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Similarity and Congruence

IGCSE Mathematics

The Panda Math Tutor

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Quality Mathematics Education for Students

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1 Introduction

Note

Similarity and congruence are fundamental concepts in geometry that deal with comparing shapes. Understanding when shapes are *the same* and when they are *scaled copies* of each other is essential for solving many problems in IGCSE Mathematics.

In this chapter, we will explore:

- Congruent shapes and triangles
- The four congruence conditions for triangles
- Similar shapes and triangles
- Scale factors for length, area, and volume
- Solving problems involving similarity and congruence

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2 Congruent Shapes

Definition

Two shapes are **congruent** if they are exactly the same shape and size. One shape can be transformed into the other using only reflections, rotations, and translations (no scaling).

If two shapes are congruent, then:

- All corresponding sides are equal in length
- All corresponding angles are equal in size

We write $\triangle ABC \cong \triangle DEF$ to mean "triangle ABC is congruent to triangle DEF".

Note

Key Point: The order of the letters matters! When we write $\triangle ABC \cong \triangle DEF$, this tells us:

- A corresponds to D, B corresponds to E, C corresponds to F
- $AB = DE$, $BC = EF$, $AC = DF$

- $\angle A = \angle D, \quad \angle B = \angle E, \quad \angle C = \angle F$

Example

Two quadrilaterals $JKLM$ and $TUVW$ are congruent. Given that $JK = 8$ cm, $KL = 5$ cm, $LM = 11$ cm, $MJ = 7$ cm, and $\angle K = 95$, find TU, VW, and $\angle U$.

Solution:
Since $JKLM \cong TUVW$, corresponding sides and angles are equal:

- $TU = JK = 8$ cm
- $VW = LM = 11$ cm
- $\angle U = \angle K = 95$

3 Congruent Triangles

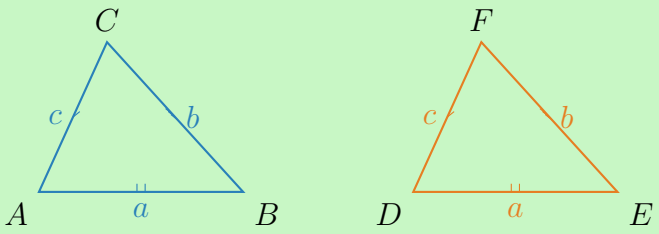
Note

To prove that two triangles are congruent, we do **not** need to show that all six measurements (three sides and three angles) are equal. Instead, we can use one of four conditions.

3.1 The Four Congruence Conditions

SSS — Side, Side, Side

If all three sides of one triangle are equal to the corresponding three sides of another triangle, then the triangles are congruent.



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