Line Assignment

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1 Problem:

Find the equation of circle passing with radius 5 whose center lies on x-axis and passes through point $\binom{2}{3}$.

2 Solution:

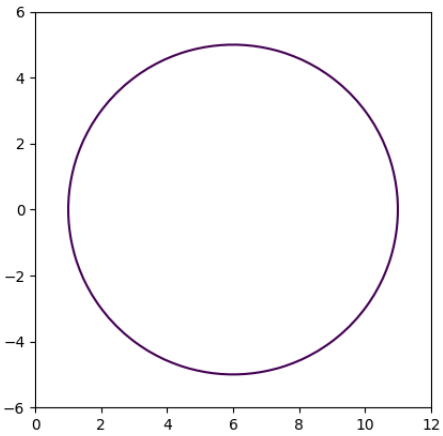

Figure 1: Circle

2.1 Theory:

The circle equation when it's center and radius are given is

$$(\mathbf{x-a})^2+(\mathbf{y-b})^2=\mathbf{r^2} \tag{1}$$
$$\tag{2}$$

where the centre of the circle is $\begin{pmatrix} a \\ b \end{pmatrix}$.

2.2 Mathematical Calculation:

Given the radius of circle is 5. The circle passes through a point $\begin{pmatrix} 2 \\ 3 \end{pmatrix}$. Also, the center of circle is assumed as $\begin{pmatrix} a \\ 0 \end{pmatrix}$. Substitute $\begin{pmatrix} a \\ 0 \end{pmatrix}$ in eq.1 we get,

$$(\mathbf{x-a})^2+(\mathbf{y})^2=\mathbf{25} \tag{3}$$
$$\tag{4}$$

As the point $\begin{pmatrix} 2 \\ 3 \end{pmatrix}$ passes through the circle, substitute $\begin{pmatrix} 2 \\ 3 \end{pmatrix}$ in the equation, we get,

$$(\mathbf{2-a})^2+(\mathbf{3})^2=\mathbf{25} \tag{5}$$
$$\mathbf{4+a^2-2a+9=25} \tag{6}$$
$$\mathbf{a^2-2a+13=25} \tag{7}$$
$$\mathbf{a^2-2a-12}=0 \tag{8}$$
$$\tag{9}$$

The roots of the equation will be $(6,-2)$. Hence, the center of the circle can be $\begin{pmatrix} 6 \\ 0 \end{pmatrix}$ or $\begin{pmatrix} -2 \\ 0 \end{pmatrix}$. The equation of circle will therefore be,

$$(\mathbf{x-6})^2+\mathbf{y^2}=25 \tag{10}$$
$$(\mathbf{x+2})^2+\mathbf{y^2}=25 \tag{11}$$

3 Construction:

variable	length/point	Description
A	np.roots(coeff)	coeff = (1,-4,-12)
c	$(a-A[0])^2+b^2-r^2$	Circle Eqn