GRADE X

Question Bank (MATHEMATICS)

Chapter-9 APPLICATIONS OF TRIGONOMETRY

1 marks:

1. From a point on the ground, which is 30 m away from the foot of the 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: **[BOARD 2024]**

   a) $10\sqrt{3}$ b) $30\sqrt{3}$ c) 60 d) 30

2. 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 the time is **[BOARD 2024]**

   a) 30° b) 45° c) 60° d) 90°

3. If a vertical pole of length 7.5 m casts a shadow 5m long on the ground and at the same time, a tower casts a shadow 24m long, then the height of the tower is: **[BOARD 2024]**

   a) 20m b) 40m c) 60m d) 80m

4. The ratio of the length of the pole and its shadow on the ground is $1:\sqrt{3}$. The angle of elevation of the Sun is: **[BOARD 2024]**

   a) 90° b) 60° c) 45° d) 30°

5. The length of the shadow of a tower on the plane ground is $\sqrt{3}$ times the height of the tower. The angle of elevation of the Sun is: **[BOARD 2024]**

   a) 30° b) 45° c) 60° d) 90°

6. If a pole 6m high casts a shadow $2\sqrt{3}m$ long on the ground, then Sun's elevation is **[BOARD 2023]**

   a) 30° b) 45° c) 60° d) 90°

7. If the angle of depression of an object from a 75m high tower is 30° then the distance of the object from the tower is

   a) $25\sqrt{3}m$ b) $50\sqrt{3}m$ c) $75\sqrt{3}m$ d) $150\ m$

8. A tree casts a shadow 15m long on the level of ground, when the angle of elevation of the Sun is 45°. The height of a tree is

   a) 10 m b) 14 m c) 8 m d) 15 m

9. A circus artist is climbing a 20 m long rope, which is tightly stretched and tied from the top of a vertical pole to the ground, then the height of the pole, if the angle made by the rope with the ground level is 30°, is

   a) 5 m b) 10 m c) 15 m d) 20 m

10. An observer, 1.5 m tall is 20.5 m away from a tower 22 m high, then the angle of elevation of the top of the tower from the eye of the observer is

    a) 10 m b) 14 m c) 8 m d) 15 m

11. From the top of 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 45°, then the height of the tower is

    a) 14.124 m b) 17.124 m c) 19.124 m d) 15.124 m

12. A tree is broken by the wind. The top stuck the ground at an angle of 30° and at a distance of 10 m from its foot. The whole height of the tree is

    a) $10\sqrt{3}\,m$ b) $3\sqrt{10}\,m$ c) $20\sqrt{3}\,m$ d) $3\sqrt{20}\,m$

2 marks:

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. **[BOARD 2023]**
2. The angle of elevation of the top of a tower from a point on the ground is 30m away from the foot of the tower, is 30°. Find the height of the tower. **[BOARD 2023]**
3. Find the length of the shadow on the ground of a pole of height 18m when angle of elevation θ of the Sun is such that $\tan\theta = \frac{6}{7}$. **[BOARD 2023]**

3 marks:

1. 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 a tower from the foot of the building is 60°. If the tower is 50 m high, then find the height of the building.
2. The top of two poles of height 16 m and 10 m are connected by a length ' l' meter. If the wire makes an angle of 30° with the horizontal, then find ' l'.
3. An electric pole is 10 m high. A steel wire tied to top of the pole is affixed at a point on the ground to keep the pole up right. If the wire makes an angle of 45° with the horizontal through the foot of the pole, find the length of the wire. $(Use\ \sqrt{2} = 1.414)$
4. A boy, flying a kite with a string of 85 m long, which is making an angle θ with the ground. Find the height of the kite. $\left(\text{Given}\tan\theta = \frac{15}{8}\right)$

5 marks:

1. A pole of 6m high is fixed on the top of the 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 the point P from the foot of the tower. $(Use\ \sqrt{3} = 1.73)$

   [BOARD 2024]

2. From the top of a building 60m high, the angles of depression of the top and bottom of the vertical lamp post are observed to be 30° and 60° respectively.
   (i) Find the horizontal distance between the building and the lamp post.
   (ii) Find the distance between the tops of the building and the lamp post.

