Assignment 4

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***Abstract*—This document explains the concept of the equation of a circle touches the straight line.**

Download the python code from

https://github.com/ee17btech11034/AI5106/blob/main/Assignment_4/AI_assignment_4.py

and latex-tikz codes from

https://github.com/ee17btech11034/AI5106/blob/main/Assignment_4/assignment_4.tex

1 Problem

Find the equation to the circle which has its centre at $\begin{pmatrix}3\\4\end{pmatrix}$ and touches the straight line $\begin{pmatrix}5 & 12\end{pmatrix}\mathbf{x} = 1$.

2 Explanation

General equation of line and circle are given by:

$$\mathbf{n}^T\mathbf{x} - d = 0 \tag{2.0.1}$$

$$\mathbf{x}^T\mathbf{x} - 2\mathbf{c}^T\mathbf{x} + f = 0 \tag{2.0.2}$$

The straight line touches the circle so the radius of circle:

$$r = \left|\frac{\mathbf{n}^T\mathbf{c} - d}{\|\mathbf{n}\|}\right| \tag{2.0.3}$$

$$f = \|\mathbf{c}\|^2 - r^2 \tag{2.0.4}$$

3 Solution

So, the radius of circle is :

$$r = \left|\frac{\begin{pmatrix}5 & 12\end{pmatrix}\begin{pmatrix}3\\4\end{pmatrix} - 1}{\sqrt{(5)^2 + (12)^2}}\right| \tag{3.0.1}$$

$$r = \frac{62}{13} \tag{3.0.2}$$

$$f = (3)^2 + (4)^2 - (\frac{62}{13})^2 \tag{3.0.3}$$

$$f = \frac{381}{169} \tag{3.0.4}$$

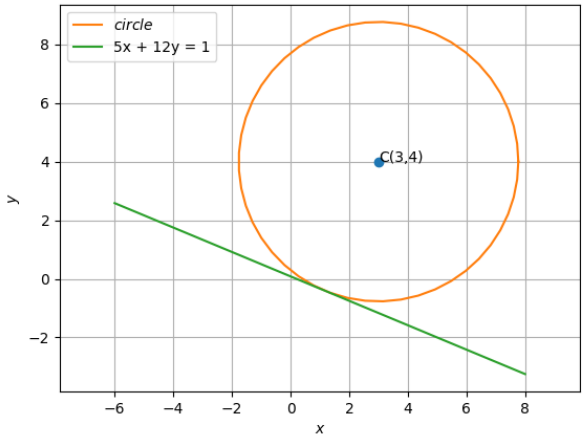

Fig. 0: Circle touches a line

Equation of circle is:

$$\mathbf{x}^T\mathbf{x} - 2\begin{pmatrix}3 & 4\end{pmatrix}\mathbf{x} + \frac{381}{169} = 0 \tag{3.0.5}$$