

Vectors

ANSWERS

Ruler | 30 minutes | Total marks: 24

Name _____ Class _____

1

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

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

Answer $\begin{pmatrix} 2 \\ 3 \end{pmatrix}$ (1) [1 mark]

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

$$\begin{pmatrix} 6 \\ -4 \end{pmatrix} - \begin{pmatrix} -1 \\ 5 \end{pmatrix} \quad (1)$$

Answer $\begin{pmatrix} 7 \\ -9 \end{pmatrix}$ (1) [2 marks]

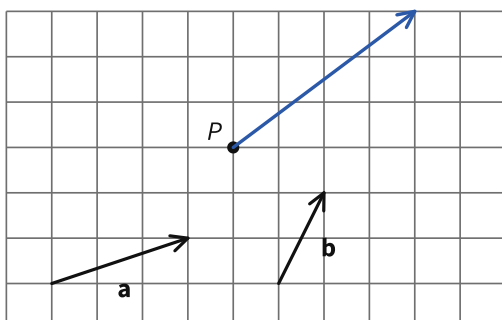
(c) Work out the magnitude of the vector $\begin{pmatrix} 6 \\ 8 \end{pmatrix}$

$$\sqrt{6^2 + 8^2} \quad (1)$$

Answer 10 (1) [2 marks]

2

The grid shows the vectors $\mathbf{a}$ and $\mathbf{b}$.



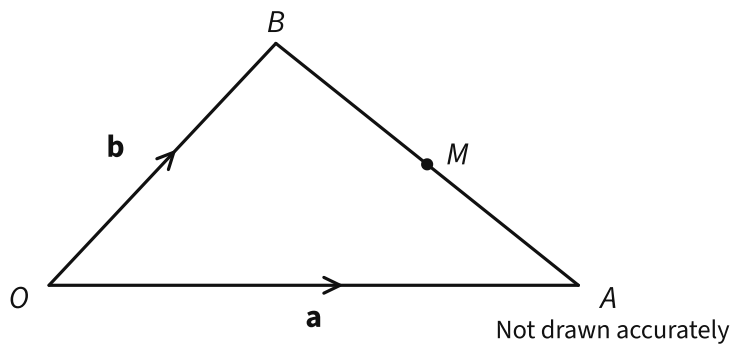
On the grid, draw the vector $\mathbf{a} + \mathbf{b}$ starting at the point P .

4 across (1) 3 up (1) [2 marks]

3

In triangle OAB , the vector from O to A is $\mathbf{a}$ and the vector from O to B is $\mathbf{b}$.

M is the midpoint of AB .



- (a) Write the vector from A to B in terms of $\mathbf{a}$ and $\mathbf{b}$.

Answer $\mathbf{b} - \mathbf{a}$ (1)

[1 mark]

- (b) Write the vector from O to M in terms of $\mathbf{a}$ and $\mathbf{b}$.

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

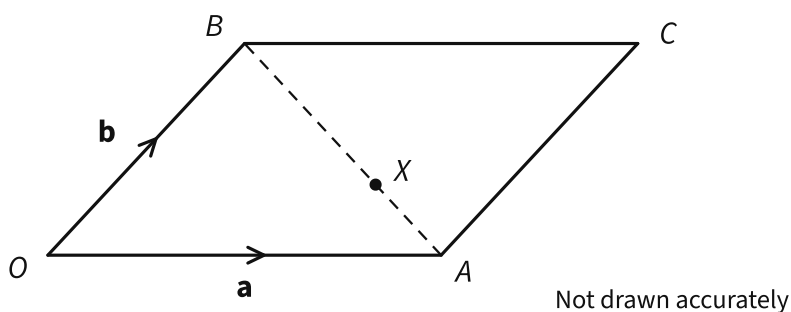
Answer $\frac{1}{2}\mathbf{a} + \frac{1}{2}\mathbf{b}$ (1)

[2 marks]

4

$OACB$ is a parallelogram. The vector from O to A is $\mathbf{a}$ and the vector from O to B is $\mathbf{b}$.

