2.7.16

EE25BTECH11004 - Aditya Appana

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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

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

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

To calculate the cross-product of the two vectors a and b, we use the following determinant:

$$\begin{pmatrix} |\mathbf{A_{23}B_{23}}| \\ |\mathbf{A_{31}B_{31}}| \\ |\mathbf{A_{12}B_{12}}| \end{pmatrix}$$

Where $\mathbf{X_{ij}} = \begin{pmatrix} \mathrm{x}_i \\ \mathrm{x}_j \end{pmatrix}$

Expanding the determinants, we get:

$$\begin{pmatrix} ((-2) - 15) \\ ((-4) - 9) \\ (10 - 3) \end{pmatrix} \tag{3}$$

$$= \begin{pmatrix} -17 \\ 13 \\ 7 \end{pmatrix} \tag{4}$$

We need to find the norm of this vector, which is done by:

$$\sqrt{17^2 + 13^2 + 7^2} \tag{5}$$

$$= 22.516660498395403 \tag{6}$$

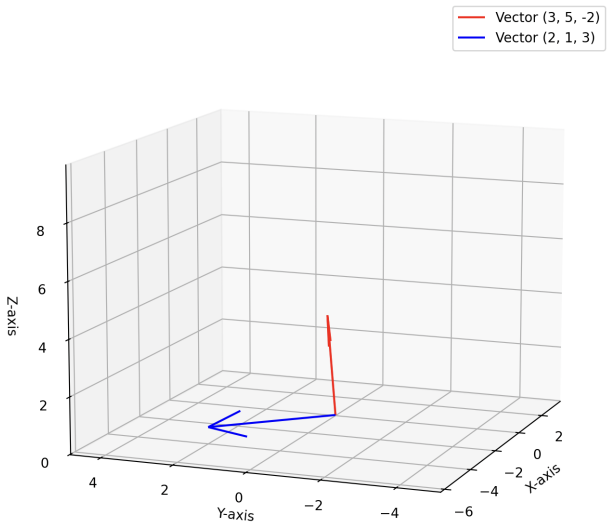

Figure 1: Plot