

**APPLICATION OF TRIGONOMETRY****MULTIPLE CHOICE QUESTIONS**

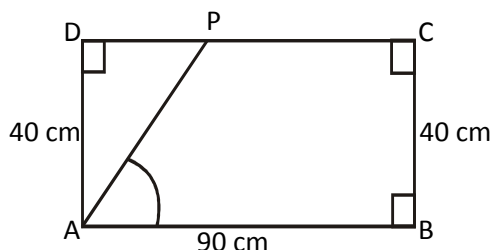
Write the correct answer for each of the following :

- Write the altitude of the sun is at  $60^\circ$ , then the height of the vertical tower that will cast a shadow of length 20 m is  
 (a)  $20\sqrt{3} m$  (b)  $\frac{20}{\sqrt{3}} m$  (c)  $\frac{15}{\sqrt{3}} m$  (d)  $40\sqrt{3} m$
- A lamp post  $5\sqrt{3}$  high casts a shadow 5 m long on the ground. The sun's elevation at this point is  
 (a)  $30^\circ$  (b)  $45^\circ$  (c)  $60^\circ$  (d)  $90^\circ$
- The ratio of the length of a rod and its shadow is 1 : 1. The angle of elevation of the Sun is  
 (a)  $30^\circ$  (b)  $45^\circ$  (c)  $60^\circ$  (d)  $90^\circ$
- If the angles of elevation of the top of a tower from two points distant a and b from the base and in the same straight line with it are complementary, then the height of the tower is  
 (a) ab (b)  $\sqrt{ab}$  (c)  $\frac{a}{b}$  (d)  $\sqrt{\frac{a}{b}}$
- A ladder 18 m long makes an angle of  $60^\circ$  with a wall. The height of the point where the ladder reaches the wall is  
 (a)  $9\sqrt{3} m$  (b)  $18\sqrt{3} m$  (c) 18 m (d) 9 m
- The length of the ladder making an angle of  $45^\circ$  with a wall & whose foot is 7 m away from the wall is  
 (a)  $\frac{7\sqrt{2}}{2} m$  (b)  $7\sqrt{2} m$  (c)  $14\sqrt{2} m$  (d) 14 m
- A ladder reaches a point on a wall which is 20 m above the ground and its foot is  $20\sqrt{3} m$  away from the ground. The angle made by the ladder with the wall is  
 (a)  $90^\circ$  (b)  $60^\circ$  (c)  $45^\circ$  (d)  $30^\circ$
- The angle of elevation, if the length of the shadow of a tower is  $\sqrt{3}$  times the height of the tower is  
 (a)  $30^\circ$  (b)  $45^\circ$  (c)  $60^\circ$  (d)  $75^\circ$
- The line drawn from the eye of an observer to the point in the object viewed by the observer is known as  
 (a) Horizontal line (b) Vertical line  
 (c) Line of sight (d) Transversal line
- When a point is observed, angle formed by the line of sight with the horizontal where the point being viewed is above the horizontal level is known as  
 (a) angle of elevation (b) angle of depression  
 (c) angle of a triangle (d) right angle
- When we raise our head to look at the object, the angle formed by the line of sight with the horizontal is known as  
 (a) acute angle (b) angle of elevation  
 (c) right angle (d) angle of depression
- When we lower our head to look at the object, the angle formed by the line of sight with the horizontal is known as  
 (a) Obtuse angle (b) angle of depression  
 (c) angle of elevation (d) acute angle
- If the flagstaff 6 m high placed on the top of a tower throws a shadow  $2\sqrt{3} m$  along the ground, then the angle of elevation of the sun is  
 (a)  $30^\circ$  (b)  $60^\circ$  (c)  $45^\circ$  (d) None of these
- The angle of elevation of the top of a 15 m high tower at a point 15 m away from the base of the tower is  
 (a)  $30^\circ$  (b)  $60^\circ$  (c)  $45^\circ$  (d)  $75^\circ$
- The elevation of the sun is  $30^\circ$ , then the length of the shadow cast by a tower of 150 feet height is  
 (a) 150 feet (b)  $50\sqrt{3}$  feet (c)  $150\sqrt{3}$  feet (d) 200 feet

