Chapter-Some Applications of Trigonometry

Q1.

In Fig. 1, AB is a 6 m high pole and CD is a ladder inclined at an angle of 60° to the horizontal and reaches up to a point D of pole. If $AD = 2.54$ m, find the length of the ladder. (use $\sqrt{3} = 1.73$)

Q2.

The ratio of the height of a tower and the length of its shadow on the ground is $\sqrt{3} : 1$. What is the angle of elevation of the sun?

Q3.

If a tower 30 m high, casts a shadow $10\sqrt{3}$ m long on the ground, then what is the angle of elevation of the sun?

Q4.

The tops of two towers of height x and y, standing on level ground, subtend angles of 30° and 60° respectively at the centre of the line joining their feet, then find $x : y$.

Q5.

The angle of elevation of the top of a building from the foot of the tower is 30° and the angle of elevation of the top of the tower from the foot of the building is 45°. If the tower is 30 m high, find the height of the building.

Q6.

A ladder, leaning against a wall, makes an angle of 60° with the horizontal. If the foot of the ladder is 2.5 m away from the wall, find the length of the ladder.

Q7.

An observer, 1.7 m tall, is 20√3 m away from a tower. The angle of elevation from the eye of observer to the top of tower is 30°. Find the height of tower.

Q8.

A 7 m long flagstaff is fixed on the top of a tower standing on the horizontal plane. From a point on the ground, the angles of elevation of the top and bottom of the flagstaff are 60° and 45° respectively. Find the height of the tower correct to one place of decimal

Q9.

Two men on either side of a 75 m high building and in line with base of building observe the angles of elevation of the top of the building as 30° and 60°. Find the distance between the two men

Q10.

An observer, 1.7 m tall, is $20\sqrt{3}$ m away from a tower. The angle of elevation from the eye of observer to the top of tower is 30°. Find the height of tower.

Solution 1.

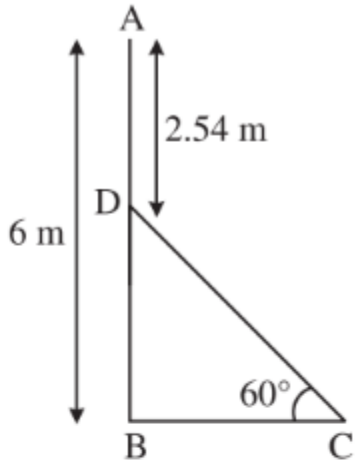


Fig. 1

Given, $AB = 6$ m and $AD = 2.54$ m.

$\therefore DB = (6 - 2.54)$ m $= 3.46$ m

In ΔDBC,

$$\sin 60^\circ = \frac{DB}{DC}$$

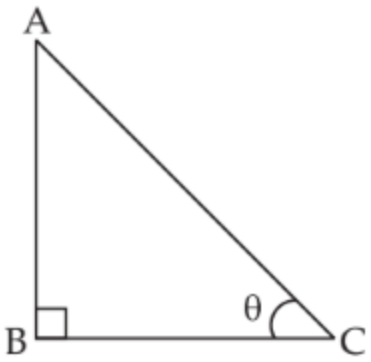
$$\Rightarrow \quad \frac{\sqrt{3}}{2} = \frac{3.46}{DC}$$

$$\Rightarrow \quad DC = \frac{3.46 \times 2}{1.73} = 4$$

$\therefore$ The length of the ladder is 4 m.

Solution 2.

Given, $\frac{AB}{BC} = \frac{\sqrt{3}}{1}$



In ΔABC,

$$\tan\theta = \frac{AB}{BC} = \frac{\sqrt{3}}{1}$$

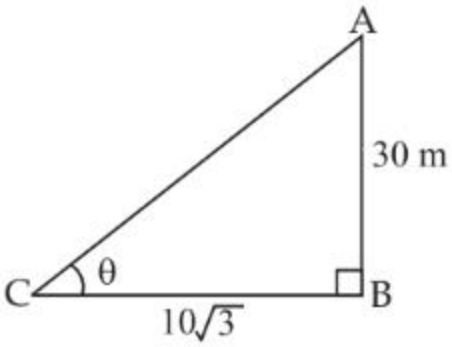
$\Rightarrow \quad = 60°$

Hence, the angle of elevation is 60°.

Solution 3.

