Vectors

A vector describes a movement of an object from one point to another.
A vector quantity has both magnitude and direction.

Check that you can:

- *add, subtract and multiply negative numbers.*

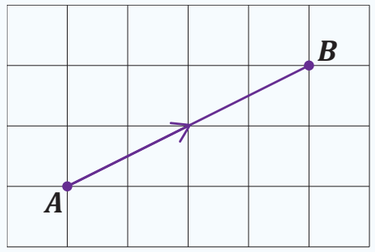
Vector representation

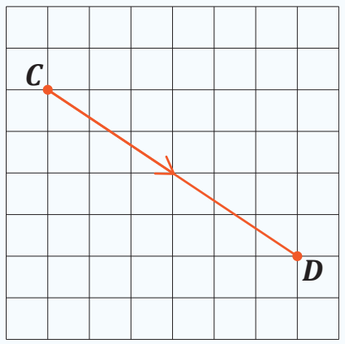
A vector between A and B can be described as $\overrightarrow{AB}$, $\boldsymbol{AB}$, $\boldsymbol{a}$ or $\underline{a}$.

Vectors can be represented using the column vector $\begin{pmatrix} x \\ y \end{pmatrix}$. Where x is the number of moves in the positive horizontal direction, and y is number of moves in the positive vertical direction.

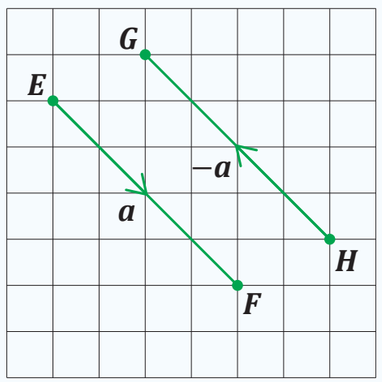
The below vector, $\boldsymbol{AB}$, can be written as $\begin{pmatrix} 4 \\ 2 \end{pmatrix}$.

The vector, $\boldsymbol{CD}$, can be written as $\begin{pmatrix} 6 \\ -4 \end{pmatrix}$.





Vectors, $\boldsymbol{EF}$ and $\boldsymbol{GH}$ are of equal magnitude but opposite direction.



$\boldsymbol{EF} = -\boldsymbol{GH}$

If $\boldsymbol{EF} = \boldsymbol{a}$,
then $\boldsymbol{GH} = -\boldsymbol{a}$

Adding and subtracting vectors

When adding or subtracting vectors either add the corresponding x components and y components or subtract them.

Example 1

If $\boldsymbol{a} = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$ and $\boldsymbol{b} = \begin{pmatrix} -5 \\ 2 \end{pmatrix}$, then,

$$\boldsymbol{a} + \boldsymbol{b} = \begin{pmatrix} 3 \\ 2 \end{pmatrix} + \begin{pmatrix} -5 \\ 2 \end{pmatrix} = \begin{pmatrix} 3 + -5 \\ 2 + 2 \end{pmatrix} = \begin{pmatrix} -2 \\ 4 \end{pmatrix}$$

Example 2

If $\boldsymbol{a} = \begin{pmatrix} 4 \\ 2 \end{pmatrix}$ and $\boldsymbol{b} = \begin{pmatrix} 2 \\ -3 \end{pmatrix}$, then,

$$\boldsymbol{a} - \boldsymbol{b} = \begin{pmatrix} 4 \\ 2 \end{pmatrix} - \begin{pmatrix} 2 \\ -3 \end{pmatrix} = \begin{pmatrix} 4 - 2 \\ 2 - -3 \end{pmatrix} = \begin{pmatrix} 2 \\ 5 \end{pmatrix}$$

REMEMBER!

Vectors have both magnitude and direction.

Scalars have magnitude only.

Negative vectors have the same magnitude but opposite direction.

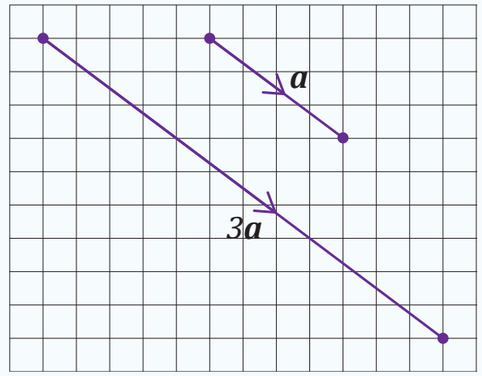
Multiplying vectors

When multiplying a vector by a scalar, multiply both x and y movements by the the scalar.

Example 1

If $\boldsymbol{a} = \begin{pmatrix} 4 \\ -3 \end{pmatrix}$, calculate $3\boldsymbol{a}$.

$$3\boldsymbol{a} = \begin{pmatrix} 3 \times 4 \\ 3 \times -3 \end{pmatrix} = \begin{pmatrix} 12 \\ -9 \end{pmatrix}$$



Example 2

If $\boldsymbol{a} = \begin{pmatrix} -10 \\ 8 \end{pmatrix}$, calculate $\frac{1}{2}\,\boldsymbol{a}$.

$$\frac{1}{2}\,\boldsymbol{a} = \begin{pmatrix} -10 \div 2 \\ 8 \div 2 \end{pmatrix} = \begin{pmatrix} -5 \\ 4 \end{pmatrix}$$