Topic 12:
Congruency & Similarity (4048)

THE ABOUT

CHAPTER ANALYSIS

MASTERY

- Relatively straight forward chapter
- 2 **key** concepts

EXAM

- Concepts usually tested as a small part in Geometry Questions
- Not an easy chapter if students have struggles identifying which figures are congruent/similar

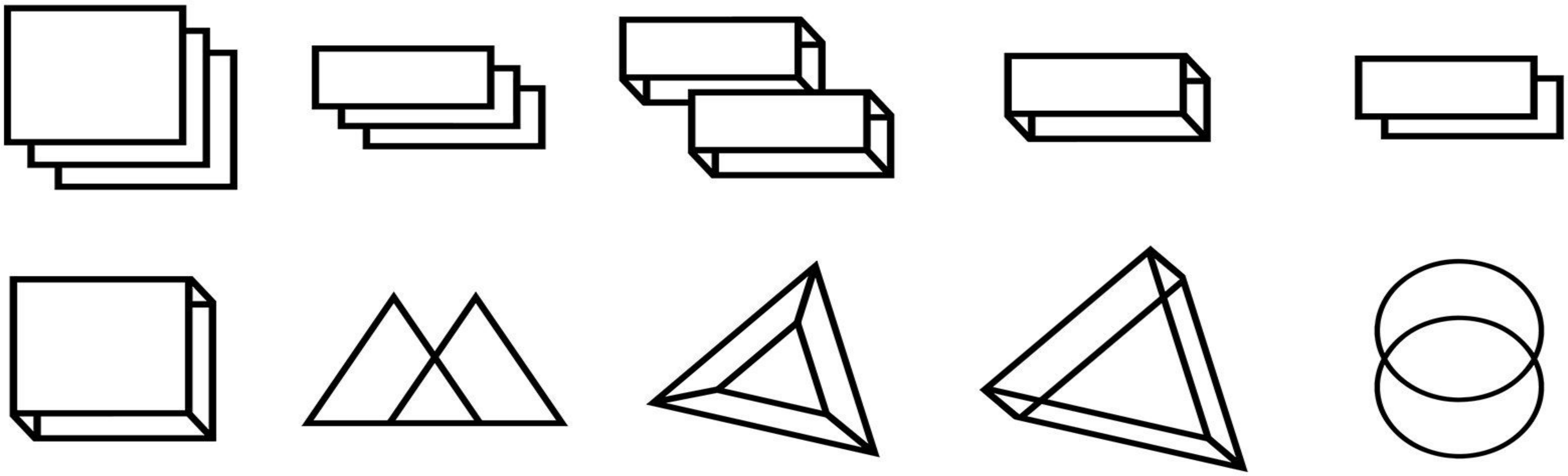
WEIGHTAGE

- High overall weightage
- Tested consistently every year
- Typically, an 8m question, 1 question in one of the papers

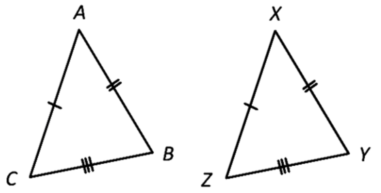
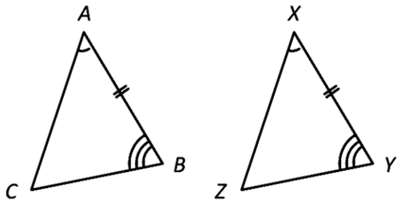
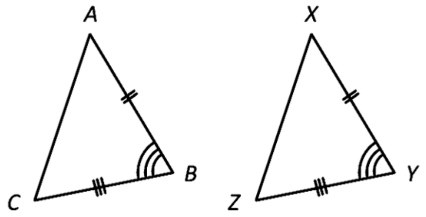
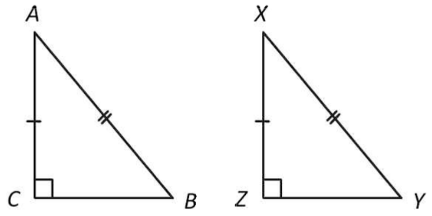
KEY CONCEPT

