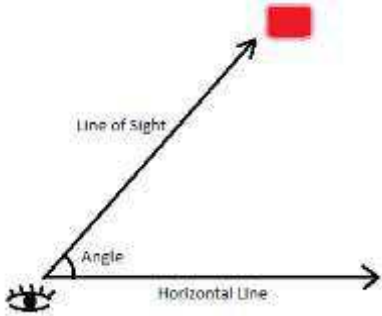
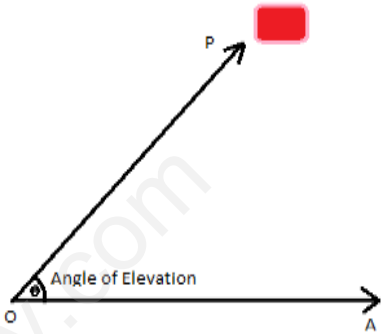
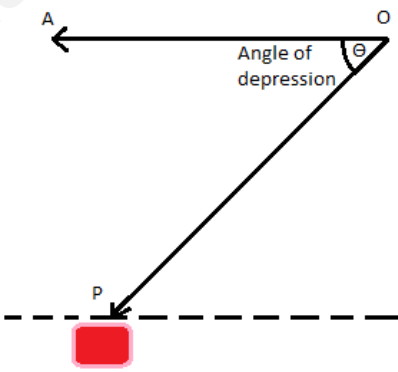


**APPLICATIONS OF TRIGONOMETRY
(HEIGHT AND DISTANCES)**

KEY POINTS

<p>Line of sight Line segment joining the object to the eye of the observer is called the line of sight.</p>	
<p>Angle of elevation When an observer sees an object situated in upward direction, the angle formed by line of sight with horizontal line is called angle of elevation.</p>	
<p>Angle of depression When an observer sees an object situated in downward direction the angle formed by line of sight with horizontal line is called angle of depression.</p>	

LEVEL- 1

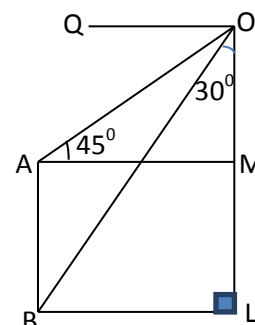
1. A pole 6cm high casts a shadow $2\sqrt{3}$ m long on the ground, then find the sun's elevation?
Ans. 60°
2. If $\sqrt{3}\tan\theta = 1$, then find the value of $\sin^2\theta - \cos^2\theta$
Ans. $-1/2$
3. An observer 1.5m tall is 20.5 metres away from a tower 22m high. Determine the angle of elevation of the top of the tower from the eye of the observer.
Ans. 45°
4. A ladder 15m long just reaches the top of vertical wall. If the ladder makes an angle 60° with the wall, find the height of the wall
Ans. $15/2$ m
5. In a rectangle ABCD, $AB = 20\text{cm}$ $\angle BAC = 60^\circ$ then find the length of the side AD.
Ans. $20\sqrt{3}\text{cm}$
6. Find the angle of elevation of the sun's altitude when the height of the shadow of a vertical pole is equal to its height:
Ans. 45°

7. From a point 20m away from the foot of a tower, the angle of elevation of top of the tower is 30° , find the height of the tower.

Ans. $\frac{20}{\sqrt{3}}m$

8. In the adjacent figure, what are the angles of depression of the top and bottom of a pole from the top of a tower h m high:

Ans $45^\circ, 60^\circ$



LEVEL - 2

1. In $\triangle ABC$, $\angle B = 45^\circ$, $\angle C = 45^\circ$, $AB = 5cm$ then find the length of the other two sides.

Ans. $5cm, 5\sqrt{2}cm$

2. From a point 20 m away from the foot of the tower, the angle of elevation of the top of the tower is 30° , find the height of the tower.

Ans. $\frac{20\sqrt{3}}{3}m$

3. A ladder 50m long just reaches the top of a vertical wall. If the ladder makes an angle of 60° with the wall, find the height of the wall.

Ans. 25 m

4. A circus artist is climbing a 20m long rope, which is tightly stretched and tied from the top of a vertical pole to the ground. Find the height of the pole, if the angle made by the rope with the ground level is 30° .

Ans. 10 m

5. A tree breaks due to storm and the broken part bends so that the top of the tree touches the ground making an angle 30° with it. The distance between the foot of the tree to the point where the top touches the ground is 8m. Find the height of the tree.

Ans. $8\sqrt{3}m$

LEVEL - 3

1. The shadow of a tower standing on a level plane is found to be 50m longer when sun's elevation is 30° then when it is 60° . Find the height of the tower.

Ans. $25\sqrt{3}m$

2. The angle of depression of the top and bottom of a tower as seen from the top of a 100m high cliff are 30° and 60° respectively. Find the height of the tower. [Ans. 66.67m]

3. From a window (9m above ground) of a house in a street, the angles of elevation and depression of the top and foot of another house on the opposite side of the street are 30° and 60° respectively.

Find the height of the opposite house and width of the street.

[Ans.12m, $3\sqrt{3}$ m]

4. From the top of a hill, the angle of depression of two consecutive kilometer stones due east are found to be 30° and 45° . Find the height of the hill.

Ans.1.37 km

5. Two poles of equal heights are standing opposite each other on either side of the road, which is 80m wide. From a point between them on the road the angles of elevation of the top of the poles are 60° and 30° . Find the heights of pole and the distance of the point from the poles.

[Ans; h=34.64m; 20m, 60m] .

6. The angle of elevation of a jet fighter from a point A on the ground is 60° . After a flight of 15 seconds, The angle of elevation changes to 30° . If the jet is flying at a speed of 720km/ hr, find the constant height at which the jet is flying.

[Ans;1500m]

7. A window in a building is at a height of 10m above the ground. The angle of depression of a point P on the ground from the window is 30° . The angle of elevation of the top of the building from the point P is 60° . Find the height of the building.

[Ans; 30m]

8. A boy, whose eye level is 1.3m from the ground, spots a balloon moving with the wind in a horizontal line at same height from the ground. The angle of elevation of the balloon from the eyes of the boy at any instant is 60° . After 2 seconds, the angle of elevation reduces to 30° . If the speed of the wind at that moment is $29\sqrt{3}$ m/s, then find the height of the balloon from the ground.

[Ans; 88.3m]

9. A man on the deck on a ship 14m above water level, observes that the angle of elevation of the top of a cliff is 60° and the angle of depression of the base of the cliff is 30° . Calculate the distance of the cliff from the ship and the height of the cliff.

[Ans ; h= 56m , distance 24.25m]

10. 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 tower with a uniform speed. Six minutes 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.

[Ans.3 minutes]

SELF EVALUATION/HOTS

1. An aeroplane when flying at a height of 3125m from the ground passes vertically below another

plane at an instant when the angle 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.

[Ans ; 6250m]

2. From the top of a building 60m high, the angles of depression of the top and bottom of a vertical lamp post are observed to be 30° and 60° respectively. Find [i] horizontal distance between the building and the lamp post [ii] height of the lamp post.

[Ans. 34.64m h=40m]

3. A vertical tower stands on a horizontal plane and is surmounted by a vertical flag staff of height h m. At a point on the plane, the angles of elevation of the bottom and the top of the flag staff are α and β , respectively. Prove that the height of the tower is $\frac{h \tan \alpha}{\tan \beta - \tan \alpha}$.
4. The angle of elevation of a cloud from a point 60m above a lake is 30° and the angle of depression of the reflection of the cloud in the lake is 60° . Find the height of the cloud from the surface of the lake.

[Ans 120m]