

# Mission: Triangle Mastery - Exploring Sine, Cosine, and Tangent

## Materials Needed

- Scientific Calculator (Physical or digital, e.g., TI-30XIIS, Casio, or Desmos)
- Graph paper and a pencil
- A ruler (metric or imperial)
- "The Height of Cool" Worksheet (Self-created or provided below)
- Tape measure (optional, for the extension activity)

## Learning Objectives

By the end of this lesson, Michael will be able to:

- Identify the **Opposite**, **Adjacent**, and **Hypotenuse** sides of a right-angled triangle relative to a given angle.
- Use the **SOH CAH TOA** mnemonic to select the correct trigonometric ratio.
- Operate a scientific calculator to find the sine, cosine, and tangent of specific angles.
- Solve for a missing side length in a real-world "shadow" scenario.

## 1. Introduction: The "Spy Satellite" Hook (10 Minutes)

**The Scenario:** Imagine you are a secret agent. You need to drop a package from a drone onto a target 500 meters away. You know the angle the drone is flying at, but you don't know how high the drone needs to be to clear the buildings. How do you find the height without a giant ladder?

**The Secret:** Right-angled triangles! If you know just one angle and one side, you can figure out everything else about that triangle. This is the "superpower" of Trigonometry.

## 2. Instruction: The "I Do" - The Language of Triangles (15 Minutes)

Before we touch the calculator, we have to know the "labels." In any right-angled triangle, the sides are named based on where the angle (let's call it  $\theta$  or  $\theta$ ) is located.

- **Hypotenuse:** Always the longest side, opposite the 90-degree angle.
- **Opposite:** The side directly across from your target angle.
- **Adjacent:** The side next to your target angle (that isn't the hypotenuse).

### The Magic Word: SOH CAH TOA

This is how we remember which button to press on the calculator:

- **SOH:** Sin = Opposite / Hypotenuse

- **CAH:** Cos = **A**djacent / **H**ypotenuse
- **TOA:** Tan = **O**pposite / **A**djacent

## The Calculator "Kill-Switch" Check

**Crucial Step:** Scientific calculators can think in "Degrees" or "Radians." For school math, we almost always use **DEGREES**. Look at your screen. Does it say "DEG"? If it says "RAD" or "GRAD," we need to change the mode, or every answer will be wrong!

## 3. Guided Practice: The "We Do" - Calculator Calibration (15 Minutes)

Let's try three quick checks to make sure we're using the calculator correctly. Type these in and see if you get the same result:

1. **Sin(30):** Press [SIN] [3] [0] [=]. (Result should be **0.5**)
2. **Cos(60):** Press [COS] [6] [0] [=]. (Result should be **0.5**)
3. **Tan(45):** Press [TAN] [4] [5] [=]. (Result should be **1**)

**Guided Problem:** A 10-meter ladder leans against a wall at a 60-degree angle to the ground. How high up the wall does it reach?

- **Identify:** We have the Hypotenuse (10m). We want the Opposite (height).
- **Choose:** Which part of SOH CAH TOA uses O and H? (SOH!)
- **Setup:**  $\sin(60) = \text{Height} / 10$
- **Solve:**  $10 * \sin(60) = \text{Height}$ .
- *Michael, try it on the calculator:  $10 * 0.866 = 8.66$  meters.*

## 4. Independent Practice: The "You Do" - The Skate Ramp Design (20 Minutes)

**The Challenge:** You are designing a custom skate ramp. You want the ramp to be 4 meters long (Hypotenuse) and it must have an incline angle of 25 degrees.

**Your Mission:** Calculate the following and draw a quick sketch of your ramp with the dimensions labeled.

1. How **high** will the deck of the ramp be? (Hint: Use SIN)
2. How much **floor space** (length along the ground) will the ramp take up? (Hint: Use COS)

*Success Criteria: Calculations should be rounded to two decimal places.*

## 5. Conclusion & Assessment (10 Minutes)

**Recap:**

- What does the 'O' stand for in SOH? (Opposite)
- If you have the Adjacent side and the Hypotenuse, which button do you use? (Cos)

- What is the most important setting to check on your calculator? (DEG mode)

**Final Check:** Michael, explain to me how a surveyor might use these buttons to find the height of a mountain without climbing it.

## Differentiation & Adaptations

- **For a Challenge:** Introduce "Inverse Trig" ( $\sin^{-1}$ ). Ask: "If the ramp is 2 meters high and 5 meters long, what is the angle?"
- **For Extra Support:** Use a "SOH CAH TOA Triangle" graphic organizer where Michael can cover the value he is looking for to see the formula (e.g., cover O to see  $S * H$ ).
- **Hands-On Variation:** Go outside! Measure a shadow's length and the angle of the sun to calculate the height of a tree or the house.