

Step by Step Guide: Introduction to Similarity

Pre-Class Preparation Checklist

- Ensure each pair has rulers, protractors, and graph paper.
- Prepare large demonstration paper or whiteboard with pre-drawn axes.
- Have the digital textbook section open:
innodems.github.io/CBC-Grade-10-Maths/subsec-enlargement.html
- Prepare colour-coded cards for struggling learners (red, blue, green for corresponding sides).
- Write the anchor activity instructions on the board or prepare printed handouts.
- Have calculators available for ratio calculations.

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

Opening (2 minutes)

[SAY] "Good morning, class. Today we are going to explore a fascinating relationship between shapes. Have you ever noticed how a passport photo and a billboard poster of the same person look exactly alike — just different sizes? Today we will discover the mathematics behind this."

[DO] Display two images of different sizes on the board (or draw two rectangles of different sizes with the same proportions).

[ASK] "What do you notice about these two shapes? What is the same? What is different?"

[WAIT] Allow 30 seconds for students to share observations.

[SAY] "Excellent observations! Let's investigate this idea more carefully with triangles."

Anchor Activity Launch (3 minutes)

[SAY] "You will work in pairs for this activity. Each pair needs a ruler, protractor, and plain paper. Follow the instructions carefully."

[DO] Distribute materials and display the instructions on the board.

[SAY] "First, draw triangle ABC with sides $AB = 7$ cm, $AC = 6$ cm, and $BC = 5$ cm. Label the angles: angle ABC = 50 degrees, angle BAC = 60 degrees, and angle BCA = 70 degrees."

[SAY] "Next, draw a second triangle PQR with sides $PQ = 21$ cm, $PR = 18$ cm, and $QR = 15$ cm. Label its angles: angle PQR = 50 degrees, angle QRP = 70 degrees, and angle QPR = 60 degrees."

[SAY] "Once both triangles are drawn, calculate the ratios: QR divided by BC, PQ divided by AB, and PR divided by AC. Write down what you notice."

Student Work Time (8 minutes)

[DO] Circulate among pairs. Check that constructions are accurate.

[ASK] To pairs who finish the ratios early: "What value did you get for each ratio? Are they the same or different?"

[ASK] "Now compare the angles. What do you notice about angle ABC and angle PQR?"

[ASK] "If I told you one triangle is a 'bigger version' of the other, would you agree? Why?"

[DO] For struggling pairs: Point to corresponding sides using colour coding — "The shortest side in the small triangle matches the shortest side in the big triangle."

[DO] Note which pairs have clear explanations for the sharing phase.

Class Sharing (2 minutes)

[SAY] "Let's hear from a few pairs. What did you discover about the ratios?"

[WAIT] Call on 2-3 pairs to share.

[SAY] "Excellent! Most of you found that $QR/BC = 15/5 = 3$, $PQ/AB = 21/7 = 3$, and $PR/AC = 18/6 = 3$. All three ratios are equal to 3."

[ASK] "And what about the angles?"

[SAY] "Yes! The corresponding angles are exactly equal. This is a very important mathematical relationship that we will now formalise."

Phase 2: Structured Instruction (10 minutes)

Formalising Definitions (4 minutes)

[SAY] "What you just discovered has a name in mathematics. When two shapes have equal corresponding angles and their corresponding sides are in the same ratio, we say the shapes are SIMILAR."

[WRITE] On the board: "Two triangles are similar if: (1) Their corresponding angles are equal, AND (2) Their corresponding sides are in the same ratio."

[SAY] "Similarity means one shape can be transformed into the other through scaling — making it bigger or smaller — without changing its shape. Think of it like zooming in or zooming out on a photograph."

[SAY] "The process of making a shape bigger while keeping it similar is called ENLARGEMENT. The number we multiply by is called the SCALE FACTOR."

[WRITE] On the board: "Scale Factor = Image length \div Object length"

[SAY] "In our activity, triangle PQR is the IMAGE and triangle ABC is the OBJECT. The scale factor is 3 because every side of PQR is 3 times the corresponding side of ABC."

Key Properties (3 minutes)

[SAY] "Let me share some important properties of enlargement."

[WRITE] "If scale factor $> 1 \rightarrow$ image is LARGER (enlargement)"

[WRITE] "If $0 < \text{scale factor} < 1 \rightarrow$ image is SMALLER (reduction)"

[WRITE] "If scale factor is negative \rightarrow image is on the OPPOSITE side and INVERTED"

[SAY] "There is also a special point called the CENTRE OF ENLARGEMENT. This is the fixed point from which all measurements are taken. If you draw lines from each point on the object to its corresponding image point, all those lines meet at the centre of enlargement."

[ASK] "In our anchor activity, if we had a centre of enlargement, what would the ratio OA'/OA equal?"

