MATGEO: 7-7.2-19

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Question

Equation of the circle with centre on the Y axis and passing through the origin and the point (2, 3) is

- $3x^2 + 3y^2 - 13y = 0$
- $3x^2 + 3y^2 + 13x + 3 = 0$
- $6x^2 + 6y^2 - 13x = 0$
- $x^2 + y^2 + 13x + 3 = 0$

(MATGEO 7-7.2-19)

Solution: Theory

parameter	Description	value
C	Centre	$\begin{pmatrix} 0 \\ 13/6 \end{pmatrix}$
O	point1	$\begin{pmatrix} 0 \\ 0 \end{pmatrix}$
P	point2	$\begin{pmatrix} 2 \\ 3 \end{pmatrix}$
r	radius	$13/6$

Given Data

From the given information,

$$x_1 = \begin{pmatrix} 2 \\ 3 \end{pmatrix}, x_2 = \begin{pmatrix} 0 \\ 0 \end{pmatrix}, n = \begin{pmatrix} 1 \\ 0 \end{pmatrix}, c = 0 \tag{1}$$

$$\begin{pmatrix} 4 & 6 & 1 \\ 0 & 0 & 1 \\ -1 & 0 & 0 \end{pmatrix} \begin{pmatrix} u \\ f \end{pmatrix} = \begin{pmatrix} -13 \\ 0 \\ 0 \end{pmatrix} \tag{2}$$

The augmented matrix is expressed as

$$\left(\begin{array}{ccc|c} 4 & 6 & 1 & -13 \\ 0 & 0 & 1 & 0 \\ -1 & 0 & 0 & 0 \end{array}\right) \tag{3}$$

Row Operations

performing sequences of row operations to transform into Echelon form

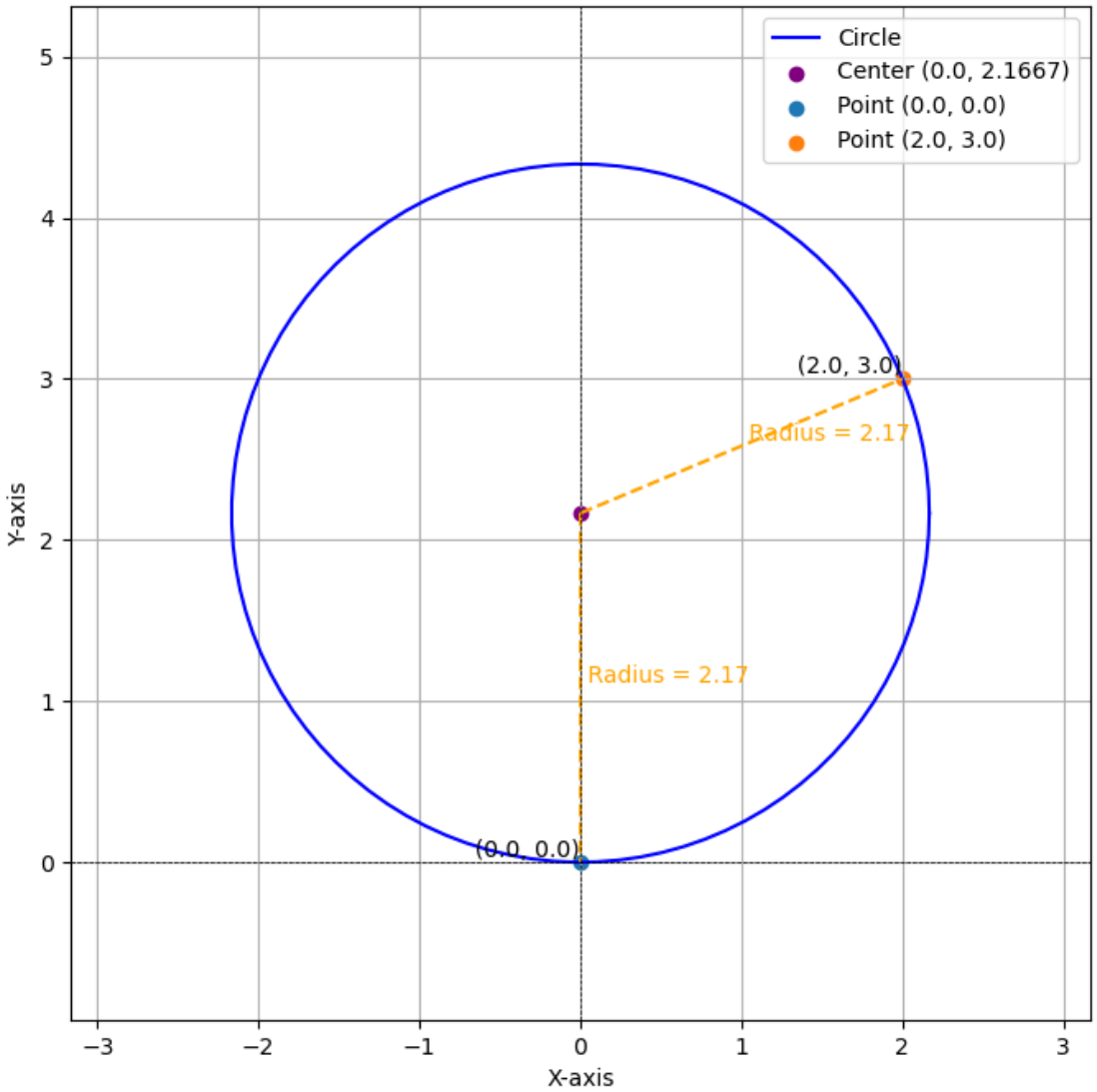
$$\xleftrightarrow{R_3 \to 4R_3 + R_1} \left(\begin{array}{ccc|c} 4 & 6 & 1 & -13 \\ 0 & 0 & 1 & 0 \\ 0 & 6 & 1 & -13 \end{array}\right) \xleftrightarrow{R_1 \to R_1 - R_3} \left(\begin{array}{ccc|c} 4 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 6 & 1 & -13 \end{array}\right) \tag{4}$$

