

# 3-3.2-28

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**Question:**

A triangle  $ABC$  can be constructed in which  $AB = 5\text{cm}$ ,  $\angle A = 45^\circ$  and  $BC + AC = 5\text{cm}$

Variable	Description
<b>a</b>	$BC$ line
<b>b</b>	$AC$ line
<b>c</b>	$AB$ line, $5\text{cm}$ length
<b>K</b>	$a + b = 5\text{cm}$
$\angle A$	$\angle BAC = 45^\circ$

TABLE I: Variables Used

**Solution:** Using cosine formula in  $\triangle ABC$ ,

$$a^2 = b^2 + c^2 - 2bc \cos A \quad (1)$$

$$(K - b)^2 = b^2 + c^2 - 2bc \cos A \quad (2)$$

$$b = \frac{K^2 - c^2}{2(K - c \cos A)} \quad (3)$$

Then the coordinates of  $\triangle ABC$  can be represented as

$$\mathbf{A} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \mathbf{B} = \begin{pmatrix} c \\ 0 \end{pmatrix}, \mathbf{C} = b \begin{pmatrix} \cos A \\ \sin A \end{pmatrix} \quad (4)$$

Substituting values, we get

$$b = 0 \quad (5)$$

$$\therefore \mathbf{A} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \mathbf{B} = \begin{pmatrix} 5 \\ 0 \end{pmatrix}, \mathbf{C} = \begin{pmatrix} 0 \\ 0 \end{pmatrix} \quad (6)$$

As two of the points ( $\mathbf{A}$ ,  $\mathbf{C}$ ) coincide, triangle of given dimensions cannot be constructed.

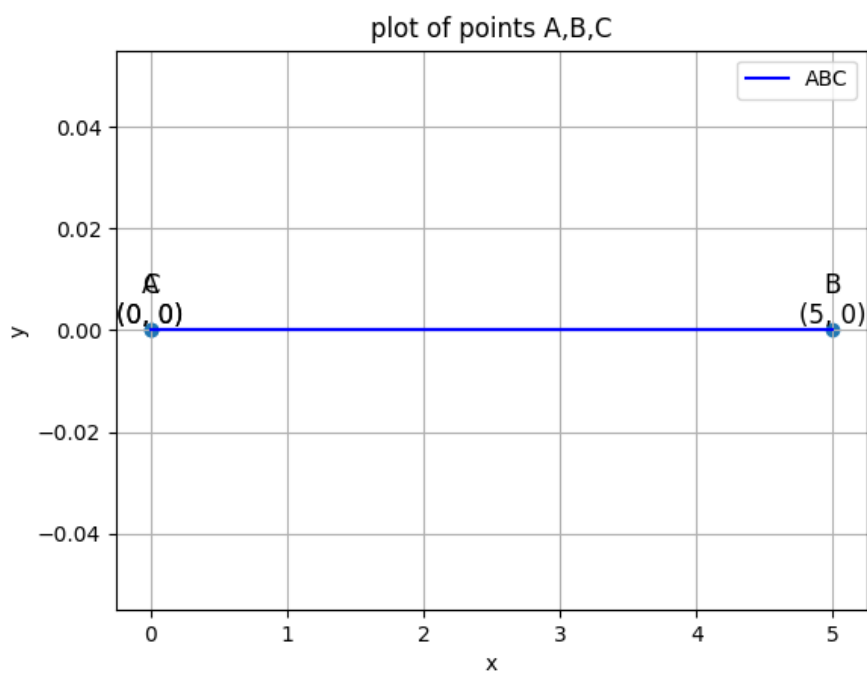


Fig. 1: Plot of the triangle