Vectors - Miscellaneous (1 page; 4/8/18)

(1) Position vectors, direction vectors and displacement vectors

It is usually worth noting whether a particular vector appearing in a question is a position vector, a direction vector, or a displacement vector . The following examples illustrate the distinction between the three types:

(a) The line $\underline{r} = \binom{x}{y} = \binom{1}{2} + \lambda \binom{3}{4}$ gives the position vector $\binom{x}{y}$ of a point on the line obtained by starting at the point represented by the position vector $\binom{1}{2}$, and moving a certain distance (dependent on λ) in the direction $\binom{3}{4}$

(b) The plane, given in the form $\underline{r} = \begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix} + \lambda \begin{pmatrix} 4 \\ 5 \\ 6 \end{pmatrix} + \mu \begin{pmatrix} 7 \\ 8 \\ 9 \end{pmatrix}$

similarly involves the position vectors $\begin{pmatrix} x \\ y \\ z \end{pmatrix}$ & $\begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix}$ and the direction vectors $\begin{pmatrix} 4 \\ 5 \\ 6 \end{pmatrix}$ & $\begin{pmatrix} 7 \\ 8 \\ 9 \end{pmatrix}$

(c) A plane may be given in the form $(\underline{r} - \underline{a}).\underline{n} = 0$, where $\underline{r}$ is the position vector of a general point in the plane, $\underline{a}$ is the position vector of a specific point in the plane, and $\underline{n}$ is the direction vector of the normal to the plane.

Here we also have the displacement vector $\underline{r} - \underline{a}$. It represents a specific line segment in space, but when taking its scalar product with $\underline{n}$, we are only concerned with its direction.