Vector Algebra

12^{th} Maths - Chapter 10

Exercise 10.2 Problem-13

1. Find the direction cosines of the vector joining the points A (1, 2, 3) and B(1, 2, 1), directed from A to B.

   Solution: The direction cosines are the cosines of the angles formed by the given vector with the respective axes, given vectors are **A** and **B**

$$\mathbf{A} = \begin{pmatrix} 1 \\ 2 \\ -3 \end{pmatrix}, \mathbf{B} = \begin{pmatrix} -1 \\ -2 \\ 1 \end{pmatrix} \tag{1}$$

   The direction vector m of the line joining two points A, B is given by

$$\mathbf{B} - \mathbf{A} = \begin{pmatrix} -1 \\ -2 \\ 1 \end{pmatrix} - \begin{pmatrix} 1 \\ 2 \\ -3 \end{pmatrix} = \begin{pmatrix} -2 \\ -4 \\ 4 \end{pmatrix} \tag{2}$$

$$\mathbf{m} = \mathbf{A} - \mathbf{B} = \begin{pmatrix} -2 \\ -4 \\ 4 \end{pmatrix} \tag{3}$$

$$\|\mathbf{m}\| = \sqrt{(-2)^2 + (-4)^2 + 4^2} = 6 \tag{4}$$

   The unit vector in the direction of m is calculated as

$$\frac{\mathbf{m}}{\|\mathbf{m}\|} = \frac{1}{6}\begin{pmatrix} -2 \\ -4 \\ 4 \end{pmatrix} = \begin{pmatrix} \frac{-1}{3} \\ \frac{-2}{3} \\ \frac{2}{3} \end{pmatrix} \tag{5}$$

   Hence,the direction cosines for given vectors are $(\frac{-1}{3}, \frac{-2}{3}, \frac{2}{3})$