

CLASS – 10

MATHEMATICS

Chapter – 9

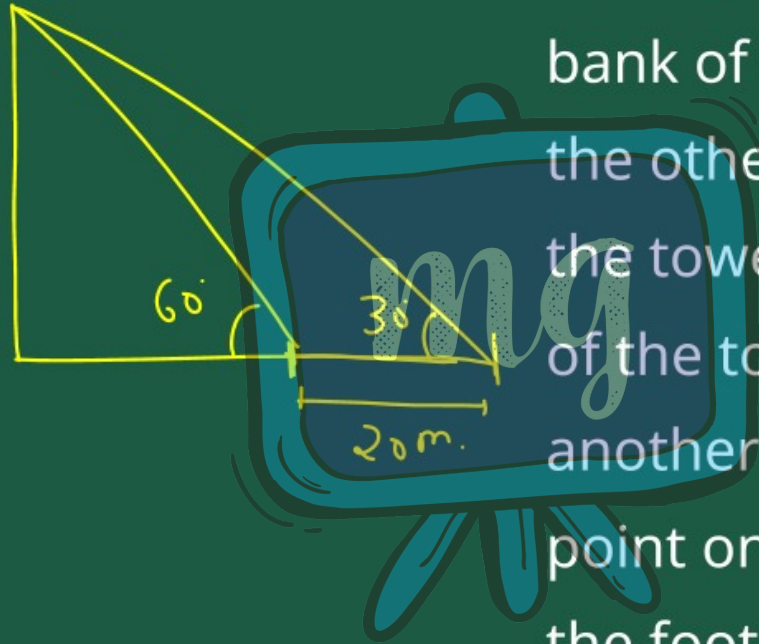
SOME APPLICATIONS OF TRIGONOMETRY

Part – 4

EXERCISE 9.1 (11 to 15)

Shubham Tiwari





11. A TV tower stands vertically on a bank of a canal. From a point on the other bank directly opposite the tower, the angle of elevation of the top of the tower is 60° . From another point 20 m away from this point on the line joining this point to the foot of the tower, the angle of elevation of the top of the tower is 30° (see Fig.).

in $\triangle ABC$

$$\theta = 60^\circ$$

$$\tan 60^\circ = \frac{h}{x} \quad \text{--- (1)}$$

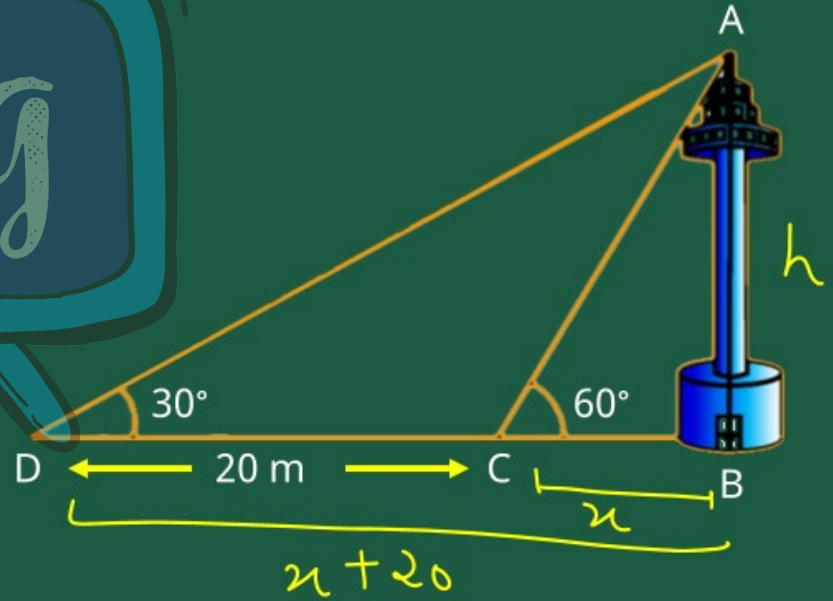
$$\sqrt{3} = \frac{h}{x}$$

$$\sqrt{3}x = h$$

$$h = 10 \times \sqrt{3}$$

$$h = 10\sqrt{3} \text{ m}$$

Find the height of the tower and the width of the canal.



