

ASSIGNMENT 1

Unnati Gupta

Download all python codes from

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

and latex-tikz codes from

<https://github.com/unnatigupta2320/Assignment1/blob/master/Assignment1.tex>

1 QUESTION NUMBER:- 2.26

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

2 SOLUTION

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

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

Then,

$$\|\mathbf{A} - \mathbf{C}\|^2 = \|\mathbf{A}\|^2 = 6^2 = 36 \quad (2.0.2)$$

$$\|\mathbf{B} - \mathbf{C}\|^2 = \|\mathbf{B}\|^2 = 6^2 = 36 \quad (2.0.3)$$

Now,

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

$$= \mathbf{A}^T \mathbf{A} + \mathbf{B}^T \mathbf{B} - \mathbf{A}^T \mathbf{B} - \mathbf{B}^T \mathbf{A} \quad (2.0.5)$$

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

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

$$= 36 + 36 = 72 \quad (2.0.8)$$

Also,

$$\|\mathbf{A} - \mathbf{B}\|^2 = 72 \quad (2.0.9)$$

Therefore,

$$AB^2 = 36 + 36 = 72 \quad (2.0.10)$$

$$\Rightarrow AB = \sqrt{72} \quad (2.0.11)$$

$$\Rightarrow AB = \pm 6\sqrt{2} \quad (2.0.12)$$

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

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

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:

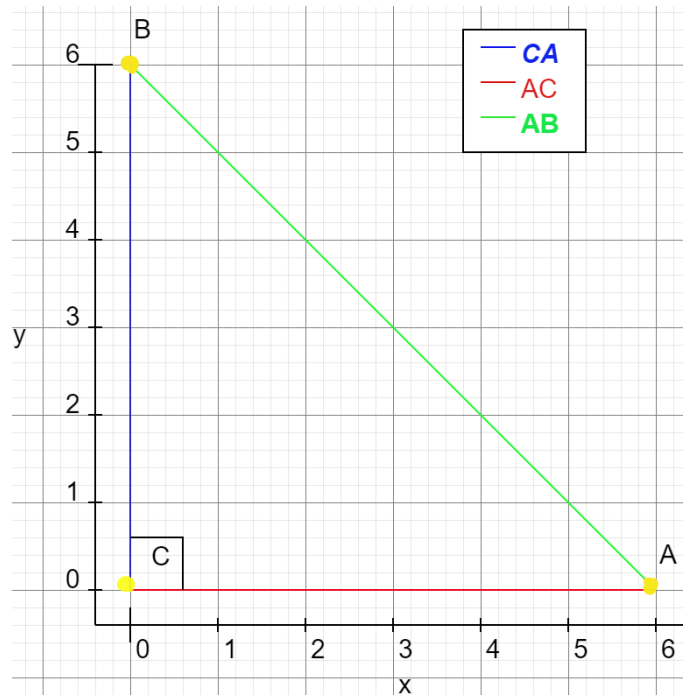


Fig. 2.1: Isosceles Right Angle $\triangle ABC$