

# 1.8.18

EE25BTECH11001 - Aarush Dilawri

## Question:

Find the values of  $y$  for which the distance between the points  $\mathbf{P}(2, -3)$  and  $\mathbf{Q}(10, y)$  is 10 units.

## Solution:

We are given the points

$$\mathbf{P} = \begin{pmatrix} 2 \\ -3 \end{pmatrix}, \quad \mathbf{Q} = \begin{pmatrix} 10 \\ y \end{pmatrix} \quad (1)$$

The distance between them is 10 units, so

$$\|\mathbf{P} - \mathbf{Q}\| = 10 \quad (2)$$

Squaring both sides,

$$\|\mathbf{P} - \mathbf{Q}\|^2 = (\mathbf{P} - \mathbf{Q})^\top (\mathbf{P} - \mathbf{Q}) = 10^2 \quad (3)$$

Substituting,

$$\left( \begin{pmatrix} 2 \\ -3 \end{pmatrix} - \begin{pmatrix} 10 \\ y \end{pmatrix} \right)^\top \left( \begin{pmatrix} 2 \\ -3 \end{pmatrix} - \begin{pmatrix} 10 \\ y \end{pmatrix} \right) = 100 \quad (4)$$

$$\begin{pmatrix} -8 \\ -3-y \end{pmatrix}^\top \begin{pmatrix} -8 \\ -3-y \end{pmatrix} = 100 \quad (5)$$

$$(-8)^2 + (-3-y)^2 = 100 \quad (6)$$

$$64 + (y+3)^2 = 100 \quad (7)$$

$$(y+3)^2 = 36 \quad (8)$$

$$y+3 = \pm 6 \quad (9)$$

$$y = 3 \quad \text{or} \quad y = -9 \quad (10)$$

See Fig. 0 ,

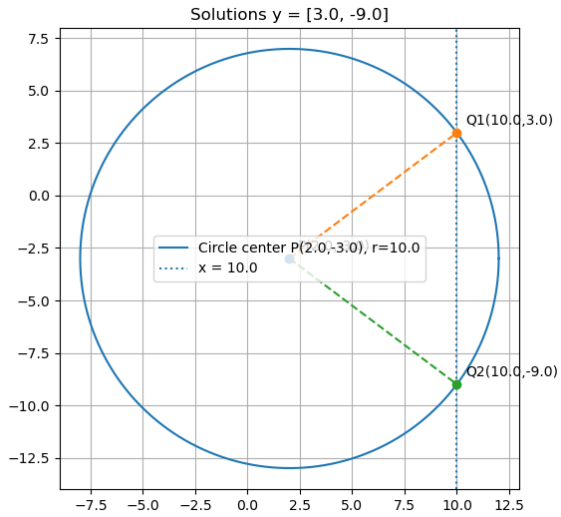


Fig. 0