

HEIGHTS AND DISTANCES (APPLICATION OF TRIGONOMETRY)

1. The angle of depression of the top and the bottom of a building 50 metres high as observed from the top of a tower are 30° and 60° respectively. Find the height of the tower and also the horizontal distance between the building and the tower. **(CBSE 2005-06, 6 marks)**

2. The angle of elevation of the top of a tower as observed from a point on the ground is ' α ' and on moving 'h' metres towards the tower, the angle of elevation is ' β '. Prove that the height of the tower is $\frac{h \tan \alpha \tan \beta}{\tan \beta - \tan \alpha}$. **(CBSE 2005-06, 6 marks)**

3. An observer in a lighthouse observes two ships on the same side of the lighthouse and in the same straight line with the base of the lighthouse. The angles of depression of the ships approaching it are 30° and 60° . If the height of the lighthouse is 150 m. Find the distance between the ships. **(CBSE 2006-07, 5 marks)**

4. A peacock is sitting on the top of a pillar, which is 9 m high. From a point 27 m away from the bottom of the pillar, a snake is coming to its hole at the base of the pillar. Seeing the snake the peacock pounces on it. If their speeds are equal, at what distance from the hole is the snake caught? **(CBSE 2007-08, 6 marks)**

5. 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 the tower with a uniform speed. Six seconds 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 from this point. **(CBSE 2008-09, 6 marks)**

6. A pole of length 10 m casts a shadow 2 m long on the ground. At the same time a tower casts a shadow of length 50 m on the ground, then find the height of the tower. **(CBSE 2010-11, 2 marks)**

7. A lamp post $5\sqrt{3}$ m high casts a shadow 5 m long on the ground. The sun's elevation at this point is: **(CBSE 2011-12, 1 mark)**
 (A) 30° (B) 45° (C) 60° (D) 90°

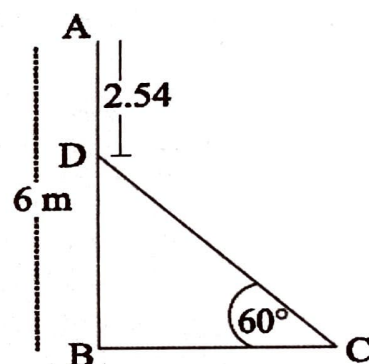
8. If the angle of elevation of the top of a tower from two points at a distance of 4 m and 9 m from the base of the tower and in the same straight line with it are complementary, find the height of the tower. **(CBSE 2011-12, 3 marks)**

9. The angle of elevation of a jet plane from a point A on the ground is 60° . After a flight of 30 seconds the angle of elevation changes to 30° . If the jet plane is flying at a constant height of $3600\sqrt{3}$ m, find the speed of the jet plane. **(CBSE 2011-12, 4 marks)**

10. The angle of depression of a car, standing on the ground, from the top of a 75 m high tower, is 30° . The distance of the car from the base of the tower (in m) is: **(CBSE 2012-13, 1 mark)**
 (A) $25\sqrt{3}$ (B) $75\sqrt{3}$ (C) $50\sqrt{3}$ (D) 150

11. The horizontal distance between two poles is 15 m. The angle of depression of the top of first pole as seen from the top of second pole is 30° . If the height of the second pole is 24 m, find the height of the first pole. [Use $\sqrt{3} = 1.732$] **(CBSE 2012-13, 3 marks)**

