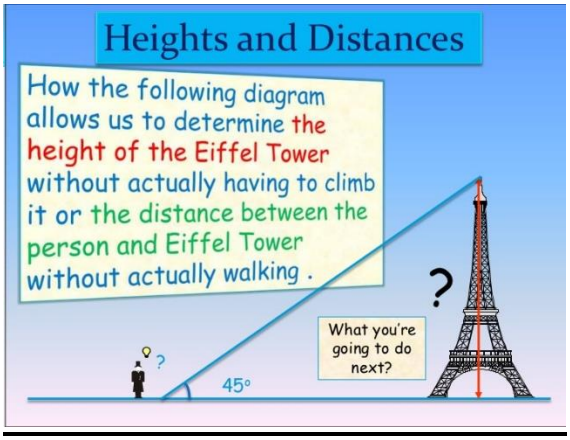
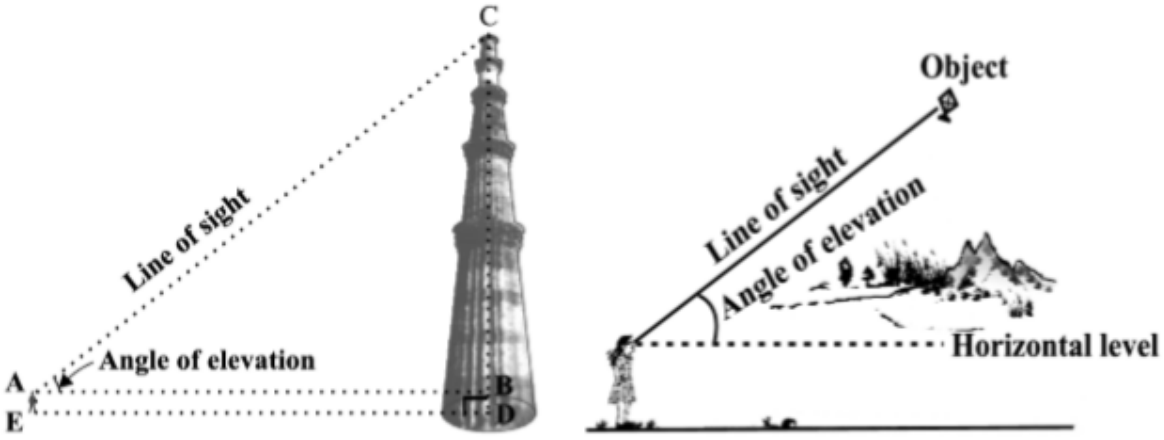
CHAPTER 9

SOME APPLICATIONS OF TRIGONOMETRY



ANGLE OF ELEVATION

In the below figure, the line AC drawn from the eye of the student to the top of the minar is called the *line of sight*. The student is looking at the top of the minar. The angle BAC, so formed by the line of sight with the horizontal, is called the *angle of elevation* of the top of the minar from the eye of the student. Thus, the **line of sight** is the line drawn from the eye of an observer to the point in the object viewed by the observer.

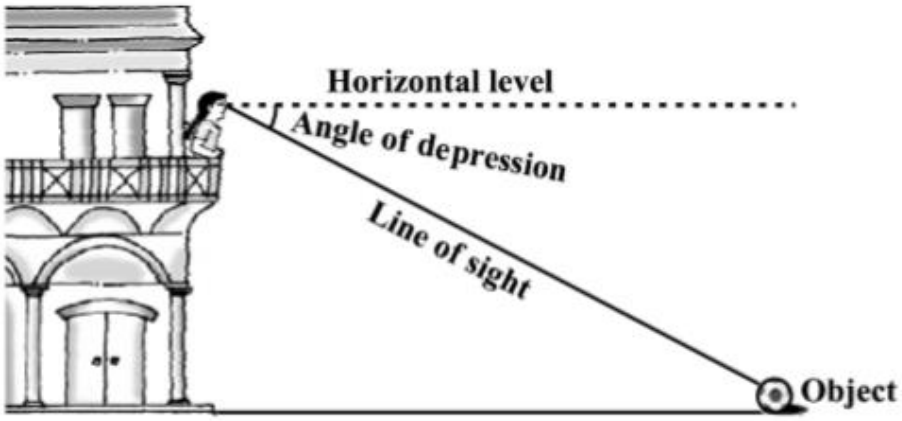


The **angle of elevation** of the point viewed is the angle formed by the line of sight with the horizontal when the point being viewed is above the horizontal level, i.e., the case when we raise our head to look at the object