[WAIT] Allow students to respond.

[SAY] "Correct! It would also equal 3, the same as our scale factor."

Addressing Misconceptions (3 minutes)

[SAY] "Let me address a common mistake. When identifying corresponding sides, you must match them by their POSITION in the triangles, not by their size."

[SAY] "For example, the side OPPOSITE the 50-degree angle in triangle ABC is $AC = 6$ cm. The side opposite the 50-degree angle in triangle PQR is $PR = 18$ cm. These are corresponding sides."

[ASK] "What is 18 divided by 6?"

[WAIT] Students respond: "3."

[SAY] "Exactly! Always check that ALL ratios give the same value. If even one ratio is different, the triangles are NOT similar."

Phase 3: Practice and Application (10 minutes)

Worked Example (3 minutes)

[SAY] "Let's work through a problem together. Triangles PQR and ABC are similar. AB corresponds to PQ, BC corresponds to QR, and AC corresponds to PR."

[WRITE] On the board: "AB = 6 cm, AC = 9 cm, PR = 12 cm, QR = 14 cm. Find x (BC) and y (PQ)."

[SAY] "Since the triangles are similar, we can write: $AB/PQ = AC/PR = BC/QR$."

[WRITE] " $6/y = 9/12 = x/14$ "

[SAY] "Let's find y first. From $6/y = 9/12$, we cross-multiply: y times 9 equals 6 times 12, so y equals 72 divided by 9, which gives us $y = 8$ cm."

[SAY] "Now for x. From $9/12 = x/14$, we cross-multiply: x times 12 equals 9 times 14, so x equals 126 divided by 12, which gives us $x = 10.5$ cm."

[ASK] "Does everyone follow the cross-multiplication step?"

Independent Practice (5 minutes)

[SAY] "Now try this problem on your own. Triangles XYZ and PQR are similar. Angle ZYX = 72 degrees, angle YZX = 61 degrees, YZ = 16 cm, PQ = 40 cm, XY = 12 cm. Find angle QPR, angle PQR, and the length of PR."

[DO] Give students 4 minutes to work. Circulate and assist.

[ASK] To students who finish early: "Can you verify your answer by checking the ratio with another pair of sides?"

[DO] After 4 minutes, call on a student to share the solution.

[SAY] "The answers are: angle QPR = 72 degrees, angle PQR = 61 degrees, and PR = 30 cm. Well done to those who got it right!"

Digital Checkpoint (2 minutes)

[SAY] "If you have access to the digital textbook, open the Enlargement section and try the interactive checkpoints. Click 'Show new example question' to get a fresh problem each time."

[DO] Display the digital textbook checkpoint on the projector if available.

Phase 4: Assessment — Exit Ticket (5 minutes)

[SAY] "For our exit ticket today, please answer these four questions on a separate piece of paper. You have 5 minutes."

[DO] Display or read out the four assessment questions.

[SAY] "Question 1: Determine which of these triangles are similar by comparing corresponding sides: Triangle A (6, 4, 3 cm), Triangle B (24, 16, 12 cm), Triangle C (20, 18, 14 cm)."

[SAY] "Question 2: Triangle ABC is similar to triangle DEF. $AB = x$, $BC = 6$ cm, angle $ABC = 56$ degrees, $DE = 14$ cm, $EF = 7$ cm, angle $DEF = \theta$. Find θ and x ."

[SAY] "Question 3: In the figure, $TP = 8$ cm, $PQ = 5$ cm, $TS = 16$ cm, $SR = x$. Find x ."

[SAY] "Question 4: Triangle ABE is similar to triangle ACD. $DC = 24$ cm, $AE = 6$ cm, $ED = 12$ cm. Find BE ."

[DO] Collect exit tickets as students leave.

Answer Key:

- 1. Triangles A and B are similar (ratios all equal 4). Triangle C is not similar.
- 2(a). $\theta = 56^\circ$. 2(b). $x/14 = 6/7 \rightarrow x = 12$ cm.
- 3. $8/16 = 5/x \rightarrow x = 10$ cm.
- 4. $AE/AD = BE/DC \rightarrow 6/18 = BE/24 \rightarrow BE = 8$ cm.

Differentiation Notes

Struggling Learners:

Provide pre-drawn triangles with measurements. Use colour-coded corresponding sides. Offer a step-by-step checklist for finding ratios.

On-Level Learners:

Complete all problems independently. Encourage peer teaching. Use digital textbook checkpoints for additional practice.

Advanced Learners:

Explore enlargement with coordinates and negative scale factors. Solve real-world problems: photograph resizing (10 cm \rightarrow 25 cm width, find new height), map scales (1:50,000), and architectural models.

Post-Lesson 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 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?