Chapter-Some Applications of Trigonometry

The line of sight is the line drawn from an observer's eye to the point being viewed. When looking upward, the angle formed between the line of sight and the horizontal is called the angle of elevation. When looking downward, it's called the angle of depression.

1. Angle of Elevation and Depression

- Angle of Elevation: The angle formed between the horizontal line of sight and the line of sight to an object above the horizontal line.
- Angle of Depression: The angle formed between the horizontal line of sight and the line of sight to an object below the horizontal line.

Example 1:

From the top of a 60 m high building, the angle of depression of a car on the ground is 30°. How far is the car from the building?

Solution:

Let the distance of the car from the building be x m.

tan 30° = 60/x

$1/\sqrt{3} = 60/x$

$x = 60\sqrt{3} \approx 103.92$ m

Example 2:

A person observes the top of a tower at an angle of elevation of 45°. If the person moves 40 m closer, the angle of elevation becomes 60°. Find the height of the tower.

Solution:

Let the initial distance be x m and the height of the tower be h m

For the first position: tan 45° = h / x

For the second position: tan 60° = h / (x - 40)

h = x (as tan 45° = 1)

$\sqrt{3} = x / (x - 40)$

Solving this: $x = 40\sqrt{3} / (\sqrt{3} - 1) \approx 109.3$ m

Height of tower = 109.3 m

2. Heights and Distances

This concept involves using trigonometric ratios to calculate heights of tall objects or distances of far-off points.

Example 1:

A ladder leaning against a wall makes an angle of 60° with the ground. If the foot of the ladder is 2 m away from the wall, find the length of the ladder.

Solution:

Let the length of the ladder be l m.

cos 60° = 2/l

1/2 = 2/l

l = 4 m

Example 2:

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.

Solution:

Let the height of the tower be h m and the distance of the point from the building be x m.

For the building: tan 45° = 20/x

1 = 20/x

x = 20 m

For the tower: tan 60° = (20+h)/20

$\sqrt{3} = (20+h)/20$

$20\sqrt{3} = 20+h$

$h = 20\sqrt{3} - 20 \approx 14.64$ m