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The Sine & Cosine Rules

IGCSE Mathematics

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Quality Mathematics Education for Students

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1 Introduction

Note

In the previous chapter on Trigonometry, we worked exclusively with **right-angled triangles** using SOH CAH TOA. However, in many real-world problems, triangles do **not** contain a right angle. To solve these **non-right-angled triangles**, we need two powerful new tools:

- The **Sine Rule** — used when we know a side and its opposite angle.
- The **Cosine Rule** — used when we know two sides and the included angle, or all three sides.
- The **Area Formula using Sine** — used when we know two sides and the included angle.

In this chapter, we will explore:

- Standard labelling notation for non-right-angled triangles
- The Sine Rule and when to apply it
- The ambiguous case of the Sine Rule
- The Cosine Rule and when to apply it
- The area of a triangle using $\frac{1}{2}ab \sin C$
- Choosing the correct rule for a given problem
- Multi-step problems combining the Sine and Cosine Rules

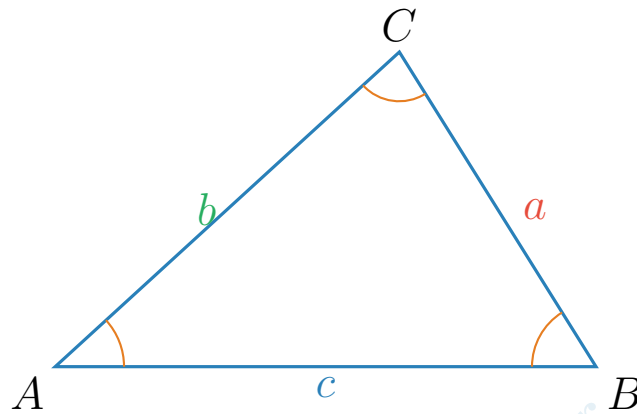
2 Labelling Non-Right-Angled Triangles

Definition

For any triangle, we use the following **standard convention**:

- **Angles** are labelled with capital letters: A , B , C .
- **Sides** are labelled with the corresponding lowercase letter of the **opposite** angle:
 - Side a is opposite angle A

- Side b is opposite angle B
- Side c is opposite angle C

**Note**

This notation is **universal** and used throughout the Sine Rule, Cosine Rule, and Area Formula. Always label your triangle before attempting any calculation — it prevents errors and makes the rules straightforward to apply.

3 The Sine Rule

The Sine Rule

For any triangle with angles A , B , C and opposite sides a , b , c :

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

Equivalently (useful when finding an angle):

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

Use the Sine Rule when you know:

- **AAS** — Two angles and any side, **or**
- **SSA** — Two sides and a non-included angle (the angle opposite one of the known sides).

Preview ends here

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