Vector

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Vector can be expressed by

2D:
$$\binom{x}{y}$$
 or $xi + yj$

$$3D: \begin{pmatrix} x \\ y \\ z \end{pmatrix} \text{ or } xi + yj + zk$$

Vector is a quantity which has a magnitude and direction.



The vector shown can be named \overrightarrow{AB} or \vec{a} . $\overrightarrow{AB} = \begin{pmatrix} 6 \\ 3 \end{pmatrix}$ or $6\vec{i} + 3\vec{j}$

 \overrightarrow{AB} is also called **direction vector**.

 \overrightarrow{BA} is opposite direction as \overrightarrow{AB} , so $\overrightarrow{BA} = \begin{pmatrix} -6 \\ -3 \end{pmatrix}$.

Position vector

It is a vector from the origin to a point. It is also a point of the vector.

If A is at
$$(4, 2)$$
, $\overrightarrow{OA} = \begin{pmatrix} 4\\ 2 \end{pmatrix}$

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Vector operation

Skill 1: $\overrightarrow{AB} = \overrightarrow{B} - \overrightarrow{A}$

1. Consider the points A(4, -2, 1), B(10, 2, -4), find \overrightarrow{AB} .

2. Consider the points X(-3, 9, 4), Y(-3, 1, 0), find \overrightarrow{XY} .

3. Consider the points H(0, 2), K(2, 0), find \overrightarrow{KH} .



Skill 2:
$$\overrightarrow{AB} = \overrightarrow{AO} + \overrightarrow{OB}$$

<u>Diagram</u>

1. Consider
$$\overrightarrow{OA} = \begin{pmatrix} 2 \\ 3 \end{pmatrix}$$
 and $\overrightarrow{OB} = \begin{pmatrix} -3 \\ 5 \end{pmatrix}$, find \overrightarrow{AB} .

Paper 1







Let $\overrightarrow{AB} \cdot \overrightarrow{AC} = -5\sqrt{3}$ and $|\overrightarrow{AB}| |\overrightarrow{AC}| = 10$. Find the area of triangle ABC.





2. Use u = -3i + j + k and v = mj + nk, where $m, n \in$

 \mathbb{R} . Given that v is a unit vector perpendicular to u, find the possible values of m and n.





Paper 2

1. The Let
$$v = \begin{pmatrix} -10 \\ 2 \\ 1 \end{pmatrix}$$
 and $w = \begin{pmatrix} 3 \\ -4 \\ 0 \end{pmatrix}$. Find the angle between v and

w, giving your answer correct to one decimal place.

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2. Use
$$v = \begin{pmatrix} 2 \\ -3 \\ 6 \end{pmatrix}$$
 and $w = \begin{pmatrix} k \\ -2 \\ 4 \end{pmatrix}$, for $k > 0$. The angle between v and w is $\frac{\pi}{3}$.

Find the value of k.

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3. Find the angle between two vectors 4i + 3j + 1k and 4i + 6j + 2k.

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