

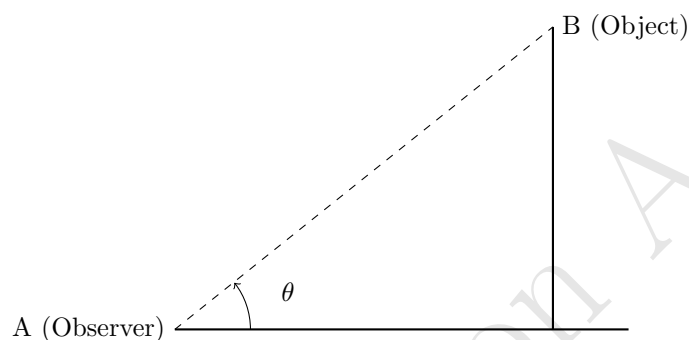
1 Introduction

Trigonometry is widely used in real-world applications to find heights and distances of objects without direct measurement. It is useful in fields such as engineering, astronomy, aviation, and construction.

2 Angle of Elevation and Depression

2.1 Angle of Elevation

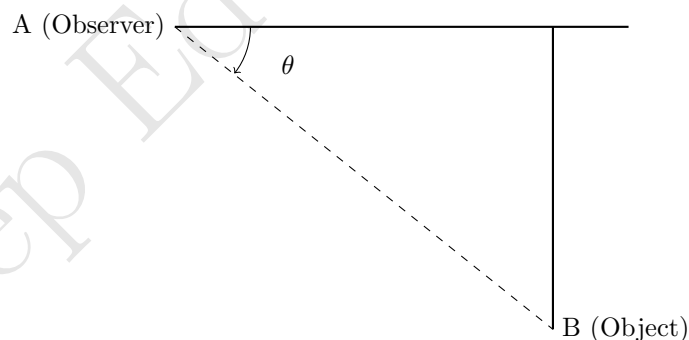
Definition: When an observer looks at an object above the horizontal level, the angle formed by the line of sight with the horizontal is called the angle of elevation.



Here, AB = Height of the object AC = Distance from the observer θ = Angle of elevation

2.2 Angle of Depression

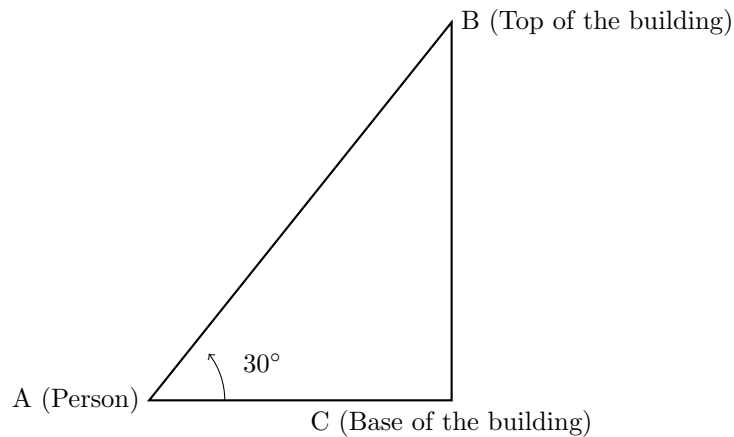
Definition: When an observer looks at an object below the horizontal level, the angle formed by the line of sight with the horizontal is called the angle of depression.



Here, AB = Height of the observer AC = Distance from the observer θ = Angle of depression

3 Example 1: Finding the Height of a Building

A person standing 50 meters away from a building observes the top of the building at an angle of elevation of 30° . Find the height of the building.



Solution:

$$\tan \theta = \frac{\text{height}}{\text{distance}}$$

$$\tan 30^\circ = \frac{h}{50}$$

$$\frac{1}{\sqrt{3}} = \frac{h}{50}$$

$$h = \frac{50}{\sqrt{3}} \approx 28.87 \text{ meters}$$

Thus, the height of the building is approximately 28.87 meters.

4 Example 2: Finding the Distance of a Ship from a Lighthouse

A lighthouse is 100 meters high. The angle of depression from the top of the lighthouse to a ship is 45° . Find the distance of the ship from the base of the lighthouse.

$$\tan 45^\circ = \frac{100}{d}$$

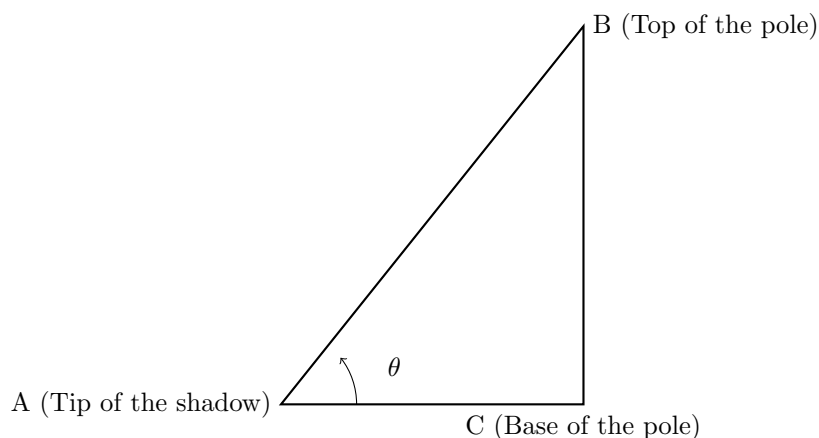
$$1 = \frac{100}{d}$$

$$d = 100 \text{ meters}$$

Thus, the distance of the ship from the lighthouse is 100 meters.

5 Example 3: Finding the Length of a Shadow

A pole of height 20 meters casts a shadow of 10 meters on the ground. Find the angle of elevation of the Sun.



Solution:

$$\tan \theta = \frac{\text{height}}{\text{shadow}}$$

$$\tan \theta = \frac{20}{10} = 2$$

$$\theta = \tan^{-1}(2)$$

$$\theta \approx 63.43^\circ$$

Thus, the angle of elevation of the Sun is approximately 63.43° .

6 Conclusion

Trigonometry is an essential tool in practical applications such as determining heights and distances where direct measurement is not feasible. Understanding the concepts of angle of elevation and depression helps in solving real-world problems effectively.