

3.2.19

AI25BTECH11003 - Bhavesh Gaikwad

Question: Two sides of a triangle are of lengths 5cm and 1.5cm. The length of the third side of the triangle cannot be

- a) 3.6 cm
- b) 4.1 cm
- c) 3.8 cm
- d) 3.4 cm

Solution:

Assume Triangle ABC with $\|\mathbf{AC}\| = b = 1.5\text{cm}$, $\|\mathbf{AB}\| = c = 5\text{cm}$, $\|\mathbf{BC}\| = a$ and Angle A = α

Let $\mathbf{A} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}$

Therefore, $\mathbf{C} = \begin{pmatrix} b \\ 0 \end{pmatrix} = \begin{pmatrix} 1.5 \\ 0 \end{pmatrix}$ and $\mathbf{B} = \begin{pmatrix} c \cos \alpha \\ c \sin \alpha \end{pmatrix} = \begin{pmatrix} 5 \cos \alpha \\ 5 \sin \alpha \end{pmatrix}$

By Cosine Law,

$$a^2 = b^2 + c^2 - 2bc \cos \alpha \quad (0.1)$$

$$a^2 = 27.25 - 15 \cos \alpha \quad (0.2)$$

$$\cos \alpha = \frac{27.25 - a^2}{15} \quad (0.3)$$

Option (A) $a = 3.6\text{cm}$

$$\cos \alpha = \frac{27.25 - 12.96}{15} = \frac{14.29}{15} \quad (0.4)$$

$$\Rightarrow \alpha = 17.7^\circ \quad (0.5)$$

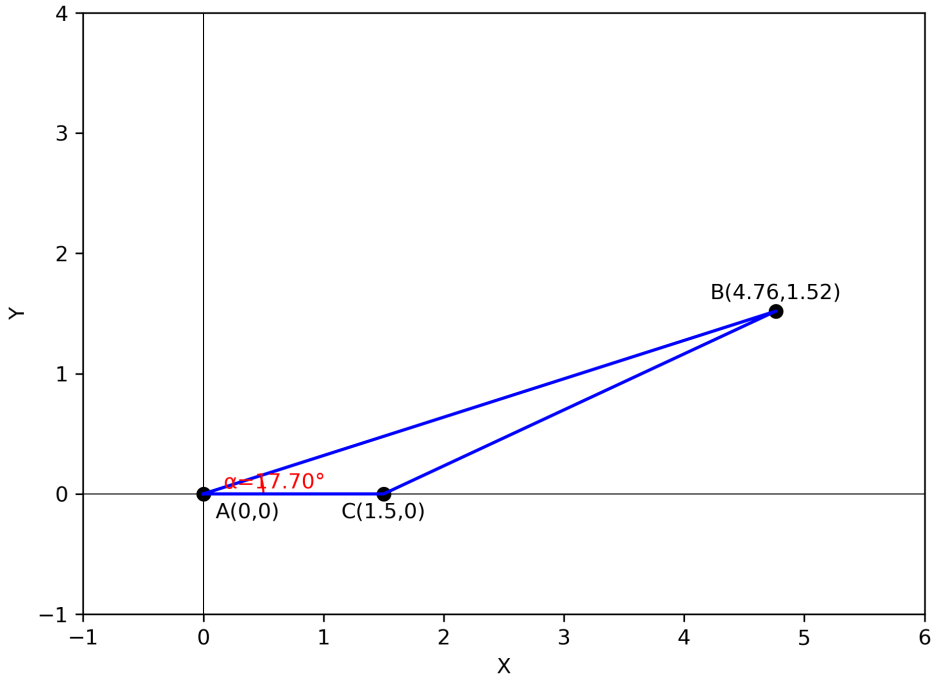


Fig. 0.1: Triangle ABC of Option (A)

Option (B) $a = 4.1\text{cm}$

$$\cos \alpha = \frac{27.25 - 16.81}{15} = \frac{10.44}{15} \quad (0.6)$$

$$\Rightarrow \alpha = 45.89^\circ \quad (0.7)$$

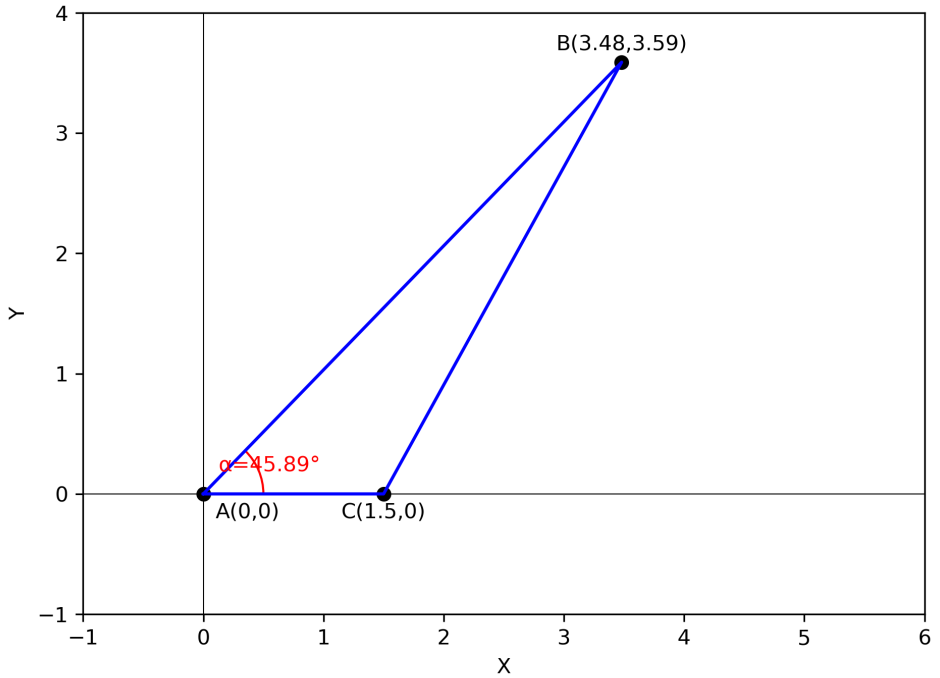


Fig. 0.2: Triangle ABC of Option (B)

