Calculate magnitude of a vector

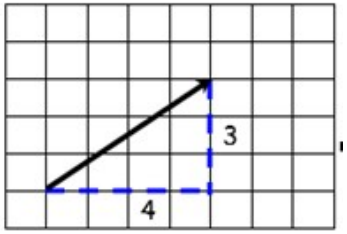
How long is the vector?

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

Magnitude (length) of a vector can be calculated by using Pythagoras' Theorem:

$4^2 + 3^2 = 25$

$\sqrt{25} = 5$



Vector addition

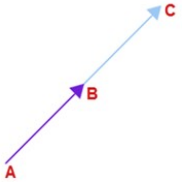
$\begin{pmatrix} 3 \\ 4 \end{pmatrix} + \begin{pmatrix} 1 \\ 5 \end{pmatrix} = \begin{pmatrix} 4 \\ 9 \end{pmatrix}$

Year 11 higher topic 18

Vectors and geometric proof

Prove lines are collinear

Collinear vectors are vectors that are on the **same line**. To show that two vectors are **collinear**, show that one vector is a **multiple** of the other (parallel) **AND** that both vectors **share a point**.



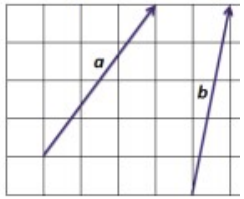
What careers would use these skills?

Airline pilots and sea captains, Doctors tracking the progress of an epidemic, Meteorologists tracking weather systems, Engineers of every kind dealing with forces and motion, Scientists, Astronauts, Gaming and film designers

Represent vectors graphically

The top number tells us how far right along in the direction of the x axis

The bottom number tells us how far up in the direction of the y axis



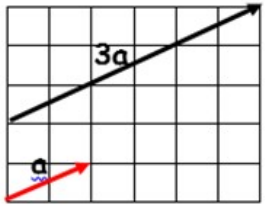
$\boldsymbol{a} = \begin{pmatrix} 3 \\ 4 \end{pmatrix}$ $\boldsymbol{b} = \begin{pmatrix} 1 \\ 5 \end{pmatrix}$

$\begin{pmatrix} 3 \\ 4 \end{pmatrix}$ means '3 right, 4 up'

Multiply vectors by a scale factor

A **scalar** is the **number** we **multiply** a vector by.

$3 \times \begin{pmatrix} 2 \\ 5 \end{pmatrix} = \begin{pmatrix} 6 \\ 15 \end{pmatrix}$



$3\mathbf{a} + 2\mathbf{b} =$

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

$= \begin{pmatrix} 6 \\ 3 \end{pmatrix} + \begin{pmatrix} 8 \\ -2 \end{pmatrix}$

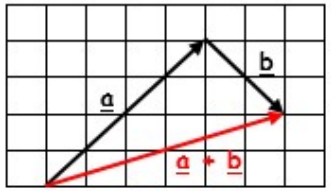
$= \begin{pmatrix} 14 \\ 1 \end{pmatrix}$

Calculate resultant of two vectors

The **resultant** vector is the vector that results from **adding** two or more vectors together.

if $\underline{\mathbf{a}} = \begin{pmatrix} 4 \\ 4 \end{pmatrix}$ and $\underline{\mathbf{b}} = \begin{pmatrix} 2 \\ -2 \end{pmatrix}$

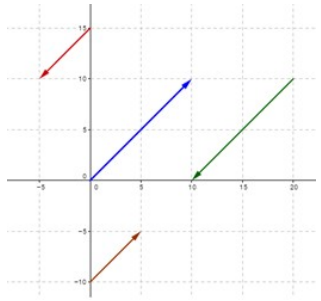
then $\underline{\mathbf{a}} + \underline{\mathbf{b}} = \begin{pmatrix} 4 \\ 4 \end{pmatrix} + \begin{pmatrix} 2 \\ -2 \end{pmatrix} = \begin{pmatrix} 6 \\ 2 \end{pmatrix}$



Prove lines are parallel

Parallel vectors are **multiples** of each other.

$2\mathbf{a}+\mathbf{b}$ and $4\mathbf{a}+2\mathbf{b}$ are parallel as they are multiple of each other



Subtract vectors

$\begin{pmatrix} 3 \\ 4 \end{pmatrix} - \begin{pmatrix} 1 \\ -2 \end{pmatrix} = \begin{pmatrix} 2 \\ 6 \end{pmatrix}$

Express points as position vectors

A vector that starts at the origin is called a position vector. Point A and a position vector **a** and point B has a position vector **b**.

If $a = \begin{pmatrix} 3 \\ 7 \end{pmatrix}$, then the coordinates of A will be (3, 7).

Similarly, if $b = \begin{pmatrix} 8 \\ 4 \end{pmatrix}$, then coordinates of B will be (8, 4)