Assignment 3

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Download all python codes from

```
https://github.com/satyasm45/Summer-Internship/tree/main/Assignment-3/Codes
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and latex-tikz codes from

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https://github.com/satyasm45/Summer-Internship/tree/main/Assignment-3
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1 Question No. 2.55

Let **A** and **B** be the centres of two circles of equal radii 3 such that each one of them passes through the centre of the other. Let them intersect at **C** and **D**. Is AB⊥CD?

2 Solution

To perform the given construction let us assume

$$\mathbf{A} = \begin{pmatrix} 0 \\ 0 \end{pmatrix} \tag{2.0.1}$$

Based on the constraints given in the question, **B** will lie on the circle with center as A and radius 3.Without loss of generality,let us assume:

$$\mathbf{B} = \begin{pmatrix} 3 \\ 0 \end{pmatrix} \tag{2.0.2}$$

Then,

$$\|\mathbf{B} - \mathbf{A}\| = \|\mathbf{A} - \mathbf{B}\| = \|\mathbf{B}\| = 3 \quad (\because \mathbf{A} = 0) \tag{2.0.3}$$

Clearly,all the constraints of the question are satisfied and we can proceed with the construction. All input values required to plot fig.2.1 are given in table 2.1 Fig. 2.1 is plotted using radii and polar coordinates with the angle ranging from 0 to 2π .

	Symbols	Circle 1	Circle 2
Centre	**A**,**B**	$\begin{pmatrix} 0 \\ 0 \end{pmatrix}$	$\begin{pmatrix} 3 \\ 0 \end{pmatrix}$
Radius	r_1,r_2	3	3
Polar coordinate	$\mathbf{C}_1$,$\mathbf{C}_2$	$3\begin{pmatrix} \cos\theta \\ \sin\theta \end{pmatrix}$	$\begin{pmatrix} 3 \\ 0 \end{pmatrix}+3\begin{pmatrix} \cos\theta \\ \sin\theta \end{pmatrix}$
Angle	θ	0-2π	0-2π

TABLE 2.1: Input values

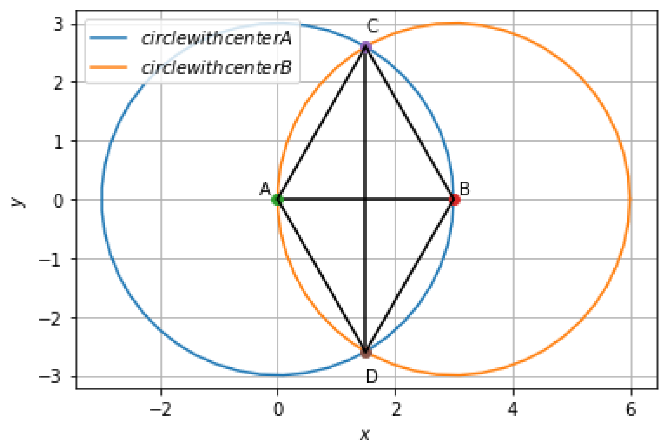

Fig. 2.1: Circles with their points of intersection

We have **C** and **D** as points of intersection.So,

$$\|\mathbf{D} - \mathbf{A}\| = \|\mathbf{C} - \mathbf{A}\| = r_1 = 3 \tag{2.0.4}$$

$$\|\mathbf{D} - \mathbf{B}\| = \|\mathbf{C} - \mathbf{B}\| = r_2 = 3 \tag{2.0.5}$$

Therefore,in quadrilateral ACBD we have

$$\|\mathbf{D} - \mathbf{B}\| = \|\mathbf{C} - \mathbf{B}\| = \|\mathbf{D} - \mathbf{A}\| = \|\mathbf{C} - \mathbf{A}\| = 3 \tag{2.0.6}$$

So,ACBD is a Rhombus. For a Rhombus we have diagonals bisect each other at right angles.

Therefore it can be concluded that AB⊥CD.