Assignment 3

Ashish Jangid

Area of Triangle

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

Download all python codes from

https://github.com/ashish−hk/Assignment_3/blob/main/Assignment3.ipynb

Download latex-tikz codes from

https://github.com/ashish−hk/Assignment_3/blob/main/main.tex

1 Problem

Solve: **Problem set: Vector2, Example-5,5**

Find the equation to the straight line cutting off intercepts 3 and 2 from the axes.

2 Solution

The line passes through the given points

$$\mathbf{x}_1 = \begin{pmatrix}3\\0\end{pmatrix} \text{ and } \mathbf{x}_2 = \begin{pmatrix}0\\2\end{pmatrix}$$

We know that,

$$\mathbf{n}^T\mathbf{x} = 1$$

$$\mathbf{n}^T\begin{pmatrix}3\\0\end{pmatrix} = 1 \tag{2.0.1}$$

$$\mathbf{n}^T\begin{pmatrix}0\\2\end{pmatrix} = 1 \tag{2.0.2}$$

resulting in the the matrix equation

$$\begin{pmatrix}3 & 0\\0 & 2\end{pmatrix}\mathbf{n} = \begin{pmatrix}1\\1\end{pmatrix} \tag{2.0.3}$$

yielding the augmented matrix

$$\begin{pmatrix}3 & 0 & 1\\0 & 2 & 1\end{pmatrix} \tag{2.0.4}$$

Performing row reduction,

$$\begin{pmatrix}3 & 0 & 1\\0 & 2 & 1\end{pmatrix} \tag{2.0.5}$$

$$\overset{R_1 \leftarrow \frac{R_1}{3}}{\longleftrightarrow} \begin{pmatrix}1 & 0 & \frac{1}{3}\\0 & 2 & 1\end{pmatrix} \tag{2.0.6}$$

$$\overset{R_2 \leftarrow \frac{R_2}{2}}{\longleftrightarrow} \begin{pmatrix}1 & 0 & \frac{1}{3}\\0 & 1 & \frac{1}{2}\end{pmatrix} \tag{2.0.7}$$

$$\tag{2.0.8}$$

From (2.0.8),

$$\mathbf{n} = \frac{1}{6}\begin{pmatrix}2\\3\end{pmatrix} \tag{2.0.9}$$

Thus the equation of the desired line is

$$\frac{1}{6}\begin{pmatrix}2 & 3\end{pmatrix}\mathbf{x} = 1 \tag{2.0.10}$$

$$\text{or, } \begin{pmatrix}2 & 3\end{pmatrix}\mathbf{x} = 6 \tag{2.0.11}$$

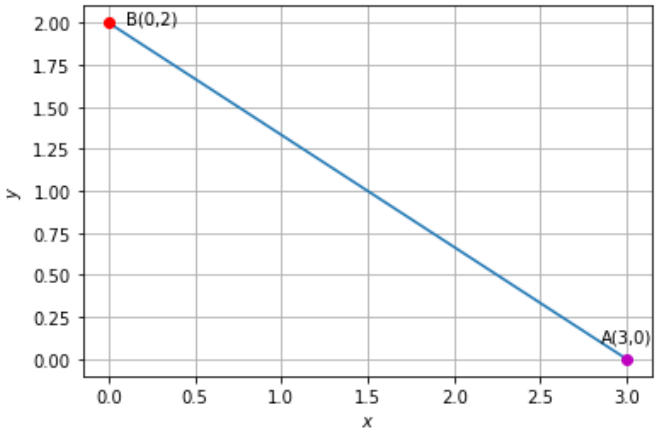

Fig. 1: Plot obtained from Python code