O Level E Maths Tutorial 16: Vectors in two dimensions

Syllabus :

• use of notations: $\begin{pmatrix}1\\4\end{pmatrix}$, $\overrightarrow{AB}$, $\boldsymbol{a}$, |AB| and $|\boldsymbol{a}|$

• representing a vector as a directed line segment

---

1. (i) Sketch the vectors $\boldsymbol{a} = \begin{pmatrix}1\\4\end{pmatrix}$ and $\boldsymbol{b} = \begin{pmatrix}5\\1\end{pmatrix}$ on the xy plane.

   (ii) Find $|\boldsymbol{a}|$ and $|\boldsymbol{b}|$.

• translation by a vector

• position vectors

---

2. The position vector of point P is $\begin{pmatrix}1\\4\end{pmatrix}$. It undergoes a translation by vector $\begin{pmatrix}5\\1\end{pmatrix}$. Find the new position vector of P.

• magnitude of a vector $\begin{pmatrix}x\\y\end{pmatrix}$ as $\sqrt{(x^2+y^2)}$

---

3. Find the magnitudes of these vectors:

   (i) $\begin{pmatrix}1\\4\end{pmatrix}$ (ii) $\begin{pmatrix}5\\-2\end{pmatrix}$

• use of sum and difference of two vectors to express given vectors in terms of two coplanar vectors

---

4. (i) On the xy plane, sketch vector $\boldsymbol{a} = \begin{pmatrix}1\\4\end{pmatrix}$ and $\boldsymbol{b} = \begin{pmatrix}5\\-2\end{pmatrix}$ as arrows from O.

   (ii) Find $\boldsymbol{a} + \boldsymbol{b}$ and $\boldsymbol{a} - \boldsymbol{b}$.

   (iii) Sketch vectors $\boldsymbol{a} + \boldsymbol{b}$ and $\boldsymbol{a} - \boldsymbol{b}$ on the xy plane.

• multiplication of a vector by a scalar

---

5. Vector $\boldsymbol{a} = \begin{pmatrix} 1 \\ 4 \end{pmatrix}$ and $\boldsymbol{b} = \begin{pmatrix} 5 \\ -2 \end{pmatrix}$. Find

   (i) $2\boldsymbol{a}$

   (ii) $-\boldsymbol{b}$

• geometric problems involving the use of vectors

---

6. Given vectors $\boldsymbol{a} = \begin{pmatrix} 3 \\ 1 \end{pmatrix}$ and $\boldsymbol{b} = \begin{pmatrix} 6 \\ 2 \end{pmatrix}$, show that the lines represented by these vectors are parallel.

7. Given points A(1, 2), B(3, 4), and C(5, 6), use vectors to show they are collinear.

8. Find the midpoint M of the line segment joining points A(2, 1) and B(6, 5).

9. In parallelogram ABCD, given AB = (2, 1) and AD = (3, 4), find BC and AC.