1.9.3

EE25BTECH11014 - Bhoomika Lokesh

Question: $AOBC$ is a rectangle whose three vertices are $(0, -3)$ $(0, 0)$ $(4, 0)$.The length of its diagonal is____________.

Solution: Given the points $\mathbf{A}, \mathbf{O}$ and $\mathbf{B}$:

Point	**vector**
Point A	$\begin{pmatrix} 4 \\ 0 \end{pmatrix}$
Point O	$\begin{pmatrix} 0 \\ 0 \end{pmatrix}$
Point B	$\begin{pmatrix} 0 \\ -3 \end{pmatrix}$

TABLE 0: Vectors of the points

Determining the Coordinates of Point C:

$$\mathbf{A} = \begin{pmatrix} 4 \\ 0 \end{pmatrix} \mathbf{B} = \begin{pmatrix} 0 \\ -3 \end{pmatrix} \tag{0.1}$$

Since $\mathbf{C}$ is opposite to $\mathbf{O}$ in the rectangle,

$$\mathbf{C} = \mathbf{A} + \mathbf{B} = \begin{pmatrix} 4 \\ 0 \end{pmatrix} + \begin{pmatrix} 0 \\ -3 \end{pmatrix} = \begin{pmatrix} 4 \\ -3 \end{pmatrix} \tag{0.2}$$

$$\therefore \mathbf{C} = \begin{pmatrix} 4 \\ -3 \end{pmatrix} \tag{0.3}$$

We know that the length of the diagonal vector is magnitude of the vector $\mathbf{C}$.

$$\mathbf{C} = \begin{pmatrix} 4 \\ -3 \end{pmatrix} \tag{0.4}$$

$$|\mathbf{C}| = \sqrt{\mathbf{C}^T \cdot \mathbf{C}} \tag{0.5}$$

$$\mathbf{C}^T = \begin{pmatrix} 4 & -3 \end{pmatrix} \tag{0.6}$$

$$\mathbf{C}^T \cdot \mathbf{C} = \begin{pmatrix} 4 & -3 \end{pmatrix} \begin{pmatrix} 4 \\ -3 \end{pmatrix} = 4^2 + (-3)^2 = 16 + 9 = 25 \tag{0.7}$$

$$|\mathbf{C}| = \sqrt{25} = 5 \tag{0.8}$$

Therefore the lenght of the diagonal is 5.

See Fig 0.1,

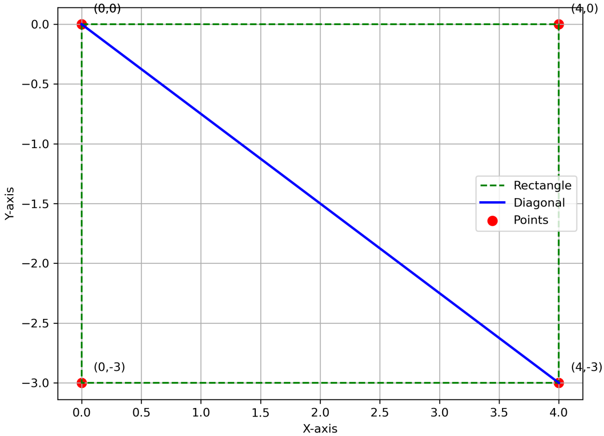

Fig. 0.1: Graph