2.7.16

EE25BTECH11004 - Aditya Appana

August 30, 2025

Question

Find $|\mathbf{a} \times \mathbf{b}|$ if $\mathbf{a} = (2\hat{i} + \hat{j} + 3\hat{k})$ and $\mathbf{b} = (3\hat{i} + 5\hat{j} - 2\hat{k})$

Solution

The vectors are

$$\mathbf{a} = \begin{pmatrix} 2 \\ 1 \\ 3 \end{pmatrix} \tag{1}$$

$$\mathbf{b} = \begin{pmatrix} 3 \\ 5 \\ -2 \end{pmatrix} \tag{2}$$

The formula to calculate the angle between the two planes is

$$|\mathbf{a} \times \mathbf{b}| = |\mathbf{a}||\mathbf{b}| \sin\theta = \tag{3}$$

$$\sqrt{|\mathbf{a}|^2|\mathbf{b}|^2 - |\mathbf{a}|^2|\mathbf{b}|^2 \cos^2\theta} = \tag{4}$$

$$\sqrt{|\mathbf{a}|^2|\mathbf{b}|^2 - |\mathbf{a} \cdot \mathbf{b}|^2} \tag{5}$$

Substituting $\mathbf{a}, \mathbf{b}$ into this formula :

$$\sqrt{\left|\begin{pmatrix}2\\1\\3\end{pmatrix}\right|^2 \left|\begin{pmatrix}3\\5\\-2\end{pmatrix}\right|^2 - \left|\begin{pmatrix}2\\1\\3\end{pmatrix} \cdot \begin{pmatrix}3\\5\\-2\end{pmatrix}\right|^2} \tag{6}$$

$$= \sqrt{14 * 38 - 25} \tag{7}$$

$$= 22.51666 \tag{8}$$

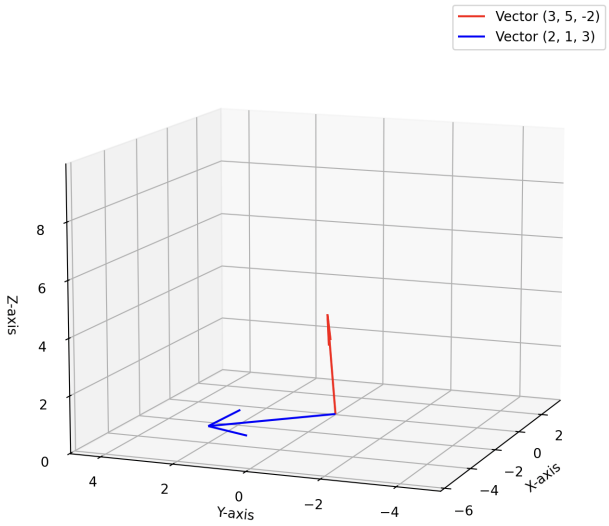

Figure 1: Plot