

# JEE matrix problem through Python

*Raktim Gautam Goswami (EE17BTECH11051)*

*Abhishek Bairagi (EE17BTECH11004)*

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# Problem Statement

Find the equation of the tangent to the circle, at the point

$$\begin{bmatrix} 1 \\ -1 \end{bmatrix}$$

whose centre is the point of intersection of the straight lines

$$(2 \ 1)\mathbf{x} = 3$$

$$(1 \ -1)\mathbf{x} = 1$$

# Steps to solve

**Find point of intersection of the two given lines**

**Find normal vector of the required tangent**

**Write in matrix format**

## Solution

**Finding point of intersection of the two given lines** The given lines are

$$(2 \ 1)x = 3$$

$$(1 \ -1)x = 1$$

(1)

This can be written as the matrix equation

$$\begin{pmatrix} 2 & 1 \\ 1 & -1 \end{pmatrix} \begin{pmatrix} x \end{pmatrix} = \begin{pmatrix} 3 \\ 1 \end{pmatrix}$$

The point of intersection can be found by multiplying both sides of the equation by the inverse matrix.

$$\begin{pmatrix} x \end{pmatrix} = \begin{pmatrix} 1/3 & 1/3 \\ 1/3 & -2/3 \end{pmatrix} \begin{pmatrix} 3 \\ 1 \end{pmatrix}$$

So the required intersection point is

$$\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 4/3 \\ 1/3 \end{pmatrix}$$

The normal vector of the tangent will be the direction vector of the line joining the centre of circle C(4/3 , 1/3) and point of contact P(1,-1). So, the direction vector will be given by : C-P

$$\begin{pmatrix} 4/3 \\ 1/3 \end{pmatrix} - \begin{pmatrix} 1 \\ -1 \end{pmatrix} = \begin{pmatrix} 1/3 \\ 4/3 \end{pmatrix}$$

The equation of the line is of the form:

$$\begin{pmatrix} 1/3 \\ 4/3 \end{pmatrix} \cdot (X - P) = 0$$

Where P is

$$\begin{pmatrix} 1 \\ -1 \end{pmatrix}$$

# Code

The link of the code can be found here - Matrix code

# Figure

The figure for the above problem from plotting is as follows.

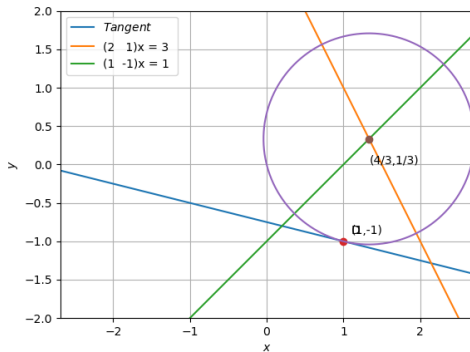


Figure: Tangent on Circle