12. The angle of elevation of the top of a building from the foot of the tower is 30° and the angle of elevation of the top of the tower from the foot of the building is 60° . If the tower is 60 m high, find the height of the building. **(CBSE 2012-13, 4 marks)**
13. The tops of two towers of height x and y , standing on level ground, subtend angles of 30° and 60° respectively at the centre of the line joining their feet, then find $x : y$. **(CBSE 2014-15, 1 mark)**
14. The angle of elevation of the top of a building from the foot of the tower is 30° and the angle of elevation of the top of the tower from the foot of the building is 45° . If the tower is 30 m high, find the height of the building. **(CBSE 2014-15, 3 marks)**
15. From a point P on the ground the angle of elevation of the top of a tower is 30° and that of the top of a flag staff fixed on the top of the tower, is 60° . If the length of the flag staff is 5 m, find the height of the tower. **(CBSE 2014-15, 4 marks)**
16. In figure, AB is a 6 m high pole and CD is a ladder inclined at an angle of 60° to the horizontal and reaches up to a point D of pole. If $AD = 2.54$ m, find the length of the ladder. (use $\sqrt{3} = 1.73$)

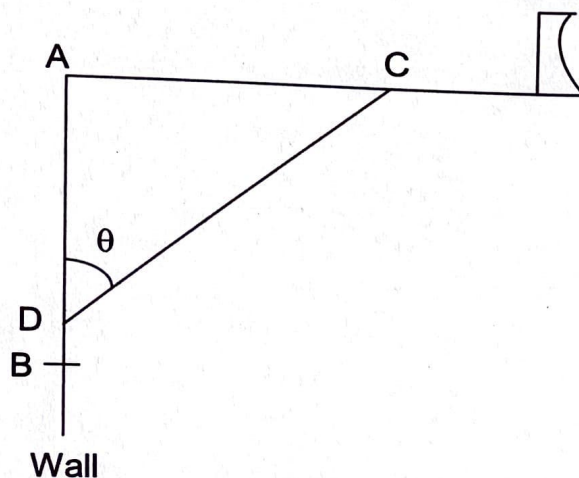


- (CBSE 2015-16, 1 mark)**
17. The angle of depression of the top and bottom of a 50 m high building from the top of a tower are 45° and 60° respectively. Find the height of the tower and the horizontal distance between the tower and the building. (use $\sqrt{3} = 1.73$) **(CBSE 2015-16, 3 marks)**
18. A bird is sitting on the top of a 80 m high tree. From a point on the ground, the angle of elevation of the bird is 45° . The bird flies away horizontally in such a way that it remained at a constant height from the ground. After 2 seconds, the angle of elevation of the bird from the same point is 30° . Find the speed of flying of the bird. (Take $\sqrt{3} = 1.732$) **(CBSE 2015-16, 4 marks)**
19. The ratio of the height of a tower and the length of its shadow on the ground is $\sqrt{3} : 1$. What is the angle of elevation of the sun? **(CBSE 2016-17, 1 mark)**
20. A moving boat is observed from the top of a 150 m high cliff moving away from the cliff. The angle of depression of the boat changes from 60° to 45° in 2 minutes. Find the speed of the boat in m/s. **(CBSE 2016-17, 3 marks)**
21. From the top of a 7 m high building, the angle of elevation of the top of a tower is 60° and the angle of depression of its foot is 45° . Find the height of the tower. **(CBSE 2016-17, 3 marks)**
22. The angle of elevation of the top of a hill at the foot of a tower is 60° and the angle of elevation of the top of the tower from the foot of the hill is 30° . If height of the tower is 50 m, find the height of the hill. **(CBSE 2016-17, 3 marks)**

23. Two points A and B are on the same side of a tower and in the same straight line with its base. The angles of depression of these points from the top of the tower are 60° and 45° respectively. If the height of the tower is 15 m, then find the distance between these points.
(CBSE 2016-17, 4 marks)
24. The angle of elevation of a cloud from a point 60m above the surface of the water of a lake is 30° and angle of depression of its shadow in water of lake is 60° . Find the height of the cloud from the surface of water.
(CBSE 2016-17, 4 marks)
25. An observer finds the angle of elevation of the top of the tower from a certain point on the ground as 30° . If the observer moves 20 m towards the base of the tower, the angle of elevation of the top increases by 15° , find the height of the tower.
(CBSE 2016-17, 4 marks)
26. As observed from the top of a 100 m high light house from the sea – level, the angles of depression of two ships are 30° and 45° . If one ship is exactly behind the other on the same side of the light house, find the distance between the two ships. [Use $\sqrt{3} = 1.732$]
(CBSE 2017-18, 4 marks)
27. A man in a boat rowing away from a light house 100 m high takes 2 minutes to change the angle of elevation of the top of the light house from 60° to 30° . Find the speed of the boat in metres per minute. [Use $\sqrt{3} = 1.732$]

