MATRICES USING PYTHON

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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

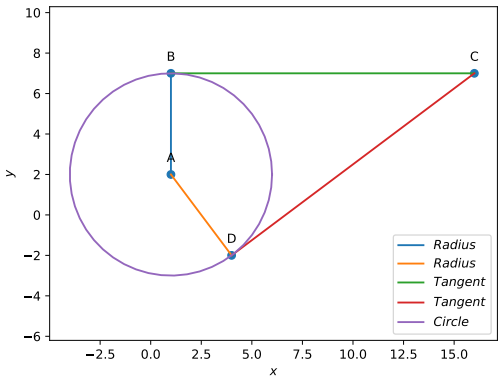

Figure of construction

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 $\mathbf{B}$,$\mathbf{D}$ on the circle
3. Find the equations of the tangents drawn from the $\mathbf{B}$,$\mathbf{D}$ 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 $\mathbf{C}$

Circle equation : $x^2+y^2-2x-4y-20=0$
Equations of tangents at $\mathbf{B},\mathbf{D}$ are given by

$$x+7y-(x+1)-2(y+7)-20=0 \quad (1)$$
$$4x-2y-(x+4)-2(y-2)-20=0 \quad (2)$$

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 ΔABC 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