Step by Step Guide: Identifying Lines of Symmetry Given an Object

Lesson Information

Topic	Properties of symmetry and reflection
Grade Level	10
Duration	40 minutes (15 + 10 + 15 + Exit Ticket)
Materials	CBC Grade 10 Mathematics Textbooks, A4 paper, scissors, rulers, pencils

Pre-Class Preparation Checklist

- Prepare enough A4 paper sheets for each group (at least 2 per group)
- Ensure each group has scissors, rulers, and pencils
- Write definitions of symmetry and line of symmetry on the board (covered until Phase 2)
- Prepare the shapes reference table on the board or chart paper
- Print or write the alphabet letters in large font for the practice activity
- Have extension activity problems ready for advanced learners

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

Opening Hook (2 minutes)

[SAY] "Good morning, class! Look around this classroom. Can you spot anything that looks the same on both sides? Think about doors, windows, desks, even your own face."

[WAIT] 10 seconds for students to observe

[ASK] "Who can name something in this room that looks the same on both sides?"

[WAIT] for 2–3 responses (Expected: door, window, clock, whiteboard)

[SAY] "Great observations! That quality of looking the same on both sides is called SYMMETRY. Today we're going to discover exactly how symmetry works by folding paper. Let's get started!"

Anchor Activity: Paper Folding (10 minutes)

[DO] Distribute A4 paper, scissors, rulers, and pencils to each group.

[SAY] "Each group needs to cut out a square from your paper. Label the four corners A, B, C, and D – A at the top left, B at the top right, C at the bottom right, and D at the bottom left."

[DO] Draw the labelled square on the board for reference.

[WAIT] 1 minute for groups to prepare their squares

[SAY] "Step 1: Fold your square in half from LEFT to RIGHT, so that corner A lines up exactly with corner B, and corner D lines up with corner C. You should have a rectangle."

[DO] Demonstrate the fold with your own paper.

[SAY] "Now unfold it. You'll see a crease line running down the middle. Draw a dotted line along that crease and label it XY."

[ASK] "What do you notice about the left side and the right side of line XY?"

[WAIT] for response (Expected: "They are exactly the same" or "identical")

[SAY] "Step 2: Now fold your square from TOP to BOTTOM, so corner D lines up with corner A and corner C lines up with corner B. Another rectangle."

[DO] Demonstrate the fold.

[SAY] "Unfold and draw a dotted line along this crease. Label it RS."

[ASK] "Is the pattern the same? Are both halves identical?"

[WAIT] for confirmation

[SAY] "Step 3: Now fold from corner A to corner C – that's a diagonal fold. You'll get a triangle."

[DO] Demonstrate the diagonal fold.

[SAY] "Unfold and trace the crease line. This goes along BD."

[SAY] "Step 4: Finally, fold from corner D to corner B – the other diagonal. Unfold and trace the crease along AC."

[ASK] "How many dotted lines do you have on your square now?"

[WAIT] for response (Expected: "Four")

Group Sharing (3 minutes)

[ASK] "What is special about each of these four lines? What do they all have in common?"

[WAIT] for responses (Expected: "Each line divides the square into two identical halves")

[ASK] "If I drew a random line through the square – say from one corner to the middle of a non-opposite side – would that also divide it into identical halves?"

[WAIT] for response (Expected: "No, the halves wouldn't be identical")

[SAY] "Excellent thinking! Not every line through a shape creates identical halves. Only special lines do. Let's now give these special lines a proper name."

Phase 2: Structured Instruction (10 minutes)

Defining Symmetry (3 minutes)

[SAY] "Based on what you discovered, let me give you the formal definition."

[WRITE] On the board:

"Symmetry is when an object or shape looks exactly similar or identical on one side and the other side when the object is folded, flipped, rotated, or reflected."

[SAY] "And those four dotted lines you drew? They have a special name."

[WRITE] On the board:

"A line of symmetry divides an object or shape into similar/identical parts – one half is the mirror image of the other half."

[SAY] "So your square has 4 lines of symmetry: XY, RS, BD, and AC. Two are straight (vertical and horizontal) and two are diagonal."

Lines of Symmetry in Common Shapes (4 minutes)

[SAY] "Let's look at how many lines of symmetry other shapes have."

[WRITE] Draw the reference table on the board:

• Equilateral Triangle: 3 lines (vertex to midpoint of opposite side)

• Square: 4 lines (2 straight + 2 diagonal)

• Rectangle: 2 lines (1 vertical + 1 horizontal, NOT diagonals)

• Regular Pentagon: 5 lines

• Regular Hexagon: 6 lines

• Circle: Infinite lines

• Isosceles Triangle: 1 line

[ASK] "Can anyone spot the pattern for regular polygons?"

[WAIT] for response (Expected: "The number of lines equals the number of sides")

[SAY] "Exactly! A regular polygon with n sides has exactly n lines of symmetry. This is a powerful rule to remember."

Addressing Misconceptions (3 minutes)

[SAY] "Now, here's a very common mistake. Many people think a rectangle has 4 lines of symmetry, just like a square. But it doesn't! Let me show you why."

