

# 9

## Chapter

# Some Applications of Trigonometry (Heights and Distances)

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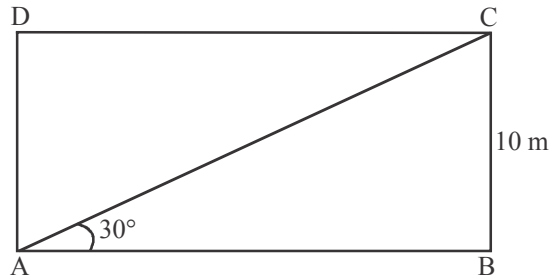
### Key Points

1. **Line of Sight** : The line of sight is the line drawn from the eyes of an observer to a point in the object viewed by the observer.
2. **Angle of Elevation** : The angle of elevation is the angle formed by the line of sight with the horizontal, when it is above the horizontal level i.e. the case when we raise our head to look at the object.
3. **Angle of Depression** : The angle of depression is the angle formed by the line of sight with the horizontal when it is below the horizontal i.e. case when we lower our head to look at the object.

### VERY SHORT ANSWER TYPE QUESTIONS

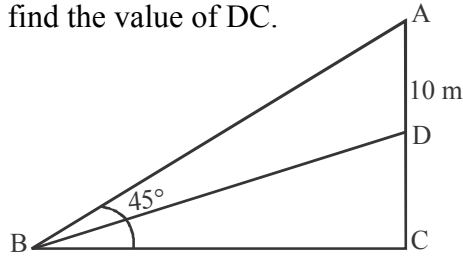
1. A tower is 50 m high. When the sun's altitude is  $45^\circ$  then what will be the length of its shadow?
2. The length of shadow of a pole 50 m high is  $\frac{50}{\sqrt{3}}$  m. find the sun's altitude.
3. Find the angle of elevation of a point which is at a distance of 30 m from the base of a tower  $10\sqrt{3}$  m high.
4. A kite is flying at a height of  $50\sqrt{3}$  m from the horizontal. It is attached with a string and makes an angle  $60^\circ$  with the horizontal. Find the length of the string.

5. In the given figure find the perimeter of rectangle ABCD.

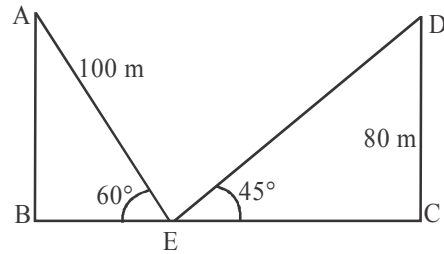


6. The length of the shadow of a pillar is  $\sqrt{3}$  times its height. Find the angle of elevation of the source of light.

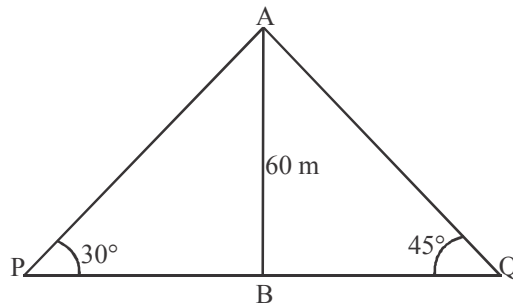
7. In the figure, find the value of DC.



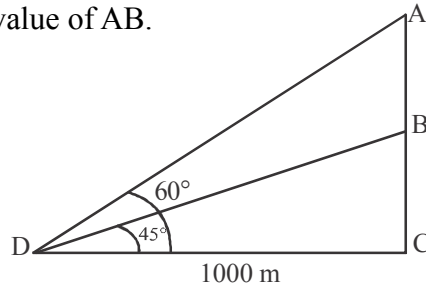
8. In the figure, find the value of BC.



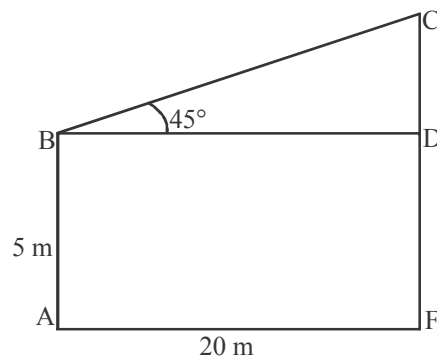
9. In the figure, two persons are standing at the opposite direction P & Q of the tower. If the height of the tower is 60 m then find the distance between the two persons.



10. In the figure, find the value of AB.



11. In the figure, find the value of CF.



12. If the horizontal distance of the boat from the bridge is  $25\text{ m}$  and the height of the bridge is  $25\text{ m}$ , then find the angle of depression of the boat from the bridge.

