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# Matrix Assignment - Circle

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where

$$\mathbf{R}_{\frac{\pi}{2}} = \begin{pmatrix} \cos \theta & -\sin \theta \\ \sin \theta & \cos \theta \end{pmatrix}$$

Equation of  $L_1$

$$\mathbf{n}^T (\mathbf{x} - \mathbf{A}) = 0 \quad (9)$$

$$\mathbf{n}^T \mathbf{x} - \mathbf{n}^T \mathbf{A} = 0 \quad (10)$$

Given circle

$$\mathbf{x}^2 + \mathbf{y}^2 - 4\mathbf{x} - 6\mathbf{y} - 3 = 0 \quad (11)$$

$$\mathbf{x}^T \mathbf{V}_2 \mathbf{x} + 2\mathbf{u}_2^T \mathbf{x} + f_2 \quad (12)$$

$$\mathbf{x}^T \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \mathbf{x} + 2 \begin{pmatrix} -2 & -3 \end{pmatrix} \mathbf{x} - 3 = 0 \quad (13)$$

Where

$$\mathbf{V}_2 = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \quad (14)$$

$$\mathbf{u}_2 = \begin{pmatrix} -2 & -3 \end{pmatrix} \quad (15)$$

$$f_2 = -3 \quad (16)$$

Common chord is given by

$$\mathbf{c}_1 - \mathbf{c}_2 + \lambda L_1 \quad (17)$$

Where

$c_1$  is circle having A and B as diameter

$c_2$  is given circle

$$(-5 - 6)\mathbf{x} + 56 + \lambda L_1 \quad (18)$$

$$(5 \ 6)\mathbf{x} = 56 - - - (L_2) \quad (19)$$

Using python we get the  $L_1$  and intersection point

$$(2 \ 3)\mathbf{x} = 27 - - - (L_1) \quad (20)$$

$$\begin{pmatrix} 5 & 6 \\ 2 & 3 \end{pmatrix} \mathbf{x} = \begin{pmatrix} 56 \\ 27 \end{pmatrix} \quad (21)$$

$$\mathbf{x} = (2, 7.667) \quad (22)$$

## I. PROBLEM

Consider a family of circles passing through two fixed points A(3,7) and B(6,5) show that the chords in which the circle  $x^2 + y^2 - 4x - 6y - 3 = 0$  cuts the members of the family are concurrent at a point. Find the coordinates of this point ?

## II. SOLUTION

$$\mathbf{x}^2 + \mathbf{y}^2 - 9\mathbf{x} - 12\mathbf{y} + 53 = 0 \quad (1)$$

$$\mathbf{x}^T \mathbf{V}_1 \mathbf{x} + 2\mathbf{u}_1^T \mathbf{x} + f_1 \quad (2)$$

$$\mathbf{x}^T \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \mathbf{x} + 2 \begin{pmatrix} -9 & -6 \end{pmatrix} \mathbf{x} + 53 = 0 \quad (3)$$

Where

$$\mathbf{V}_1 = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \quad (4)$$

$$\mathbf{u}_1 = \begin{pmatrix} -9 & -6 \end{pmatrix} \quad (5)$$

$$f_1 = 53 \quad (6)$$

Equation of circle with A and B as diameter

Equation of line passing through A and B

Direction vector

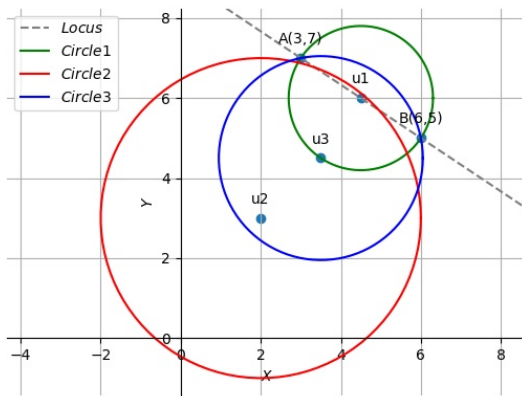
$$\mathbf{m} = \mathbf{A} - \mathbf{B} \quad (7)$$

Normal vector

$$\mathbf{n} = \mathbf{R}_{\frac{\pi}{2}} (\mathbf{m}) \quad (8)$$

<https://github.com/sssurajit/fwc/blob/main/matrix/circle/codes/scircle.py>

### III. FIGURE



### IV. CODE LINK

<https://github.com/sssurajit/fwc/blob/main/matrix/circle/codes/circle.py>

Execute the code by using the command  
**python3 circle.py**