OR

- Two poles of equal heights are standing opposite each other on either side of the road, which is 80 m wide. From a point between them on the road, the angles of elevation of the top of the poles are 60° and 30° respectively. Find the height of the poles and the distances of the point from the poles.
(CBSE 2018-19, 4 marks)
28. The ratio of the length of a vertical rod and the length of its shadow is $1:\sqrt{3}$. Find the angle of elevation of the sun at that moment?
(CBSE 2019-20, 1 mark)
29. The rod AC of a TV disc antenna is fixed at right angle to the wall AB and a rod CD is supporting the disc as shown. If AC = 1.5 m long and CD = 3 m, find
(i) $\tan \theta$
(ii) $\sec \theta + \operatorname{cosec} \theta$



(CBSE 2019-20, 2 marks)

30. A vertical tower stands on a horizontal plane and is surmounted by a vertical flag – staff of height 6 m. At a point on the plane, the angle of elevation of the bottom and top of the flag – staff are 30° and 45° respectively. Find the height of the tower. (take $\sqrt{3} = 1.73$)
(CBSE 2019-20, 4 marks)

31. From a point on the ground, which is 30 m away from the foot of a vertical tower, the angle of elevation of the top of the tower is found to be 60° . The height (in meters) of the tower is:
(CBSE 2023-24, 1 Mark)
- (A) $10\sqrt{3}$ (B) $30\sqrt{3}$
(C) 60 (D) 30
32. At some time of the day, the length of the shadow of a tower is equal to its height. Then, the Sun's altitude at that time is:
(CBSE 2023-24, 1 Mark)
- (A) 30° (B) 45°
(C) 60° (D) 90°
33. If a vertical pole of length 7.5 m casts a shadow 5 m long on the ground and at the same time, a tower casts a shadow 24 m long, then the height of the tower is:
(CBSE 2023-24, 1 Mark)
- (A) 20 m (B) 40 m
(C) 60 m (D) 36 m
34. A pole 6m high is fixed on the top of a tower. The angle of elevation of the top of the pole observed from a point P on the ground is 60° and the angle of depression of the point P from the top of the tower is 45° . Find the height of the tower and the distance of point P from the foot of the tower. (Use $\sqrt{3} = 1.73$)
(CBSE 2023-24, 5 Marks)
35. From a point on a bridge across the river, the angles of depressions of the banks on opposite sides of the river are 30° and 60° respectively. If the bridge is at height of 4 m from the banks, find the width of the river.
(CBSE 2023-24, 5 Marks)
36. From the top of a 45 m high light house, the angles of depression of two ships, on the opposite side of it, are observed to be 30° and 60° . If the line joining the ships passes through the foot of the light house, find the distance between the ships. (Use $\sqrt{3} = 1.73$)
(CBSE 2023-24, 5 Marks)
37. From a point on the ground, the angles of elevation of the bottom and the top of a transmission tower fixed at the top of a 20 m high building are 45° and 60° respectively. Find the height of the tower.
(CBSE 2023-24, 5 Marks)
38. Two pillar of equal lengths stand on either side of road which is 100 m wide, exactly opposite to each other. At a point on the road between the pillar, the angles of elevation of the tops of the pillars are 60° and 30° . Find the length of each pillar and distance of the point on the road from the pillars. (Use $\sqrt{3} = 1.732$)
(CBSE 2023-24, 5 Marks)