9. Some Applications of Trigonometry - Board Exam Questions

The detailed solution for all the questions can be found at
pschool.in/math/ncert/g10/chap-9

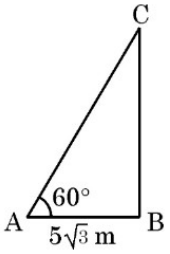
1 Mark Questions (MCQ)

1) A car is moving away from the base of a 30 m high tower. The angle of elevation of the top of the tower from the car at an instant, when the car is $10\sqrt{3}$ m away from the base of the tower, is:

2) From a point on the ground, which is 60 m away from the foot of a vertical tower, the angle of elevation of the top of the tower is found to be 45°. The height (in metres) of the tower is:

3) If the length of the shadow of a tower is $\sqrt{3}$ times that of its height, then altitude of the Sun is:

4) A wire is attached from a point A on the ground to the top of a pole BC, making an angle of elevation as 60°. If AB = $5\sqrt{3}$ m, then length of the wire is



5) A flying kite is tied to a point on the ground with the help of a string. The string makes an angle θ with the ground level such that $\tan\theta = \frac{12}{5}$. If the length of the string is 52 m, then the height of the kite above the ground is:

6) A kite is flying at a height of 150 m from the ground. It is attached to a string inclined at an angle of 30° to the horizontal. The length of the string is:

7) A 30 m long rope is tightly stretched and tied from the top of pole to the ground. If the rope makes an angle of 60° with the ground, the height of the pole is:

8) An observer 1.8 m tall stands away from a chimney at a distance of 38.2 m along the ground. The angle of elevation of top of chimney from the eyes of observer is 45°. The height of chimney above the ground is

9) A peacock sitting on the top of a tree of height 10 m observes a snake

moving on the ground. If the snake is $10\sqrt{3}$ m away from the base of the tree, then angle of depression of the snake from the eye of the peacock is

10) 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 metres) of the tower is:

11) 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:

12) If a pole 6 m high casts a shadow $2\sqrt{3}$ m long on the ground, then sun's elevation is:

Assertion and Reason

1) ASSERTION (A): A ladder leaning against a wall, stands at a horizontal distance of 6 m from the wall. If the height of the wall up to which the ladder reaches is 8 m, then the length of the ladder is 10 m.
REASON (R): The ladder makes an angle of 60° with the ground.

2 Mark Questions

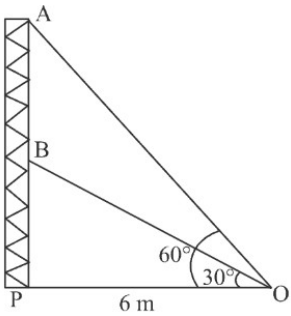
1) The length of the shadow of a tower on the plane ground is $\sqrt{3}$ times the height of the tower. Find the angle of elevation of the sun.

2) Find the length of the shadow on the ground of a pole of height 18 m when angle of elevation θ of the sun is such that $\tan\theta = \frac{6}{7}$.

3) The angle of elevation of the top of a tower from a point on the ground which is 30 m away from the foot of the tower, is 30°. Find the height of the tower.

4 Mark Questions

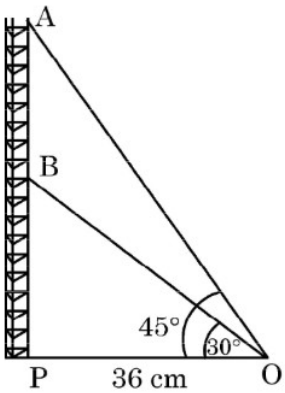
1) Radio towers are used for transmitting a range of communication services including radio and television. The tower will either act as an antenna itself or support one or more antennas on its structure. On a similar concept, a radio station tower was built in two sections 'A' and 'B'. Tower is supported by wires from a point 'O' (as shown in figure).



Distance between the base of the tower and point 'O' is 6 m. From point

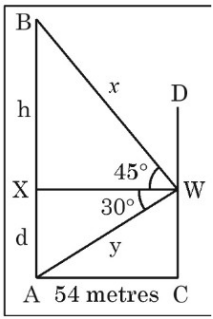
'O', the angle of elevation of the top of the section 'B' is 30° and the angle of elevation of the top of section 'A' is 60°.
(i) Find the length of the wire from the point 'O' to the top of section 'B'. (1)
(ii) Find the length of the wire from the point 'O' to the top of section 'A'. (1)
(iii) (a) Find the distance AB. (2)
OR (b) Find the area of $\triangle OPB$.

