CLASS 10 CHEAT SHEET

ANGLE ELEVATION

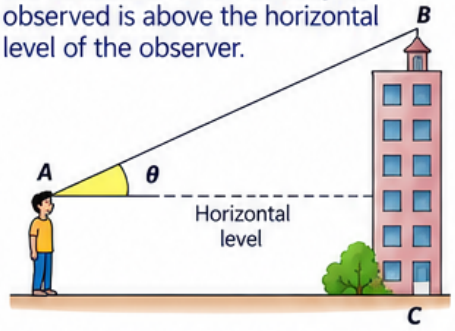
Some Applications of Trigonometry

Pumpa



1 WHAT IS ANGLE ELEVATION?

Angle of elevation is the angle made by the line of sight with the horizontal, when the object observed is above the horizontal level of the observer.



In right ΔABC (right angled at C),

∠BAC = angle of elevation of B from A = θ

2 BASIC FORMULAS (Right-angled Triangle)

Let θ be the angle of elevation.

Let the height of the object = h (BC)

Let the horizontal distance from observer to base = d (AC)

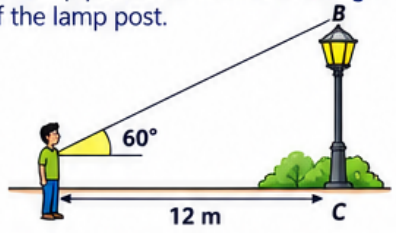
Line of sight (hypotenuse) = AB

- $\tan\theta = \frac{\text{Opposite}}{\text{Adjacent}} = \frac{h}{d} \Rightarrow h = d\tan\theta$
- $\sin\theta = \frac{\text{Opposite}}{\text{Hypotenuse}} = \frac{h}{AB} \Rightarrow AB = \frac{h}{\sin\theta}$
- $\cos\theta = \frac{\text{Adjacent}}{\text{Hypotenuse}} = \frac{d}{AB} \Rightarrow AB = \frac{d}{\cos\theta}$

Use tan θ most often in angle of elevation problems!

3 EXAMPLE 1

From a point on the ground, the angle of elevation of the top of a lamp post is 60°. If the distance between the point and the foot of the lamp post is 12 m, find the height of the lamp post.



Solution:

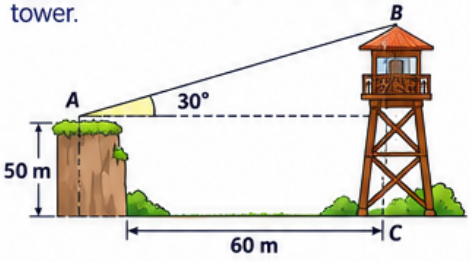
Here, $\theta = 60°$, $d = 12$ m, height (h) = ?

$$\tan 60° = \frac{h}{12} \Rightarrow \sqrt{3} = \frac{h}{12}$$

$$\Rightarrow h = 12\sqrt{3} \text{ m} \approx 20.78 \text{ m}$$

4 EXAMPLE 2

From the top of a cliff 50 m high, the angle of elevation of the top of a watch tower is 30°. If the horizontal distance between the cliff and the watch tower is 60 m, find the height of the watch tower.



Solution:

Here, $\theta = 30°$, horizontal distance $d = 60$ m, height of tower = $50 + h$

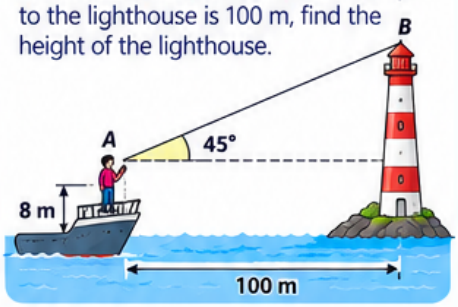
$$\tan 30° = \frac{h}{60} \Rightarrow \frac{1}{\sqrt{3}} = \frac{h}{60}$$

$$\Rightarrow h = \frac{60}{\sqrt{3}} = 20\sqrt{3} \text{ m}$$

Height of tower = $50 + 20\sqrt{3}$ m ≈ 84.64 m

5 EXAMPLE 3

A person is standing on the deck of a ship 8 m above the water level. The angle of elevation of the top of a lighthouse from the person is 45°. If the horizontal distance from the ship to the lighthouse is 100 m, find the height of the lighthouse.



Solution:

Here, $\theta = 45°$, $d = 100$ m, height of lighthouse = $8 + h$

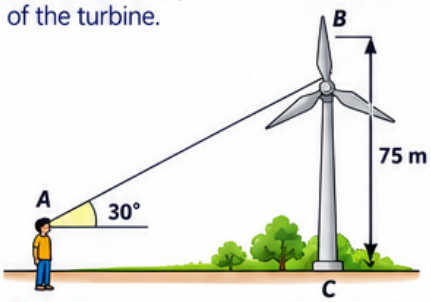
$$\tan 45° = \frac{h}{100} \Rightarrow 1 = \frac{h}{100}$$

$$\Rightarrow h = 100 \text{ m}$$

Height of lighthouse = 8 + 100 = 108 m

6 EXAMPLE 4

From a point on the ground, the angle of elevation of the top of a wind turbine is 30°. If the height of the wind turbine is 75 m, find the distance of the point from the base of the turbine.



Solution:

Here, $\theta = 30°$, height (h) = 75 m, horizontal distance (d) = ?

$$\tan 30° = \frac{75}{d} \Rightarrow \frac{1}{\sqrt{3}} = \frac{75}{d}$$

$$\Rightarrow d = 75\sqrt{3} \text{ m} \approx 129.90 \text{ m}$$

QUICK FORMULAS & MATHEMATICAL RELATIONS

1. $\tan\theta = \frac{h}{d} \Rightarrow h = d\tan\theta$
2. $\sin\theta = \frac{h}{AB} \Rightarrow AB = \frac{h}{\sin\theta}$
3. $\cos\theta = \frac{d}{AB} \Rightarrow AB = \frac{d}{\cos\theta}$

TIPS & QUICK FACTS

- Draw a neat diagram and mark the right angle clearly.
- Identify opposite side (height) and adjacent side (distance).
- Use $\tan\theta = \frac{\text{Opposite}}{\text{Adjacent}}$ in most angle of elevation problems.
- If angles are 30° and 60°, think of $\sqrt{3}$ and $\frac{1}{\sqrt{3}}$ values.
- If two angles are given from two points, use both equations to eliminate the distance.

COMMON MISTAKES

- Confusing angle of elevation with angle of depression.
- Using sin or cos when tan would be easier.
- Not converting all distances to the same units.
- Forgetting to subtract the height of the building when observer is above ground.
- Taking the wrong side as opposite or adjacent.

KEY TAKEAWAY

Angle of elevation helps us find heights and distances of tall objects that cannot be measured directly using trigonometric ratios.