VECTOR ASSIGNMENT

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1 PROBLEM 1

1. Let the vectors $\mathbf{a}$ and $\mathbf{b}$ be such that $\|\mathbf{a}\| = 3$, $\|\mathbf{b}\| = \frac{\sqrt{2}}{3}$, then $\mathbf{a} \times \mathbf{b}$ is a unit vector, if the angle between $\mathbf{a}$ and $\mathbf{b}$ is

1) $\frac{\pi}{6}$

2) $\frac{\pi}{4}$

3) $\frac{\pi}{3}$

4) $\frac{\pi}{2}$

SOLUTION:

$$\mathbf{a} \times \mathbf{b} = \|\mathbf{a}\| \|\mathbf{b}\| \sin\theta \tag{1.0.1}$$

1) Here, $\theta = \frac{\pi}{6}$
$\therefore \|\mathbf{a}\| \|\mathbf{b}\| \sin\theta = 0$

2) Here, $\theta = \frac{\pi}{4}$
$\therefore \|\mathbf{a}\| \|\mathbf{b}\| \sin\theta = 1$

3) Here, $\theta = \frac{\pi}{3}$
$\therefore \|\mathbf{a}\| \|\mathbf{b}\| \sin\theta = 0$

4) Here, $\theta = \frac{\pi}{2}$
$\therefore \|\mathbf{a}\| \|\mathbf{b}\| \sin\theta = 0$

Thus, correct option is 2, $\mathbf{a} \times \mathbf{b}$ is a unit vector, if the angle between $\mathbf{a}$ and $\mathbf{b}$ is $\frac{\pi}{4}$