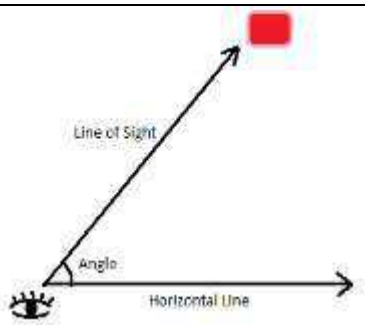
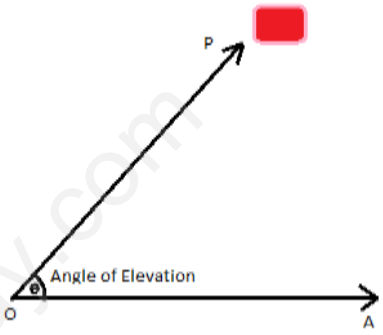
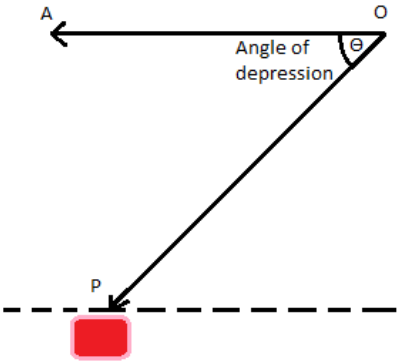
APPLICATIONS OF TRIGONOMETRY
(HEIGHT AND DISTANCES)

IMPORTANT CONCEPTS
TAKE A LOOK

Line of sight Line segment joining the object to the eye of the observer is called the line of sight.	
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.	
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.	

LEVEL – 1 (Questions carrying one marks)

1. The height of a tower is 10m. What is the length of its shadow when sun's altitude is 45°.

   Ans : 10m
2. A ladder 15m 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: $7.5\sqrt{3}$m
3. A pole 6cm high casts a shadow $2\sqrt{3}$ m long on the ground, then find the sun's elevation.

   Ans : 60°
4. A bridge across a river makes an angle of 45° with the river bank. If the length of the bridge across the river is 150m, then find the width of the river.

   Ans : $75\sqrt{2}$m
5. A 6m tall tree casts a shadow of length 4m. If at the same time a flagpole casts a shadow 50m in length, then find the length of the flagpole.

   Ans: 75m

LEVEL – 2 (Questions carrying 3 marks)

1. A tree breaks due to storm and the broken part bends so that the top of the tree touches the ground making an angle of 30° with the ground. 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√3m]

2. A kite is flying at a height of 60m above the ground. The string attached to the kite is temporarily tied to a point on the ground. The inclination of the string to the ground is 60°. Find the length of the string assuming that there is no slack in the string. [Ans-40√3m]
3. The angle of elevation of the top of a hill at the foot of the tower is 60° and the angle of elevation of the top of the tower from the foot of the hill is 30°. If the tower is 50m high, find the height of the hill. [Ans-150m]

LEVEL – 3 (Questions carrying 4 marks)

1. From the top of a 7m high building, the angle of elevation of the top of a cable tower is 60° and the angle of depression of the foot of the tower is 30°. Find the height of the tower. [Ans-28m]
2. The angle of elevation of an aeroplane from a point on the ground is 45°. After flight for 15 seconds the elevation changes to 30°. If the aeroplane is flying at a height of 3000m. Find the speed of the aeroplane. [Ans-527.4km/h]
3. The angle of elevation of a cloud from a point h metres above a lake is α and the angle of derpression of its reflection in the lake is β. Prove that the height of the cloud is $\frac{h(\tan[\beta + tan\alpha)]}{tan\beta - tan\alpha}$ metres.

SELF EVALUATION

1. From the top of a light house, the angles of depression of two ships on opposite sides of it are observed to be α and β. If the height of the light house is h metres and the line joining the ships passes through the foot of the lighthouse, show that the distance between ships is $\frac{h(\tan[\alpha + tan\beta)]}{tan\alpha.tan\beta}$ metres.
2. The angle of elevation of the top of towers from points p and q at distances of a and b respectively from the base and in the same straight line with it are complementary. Prove that the height of the tower is $\sqrt{ab}$.
3. A man standing on the deck of a ship which is 10m above the water level observes the angle of elevation of the top of a hill as 60° and the angle of depression of the base of the hill is 30°. Calculate the distance of the hill from the ship and the height of the hill.
4. The angle of elevation of the top of the tower as observed from a point on the ground is α and on moving 'a' m towards the tower, the angle of elevation is β. Prove that the height of the tower is $\frac{a\tan\alpha.\tan\beta}{\tan\beta - \tan\alpha}$
5. A person standing on the bank of a river observes that the angle of elevation of the top of a tree standing on the opposite bank is 60°. When he moves 40m away from the bank, he finds that angle of elevation to be 30°. Find the height of the tree and the width of the river. [use √3=1.732]