2) Radio towers are used for transmitting a range of communication services including radio and television. The tower will either act as an antenna itself or support one or more antennas on its structure. On a similar concept, a radio station tower was built in two Sections A and B. Tower is supported by wires from a point O.
Distance between the base of the tower and point O is 36 cm. From point O, the



angle of elevation of the top of the Section B is 30° and the angle of elevation of the top of Section A is 45°.
(i) Find the length of the wire from the point O to the top of Section B. (1)
(ii) Find the distance AB. (2)
OR Find the area of $\triangle OPB$.
(iii) Find the height of the Section A from the base of the tower. (1)

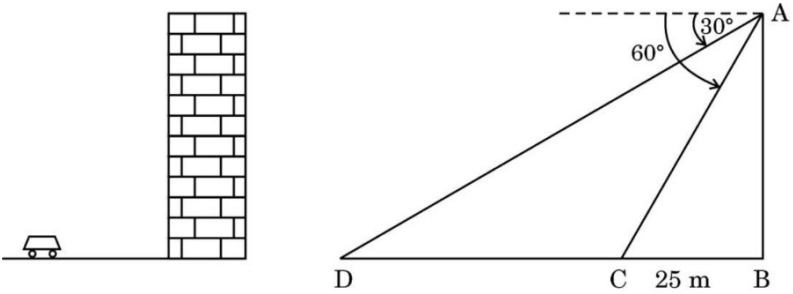
3) Elevated water storage tanks are built to store and supply water to nearby colonies. In the diagram given above, AB is an elevated water tank and CD is a nearby multistorey building. The building is 54 metres away from the water tank.
From a window (W) of the building, the angle of elevation of top of the tank is 45° and angle of depression of its foot is 30°.



(i) Write a relation between d (the height of window) and y. (1)
(ii) Determine the value of h. (1)
(iii) (a) Determine height of the water tank. (2)
OR (b) Find the value of x and height of the window above ground

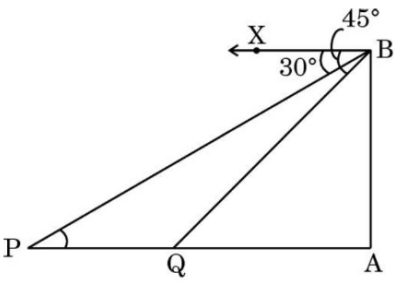
level.

4) Tejas is standing at the top of a building and observes a car at an angle of depression of 30° as it approaches the base of the building at a uniform speed. 6 seconds later, the angle of depression increases to 60°, and at that moment, the car is 25 m away from the building.



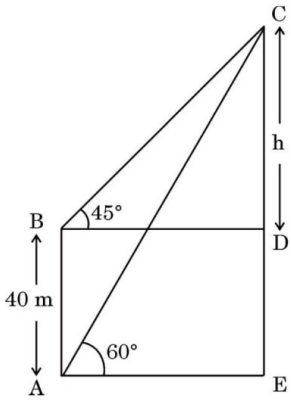
(i) What is the height of the building? (1)
(ii) What is the distance between the two positions of the car? (1)
(iii) (a) What would be the total time taken by the car to reach the foot of the building from the starting point? (2)
OR (b) What is the distance of the observer from the car when it makes an angle of 60°?

5) A lighthouse stands tall on a cliff by the sea, watching over ships that pass by. One day a ship is seen approaching the shore and from the top of the lighthouse, the angles of depression of the ship are observed to be 30° and 45° as it moves from point P to point Q.



The height of the lighthouse is 50 metres.
(i) Find the distance of the ship from the base of the lighthouse when it is at point Q, where the angle of depression is 45°. (1)
(ii) Find the measures of $\angle$PBA and $\angle$QBA. (1)
(iii) (a) Find the distance travelled by the ship between points P and Q. (2)
OR (b) If the ship continues moving towards the shore and takes 10 minutes to travel from Q to A, calculate the speed of the ship in km/h, from Q to A.

6) Amrita stood near the base of a lighthouse, gazing up at its towering height. She measured the angle of elevation to the top and found it to be 60°. Then, she climbed a nearby observation deck, 40 metres higher than her original position and noticed the angle of elevation to the top of lighthouse to be 45°.



(i) If CD is h metres, find the distance BD in terms of 'h'. (1)

(ii) Find distance BC in terms of 'h'. (1)

(iii) (a) Find the height CE of the lighthouse. [Use $\sqrt{3} = 1.73$] (2)

OR (b) Find distance AE, if $AC = 100$ m.

7) A drone was used to facilitate movement of an ambulance on the straight highway to a point P on the ground where there was an accident. The ambulance was travelling at the speed of 60 km/h. The drone stopped at a point Q, 100 m vertically above the point P. The angle of depression of the ambulance was found to be 30° at a particular instant.

(i) Represent the above situation with the help of a diagram. (1)

(ii) Find the distance between the ambulance and the site of accident (P) at the particular instant. (Use $\sqrt{3} = 1.73$) (1)

(iii) (a) Find the time (in seconds) in which the angle of depression changes from 30° to 45°. (2)

OR (b) How long (in seconds) will the ambulance take to reach point P from a point T on the highway such that angle of depression of the ambulance at T is 60° from the drone?

