# ASSIGNMENT 1

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Download all python codes from

https://github.com/unnatigupta2320/Assignment1/tree/master/CODES

and latex-tikz codes from

## 1 Question Number:- 2.26

Construct an isosceles right angeled $\triangle ABC$ right angled at $C$ such that $AC = 6$ .

## 2 SOLUTION

As $\triangle ABC$ is an isosceles triangle, therefore:

$$\mathbf{C} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \mathbf{A} = \begin{pmatrix} 6 \\ 0 \end{pmatrix}, \mathbf{B} = \begin{pmatrix} 0 \\ 6 \end{pmatrix} \tag{2.0.1}$$

Then,

$$\|\mathbf{A} - \mathbf{C}\|^2 = \|\mathbf{A}\|^2 = 6^2 = 36 \tag{2.0.2}$$

$$\|\mathbf{B} - \mathbf{C}\|^2 = \|\mathbf{B}\|^2 = 6^2 = 36 \tag{2.0.3}$$

Now,

$$\|\mathbf{A} - \mathbf{B}\|^2 = (\mathbf{A} - \mathbf{B})^T(\mathbf{A} - \mathbf{B}) \tag{2.0.4}$$

$$= \mathbf{A}^T\mathbf{A} + \mathbf{B}^T\mathbf{B} - \mathbf{A}^T\mathbf{B} - \mathbf{B}^T\mathbf{A} \tag{2.0.5}$$

$$= \|\mathbf{A}\|^2 + \|\mathbf{B}\|^2 - 2\mathbf{A}^T\mathbf{B} \quad \left(\because \mathbf{A}^T\mathbf{B} = \mathbf{B}^T\mathbf{A}\right) \tag{2.0.6}$$

$$= \|\mathbf{A}\|^2 + \|\mathbf{B}\|^2 \quad \left(\because \mathbf{B}^T\mathbf{A} = 0\right) \tag{2.0.7}$$

$$= 36 + 36 = 72 \tag{2.0.8}$$

Also,

$$\|\mathbf{A} - \mathbf{B}\|^2 = 72 \tag{2.0.9}$$

Therefore,

$$AB^2 = 36 + 36 = 72 \tag{2.0.10}$$

$$\implies AB = \sqrt{72} \tag{2.0.11}$$

$$\implies AB = \pm 6\sqrt{2} \tag{2.0.12}$$

So the vertices of $\triangle ABC$ in fig. 2.1 are:

$$\mathbf{B} = \begin{pmatrix} 0 \\ 6 \end{pmatrix}, \mathbf{C} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \mathbf{A} = \begin{pmatrix} 6 \\ 0 \end{pmatrix} \tag{2.0.13}$$

Now, Lines $AB$ , $BC$ and $CA$ Can be plotted using these coordinates to form an isosceles $\triangle ABC$. The Plot of the right angle $\triangle ABC$ is:

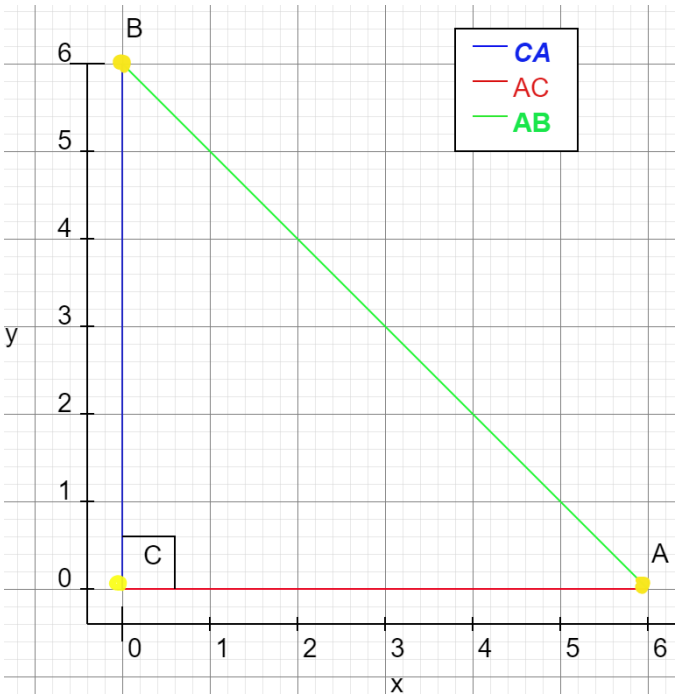


Fig. 2.1: Isosceles Right Angle $\triangle ABC$