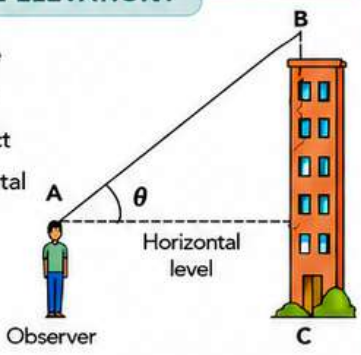
CLASS 10 CHEAT SHEET

ANGLE ELEVATION

Some Applications of Trigonometry

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

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

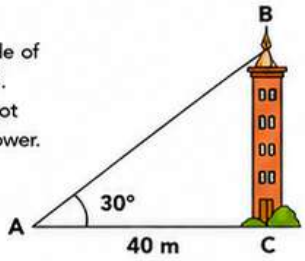
- $\tan\theta = \frac{\text{Opposite}}{\text{Adjacent}} = \frac{h}{d} \Rightarrow h = d\tan\theta$
- $\sin\theta = \frac{\text{Opposite}}{\text{Hypotenuse}} = \frac{h}{AB} \Rightarrow AB = \frac{h}{\sin\theta}$
- $\cos\theta = \frac{\text{Adjacent}}{\text{Hypotenuse}} = \frac{d}{AB} \Rightarrow AB =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

Use tan θ most often in angle of elevation problems!

EXAMPLES

Example 1

From a point on the ground, the angle of elevation of the top of a tower is 30°. If the point is 40 m away from the foot of the tower, find the height of the tower.



Solution:

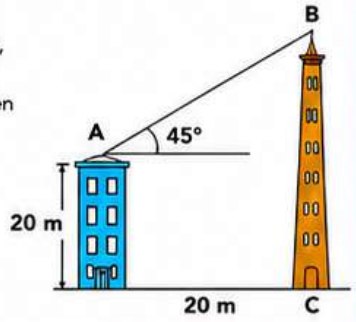
Here, $\theta = 30°$, $d = 40$ m, height (h) = ?

$$\tan 30° = \frac{h}{40} \Rightarrow \frac{1}{\sqrt{3}} = \frac{h}{40}$$

$$\Rightarrow h = \frac{40}{\sqrt{3}} \approx 23.09 \text{ m}$$

Example 2

From the top of a building 20 m high, the angle of elevation of the top of a tower is 45°. If the distance between the building and the tower is 20 m, find the height of the tower.



Solution:

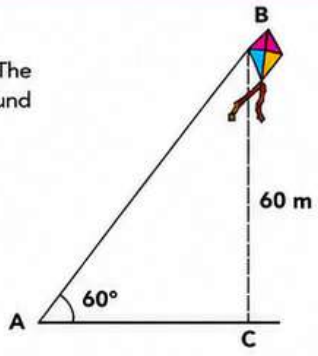
Here, $\theta = 45°$, $d = 20$ m, height of building = 20 m

$$\tan 45° = \frac{h-20}{20} \Rightarrow 1 = \frac{h-20}{20}$$

$$\Rightarrow h - 20 = 20 \Rightarrow h = 40 \text{ m}$$

Example 3

A kite is flying at a height of 60 m above the ground. The angle of elevation of the string from a point on the ground is 60°. Find the length of the string.



Solution:

Here, $\theta = 60°$, height = 60 m, length of string (AB) = ?

$$\sin 60° = \frac{60}{AB} \Rightarrow \frac{\sqrt{3}}{2} = \frac{60}{AB}$$

$$\Rightarrow AB = \frac{120}{\sqrt{3}} = 40\sqrt{3} \text{ m} \approx 69.28 \text{ m}$$

TRICKS TO REMEMBER

- 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.

STANDARD VALUES TO REMEMBER

$\tan 30° = \frac{1}{\sqrt{3}}$	$\tan 45° = 1$	$\tan 60° = \sqrt{3}$	$\sin 30° = \frac{1}{2}$	$\sin 45° = \frac{1}{\sqrt{2}}$	$\sin 60° = \frac{\sqrt{3}}{2}$

REMEMBER!

Good diagram + Correct ratio = Right answer!

Practice more problems to master ideas!

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