Value Based Questions

Que 1. A circus artist is climbing from the ground along a rope stretched from the top of a vertical pole and tied at the ground. The height of the pole is 10 m and angle made by the top with ground level is 60 °.
(i) Calculate the distance covered by the artist in climbing to the top of the pole.
(ii) Which mathematical concept is used in this problem?
(iii) What is its value?

Sol. (i) Clearly distance covered by the artist is equal to the length of the rope AC.
Let AB be the vertical pole of height 10 m.
It is given that $\angle ACB = 60°$
Thus, in right angled ΔABC.

$$\sin 60° = \frac{AB}{AC} \qquad \Rightarrow \qquad \frac{\sqrt{3}}{2} = \frac{10}{AC}$$

$$AC = \frac{10\times2}{\sqrt{3}} = \frac{20}{\sqrt{3}} = \frac{20\sqrt{3}}{3}m.$$

Hence, distance covered by artist is $\frac{20\sqrt{3}}{3}m.$
(ii) Trigonometric ratios of an acute angle of right angled triangle.
(iii) Single mindedness help us to gain success in life.

Que 2. A tree is broken by the wind. The top struck the ground at an angle of 45° and at a distance of 30 m from the root.
(i) Find whole height of the tree.
(ii) Which mathematical concept is used in this problem?
(iii) Which value is being emphasised here?

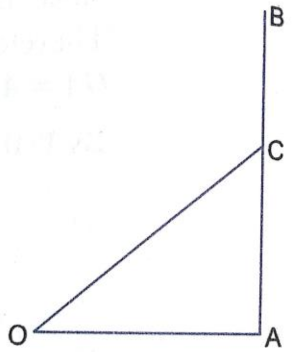


Fig. 6

Sol. (i) Let AB be the tree broken at C, such that the broken part CB takes the position CO and strikes the ground at O.
It is given that OA = 30 m and $\angle AOC = 45°$
Let AC = x and CB = y, then CO y
In ΔOAC, we have,

$$\tan 45° = \frac{AC}{OA} \quad \Rightarrow \quad 1 = \frac{x}{30} \quad \Rightarrow \; x = 30$$

Again in ΔOAC, we have

$$\cos 45° = \frac{OA}{OC} \quad \Rightarrow \quad \frac{1}{\sqrt{2}} = \frac{30}{y} \quad \Rightarrow \; y = 30\sqrt{2}$$

Height of the tree = (x + y)

$$= 30 + 30\sqrt{2} = 30(1 + \sqrt{2})$$

$$= 30(1 + 1.414) = 30 \times 2.414 = \; 72.42\, m$$

(ii) Trigonometric ratios of an acute angle of right angled triangle.

(iii) Decreasing tree leads to deforestation which ultimately give birth to various problems.

Que 3. A person standing on the bank of a river observes that the angle of elevation of the top of a building of an organisation working for conservation of wild life, standing on the opposite bank is 60°. When he moves 40 metres away from the bank, he finds the angle of elevation to be 30°. Find the height of the building and the width of the river.

(a) Why do we need to conserve wild life?

(b) Suggest some steps that can be taken to conserve wild life.

Sol. Let AB be the building of height h metres standing on the bank of a river. Let C be the position of man standing on the opposite bank of the river such that BC = x m. Let D be the new position of the man. It is given that CD = 40 m and the angles of elevation of the top of the building at C and D are 60° and 30° respectively, i.e., ∠ACB 60° and ∠ADB 30°.

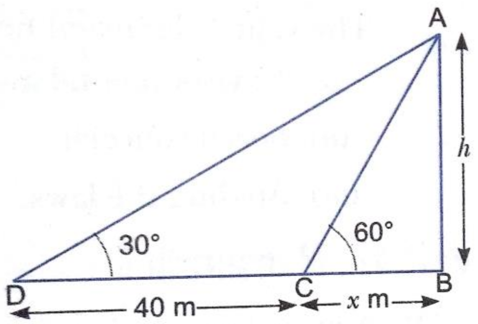


Fig. 7

In ΔACB, we have

$$\tan 60° = \frac{AB}{BC} \quad \Rightarrow \quad \tan 60° = \frac{h}{x}$$

$$\Rightarrow \qquad \sqrt{3} = \frac{h}{x} \quad \Rightarrow \qquad x = \frac{h}{\sqrt{3}} \qquad \ldots(i)$$

In ΔADB, we have

$$\tan 30° = \frac{AB}{BD} \quad \Rightarrow \quad \frac{1}{\sqrt{3}} = \frac{h}{x + 40}$$

$$\Rightarrow \quad \sqrt{3}h = x + 40 \qquad \ldots(ii)$$

Substituting x = $\frac{h}{\sqrt{3}}$ in equation (ii), we get

$$\sqrt{3}h = \frac{h}{\sqrt{3}} + 40 \quad \Rightarrow \quad \sqrt{3}h - \frac{h}{\sqrt{3}} = 40$$

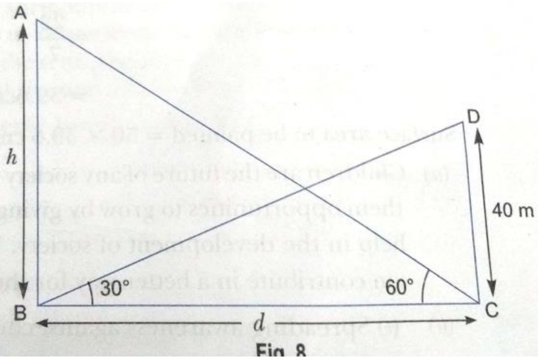
$$\Rightarrow \quad \frac{3h-h}{\sqrt{3}} = 40 \quad \Rightarrow \quad \frac{2h}{\sqrt{3}} = 40$$

$$\Rightarrow \quad h = \frac{40\times\sqrt{3}}{2} \quad \Rightarrow \quad h = 20\sqrt{3} = 20 \times 1.732 = 34.64\ m$$

Substituting h in equation (i), we get x = $\frac{20\sqrt{3}}{\sqrt{3}} = 20\ metres.$

Hence, the height of the building is 34.64 m and width of the river is 20 m.
(a) Wild life is a part of our environment and conservation of each of its element is important for ecological balance.
(b) Ban on hunting, providing wild animals a healthy environment.

Que 4. The angle of elevation of the top of a chimney from the foot of a tower is 60° and the angle of depression of the foot of the chimney from the top of the tower is 30°. If the height of the tower is 40 m, find the height of the chimney. According to pollution control norms, the minimum height of a smoke emitting chimney should be 100 m. State if the height of the above mentioned chimney meets the pollution norms. What value is discussed in this question?



Sol. Let the height of the chimney AB be h. Height of tower CD = 40 m.
The distance between the tower and chimney be d.
In ΔBCD

$$\tan 30° = \frac{CD}{BC}$$

$$\frac{1}{\sqrt{3}} = \frac{40}{d} \quad \Rightarrow \quad d = 40\sqrt{3}$$

In ΔBCD

$$\tan 60° = \frac{AB}{BC}$$

$$\sqrt{3} = \frac{h}{40\sqrt{3}} \quad \Rightarrow \quad h = 40\sqrt{3} \times \sqrt{3}$$

$$\Rightarrow \quad h = 120\ m.$$

The height of the chimney is 120 m which is more than the minimum requirement to meet the pollution norms.

The values discussed here are:
(i) Environmental awareness
(ii) Social concern
(iii) Abiding the laws.