

CLASS – 10 MATHEMATICS

CH – 9 : Some applications of Trigonometry

CBSE Board

Previous Year Questions – 1

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1. If a pole 6 m high casts a shadow $2\sqrt{3}$ m long on the ground, then

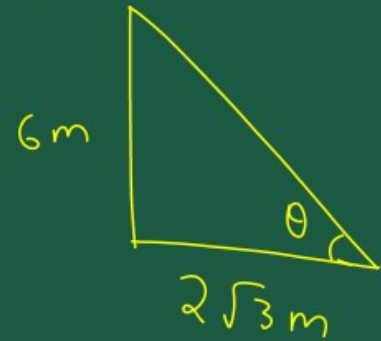
$\frac{P}{B} = \tan \theta$
 $\frac{6}{2\sqrt{3}} = \tan \theta$
 $\frac{\sqrt{3}}{1} = \tan \theta$

sun's elevation is

A. 60°
B. 45°
C. 30°
D. 90°

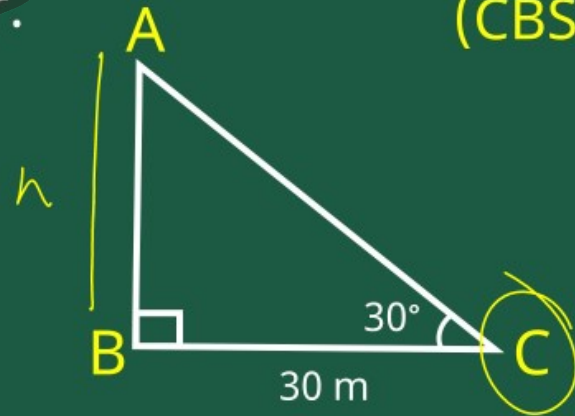
(CBSE 2023)

Solu.



2. In figure, the angle of elevation of the top of a tower from a point C on the ground, which is 30 m away from the foot of the tower, is 30° . Find the height of the tower. (CBSE 2020)

Solu.
 in ΔABC
 $\angle C = 30^\circ$, $\angle B = 90^\circ$
 $AB = h$, $BC = 30\text{m}$
 $\tan \theta = \frac{P}{B} = \frac{AB}{BC}$
 $\tan 30^\circ = \frac{h}{30}$

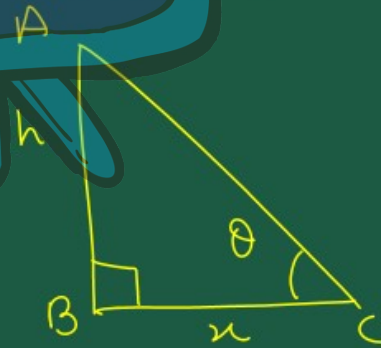
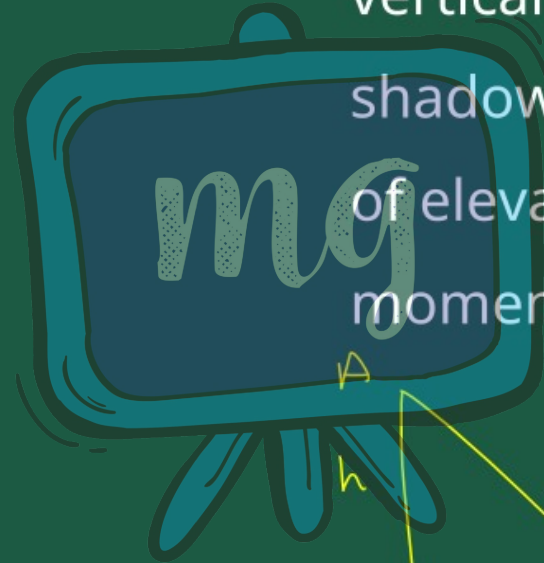


$$\tan 30^\circ = \frac{h}{30}$$

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

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

3. The ratio of the length of a vertical rod and the length of its shadow is $1 : \sqrt{3}$. Find the angle of elevation of the Sun at that moment.



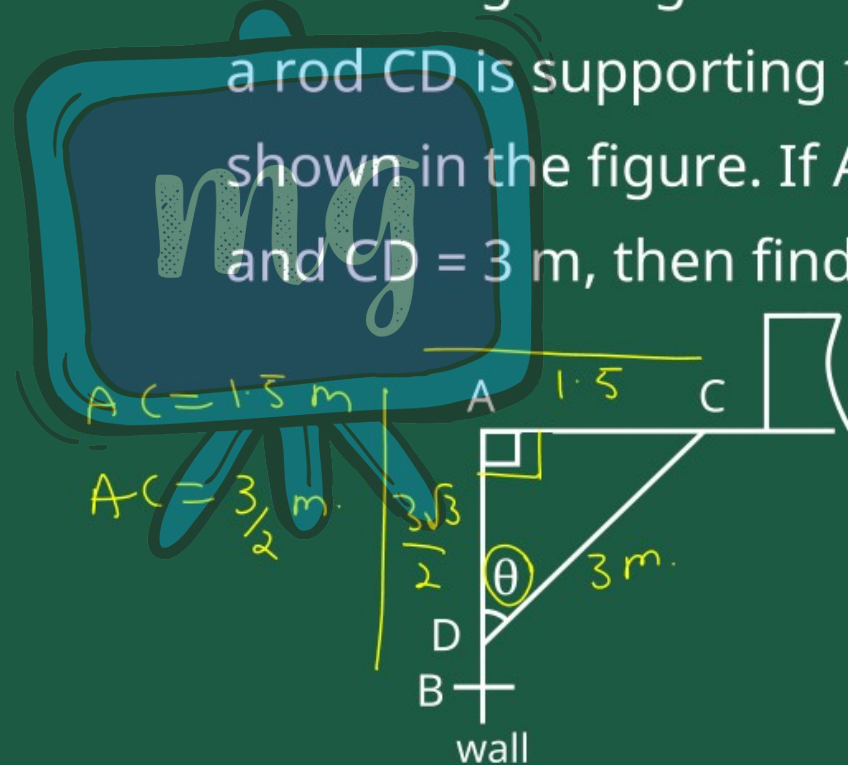
(CBSE 2020)