In $\Delta\, ABC$,

$$\tan\theta = \frac{AB}{BC}$$



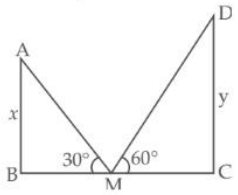
$$\tan\theta = \frac{30}{10\sqrt{3}} = \sqrt{3}$$

$$\tan\theta = \tan 60^\circ \Rightarrow \theta = 60^\circ$$

Hence angle of elevation is 60°.

Solution 4.

Ans. Let AB and CD be two towers of height x and y respectively.



M is the mid-point of BC *i.e.*, $BM = MC$

In ΔABM, we have

$$\frac{AB}{BM} = \tan 30°$$

$$\Rightarrow \quad BM = \frac{x}{\tan 30°} \qquad ...(i)$$

In ΔCDM, we have

$$\frac{DC}{MC} = \tan 60°$$

$$\Rightarrow \quad \frac{y}{MC} = \tan 60°$$

$$MC = \frac{y}{\tan 60°} \qquad ...(ii)$$

From *eq.* (i) and (ii), we get

$$\frac{x}{\tan 30°} = \frac{y}{\tan 60°}$$

$$\Rightarrow \quad \frac{x}{y} = \frac{\tan 30°}{\tan 60°}$$

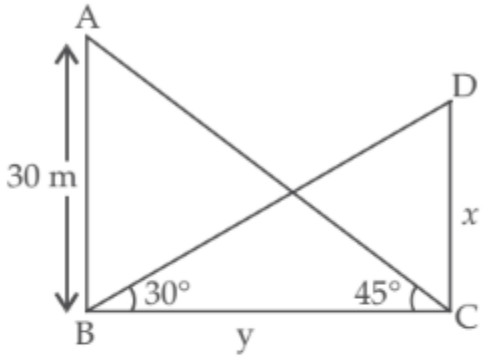
$$\Rightarrow \quad \frac{x}{y} = \frac{1/\sqrt{3}}{\sqrt{3}} = \frac{1}{3}$$

$$\therefore \quad x : y = 1 : 3.$$

Solution 5.

Let AB be the tower and CD be a building of height 30 m and x m respectively.

Let the distance between the two be y m.



Then, in ΔABC

$$\frac{30}{y} = \tan 45°$$

$$\frac{30}{y} = 1 \Rightarrow y = 30$$

And, in ΔBDC

$$\frac{x}{y} = \tan 30°$$

$$x = y \tan 30°$$

$$x = 30 \times \frac{1}{\sqrt{3}} = 10\sqrt{3}$$

Hence, the height of the building is $10\sqrt{3}$ m.

Solution 6.

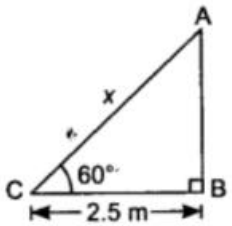
Let AC be the ladder of length x.

In ΔABC, $\frac{BC}{x} = \cos 60°$

$\Rightarrow \frac{2.5}{x} = \frac{1}{2}$

$\Rightarrow x = 2 \times 2.5 = 5$ m

Thus, length of the ladder is 5 m.



Solution 7.

Let CD be the tower of height h.

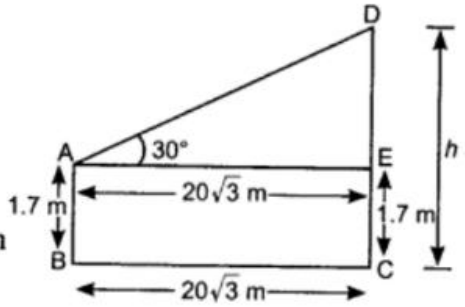
In ΔDEA, $\frac{DE}{AE} = \tan 30°$

$\Rightarrow \frac{h-1.7}{20\sqrt{3}} = \frac{1}{\sqrt{3}}$

$\Rightarrow h - 1.7 = 20$

$\Rightarrow h = 20 + 1.7 = 21.7$ m

So, height of tower is 21.7 m.



Solution 8.

A 7 m long flagstaff is fixed on the top of a tower standing on the horizontal plane. From a point on the ground, the angles of elevation of the top and bottom of the flagstaff are 60° and 45° respectively. Find the height of the tower correct to one place of decimal

Let AB is the tower of height h and DA is the flagstaff of height 7 m and BC is x.

