VECTORS: MAGNITUDE AND DIRECTION

lesson link: parkermaths.com/y1vectors

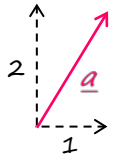
Objectives

- To calculate the magnitude and direction of a vector.

Vector Notation

Here are some way we will represent vectors:

Using a **diagram**



Using **column vector** notation

$\underline{a} = \begin{pmatrix} 1 \\ 2 \end{pmatrix}$

Using **unit vector** notation

$\underline{a} = \underline{i} + 2\underline{j}$

Unit Vectors

$\underline{i}$ and $\underline{j}$ represent unit vectors:

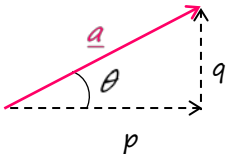
$$\underline{i} = \begin{pmatrix} 1 \\ 0 \end{pmatrix} \text{ and } \underline{j} = \begin{pmatrix} 0 \\ 1 \end{pmatrix}$$

Note: The directions of $\underline{i}$ and $\underline{j}$ are often specified.
e.g.
$\underline{i}$ - east
$\underline{j}$ - north

Magnitude and Direction

The **magnitude** of a vector is its **length**.

If $\underline{a} = \begin{pmatrix} p \\ q \end{pmatrix}$, then $|\underline{a}| = \sqrt{p^2 + q^2}$



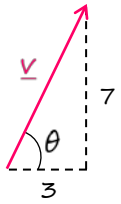
The **direction** of a vector is the **angle** it makes with a specified direction.

2.2e. (a) $\mathbf{v} = 3\mathbf{i} + 7\mathbf{j}$

(i) Find the exact magnitude of **v**.

$|\underline{v}| = \sqrt{3^2 + 7^2}$

$= \sqrt{58}$



(ii) Find the angle that **v** makes with the positive **i** – direction.

$\tan\theta = \frac{7}{3}$

$\theta = 66.8°$ from the +ve i-direction.

2.2p. (a) $\mathbf{w} = 2\mathbf{i} + 6\mathbf{j}$

(i) Find the exact magnitude of **w**.

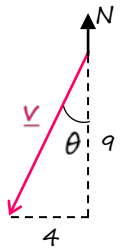
(ii) Find the angle that **w** makes with the positive **i** – direction.

2.2e. (b) $\mathbf{s} = \begin{pmatrix} -4 \\ -9 \end{pmatrix}$

(i) Find the exact magnitude of **s.**

$|\underline{s}| = \sqrt{(-4)^2 + (-9)^2}$

$= \sqrt{97}$



(ii) Find the direction of **s.**

Give your answer as a bearing.

$\tan\theta = \frac{4}{9}$

$\theta = 23.9...$

Bearing $= 180 + 23.9...$

$= 204°$ (3 s.f.)

2.2p. (b) $\mathbf{t} = \begin{pmatrix} 1 \\ -6 \end{pmatrix}$

(i) Find the exact magnitude of **t.**

(ii) Find the direction of **t.**

Give your answer as a bearing.

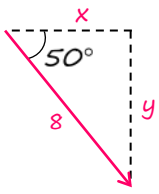
2.3e. Vector **p** has magnitude 8 and makes an angle of 50° below the **i** – direction.

Write **p** as a column vector, correct to 3 significant figures.

$\cos 50° = \frac{x}{8}$

$x = 8\cos 50°$

$= 5.14$ (3 s.f.)



$\sin 50° = \frac{y}{8}$

$y = 8\sin 50°$

$= 6.13$ (3 s.f.)

$\therefore \quad \underline{p} = \begin{pmatrix} 5.14 \\ 6.13 \end{pmatrix}$

2.3e. Vector **q** has magnitude 9 on a bearing of 82°.

Write **q** using unit vector notation, correct to 3 significant figures.