2.7.8

AI25BTECH11033–SNEHAMRUDULA

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

$$|A_{23}\ B_{23}| = \begin{vmatrix} 1 & 3 \\ 5 & -2 \end{vmatrix} = (1)(-2) - (3)(5) = -17 \tag{2.7.8.1}$$

$$|A_{31}\ B_{31}| = \begin{vmatrix} 2 & 3 \\ 3 & -2 \end{vmatrix} = (2)(-2) - (3)(3) = -13 \tag{2.7.8.2}$$

$$|A_{12}\ B_{12}| = \begin{vmatrix} 2 & 1 \\ 3 & 5 \end{vmatrix} = (2)(5) - (1)(3) = 7 \tag{2.7.8.3}$$

$$\mathbf{a} \times \mathbf{b} = \begin{vmatrix} \mathbf{i} & \mathbf{j} & \mathbf{k} \\ 2 & 1 & 3 \\ 3 & 5 & -2 \end{vmatrix} = (-17)\mathbf{i} - (-13)\mathbf{j} + (7)\mathbf{k} \tag{2.7.8.4}$$

$$\mathbf{a} \times \mathbf{b} = -17\mathbf{i} + 13\mathbf{j} + 7\mathbf{k}$$

$$|\mathbf{a} \times \mathbf{b}| = \sqrt{(-17)^2 + (13)^2 + (7)^2} = \sqrt{289 + 169 + 49} = \sqrt{507} = 13\sqrt{3} \tag{2.7.8.5}$$

$$\boxed{|\mathbf{a} \times \mathbf{b}| = 13\sqrt{3}}$$

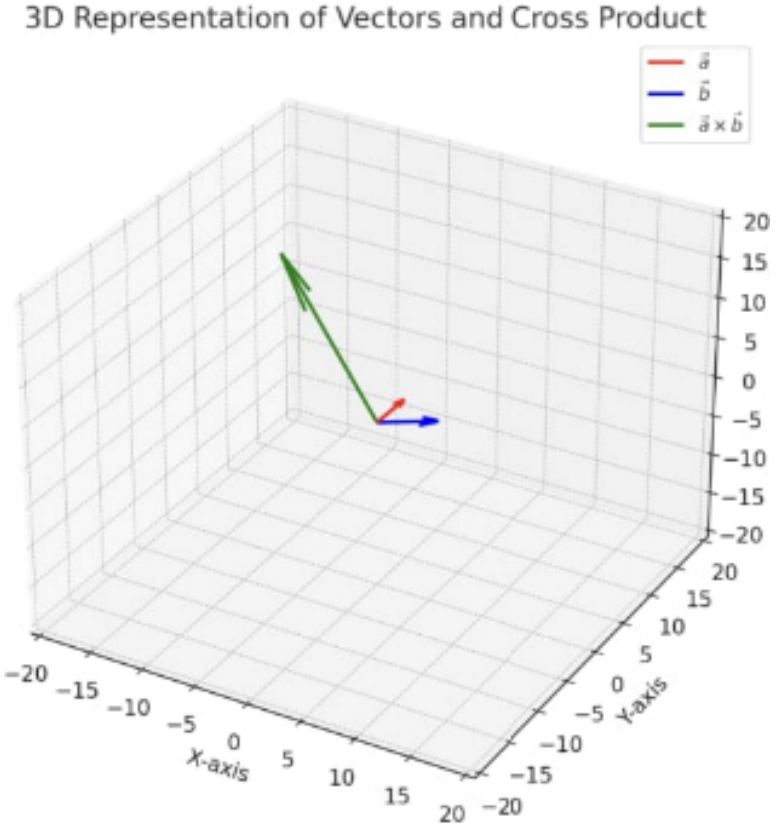
3D Representation of Vectors and Cross Product
$\vec{a}$
$\vec{b}$
$\vec{a} \times \vec{b}$
X-axis
Y-axis
−20
−15
−10
−5
0
5
10
15
20

Fig. 0.1