X is the point on AB such that $AX : XB = 1 : 2$



(a) Write the vector from O to C in terms of $\mathbf{a}$ and $\mathbf{b}$.

Answer $\mathbf{a} + \mathbf{b}$ (1) [1 mark]

(b) Write the vector from A to B in terms of $\mathbf{a}$ and $\mathbf{b}$.

Answer $\mathbf{b} - \mathbf{a}$ (1) [1 mark]

(c) Write the vector from O to X in terms of $\mathbf{a}$ and $\mathbf{b}$.

Give your answer in its simplest form.

$$AX = \frac{1}{3}(\mathbf{b} - \mathbf{a}) \text{ (1)}$$

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

Answer $\frac{2}{3}\mathbf{a} + \frac{1}{3}\mathbf{b}$ (1) [3 marks]

5

$$\mathbf{p} = \begin{pmatrix} 4 \\ 6 \end{pmatrix} \quad \mathbf{q} = \begin{pmatrix} 6 \\ 9 \end{pmatrix}$$

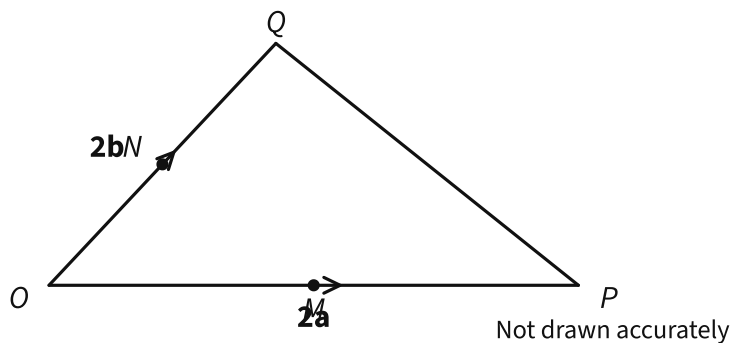
Show that $\mathbf{p}$ and $\mathbf{q}$ are parallel.

$$\mathbf{q} = 1.5\mathbf{p} \text{ (1)}$$

One is a multiple of the other, so they are parallel (1)

[2 marks]

- 6 In triangle OPQ , the vector from O to P is $2\mathbf{a}$ and the vector from O to Q is $2\mathbf{b}$.
 M is the midpoint of OP and N is the midpoint of OQ .



Prove that MN is parallel to PQ and half its length.

$$\begin{aligned} MN &= -\mathbf{a} + \mathbf{b} = \mathbf{b} - \mathbf{a} \quad (1)(1) \\ PQ &= -2\mathbf{a} + 2\mathbf{b} = 2(\mathbf{b} - \mathbf{a}) \quad (1) \\ PQ &= 2 \times MN, \text{ so they are parallel and } MN \text{ is half as long } (1) \end{aligned}$$

[4 marks]

- 7 The vector from O to A is $\mathbf{a}$, from O to B is $\mathbf{b}$ and from O to C is $3\mathbf{b} - 2\mathbf{a}$.
 Show that A , B and C lie on a straight line.

$$\begin{aligned} AB &= \mathbf{b} - \mathbf{a} \quad (1) \\ AC &= 3\mathbf{b} - 3\mathbf{a} = 3(\mathbf{b} - \mathbf{a}) \quad (1) \\ AC &\text{ is a multiple of } AB \text{ and both start at } A \quad (1) \end{aligned}$$

[3 marks]

Question	Topic	RAG
1	I can calculate with column vectors and find a magnitude	
2	I can draw the sum of two vectors	
3	I can write vectors in a triangle, including to a midpoint	
4	I can find a vector to a point that divides a line in a ratio	
5	I can show that two vectors are parallel	
6	I can complete a vector proof	
7	I can show that three points lie on a straight line	