

Vectors

A Level Maths · Knowledge organiser



KEY DEFINITIONS

Vector

A quantity with size and direction, written as a column or as $ai + bj + ck$.

Magnitude

The length of a vector: $\sqrt{a^2 + b^2 + c^2}$.

Unit vector

A vector of length 1: divide a vector by its magnitude.

Position vector

The vector from the origin O to a point.

KEY FORMULAS

Magnitude; unit vector $|xi + yj + zk| = \sqrt{x^2 + y^2 + z^2}$, $\hat{a} = \frac{a}{|a|}$

$\vec{AB}$; distance AB $\mathbf{b} - \mathbf{a}$; $|\mathbf{b} - \mathbf{a}| = \sqrt{\Delta x^2 + \Delta y^2 + \Delta z^2}$

WORKED EXAMPLE

A is (1, 2, 3) and B is (4, 6, 3). Find AB, its length and a unit vector in its direction.

1. $AB = b - a = 3i + 4j + 0k$

2. $|AB| = \sqrt{9 + 16 + 0} = 5$

Answer: $AB = 3i + 4j$, $|AB| = 5$, unit vector = $0.6i + 0.8j$

YOU SHOULD BE ABLE TO...

- Represent vectors as directed line segments, in column form and with i and j , and add, subtract and multiply vectors by scalars.
- Use position vectors to find the vector between two points and the distance between them, and find the position vector of a midpoint.
- Solve geometric problems with vectors, such as showing that three points are collinear or that two lines are parallel, by writing vectors in terms of others.
- Use three-dimensional coordinates to plot points and find the distance between two points in 3D using an extension of Pythagoras' theorem.
- Represent vectors in 3D with i , j and k , add and scale them, and find magnitudes, unit vectors and the angles a vector makes with the axes.
- Use 3D vectors in mechanics contexts, such as finding the resultant of forces in three dimensions and the acceleration they produce.

COMMON MISTAKES

- ✗ $\sin \theta = 2$ not rejected
- ✗ Interval not adjusted for multiple angles
- ✗ Magnitude as $a + b$ instead of $\sqrt{a^2 + b^2}$
- ✗ Distance in 3D missing the z -component