

## 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

$$\mathbf{a} = \begin{pmatrix} 2 \\ 1 \\ 3 \end{pmatrix} \quad (1)$$

$$\mathbf{b} = \begin{pmatrix} 3 \\ 5 \\ -2 \end{pmatrix} \quad (2)$$

To calculate the cross-product of the two vectors  $\mathbf{a}$  and  $\mathbf{b}$ , we use the following determinant:

$$\begin{vmatrix} \mathbf{a}_{23} \mathbf{b}_{23} \\ \mathbf{a}_{31} \mathbf{b}_{31} \\ \mathbf{a}_{12} \mathbf{b}_{12} \end{vmatrix}$$

$$\text{Where } \mathbf{X}_{ij} = \begin{pmatrix} x_i \\ x_j \end{pmatrix}$$

$$\text{Expanding the determinants, we get: } \begin{pmatrix} ((-2) - 15) \\ ((-4) - 9) \\ (10 - 3) \end{pmatrix} = \begin{pmatrix} -17 \\ 13 \\ 7 \end{pmatrix}$$

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

$$\sqrt{17^2 + 13^2 + 7^2} \quad (3)$$

$$= 22.516660498395403 \quad (4)$$

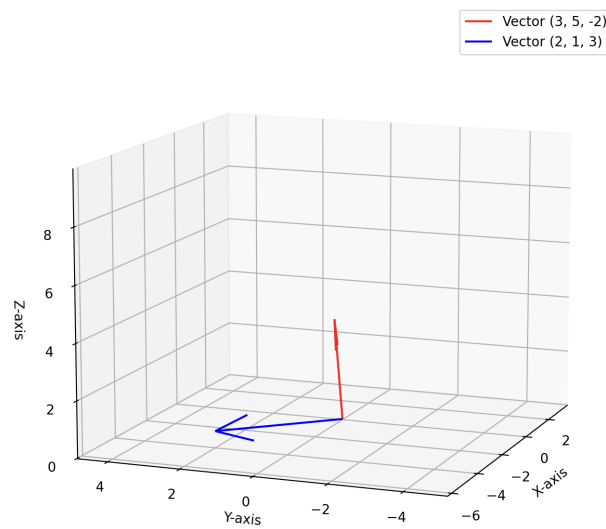


Figure 1: Plot