

1-1.9-11

EE24BTECH11060 - Sruthi Bijili

Question:

If the distance between the points $(k, -2)$ and $(3, -6)$ is 10 units, find the positive value of k . (10,2021)

solution:

Variable	Description
$\mathbf{A}(k, -2)$	coordinates of first points
$\mathbf{B}(3, -6)$	coordinates of second points
$d = 10$	distance between AB

TABLE 0: Input parameters

$$\|AB\| = \sqrt{(A - B)^T (A - B)} \quad (0.1)$$

$$\Rightarrow \|AB\| = \sqrt{(A^T - B^T) (A - B)} \quad (0.2)$$

$$\Rightarrow \|AB\| = \sqrt{A^T A - A^T B - B^T A + B^T B} \quad (0.3)$$

$$\Rightarrow \|AB\| = \sqrt{A^T A - 2A^T B + B^T B} \quad (0.4)$$

$$\Rightarrow 10 = \sqrt{\begin{pmatrix} k \\ -2 \end{pmatrix}^T \begin{pmatrix} 3 \\ -6 \end{pmatrix} - 2 \begin{pmatrix} k \\ -2 \end{pmatrix}^T \begin{pmatrix} 3 \\ -6 \end{pmatrix} + \begin{pmatrix} 3 \\ -6 \end{pmatrix}^T \begin{pmatrix} 3 \\ -6 \end{pmatrix}} \quad (0.5)$$

$$\Rightarrow 10 = \sqrt{k^2 - 6k + 25} \quad (0.6)$$

$$k^2 - 6k - 75 = 0 \quad (0.7)$$

$$\Rightarrow k = 3 - 2\sqrt{21}, 3 + 2\sqrt{21} \quad (0.8)$$

Therefore the positive value of k is $3 + 2\sqrt{21}$

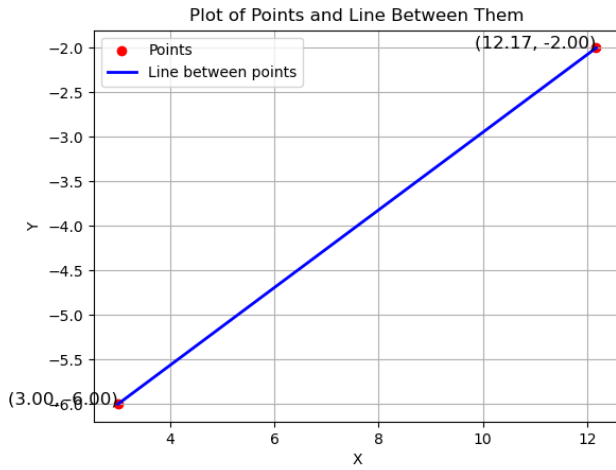


Fig. 0.1: line AB