in $\triangle ABD$

$$\theta = 30^\circ$$

$$\tan \theta = \frac{P}{B} = \frac{h}{x+20}$$

$$2x = 20$$

$$x = 10\text{m.}$$

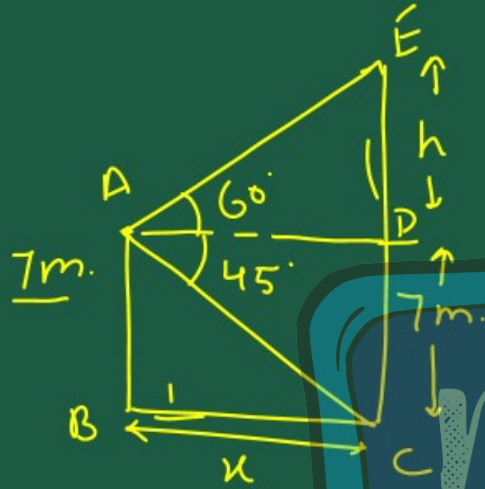
$$\tan 30^\circ = \frac{1}{\sqrt{3}} = \frac{h}{x+20}$$

$$\Rightarrow h\sqrt{3} = x+20$$

$$(x\sqrt{3})\sqrt{3} = x+20$$

$$3x = x+20$$

$$3x - x = 20$$



12. From the top of a 7 m high building, the angle of elevation of the top of a cable tower is 60° and the angle of depression of its foot is 45° . Determine the height of the tower.

