

Name: \_\_\_\_\_

## GCSE (1 – 9)

### Vectors

#### Instructions

- Use **black** ink or ball-point pen.
- Answer all questions.
- Answer the questions in the spaces provided  
– *there may be more space than you need.*
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- You must **show all your working out.**

#### Information

- The marks for each question are shown in brackets  
– *use this as a guide as to how much time to spend on each question.*

#### Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end

1

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

(a) Write down as a column vector

(i)  $\mathbf{a} + \mathbf{b}$        $\begin{pmatrix} 2 \\ 3 \end{pmatrix} + \begin{pmatrix} 1 \\ 5 \end{pmatrix}$

$$\begin{pmatrix} 3 \\ 8 \end{pmatrix}$$

(1)

(ii)  $2\mathbf{a} + 3\mathbf{b}$        $2\begin{pmatrix} 2 \\ 3 \end{pmatrix} + 3\begin{pmatrix} 1 \\ 5 \end{pmatrix}$

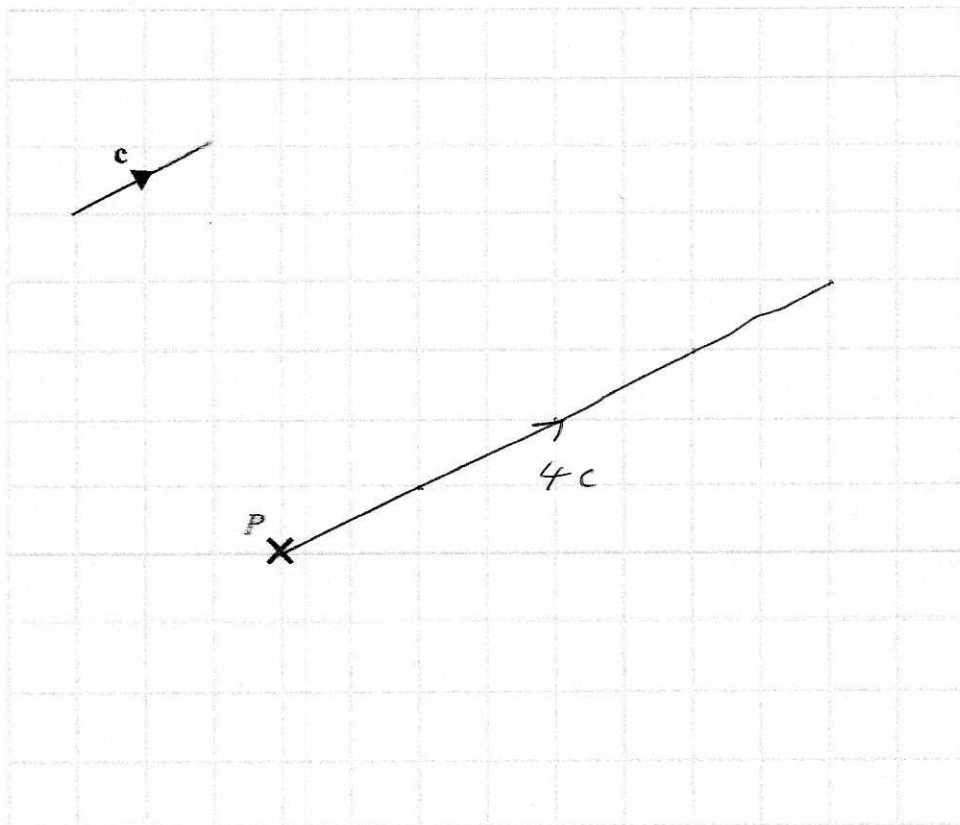
$$\begin{pmatrix} 4 \\ 6 \end{pmatrix} + \begin{pmatrix} 3 \\ 15 \end{pmatrix}$$

$$\begin{pmatrix} 7 \\ 21 \end{pmatrix}$$

(2)

The vector  $\mathbf{c}$  is drawn on the grid.

