1-1.9-22

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Vector Arithmetic(CBSE)

Question(1.9.22)Find the value of y for which the distance between the points P $\begin{pmatrix}2\\-3\end{pmatrix}$ and Q $\begin{pmatrix}10\\y\end{pmatrix}$ is 10 units. **Solution:** We have the points

Variable	Description
A	$\begin{pmatrix}2\\-3\end{pmatrix}$
B	$\begin{pmatrix}10\\y\end{pmatrix}$
D	**B** − **A**

TABLE 0: Variables Used

$$\mathbf{D} = \begin{pmatrix}8\\y+3\end{pmatrix} \tag{0.1}$$

$$\|\mathbf{D}\|^2 = \mathbf{D}\mathbf{D}^\top \tag{0.2}$$

$$\implies \|\mathbf{D}\|^2 = \begin{pmatrix}8\\y+3\end{pmatrix}\begin{pmatrix}8 & y+3\end{pmatrix} \tag{0.3}$$

$$\implies \|\mathbf{D}\|^2 = 8^2 + (y+3)^2 \tag{0.4}$$

$$\implies \|\mathbf{D}\|^2 = 73 + y^2 + 6 * y \tag{0.5}$$

$$\tag{0.6}$$

It has been given that the distance between the points is 10 units, so

$$\|\mathbf{D}\|^2 = 100 \tag{0.7}$$

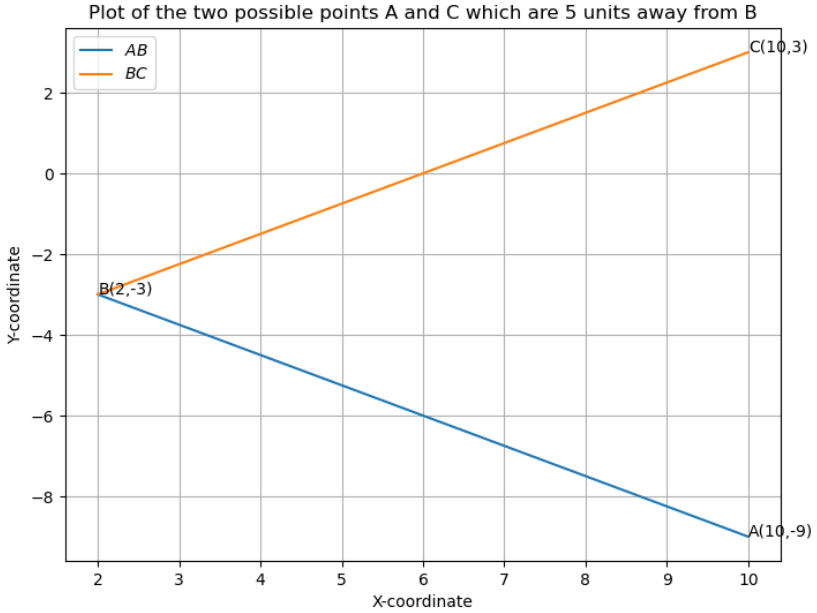
$$\implies 100 = 73 + y^2 + 6y \tag{0.8}$$

$$\implies 0 = y^2 + 6y - 27 \tag{0.9}$$

$$\implies y = -9 \tag{0.10}$$

$$\implies y = 3 \tag{0.11}$$

$$\tag{0.12}$$


Plot of the two possible points A and C which are 5 units away from B
AB
BC
C(10,3)
B(2,-3)
A(10,-9)
Y-coordinate
X-coordinate
2
0
−2
−4
−6
−8
2
3
4
5
6
7
8
9
10