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

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: Input parameters

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

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

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

Thus the desired distance is

$$d = \|x\| = \sqrt{x^{\top}x} \text{(where } x = P-Q) \tag{0.4}$$

$$d = \|P-Q\| = \sqrt{(b-a)^2+(a+b)^2} \tag{0.5}$$

Assuming the points a = 2 and b = 3

$$\mathbf{P} = \begin{pmatrix}0\\0\end{pmatrix} \text{ and } \mathbf{Q} = \begin{pmatrix}-1\\5\end{pmatrix} \tag{0.6}$$

$$d = \|P-Q\| = \sqrt{(3-2)^2+(2+3)^2} \tag{0.7}$$

$$d = \sqrt{26} \tag{0.8}$$

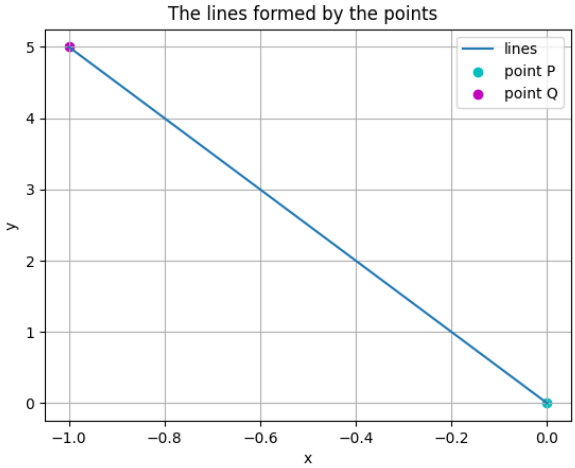

Fig. 0.1: Plot of the line passing through P and Q