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

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

$$\theta = 30^\circ$$

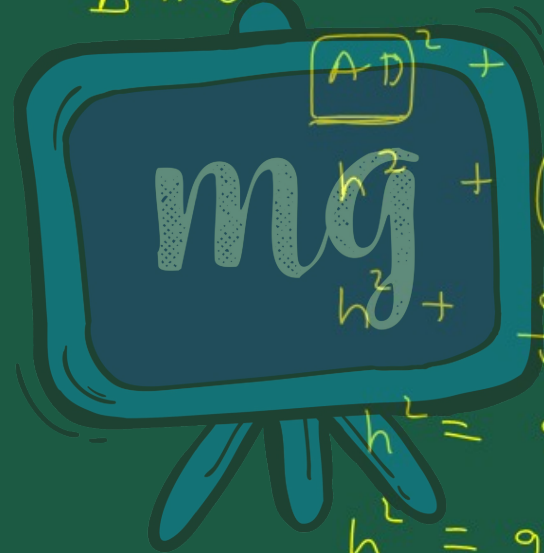
4. The rod AC of a TV disc antenna is fixed at right angles to the wall AB and a rod CD is supporting the disc as shown in the figure. If AC = 1.5 m long and CD = 3 m, then find



(CBSE 2020)

Let's apply Pythagorean Theorem in

$\triangle ACD$



$$AD^2 + AC^2 = CD^2$$

$$h^2 + \left(\frac{3}{2}\right)^2 = (3)^2$$


$$h^2 + \frac{9}{4} = 9$$

$$h^2 = 9 - \frac{9}{4}$$

$$h^2 = 9 \left[1 - \frac{1}{4}\right] = 9 \times \frac{3}{4}$$

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


(i) $\tan\theta$



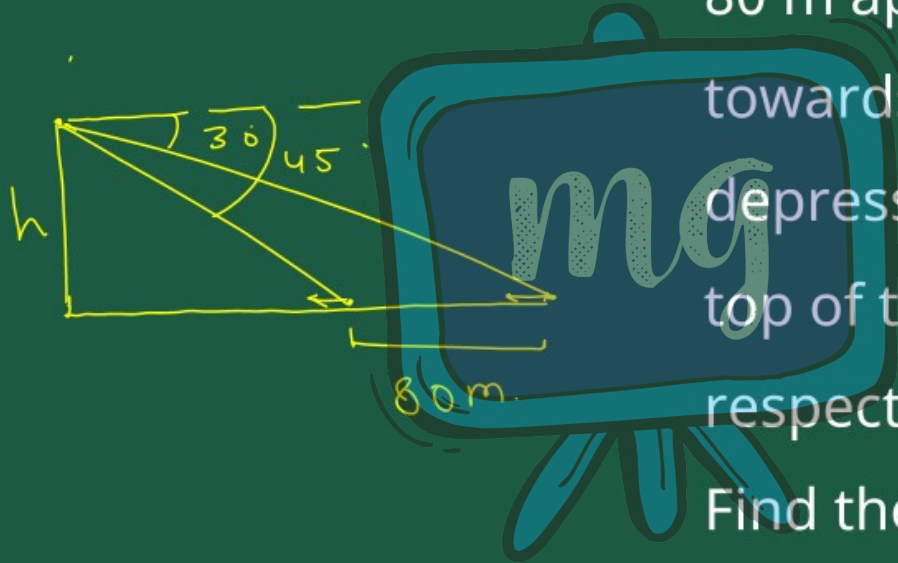
Handwritten work on the chalkboard and around it:

$$\tan\theta = \frac{p}{13} = \frac{AC}{AD}$$
$$\tan\theta = \frac{\cancel{3}/2}{\cancel{3}\sqrt{3}} = \frac{1}{\sqrt{3}}$$
$$\tan\theta = \frac{1}{\sqrt{3}}$$

(ii) $\sec\theta + \operatorname{cosec}\theta$


$$\begin{aligned} & \frac{H}{B} + \frac{H}{P} \\ &= \frac{3}{3\sqrt{3}} + \frac{3}{3/2} \\ &= \frac{2}{\sqrt{3}} + \frac{2}{1} = \frac{2+2\sqrt{3}}{\sqrt{3}} \\ &= 2 \left(\frac{\sqrt{3}+1}{\sqrt{3}} \right) \times \frac{\sqrt{3}}{\sqrt{3}} = \frac{2}{3} (\sqrt{3}+1)\sqrt{3} \end{aligned}$$

5. Two boats are sailing in the sea 80 m apart from each other towards a cliff AB. The angles of depression of the boats from the top of the cliff are 30° and 45° respectively, as shown in figure. Find the height of the cliff



