

MATRICES USING PYTHON

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IITH Future Wireless Communication (FWC)

ASSIGN-4

Contents

1 Problem

2 Construction

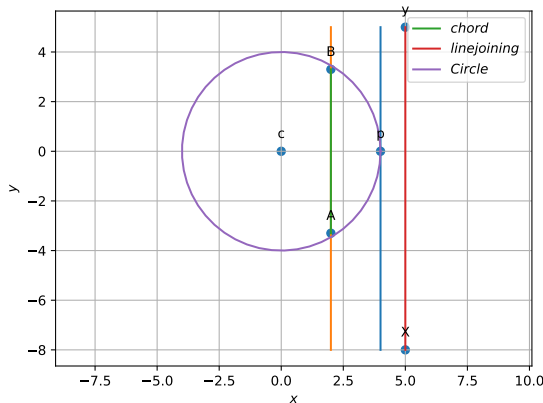
3 Solution

1 Problem

Draw a circle and two lines parallel to a given line such that one is a tangent and the other is a secant to the circle

2 Construction

Figure of Construction



The input parameters for this construction are

Symbol	Value	Description
r	4	Radius of the circle
C	$\begin{pmatrix} 0 \\ 0 \end{pmatrix}$	Point A

3 Solution

Termux commands :

```
python3 xyz.py
```

To Prove: In a given circle and a line draw two lines such that one is a secant and other one is tangent.

Given: Circle center with (0,0), radius 4 and a line.

$$\mathbf{x}^T \mathbf{V} \mathbf{x} + 2\mathbf{U}^T \mathbf{x} + f = 0 \quad (1)$$

$$\mathbf{V} = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}, \mathbf{U} = \begin{pmatrix} 0 \\ 0 \end{pmatrix} f = -16$$

By substituting above values in the equation (1) , we get circle equation.

Now let us take the given line equation as

$$\mathbf{n}^T \mathbf{x} = 5 \quad (2)$$

condition for tangent to the given circle will be

$$D = \pm C \quad (3)$$

$$D = \pm \sqrt{e^2 (\mathbf{u}^T \mathbf{n})^2 - \lambda_2 (e^2 - 1) (\|\mathbf{u}\|^2 - \lambda_2 f)} \quad (4)$$

by sloving the above eq we get,

$$D = \pm 4 \quad (5)$$

and the condition for secant which is also parallel to the given line will be

$$D \geq 0 \quad (6)$$

i.e

$$-4 < C < 4 \quad (7)$$

The below python code realizes the above construction:

https://github.com/Rahulraj00/Assignments/tree/main/Assignments/assg_5/xyz.py