

Exercise walk-through

Vectors in two dimensions ■ E7.2

eXercise

You must be able to

- add, subtract and multiply column vectors by a scalar
- find the magnitude of a vector
- use $\overrightarrow{AB} = \mathbf{b} - \mathbf{a}$

Method — Working with vectors

■ **Add/scale:** $\mathbf{a} = \begin{pmatrix} 3 \\ 1 \end{pmatrix}$, $\mathbf{b} = \begin{pmatrix} 2 \\ -4 \end{pmatrix}$

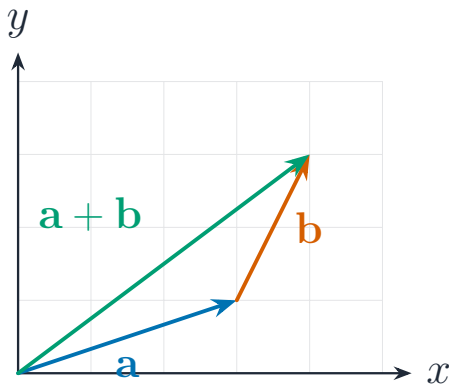
$$\rightarrow \mathbf{a} + \mathbf{b} = \begin{pmatrix} 5 \\ -3 \end{pmatrix}; 3\mathbf{a} = \begin{pmatrix} 9 \\ 3 \end{pmatrix}.$$

■ **Magnitude 模:** $\left| \begin{pmatrix} x \\ y \end{pmatrix} \right| = \sqrt{x^2 + y^2}$

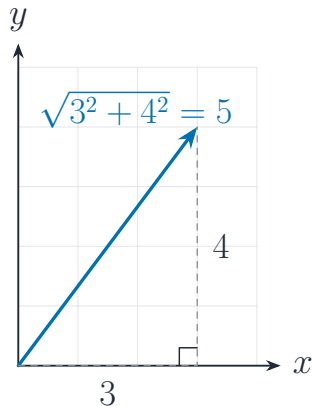
$$\rightarrow \left| \begin{pmatrix} 3 \\ 4 \end{pmatrix} \right| = 5.$$

■ **Position vectors:** $\overrightarrow{AB} = \mathbf{b} - \mathbf{a}$.

Answer shapes: **M1** a correct method,
A1 the correct answer.



Method — Working with vectors



The magnitude (length) of a vector

Practice 2.1 ■ 1 mark

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

Solution 2.1

Method: Working with vectors

Worked steps

$$\begin{pmatrix} 4 + 1 \\ 2 - 3 \end{pmatrix} = \begin{pmatrix} 5 \\ -1 \end{pmatrix} \quad \text{B1}.$$

Practice 2.2 ■ 1 mark

Find $2\mathbf{a}$ for $\mathbf{a} = \begin{pmatrix} 3 \\ -1 \end{pmatrix}$.

Solution 2.2

Method: Working with vectors

Worked steps

$$\begin{pmatrix} 6 \\ -2 \end{pmatrix} \quad \text{B1.}$$

Practice 2.3 ■ 2 marks

Find the magnitude of $\begin{pmatrix} 6 \\ 8 \end{pmatrix}$.

Solution 2.3

Method: Working with vectors

Worked steps

$$\sqrt{6^2 + 8^2} = \sqrt{100} = 10 \quad \text{M1 A1 for } \sqrt{36 + 64}; \text{ for } 10.$$

Exam-style 3.1 ■ 2 marks

$$\mathbf{a} = \begin{pmatrix} 5 \\ 2 \end{pmatrix} \text{ and } \mathbf{b} = \begin{pmatrix} 1 \\ 6 \end{pmatrix}. \text{ Find } \mathbf{a} - \mathbf{b}.$$

Solution 3.1

Method: Working with vectors

Worked steps

$$\begin{pmatrix} 5 - 1 \\ 2 - 6 \end{pmatrix} = \begin{pmatrix} 4 \\ -4 \end{pmatrix} \quad \text{M1 A1 for subtracting components.}$$

Exam-style 3.2 ■ 3 marks

The position vector of A is $\begin{pmatrix} 1 \\ 3 \end{pmatrix}$ and of B is $\begin{pmatrix} 7 \\ 11 \end{pmatrix}$. Find $\overrightarrow{AB}$ and its magnitude.

Solution 3.2

Method: Working with vectors

Worked steps

$$\overrightarrow{AB} = \mathbf{b} - \mathbf{a} = \begin{pmatrix} 6 \\ 8 \end{pmatrix}; \text{ magnitude} = \sqrt{6^2 + 8^2} = 10 \quad \text{M1 M1 A1 for } \mathbf{b} - \mathbf{a}; \text{ for } \sqrt{36 + 64}; \text{ for } \begin{pmatrix} 6 \\ 8 \end{pmatrix} \text{ and } 10.$$