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

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

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

Assuming the points a = 2 and b = 3

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

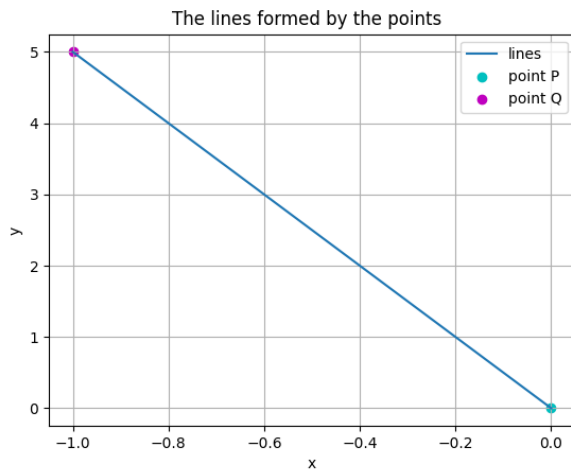$$d = \|P - Q\| = \sqrt{(3-2)^2 + (2+3)^2} \tag{0.7}$$

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

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