(CBSE 2022)

in ΔABC
 $\angle C = \angle CAx$

{A I A}

$\angle C = 45^\circ$

$\angle B = 90^\circ$

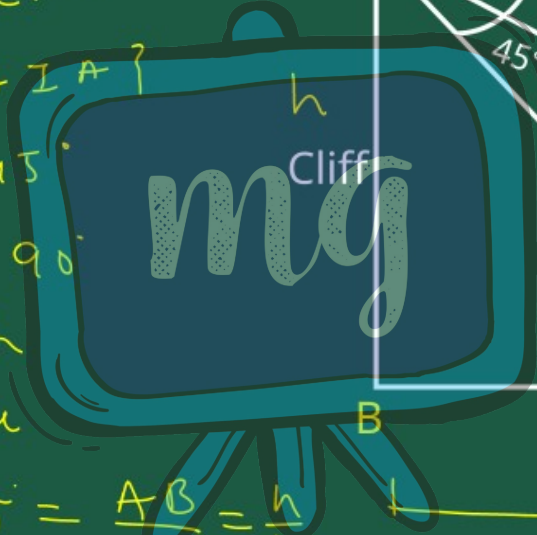
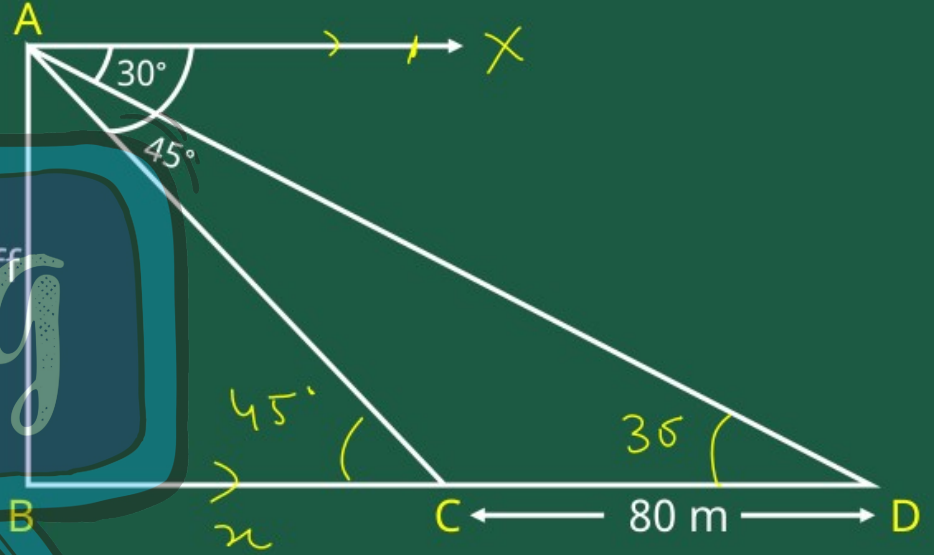
$AB = h$

$BC = x$

$$\tan 45^\circ = \frac{AB}{BC} = \frac{h}{x}$$

$$1 = \frac{h}{x}$$

$$\boxed{h = x} \text{ --- (1)}$$



in $\triangle ABD$.

$$\angle D = 30^\circ, AB = h$$

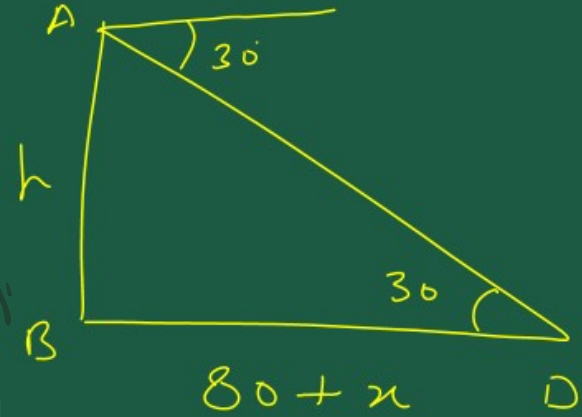
$$BD = 80 + x$$

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

$$\tan 30^\circ = \frac{h}{80 + x}$$

$$\frac{1}{\sqrt{3}} = \frac{h}{80 + x}$$

$$80 + x = h\sqrt{3} \quad \text{--- (2)}$$




By placing the values of x from eq (1)

$$80 + h = h\sqrt{3}$$

$$80 = h\sqrt{3} - h$$

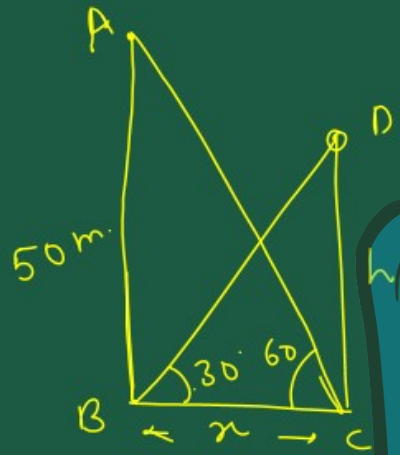
$$80 = h(\sqrt{3} - 1)$$

$$h = \frac{80}{\sqrt{3}-1} \times \frac{(\sqrt{3}+1)}{(\sqrt{3}+1)}$$


$$= \frac{80(\sqrt{3}+1)}{3-1}$$
$$= \frac{40}{\cancel{80}}(\sqrt{3}+1)$$

x

$$h = \underline{40(\sqrt{3}+1) \text{ m.}}$$



In $\triangle ABC$, $AB = 50\text{m}$.
 $BC = x$, $\theta = 60^\circ$

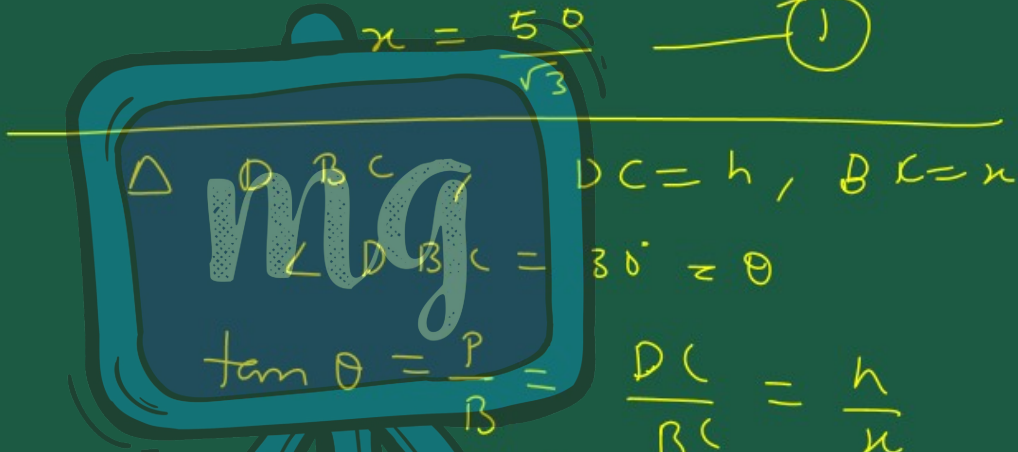
$$\tan \theta = \frac{P}{B} = \frac{AB}{BC}$$