### SHORT ANSWER TYPE QUESTIONS

13. From the top of a hill, the angles of depression of two consecutive kilometre stones due east are found to be  $30^\circ$  and  $45^\circ$ . Find the height of the hill.
14. The string of a kite is  $150\text{ m}$  long and it makes an angle  $60^\circ$  with the horizontal. Find the height of the kite above the ground. (Assume string to be tight)
15. The shadow of a vertical tower on level ground increases by  $10\text{ m}$  when the altitude of the sun changes from  $45^\circ$  to  $30^\circ$ . Find the height of the tower.
16. An aeroplane at an altitude of  $200\text{ m}$  observes angles of depression of opposite points on the two banks of the river to be  $45^\circ$  and  $60^\circ$ , find the width of the river.
17. The angle of elevation of a tower at a point is  $45^\circ$ . After going  $40\text{ m}$  towards the foot of the tower, the angle of elevation of the tower becomes  $60^\circ$ . Find the height of the tower.

18. The upper part of a tree broken over by the wind makes an angle of  $30^\circ$  with the ground and the distance of the root from the point where the top touches the ground is 25 m. What was the height of the tree?
19. A vertical flagstaff stands on a horizontal plane. From a point 100 m from its foot, the angle of elevation of its top is found to be  $45^\circ$ . Find the height of the flagstaff.
20. The length of a string between kite and a point on the ground is 90 m. If the string makes an angle with the level ground and  $\sin \alpha = \frac{3}{5}$ . Find the height of the kite. There is no slack in the string.
21. An aeroplane, when 3000 m high, passes vertically above another plane at an instant when the angle of elevation of two aeroplanes from the same point on the ground are  $60^\circ$  and  $45^\circ$  respectively. Find the vertical distance between the two planes.
22. The angle of elevation of a cloud from a point 60 metres above a lake is  $30^\circ$  and the angle of depression of its reflection of the cloud in the lake is  $60^\circ$ . Find the height of the cloud.
23. A man standing on the deck of a ship, 10 m above the water level observes the angle of elevation of the top of a hill as  $60^\circ$  and angle of depression the bottom of a hill as  $30^\circ$ . Find the distance of the hill from the ship and height of the hill.
24. A 7 m long flagstaff is fixed on the top of a tower on the horizontal plane. From a point on the ground, the angle of elevation of the top and the bottom of the flagstaff are  $45^\circ$  and  $30^\circ$  respectively. Find the height of the tower.
25. From a window 60 m high above the ground of a house in a street, the angle of elevation and depression of the top and the foot of another house on the opposite side of the street are  $60^\circ$  and  $45^\circ$  respectively. Show that the height of opposite house is  $60(1 + \sqrt{3})$  metres.

26. The angle of elevation of an aeroplane from a point A on the ground is  $60^\circ$ . After a flight of 30 seconds, the angle of elevation changes to  $30^\circ$ . If the plane is flying at a constant height of  $3600\sqrt{3}$  m, find the speed in km/hour of the plane.
27. A bird is sitting on the top of a tree, which is 80 m high. The angle of elevation of the bird, from a point on the ground is  $45^\circ$ . The bird flies away from the point of observation horizontally and remains at a constant height. After 2 seconds, the angle of elevation of the bird from the point of observation becomes  $30^\circ$ . Find the speed of flying of the bird.
28. From the top of a 7 m high building, the angle of elevation of the top of the tower is  $60^\circ$  and the angle of depression of the foot of the tower is  $30^\circ$ . Find the height of the tower.
29. The angles of elevation of the top of a tower from two points on the ground at distances 9 m and 4 m from the base of the tower are in the same straight line with it are complementary. Find the height of the tower.
30. 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 the same bird to be  $45^\circ$ . Both the boy and girl are on the opposite sides of the bird. Find the distance of bird from the girl.
31. As observed from the top of a light house, 100 m high above sea level, the angle of depression of a ship, sailing directly towards it, changes from  $30^\circ$  to  $60^\circ$ . Determine the distance travelled by the ship during the period of observation.
32. The angles of elevation and depression of the top and bottom of a light house from the top of a building 60 m high are  $30^\circ$  and  $60^\circ$  respectively. Find
- (i) The difference between the height of the light house and the building.
  - (ii) distance between the light house and the building.

33. Anand is watching a circus artist climbing a 20m long rope which is tightly stretched and tied from the top of vertical pole to the ground. Find the height of the pole if the angle made by the rope with the ground level is  $30^\circ$ . What value is experienced by Anand?
34. A fire in a building 'B' is reported on telephone in two fire stations P and Q, 20 km apart from each other on a straight road. P observes that the fire is at an angle of  $60^\circ$  to the road, and Q observes, that it is at an angle of  $45^\circ$  to the road. Which station should send its team and how much distance will this team have to travel? What value is depicted from the problem?
35. A 1.2m tall girl spots a balloon on the eve of Independence Day, 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 eye of the girl at an instant is  $60^\circ$ . After some time, the angle of elevation reduces to  $30^\circ$ . Find the distance travelled by the balloon. What value is depicted here?