2.8.15

EE25BTECH11032 - Kartik Lahoti

Question:

Find the position vector of a point **A** in space such that **OA** is inclined at 60° with **OX** and 45° to **OY** and $\left|\mathbf{OA}\right| = 10$units.

Solution:

Given : Let $\mathbf{A} - \mathbf{O}$ be represented as $\mathbf{R}$

$$\|\mathbf{R}\| = 10 \text{ , Angle with } x\text{-axis} = 60° \text{ and } y\text{-axis } = 45° \tag{0.1}$$

Theory :

If l , m and n are the direction cosines of a given vector then ,

$$l^2 + m^2 + n^2 = 1 \tag{0.2}$$

$$\mathbf{R} = \|\mathbf{R}\| \begin{pmatrix} l \\ m \\ n \end{pmatrix} \tag{0.3}$$

$$l = \cos 60° = \frac{1}{2}, m = \cos 45° = \frac{1}{\sqrt{2}} \tag{0.4}$$

$$l^2 + m^2 + n^2 = 1 \tag{0.5}$$

$$\implies \frac{1}{4} + \frac{1}{2} + n^2 = 1 \tag{0.6}$$

$$\implies n = \pm\frac{1}{2} \tag{0.7}$$

$$\mathbf{R} = 10 \begin{pmatrix} \frac{1}{2} \\ \frac{1}{\sqrt{2}} \\ \pm\frac{1}{2} \end{pmatrix} \tag{0.8}$$

$$\mathbf{R} = \begin{pmatrix} 5 \\ 5\sqrt{2} \\ +5 \end{pmatrix} \text{ or } \mathbf{R} = \begin{pmatrix} 5 \\ 5\sqrt{2} \\ -5 \end{pmatrix} \tag{0.9}$$

Hence ,

$$\mathbf{A}_1 = \begin{pmatrix} 5 \\ 5\sqrt{2} \\ +5 \end{pmatrix} \text{ and } \mathbf{A}_2 = \begin{pmatrix} 5 \\ 5\sqrt{2} \\ -5 \end{pmatrix} \tag{0.10}$$

are the position vector for point **A**

Fig:2.8.15