16. If two towers of height  $h_1$  and  $h_2$  subtend angles of  $60^\circ$  and  $30^\circ$  respectively at the mid point of the line joining their feet then  $h_1 : h_2 =$   
 (a) 1 : 2                      (b) 1 : 3                      (c) 2 : 1                      (d) 3 : 1
17. The tree 6 m tall casts a 4 m long shadow. At the same time, a flag pole casts a shadow 50 m long. How long is the flag pole ?  
 (a) 75 m                      (b) 100 m                      (c) 150 m                      (d) 50 m
18. The distance between the tops of two trees 20 m & 28 m high is 17 m. The horizontal distance between the two trees is  
 (a) 9 m                      (b) 11 m                      (c) 15 m                      (d) 31 m

### SHORT QUESTIONS

1. Find the length AP from the following figure



2. The height of the tower is 10 m. Calculate the height of its shadow, when the Sun's altitude is  $45^\circ$
3. A tree 12 m long is broken by the wind in such a way that its top touches the ground and makes an angle  $60^\circ$  with the ground. At what height from the bottom the tree is broken by the wind ?
4. A ladder makes an angle of  $30^\circ$  with a wall. If the foot of the ladder is 5 m away from the wall, find the length of the ladder.
5. If the ratio of the height of a pole and the length of its shadow is  $\sqrt{3}:1$ , what is the angle of elevation of the sun ?
6. From a point on the ground, 20 m away from the foot of a vertical tower the angle of elevation of the top of the tower is  $60^\circ$ , what is the height of the tower
7. The angle of elevation of the top of a vertical tower from a point on the ground is  $60^\circ$ . From another point 10 m vertically above the first, its angle of elevation is  $45^\circ$ . Find the height of the tower.
8. The length of a string between a kite and a point on the ground is 90 m. If the string makes an angle  $\theta$  with the ground level such that  $\tan\theta = 15/8$ , how high is the kite ? Assume that there is no slack in the string.
9. The angle of elevation of the top of a tower from certain point is  $30^\circ$ . If the observer moves 20 m towards the tower, the angle of elevation of the top increases  $60^\circ$ . Find the height of the tower.
10. A kite is flying at a height of 75 m from the ground level, attached at a string makes an angle  $60^\circ$  to the horizontal. Find the length of the string to the nearest metre.
11. A tree is broken by wind. The top struck the ground at an angle of  $30^\circ$  & at a distance of 30 m from the root. Find the height of the whole tree.

### LONG QUESTIONS

1. The angle of elevation of a Jet plane from a point A on the ground is  $60^\circ$ . After a flight of 15 seconds, the angle of elevation changes to  $30^\circ$ . If the Jet plane is flying at a constant height of  $1500\sqrt{3}$  m. Find the speed of the Jet plane.
2. An aeroplane, when 3000 m high, passes vertically above another aeroplane at an instant when the angles of elevation of two aeroplanes from the same point on the ground are  $60^\circ$  to  $45^\circ$  respectively. Find the vertical distance between the two aeroplanes.
3. From a window (h metre high above the ground) of a house in a street, the angles of elevation and depression of the top and the foot of another house on the opposite side of the street are  $\theta$  and  $\phi$  respectively. Show that the height of the opposite house is  $h(1 + \tan\theta \cdot \cot\phi)$ .