(b) From the point  $P$ , draw the vector  $4\mathbf{c}$



(1)

(Total for question 1 is 4 marks)

2

$$\mathbf{a} = \begin{pmatrix} 4 \\ 1 \end{pmatrix} \text{ and } \mathbf{b} = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$$

(a) Write down as a column vector

$$(i) \mathbf{a} + \mathbf{b} \quad \begin{pmatrix} 4 \\ 1 \end{pmatrix} + \begin{pmatrix} 3 \\ 2 \end{pmatrix}$$

$$\begin{pmatrix} 7 \\ 3 \end{pmatrix}$$

(1)

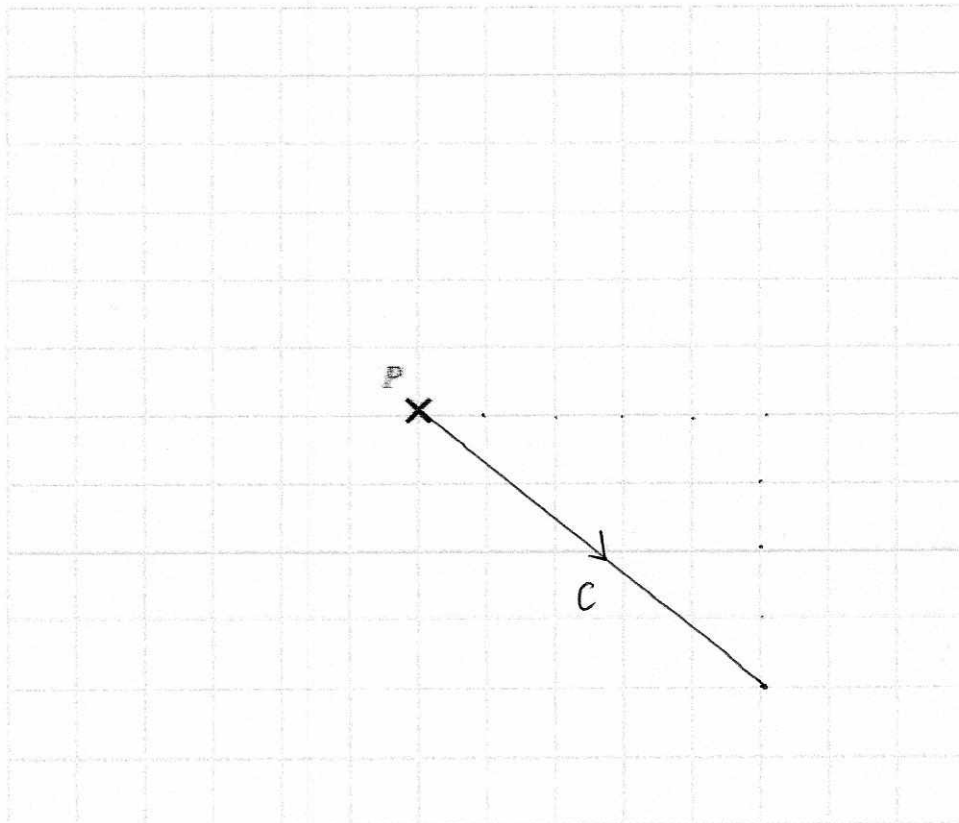
$$(ii) 2\mathbf{a} - \mathbf{b} \quad 2 \begin{pmatrix} 4 \\ 1 \end{pmatrix} - \begin{pmatrix} 3 \\ 2 \end{pmatrix}$$

$$\begin{pmatrix} 8 \\ 2 \end{pmatrix} - \begin{pmatrix} 3 \\ 2 \end{pmatrix}$$

$$\begin{pmatrix} 5 \\ 0 \end{pmatrix}$$

(2)

$$\mathbf{c} = \begin{pmatrix} 5 \\ -4 \end{pmatrix}$$

(b) From the point  $P$ , draw the vector  $\mathbf{c}$ 

(1)

(Total for question 2 is 4 marks)

3

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

(a) Write down as a column vector

(i)  $\mathbf{a} + \mathbf{b}$        $\begin{pmatrix} -2 \\ 3 \end{pmatrix} + \begin{pmatrix} 5 \\ -1 \end{pmatrix}$

