MATRICES USING PYTHON

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Contents

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 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

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

Equations of tangents at $\mathbf{B}, \mathbf{D}$ are given by

$$x + 7y - (x+1) - 2(y+7) - 20 = 0 \tag{1}$$
$$4x - 2y - (x+4) - 2(y-2) - 20 = 0 \tag{2}$$

The above equations result in the system

$$y = 7 \tag{3}$$
$$3x - 4y = 20 \tag{4}$$

From (3),(4) let

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

$$\mathbf{X} = \begin{pmatrix} 7 \\ 20 \end{pmatrix} \tag{6}$$

Solve (5) and (6)

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

Length of BC is

$$\mathbf{B} - \mathbf{C} = \begin{pmatrix} -15 \\ 0 \end{pmatrix} \tag{7}$$

$$\|\mathbf{B} - \mathbf{C}\| = \left\| \begin{pmatrix} -15 \\ 0 \end{pmatrix} \right\| \tag{8}$$

$$= \sqrt{\begin{pmatrix} -15 & 0 \end{pmatrix} \begin{pmatrix} -15 \\ 0 \end{pmatrix}} \tag{9}$$

$$= 15 \tag{10}$$

Letting,

$$\mathbf{v1} = \mathbf{A} - \mathbf{B} \tag{11}$$
$$\mathbf{v2} = \mathbf{A} - \mathbf{C} \tag{12}$$

Area of the $\triangle$ABC is given by

$$= \frac{1}{2} \|\mathbf{v1} \times \mathbf{v2}\| \tag{13}$$

Area of the of quadrilateral ABCD is given by

$$= 2 \times \frac{1}{2} \|\mathbf{v1} \times \mathbf{v2}\| \tag{14}$$

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

termux commands :

```
bash sh.sh
```

The below python code realizes the above construction:

https://github.com/velicharlagokulkumar/FWC_module1/blob/main/matrices/circle/codes/matrix.py
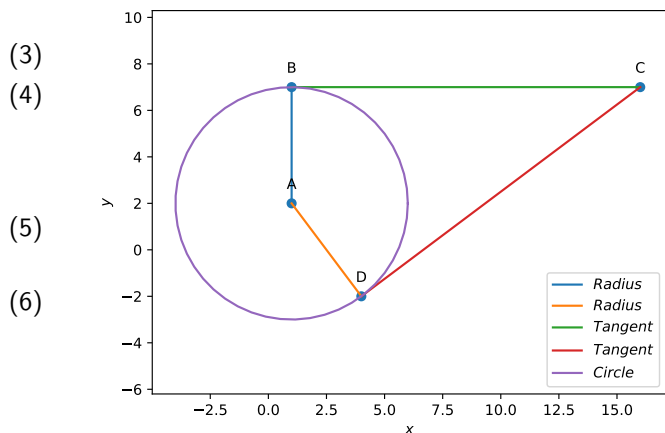
3 Construction

Figure of construction