

Assignment 2

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Area of Triangle

Abstract—This document contains the sketching of the loci using equations.

Download all python codes from

<https://github.com/ashish-hk/Assignment2/blob/main/Assignment2.ipynb>

Download latex-tikz codes from

<https://github.com/ashish-hk/Assignment2/blob/main/main.tex>

1 PROBLEM

Solve: **Problem set: Vector2, Example-4,4**

By taking a number of solutions, sketch the loci of the following equation

$$x^2 - 4x + y^2 + 3 = 0 \quad (1.0.1)$$

2 SOLUTION

The general equation is given as,

$$\mathbf{x}^T \mathbf{V} \mathbf{x} + 2\mathbf{u}^T \mathbf{x} + f = 0 \quad (2.0.1)$$

Comparing (1.0.1) and (2.0.1) we get,

$$\mathbf{V} = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}, \mathbf{u} = \begin{pmatrix} -2 \\ 0 \end{pmatrix}, f = 3 \quad (2.0.2)$$

The center of circle is given as \mathbf{c} and can be obtained from,

$$\mathbf{c} = -\mathbf{V}^{-1} \mathbf{u} \quad (2.0.3)$$

The inverse of \mathbf{V} (which is an identity matrix here) is identity itself,

$$\mathbf{V}^{-1} = \mathbf{V} = \mathbf{I} \quad (2.0.4)$$

Putting the values of (2.0.2) and (2.0.4) in (2.0.3) we get,

$$\mathbf{c} = -\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \begin{pmatrix} -2 \\ 0 \end{pmatrix} \quad (2.0.5)$$

$$\mathbf{c} = \begin{pmatrix} 2 \\ 0 \end{pmatrix} \quad (2.0.6)$$

Now we'll calculate the radius of the circle:

$$\mathbf{r} = \sqrt{\mathbf{u}^T \mathbf{u} - f} \quad (2.0.7)$$

$$\mathbf{u}^T \mathbf{u} = \|\mathbf{u}\|^2 \quad (2.0.8)$$

$$= 2^2 = 4 \quad (2.0.9)$$

Putting the value of (2.0.8) in (2.0.4) we get,

$$\mathbf{r} = \sqrt{4 - 3} \quad (2.0.10)$$

$$= 1 \text{ unit} \quad (2.0.11)$$

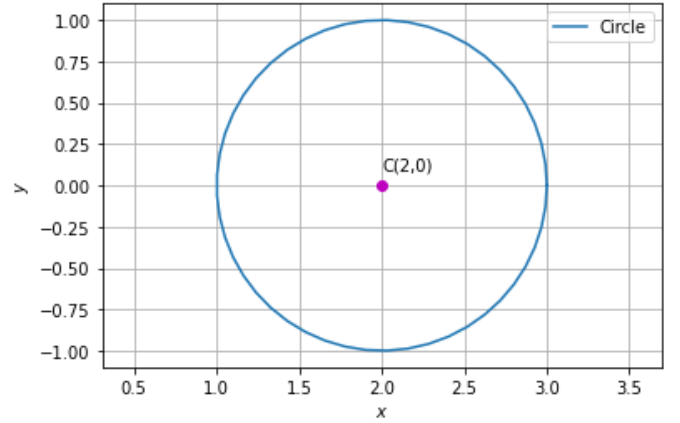


Fig. 1: Plot obtained from Python code