   [BOARD 2024]

3. From the top of a 15m high building, the angle of elevation of the top of a tower is found to be 30°. From the bottom of the same building, the angle of elevation of the top of the tower is found to be 60°. Find the height of the tower and the distance between tower and the building. **[BOARD 2024]**

4. As observed from the top of a 75m 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 two ships.
   $(Use\ \sqrt{3} = 1.73)$ **[BOARD 2023]**

5. From the top of 45m 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. $(Use\ \sqrt{3} = 1.73)$ **[BOARD 2024]**

6. The angle of elevation of an aircraft from a point A on the ground is 60°. After a flight of 30 seconds, the angle of elevation changes to 30°. The aircraft is flying at a constant height of $3500\sqrt{3}m$ at a uniform speed. Find the speed of the aircraft.

   [BOARD 2024]

7. A person standing on the bank of a river observes that the angle of elevation of the top of a tower on the opposite bank is 60°. When he moves 30m away from the bank, he finds the angle of elevation to be 30°. Find the height of the tower and width of the river. $(Use\ \sqrt{3} = 1.732)$ **[BOARD 2024]**

8. 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 20m high building are 45° and 60° respectively. Find the height of the tower. **[BOARD 2024]**
9. Two pillars of equal lengths stand on either side of a road which is 100m 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. $(Use\ \sqrt{3} = 1.732)$ **[BOARD 2024]**
10. The angles of depression of the top and the bottom of a 50 m high building from the top of a tower are 45° and 60°, respectively. Find the height of the tower. $(Use\ \sqrt{3} = 1.73)$ **[BOARD 2024]**
11. From a top of 7m high building, the angle of elevation of the top a cable tower is 60° and the angle of depression of its foot is 30°. Find the height of the tower. **[BOARD 2023]**
12. The angles of depression of the top and the bottom of a 8m tall building from the top of a multi-storied building are 30° and 45° respectively. Find the height of the multi-storied building and the distance between the two buildings. **[BOARD 2024]**
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 4m from the banks, find the width of the river. **[BOARD 2024]**
14. From a window 15 m high above the ground in a street, the angles of elevation and depression of top and the foot of another house on the opposite side of the street are 30° and 45° respectively. Find the height of the opposite house. $(Use\ \sqrt{3} = 1.732)$ **[BOARD 2024]**
15. The angle of elevation of the top of a tower 24m 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 wire attached to the tops of both the towers. **[BOARD 2023]**
16. 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. **[BOARD 2023]**

17. A ladder set against a wall at angle 45° to the ground. If the foot of the ladder is pulled away from the wall through a distance of 4m, its top slides a distance of 3m down the wall making an angle 30° with the ground. Find the final height of the top of the ladder from the ground and length of the ladder. **[BOARD 2023]**
18. An aeroplane when flying at a height of 3000m from the ground passes vertically above another aeroplane at an instant when the angles of elevation of the two planes from the same point on the ground are 60° and 45° respectively. Find the vertical distance between the aeroplanes at that instant. Also, find the distance of the first plane from the point of observation. $(Use\ \sqrt{3} = 1.73)$ **[BOARD 2023]**
19. A straight highway leads to the foot of the tower. A man standing on the top of the 75m 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. $(Use\ \sqrt{3} = 1.73)$

[BOARD 2023]

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

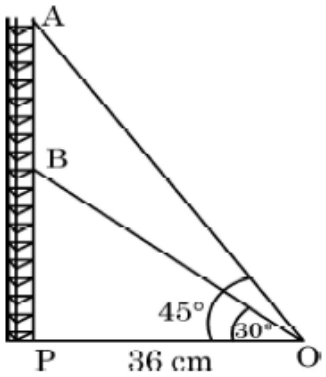
[BOARD 2023]

21. Amit standing on a horizontal plane, find a bird flying at a distance of 200m from him at an elevation of 30°. Deepak standing on the roof of a 50 m high building, find the angle elevation of the same bird to be 45°. Amit and Deepak are on opposite sides of the bird. Find the distance of the bird from Deepak.

Case Based 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.

