DAY 3

1. **The angles of depression of the top and the bottom of the building of an 8m tall building from the top of a multi-storeyed building are 30^0 and 45^0 respectively. Find the height of the multi-storeyed building and the distance between the two buildings.** **[Example 6]**

Sol:- Let AE $= h + 8$ be the height of the multi-storeyed building, DE $=$ BC $= x$ and BE $=$ CD $= 8\,m$

In right ∠d ΔABC,

$$\frac{P}{B} = \tan 30^0$$

$$\Rightarrow \frac{h}{x} = \frac{1}{\sqrt{3}} \qquad \Rightarrow \boldsymbol{x = \sqrt{3}h} \ldots\ldots\ldots\ldots\ldots\ldots \text{i)}$$

and In right ∠d ΔAED,

$$\frac{P}{B} = \tan 45^0$$

$$\Rightarrow \frac{h+8}{x} = 1 \qquad \Rightarrow h + 8 = \boldsymbol{x}$$

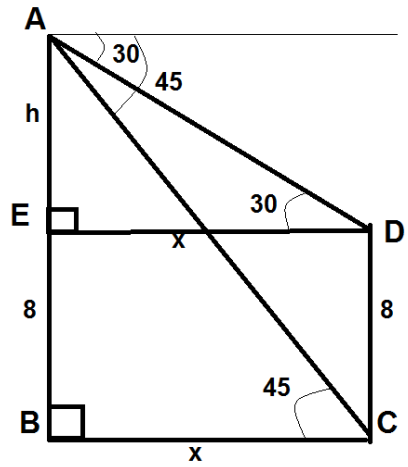
$$\Rightarrow h + 8 = \boldsymbol{\sqrt{3}h} \qquad \{\text{by i)}\}$$

$$\Rightarrow 8 = \sqrt{3}h - h = h\left(\sqrt{3} - 1\right)$$

$$\Rightarrow h = \frac{8}{\sqrt{3}-1} \times \frac{\sqrt{3}+1}{\sqrt{3}+1} = \frac{8(\sqrt{3}+1)}{(\sqrt{3})^2-(1)^2} = \frac{8(\sqrt{3}+1)}{3-1}$$

$$= \frac{8(\sqrt{3}+1)}{2} = \boldsymbol{4\left(\sqrt{3}+1\right)m}$$

and $\boldsymbol{x = \sqrt{3}h = 4\sqrt{3}\left(\sqrt{3}+1\right)m}$



2. **The angle of elevation of the top of a building from the foot of the tower is 30^0 and the angle of elevation of top of the tower from the foot of the building is 60^0. If the tower is 50m high, find the height of the building.** **[Ex 9.1, Q 9]**

Sol:- Let AD $= 50\,m$ be the height of the tower and CB $= h$ be the height of the building.

In right ∠d ΔADB,

$$\frac{P}{B} = \tan 60^0$$

$$\Rightarrow \frac{50}{x} = \sqrt{3} \qquad \Rightarrow \boldsymbol{x = \frac{50}{\sqrt{3}}} \ldots\ldots\ldots\ldots\ldots\ldots \text{i)}$$

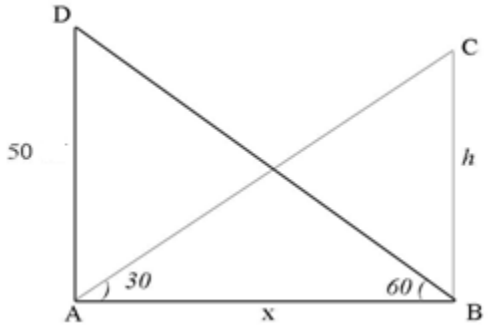
and In right ∠d ΔABC,

$$\frac{P}{B} = \tan 30^0$$

$$\Rightarrow \frac{h}{x} = \frac{1}{\sqrt{3}} \qquad \Rightarrow \sqrt{3}h = \boldsymbol{x}$$

$$\Rightarrow \sqrt{3}h = \boldsymbol{\frac{50}{\sqrt{3}}} \qquad \{\text{by i)}\}$$

$$\Rightarrow h = \boldsymbol{\frac{50}{3}m}$$



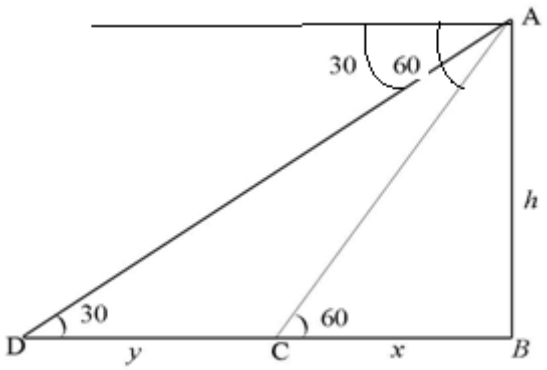
3. A man on a tower observes a car at an angle of depression of 30^0 which is approaching the foot of the tower a uniform speed. Six seconds later, the angle of depression of the car is found to be 60^0. Find the time taken by the car to reach the foot of the tower from this point. [Ex 9.1, Q 15]

