

# MATRICES USING PYTHON

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Assignment

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## 1 Problem

Let A be the centre of the circle  $x^2 + y^2 - 2x - 4y - 20 = 0$ . Suppose the tangents at the points B(1,7) and D(4,-2) on the circle meet at the point C. Find the area of the quadrilateral ABCD.

## 2 Construction

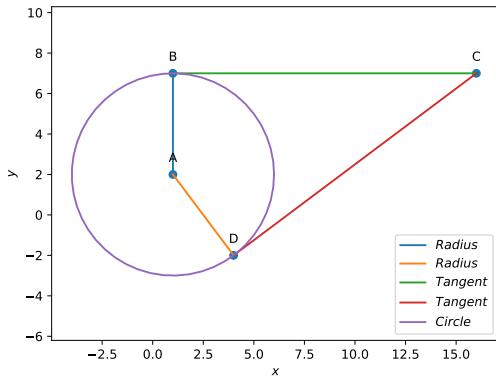


Figure of construction

## 3 Solution

The input parameters for this construction are

Symbol	Value	Description
r	5	Radius
A	$\begin{pmatrix} 1 \\ 2 \end{pmatrix}$	Centre
B	$\begin{pmatrix} 1 \\ 7 \end{pmatrix}$	Point B
D	$\begin{pmatrix} 4 \\ -2 \end{pmatrix}$	Point D

The steps for constructing above figure are :

1. Draw a circle of radius  $r$

2. Locate B,D on the circle

3. Find the equations of the tangents drawn from the B,D using the formula

$$xx_1 + yy_1 + g(x + x_1) + f(y + y_1) + c = 0$$

where

$x_1, y_1$  are the coordinates of the point from where the tangents are drawn

4. Solve the both the equations of the tangents to find C

Circle equation :  $x^2 + y^2 - 2x - 4y - 20 = 0$

Equations of tangents at B,D are given by

$$x + 7y - (x + 1) - 2(y + 7) - 20 = 0 \quad (1)$$

$$4x - 2y - (x + 4) - 2(y - 2) - 20 = 0 \quad (2)$$

The above equations result in the system

$$y = 7 \quad (3)$$

$$3x - 4y = 20 \quad (4)$$

From (3),(4) let

$$\mathbf{Z} = \begin{pmatrix} 0 & 1 \\ 3 & -4 \end{pmatrix} \quad (5)$$

$$\mathbf{X} = \begin{pmatrix} 7 \\ 20 \end{pmatrix} \quad (6)$$

Solve (5) and (6)

$\therefore$  Coordinates of C is  $\mathbf{C} = \begin{pmatrix} 16 \\ 7 \end{pmatrix}$

Letting,

$$\mathbf{v1} = \mathbf{A} - \mathbf{B} \quad (7)$$

$$\mathbf{v2} = \mathbf{A} - \mathbf{C} \quad (8)$$

Area of the  $\triangle ABC$  is given by

$$= \frac{1}{2} \|\mathbf{v1} \times \mathbf{v2}\| \quad (9)$$

Area of the of quadrilateral ABCD is given by

$$= 2 \times \frac{1}{2} \|\mathbf{v1} \times \mathbf{v2}\| \quad (10)$$

$\therefore$  The area of quadrilateral ABCD=75 sq.units

**termux commands :**

```
bash sh2.sh.....using shell command
```

Below python code realizes the above construction :

```
https://github.com/velicharlagokulkumar/FWC\_module1/blob/main/matrices/circle/codes/matrix.py
```