

Question 13: A unit vector a makes an angle $\pi / 4$ with z-axis. If $a + i + j$ is a unit vector, then a is equal to

_____.

Ans let $\vec{u} = \vec{a} + \hat{i} + \hat{j}$ unit vector
 \vec{a} is also unit vector

$$\vec{a} = l\hat{i} + m\hat{j} + n\hat{k}$$

$$l^2 + m^2 + n^2 = 1$$

$$\frac{n}{1} = \cos\left(\frac{\pi}{4}\right)$$

$$l^2 + m^2 = \frac{1}{2}$$

$$n = \frac{1}{\sqrt{2}} \quad \text{--- (1)}$$

$$\vec{u} = (l+1)\hat{i} + (m+1)\hat{j} + \frac{1}{\sqrt{2}}\hat{k}$$

$$\Rightarrow (l+1)^2 + (m+1)^2 + \frac{1}{2} = 1 \quad \text{--- (2)}$$

$$\therefore \vec{a} = \frac{1}{2}\hat{i} - \frac{1}{2}\hat{j} + \frac{1}{\sqrt{2}}\hat{k}$$

From (1) and (2)

$$l = m = -\frac{1}{2}$$