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 the elevation of the top of section A is 45°. **[BOARD 2023]**



Based on the above information, answer the following questions:

(i) Find the length of the wire from the point O to the top of section B. **1**

(ii) Find the distance AB. **2**

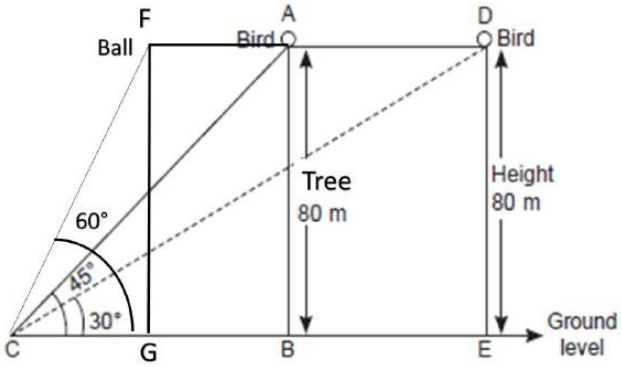
OR

Find the area of ΔOPB. **2**

(iii) Find the height of the section A from the base of the tower. **1**

2. One evening, Karthi was in a park. Children were playing cricket. Birds were singing on a nearby tree of height 80m. 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°.



Based on the above information, answer the following questions:

(i) At what distance from the foot of the tree was he observing the bird sitting on the tree? **1**

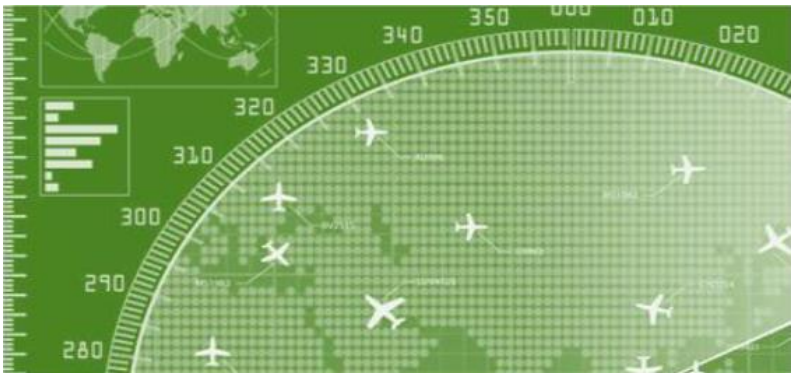
(ii) How far did the bird fly in the mentioned time? **2**

OR

After hitting the tree, how far did the ball travel in the sky when Karthi saw the ball? **2**

(iii) What is the speed of the bird in m/min if it had flown $20(\sqrt{3}+1)$m? **1**

3. 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 follows:

(i) Draw neat labeled figure to show the above situation diagrammatically. **1**

(ii) What is the distance travelled by the plane in 30 seconds? **2**

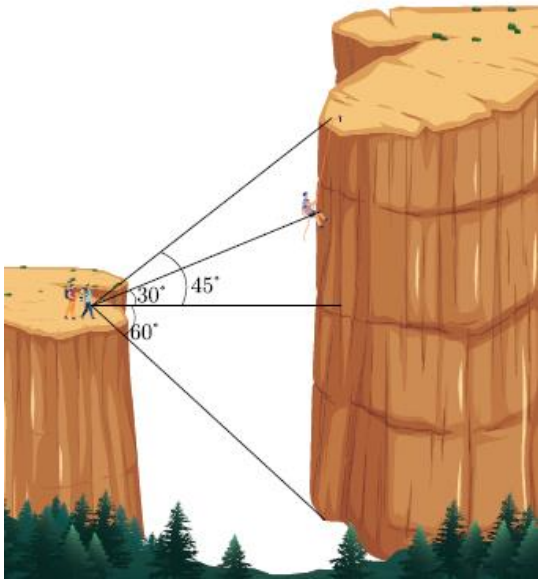
OR

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. **2**

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

4. **Height of a Climber:** Himalayan trekking Club has just hiked to the south rim of a large canyon, when they spot a climber attempting to scale the taller northern face. Knowing the distance between the sheer walls of the northern and southern faces of the canyon is approximately 150 m, they attempt to compute the distance remaining for the climbers to reach the top of the northern rim.

Using a homemade transit, they sight an angle of depression of 60° to the bottom of the north face and angles of elevation of 30° and 45° to the climbers and top of the northern rim respectively.



Based on the above information answer the following questions:

(i) How high is the southern rim of the canyon? **1**

(ii) How high is the northern rim? **2**

(iii) How much farther until the climber reaches the top? **1**