Assignment 1

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Download all python codes from

https://github.com/Sowmyabandi99/Assignment1/blob/main/Assignment1.py

and latex-tikz codes from

https://github.com/Sowmyabandi99/Assignment1/blob/main/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

The vertex $\mathbf{A}$ can be expressed in *polar coordinate form* as

$$\mathbf{A} = c\begin{pmatrix}\cos\theta\\ \sin\theta\end{pmatrix}, \mathbf{B} = \begin{pmatrix}0\\0\end{pmatrix}, \mathbf{C} = \begin{pmatrix}a\\0\end{pmatrix}, \tag{2.0.1}$$

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

$$b^2 = a^2 + c^2 - 2ac\cos B \tag{2.0.2}$$

$$c^2 - b^2 + a^2 - 2ac\cos B = 0 \tag{2.0.3}$$

$$(c+b)(c-b) + 8^2 - 2(8)\left(\frac{1}{\sqrt{2}}\right)c = 0 \quad \left(\because \angle B = 45^{\circ}\right) \tag{2.0.4}$$

$$\frac{35}{10}(c+b) + 64 - 8\sqrt{2}c = 0 \quad (\because c - b = 3.5) \tag{2.0.5}$$

$$\implies (35 - 80\sqrt{2})c + 35b = -640 \tag{2.0.6}$$

And we have,

$$c - b = 3.5 \tag{2.0.7}$$

$$\implies 10c - 10b = 35 \tag{2.0.8}$$

which can be expressed as the matrix equation

$$\begin{pmatrix}35 - 80\sqrt{2} & 35\\ 10 & -10\end{pmatrix}\begin{pmatrix}c\\b\end{pmatrix} = \begin{pmatrix}-640\\35\end{pmatrix} \tag{2.0.9}$$

Therefore,

$$\begin{pmatrix}c\\b\end{pmatrix} = \begin{pmatrix}11.99\\8.49\end{pmatrix} \tag{2.0.10}$$

So,the vertices of $\triangle ABC$ are

$$\mathbf{A} = 11.99\begin{pmatrix}\cos 45\\ \sin 45\end{pmatrix} = \begin{pmatrix}5.9\sqrt{2}\\5.9\sqrt{2}\end{pmatrix}, \mathbf{B} = \begin{pmatrix}0\\0\end{pmatrix}, \mathbf{C} = \begin{pmatrix}8\\0\end{pmatrix} \tag{2.0.11}$$

Plot of the $\triangle ABC$:

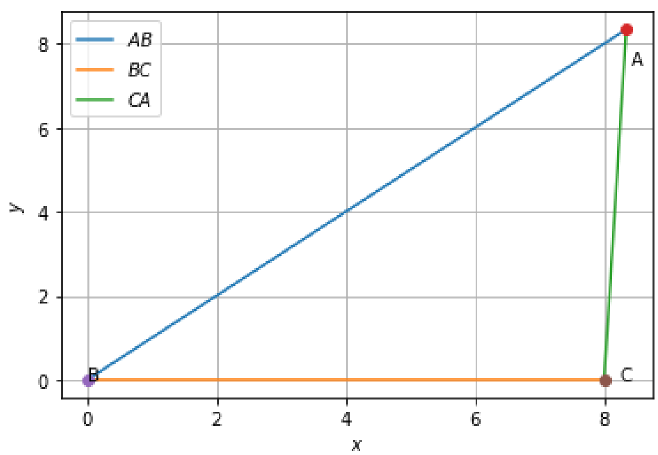

Fig. 2.1: $\triangle ABC$