$$\xleftrightarrow{R_2 \to R_2 - R_3} \left(\begin{array}{ccc|c} 4 & 0 & 0 & 0 \\ 0 & -6 & 0 & 13 \\ 0 & 6 & 1 & -13 \end{array}\right) \xleftrightarrow{R_3 \to R_3 + R_2} \left(\begin{array}{ccc|c} 4 & 0 & 0 & 0 \\ 0 & -6 & 0 & 13 \\ 0 & 0 & 1 & 0 \end{array}\right) \tag{5}$$

$$\xleftrightarrow{R_1 \to R_1/4, R_2 \to R_2/-6} \left(\begin{array}{ccc|c} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & -13/6 \\ 0 & 0 & 1 & 0 \end{array}\right) \tag{6}$$

$$u = \begin{pmatrix} 0 \\ -13/6 \end{pmatrix}, f = 0 \tag{7}$$

Graph


Circle
Center (0.0, 2.1667)
Point (0.0, 0.0)
Point (2.0, 3.0)
(2.0, 3.0)
Radius = 2.17
Radius = 2.17
(0.0, 0.0)
Y-axis
X-axis
5
4
3
2
1
0
−3
−2
−1
0
1
2
3

C-Code

include ¡stdio.h¿ int main() float centerX = 0.0f, centerY = 2.1667f; float radius = 2.1667f; float points[2][2] = 0.0f, 0.0f, 2.0f, 3.0f ; float *center = centerX; float *radiusPtr = radius; float (*pointsPtr)[2] = points; FILE *file = fopen("data.txt", "w"); if (file == NULL) perror("Error opening file"); return 1; fprintf(file, "Center: fprintf(file, "Radius: fprintf(file, "Points: (pointsPtr[0][0], pointsPtr[0][1], pointsPtr[1][0], pointsPtr[1][1]); fclose(file); printf("Data written to data.txt successfully."); return 0;

Python-Code

import numpy as np import matplotlib.pyplot as plt def
$read_data(file_name) : with open(file_name,' r')as file : lines =$
$file.readlines()center = tuple(map(float, lines[0].strip().split(':'$
$)[1].strip().split(',')))radius = float(lines[1].strip().split(':'$
$)[1].strip())points_line = lines[2].strip().split(':')[1].strip()points =$
$[tuple(map(float, p.strip().strip('()').split(',')))for p in points_line.split('), ('),ret$
$read_data('data.txt')theta = np.linspace(0, 2 * np.pi, 100)x_circle =$
$radius * np.cos(theta) + center[0]y_circle = radius * np.sin(theta) +$
$center[1]plt.figure(figsize = (8, 8))plt.plot(x_circle, y_circle, label ='$
$Circle', color =' blue')plt.scatter(center[0], center[1], color ='$
$purple', label = f'Center center')for point in points :$
$plt.scatter(*point, label = f'Point point')for point in points :$
$plt.plot([center[0], point[0]], [center[1], point[1]], color ='$
$orange', linestyle =' --')mid_x = (center[0] + point[0])/2mid_y =$
$(center[1] + point[1])/2plt.text(mid_x, mid_y, f'Radius =$
$radius : .2f', fontsize = 10, color =' orange', vertical alignment ='$
$bottom')for point in points : plt.text(point[0], point[1], f'point', fontsize =$