I. Lesson Overview

Strand	**Measurement and Geometry**
Sub-Strand	Similarity and Enlargement
Specific Learning Outcome	Determining similarities in shapes
Grade Level	Grade 10
Duration	40 minutes
Key Inquiry Question	How is similarity and enlargement applied in day-to-day life?
Learning Resources	CBC Grade 10 Mathematics Textbooks

II. Learning Objectives

Category	Objective
Know	Define similarity and identify the conditions for two shapes to be similar (equal corresponding angles and proportional corresponding sides).
Do	Calculate unknown side lengths and angles in similar triangles using ratios of corresponding sides.
Apply	Apply the concept of similarity and enlargement to solve real-world problems involving maps, models, photographs, and architectural drawings.

III. Materials & Resources

- CBC Grade 10 Mathematics Textbooks
- Rulers, protractors, graph paper, pencils
- Digital textbook: INNODEMS CBC Grade 10 Maths (Section 2.1 Similarity and Enlargement)

IV. Lesson Procedure

Phase 1: Problem-Solving and Discovery (15 minutes)

Anchor Activity: "Exploring Similar Triangles"

Students work in pairs to complete the following construction and investigation:

Instructions:

- (a) Draw triangle ABC with the following side lengths: AB = 7 cm, AC = 6 cm, and BC = 5 cm.
- (b) Label the angles in triangle ABC as follows: $\angle ABC = 50°$, $\angle BAC = 60°$, $\angle BCA = 70°$.
- (c) Draw triangle PQR with the following side lengths: PQ = 21 cm, PR = 18 cm, and QR = 15 cm.
- (d) Label the angles in triangle PQR as follows: $\angle PQR = 50°$, $\angle QRP = 70°$, $\angle QPR = 60°$.
- (e) Find the ratio of corresponding sides: QR/BC, PQ/AB, PR/AC.
- (f) What do you notice about the ratios of corresponding sides above?
- (g) What do you observe between $\angle ABC$ and $\angle PQR$, $\angle BCA$ and $\angle QRP$, $\angle BAC$ and $\angle QPR$?
- (h) What do you observe about the two triangles based on their corresponding sides and angles?
- (i) What is the relationship between triangle ABC and triangle PQR?
- (j) Discuss your findings and share your conclusions with the class.

Teacher's Role During Discovery:

- Circulate among pairs, observing construction accuracy and ratio calculations.
- Ask probing questions: "What pattern do you see in the ratios?" "Are the angles the same in both triangles?"
- Encourage students to articulate their observations before sharing with the class.
- Identify groups with clear explanations to present their findings first.
- Surface common errors (e.g., matching wrong corresponding sides) for whole-class discussion.

Expected Student Discoveries:

- All three ratios are equal: QR/BC = PQ/AB = PR/AC = 15/5 = 21/7 = 18/6 = 3.
- The corresponding angles are equal: $\angle ABC = \angle PQR = 50°$, $\angle BCA = \angle QRP = 70°$, $\angle BAC = \angle QPR = 60°$.
- Triangle PQR is an enlarged version of triangle ABC with a scale factor of 3.
- The two triangles are similar because their corresponding angles are equal and their corresponding sides are in the same ratio.

Phase 2: Structured Instruction (10 minutes)

Key Takeaways:

Definition of Similarity:

Two triangles are similar if their corresponding angles are equal and their corresponding sides are in the same ratio.

Definition of Enlargement:

Enlargement is a transformation that changes the size of a shape by a scale factor while preserving its shape. The object and its image remain similar under enlargement.

Key Properties of Enlargement:

- Scale Factor = Image length ÷ Object length.
- If scale factor > 1, the image is larger than the object (enlargement).
- If 0 < scale factor < 1, the image is smaller than the object (reduction).
- If scale factor is negative, the image is on the opposite side of the centre and is inverted.
- The centre of enlargement is the point from which all measurements are taken.
- Lines connecting object points to their corresponding image points intersect at the centre of enlargement.
- OA'/OA = OB'/OB = OC'/OC = A'B'/AB = A'C'/AC = B'C'/BC = Scale Factor.

Connecting to Student Discoveries:

- Reference the ratio of 3 that students found — this is the linear scale factor.
- Show how equal corresponding angles confirm similarity.
- Demonstrate that triangle PQR is the image of triangle ABC under an enlargement with scale factor 3.
- Address any misconceptions about matching corresponding sides (must match by position, not by size).

Phase 3: Practice and Application (10 minutes)

Problem 1: Finding Unknown Lengths in Similar Triangles

Triangles PQR and ABC are similar. AB corresponds to PQ, BC corresponds to QR, and AC corresponds to PR.

Given: AB = 6 cm, AC = 9 cm, PR = 12 cm, QR = 14 cm. Calculate the lengths x (BC) and y (PQ).

Solution:

- AB/PQ = AC/PR = BC/QR
- 6/y = 9/12 = x/14
- Finding y (PQ): 6/y = 9/12 ⟶ y × 9 = 6 × 12 ⟶ y = 72/9 = 8 cm. Therefore PQ = 8 cm.
- Finding x (BC): 9/12 = x/14 ⟶ x × 12 = 9 × 14 ⟶ x = 126/12 = 10.5 cm. Therefore BC = 10.5 cm.

