Column Vectors

Starter

1. **(Review of last lesson)** A hemisphere has a base diameter of 24 cm. Find the exact value of the surface area of the hemisphere (i.e. give your answer in terms of π).

Notes

Vectors have both magnitude and direction (e.g. force, acceleration, velocity, displacement)
Scalars just have magnitude (e.g. speed, distance)

1. Notation

Vectors are denoted by an arrow above two letters or bold type

- $\overrightarrow{AB}$ means the vector from point A to point B
- $\mathbf{v}$ — notice the bold lettering

N.B. When writing by hand, we write a tilde ~ (i.e. a squiggle) underneath the letter.

2. Column vectors

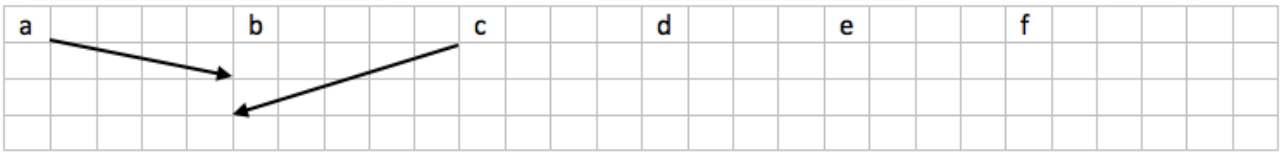
Top number (horizontal translation): ***positive*** is to the ***right*** ***negative*** is to the ***left***
Bottom number (vertical translation): ***positive*** is ***up*** ***negative*** is ***down***

So $\begin{pmatrix} 4 \\ -1 \end{pmatrix} \equiv$ 4 squares ***to the right*** and 1 square ***down***

So $\begin{pmatrix} -5 \\ -2 \end{pmatrix} \equiv$ 5 squares ***to the left*** and 2 squares ***down***

N.B. The vectors are drawn below.
The direction of the arrow is important; without the arrow, it is a line and not a vector.

E.g. 1 Draw these vectors on the grid: (c) $\begin{pmatrix} 3 \\ 2 \end{pmatrix}$ (d) $\begin{pmatrix} -3 \\ 2 \end{pmatrix}$ (e) $\begin{pmatrix} 3 \\ -2 \end{pmatrix}$ (f) $\begin{pmatrix} -3 \\ -2 \end{pmatrix}$



3. Magnitude of a vector

The ***magnitude*** of a vector is its ***length*** (the hypotenuse of the right-angled triangle).

i.e. $\left| \begin{pmatrix} a \\ b \end{pmatrix} \right| = \sqrt{a^2 + b^2}$

Notation: Two straight lines either side of the vector denote magnitude e.g. $\left|\overrightarrow{AB}\right|$ or $|\mathbf{v}|$

E.g. 2 Find the magnitude of: (a) $\begin{pmatrix} -4 \\ 2 \end{pmatrix}$ (b) $\begin{pmatrix} 3 \\ -3 \end{pmatrix}$

Working: (a) $\left| \begin{pmatrix} -4 \\ 2 \end{pmatrix} \right| = \sqrt{(-4)^2 + 2^2} = \sqrt{20} = \sqrt{4 \times 5} = 2\sqrt{5}$

Video: Column vectors

Solutions to Starter and E.g.s

Exercise

9-1 class textbook:	p333 M10.12 Qu 1-4
A*-G class textbook:	p296 E10.1 Qu 1-4
9-1 homework book:	p117 M10.12 Qu 1-4
A*-G homework book:	p86 E10.1 Qu 1-4

Summary

Vectors have both magnitude and direction (e.g. force, acceleration, velocity, displacement)
Scalars just have magnitude (e.g. speed, distance)
Vectors are denoted by an arrow above two letters or bold type

- $\overrightarrow{AB}$ means the vector from point A to point B
- $\mathbf{v}$ — notice the bold lettering

Column vectors:
Top number (horizontal translation): ***positive*** is to the ***right*** ***negative*** is to the ***left***
Bottom number (vertical translation): ***positive*** is ***up*** ***negative*** is ***down***

The ***magnitude*** of a vector is its ***length:*** $\left|\begin{pmatrix} a \\ b \end{pmatrix}\right| = \sqrt{a^2 + b^2}$

Homework book answers (only available during a lockdown)