

1-1.9-8

EE24BTECH11010 - BALAJI B

Question :

The distance between the points $\begin{pmatrix} 0 \\ 0 \end{pmatrix}$ and $\begin{pmatrix} a-b \\ a+b \end{pmatrix}$ is

(10, 2022)

Answer :

Variable	Value	Description
P	$\begin{pmatrix} 0 \\ 0 \end{pmatrix}$	First Endpoint
Q	$\begin{pmatrix} a-b \\ a+b \end{pmatrix}$	Second Endpoint

TABLE 0: Variables Used

$$\therefore \mathbf{P} - \mathbf{Q} = \begin{pmatrix} 0 \\ 0 \end{pmatrix} - \begin{pmatrix} a-b \\ a+b \end{pmatrix} = \begin{pmatrix} b-a \\ -a-b \end{pmatrix} \quad (0.1)$$

$$(\mathbf{P} - \mathbf{Q})^\top (\mathbf{P} - \mathbf{Q}) = \begin{pmatrix} b-a & -a-b \end{pmatrix} \begin{pmatrix} b-a \\ -a-b \end{pmatrix} \quad (0.2)$$

$$(\mathbf{P} - \mathbf{Q})^\top (\mathbf{P} - \mathbf{Q}) = (b-a)^2 + (a+b)^2 \quad (0.3)$$

Thus the desired distance is

$$d = \|\mathbf{P} - \mathbf{Q}\| = \sqrt{(b-a)^2 + (a+b)^2} \quad (0.4)$$

Assuming the points $a = 2$ and $b = 3$

$$\mathbf{P} = \begin{pmatrix} 0 \\ 0 \end{pmatrix} \text{ and } \mathbf{Q} = \begin{pmatrix} -1 \\ 5 \end{pmatrix} \quad (0.5)$$

$$d = \|\mathbf{P} - \mathbf{Q}\| = \sqrt{(3-2)^2 + (2+3)^2} \quad (0.6)$$

$$d = \sqrt{26} \quad (0.7)$$

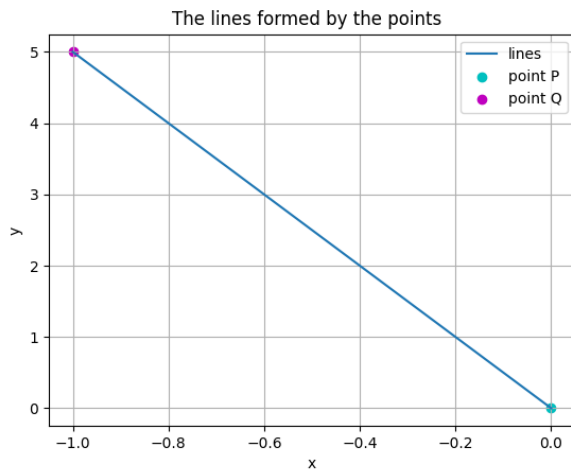


Fig. 0.1: Plot of the line passing through P and Q