

Assignment 4: 2.9.6

EE25BTECH11055 - Subhodeep Chakraborty

Question:

$|\mathbf{a}| = 8$, $|\mathbf{b}| = 3$, and $\mathbf{a} \cdot \mathbf{b} = 12\sqrt{3}$, then the value $|\mathbf{a} \times \mathbf{b}|$ is

Solution:

Given:

$$\|\mathbf{a}\| = 8 \quad (1)$$

$$\|\mathbf{b}\| = 3 \quad (2)$$

$$\mathbf{a}^\top \mathbf{b} = 12\sqrt{3} \quad (3)$$

We know:

$$\|\mathbf{a} \times \mathbf{b}\| = \|\mathbf{a}\| \|\mathbf{b}\| \sin \theta \quad (4)$$

$$\cos \theta = \frac{\mathbf{a}^\top \mathbf{b}}{\|\mathbf{a}\| \|\mathbf{b}\|} \quad (5)$$

Thus

$$(\mathbf{a}^\top \mathbf{b})^2 + (\|\mathbf{a} \times \mathbf{b}\|)^2 = \|\mathbf{a}\|^2 \|\mathbf{b}\|^2 \quad (6)$$

Substituting values

$$\|\mathbf{a} \times \mathbf{b}\| = \sqrt{64 * 9 - 144 * 3} \quad (7)$$

$$\|\mathbf{a} \times \mathbf{b}\| = 12 \quad (8)$$

2.9.6

