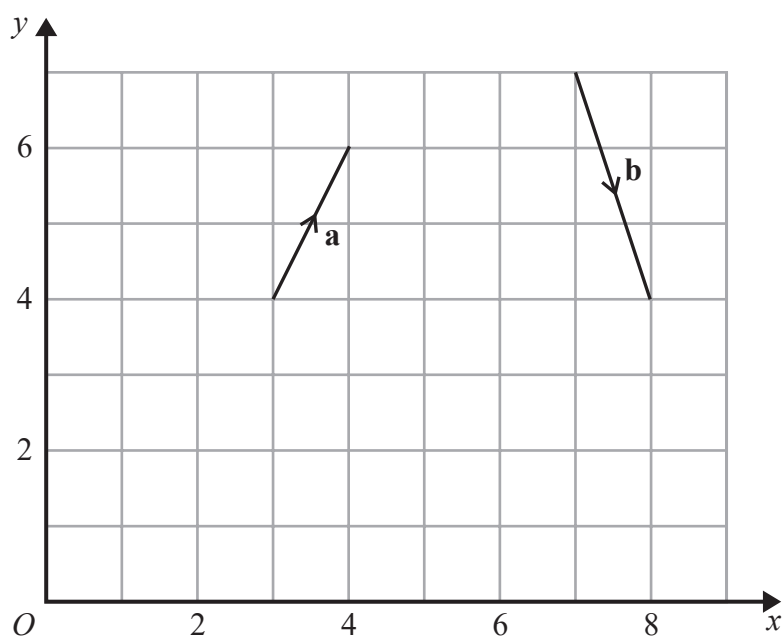

(a) On the grid, draw and label vector –2**a**

(1)

(b) Work out **a** + 2**b** as a column vector.

$$\begin{pmatrix} \rule{1cm}{0.4pt} \\ \rule{1cm}{0.4pt} \end{pmatrix}$$

(2)

(Total for Question 1 is 3 marks)

2 $\mathbf{a} = \begin{pmatrix} 3 \\ 4 \end{pmatrix}$ $\qquad$ $\mathbf{b} = \begin{pmatrix} 5 \\ -2 \end{pmatrix}$

Find $2\mathbf{a} - 3\mathbf{b}$ as a column vector.

$$\begin{pmatrix} \ldots\ldots\ldots \\ \ldots\ldots\ldots \end{pmatrix}$$

(Total for Question 2 is 2 marks)

3 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 3 is 2 marks)

4 **a** and **b** are vectors such that

$$\mathbf{a} = \begin{pmatrix} 2 \\ -3 \end{pmatrix} \qquad \text{and} \qquad 3\mathbf{a} - 2\mathbf{b} = \begin{pmatrix} 8 \\ -17 \end{pmatrix}$$

Find **b** as a column vector.

$$\begin{pmatrix} .... \\ .... \end{pmatrix}$$

(Total for Question 4 is 3 marks)

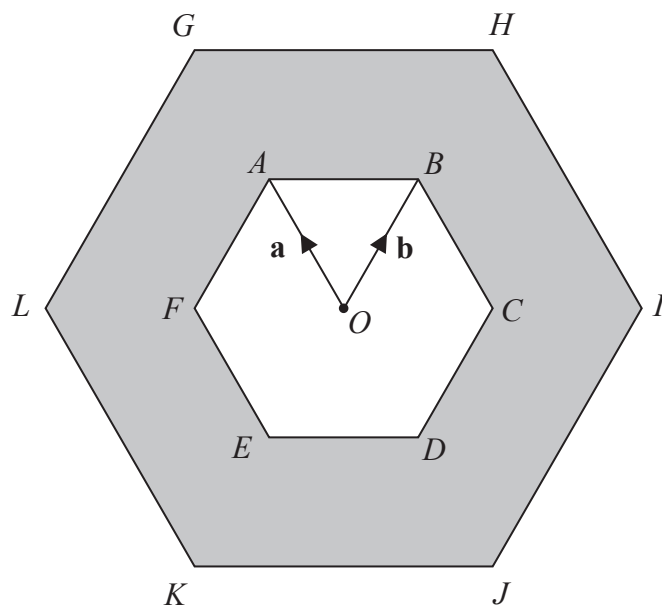**5** *ABCDEF* and *GHIJKL* are regular hexagons each with centre *O*.

Diagram **NOT** accurately drawn

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

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

(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)

(Total for Question 5 is 5 marks)

6 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.

$$\overrightarrow{AC} = \begin{pmatrix} \text{............} \\ \text{............} \end{pmatrix}$$

(Total for Question 6 is 2 marks)

7 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 7 is 3 marks)

8 *A*, *B* and *C* are three points such that

$$\vec{AB} = 3\mathbf{a} + 4\mathbf{b}$$

$$\vec{AC} = 15\mathbf{a} + 20\mathbf{b}$$

(a) Prove that *A*, *B* and *C* lie on a straight line.

(2)

D, *E* and *F* are three points on a straight line such that

$$\vec{DE} = 3\mathbf{e} + 6\mathbf{f}$$

$$\vec{EF} = -10.5\mathbf{e} - 21\mathbf{f}$$

(b) Find the ratio

length of *DF* : length of *DE*

(3)

(Total for Question 8 is 5 marks)
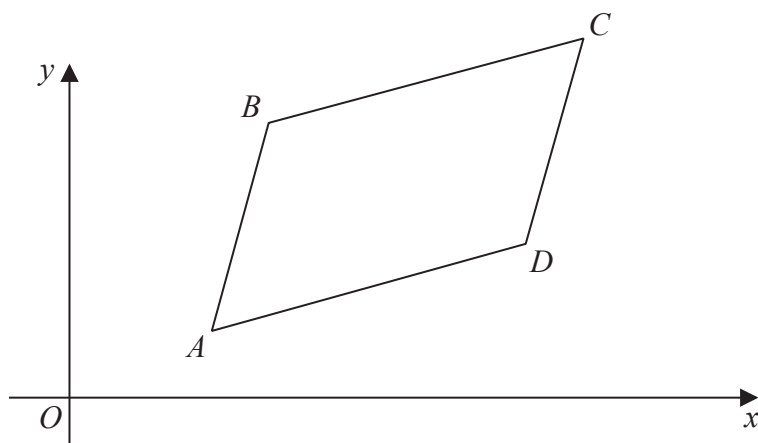
9 The diagram shows parallelogram *ABCD*.

Diagram **NOT** accurately drawn

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

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 9 is 5 marks)