$$\tan 60^\circ = \frac{50}{x}$$

6. 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 60° . If the tower is 50 m high, then find the height of the building. (CBSE 2022)

$$\sqrt{3} = \frac{50}{x}$$

$$x = \frac{50}{\sqrt{3}} \quad \text{--- (1)}$$



$$\tan \theta = \frac{P}{B} = \frac{DC}{BC} = \frac{h}{x}$$

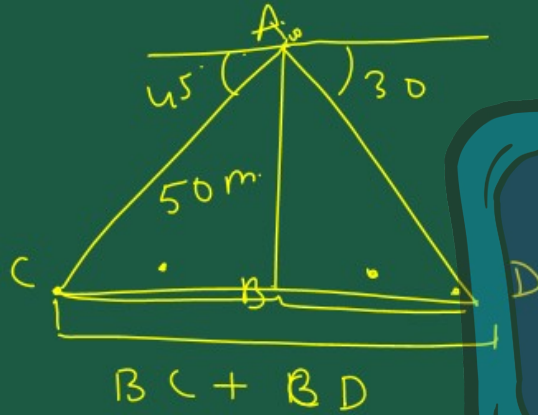
$$\tan 30 = \frac{h}{x}$$

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

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

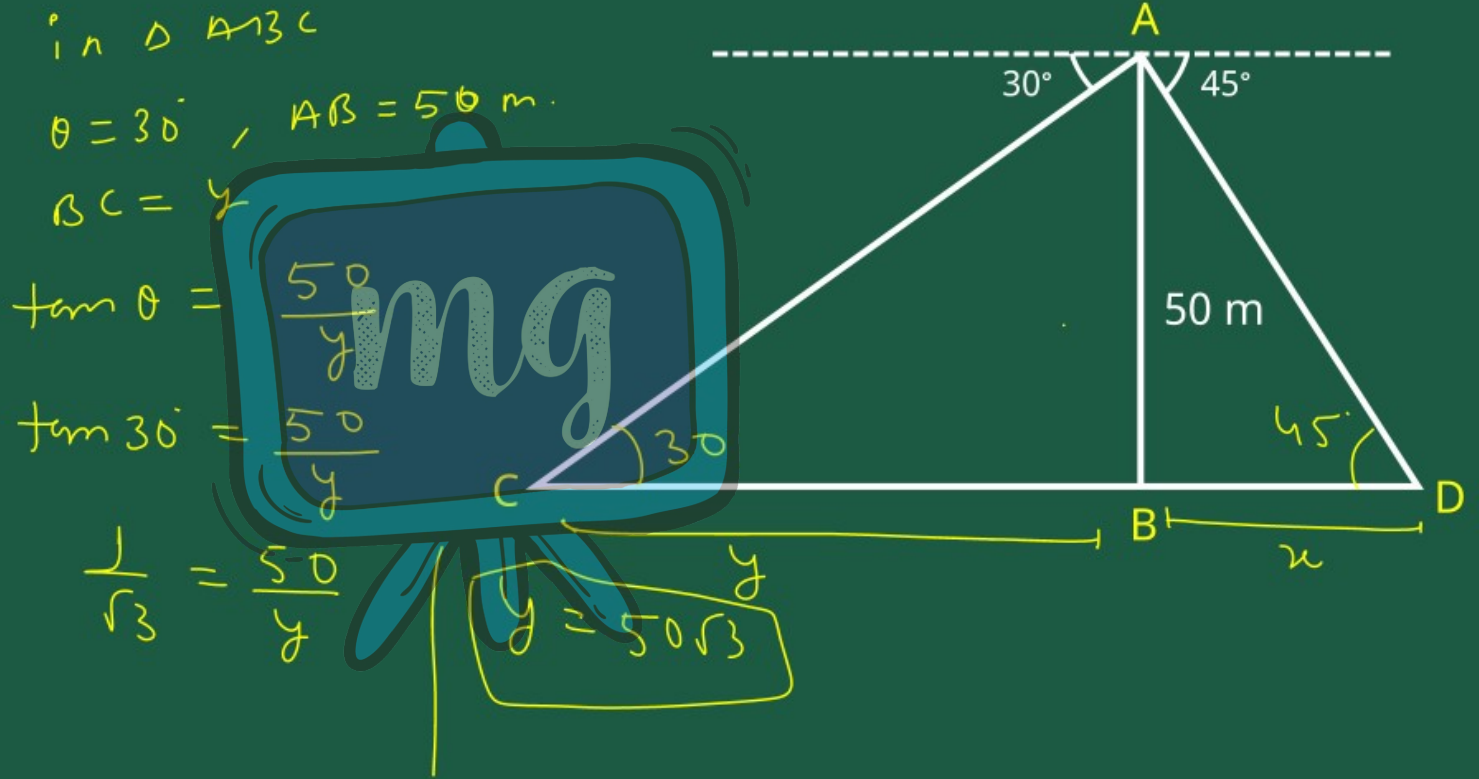
$$h = \frac{50}{\sqrt{3}} \times \frac{1}{\sqrt{3}} = \frac{50}{3} \text{ m.}$$

$$h = 16.66 \text{ m.}$$



7. In figure, AB is tower of height 50 m. A man standing on its top, observes two cars on the opposite sides of the tower with angles of depression 30° and 45° respectively. Find the distance between the two cars.