Problem 2: Finding Angles and Lengths in Similar Triangles

Given that triangles XYZ and PQR are similar. ∠ZYX = 72°, ∠YZX = 61°, YZ = 16 cm, PQ = 40 cm, XY = 12 cm. Find ∠QPR, ∠PQR, and the length of PR.

Solution:

- Since the triangles are similar, corresponding angles are equal:
- ∠ZYX corresponds to ∠QPR ⟶ ∠QPR = 72°
- ∠YZX corresponds to ∠PQR ⟶ ∠PQR = 61°
- Finding PR using similarity ratio: YZ/PQ = XY/PR ⟶ 16/40 = 12/PR
- PR × 16 = 40 × 12 ⟶ PR = 480/16 = 30 cm.

Phase 4: Assessment — Exit Ticket (5 minutes)

Assessment Questions:

1. Determine which of the following triangles are similar by comparing their corresponding sides: Triangle A (6 cm, 4 cm, 3 cm), Triangle B (24 cm, 16 cm, 12 cm), Triangle C (20 cm, 18 cm, 14 cm).

2. Given that triangle ABC is similar to triangle DEF, where AB = x, BC = 6 cm, ∠ABC = 56°, DE = 14 cm, EF = 7 cm, and ∠DEF = θ:

- (a) Determine the measure of angle θ.
- (b) Calculate the value of x.

3. In the figure, TPQRS has TP = 8 cm, PQ = 5 cm, TS = 16 cm, and SR = x. Find the value of x.

4. Triangle ABE is similar to triangle ACD. Given that DC = 24 cm, AE = 6 cm, ED = 12 cm, determine the length of BE.

Answer Key:

- 1. Triangle A and Triangle B are similar. Ratios: 24/6 = 16/4 = 12/3 = 4. Triangle C is NOT similar to A or B (ratios 20/6 ≈ 3.33, 18/4 = 4.5, 14/3 ≈ 4.67 — not equal).
- 2(a). Since ABC ~ DEF and ∠ABC corresponds to ∠DEF, θ = 56°.
- 2(b). AB/DE = BC/EF → x/14 = 6/7 → x = 84/7 = 12 cm.
- 3. By similarity: TP/TS = PQ/SR → 8/16 = 5/x → x = 80/8 = 10 cm.
- 4. Since ABE ~ ACD: AE/AD = BE/DC → 6/18 = BE/24 → BE = 144/18 = 8 cm.

V. Differentiation Strategies

Learner Level	Strategy
Struggling Learners	Provide pre-drawn triangles with measurements already labelled so students can focus on calculating ratios. Use colour-coded corresponding sides (e.g., red for AB↔PQ, blue for BC↔QR). Offer a step-by-step checklist: (1) Identify corresponding sides, (2) Write ratios, (3) Simplify, (4) Compare.
On-Level Learners	Complete all anchor activity steps and practice problems independently. Encourage peer explanation — have students teach a partner how to find unknown lengths. Use the digital textbook checkpoints for additional randomized practice.
Advanced Learners	Extension Activity: Enlargement with Coordinates — Given triangle with vertices A(2,3), B(1,1), C(4,1) and centre of enlargement at the origin, find the image under enlargement with scale factors of 2, 1/2, and −1. Explore negative scale factors and explain what happens to the image. Apply enlargement to real-world problems: map scales, architectural models, photograph resizing.

VI. Extension Activity

Real-World Enlargement Challenge:

1. A photograph is enlarged so that its width increases from 10 cm to 25 cm. If the original height is 15 cm, find the new height.

- Solution: Scale factor = 25/10 = 2.5. New height = 15 × 2.5 = 37.5 cm.

2. A map has a scale of 1:50,000. If the distance between two cities on the map is 8 cm, find the actual distance.

- Solution: Actual distance = 8 × 50,000 = 400,000 cm = 4 km.

3. A triangle with vertices X(4,0), Y(6,3), Z(5,4) is enlarged with centre (1,1) and scale factor −2. Find the coordinates of the image.

- Solution: For each vertex, apply: Image = Centre + scale factor × (Vertex − Centre).
- X' = (1 + (−2)(4−1), 1 + (−2)(0−1)) = (1−6, 1+2) = (−5, 3)
- Y' = (1 + (−2)(6−1), 1 + (−2)(3−1)) = (1−10, 1−4) = (−9, −3)
- Z' = (1 + (−2)(5−1), 1 + (−2)(4−1)) = (1−8, 1−6) = (−7, −5)

VII. Assessment Methods

Type	Method
Formative	Observation during pair work (accurate constructions, correct ratios). Questioning during discovery phase ("What do you notice about the ratios?"). Monitoring practice problem solutions for correct identification of corresponding sides.
Summative	Exit ticket with 4 questions covering: identifying similar triangles, finding unknown angles, calculating unknown side lengths, and applying similarity in context.

VIII. Teacher Reflection

1. Did students successfully identify that corresponding sides are in the same ratio during the anchor activity?

2. Were students able to connect equal corresponding angles to the concept of similarity?

3. How effectively did the pair work support collaborative discovery?

4. Did the structured instruction adequately bridge student discoveries to formal definitions?

5. Were students able to apply similarity ratios to find unknown lengths independently?

6. How well did the differentiation strategies meet the needs of all learner levels?

7. What adjustments would improve the lesson for future delivery?