

CLASS 10 CHEAT SHEET

ANGLE OF ELEVATION & DEPRESSION

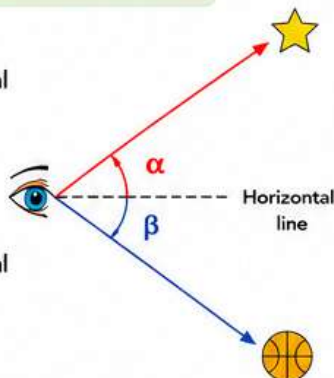
Some Applications of Trigonometry



WHAT ARE THEY? (Definitions)

Angle of Elevation (α) is measured from the horizontal looking **UP** to an object.

Angle of Depression (β) is measured from the horizontal looking **DOWN** to an object.



1. Create two Right Δ s
2. Angle of Depression (β) = Angle of Elevation (α)

BASIC FORMULAS (Double Triangle Problems)

Let h be given height (Building).

Let d be horizontal distance. T1 height is $h + x$.

1. Lower Δ (β): $\tan \beta = \frac{h}{d}$, solve for d .

2. Upper Δ (α): $\tan \alpha = \frac{x}{d}$, solve for x .

Use d from step 1.

► $\tan \theta = \frac{\text{Opposite}}{\text{Hypotenuse}} = \frac{h}{AB} \Rightarrow AB = \frac{h}{\sin \theta}$

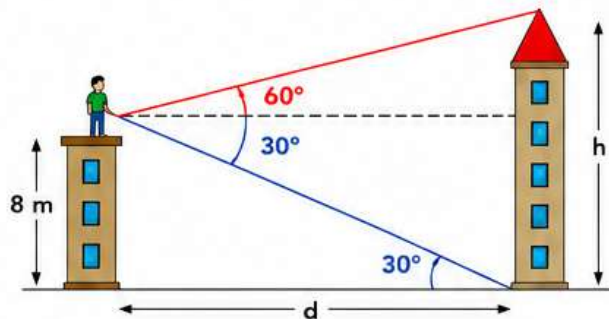
► $\cos \theta = \frac{\text{Adjacent}}{\text{Hypotenuse}} = \frac{d}{AB} \Rightarrow AB = \frac{d}{\cos \theta}$

Use $\tan \theta$ most often in angle of elevation problems!

COMBINED EXAMPLES

Example 1

From a window 8 m high above the ground, the angle of elevation of the top of a tower is 60° and the angle of depression of its foot is 30° . Find the height of the tower and the distance between the window and tower.



Solution:

From window to foot of tower (depression 30°):

$$\tan 30^\circ = \frac{8}{d} \Rightarrow d = 8\sqrt{3} \text{ m}$$

From window to top of tower (elevation 60°):

$$\tan 60^\circ = \frac{h-8}{d} \Rightarrow \sqrt{3} = \frac{h-8}{8\sqrt{3}}$$

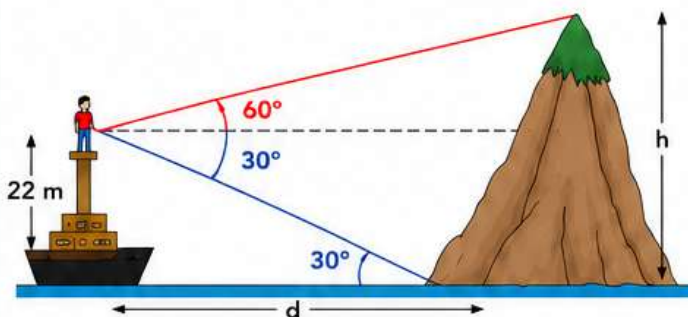
$$\Rightarrow h-8 = 24 \Rightarrow h = 32 \text{ m}$$

Hence,

Height of tower = 32 m, Distance = $8\sqrt{3}$ m

Example 2

A man standing on the deck of a ship, 22 m above the water level observes the top of a hill as 60° and the bottom of the hill as 30° . Estimate the distance of the hill from the ship and height of the hill.



Solution:

From ship to bottom of hill (depression 30°):

$$\tan 30^\circ = \frac{22}{d} \Rightarrow d = 22\sqrt{3} \text{ m}$$

From ship to top of hill (elevation 60°):

$$\tan 60^\circ = \frac{h-22}{d} \Rightarrow \sqrt{3} = \frac{h-22}{22\sqrt{3}}$$

$$\Rightarrow h-22 = 66 \Rightarrow h = 88 \text{ m}$$

Hence,

Distance of hill from ship = $22\sqrt{3}$ m, Height of hill = 88 m

TRICKS TO REMEMBER



- ★ Draw a horizontal line through the observer.
- ★ Mark the angle between the horizontal and line of sight.
- ★ Angle of Depression = Angle of Elevation.
- ★ Identify: Opposite (height) and Adjacent (horizontal distance).
- ★ Use $\tan \theta$ when height and distance are involved.

COMMON MISTAKES



- ✗ Measuring the angle from the vertical.
- ✗ Forgetting that angle of depression equals angle of elevation.
- ✗ Using sin instead of tan unnecessarily.
- ✗ Ignoring units in the final answer.
- ✗ Forgetting to draw the horizontal line through the observer.

STANDARD VALUES TO REMEMBER

θ	30°	45°	60°
$\tan \theta$	$1/\sqrt{3}$	1	$\sqrt{3}$
$\sin \theta$	$1/2$	$1/\sqrt{2}$	$\sqrt{3}/2$
$\cos \theta$	$\sqrt{3}/2$	$1/\sqrt{2}$	$1/2$

REMEMBER!



- ✓ Draw a neat labelled diagram.
- ✓ Convert the angle of depression into the angle of elevation.
- ✓ Choose the correct trigonometric ratio.
- ✓ Write the answer with proper units.

KEY TAKEAWAY: Combined elevation and depression problems use two right-angled triangles using a horizontal line to solve for heights and distances.

Good diagram $\rightarrow$ Correct ratio $\rightarrow$ Right answer!
Practice more problems to master ideas!