

Practical Trigonometry

ਟ੍ਰਿਗੋਨੋਮੈਟਰੀ (Trigonometry) - ਉਚਾਈਆਂ, ਦੂਰੀਆਂ ਅਤੇ ਪੌੜੀ ਦੀ ਸੁਰੱਖਿਆ ਦਾ ਹਿਸਾਬ

1. What is Trigonometry in Daily Life? (ਟ੍ਰਿਗੋਨੋਮੈਟਰੀ ਕੀ ਹੈ?)

Trigonometry measures relationships between the angles and sides of triangles. In real life, it allows us to measure heights and distances of objects (like trees, buildings, and ramps) without climbing them!

CORE RATIOS (SOH CAH TOA)

$$\sin(\theta) = \text{Opposite} / \text{Hypotenuse}$$

$$\cos(\theta) = \text{Adjacent} / \text{Hypotenuse}$$

$$\tan(\theta) = \text{Opposite} / \text{Adjacent}$$

2. Real-Life Practical Scenarios

Scenario A: Ladder Safety Angle (ਪੌੜੀ ਲਗਾਉਣ ਦਾ ਸਹੀ ਕੋਣ)

Example: Safety guidelines state that a ladder should form a **75° angle (θ)** with the ground. If you need to reach a wall height of **12 feet (Opposite)**, how long must the ladder be (Hypotenuse)?

1. Step 1: Identify Formula

$$\sin(75^\circ) = \text{Opposite} / \text{Hypotenuse}$$

[Note: $\sin(75^\circ) \approx 0.966$]

2. Step 2: Solve for Ladder Length (Hypotenuse)

$$0.966 = 12 / \text{Ladder Length}$$

$$\text{Ladder Length} = 12 / 0.966 \approx 12.42 \text{ feet}$$



Pro Tip (1:4 Rule): For every 4 feet of wall height, place the ladder base 1 foot away from the wall to ensure ideal stability!

Scenario B: Tree / Building Height Measurement (ਇਮਾਰਤ ਜਾਂ ਰੁੱਖ ਦੀ ਉਚਾਈ)

Example: You stand **20 metres away (Adjacent)** from a tall tree. Looking at the top of the tree, your sightline forms a **45° angle of elevation (θ)** with the ground. How tall is the tree?

1. Step 1: Apply Tangent Formula

$$\tan(45^\circ) = \text{Height} / \text{Distance}$$

2. Step 2: Calculate Height

$$1 = \text{Height} / 20 \implies \text{Height} = 20 \text{ metres}$$

3. Standard Angle Reference Table

Angle (θ)	sin(θ)	cos(θ)	tan(θ)	Practical Application
30°	0.500	0.866	0.577	Wheelchair Ramps & Slopes
45°	0.707	0.707	1.000	Distance equals Height (Easy estimation)
60°	0.866	0.500	1.732	Solar Panel Tilt & Roof Pitches

4. Practical Practice Exercises (ਅਭਿਆਸ ਲਈ ਪ੍ਰਸ਼ਨ)

Q1 Wheelchair Ramp Slope: A wheelchair ramp needs to rise 3 feet high at a gentle angle of 30°. How long does the ramp surface (Hypotenuse) need to be?

Answer: $\sin(30^\circ) = 3 / \text{Ramp Length} \implies 0.5 = 3 / \text{Ramp Length} \implies \text{Ramp Length} = 6 \text{ feet.}$

Q2 Flagpole Shadow: A 10-metre tall flagpole casts a shadow on the ground when the sun angle is 45°. How long is the shadow cast on the ground?

Answer: $\tan(45^\circ) = 10 / \text{Shadow Length} \implies 1 = 10 / \text{Shadow Length} \implies \text{Shadow} = 10 \text{ metres.}$

Q3 Kite String Length: A kite is flying at a height of 50 metres above the ground. The string attached to the kite is taut and forms a 60° angle with the ground. Calculate the length of the string.

Answer: $\sin(60^\circ) = 50 / \text{String} \implies 0.866 = 50 / \text{String} \implies \text{String Length} = 50 / 0.866 \approx 57.7 \text{ metres.}$