

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

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

The distance between them is 10 units, so

$$\|\mathbf{P} - \mathbf{Q}\| = 10$$

Squaring both sides,

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

Substituting,

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

$$\begin{pmatrix} -8 \\ -3-y \end{pmatrix}^\top \begin{pmatrix} -8 \\ -3-y \end{pmatrix} = 100$$

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

$$64 + (y+3)^2 = 100$$

$$(y+3)^2 = 36$$

$$y+3 = \pm 6$$

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

See Fig. 0 ,

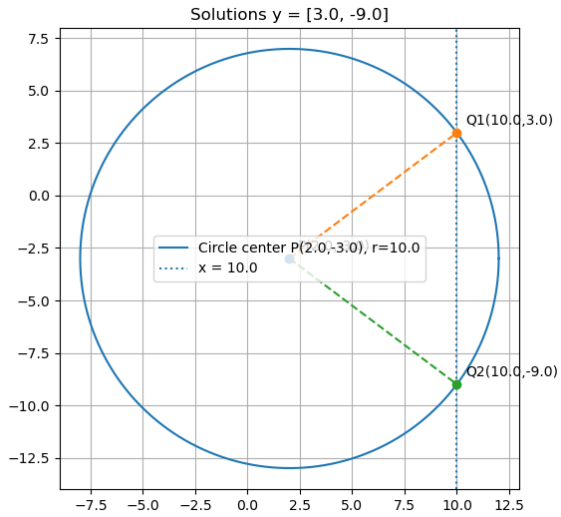


Fig. 0