# 1.9.29

EE25BTECH11041 - Naman Kumar

Question:
Find the value of y for which the distance between the points $\mathbf{A}\,(3,-1)$ and $\mathbf{B}\,(11,y)$ is 10 units.

**Solution:**
Distace Between any two vectors =

$$D = \|\mathbf{A}-\mathbf{B}\| \tag{1}$$

Where

$$\|\mathbf{A}-\mathbf{B}\| = \sqrt{(\mathbf{A}-\mathbf{B})^T(\mathbf{A}-\mathbf{B})} \tag{2}$$

Given,

$$\mathbf{A} = \begin{pmatrix} 3 \\ -1 \end{pmatrix} \mathbf{B} = \begin{pmatrix} 11 \\ y \end{pmatrix} \tag{3}$$

and distance, D = 10
Now using values of Both **A** and **B**,

$$\mathbf{A}-\mathbf{B} = \begin{pmatrix} 3-11 \\ -1-y \end{pmatrix} \tag{4}$$

Next

$$(\mathbf{A}-\mathbf{B})^T(\mathbf{A}-\mathbf{B}) = \begin{pmatrix} 3-11 & -1-y \end{pmatrix}\begin{pmatrix} 3-11 \\ -1-y \end{pmatrix} \tag{5}$$

Putting values in (2)

$$\sqrt{(3-11)^2+(-1-y)^2} = 10 \tag{6}$$

$$(3-11)^2+(-1-y)^2 = 100 \tag{7}$$

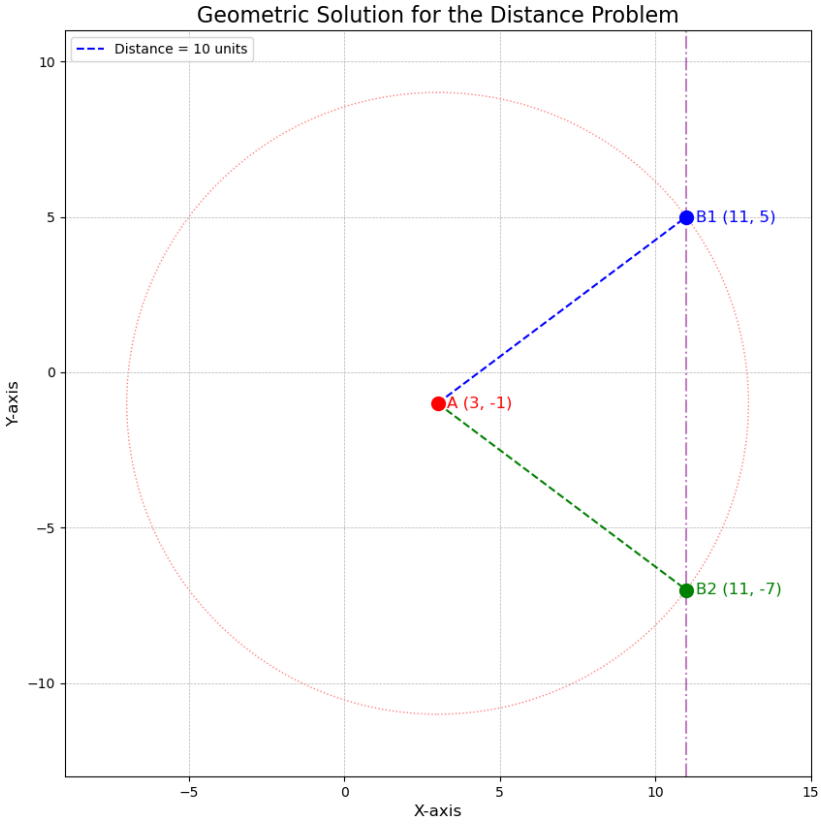
$$64+1+y^2+2y = 100 \tag{8}$$

$$y^2+2y-35 = 0 \tag{9}$$

$$(y+7)(y-5) = 0 \tag{10}$$

$$y = -7 \text{ or } 5 \tag{11}$$

Therefore, there are two possible values of $\mathbf{B}\,(11,5)$ or $\mathbf{B}\,(11,-7)$


Geometric Solution for the Distance Problem
Distance = 10 units
B1 (11, 5)
A (3, -1)
B2 (11, -7)
Y-axis
X-axis
10
5
0
−5
−10
−5
0
5
10
15