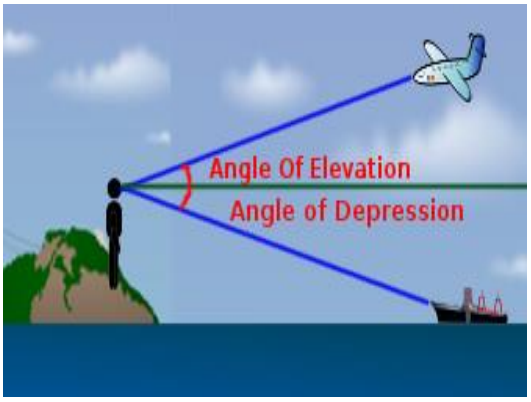
Synopsis

ANGLE OF DEPRESSION

In the below figure, the girl sitting on the balcony is *looking down* at a flower pot placed on a stair of the temple. In this case, the line of sight is *below* the horizontal level. The angle so formed by the line of sight with the horizontal is called the *angle of depression*. Thus, the **angle of depression** of a point on the object being viewed is the angle formed by the line of sight with the horizontal when the point is below the horizontal level, i.e., the case when we lower our head to look at the point being viewed



-



If the angle formed by the line of sight with the horizontal when it is above the horizontal level is called the ANGLE OF ELEVATION
If the angle formed by the line of sight with the horizontal when it is below the horizontal level is called the ANGLE OF DEPRESSION.

SECTION-A

Multiple choice questions (1mark)

1.	**Q1: When a point is observed, the angle formed by the line of sight with the horizontal level where the point being viewed is above the horizontal plane is known as:** (a) angle of triangle (b) angle of depression (c) angle of elevation (d) none of these
2.	**Q2: When we raise our hand to look at the object, the angle formed by the line of sight with horizontal is known as:** (a) obtuse angle (b) angle of elevation (c) angle of depression (d) acute angle
3.	**Q3: When we lower our hand to look at the object, the angle formed by the line of sight with horizontal is known as:** (a) obtuse angle (b) angle of elevation (c) angle of depression (d) acute angle
4.	**Q4: When the length of the shadow of a pillar is equal to its height, the elevation at source of sight is:** (a) 30° (b) 45° (c) 60° (d) 90°
5.	**Q5: A pole 10 m high casts a shadow 10 m long on the ground, then the sun's elevation is?** (a) 60° (b) 45° (c) 30° (d) 90°

6.	**Q6: The angle of depression from the top of a tower 12 m high, at a point on the ground is 30°. The distance of the point from the top of the tower is:** (a) 12 m (b) $4\sqrt{3}$ m (c) $12\sqrt{3}$ m (d) 24 m
7.	**Q7: A ladder is 10 m long. It touches a wall at height of 5 m. The angle θ made by it with the horizontal is:** (a) 90° (b) 60° (c) 45° (d) 30°
8.	**Q8: If the angle of depression of an object from a 75 m high tower is 30°, then the distance of the object from the base of tower is:** (a) $25\sqrt{3}$ m (b) $50\sqrt{3}$ m (c) $75\sqrt{3}$ m (d) 150 m
9.	**Q9: The ratio of the length of a rod and its shadow is 1 :$\sqrt{3}$. The altitude of the sun is:** (a) 30° (b) 45° (c) 60° (d) 90°
10.	**Q10: The tops of two poles of height 10m and 18m are connected with wire. If wire makes an angle of 30° with horizontal, then length of wire is:** (a) 10 m (b) 12 m (c) 16 m (d) 18 m