Congruency & Similarity of Triangles

Area & Volume of Similar Figures & Solids



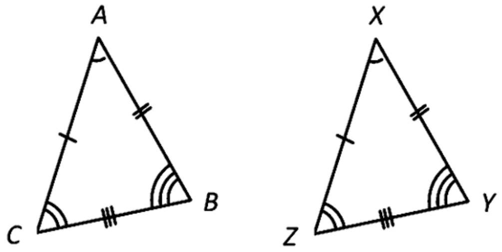
Congruency Tests

Name	Test	Diagram
SSS	$AB = XY$ $BC = YZ$ $AC = XZ$	
ASA	$AB = XY$ $\angle CAB = \angle ZXY$ $\angle ABC = \angle XYZ$	
SAS	$AB = XY$ $BC = YZ$ $\angle ABC = \angle XYZ$	
RHS	$AB = XY$ $BC = YZ$ $\angle ACB = \angle XZY = 90°$	

Symbol for Congruency: $\equiv$

Congruency

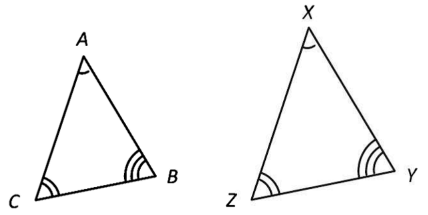
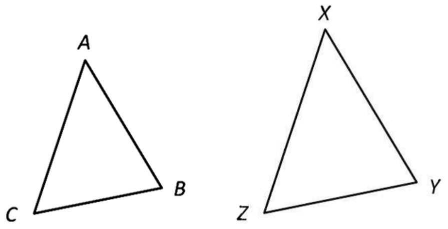
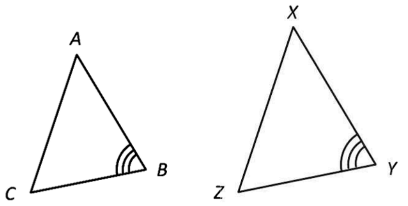
Figures that are identical in every aspect



For 2 triangles to be congruent, their corresponding sides and angles **MUST** be equal

4 tests for Congruency:

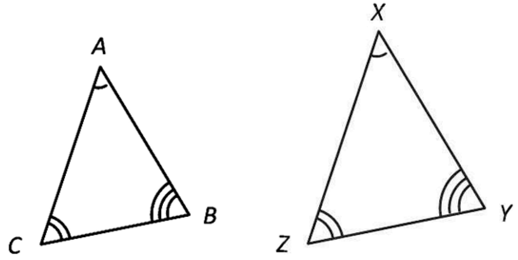
1. **'SSS' or 'side-side-side' test**
2. **'ASA' or 'angle-side-angle' test**
3. **'SAS' or 'side-angle-side' test**
4. **'RHS' or 'right angle-hypotenuse-side' test**

Similarity Tests		
Name	**Test**	**Diagram**
AAA	$\angle CAB = \angle ZXY$ $\angle ABC = \angle XYZ$ $\angle BCA = \angle YZX$	
Corresponding sides same ratio	$\frac{AB}{XY} = \frac{BC}{YZ} = \frac{AC}{XZ}$	
Ratio of 2 sides same + 1 angle	$\angle ABC = \angle XYZ$ $\frac{AB}{XY} = \frac{BC}{YZ}$	

Make sure that all Congruency & Similarity Tests have <u>3 lines of justifications</u> each to fulfil all test conditions

<u>Similarity</u>

Figures that have the same shape but different sizes



For 2 triangles to be similar, their ratio of the corresponding sides are the same for all lengths, and the corresponding angles are equal

3 tests for Congruency:

1. **'AAA' or 'angle-angle-angle' test**

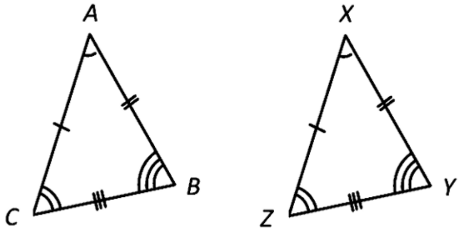
2. **Corresponding sides same ratio**

3. **Ratio of 2 pairs of corresponding sides is the same and the included angles <u>between</u> them are equal**