(CBSE 2022)



in triangle ABC

$\theta = 30^\circ$, $AB = 50 \text{ m}$.

$BC = y$

$$\tan \theta = \frac{50}{y}$$

$$\tan 30^\circ = \frac{50}{y}$$

$$\frac{1}{\sqrt{3}} = \frac{50}{y}$$

$$y = 50\sqrt{3}$$

in $\triangle ABD$

$$\angle D = 45^\circ$$

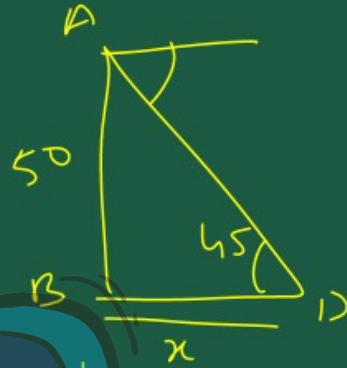
$$AB = 50$$

$$BD = x$$

$$\tan 45^\circ = \frac{50}{x}$$

$$1 = \frac{50}{x}$$

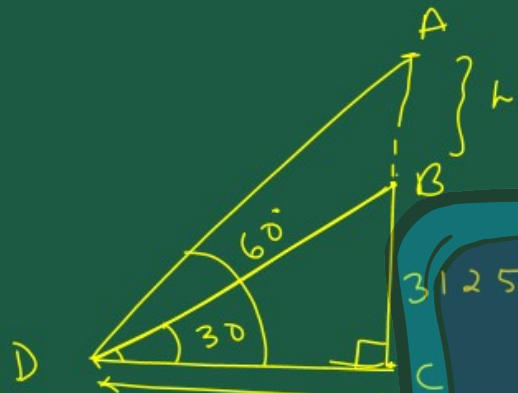
$$x = 50 \text{ m}$$



$$CD = x + y$$

$$= 50 + 50\sqrt{3}$$

$$CD = 50(\sqrt{3} + 1) \text{ m}$$



In $\triangle ADC$

$\angle ADC = 60^\circ$

$$AC = h + 3125 \text{ m}$$

$$CD = x$$

$$\tan 60^\circ = \frac{h + 3125}{x}$$

8. An aeroplane when flying at a height of 3125 m from the ground passes vertically below another plane at an instant when the angles of elevation of the two planes from the same point on the ground are 30° and 60° respectively. Find the distance between the two planes at that instant. **(CBSE 2022)**

$$\tan 60^\circ = \frac{h + 3125}{x}$$

$$\sqrt{3} = \frac{h + 3125}{x}$$

$$\Rightarrow x = \frac{h + 3125}{\sqrt{3}} \quad \text{--- (1)}$$

In $\triangle DBC$, $BC = 3125$, $CD = x$

$$\angle BDC = 30^\circ$$

$$\tan 30^\circ = \frac{P}{B} = \frac{3125}{x}$$

$$\frac{1}{\sqrt{3}} = \frac{3125}{x}$$

$$x = \frac{3125(\sqrt{3})}{1} \quad \text{--- (2)}$$

$$x = \frac{h + 3125}{\sqrt{3}}$$

from eq (1) and eq (2)

$$3125\sqrt{3} = \frac{h + 3125}{\sqrt{3}}$$

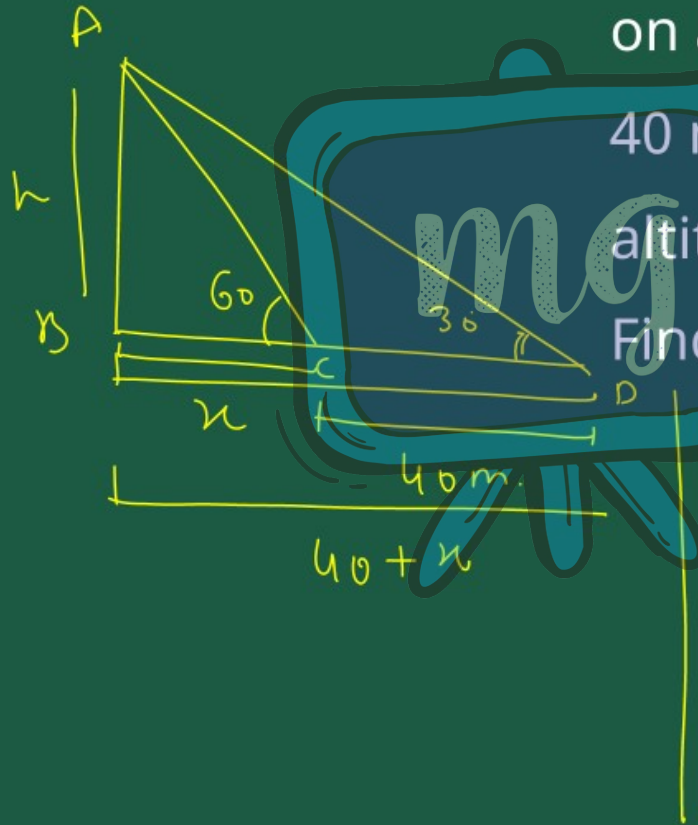
$$3125 \times (\sqrt{3})^2 = h + 3125$$

$$3(3125) - 3125 = h$$

$$2(3125) = h$$

$$\boxed{6250 = h}$$

9. The shadow of a tower standing on a level ground is found to be 40 m longer when the Sun's altitude is 30° than when it is 60° . Find the height of the tower.



