

Matrix Assignment

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Problem Statement -Two concentric circles are of radii 5cm and 3cm. Find the length of the chord of the larger circle which touches the smaller circle.

Substitute eqn10 value in eqn9

$$||o||^2 = 34 - 2(3)(5)\left(\frac{3}{5}\right) \quad (11)$$

$$||o||^2 = 34 - 18 \quad (12)$$

$$||o||^2 = 16 \quad (13)$$

$$||o|| = 4 \quad (14)$$

Solution

Given the radii of the circles : 3cm, 5cm

$r_1 = 5\text{cm}$, $r_2 = 3\text{cm}$. Let,

$$O - A = p$$

(1) Similarly, in $\triangle OPB$,

$$O - P = a$$

(2)

$$P - B = b \quad (15)$$

$$P - A = o$$

(3)

$$||b|| = 4 \quad (16)$$

From the triangle law of addition of vectors:

$$p = a + o \quad (4)$$

$$o = p - a \quad (5)$$

$$||A - B|| = |o| + |b| \quad (17)$$

$$A - B = 4 + 4 \quad (18)$$

$$A - B = 8 \quad (19)$$

find the magnitude of the vector o

$$||o||^2 = ||p-a||^2$$

$$||o||^2 = |p-a||p-a|^T$$

$$||o||^2 = ||p||^2 + ||a||^2 - 2p \cdot a^T$$

$$||o||^2 = 25 + 9 - 2(|p||a|)(\cos\theta)$$

(6)

Construction

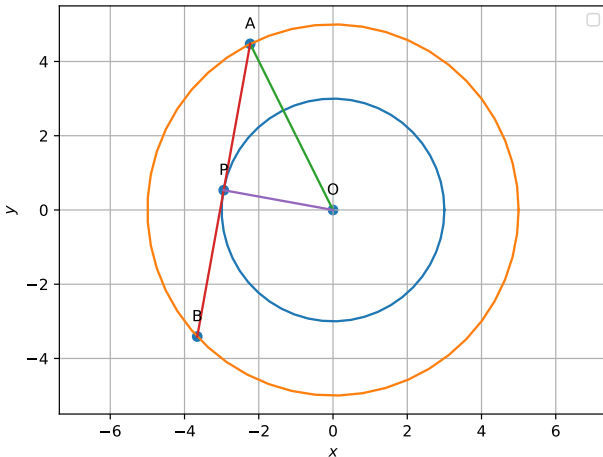
(7)

(8)

(9)

The input parameters are the lengths r_1 and r_2 .

symbol	value	description
r_1	3	OP
r_2	5	OA
θ	$\text{acos}(\frac{r_1}{r_2})$	$\angle O$
A	$r_1 \begin{pmatrix} \cos(90 - \theta) \\ \sin(90 - \theta) \end{pmatrix}$	Point A
B	$r_1 \begin{pmatrix} \cos(270 + \theta) \\ -\sin(270 + \theta) \end{pmatrix}$	Point B



From the figure, in $\triangle OPA$:

$$\cos\theta = \frac{3}{5} \quad (10)$$