4. If the angle of elevation of a cloud from a point 'h' metres above a lake is  $\alpha$  and angle of depression of its reflection in lake is  $\beta$ , prove that the distance of the cloud from the point of observation is  $\frac{2h \sec \alpha}{\tan \beta - \tan \alpha}$
5. From an aeroplane vertically above a straight horizontal plane the angles of depression of two consecutive kilometre stones on opposite sides of aeroplane are found to be  $\alpha$  and  $\beta$ . Show the height of aeroplane is  $\frac{\tan \alpha \tan \beta}{\tan \alpha + \tan \beta}$
6. A man standing on the deck of a ship which is 10 m above water level, observes the angle of elevation of the top of a hill as  $60^\circ$  and angle of depression of base of a hill as  $30^\circ$ . Find the distance of hill from the ship and height of the hill.
7. The angles of elevation of the top of a tower from two points P & Q at distance of a and b respectively from the base and in same straight line with it, are complimentary. Prove that the height of tower is  $\sqrt{ab}$
8. An aeroplane, flying horizontally 1000 m above the ground is observed at an angle of elevation of  $60^\circ$  from a point on the ground. After a flight of 10 seconds the angle of elevation at the point of observation changes to  $30^\circ$ . Find the speed of plane in m/second.
9. A man on the top of a vertical tower observes a car moving at a uniform speed coming directly towards it. If it takes 12 minutes for the angle of depression to change from  $30^\circ$  to  $45^\circ$  how soon after this, will car reach the tower.
10. A boy standing on a horizontal plane finds a bird flying at a distance of 100 m from him at an elevation of  $30^\circ$ . A girl standing on the roof of 20 m high building, finds the angle of elevation of same bird to be  $45^\circ$ . Both the boy and girl are on opposite sides of the bird. Find the distance of bird from the girl.
11. If the angle of elevation of a cloud from a point 'h' metres above a lake is  $\alpha$  and the angle of depression of its reflection in the lake is  $\beta$ , prove that the height of the cloud is  $h \left\{ \frac{1+r}{1-r} \right\}$  where  $r = \frac{\tan \alpha}{\tan \beta}$
12. From an aeroplane vertically above a straight horizontal plane, the angle of depressions of two consecutive kilometers stones on the opposite sides of the aeroplane are found to be  $\alpha$  and  $\beta$ . Show that height of the aeroplane is  $\{\cot \alpha + \cot \beta\}^{-1}$
13. As observed from the foot of a mountain the angle of elevation of the summit of the mountain is  $45^\circ$ ; after ascending 1000 m towards the mountain up a slope of  $30^\circ$  inclination, the angle of elevation is observed as  $60^\circ$ . Find the height of the summit of the mountain from the level ground.
14. The elevation of a tower of a station A due north of it is ' $\alpha$ ' and at a station B due east of A is  $\beta$ . Prove that the height of the tower is  $\frac{d \sin \alpha \cdot \sin \beta}{\sqrt{\sin^2 \alpha - \sin \beta}}$  where AB = d.
15. The angle of Elevation of the top of a tower from a point A due south of the tower is  $\alpha$  and from B due east of the tower is  $\beta$ . If AB = d, show that height of the tower is  $\frac{d}{\sqrt{\cot^2 \alpha + \cot^2 \beta}}$
16. The angle of elevation of a cliff from a fixed point is ' $\theta$ '. After going up a distance of 'k' meters towards the top of the cliff at angle of  $\phi$ , it is found that the angle of elevation is  $\alpha$ . Show that the height of the cliff is  $\frac{k(\cos \phi - \sin \phi \cdot \cot \alpha)}{\cot \theta - \cot \alpha}$
17. Two stations due south of a leaning tower which leans towards north are at distance a & b from its foot. If  $\alpha$  and  $\beta$  be the elevation of the top of the tower, from these stations, prove that its inclination ' $\theta$ ' to the horizontal is given by  $\cot \theta = \frac{b \cot \alpha - a \cot \beta}{b - a}$
18. A vertical rod is fixed in a horizontal rectangular field ABCD. The angular elevations of its top from A, B, C and D are  $\alpha$ ,  $\beta$ ,  $\lambda$  &  $\delta$  respectively, show that  $\cot^2 \alpha - \cot^2 \beta = \cot^2 \delta - \cot^2 \lambda$