[DO] Draw a rectangle on the board. Show that folding along the diagonal does NOT create identical halves – the triangles overlap unevenly.

[SAY] "When you fold a rectangle along its diagonal, the two triangles are the same size but they are NOT mirror images along that fold line. So the diagonal is NOT a line of symmetry for a rectangle. A rectangle has only 2 lines of symmetry."

[ASK] "Can a shape have zero lines of symmetry?"

[WAIT] for response (Expected: "Yes – irregular shapes, parallelogram")

[SAY] "Correct! A parallelogram, for example, has no lines of symmetry even though it looks 'balanced.' Always test by folding or using a mirror."

Phase 3: Practice and Application (15 minutes)

Worked Example: Equilateral Triangle (3 minutes)

[SAY] "Let's work through an example together. How many lines of symmetry does an equilateral triangle have?"

[DO] Draw an equilateral triangle on the board.

[SAY] "An equilateral triangle has all sides equal and all angles equal. Each line of symmetry goes from one vertex straight down to the midpoint of the opposite side."

[WRITE] Draw all 3 lines of symmetry on the triangle, labelling each.

[SAY] "So an equilateral triangle has 3 lines of symmetry. This confirms our rule: 3 sides = 3 lines of symmetry."

Alphabet Symmetry Challenge (7 minutes)

[SAY] "Now for a fun challenge! I want you to work with your partner. Look at every letter of the alphabet and decide: does it have a line of symmetry? If so, is it vertical, horizontal, or both?"

[WRITE] Display on the board:

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

[SAY] "Sort each letter into one of four groups: vertical symmetry only, horizontal symmetry only, both vertical and horizontal, or no symmetry at all."

[DO] Circulate among pairs. Use these probing questions:

- "Try imagining folding the letter A in half vertically. Do both halves match?"
- "What about the letter B? Try folding it horizontally instead."
- "Does the letter S have any line of symmetry? Be careful – test it!"
- "How is the letter H different from the letter A in terms of symmetry?"

[DO] After 5 minutes, review answers together:

• Vertical only: A, M, T, U, V, W, Y

• Horizontal only: B, C, D, E, K

• Both: H, I, O, X

• None: F, G, J, L, N, P, Q, R, S, Z

Real-World Symmetry Hunt (5 minutes)

[SAY] "For our final practice, look around this classroom. With your group, find at least 5 objects that have lines of symmetry. Write down the object and how many lines of symmetry it has."

[DO] Allow groups to explore the classroom. Circulate and guide.

[SAY] "Remember – also think about objects at home. Doors, windows, plates, butterflies, leaves... symmetry is everywhere!"

[DO] Have 2–3 groups share their findings.

Phase 4: Assessment – Exit Ticket

[SAY] "For our exit ticket, complete these questions independently in your notebooks."

[WRITE] Display exit ticket questions:

1. Identify the lines of symmetry in each of the 26 alphabetical letters.

2. Identify and draw lines of symmetry on 5 different objects in your classroom or at home.

3. How many lines of symmetry does a regular hexagon have? Draw and label each one.

4. Explain why a rectangle has 2 lines of symmetry but NOT 4.

5. Design a logo with exactly 3 lines of symmetry. Sketch and explain.

Closure (1 minute)

[SAY] "Today we discovered that symmetry is all about mirror images. A line of symmetry divides a shape into two identical halves. We learned that a square has 4, an equilateral triangle has 3, and a regular polygon with n sides has n lines of symmetry. Most importantly, we saw that symmetry is everywhere – in letters, in our classroom, and in nature. For homework, find 10 symmetric objects at home and draw their lines of symmetry. See you next class!"

Complete Answer Key

1. Alphabet Symmetry:

Vertical only: A, M, T, U, V, W, Y

Horizontal only: B, C, D, E, K

Both: H, I, O, X

None: F, G, J, L, N, P, Q, R, S, Z

2. Answers will vary. Accept any correct identification with drawn lines.

3. Regular hexagon: 6 lines of symmetry (3 vertex-to-vertex + 3 midpoint-to-midpoint)

4. Rectangle: Only 2 lines (vertical and horizontal). Diagonals do NOT create mirror-image halves.

5. Accept any design based on equilateral triangle or 3-fold symmetric shape.

Differentiation Notes

Struggling Learners: Provide pre-cut shapes for physical folding. Use mirrors to verify symmetry. Start with simple shapes before letters. Focus on questions 1 and 2 from the exit ticket.

On-Level Learners: Complete all practice activities and exit ticket questions. Verify answers by folding or using a ruler.

Advanced Learners: Extend to challenge problems: symmetry in flags, architecture, tile patterns, and rotational vs reflective symmetry. Create a symmetry portfolio.

Post-Lesson Reflection Prompts

1. Did the paper folding activity effectively help students discover lines of symmetry?
2. Were students able to distinguish between lines of symmetry and other lines through a shape?
3. Which letters caused the most confusion?
4. How well did students connect symmetry to real-world objects?
5. Were differentiation strategies effective?
6. Was the 40-minute timeframe sufficient?
7. What modifications would improve this lesson?