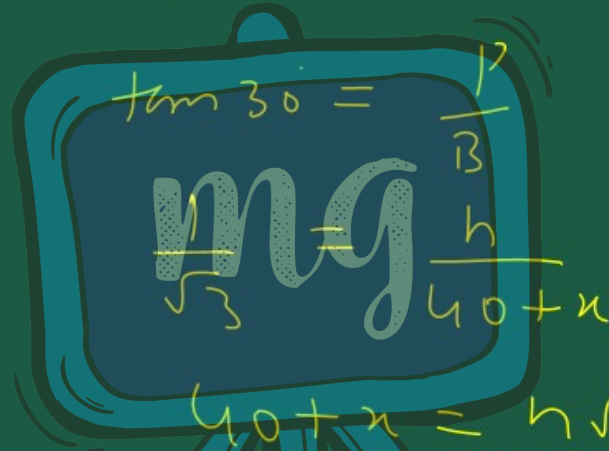
Solu. In $\triangle ABC$ (CBSE 2022)

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

$$\sqrt{3} = \frac{h}{x} \quad \left| \quad h = x\sqrt{3} \quad \text{--- (2)} \right.$$

in $\triangle ABD$

$$AB = h, \quad BD = 40 + x, \quad \theta = 30^\circ$$


$$\tan 30 = \frac{1}{\sqrt{3}} = \frac{h}{40+x}$$

$$40+x = h\sqrt{3}$$

$$40+x = (x\sqrt{3})\sqrt{3}$$

$$40+x = 3x$$

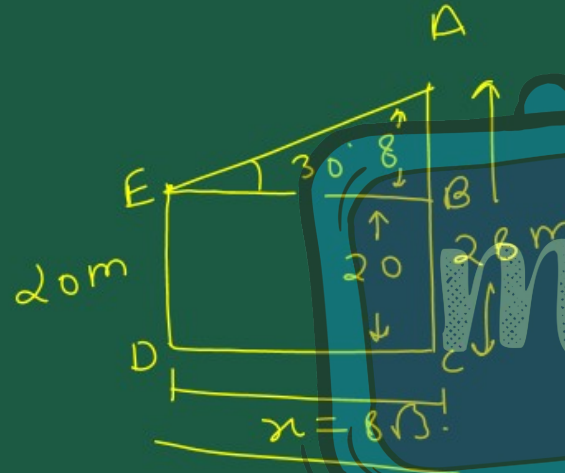
$$40 = 2x$$

$$x = \frac{40}{2}$$

$$x = 20 \text{ m}$$

$$h = 20\sqrt{3} \text{ m}$$

10. The tops of two poles of heights 20 m and 28 m are connected with a wire. The wire is inclined to the horizontal at an angle of 30° . Find the length of the wire and the distance between the two poles.



in $\triangle ABE$

$$AB = AC - BC$$

$$= 28 - 20$$

$$AB = 8 \text{ m}$$

$$\theta = 30^\circ$$

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

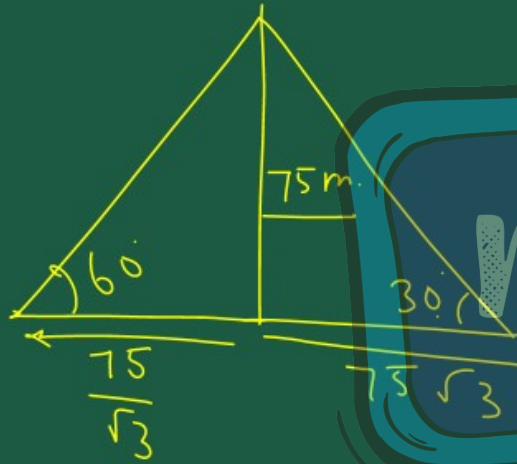
$$\frac{1}{\sqrt{3}} = \frac{8}{B}$$

(CBSE 2022)

$$B = 8\sqrt{3}$$

$$CD = 8\sqrt{3} \text{ m.}$$

11. Two men on either side of a cliff 75 m high observe the angles of elevation of the top of the cliff to be 30° and 60° . Find the distance between the two men.



