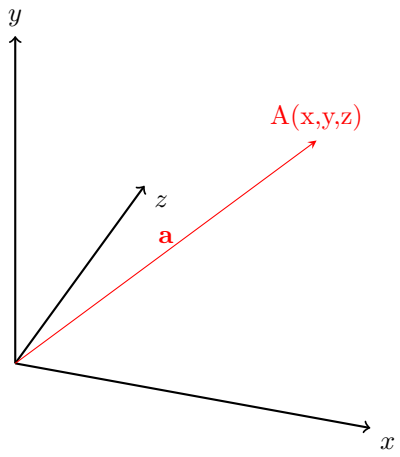
Differentiation

1 3D Vectors



$\overrightarrow{OA} = xi + yj + zk$

$\overrightarrow{OA} = \begin{pmatrix} x \\ y \\ z \end{pmatrix}$

Magnitude of $\overrightarrow{OA}$

$|\overrightarrow{OA}| = \sqrt{x^2 + y^2 + z^2}$

The vector between two vectors

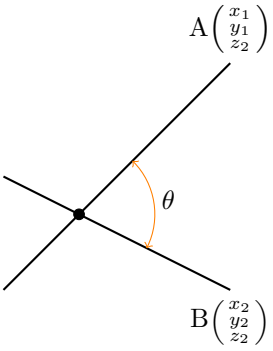
$\overrightarrow{OA} = \begin{pmatrix} x_1 \\ y_1 \\ z_1 \end{pmatrix} \quad \overrightarrow{OB} = \begin{pmatrix} x_2 \\ y_2 \\ z_2 \end{pmatrix}$

$|\overrightarrow{AB}| = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2 + (z_2 - z_1)^2}$

2 Vector dot product

$\mathbf{a} = \begin{pmatrix} x_1 \\ y_1 \\ z_1 \end{pmatrix} \quad \mathbf{b} = \begin{pmatrix} x_2 \\ y_2 \\ z_2 \end{pmatrix}$

$\mathbf{a}\cdot\mathbf{b} = x_1x_2 + y_1y_2 + z_1z_2$



$$\cos\theta = \frac{\mathbf{a}\cdot\mathbf{b}}{|\mathbf{a}||\mathbf{b}|}$$

2.1 Perpendicular vectors

$\cos 90 = 0$

$$\cos\theta = \frac{\mathbf{a}\cdot\mathbf{b}}{|\mathbf{a}||\mathbf{b}|}$$

$\mathbf{a}\cdot\mathbf{b} = 0$

2.2 Parallel vectors

$\theta = 1 \quad \cos\theta = 1$

$\mathbf{a}\cdot\mathbf{b} = |\mathbf{a}||\mathbf{b}|$

3 Vector equation of a straight line

Types of situation:

1. Through one point parallel to a given vector

Find the equation of the line through ***a*** *which is parallel to* ***b***

r=a+tb

2. A line through two points

Find the equation of a line through a and b

$\mathbf{r} = \mathbf{a} + t(\mathbf{b} - \mathbf{a})$