8) Passenger boarding stairs, sometimes referred to as boarding ramps, stair cars or aircraft steps, provide a mobile means to travel between the aircraft doors and the ground. Larger aircraft have door sills 5 to 20 feet (1 foot $= 30$ cm) high. Stairs facilitate safe boarding and de-boarding.

An aircraft has a door sill at a height of 15 feet above the ground. A stair car is placed at a horizontal distance of 15 feet from the plane.

(i) Find the angle at which stairs are inclined to reach the door sill 15 feet high above the ground. (1)

(ii) Find the length of stairs used to reach the door sill. (1)

(iii) (a) If the 20 feet long stairs is inclined at an angle of 60° to reach

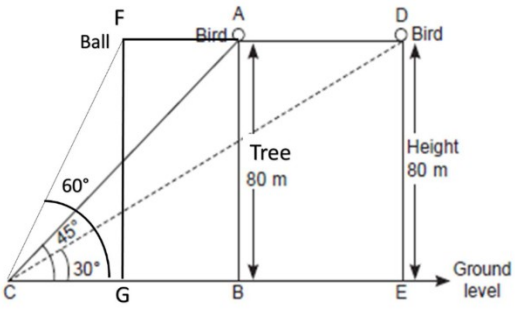
the door sill, then find the height of the door sill above the ground. (use $\sqrt{3} = 1.732$) (2)
OR (b) What should be the shortest possible length of stairs to reach the door sill of the plane 20 feet above the ground, if the angle of elevation cannot exceed 30°? Also, find the horizontal distance of base of stair car from the plane.

9) The Statue of Unity situated in Gujarat is the world's largest Statue which stands over a $58\ \text{m}$ high base. As part of the project, a student constructed an inclinometer and wishes to find the height of Statue of Unity using it. He noted following observations from two places:
Situation – I: The angle of elevation of the top of Statue from Place A which is $80\sqrt{3}\ \text{m}$ away from the base of the Statue is found to be 60°.
Situation – II: The angle of elevation of the top of Statue from a Place B which is $40\ \text{m}$ above the ground is found to be 30° and entire height of the Statue including the base is found to be $240\ \text{m}$.
(i) Represent the Situation – I with the help of a diagram. (1)
(ii) Represent the Situation – II with the help of a diagram. (1)
(iii) (a) Calculate the height of Statue excluding the base and also find the height including the base with the help of Situation – I. (2)
OR (b) Find the horizontal distance of point B (Situation – II) from the Statue and the value of $\tan\alpha$, where α is the angle of elevation of top of base of the Statue from point B.

10) India Gate (formerly known as All India War Memorial) is located near Kartavya Path (formerly Rajpath) at New Delhi. It stands as a memorial to 74187 soldiers of Indian Army, who gave their life in the first world war. This $42\ \text{m}$ tall structure was designed by Sir Edwin Lutyens in the style of Roman triumphal arches. A student Shreya of height $1\ \text{m}$ visited India Gate as a part of her study tour.
(i) What is the angle of elevation from Shreya's eye to the top of India Gate, if she is standing at a distance of $41\ \text{m}$ away from the India Gate? (1)
(ii) If Shreya observes the angle of elevation from her eye to the top of India Gate to be 60°, then how far is she standing from the base of the India Gate? (1)
(iii) If the angle of elevation from Shreya's eye changes from 45° to 30°, when she moves some distance back from the original position. Find the distance she moves back. (2)
OR If Shreya moves to a point which is at a distance of $\frac{41}{\sqrt{3}}\ \text{m}$ from the India Gate, then find the angle of elevation made by her eye to the top

of India Gate.

11) One evening, Kaushik was in a park. Children were playing cricket. Birds were singing on a nearby tree of height 80 m. He observed a bird on the tree at an angle of elevation of 45°.
When a sixer was hit, a ball flew



through the tree frightening the bird to fly away. In 2 seconds, he observed the bird flying at the same height at an angle of elevation of 30° and the ball flying towards him at the same height at an angle of elevation of 60°.
(i) At what distance from the foot of the tree was he observing the bird sitting on the tree? (1)
(ii) How far did the bird fly in the mentioned time? (2)
OR After hitting the tree, how far did the ball travel in the sky when Kaushik saw the ball?
(iii) What is the speed of the bird in m/min if it had flown $20(\sqrt{3}+1)$ m? (1)

12) We all have seen the airplanes flying in the sky but might have not thought of how they actually reach the correct destination. Air Traffic Control (ATC) is a service provided by ground-based air traffic controllers who direct aircraft on the ground and through a given section of controlled airspace, and can provide advisory services to aircraft in non-controlled airspace. Actually, all this air traffic is managed and regulated by using various concepts based on coordinate geometry and trigonometry.
At a given instance, ATC finds that the angle of elevation of an airplane from a point on the ground is 60°. After a flight of 30 seconds, it is observed that the angle of elevation changes to 30°. The height of the plane remains constantly as $3000\sqrt{3}$ m. Use the above information to answer the questions that follow:
(i) Draw a neat labelled figure to show the above situation diagrammatically. (1)
(ii) What is the distance travelled by the plane in 30 seconds? (2)
OR Keeping the height constant, during the above flight, it was observed that after $15(\sqrt{3}-1)$ seconds, the angle of elevation changed to 45°. How much is the distance travelled in that duration?

