CHAPTER-11
TRIANGLES

1 Exercise 11.2

Q2.Construct a triangle ABC in which $BC = 8cm, \angle B = 45^0$ and $AB - AC = 3.5cm$.

Solution:

Let **A**,**B** and **C** are the vertices of the triangle with coordinates. Given $BC = 8cm$.So the coordinates of vertices **B**,**C** are:

$$\mathbf{B} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \mathbf{C} = \begin{pmatrix} 8 \\ 0 \end{pmatrix}$$

Also given $\angle B = 45^0$, so by finding the coordinates of the other side we can form a required triangle.

The input parameters for this construction are

Symbol	Value	Description
a	8	BC
θ	$45°$	$\angle BC$ in ΔABC
k	3.5	$AB - AC$ i.e $c - b$
$\mathbf{e_2}$	$\begin{pmatrix} 0 \\ 1 \end{pmatrix}$	basis vector

Table 1: Parameters

Caluclating Other Coordinate:

$$\mathbf{A} = c \begin{pmatrix} \cos\theta \\ \sin\theta \end{pmatrix} \tag{1}$$

We know that

$$c = \frac{1}{2(1 - \frac{a cos \mathbf{B}}{k})} \mathbf{e_2}^\top \begin{pmatrix} 1 & 1 \\ 1 & -1 \end{pmatrix} \begin{pmatrix} \frac{-a^2}{k} \\ -k \end{pmatrix} \tag{2}$$

$$c = \frac{1}{2(1 - \frac{a cos \mathbf{B}}{k})} \mathbf{e_2}^\top \begin{pmatrix} \frac{-a^2}{k} - k \\ \frac{-a^2}{k} + k \end{pmatrix} \tag{3}$$

$$c = \frac{1}{2(1 - \frac{8 cos 45^0}{3.5})} \begin{pmatrix} 0 & 1 \end{pmatrix} \begin{pmatrix} \frac{-64}{3.5} - 3.5 \\ \frac{-64}{3.5} + 3.5 \end{pmatrix} \tag{4}$$

$$c = \frac{1}{2\left(\frac{3.5 - 5.65}{3.5}\right)} \begin{pmatrix} \frac{-64 + 12.25}{3.5} \end{pmatrix} \tag{5}$$

$$c = 12 \tag{6}$$

The vertices of $\Delta\ ABC$ are

$$\mathbf{A} = 12\begin{pmatrix} cos45^\circ \\ sin45^\circ \end{pmatrix} = \begin{pmatrix} 8.48 \\ 8.48 \end{pmatrix} \tag{7}$$

$$\mathbf{B} = \begin{pmatrix} 0 \\ 0 \end{pmatrix} \tag{8}$$

$$\mathbf{C} = \begin{pmatrix} 8 \\ 0 \end{pmatrix} \tag{9}$$

Construction:

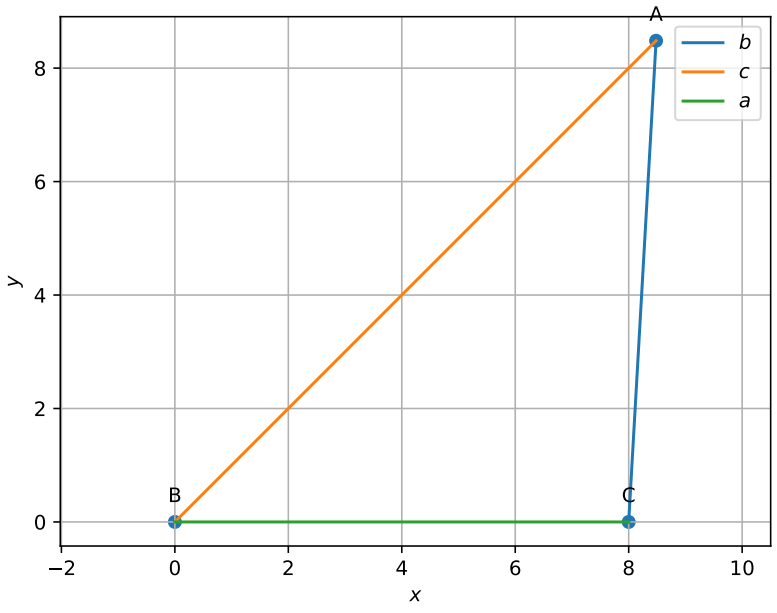

Figure 1: Triangle ABC