Assignment 1

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Download all python and latex codes from

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

1 Problem 2.5

Check whether

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

are the vertices of an isosceles triangle.

2 Solution

Let,

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

For the triangle to be isosceles triangle, one of

$$\|\mathbf{A} - \mathbf{B}\| = \|\mathbf{B} - \mathbf{C}\| \tag{2.0.2}$$
$$or \, \|\mathbf{A} - \mathbf{B}\| = \|\mathbf{B} - \mathbf{C}\| \tag{2.0.3}$$
$$or \, \|\mathbf{B} - \mathbf{C}\| = \|\mathbf{C} - \mathbf{A}\| \tag{2.0.4}$$
$$or \, \|\mathbf{C} - \mathbf{A}\| = \|\mathbf{A} - \mathbf{B}\| \tag{2.0.5}$$

Now,

$$\mathbf{A} - \mathbf{B} = \begin{pmatrix} 5-6 \\ (-2)-4 \end{pmatrix} = \begin{pmatrix} -1 \\ -6 \end{pmatrix} \tag{2.0.6}$$
$$\implies \|\mathbf{A} - \mathbf{B}\|^2 = (-1)^2 + (-6)^2 = 37 \tag{2.0.7}$$
$$\mathbf{B} - \mathbf{C} = \begin{pmatrix} 6-7 \\ 4-(-2) \end{pmatrix} = \begin{pmatrix} -1 \\ 6 \end{pmatrix} \tag{2.0.8}$$
$$\implies \|\mathbf{B} - \mathbf{C}\|^2 = (-1)^2 + 6^2 = 37 \tag{2.0.9}$$
$$\mathbf{C} - \mathbf{A} = \begin{pmatrix} 7-5 \\ (-2)-(-2) = \begin{pmatrix} 2 \\ 0 \end{pmatrix} \end{pmatrix} \tag{2.0.10}$$
$$\implies \|\mathbf{C} - \mathbf{A}\|^2 = 2^2 = 4 \tag{2.0.11}$$

As

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

(From (2.0.7) and (2.0.9))
$\implies$ In ΔABC sides AB, BC are equal.
$\implies$ ΔABC is an isosceles triangle.

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

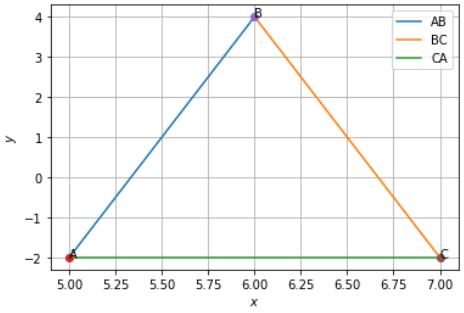

Fig. 0: ΔABC