Take Note:

The naming conventions of Congruency & Similarity Questions are important! Many students make mistake when defining the sides that they want to use in their arguments

EX: To show that $\Delta ABC \equiv \Delta XYZ$



To show that 2 sides are equal in length, the direction of how students define the length must stay consistent (Either all Clockwise or Anti-Clockwise)

$$AC = XZ \qquad \text{OR} \qquad CA = ZX$$

To show that 2 angles are equal in size, the direction of how students define the angles must stay consistent (Either all Clockwise or Anti-Clockwise)

$$\angle ABC = \angle XYZ \qquad \text{OR} \qquad \angle CBA = \angle ZYX$$

Justifications for each argument

Formal Justifications must be provided at each step, no matter how trivial

1. If the question states that the lengths/angles are equal, simply write the equal lengths/angles and state that it is "**Given**"

$$AC = XZ \quad (\textbf{given})$$

* Note that you can only use "Given" if the question explicitly states that the lengths/angles are equal! If you require to perform some calculations to find the lengths, you are NOT allowed to write "Given"

2. If 2 triangles have a common side/angle (means that 2 triangles are stuck together and joined with a side/angle that both triangles have), simply write that the side/angle is common

$$AC \textbf{ is a common side}$$

3. If the question requires some calculations for the angles, reasons must be explicitly stated as to how you come about with said calculations. Use reasons from **Topic 11:** Angles, Triangles & Polygons, and **Topic 13:** Properties of Circles to help justify all your arguments

$$\angle ABC = \angle XYZ \ (\textbf{alternate angles})$$

Scale Factor

A value $k > 1$ which alters the size of a figure

Shape and angles of the figure are preserved

$$\text{Scale Factor } k = \frac{\text{Length of side of image}}{\text{Length of corresponding side of figure}}$$

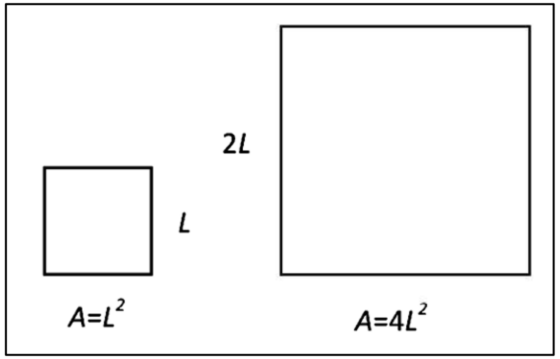
Scale Factor k	Figure Transformation
$k > 1$	Enlargement
$k < 1$	Reduction

Area/Volume of similar plane figures

1. Area of similar plane figures

Similar figures have the ratios of their areas equal to the square of the ratio of lengths of any pairs of corresponding sides

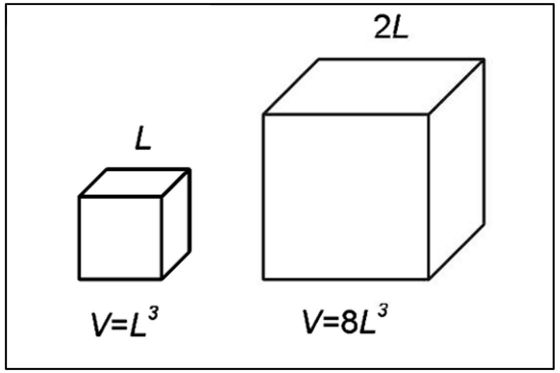
$$\frac{A_1}{A_2} = \left(\frac{I_1}{I_2}\right)^2 = \frac{(I_1)^2}{(I_2)^2}$$



2. Volume of similar solids

Similar solids have the ratios of their volumes equal to the cube of the ratio of lengths of any pairs of corresponding sides

$$\frac{V_1}{V_2} = \left(\frac{I_1}{I_2}\right)^3 = \frac{(I_1)^3}{(I_2)^3}$$



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