(iii) What is the speed of the plane in km/hr? (1)

5 Mark Questions

1) 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.

2) From a point on the ground, the angle of elevation of the bottom and top of a transmission tower fixed at the top of 30 m high building are 30° and 60°, respectively. Find the height of the transmission tower. (Use $\sqrt{3} = 1.73$)

3) 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 $\sqrt{3} = 1.73$)

4) From the top of a 7 m high building, the angle of elevation of the top of a cable tower is 60° and the angle of depression of its foot is 30°. Determine the height of the tower.

5) The angles of depression of the top and the bottom of an 8 m tall building from the top of another multistoried building are 30° and 45°, respectively. Find the height of the multistoried building and the distance between the two buildings.

6) The angle of elevation of the top of a tower 24 m high from the foot of another tower in the same plane is 60°. The angle of elevation of the top of second tower from the foot of the first tower is 30°. Find the distance between two towers and the height of the other tower. Also, find the length of the wire attached to the tops of both the towers.

7) Two pillars of equal lengths stand on either side of a road which is 100 m wide, exactly opposite to each other. At a point on the road between the pillars, 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 $\sqrt{3} = 1.732$)

8) The angles of depression of two ships from the top of a lighthouse and on the same side of it are found to be 45° and 30°. If the ships are 200 m apart and one ship is exactly behind the other then find the height of lighthouse.

9) As observed from the top of a 75 m high lighthouse from the sea-level, the angles of depression of two ships are 30° and 60°. If one ship is

exactly behind the other on the same side of the lighthouse, find the distance between the two ships. (Use $\sqrt{3} = 1.73$)

10) A straight highway leads to the foot of a tower. A man standing on the top of the 75 m high tower observes two cars at angles of depression of 30° and 60°, which are approaching the foot of the tower. If one car is exactly behind the other on the same side of the tower, find the distance between the two cars. (use $\sqrt{3} = 1.73$)

11) 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 $\sqrt{3} = 1.73$)

12) Two ships are sailing in the sea on either side of a lighthouse. The angles of depression to the two ships as observed from the top of the lighthouse are 60° and 45°, respectively. If the distance between the ships is $100\left(\frac{1+\sqrt{3}}{\sqrt{3}}\right)$ m, then find the height of the lighthouse.

13) 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 a height of 4 m from the banks, find the width of the river.

14) Manish is standing on level ground and observes a kite flying 200 m away from him at an angle of elevation of 30°. Mahesh, standing on the roof of a 50 m high building on the opposite side of the kite, observes the same kite at an angle of elevation of 45°. Find the distance between the kite and Mahesh.

15) A boy standing on a horizontal plane is flying a kite with a string of length 60 m, at an angle of elevation of 30°. Another boy standing on the roof of a 20 m high building, finds the angle of elevation of same kite to be 45°. If both the boys are on opposite sides of the kite, find the distance of the first boy from the base of the building. Also, find the height of the kite from the ground. (Use $\sqrt{3} = 1.73$)

16) A kite is flying at a height of 60 m above the ground level. Ravi, standing at the roof of the house is holding the string straight and observes the angle of elevation of kite as 30°. From the bottom of the same building, the angle of elevation of kite is 45°. Find the length of the string and height of roof from the ground. (Use $\sqrt{3} = 1.73$)

17) A boy whose eye level is 1.35 m from the ground, spots a balloon moving with the wind in a horizontal line at some height from the

ground. The angle of elevation of the balloon from the eyes of the boy at an instant is 60°. After 12 seconds, the angle of elevation reduces to 30°. If the speed of the wind is 3 m/s then find the height of the balloon from the ground. (Use $\sqrt{3} = 1.73$)

18) One observer estimates the angle of elevation to the basket of a hot air balloon to be 60°, while another observer 100 m away estimates the angle of elevation to be 30°. Find:
(a) The height of the basket from the ground.
(b) The distance of the basket from the first observer's eye.
(c) The horizontal distance of the second observer from the basket.

19) A spherical balloon of radius r subtends an angle of 60° at the eye of an observer. If the angle of elevation of its centre is 45° from the same point, then prove that height of the centre of the balloon is $\sqrt{2}$ times its radius.