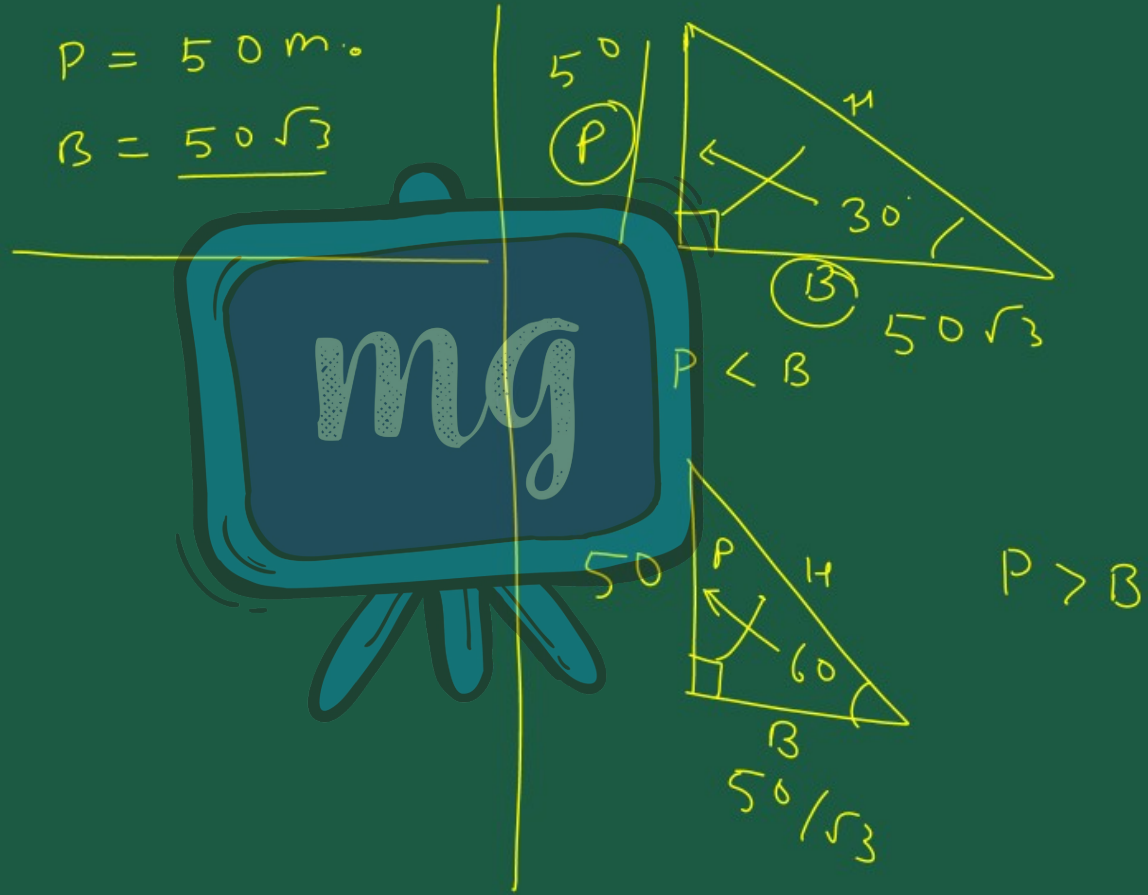
$$\frac{75}{\sqrt{3}} + 75\sqrt{3}$$

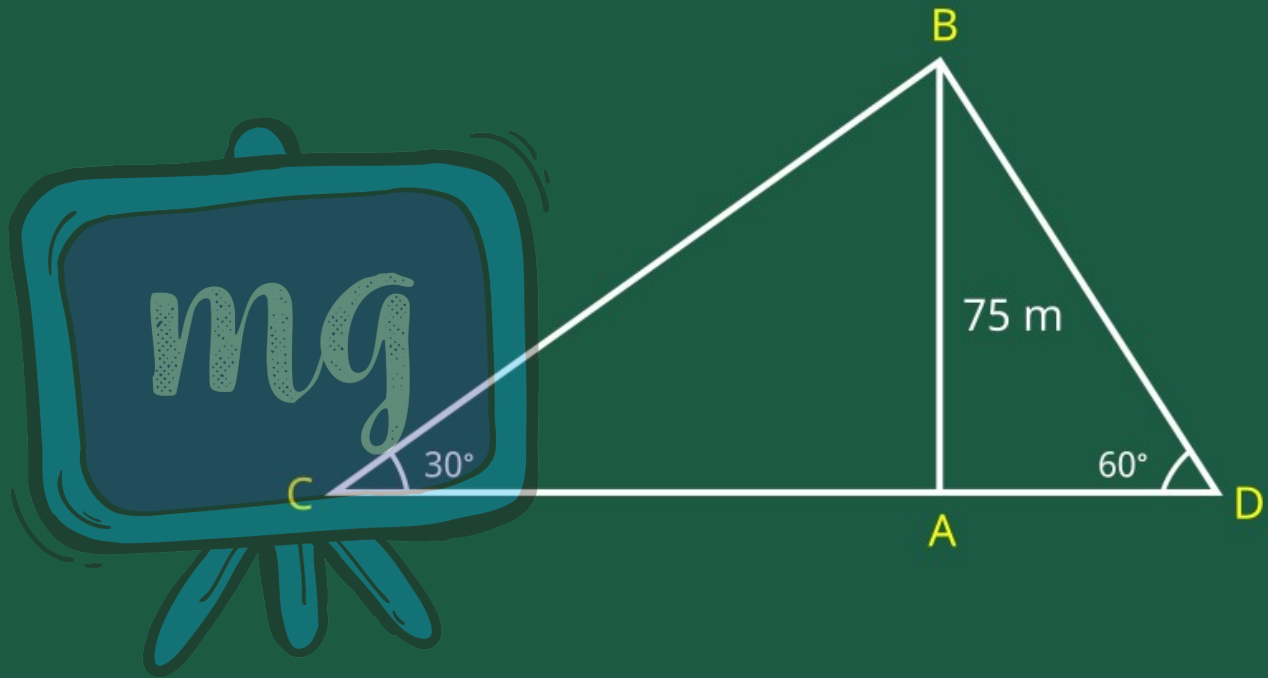
$$25 \times \frac{\sqrt{3} \times 75 \times 4}{\sqrt{3}}$$

$$100\sqrt{3}$$

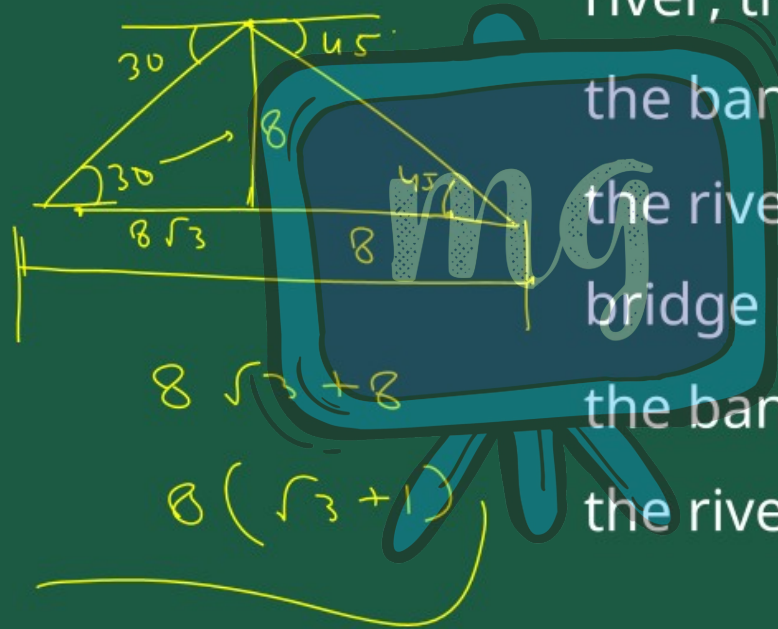
(CBSE 2022)