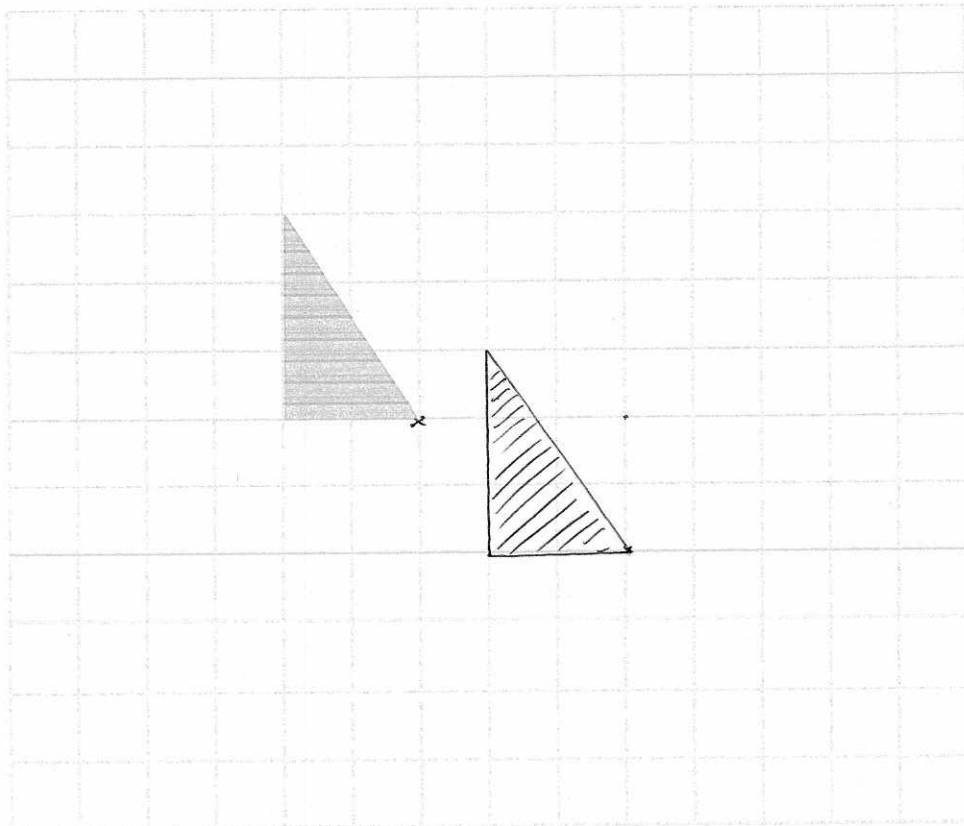
$$\begin{pmatrix} 3 \\ 2 \end{pmatrix}$$

(1)

(ii)  $2\mathbf{a} - \mathbf{b}$        $2 \begin{pmatrix} -2 \\ 3 \end{pmatrix} - \begin{pmatrix} 5 \\ -1 \end{pmatrix}$   
 $\begin{pmatrix} -4 \\ 6 \end{pmatrix} - \begin{pmatrix} 5 \\ -1 \end{pmatrix}$

$$\begin{pmatrix} -9 \\ 7 \end{pmatrix}$$

(2)

(b) Translate the triangle by the vector  $\begin{pmatrix} 3 \\ -2 \end{pmatrix}$ 

(1)

(Total for question 3 is 4 marks)

4  $A$  is the point  $(3, 2)$  and  $B$  is the point  $(4, -1)$ .

(a) Write down as a column vector  $\overrightarrow{AB}$

$$\begin{pmatrix} 4 \\ -1 \end{pmatrix} - \begin{pmatrix} 3 \\ 2 \end{pmatrix}$$

$$\begin{pmatrix} 1 \\ -3 \end{pmatrix}$$

(1)

$C$  is the point  $(5, -2)$  and  $D$  is the point  $(2, 1)$ .

(b) Write down as a column vector  $\overrightarrow{CD}$

$$\begin{pmatrix} 2 \\ 1 \end{pmatrix} - \begin{pmatrix} 5 \\ -2 \end{pmatrix}$$

$$\begin{pmatrix} -3 \\ 3 \end{pmatrix}$$

(1)

**(Total for question 4 is 2 marks)**

5  $A$  is the point  $(5, -1)$  and  $B$  is the point  $(4, -3)$ .

(a) Write down as a column vector  $\overrightarrow{AB}$

$$\begin{pmatrix} 4 \\ -3 \end{pmatrix} - \begin{pmatrix} 5 \\ -1 \end{pmatrix}$$

$$\begin{pmatrix} -1 \\ -2 \end{pmatrix}$$

(1)

$C$  is the point  $(1, 6)$  and  $D$  is the point  $(-3, 9)$ .

