

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 $\mathbf{a} = \hat{i} - 7\hat{j} + 7\hat{k}$ and $\mathbf{b} = 3\hat{i} - 2\hat{j} + 2\hat{k}$
Let

$$\mathbf{a} = \begin{pmatrix} A_1 \\ A_2 \\ A_3 \end{pmatrix} \quad \mathbf{b} = \begin{pmatrix} B_1 \\ B_2 \\ B_3 \end{pmatrix} \quad (1)$$

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

$$|\mathbf{a} \times \mathbf{b}| = \begin{vmatrix} \mathbf{A}_1 & \mathbf{B}_1 \\ \mathbf{A}_2 & \mathbf{B}_2 \\ \mathbf{A}_3 & \mathbf{B}_3 \end{vmatrix} \quad (2)$$

$$|A_1 \quad B_1| = \begin{vmatrix} -7 & -2 \\ 7 & 2 \end{vmatrix} = -14 + 14 = 0 \quad (3)$$

$$(4)$$

$$|A_2 \quad B_2| = \begin{vmatrix} 1 & 3 \\ 7 & 2 \end{vmatrix} = 2 - 21 = -19 \quad (5)$$

$$(6)$$

$$|A_3 \quad B_3| = \begin{vmatrix} 1 & 3 \\ -7 & -2 \end{vmatrix} = -2 + 21 = 19 \quad (7)$$

$$(8)$$

$$|\mathbf{a} \times \mathbf{b}| = \sqrt{(-19)^2 + (19)^2} \quad (9)$$

$$= \sqrt{2} \times 19 \quad (10)$$

$$= 19\sqrt{2} \quad (11)$$
