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

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

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

$$\implies \|AB\| = \sqrt{A^TA - A^TB - B^TA + B^TB} \tag{0.3}$$

$$\implies \|AB\| = \sqrt{A^TA - 2A^TB + B^TB} \tag{0.4}$$

$$\implies 10 = \sqrt{\begin{pmatrix} k \\ -2 \end{pmatrix}^T \begin{pmatrix} 3 \\ -6 \end{pmatrix} - 2\begin{pmatrix} K \\ -2 \end{pmatrix}^T \begin{pmatrix} 3 \\ -6 \end{pmatrix} + \begin{pmatrix} 3 \\ -6 \end{pmatrix}^T \begin{pmatrix} 3 \\ -6 \end{pmatrix}} \tag{0.5}$$

$$\implies 10 = \sqrt{k^2 - 6k + 25} \tag{0.6}$$

$$k^2 - 6k - 75 = 0 \tag{0.7}$$

$$\implies k = 3 - 2\sqrt{21}, 3 + 2\sqrt{21} \tag{0.8}$$

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

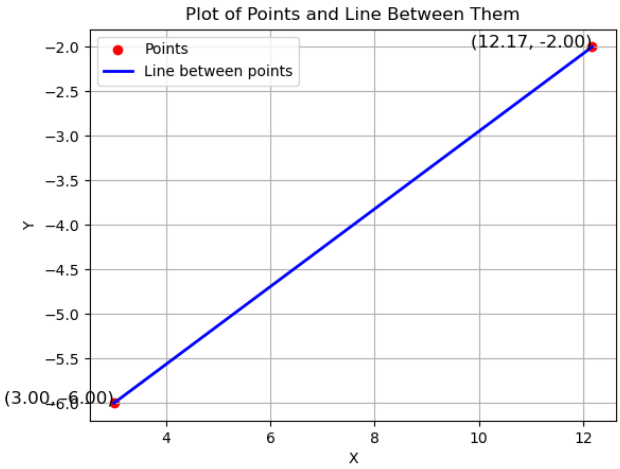

Fig. 0.1: line AB