

Ques: Find a unit vector that makes an angle of $90^\circ, 135^\circ, 45^\circ$ with positive X,Y and Z axis respectively.

Soln: Given,

$$\begin{aligned}\alpha &= 90^\circ, \\ \beta &= 135^\circ, \\ \gamma &= 45^\circ\end{aligned}$$

$$\text{i.e } l = \cos 90^\circ = 0, m = \cos 135^\circ = \frac{-1}{\sqrt{2}}, n = \cos 45^\circ = \frac{1}{\sqrt{2}} \quad (1)$$

Also, we know that,

$$\hat{a} = \frac{\vec{a}}{|\vec{a}|} = l\hat{i} + m\hat{j} + n\hat{k} \quad (2)$$

$$\text{Now, } |\vec{a}| = \sqrt{0^2 + \left(\frac{-1}{\sqrt{2}}\right)^2 + \left(\frac{1}{\sqrt{2}}\right)^2}$$

$$\implies |\vec{a}| = 1$$

Hence, from equation (1) and (2) we have the unit vector: $\hat{a} = \frac{-1}{\sqrt{2}}\vec{j} + \frac{1}{\sqrt{2}}\vec{k}$