## 1

## Assignment 1

## Y.kavya

Download all python codes from

https://github.com/Y.kavya/Matrix-Theory/tree/main/Assignment1/Codes

and latex-tikz codes from

https://github.com/Y.kavya/Matrix-Theory/tree/main/Assignment1

1 Question No. 2.10

Construct  $\triangle ABC$  where AB = 4.5, BC = 5 and CA=6

2 EXPLANATION

Let us assume that:

$$\mathbf{A} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \mathbf{B} = \begin{pmatrix} c \\ 0 \end{pmatrix}, \mathbf{C} = \begin{pmatrix} p \\ q \end{pmatrix}$$
 (2.0.1)

Then

$$AB = \|\mathbf{B} - \mathbf{A}\|^2 = \|\mathbf{B}\|^2 = c^2 \quad :: \mathbf{A} = \mathbf{0} \quad (2.0.2)$$

$$BC = \|\mathbf{B} - \mathbf{C}\|^2 = a^2 \tag{2.0.3}$$

$$AC = \|\mathbf{C} - \mathbf{A}\|^2 = \|\mathbf{C}\|^2 = b^2$$
 (2.0.4)

The vertex C can be expressed in polar coordinate form as

$$\mathbf{C} = b \begin{pmatrix} \cos A \\ \sin A \end{pmatrix} \tag{2.0.5}$$

From  $\triangle ABC$ , we use the law of cosines:

$$a^2 = b^2 + c^2 - 2bc\cos A \tag{2.0.6}$$

$$\cos A = \frac{b^2 + c^2 - a^2}{2bc} \tag{2.0.7}$$

$$\cos A = \frac{31.25}{54} \tag{2.0.8}$$

$$\cos A = 0.578703704 \tag{2.0.9}$$

$$\angle A = \arccos(0.578703704)$$
 (2.0.10)

$$\angle A = 54.6405804$$
 (2.0.11)

We know that,

$$sinA = \sqrt{1 - cos^2 A} \tag{2.0.12}$$

$$sinA = \sqrt{1 - (0.578703704)^2}$$
 (2.0.13)

$$sinA = 0.665102023$$
 (2.0.14)

C can be expressed as

$$\mathbf{C} = b \begin{pmatrix} \cos A \\ \sin A \end{pmatrix} \tag{2.0.15}$$

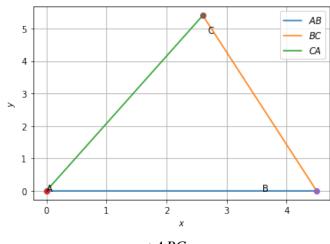
$$\mathbf{C} = \begin{pmatrix} 3.472222222\\ 3.99061214 \end{pmatrix} \tag{2.0.16}$$

Now, Vertices of given  $\triangle ABC$  can be written as,

$$\mathbf{C} = \begin{pmatrix} p \\ q \end{pmatrix} = \begin{pmatrix} 3.472222222 \\ 3.99061214 \end{pmatrix}, \mathbf{A} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \mathbf{B} = \begin{pmatrix} c \\ 0 \end{pmatrix} = \begin{pmatrix} 4.5 \\ 0 \end{pmatrix}$$
(2.0.17)

Now,  $\triangle ABC$  can be plotted using vertices AB, BC and CA.

Plot of the  $\triangle ABC$ :



 $\triangle ABC$