Position and Displacement Vectors

Starter

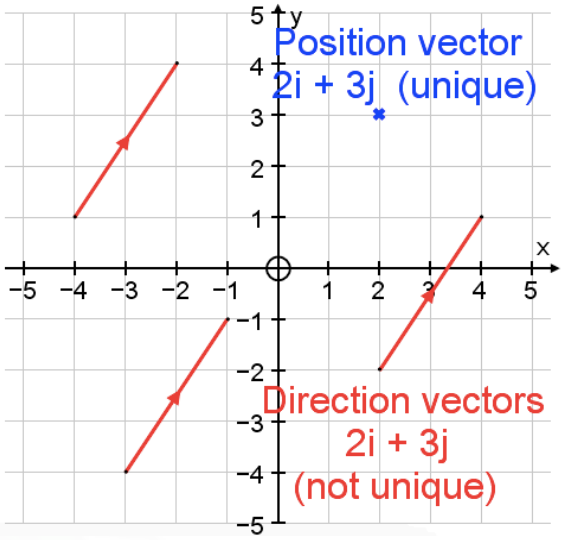
1. **(Review of last lesson)** Given that $\mathbf{a} = 2\mathbf{i} + 5\mathbf{j}$ and $\mathbf{b} = 3\mathbf{i} - \mathbf{j}$, find:
   (a) λ if $\mathbf{a} + \lambda\mathbf{b}$ is parallel to the vector $\mathbf{i}$
   (b) μ if $\mu\mathbf{a} + \mathbf{b}$ is parallel to the vector $\mathbf{j}$.

Notes

Position vectors

A position vector is a unique point in space with respect to the origin.

So the point P(2, 3) has position vector $\overrightarrow{OP} = \begin{pmatrix} 2 \\ 3 \end{pmatrix}$



Displacement (or direction) vectors

A displacement vector is a vector that connects two points.

The displacement vector $\begin{pmatrix} 2 \\ 3 \end{pmatrix}$ is not unique and can be placed anywhere in space. Obviously all the displacement vectors $\begin{pmatrix} 2 \\ 3 \end{pmatrix}$ are parallel.

The distinction between position and displacement vectors is not hugely important but it does allow the addition of points and vectors which is the key idea.

$\overrightarrow{AB} = \mathbf{b} - \mathbf{a}$ "the vector from A to B is $\mathbf{b} - \mathbf{a}$"

Finding the displacement vector between two points

E.g. 1 Find the displacement vector from the point $A(1, 5)$ to $B(4, 3)$.

Working: $\overrightarrow{AB} = \begin{pmatrix} 4 \\ 3 \end{pmatrix} - \begin{pmatrix} 1 \\ 5 \end{pmatrix} = \begin{pmatrix} 3 \\ -2 \end{pmatrix}$

Distance between two points

We can find the distance between two points by finding the magnitude of the direction vector between the two points i.e. $\left|\overrightarrow{AB}\right| = \left|\mathbf{b} - \mathbf{a}\right|$.

E.g. 2 Find the distance between the points $P(6, 2)$ and $Q(1, -10)$.

Video: Position vectors
Video: Vector notation

Solutions to Starter and E.g.s

Exercise

p236 12C Qu 2i, 4i, 5-6

Summary

A ***position vector*** is a unique point in space with respect to the origin.
A ***displacement vector*** is a vector that connects two points.

$\overrightarrow{AB} = \mathbf{b} - \mathbf{a}$ "the vector from A to B is $\mathbf{b} - \mathbf{a}$"

Distance between two points: $\left|\overrightarrow{AB}\right| = \left|\mathbf{b} - \mathbf{a}\right|$.