Sol:- Let AB = h m be the height of the tower and BC $= x$ and CD $= y$

In right ∠d ΔABC,

$$\frac{P}{B} = \tan 60^0$$

$$\Rightarrow \frac{h}{x} = \sqrt{3} \qquad \Rightarrow \boldsymbol{h = \sqrt{3}x} \ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{i)}$$



and In right ∠d ΔABD,

$$\frac{P}{B} = \tan 30^0$$

$$\Rightarrow \frac{h}{x+y} = \frac{1}{\sqrt{3}} \qquad \Rightarrow \sqrt{3}\boldsymbol{h} = x + y$$

$$\Rightarrow \sqrt{3}(\sqrt{\boldsymbol{3}}\boldsymbol{x}) = x + y \qquad \{\text{by i)}\}$$

$$\Rightarrow 3x = x + y \qquad \Rightarrow y = 3x - x = 2x \ldots\ldots\ldots \text{ii)}$$

Now For covering distance y m, time taken by the car $= 6$ sec

For covering distance 1 m, time taken by the car $= \frac{6}{y}$ sec

For covering distance x m, time taken by the car $= \frac{6}{\boldsymbol{y}} \times x = \frac{6}{\boldsymbol{2x}} \times x = 3$ sec

4. A girl who is 1.2 m tall, 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 60^0. After some time, the angle of elevation reduces to 30^0. Find the distance travelled by the balloon during the interval. [Ex 9.1, Q14]

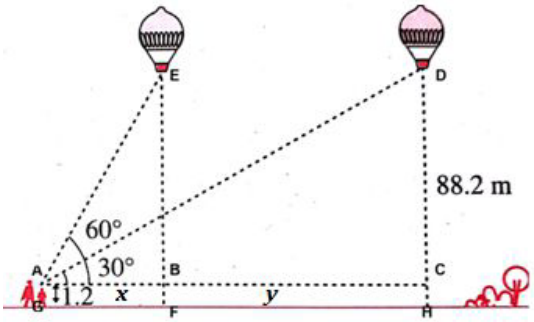
Sol:- Let AG $= 1.2$ m be height of the girl and EF $=$ DH $= 88.2$ m and EB $=$ DC $= 87$ m

In right ∠d ΔABE,

$$\frac{P}{B} = \tan 60^0$$

$$\Rightarrow \frac{87}{x} = \sqrt{3}$$

$$\Rightarrow \boldsymbol{x} = \frac{87}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = \frac{87\sqrt{3}}{3} = \boldsymbol{29\sqrt{3}} \ldots\ldots\ldots\ldots\ldots \text{i)}$$



and In right ∠d ΔACD,

$$\frac{P}{B} = \tan 30^0$$

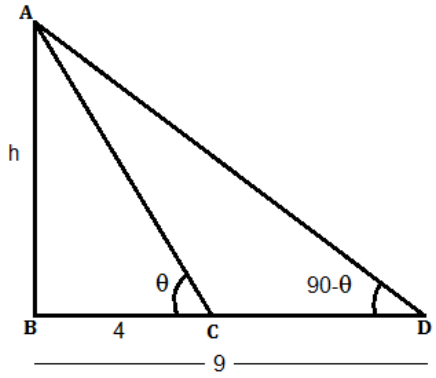
$$\Rightarrow \frac{87}{x+y} = \frac{1}{\sqrt{3}} \qquad \Rightarrow 87\sqrt{3} = \boldsymbol{x} + y$$

$$\Rightarrow 87\sqrt{3} = \boldsymbol{29\sqrt{3}} + y \qquad \{\text{by i)}\}$$

$$\Rightarrow y = 87\sqrt{3} - 29\sqrt{3} = 58\sqrt{3}$$

5. The angles of elevation of the top of a tower from two points at a distance of 4 m and 9 m from the base of the tower and in the same straight line with it are complementary. Prove that the height of the tower is 6 m. [Ex 9.1, Q16]

Sol:- Let BC $= 4\ m$ and BD $= 9\ m$ be the distances from the base of the tower and h be the height of the tower. **Let ∠ACB** $= \theta$ and $\angle$ ADB $= 90^0 - \theta$ be the complementary angles.



In right ∠d ΔACB,

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

$$\Rightarrow \frac{h}{4} = \tan\theta \ldots\ldots\ldots\ldots\ldots\ldots\ldots i)$$

and In right ∠d ΔABD,θ

$$\frac{P}{B} = \tan(90^0 - \theta)$$

$$\Rightarrow \frac{h}{9} = \cot\theta \ldots\ldots\ldots\ldots\ldots\ldots\ldots ii)$$

Multiply i) and ii), we get

$$\frac{h}{4} \times \frac{h}{9} = \tan\theta \times \cot\theta$$

$$\Rightarrow \frac{h^2}{36} = \tan\theta \times \frac{1}{\tan\theta} = 1$$

$$\Rightarrow h^2 = 36 \qquad \Rightarrow \boldsymbol{h = 6}$$