Edexcel A level Mathematics Vectors

Section 1: Vectors in three dimensions

Notes and Examples

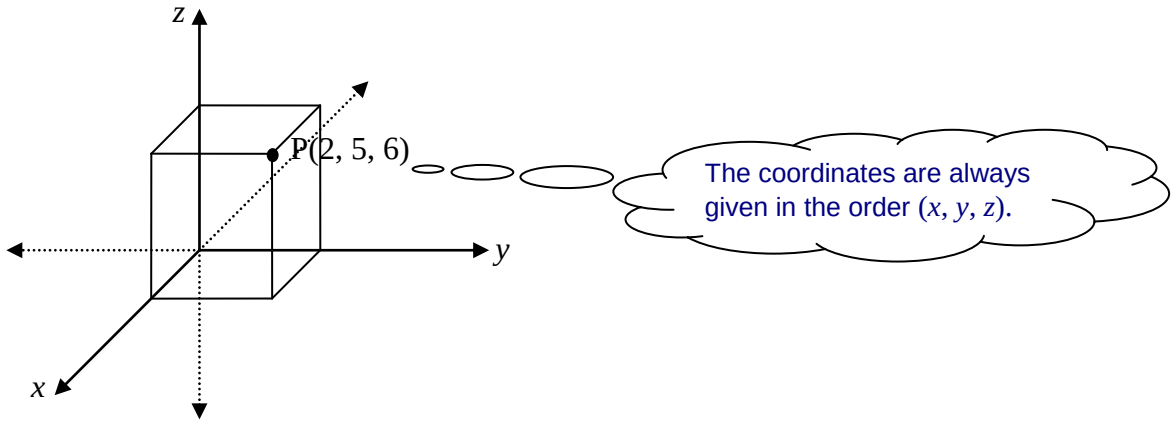
These notes contain subsections on

- **3-D coordinates**
- **Magnitude of a 3-D vector**

3-D coordinates

Much the same methods can be applied to solve 3-D problems using vector geometry as were covered in year 1 / AS. In this section you will learn to work with vectors and solve problems in 3-D.

3-D coordinates can be plotted on a grid like this one:



Magnitude of a 3-D vector

The length of the vector $\mathbf{a} = a_1\mathbf{i} + a_2\mathbf{j} + a_3\mathbf{k}$ is:

$$|\mathbf{a}| = \sqrt{a_1^{\,2} + a_2^{\,2} + a_3^{\,2}}$$

Example 1

The points A and B have coordinates (4, -1, 2) and (-1, 3, 1) respectively.

Find $\left|\overrightarrow{AB}\right|$.

Solution

$$\overrightarrow{OA} = \begin{pmatrix} 4 \\ -1 \\ 2 \end{pmatrix} \text{ and } \overrightarrow{OB} = \begin{pmatrix} -1 \\ 3 \\ 1 \end{pmatrix}$$

$$\overrightarrow{AB} = \overrightarrow{OB} - \overrightarrow{OA}$$

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

$$\left|\overrightarrow{AB}\right| = \sqrt{(-5)^2 + 4^2 + (-1)^2} = \sqrt{25+16+1} = \sqrt{42}$$