

# Assignment 3

Perambuduri Srikan - AI20BTECH11018

Download all python codes from

<https://github.com/srikan-p/EE3900/tree/main/Assignment3/codes>

Download all latex codes from

<https://github.com/srikan-p/EE3900/tree/main/Assignment3>

The equation of line in terms of normal vector

$$\mathbf{n}^T(\mathbf{x} - \mathbf{M}) = 0 \quad (0.0.9)$$

$$\begin{pmatrix} 1 & -1 \end{pmatrix} \mathbf{x} = \begin{pmatrix} 1 & -1 \end{pmatrix} \mathbf{M} \quad (0.0.10)$$

$$\begin{pmatrix} 1 & -1 \end{pmatrix} \mathbf{x} = \begin{pmatrix} 1 & -1 \end{pmatrix} \begin{pmatrix} 4 \\ 1 \end{pmatrix} \quad (0.0.11)$$

$$\begin{pmatrix} 1 & -1 \end{pmatrix} \mathbf{x} = 3 \quad (0.0.12)$$

## PROBLEM

(Ramsey 4.2 Q18) Find the equation of the chord of the circle  $\mathbf{x}^T \mathbf{x} - \begin{pmatrix} 6 & 4 \end{pmatrix} \mathbf{x} - 23 = 0$  which has the point  $\begin{pmatrix} 4 \\ 1 \end{pmatrix}$  as its middle point.

## SOLUTION

The general equation of circle is

$$\mathbf{x}^T \mathbf{x} - 2\mathbf{c}^T \mathbf{x} + f = 0 \quad (0.0.1)$$

where  $\mathbf{c}$  is the centre of the circle.

$$\mathbf{c} = \begin{pmatrix} 3 \\ 2 \end{pmatrix} \quad (0.0.2)$$

$$\mathbf{O} = \mathbf{c} \quad (0.0.3)$$

$$\mathbf{M} = \begin{pmatrix} 4 \\ 1 \end{pmatrix} \quad (0.0.4)$$

The line passing through the centre bisects any chord perpendicularly. The direction vector of  $\mathbf{OM}$  is

$$\mathbf{OM} = \mathbf{M} - \mathbf{O} \quad (0.0.5)$$

$$= \begin{pmatrix} 4 \\ 1 \end{pmatrix} - \begin{pmatrix} 3 \\ 2 \end{pmatrix} \quad (0.0.6)$$

$$= \begin{pmatrix} 1 \\ -1 \end{pmatrix} \quad (0.0.7)$$

The normal vector  $\mathbf{n}$  is

$$\mathbf{n} = \mathbf{OM} \quad (0.0.8)$$

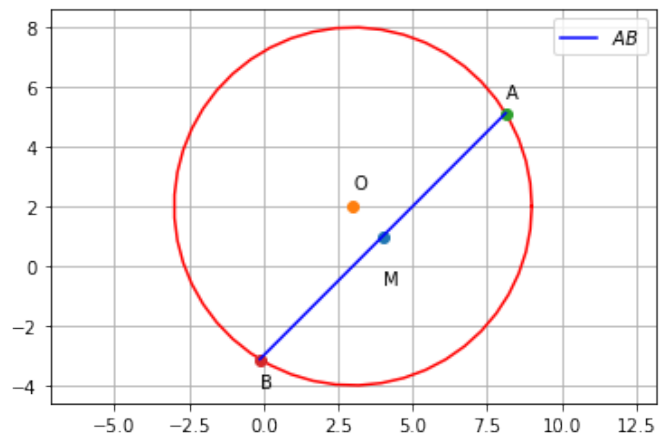


Fig. 0: Plot of the given points and circle