

Vectors Assignment-1

Section 12th Math- Exercise 12.10.4.1

1. Find $|\mathbf{a} \times \mathbf{b}|$, if $\mathbf{a} = \hat{i} - 7\hat{j} + 7\hat{k}$ and $\mathbf{b} = 3\hat{i} - 2\hat{j} + 2\hat{k}$

Solution:

The given two vectors are

$$\mathbf{a} = \begin{pmatrix} 1 \\ -7 \\ 7 \end{pmatrix}, \mathbf{b} = \begin{pmatrix} 3 \\ -2 \\ 2 \end{pmatrix} \quad (1)$$

The cross product of vectors \mathbf{a} and \mathbf{b} is given as

$$|\mathbf{a} \times \mathbf{b}| = \begin{pmatrix} \left| \begin{matrix} \mathbf{A}_{23} & \mathbf{B}_{23} \\ \mathbf{A}_{31} & \mathbf{B}_{31} \\ \mathbf{A}_{12} & \mathbf{B}_{12} \end{matrix} \right| \end{pmatrix} \quad (2)$$

$$\left| \begin{matrix} \mathbf{A}_{23} & \mathbf{B}_{23} \end{matrix} \right| = \left| \begin{matrix} -7 & -2 \\ 7 & 2 \end{matrix} \right| = -14 + 14 = 0 \quad (3)$$

$$\left| \begin{matrix} \mathbf{A}_{31} & \mathbf{B}_{31} \end{matrix} \right| = \left| \begin{matrix} 1 & 3 \\ 7 & 2 \end{matrix} \right| = 2 - 21 = -19 \quad (4)$$

$$\left| \begin{matrix} \mathbf{A}_{12} & \mathbf{B}_{12} \end{matrix} \right| = \left| \begin{matrix} 1 & 3 \\ -7 & -2 \end{matrix} \right| = -2 + 21 = 19 \quad (5)$$

Then,

$$|\mathbf{a} \times \mathbf{b}| = \sqrt{-19^2 + 19^2} \quad (6)$$

$$= 19\sqrt{2} \quad (7)$$