

Matgeo-q.2.7.8

AI25BTECH11036-SNEHAMRUDULA

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Question

2.7.8 Find $|\mathbf{a} \times \mathbf{b}|$, if $\mathbf{a} = 2\mathbf{i} + \mathbf{j} + 3\mathbf{k}$ and $\mathbf{b} = 3\mathbf{i} + 5\mathbf{j} - 2\mathbf{k}$.

solution

Let

$$\mathbf{a} = 2\hat{i} + \hat{j} + 3\hat{k}, \quad \mathbf{b} = 3\hat{i} + 5\hat{j} - 2\hat{k}.$$

We compute:

$$A_{23}B_{23} = \begin{vmatrix} 1 & 3 \\ 5 & -2 \end{vmatrix} = (1)(-2) - (3)(5) = -17,$$

$$A_{31}B_{31} = \begin{vmatrix} 2 & 3 \\ 3 & -2 \end{vmatrix} = (2)(-2) - (3)(3) = -13,$$

$$A_{12}B_{12} = \begin{vmatrix} 2 & 1 \\ 3 & 5 \end{vmatrix} = (2)(5) - (1)(3) = 7.$$

Thus,

$$\mathbf{a} \times \mathbf{b} = \begin{bmatrix} A_{23}B_{23} \\ A_{31}B_{31} \\ A_{12}B_{12} \end{bmatrix} = \begin{bmatrix} -17 \\ -13 \\ 7 \end{bmatrix}.$$

$$|\mathbf{a} \times \mathbf{b}| = \sqrt{(-17)^2 + (-13)^2 + (7)^2} = \sqrt{289 + 169 + 49} = \sqrt{507}$$

Graphical Representation

3D Representation of Vectors and Cross Product

