

AI25BTECH11034 - SUJAL CHAUHAN

Problem 1.8.10 Find the distance between the points $(0, 5)$ and $(-5, 0)$.

Solution. let us define our points as **A** and **B**

| Input variable | Value |
|----------------|---|
| A | $\begin{pmatrix} 0 \\ 5 \end{pmatrix}$ |
| B | $\begin{pmatrix} -5 \\ 0 \end{pmatrix}$ |

Table 1

Represent the points as vectors:

$$\mathbf{A} = \begin{pmatrix} 0 \\ 5 \end{pmatrix}, \quad \mathbf{B} = \begin{pmatrix} -5 \\ 0 \end{pmatrix} \quad (1)$$

The distance between **A** and **B** is

$$d(\mathbf{A}, \mathbf{B}) = \|\mathbf{B} - \mathbf{A}\| \quad (2)$$

Subtracting the vectors,

$$\mathbf{B} - \mathbf{A} = \begin{pmatrix} 0 \\ 5 \end{pmatrix} - \begin{pmatrix} -5 \\ 0 \end{pmatrix} = \begin{pmatrix} 5 \\ 5 \end{pmatrix} \quad (3)$$

Now, compute the Euclidean norm:

$$d(\mathbf{A}, \mathbf{B}) = \sqrt{(\mathbf{B} - \mathbf{A})^T (\mathbf{B} - \mathbf{A})} \quad (4)$$

$$d(\mathbf{A}, \mathbf{B}) = \sqrt{\begin{pmatrix} 5 & 5 \end{pmatrix} \begin{pmatrix} 5 \\ 5 \end{pmatrix}} = \sqrt{50} \quad (5)$$

$$d(\mathbf{A}, \mathbf{B}) = 5\sqrt{2} \quad (6)$$

Final Answer:

$$d(\mathbf{A}, \mathbf{B}) = \|\mathbf{B} - \mathbf{A}\| = 5\sqrt{2} \quad (7)$$

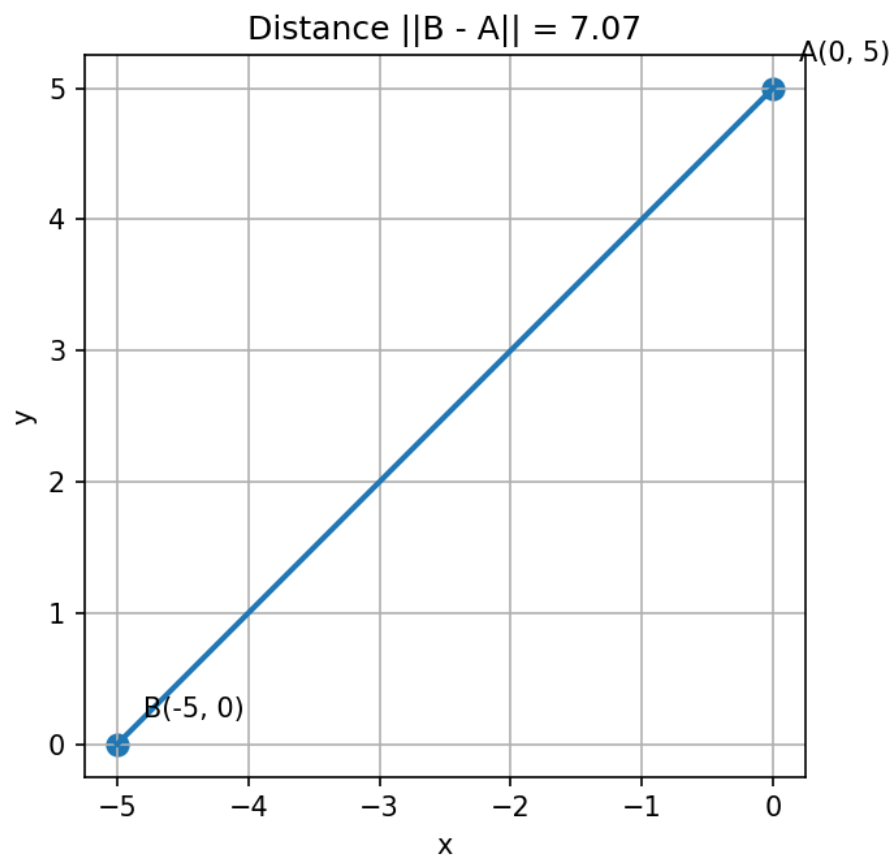


Figure 1