in $\triangle ADE$
 $DE = h$, $BC = AD = x$
 $\theta = 60^\circ$

$$\tan \theta = \frac{P}{B}$$

$$\tan 60^\circ = \frac{h}{x}$$

$$\sqrt{3} = \frac{h}{x}$$

$$h = x\sqrt{3}$$

$$h = 7\sqrt{3} \text{ m.}$$

in $\triangle ADC$

$$\angle A = 45^\circ$$

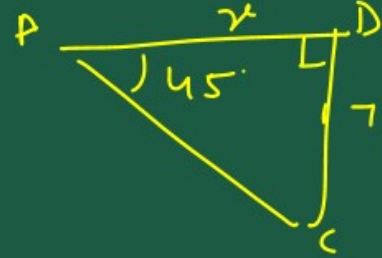
$$DC = 7\text{m}$$

$$AD = x$$

$$\tan \theta = \frac{P}{B} = \frac{7}{x}$$

$$\tan 45^\circ = 1 = \frac{7}{x}$$

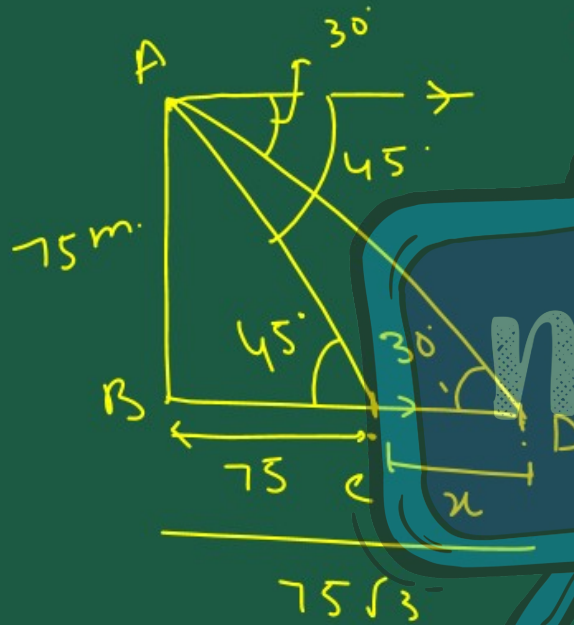
$$x = 7$$



So the height of the tower $(E = CD + DE)$

$$CE = 7 + 7\sqrt{3}$$

$$CE = 7(1 + \sqrt{3})\text{m}$$

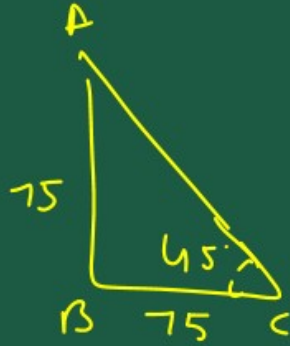
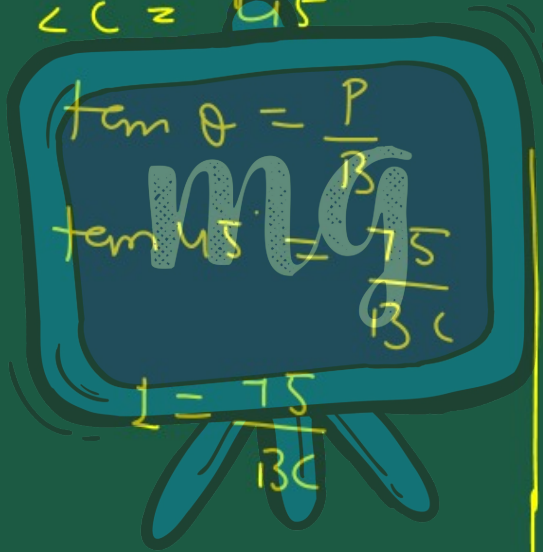


13. As observed from the top of a 75 m high lighthouse from the sea-level, the angles of depression of two ships are 30° and 45° . If one ship is exactly behind the other on the same side of the lighthouse, find the distance between the two ships.

in $\triangle ABC$

$$AB = 75 \text{ m.}$$

$$\angle C = 45^\circ$$



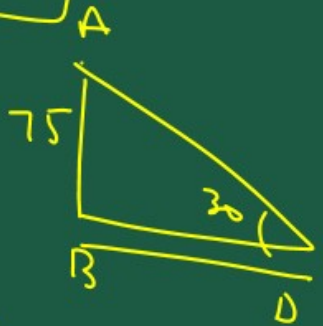
$$BC = 75 \text{ m.}$$

in $\triangle ABD$

$$AB = 75 \text{ m.}$$

$$\tan \theta = \frac{P}{B}$$

$$\tan 30 = \frac{75}{BD}$$



$$\tan 30 = \frac{75}{BD}$$

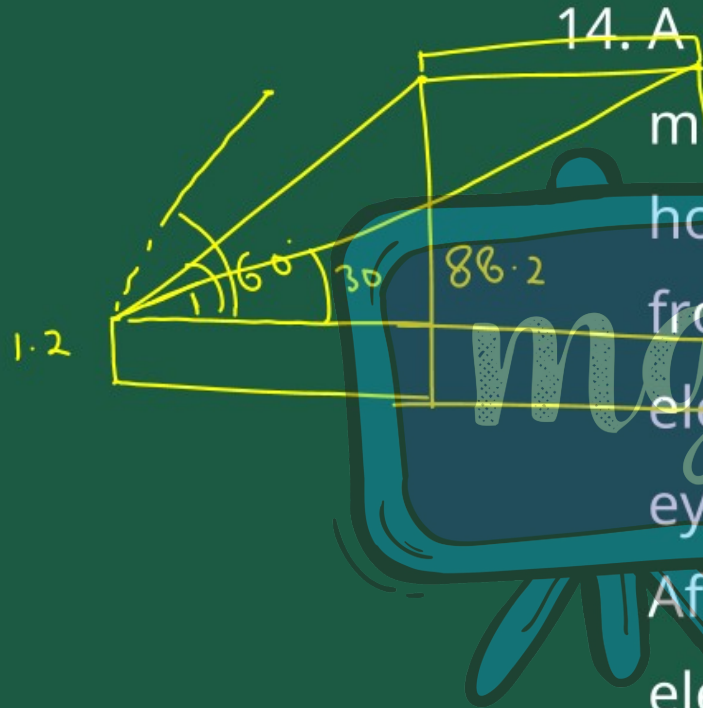
$$\frac{1}{\sqrt{3}} = \frac{75}{BD}$$

$$BD = 75\sqrt{3} \text{ m.}$$

Hence $CD = BD - BC$

$$= 75\sqrt{3} - 75$$

$$CD = 75(\sqrt{3} - 1) \text{ m.}$$



14. A 1.2 m tall girl spots a balloon moving with the wind in a horizontal line at a height of 88.2 m from the ground. The angle of elevation of the balloon from the eyes of the girl at any instant is 60° . After some time, the angle of elevation reduces to 30° (see Fig.). Find the distance travelled by the balloon during the interval.

