

Assignment 5

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Download all python codes from

<https://github.com/ka-raja-babu/Matrix-Theory/tree/main/Assignment5/Codes>

and latex-tikz codes from

<https://github.com/ka-raja-babu/Matrix-Theory/tree/main/Assignment5>

1 QUESTION No. 2.1

Find the equation of the circle with radius 5 whose centre lies on x-axis and passes through the point $\begin{pmatrix} 2 \\ 3 \end{pmatrix}$.

2 SOLUTION

Let \mathbf{O} be the centre and r be the radius of the given circle.

\therefore

$$\mathbf{O} = \begin{pmatrix} p \\ 0 \end{pmatrix} \quad (2.0.1)$$

$$r = 5 \quad (2.0.2)$$

General equation of a circle is given by

$$\mathbf{x}^T \mathbf{x} - 2\mathbf{O}^T \mathbf{x} + \|\mathbf{O}\|^2 - r^2 = 0 \quad (2.0.3)$$

\therefore The equation of given circle is

$$\mathbf{x}^T \mathbf{x} - 2(p \ 0) \mathbf{x} + p^2 - 25 = 0 \quad (2.0.4)$$

\therefore Point $\mathbf{A} = \begin{pmatrix} 2 \\ 3 \end{pmatrix}$ lies on this equation and satisfies it.

\therefore

$$\begin{pmatrix} 2 & 3 \end{pmatrix} \begin{pmatrix} 2 \\ 3 \end{pmatrix} - 2(p \ 0) \begin{pmatrix} 2 \\ 3 \end{pmatrix} + p^2 - 25 = 0 \quad (2.0.5)$$

$$\Rightarrow 13 - 4p + p^2 - 25 = 0 \quad (2.0.6)$$

$$\Rightarrow p^2 - 4p - 12 = 0 \quad (2.0.7)$$

$$\Rightarrow p = 6 \quad (2.0.8)$$

$$\text{or, } p = -2 \quad (2.0.9)$$

Hence, the equation of the circle can be written as

$$\mathbf{x}^T \mathbf{x} - 2 \begin{pmatrix} 6 & 0 \end{pmatrix} \mathbf{x} + 11 = 0 \quad (2.0.10)$$

$$\text{or, } \mathbf{x}^T \mathbf{x} - 2 \begin{pmatrix} -2 & 0 \end{pmatrix} \mathbf{x} - 21 = 0 \quad (2.0.11)$$

Plot of the equation (2.0.10)

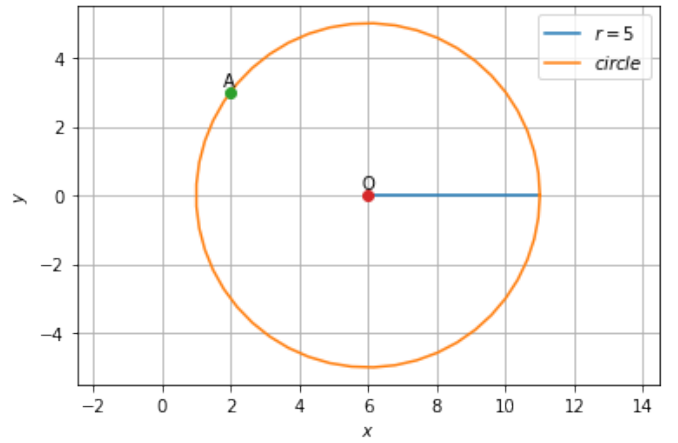


Fig. 2.1: Circle with centre (6,0)

Plot of the equation (2.0.11)

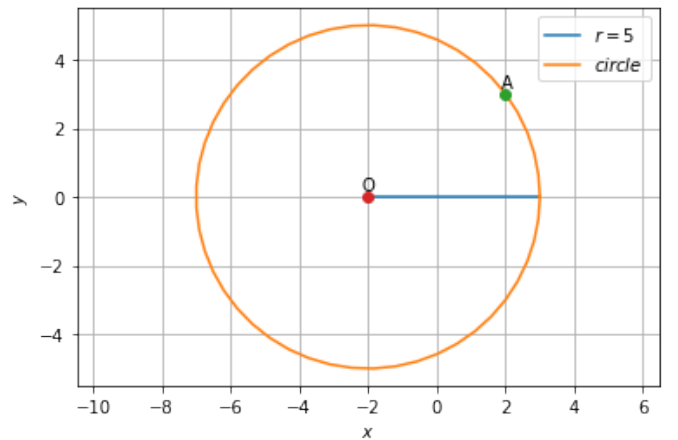


Fig. 2.2: Circle with centre (-2,0)