1.9.8

EE25BTECH11019 - Darji Vivek M.

Question:
The distance between the points $(0, 0)$ and $(a - b,\ a + b)$ is _____ $(10, 2021)$

Solution:

Variable	Description
A	Point $(0, 0)$
B	Point $(a - b, a + b)$
d	Distance between **A** and **B**

TABLE 0: Variables Used

$$\mathbf{A} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \quad \mathbf{B} = \begin{pmatrix} a - b \\ a + b \end{pmatrix} \tag{1}$$

The distance between two points is given by

$$d = \|\mathbf{A} - \mathbf{B}\| \tag{2}$$

Substituting values,

$$d = \left\| \begin{pmatrix} 0 \\ 0 \end{pmatrix} - \begin{pmatrix} a - b \\ a + b \end{pmatrix} \right\| \tag{3}$$

$$= \left\| \begin{pmatrix} -(a - b) \\ -(a + b) \end{pmatrix} \right\| \tag{4}$$

$$= \sqrt{(a - b)^2 + (a + b)^2} \tag{5}$$

Simplifying,

$$d = \sqrt{a^2 - 2ab + b^2 + a^2 + 2ab + b^2} \tag{6}$$

$$= \sqrt{2a^2 + 2b^2} \tag{7}$$

$$\implies d = \sqrt{2}\sqrt{a^2 + b^2} \tag{8}$$

Hence, the required distance is $\boxed{\sqrt{2}\sqrt{a^2 + b^2}}$.

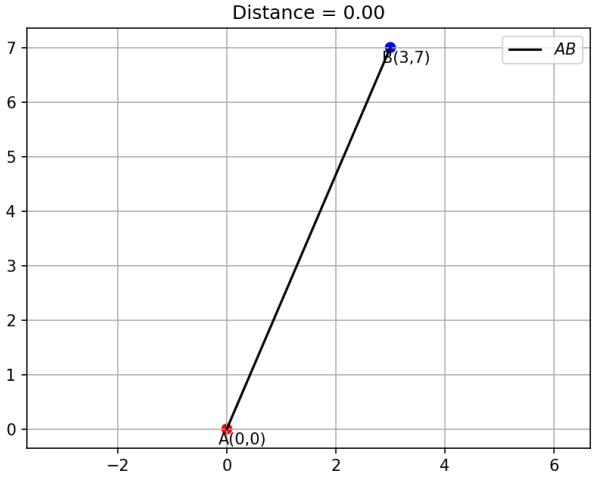

Fig. 0.1: plot