Option (C) $a = 3.8\text{cm}$

$$\cos \alpha = \frac{27.25 - 14.44}{15} = \frac{12.81}{15} \quad (0.8)$$

$$\Rightarrow \alpha = 31.35^\circ \quad (0.9)$$

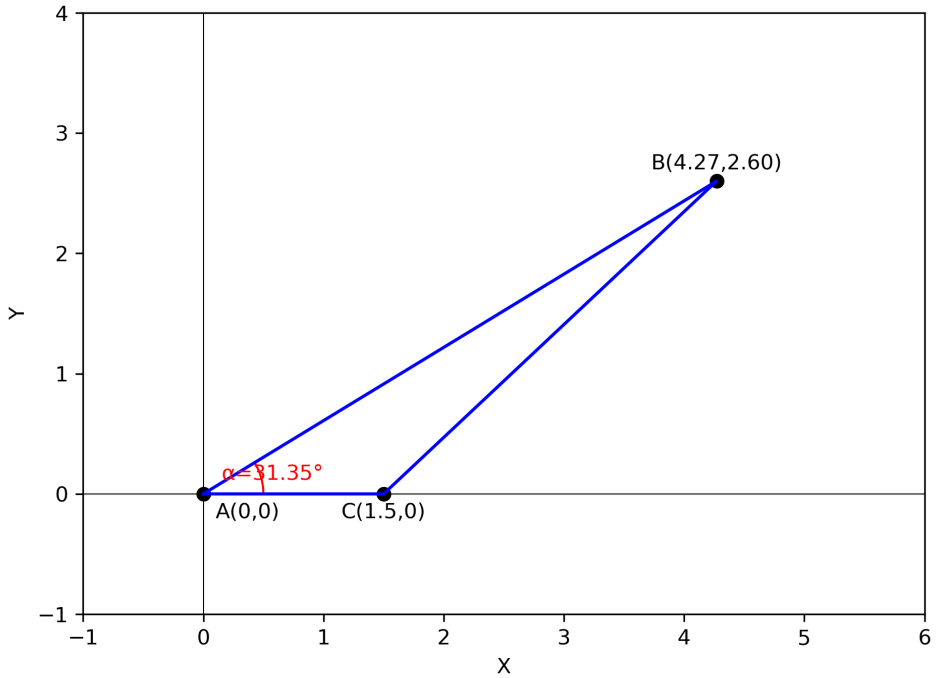


Fig. 0.3: Triangle ABC of Option (C)

Option (D) $a = 3.4\text{cm}$

$$\cos \alpha = \frac{27.25 - 11.56}{15} = \frac{15.69}{15} \quad (0.10)$$

Here, $\cos \alpha > 1$ which is not possible (0.11)

Thus, Option (D) is incorrect.

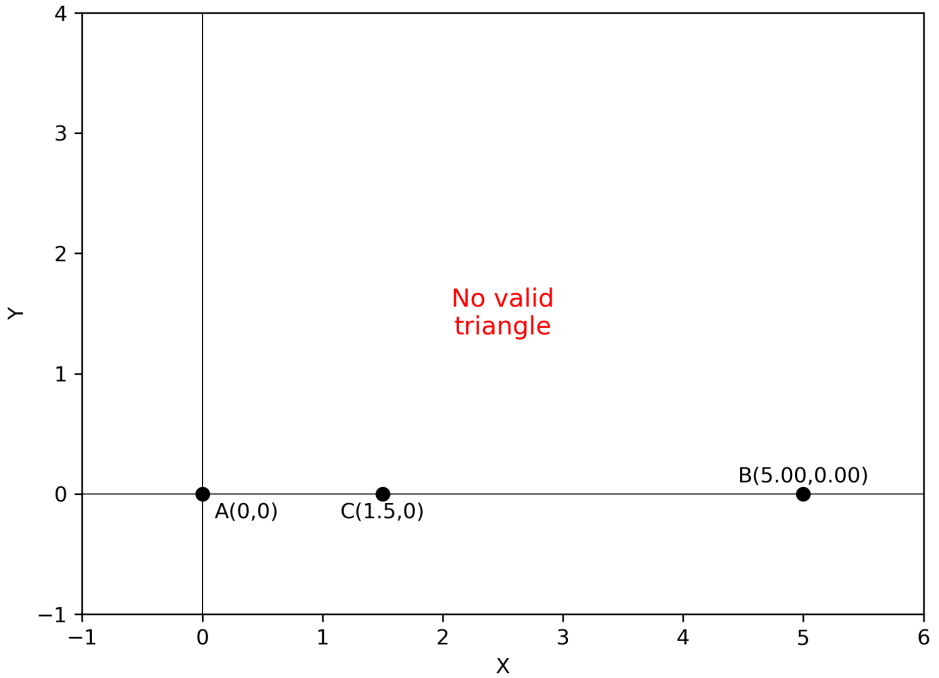


Fig. 0.4: Image of Option (D)