in $\triangle ABC$

$$AC = h$$

$$\theta = 60^\circ$$

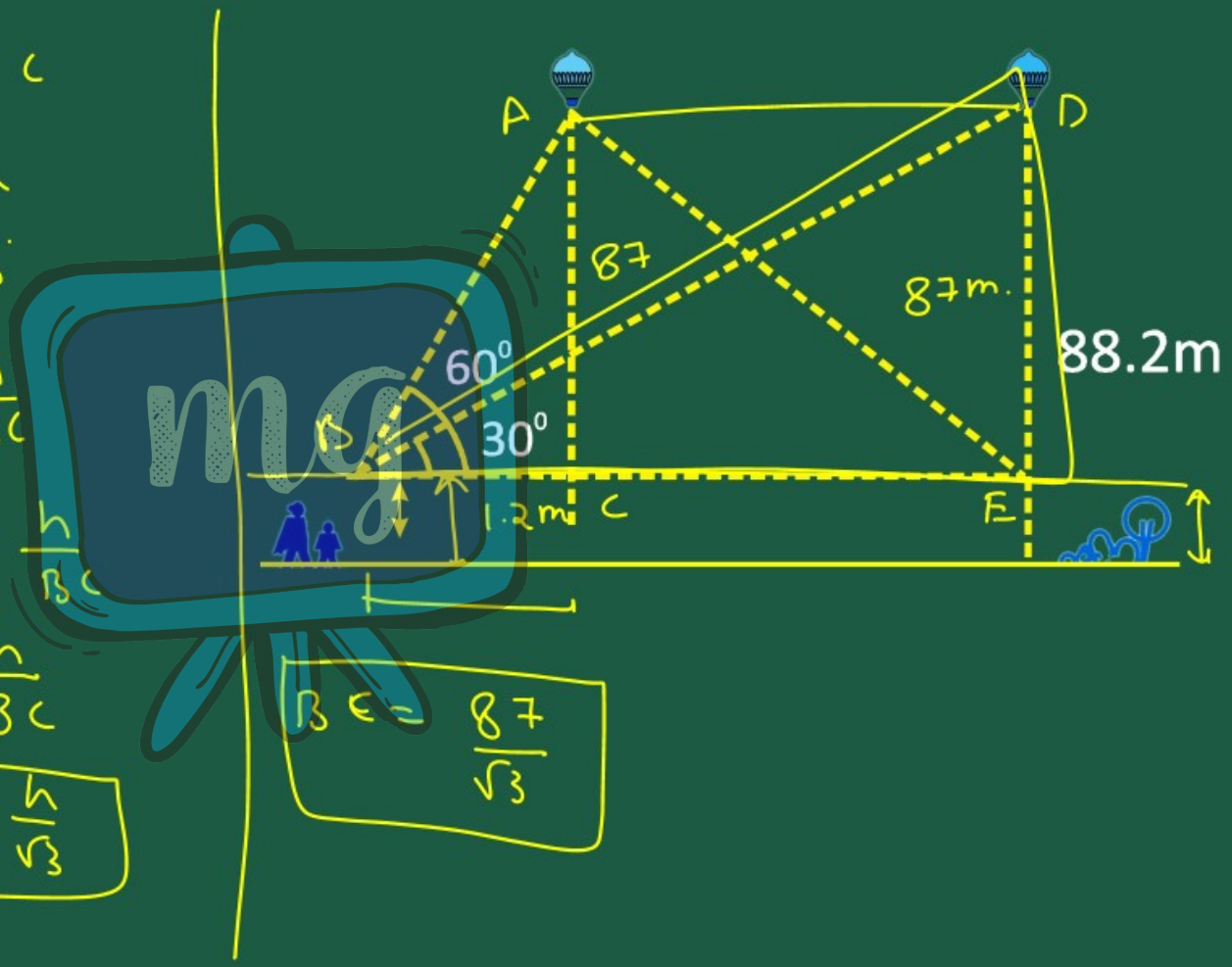
$$\tan \theta = \frac{h}{BC}$$

$$\tan 60^\circ = \frac{h}{BC}$$

$$\sqrt{3} = \frac{h}{BC}$$

$$BC = \frac{h}{\sqrt{3}}$$

$$BE = \frac{87}{\sqrt{3}}$$



in $\triangle DBE$

$$DE = 87, \theta = 30^\circ$$

$$\tan \theta = \frac{P}{B}$$

$$\tan 30^\circ = \frac{87}{BE}$$

$$\frac{1}{\sqrt{3}} = \frac{87}{BE}$$

$$BE = 87\sqrt{3}$$

The distance travelled by
the balloon is CE

$$\frac{BE - BC}{87\sqrt{3} - \frac{87}{\sqrt{3}}}$$

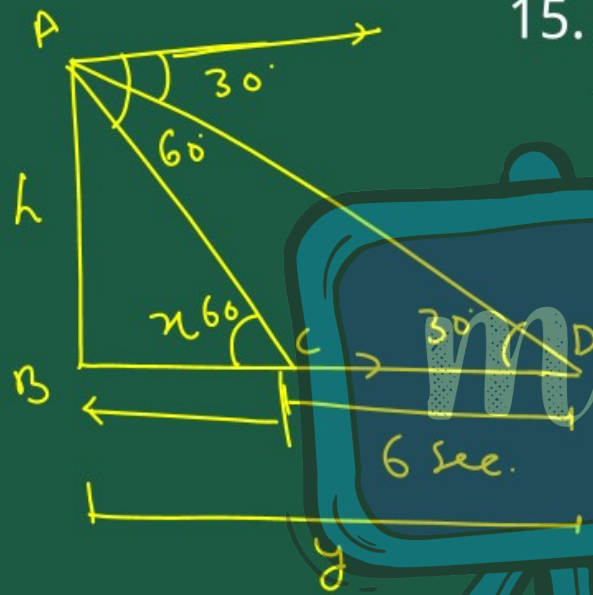
$$87 \left[\sqrt{3} - \frac{1}{\sqrt{3}} \right]$$

$$87 \left[\frac{2}{\sqrt{3}} \right]$$

$$\frac{87 \times 2 \times \sqrt{3}}{\sqrt{3} \times \sqrt{3}}$$

$$\frac{29}{87} \times 2\sqrt{3}$$

$$58\sqrt{3} \text{ m.}$$



15. A straight highway leads to the foot of a tower. A man standing at the top of the tower observes a car at an angle of depression of 30° , which is approaching the foot of the tower with a uniform speed. Six seconds later, the angle of depression of the car is found to be 60° . Find the time taken by the car to reach the foot of the tower from this point.

in $\triangle ABC$ $\theta = 60^\circ$, $AB = h$
 $BC = x$

$$\tan 60^\circ = \frac{h}{x}$$
$$\sqrt{3} = \frac{h}{x}$$
$$h = \sqrt{3}x \quad \text{--- (1)}$$
$$\frac{h}{\sqrt{3}} = x \quad \text{--- (2)}$$

in $\triangle ABD$

$$AB = h$$

$$BD = y$$

$$\angle D = 30^\circ$$

$$\tan 30^\circ = \frac{P}{B}$$

$$\frac{1}{\sqrt{3}} = \frac{h}{y}$$

$$y = \sqrt{3}h \quad \text{--- (3)}$$

$$y - x = h\sqrt{3} - \frac{h}{\sqrt{3}}$$
$$= h \left[\frac{\sqrt{3} - 1}{\sqrt{3}} \right]$$

