

Vectors

1 12th Maths - Chapter 10

This is Problem-6 from Exercise 10.5 (Miscellaneous Exercise)

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

2 Solution

Let us assume that required vector as \mathbf{x}
Given \mathbf{a} and \mathbf{b} are

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

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

now assume that

$$\mathbf{a} + \mathbf{b} = \mathbf{c} \quad (3)$$

$$\mathbf{c} = \begin{pmatrix} 2 \\ 3 \\ -1 \end{pmatrix} + \begin{pmatrix} 1 \\ -2 \\ 1 \end{pmatrix} \quad (4)$$

$$\mathbf{c} = \begin{pmatrix} 3 \\ 1 \\ 0 \end{pmatrix} \quad (5)$$

so our resultant vector is $\mathbf{c} = \begin{pmatrix} 3 \\ 1 \\ 0 \end{pmatrix}$

$$\frac{\mathbf{c}}{\|\mathbf{c}\|} = \frac{1}{\sqrt{10}} \times \begin{pmatrix} 3 \\ 1 \\ 0 \end{pmatrix} \quad (6)$$

so (6) is a unit vector which is in the direction of resultant vector of \mathbf{a} and \mathbf{b} but we want the \mathbf{x} which magnitude is 5 so

$$\mathbf{x} = 5 \times \frac{1}{\sqrt{10}} \times \begin{pmatrix} 3 \\ 1 \\ 0 \end{pmatrix} \quad (7)$$

$$\mathbf{x} = \begin{pmatrix} \frac{3\sqrt{10}}{2} \\ \frac{\sqrt{10}}{2} \\ 0 \end{pmatrix} \quad (8)$$

Hence the required vector \mathbf{x} is $\begin{pmatrix} \frac{3\sqrt{10}}{2} \\ \frac{\sqrt{10}}{2} \\ 0 \end{pmatrix}$