$$75 \left(\frac{\sqrt{3} + 1}{\sqrt{3}} \right)^2 = \frac{75}{\sqrt{3}}$$

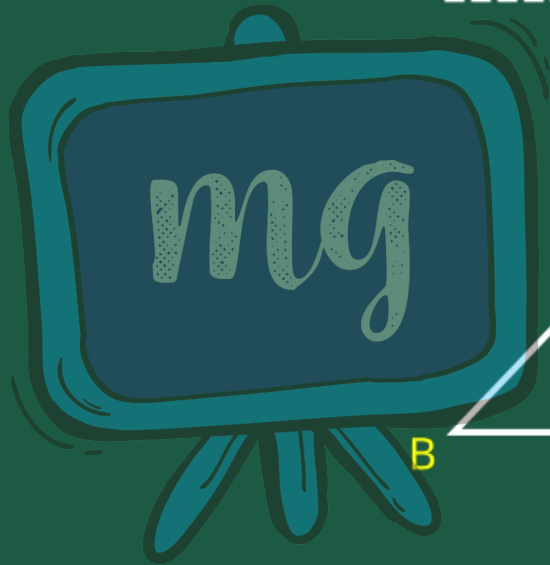
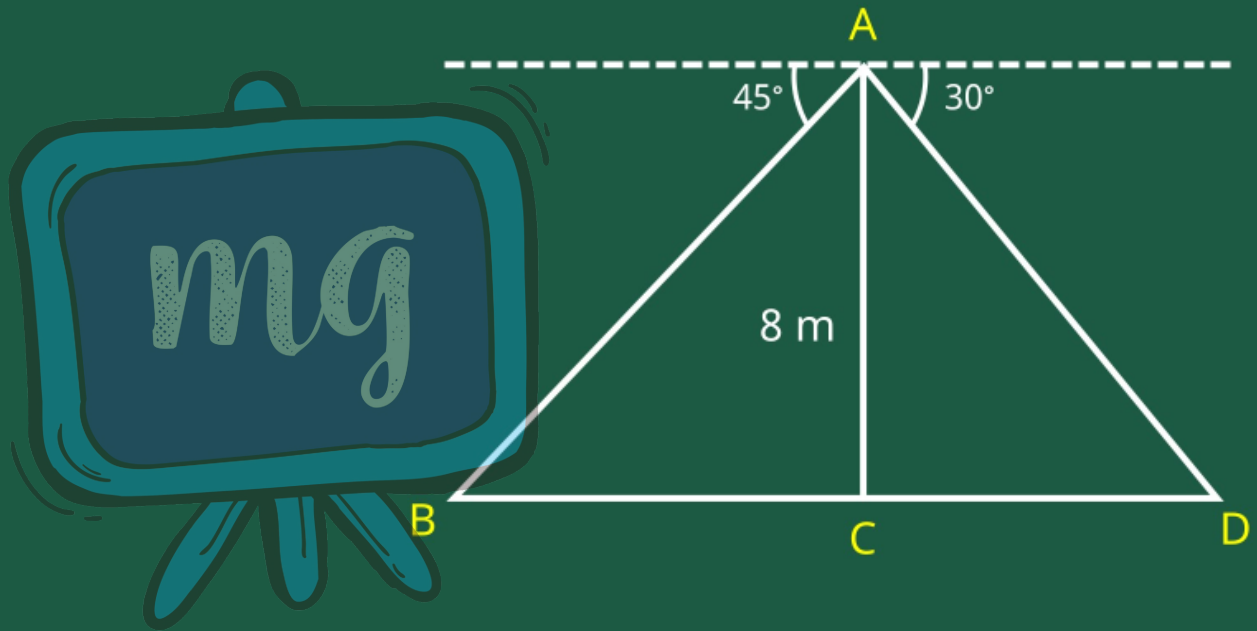




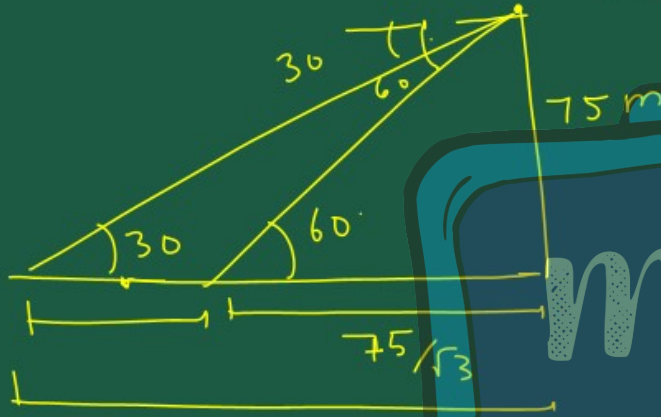
12. From a point on a bridge across a river, the angles of depression of the banks on opposite sides of the river are 30° and 45° . If the bridge is at a height of 8 m from the banks, then find the width of the river.



(CBSE 2022)



13. A straight highway leads to the foot of a tower. A man standing on the top of the 75 m high observes two cars at angles of depression of 30° and 60° which are approaching the foot of the tower.



$$75\sqrt{3}$$

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

$$75 \left[\sqrt{3} - \frac{1}{\sqrt{3}} \right]$$

$$75 \left[\frac{3-1}{\sqrt{3}} \right] = \frac{75 \times 2}{\sqrt{3}} = \frac{150}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}}$$

$50 \sqrt{3}$

$50 (\sqrt{3})$

distance between cars = 50×1.73

If one car is exactly behind the other on the same side of the tower, find the distance between the two cars. (Use $\sqrt{3} = 1.73$)

(CBSE 2023)