$$y - x = h \left[\frac{2}{\sqrt{3}} \right]$$

Let the speed of the car is ϕ

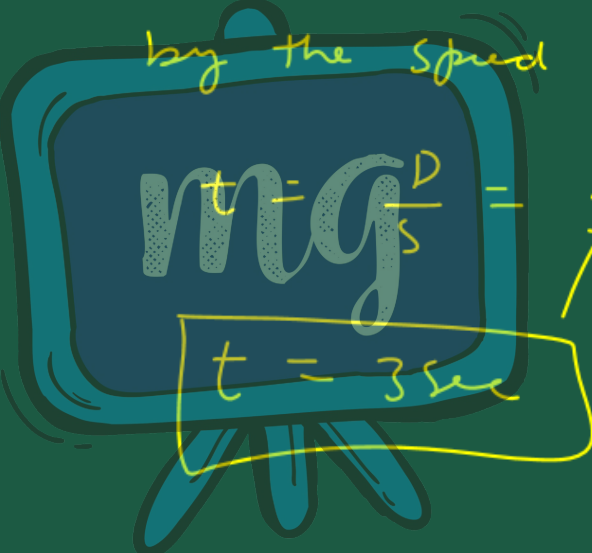
$$D = \phi \times t$$

$$h \left(\frac{2}{\sqrt{3}} \right) = \phi \times 6$$

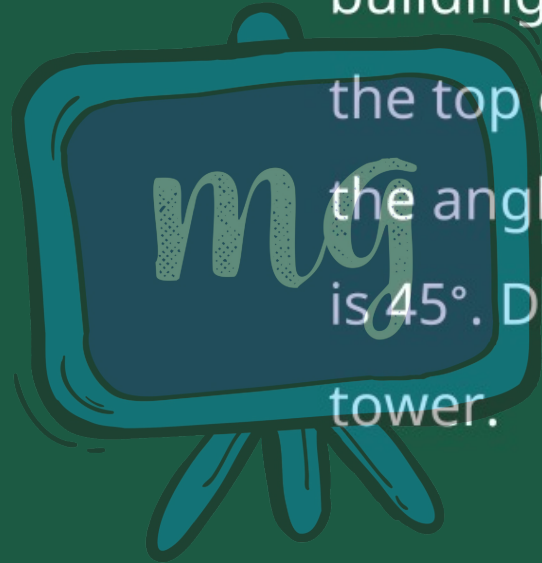
$$\frac{h \cdot 2/\sqrt{3}}{\phi \cdot 3} = 8$$

$$\phi = \frac{h}{3\sqrt{3}}$$

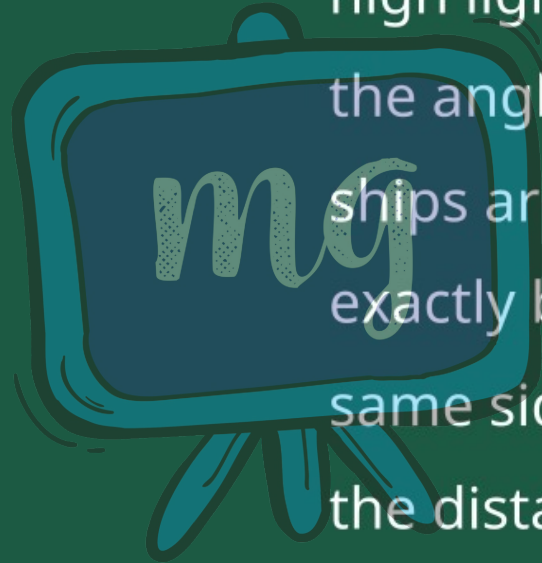
The distance $BC = h/\sqrt{3}$ covered
by the speed β in:-


