



Trigonometry

1. The Basics: Right-Angled Triangles

Trigonometry is based on the relationship between the angles and sides of triangles. For a right-angled triangle, we use the mnemonic **SOH CAH TOA**.

- **Sine ($\sin \theta$):** $\frac{\text{Opposite}}{\text{Hypotenuse}}$
- **Cosine ($\cos \theta$):** $\frac{\text{Adjacent}}{\text{Hypotenuse}}$
- **Tangent ($\tan \theta$):** $\frac{\text{Opposite}}{\text{Adjacent}}$

The Pythagorean Connection: In any right-angled triangle, $a^2 + b^2 = c^2$, where c is the hypotenuse.

2. Trigonometric Ratios of Special Angles

In exams, you are often expected to know the exact values for 30° , 45° , and 60° without a calculator.

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

3. Angles of Elevation and Depression

These are real-world applications of trigonometry used to find heights and distances.

- **Angle of Elevation:** The angle measured **upwards** from the horizontal line of sight to an object.
- **Angle of Depression:** The angle measured **downwards** from the horizontal line of sight to an object.
- **Crucial Rule:** The angle of elevation from point A to B is always **equal** to the angle of depression from point B to A (Alternate angles).

4. The Four Quadrants (ASTC Rule)

When angles exceed 90° , their signs (+ or -) change based on the quadrant they fall in:

1. **1st Quadrant (0° to 90°): All** are positive.
2. **2nd Quadrant (90° to 180°): Sine** only is positive.
3. **3rd Quadrant (180° to 270°): Tangent** only is positive.
4. **4th Quadrant (270° to 360°): Cosine** only is positive.

Memory Trick: Add Sugar To Coffee.

5. Solving Non-Right Angled Triangles

When the triangle does **not** have a 90° angle, we use the Sine and Cosine rules.

A. The Sine Rule

Use this when you have two angles and one side, or two sides and an angle opposite one of them.

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

B. The Cosine Rule

Use this when you have two sides and the **included angle** (SAS), or all three sides (SSS).

$$a^2 = b^2 + c^2 - 2bc \cos A$$

6. Trigonometric Identities

These are fundamental formulas used to simplify complex equations:

1.

$$\tan \theta = \frac{\sin \theta}{\cos \theta}$$

2.

$$\sin^2 \theta + \cos^2 \theta = 1$$

3.

$$1 + \tan^2 \theta = \sec^2 \theta$$

7. Bearings and Distances

In Senior Secondary Geography and Maths, trigonometry is used to solve bearing problems.

- **Three-Figure Bearing:** Measured clockwise from the North (e.g., 060°).
- **Compass Bearing:** Measured from North or South towards East or West (e.g., $N60^\circ E$).

Exam Practice Tip

When solving 3D trigonometry problems (like finding the height of a pole from two different points), always **draw the 2D triangles separately**. It makes it much harder to get confused by the perspective!