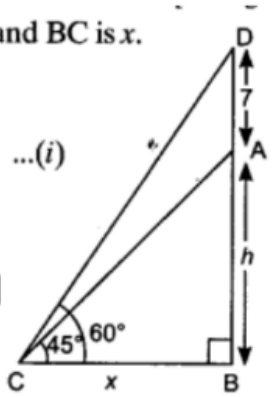
In ΔABC, $\frac{AB}{BC} = \tan 45°$

$\Rightarrow \frac{h}{x} = 1 \Rightarrow h = x$ ...(i)

Now, in ΔDBC, $\frac{DB}{BC} = \tan 60° \Rightarrow \frac{h+7}{x} = \sqrt{3}$

$\Rightarrow h + 7 = \sqrt{3}h$ $[\because h = x$, using $(i)]$

$\Rightarrow (\sqrt{3}-1)h = 7$



Solution:

$\Rightarrow h = \frac{7}{\sqrt{3}-1} = \frac{7(\sqrt{3}+1)}{(\sqrt{3}-1)(\sqrt{3}+1)}$

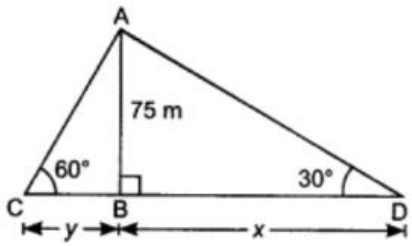
$= \frac{7 \times (1.73+1)}{2} = 9.5$ m

So, height of the tower is 9.5 m.

Solution 9.

Let C and D be the positions of two men.

Let CB = y and BD = x



In ΔABC, $\frac{AB}{BC} = \tan 60°$

$\Rightarrow \frac{75}{y} = \sqrt{3}$

$\Rightarrow y = \frac{75}{\sqrt{3}} = \frac{75\sqrt{3}}{3} = 15\sqrt{3}$ m

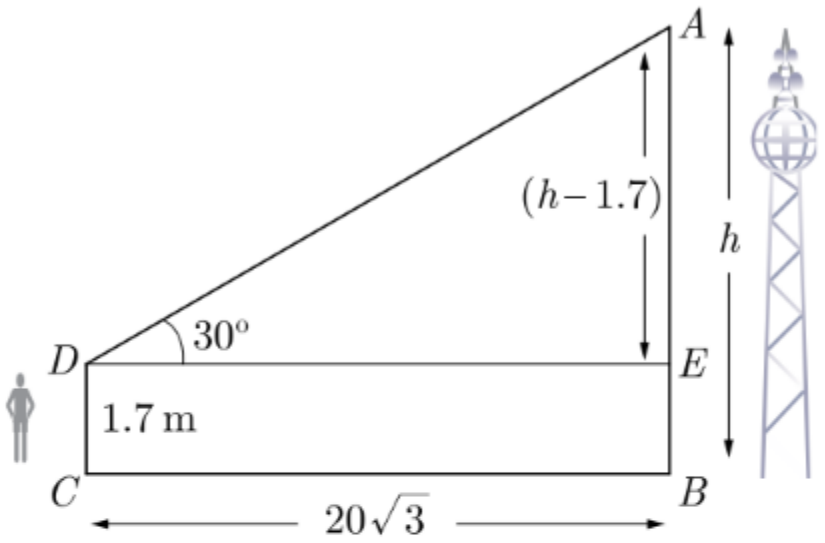
$= 15 \times 1.73 = 25.95$ m

Now, in ΔABD, $\tan 30° = \frac{75}{x} \Rightarrow \frac{1}{\sqrt{3}} = \frac{75}{x} \Rightarrow x = 75\sqrt{3} \Rightarrow 75 \times 1.73 = 129.75$ m

Hence, distance between two men is $x + y = 129.75 + 25.95 = 155.7$ m

Solution 10.

Let height of the tower AB be h. As per given in question we have drawn figure below.



Here $AE = h - 1.7$

and $BC = DE = 20\sqrt{3}$

In ΔADE, $\angle E = 90^\circ$

$$\tan 30^\circ = \frac{h-1.7}{20\sqrt{3}}$$

$$\frac{1}{\sqrt{3}} = \frac{h-1.7}{20\sqrt{3}}$$

$$h - 1.7 = 20$$

or $$h = 20 + 1.7 = 21.7 \text{ m}$$