Assignment 1

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Download all python codes from

https://github.com/sowmyabandi882/ASSIGNMNT/blob/main/Asignment%201/Assignment1.py

and latex-tikz codes from

https://github.com/sowmyabandi882/ASSIGNMNT/blob/main/Asignment%201/main.tex

1 Question No.2.7

In $\triangle ABC$, $a = 8, \angle B = 45^{\circ}$ and $c - b = 3.5$. Sketch $\triangle ABC$.

2 SOLUTION

Given,

$$BC = 8, \angle B = 45^{\circ} \text{ and } \text{ AB-AC} = 3.5 \tag{2.0.1}$$

let the vertices of $\triangle ABC$ and D be

$$\mathbf{A} = \begin{pmatrix} p \\ q \end{pmatrix}, \mathbf{B} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \mathbf{C} = \begin{pmatrix} a \\ 0 \end{pmatrix}, \mathbf{D} = \begin{pmatrix} p \\ 0 \end{pmatrix} \tag{2.0.2}$$

we have,

$$c - b = 3.5 \tag{2.0.3}$$

$$\implies c = 3.5 + b \tag{2.0.4}$$

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

$$b^2 = a^2 + c^2 - 2acCosB \tag{2.0.5}$$

$$b^2 = (8)^2 + (3.5 + b)^2 - 2(8)(3.5 + b)Cos45 \tag{2.0.6}$$

$$b^2 = 64 + 12.25 + 7b + b^2 - 29.4168 - 8.4b \tag{2.0.7}$$

$$\implies 0 = 46.83 - 1.4b \tag{2.0.8}$$

$$\implies b = \frac{46.83}{1.4} \tag{2.0.9}$$

$$\implies b = 33.45 \tag{2.0.10}$$

From 2.0.3,

$$c - b = 3.5 \tag{2.0.11}$$

$$\implies c - 33.45 = 3.5 \tag{2.0.12}$$

$$c = 36.95 \tag{2.0.13}$$

Then,

$$AB = ||\mathbf{A} - \mathbf{B}|| = ||A||^2 = c^2 \tag{2.0.14}$$

$$BC = ||\mathbf{C} - \mathbf{B}||^2 = ||C||^2 = a^2 \tag{2.0.15}$$

$$AC = ||\mathbf{A} - \mathbf{C}||^2 = b^2 \tag{2.0.16}$$

From 2.0.16,

$$\implies b^2 = ||\mathbf{A} - \mathbf{C}||^2 = (\mathbf{A} - \mathbf{C})^T(\mathbf{A} - \mathbf{C}) \tag{2.0.17}$$

$$b^2 = \mathbf{A}^T\mathbf{A} + \mathbf{C}^T\mathbf{C} - \mathbf{A}^T\mathbf{C} - \mathbf{A}\mathbf{C}^T \tag{2.0.18}$$

$$b^2 = ||\mathbf{A}||^2 + ||\mathbf{C}||^2 - 2\mathbf{C}^T\mathbf{A} \tag{2.0.19}$$

$$b^2 = a^2 + c^2 - \tag{2.0.20}$$

yielding,

$$p = \frac{a^2 + c^2 - b^2}{2c} \tag{2.0.21}$$

$$p = \frac{(8)^2 + (36.95)^2 - (33.45)^2}{2(36.95)} \tag{2.0.22}$$

$$p = \frac{310.9}{73.9} \tag{2.0.23}$$

$$p = 4.2 \tag{2.0.24}$$

From 2.0.14,

$$||A||^2 = c^2 = p^2 + (2q)^2 \tag{2.0.25}$$

$$q^2 = \frac{c^2 - p^2}{4} \tag{2.0.26}$$

$$q^2 = \frac{(36.95)^2 - (4.2)^2}{4} \tag{2.0.27}$$

$$q^2 = 336.91 \tag{2.0.28}$$

$$q = \pm 18.35 \tag{2.0.29}$$

As we consider $\triangle ABC$ in first quadrant.we consider $q = 18.35$

Therefore,$q = 18.35$

so,the vertices of $\triangle ABC$ and D are

$$\mathbf{A} = \begin{pmatrix} 4.2 \\ 18.35 \end{pmatrix}, \mathbf{B} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \mathbf{C} = \begin{pmatrix} 8 \\ 0 \end{pmatrix}, \mathbf{D} = \begin{pmatrix} 4.2 \\ 0 \end{pmatrix} \tag{2.0.30}$$

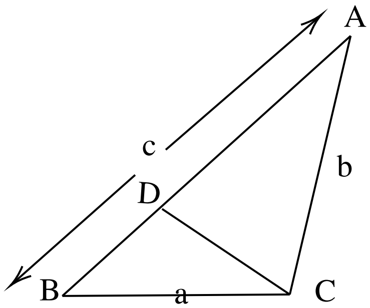

Fig. 2.1:$\triangle ABC$