19. A ladder rests against a wall at angle  $\alpha$  to the horizontal. Its foot is pulled away from the wall through a distance 'a' so that it slides a distance 'b' down the wall making an angle  $\beta$  with horizontal. Show that  $\frac{b}{a} = \frac{\cos \alpha - \cos \beta}{\sin \beta - \sin \alpha}$
20. A man on the deck of a ship is 12 m above water level. He observes that the angle of elevation of the top of a cliff is  $45^\circ$ , and angle of depression of the base is  $30^\circ$ . Calculate the distance of cliff from the ship and the height of the cliff.
21. A pole 5 m high is fixed on the top of a tower. The angle of elevation of the top of the pole observed from a point 'A' on the ground is  $60^\circ$  and the angle of depression of the point 'A' from the top of the tower is  $45^\circ$ . Find the height of the tower.
22. From the top of a tower 50 m high the angle of depression of the top and bottom of a pole are observed to be  $45^\circ$  and  $60^\circ$  respectively. Find the height of the tower.
23. From the top of a tower, the angles of depression of two objects on the same side of the tower are found to be  $\alpha$  and  $\beta$  ( $\alpha > \beta$ ). If the distance between the objects is 'P' meters, show that the height 'h' of the tower is given by  $h = \frac{P \tan \alpha \tan \beta}{\tan \alpha - \tan \beta}$ . Also determine the height of the tower and the building.
24. The angle of elevation of the top of a tower from a point A on the ground is  $30^\circ$  on making a distance of 20 m towards the foot of the tower to a point B, the angle of elevation increases to  $60^\circ$ . Find the height of the tower and distance of the tower from the point A.
25. The angle of elevation  $\theta$  of the top of a light house, as seen by a person on the ground, is such that  $\tan \theta = 5/12$ . When the person moves a distance of 240 m towards the light house, the angle of elevation become  $\phi$  such that  $\tan \phi = 3/4$ . Find the 'h' of the light house. (h = height)
26. From a window (60 m high above the ground) of a house in street the angles of elevation and depression of the top and the foot of another house on opposite side of street are  $60^\circ$  and  $45^\circ$  respectively. Show that the height of the opposite house is  $60(1 + \sqrt{3})$  metres.
27. The angle of elevation of a jet fighter from a point A on the ground is  $60^\circ$ . After a flight of 10 sec the angle of elevation changes to  $30^\circ$ . If the jet is flying at a speed of 432 km/hr, find the constant height at which the jet is flying.
28. A round balloon of a radius 'a' subtends an angle  $\theta$  at the eye of the observer while the angle of elevation of its centre is  $\phi$ . Prove that the height of the centre of the balloon is  $a \sin \phi \operatorname{cosec} \theta / 2$

### Value based questions

- A person standing on the bank of a river observes that the angle of elevation of the top of a building of an organization working for conservation of wild life, standing on the opposite bank is  $60^\circ$ . When he moves 40m away from the bank, he finds the angle of elevation to be  $30^\circ$ . Find the height of the building and the width of the river.
  - Why do we need to conserve wild life?
  - Suggest some steps that can be taken to conserve wild life.
- Two hoardings on cleanliness are put on two poles of equal heights standing opposite to 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  $60^\circ$  and  $30^\circ$  respectively. Find the height of the poles and the distances of the point from the poles.
  - How can we spread awareness for cleanliness in a society?
  - Does cleanliness play any role in the development of a society
- From a window 15 metres high above of organization working for consumer protection the ground in a street, the angles of elevation and depression of the top and the foot of a building on the opposite side of the street are  $30^\circ$  and  $45^\circ$  respectively. Show that the height of the building is 23.66 metres (Take  $\sqrt{3} = 1.732$ )
  - What do you understand by consumer protection?
  - What is the need for such an organization in a society?

4. A man constructed a school building in a village for welfare. The angle of elevation of the top of the building from a point on the bus stand is  $30^\circ$ . If the observer moves 50m towards the building, the angle of elevation of the top increases by  $30^\circ$ . Find the height of the building and the distance of the bus stand from the school building.  
How is the man contributing towards the development of the society? What traits of his character are reflected here?

5. A hoarding on "Save Girl Child", 5 m high is fixed on the top of a tower. The angle of elevation of the top of the hoarding as observed from a point A on the ground is  $60^\circ$  and the angle of depression of point A from the top of the tower is  $45^\circ$ . Find the height of the tower. (Take  $\sqrt{3} = 1.73$ )

Why is it necessary to spread awareness for saving the girl child?

6. A survey was conducted in a particular area to find its most polluted region and it was found that the shaded region is the most polluted. If the radius of the circular part that was surveyed is 14m and the angle formed between the two radii is  $60^\circ$ , find the area of the polluted region. (Take  $\pi = 3.14$  and  $\sqrt{3} = 1.732$ )

i) How is pollution harmful?

ii) What steps can be taken to reduce pollution in any region?