

Chapter 9: Some Applications of Trigonometry

Top 20 Practice Questions

A. Basic Angle of Elevation & Depression

1. A tower stands vertically on the ground. From a point **15 m** away from the foot, the **angle of elevation** of the top is 60° . Find the **height of the tower**.
2. An observer **1.5 m tall** is **28.5 m** away from a chimney. The angle of elevation of the top of the chimney from her eyes is 45° . Find the **height of the chimney**.
3. The shadow of a tower becomes **40 m longer** when the Sun's altitude changes from 60° to 30° . Find the **height of the tower**.
4. From a point on the ground, the angles of elevation of the **bottom** and **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**.
5. A kite is flying at a height of **60 m** above the ground. The string is inclined at 60° to the ground. Find the **length of the string**.

B. Two-Object Problems (Double Triangles)

6. Two poles of equal heights are standing opposite each other on either side of an **80 m** wide road. From a point between them on the road, the angles of elevation are 60° and 30° . Find the **height of the poles**.

7. 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 45° . Determine the **height of the tower**.

8. As observed from the top of a **75 m** high lighthouse, the angles of depression of two ships are 30° and 45° . If one ship is exactly behind the other, find the **distance between the ships**.

9. A **1.2 m** tall girl spots a balloon moving with the wind at a height of **88.2 m**. The angle of elevation changes from 60° to 30° . Find the **distance travelled by the balloon**.

10. A straight highway leads to the foot of a tower. A man at the top observes a car at an angle of depression of 30° . Six seconds later, it is 60° . How much **more time** will it take to reach the tower?

C. Advanced Concepts

11. The angle of elevation of the top of a tower from two points at distances of **4 m** and **9 m** from the base are complementary. Prove that the **height of the tower is 6 m**.

12. A statue **1.6 m** tall stands on the top of a pedestal. From a point on the ground, the angle of elevation of the top of the statue is 60° and from the same point, the elevation of the top of the pedestal is 45° . Find the **height of the pedestal**.

13. A tree breaks due to a storm and the broken part touches the ground making an angle of 30° with it. The distance from the foot to the point where the top touches is **8 m**. Find the **height of the tree**.

14. The angle of elevation of a cloud from a point h meters above a lake is α and the angle of depression of its reflection in the lake is β . Prove that the **height of the cloud** is:

$$\text{Height} = \frac{h(\tan \beta + \tan \alpha)}{\tan \beta - \tan \alpha}$$

15. A round balloon of radius r subtends an angle α at the eye of the observer while the angle of elevation of its centre is β . Prove that the **height of the centre** of the balloon is:

16. From a window **15 m** high above the ground in a street, the angles of elevation and depression of the top and foot of another house on the opposite side of the street are 30° and 45° respectively. Find the **height of the opposite house**.

17. 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 changes to 30° . If the jet is flying at a **constant height of $3600\sqrt{3}$ m**, find the **speed of the jet**.

18. A flagstaff stands on the top of a **10 m** high tower. From a point on the ground, the angle of elevation of the top of the flagstaff is 60° and that of the top of the tower is 45° . Find the **height of the flagstaff**.

19. A bridge over a river makes an angle of 45° with the river bank. If the length of the bridge across the river is **150 m**, find the **width of the river**.

20. The angles of depression of the top and bottom of an **8 m** tall building from the top of a multi-store building are 30° and 45° respectively. Find the **height of the multi-store building**.

PYQs: Long Answer / Case Study (4–5 Marks)

1.(2023)

From the top of a **75 m** high lighthouse, the angles of depression of two ships are 30° and 60° . Find the **distance between the ships**.

2.(2020)

A **1.5 m** tall boy is standing at some distance from a **30 m** tall building. The angle of elevation of the top of the building increases from 30° to 60° as he walks towards the building. Find the **distance walked by the boy**.

3.(2022)

The angle of elevation of the top of a building from the foot of a 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 **50 m** high, find the **height of the building**.

4.(2024)

Two ships are approaching a lighthouse from **opposite sides**. The angles of depression of the ships from the top of the lighthouse are 30° and 45° . If the lighthouse is **100 m** high, find the **distance between the ships**.

5.(2021)

A pole **6 m** high casts a shadow of length $2\sqrt{3}$ m on the ground. Find the **angle of elevation of the Sun**.

6.(2023 – Case Study)

An electrician has to repair an electric fault on a pole of height **5 m**. She needs to reach a point **1.3 m below the top** of the pole. Find the **length of the ladder** required.

7.(2020)

From a point on a bridge across a river, the angles of depression of the banks on opposite sides are 30° and 45° . If the bridge is at a height of **3 m**, find the **width of the river**.

8.(2022)

A TV tower stands vertically on a bank of a canal. From a point on the opposite bank, the angle of elevation of the top is 60° . From another point **20 m** away, the angle of elevation is 30° . Find the **height of the tower**.

9.(2024)

From the top of a tower, the angles of depression of two objects on the same side are α and β ($\alpha > \beta$). If the distance between the objects is p , show that the height h of the tower is:

$$h = \frac{p \tan \alpha \tan \beta}{\tan \alpha - \tan \beta}$$

10.(2021)

The ratio of the length of a rod and its shadow is $1 : \sqrt{3}$. Find the **angle of elevation of the Sun**.

11.(2023)

A man standing on the deck of a ship, which is **10 m** above the water level, observes the angle of elevation of the top of a hill as 60° and the angle of depression of the base of the hill as 30° . Find:

- (i) the **distance of the hill from the ship**,
- (ii) the **height of the hill**.

12.(2020)

The angle of elevation of the top of a tower from a point on the ground is 30° . After walking **30 m** towards the tower, the angle becomes 60° . Find the **height of the tower**.

13.(2022)

Two poles of heights **6 m** and **11 m** stand on plane ground. If the distance between their feet is **12 m**, find the **distance between their tops**.

14.(2024)

A parachute is descending vertically and makes angles of elevation of 45° and 60° at two observing points on the ground which are **100 m apart**. Find the **maximum height** from which the parachutist falls.

15.(2021)

If the angle of elevation of a tower from a distance of **100 m** from its foot is 60° , find the **height of the tower**.

16.(2023)

From a point P on the ground, the angle of elevation of the top of a **10 m** tall building is 30° . A flag is hoisted at the top of the building and the angle of elevation of the top of the flagstaff from P becomes 45° . Find the **length of the flagstaff**.

17.(2020)

An aeroplane flying at a height of **4000 m** passes vertically above another aeroplane. At that instant, 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**.

18.(2022)

The shadow of a vertical tower on level ground increases by **10 m** when the altitude of the Sun changes from 45° to 30° . Find the **height of the tower**.

19.(2024 – Case Study)

A person is watching a boat from the top of a tower. The boat moves towards the tower and the angles of depression change with time. Based on the given data, find the **distance and speed of the boat**.

(Data to be interpreted as per the case study.)

20.(2021)

A **1.5 m** tall girl stands at a distance of **3 m** from a lamp-post and casts a shadow of **4.5 m** on the ground. Find the **height of the lamp-post**.