(b) Write down as a column vector  $\overrightarrow{CD}$

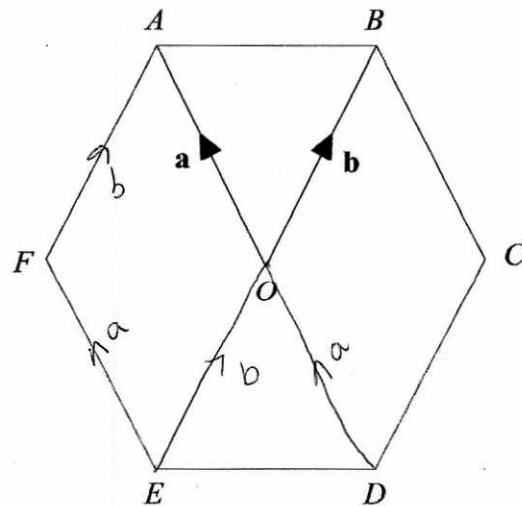
$$\begin{pmatrix} -3 \\ 9 \end{pmatrix} - \begin{pmatrix} 1 \\ 6 \end{pmatrix}$$

$$\begin{pmatrix} -4 \\ 3 \end{pmatrix}$$

(1)

**(Total for question 5 is 2 marks)**

6  $ABCDEF$  is a regular hexagon with centre  $O$ .



$$\vec{OA} = a$$

$$\vec{OB} = b$$

(a) Find, in terms of  $a$ , the vector  $\vec{AD}$

$$\frac{-2a}{(1)}$$

(b) Find, in terms of  $a$  and  $b$ , the vector  $\vec{AB}$

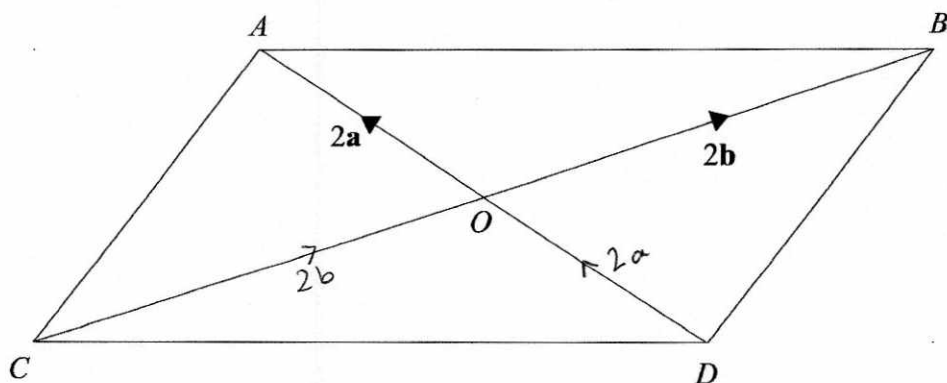
$$\frac{-a + b}{(1)}$$

(c) Find, in terms of  $a$  and  $b$ , the vector  $\vec{AF}$

$$\frac{-b}{(1)}$$

(Total for question 6 is 3 marks)

7 The diagram shows a parallelogram.



$$\vec{OA} = 2a$$

$$\vec{OB} = 2b$$

(a) Find, in terms of a, the vector  $\vec{DA}$

$$\frac{4a}{(1)}$$

(b) Find, in terms of a and b, the vector  $\vec{AB}$

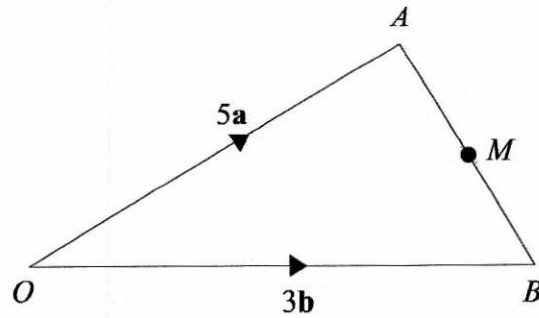
$$\frac{-2a + 2b}{(1)}$$

(c) Find, in terms of a and b, the vector  $\vec{AC}$

$$\frac{-2a - 2b}{(1)}$$

(Total for question 7 is 3 marks)

8



$$\vec{OA} = 5a$$

$$\vec{OB} = 3b$$

M is the midpoint of AB

(a) Find, in terms of a and b, the vector  $\vec{AB}$

$$\frac{-5a + 3b}{(1)}$$

(b) Find, in terms of a and b, the vector  $\vec{AM}$

half of  $\vec{AB}$

$$\frac{-\frac{5}{2}a + \frac{3}{2}b}{(1)}$$

(c) Find, in terms of a and b, the vector  $\vec{OM}$

$$5a - \frac{5}{2}a + \frac{3}{2}b$$

or  $5a - 2.5a + 1.5b$

$$\frac{\frac{5}{2}a + \frac{3}{2}b}{(1)}$$

(Total for question 8 is 3 marks)