

1.10.11

EE25BTECH11053 - Surya Sri

Question:

Find a vector of magnitude 5 units, and parallel to the resultant of the vectors $\mathbf{a} = 2\hat{i} + 3\hat{j} - \hat{k}$ and $\mathbf{b} = \hat{i} - 2\hat{j} + \hat{k}$.

Solution:

$$\mathbf{a} = \begin{bmatrix} 2 \\ 3 \\ -1 \end{bmatrix}, \quad \mathbf{b} = \begin{bmatrix} 1 \\ -2 \\ 1 \end{bmatrix}$$

Resultant Vector is,

$$\mathbf{R} = \mathbf{a} + \mathbf{b} = \begin{bmatrix} 2 \\ 3 \\ -1 \end{bmatrix} + \begin{bmatrix} 1 \\ -2 \\ 1 \end{bmatrix} = \begin{bmatrix} 3 \\ 1 \\ 0 \end{bmatrix} \quad (1)$$

Magnitude of Resultant vector is,

$$|R| = \sqrt{3^2 + 1^2 + 0^2} = \sqrt{9 + 1} = \sqrt{10} \quad (2)$$

Unit Vector Parallel to Resultant is,

$$\hat{R} = \frac{1}{\sqrt{10}} \begin{bmatrix} 3 \\ 1 \\ 0 \end{bmatrix} \quad (3)$$

Scale to Magnitude 5,

$$\mathbf{v} = 5 \cdot \hat{R} = 5 \cdot \frac{1}{\sqrt{10}} \begin{bmatrix} 3 \\ 1 \\ 0 \end{bmatrix} = \begin{bmatrix} \frac{15}{\sqrt{10}} \\ \frac{5}{\sqrt{10}} \\ 0 \end{bmatrix} \quad (4)$$

Therefore,

$$\mathbf{v} = \begin{bmatrix} \frac{15}{\sqrt{10}} \\ \frac{5}{\sqrt{10}} \\ 0 \end{bmatrix} \quad (5)$$

is a matrix with magnitude 5 parallel to the resultant vector.

3D Plot: Vectors a, b, and Resultant Parallel of Mag 5

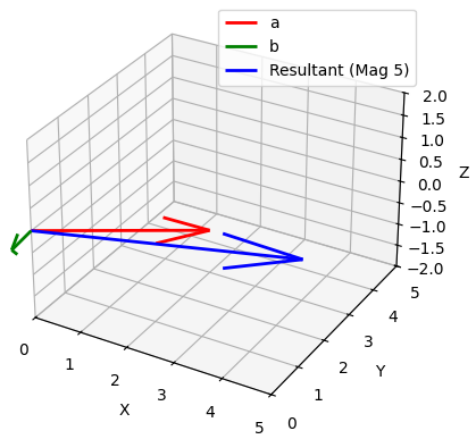


Fig. 0