A.		Very Short Answer Questions (VSA) (1 Mark)	
1		Persons are 1 meters apart and the height of 1 is double that of the other. If from the middle point from the line joining their feet ,and observer finds angular elevation of the tops to be complementary ,Find the height of the short person?	C
2		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 30^0,which is approaching the foot of the tower at a uniform speed.6 min later ,the angle of depression of the car is fund to be 60^0,Find the time taken by the car to reach the foot of the tower from this point?	U
3		As observed from the top of a 75 m height light house from the sea level, the angle of depression of two ships are 30^0 and 45^0.One ship is exactly behind the other on the same side of the light house, Find the distance between the two ships?	C
4		A player sitting on the top of a tower of height 20m observes the angle of depression of a ball lying on the ground is 60^o. Find the distance between the foot of the tower and the ball.	U
5		A plane is observed to be approaching the airport. It is at a distance of 12km from the point of observation and makes an angle of elevation of 30^o .Find its height above the ground.	U

B.		Short Answer Questions (SA) (2 marks)	level
1		A vertically straight tree, 15m high, is broken by the wind in such a way that its top just touches the ground and makes an angle of 60^o with the ground. At what height from the ground did the tree break?	HOT
2		The angle of elevation of the top of a tower from a point on the ground is 30^0. If on walking 30 meter towards the tower, the angle of elevation becomes 60^0. Find the height of the tower?	C

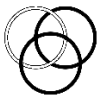
3		Find the angle of elevation of the sun when the shadow of a pole h meters high is √3h meters long.	HOT
4		The angle of elevation of the top a hill at the foot of the tower is 60^o and the angle of elevation of the top of the tower from the foot of the hill is 30^o. if the tower is 50 m high, Prove that the height of the hill is 150m.	C
5		The angle of elevation of the top of the tower from two points P and Q at distance of 'a' and 'b' respectively, from the base and in the straight line with its are complementary. Prove that the height of the tower is $\sqrt{ab}$.	U

C.		Long Answer Questions (LA) (3 Marks)	
1		From the top of a cliff 50m high the angle of depression of the top and bottom of the tower are observed to be 30^o and 45^o respectively. Find the height of the tower?	U
2		Two men are on the opposite sides of a tower .They measure the angle of elevation of the top of the tower as 30^o and 60^o respectively. If the height of the tower is 80m, find the distance between them.	C
3		At a point on a level ground, the angle of elevation of the vertical tower is found to be such that its tangent is 5/12. On walking 192 m towards the tower, the tangent of the angle is found to be ¾.Find the height of the tower.	HOT

D.		V Long Answer Questions (VLA) (4 Marks)	
1		The height of a tower is half the height of the flag staff at its top .The angle of elevation of the top of the tower as seen from a distance of 10m from its foot is 30^o.Find the angle of elevation of the flag staff from the same point.	HOT

2  The angle of elevation and depression of the top and bottom of a light house from a top of a building 60m high, are 30^o and 60^o respectively. Find the (a) difference between the height of the light house and the building. (b) The distance between the light house and the building. U

3  Two ships are sailing in the sea on either side of a light house. Angle of depression of the two ships are observed as 60^o and 45^o respectively. If the distance between the two ships is $\frac{200\left(\sqrt{3}+1\right)}{\sqrt{3}}$ m. find the height of the light house. C

4  A person standing on the bank of a river observes that the angle of elevation of the top a tree standing on the opposite bank is 60 When he moves 30 m away from the bank he finds the angle of elevation to be 30 find the height of the tree and width of the river. MD

5  An aero plane flying horizontally at a height of 1.5km above the ground is observed at a certain point on earth to subtend and angle of 60^o. After 15sec, its angle of elevation at the same point is observed to be 30. Calculate the speed of the plane in km/hr. HOT

ANSWERS

SEC-A MCQ	1: (c) angle of elevation 2: (b) angle of elevation 3: (c) angle of depression 4: (b) 45° 5: (b) 45° 6: (b) $4\sqrt{3}$ m 7: (d) 30° 8: (c) $75\sqrt{3}$ m 9: (a) 30° 10: (c) 16m
<u>SEC- A</u> VSA	1) $\frac{a}{2\sqrt{2}}$ 2)5min 3) $75(\sqrt{3}-1)$m 4) 11.55m 5)6km
SEC-B SA	1)6.96m 2)$15\sqrt{3}$ m 3) 30
SEC-C LA	1) $\frac{50\left(3-\sqrt{3}\right)}{3}$ m 2)184.74m 3)180m
SEC-D VLA	1)60^{o} 2)20m,34.64m 3)200m 4)25.98m,15m 5)415.69 km/hr