

# Solving 2D geometric problems using matrices

Your subtitle (if there's one)

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# Geometric Problem

- A circle whose radius is 3 touches externally the circle C at point (2,2). The circle C is  $x^2 + y^2 + 4x - 2y - 4 = 0$ .

Then find the length of intercept made by that Circle on X-axis.

# Matrix Transformation

$$x^T x + \begin{bmatrix} -2 & 4 \end{bmatrix} x - 4 = 0 \quad (1)$$

intersects the circle at point  $\begin{bmatrix} 2 \\ 2 \end{bmatrix}$  Then, find intercept made by circle on x-axis by using matrices.

## Solution using matrices

Given point  $B = \begin{bmatrix} 2 \\ 2 \end{bmatrix}$  is midpoint of  $A = \begin{bmatrix} x \\ y \end{bmatrix}$  and  $C = \begin{bmatrix} -1 \\ 2 \end{bmatrix}$

Where A,C are centers of circles and B is point of intersection of those circles.

So, from above conditions we get  $A = \begin{bmatrix} 5 \\ 2 \end{bmatrix}$  Given radius of circle is 3, the equation of circle in matrix form is  $C' =$

$$x^T x + \begin{bmatrix} -10 & -4 \end{bmatrix} x + 20 = 0$$

(2)

## Intercept on x-axis

To find intercept on x-axis ,y co-ordinate should be zero.so,we get a quadratic equation,

$$x^2 - 10x + 20 = 0 \quad (3)$$

The roots of above equation are  $D = \begin{bmatrix} 7.236 \\ 2.764 \end{bmatrix}$ . Take a matrix  $M = \begin{bmatrix} 1 & -1 \end{bmatrix}$

Then,distance d is

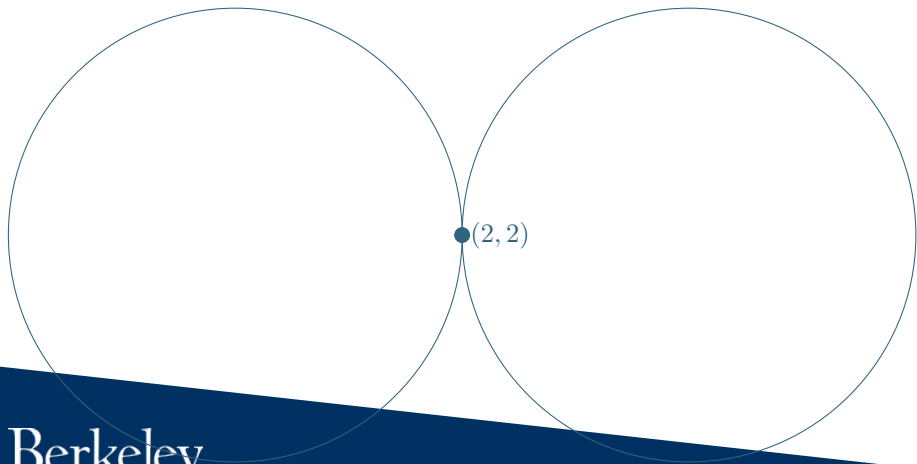
$$d = DM$$

(4)

Then,by matrix multiplication,distance

$$d = 4.472 \quad (5)$$

## Figure of solution



# Uploaded photo from python code