$$t = \frac{D}{S} = \frac{h/\sqrt{3}}{h/3\sqrt{3}} = 3$$
$$t = 3 \text{ sec}$$

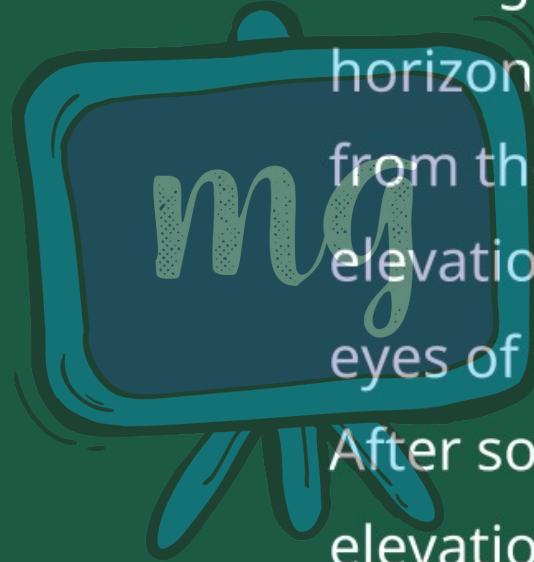
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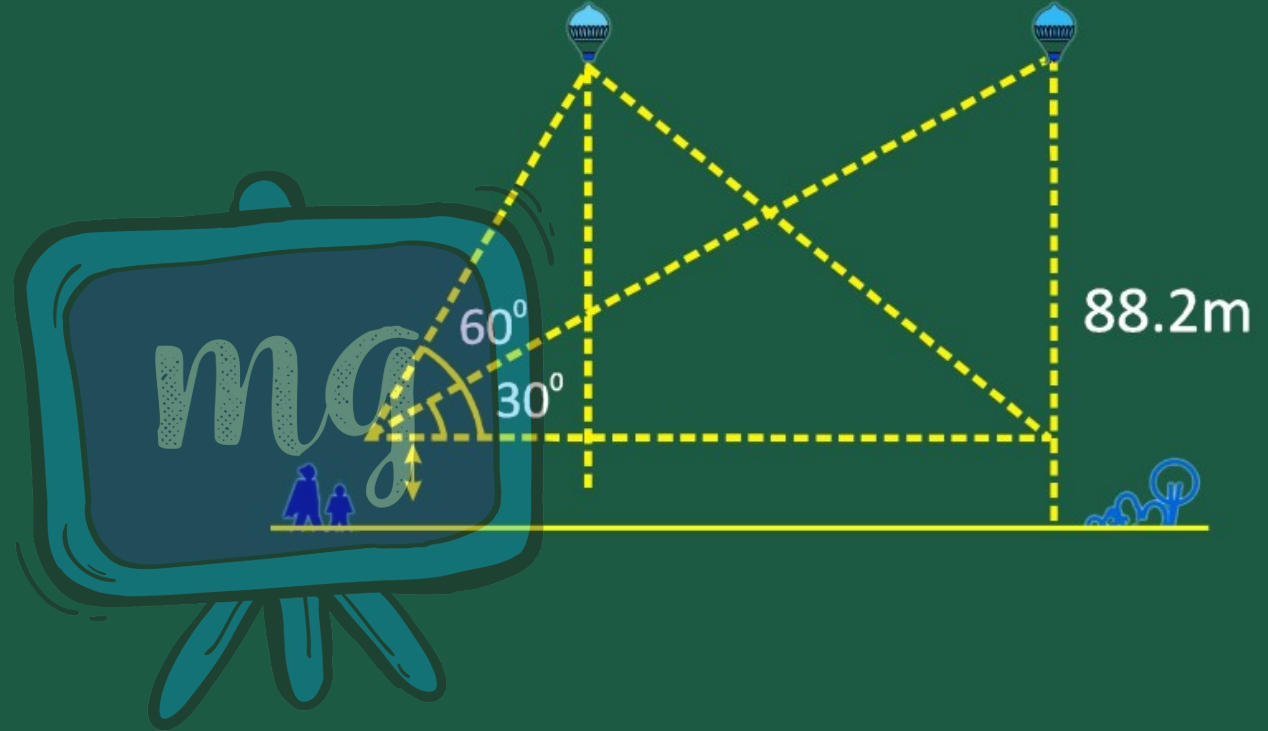


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