## 1

## Assignment 1

## Abhiroop Chintalapudi - AI20BTECH11005

Download all python and latex codes from

https://github.com/abhiroopchintalapudi03/EE3900. git

## 1 Problem 2.5

Check whether

$$\mathbf{A} = \begin{pmatrix} 5 \\ -2 \end{pmatrix}, \mathbf{B} = \begin{pmatrix} 6 \\ 4 \end{pmatrix}, \mathbf{C} = \begin{pmatrix} 7 \\ -2 \end{pmatrix}$$
 (1.0.1)

are the vertices of an isosceles triangle.

2 Solution

Let,

$$\mathbf{A} = \begin{pmatrix} 5 \\ -2 \end{pmatrix}, \mathbf{B} = \begin{pmatrix} 6 \\ 4 \end{pmatrix}, \mathbf{C} = \begin{pmatrix} 7 \\ -2 \end{pmatrix}$$
 (2.0.1)

For the triangle to be isosceles triangle, one of

$$\|\mathbf{A} - \mathbf{B}\| = \|\mathbf{B} - \mathbf{C}\|$$
 (2.0.2)

$$or \|\mathbf{A} - \mathbf{B}\| = \|\mathbf{B} - \mathbf{C}\| \tag{2.0.3}$$

$$or \|\mathbf{B} - \mathbf{C}\| = \|\mathbf{C} - \mathbf{A}\| \tag{2.0.4}$$

$$or \|\mathbf{C} - \mathbf{A}\| = \|\mathbf{A} - \mathbf{B}\| \tag{2.0.5}$$

Now,

$$\mathbf{A} - \mathbf{B} = \begin{pmatrix} 5 - 6 \\ (-2) - 4 \end{pmatrix} = \begin{pmatrix} -1 \\ -6 \end{pmatrix} \tag{2.0.6}$$

$$\implies \|\mathbf{A} - \mathbf{B}\|^2 = (-1)^2 + (-6)^2 = 37$$
 (2.0.7)

$$\mathbf{B} - \mathbf{C} = \begin{pmatrix} 6 - 7 \\ 4 - (-2) \end{pmatrix} = \begin{pmatrix} -1 \\ 6 \end{pmatrix}$$
 (2.0.8)

$$\implies$$
  $\|\mathbf{B} - \mathbf{C}\|^2 = (-1)^2 + 6^2 = 37$  (2.0.9)

$$\mathbf{C} - \mathbf{A} = \begin{pmatrix} 7 - 5 \\ (-2) - (-2) = \begin{pmatrix} 2 \\ 0 \end{pmatrix} \end{pmatrix} \quad (2.0.10)$$

$$\implies$$
  $\|\mathbf{C} - \mathbf{A}\|^2 = 2^2 = 4$  (2.0.11)

As

$$\|\mathbf{A} - \mathbf{B}\|^2 = \|\mathbf{B} - \mathbf{C}\|^2 = 37$$
 (2.0.12)

(From (2.0.7) and (2.0.9))

- $\implies$  In  $\triangle ABC$  sides AB, BC are equal.
- $\implies \Delta ABC$  is an isosceles triangle.

You can also see fom the below diagram that the triangle is an isosceles triangle with sides AB, BC equal.

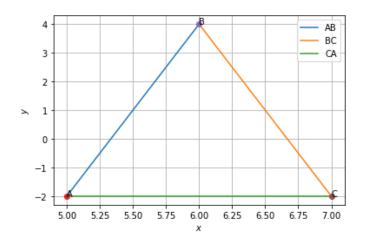


Fig. 0:  $\triangle ABC$