# Class 12

## Chapter 10 - Vector Algebra

1. If $\theta$ is the angle between and two vectors $\mathbf{a}$ and $\mathbf{b}$, then $\|\mathbf{a}.\mathbf{b}\| = \|\mathbf{a} \times \mathbf{b}\|$ when $\theta$ is equal to

   a) 0 b) $\frac{\pi}{4}$ c) $\frac{\pi}{2}$ d) $\pi$

**Solution:**
Given,

$$\|\mathbf{a}.\mathbf{b}\| = \|\mathbf{a} \times \mathbf{b}\| \tag{1}$$

Since, scalar product of two vectors is $\|\mathbf{a}.\mathbf{b}\| = \|\mathbf{a}\|\|\mathbf{b}\| \cos\theta$ (2)

and vector product of two vector is $\|\mathbf{a} \times \mathbf{b}\| = \|\mathbf{a}\|\|\mathbf{b}\| \sin\theta$ (3)

Substituting (3) (2) in (1), we get

$$\implies \|\mathbf{a}\|\|\mathbf{b}\| \cos\theta = \|\mathbf{a}\|\|\mathbf{b}\| \sin\theta \tag{4}$$

$$\implies \cos\theta = \sin\theta \tag{5}$$

$$\implies \tan\theta = 1 \tag{6}$$

$$\implies \theta = \frac{\pi}{4} \tag{7}$$

!h

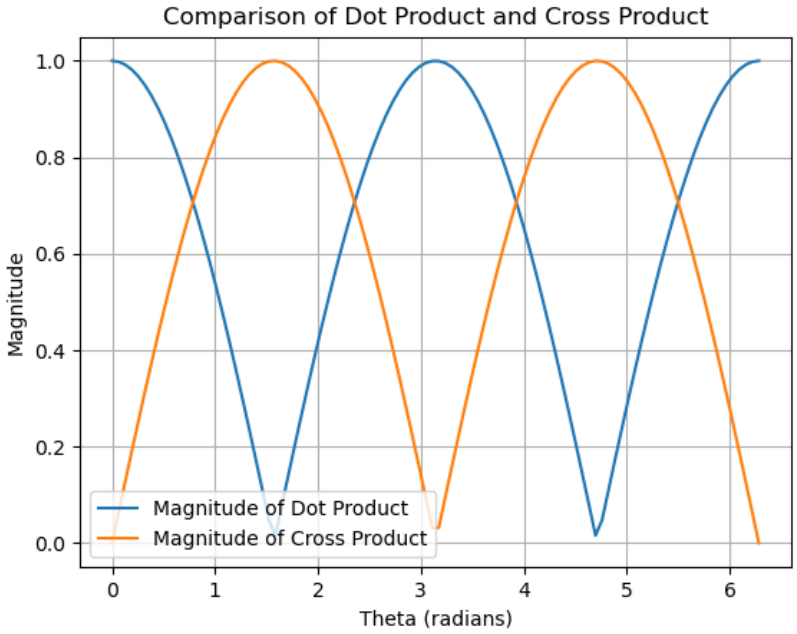


Figure 1: $\|\mathbf{a}.\mathbf{b}\| = \|\mathbf{a} \times \mathbf{b}\|$