

1.11.1

EE24BTECH11020 - Ellanti Rohith

Question: Find a vector \vec{r} equally inclined to the three axes and whose magnitude is $3\sqrt{3}$ units.

Solution: Let α be the angle made by the vector with the axes. The unit direction vector can be expressed as

$$\mathbf{x} = \begin{pmatrix} \cos \alpha \\ \cos \alpha \\ \cos \alpha \end{pmatrix} \quad (0.1)$$

$$\Rightarrow \|\mathbf{x}\| = 1 \quad (0.2)$$

$$\text{or, } \cos \alpha = \frac{1}{\sqrt{3}} \quad (0.3)$$

$$\mathbf{x} = \frac{1}{\sqrt{3}}(\hat{i} + \hat{j} + \hat{k}) \quad (0.4)$$

Given that $\|\mathbf{r}\| = 3\sqrt{3}$, we have:

$$\|\mathbf{r}\| = 3\sqrt{3} \quad (0.5)$$

$$\mathbf{x} = \frac{\mathbf{r}}{\|\mathbf{r}\|} \quad (0.6)$$

$$\Rightarrow \mathbf{r} = \mathbf{x} \|\mathbf{r}\| \quad (0.7)$$

$$\text{Thus, the vector } \mathbf{r} = (3\hat{i} + 3\hat{j} + 3\hat{k}) \quad (0.8)$$

