

Properties of vectors

12th Maths - Exercise 10.2.1

1. Compute the magnitude of the following vectors

$$\vec{a} = \hat{i} + \hat{j} + \hat{k}, \vec{b} = 2\hat{i} - 7\hat{j} + 3\hat{k} \text{ and } \vec{c} = \frac{1}{\sqrt{3}}\hat{i} + \frac{1}{\sqrt{3}}\hat{j} - \frac{1}{\sqrt{3}}\hat{k}.$$

Solution:

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

let us assume magnitudes of $\mathbf{a}, \mathbf{b}, \mathbf{c}$ are x, y, z respectively

$$x = \|\mathbf{a}\|, y = \|\mathbf{b}\|, z = \|\mathbf{c}\| \quad (2)$$

so

$$x = \|\mathbf{a}\| = \mathbf{a}^\top \mathbf{a}, \quad (3)$$

$$y = \|\mathbf{b}\| = \mathbf{b}^\top \mathbf{b}, \quad (4)$$

$$z = \|\mathbf{c}\| = \mathbf{c}^\top \mathbf{c} \quad (5)$$

now substituting values of (1) in (3),(4) and (5) respectively

$$x = 1.732 \quad (6)$$

$$y = 7.874 \quad (7)$$

$$z = 1 \quad (8)$$

the magnitudes of $\mathbf{a} = \sqrt{3}, \mathbf{b} = \sqrt{62}, \mathbf{c} = 1$