Step by Step Guide: Rotational Symmetry of Plane Figures

Pre-Class Preparation Checklist

- Print multiple copies of the 5-pointed star figure (one per group).
- Prepare construction paper (one sheet per group).
- Ensure push pins, pencils, and scissors are available for each group.
- Print copies of regular polygons: equilateral triangle, square, pentagon, hexagon, octagon.
- Prepare alphabet letter cards: H, I, N, O, S, X, Z, A, B, C.
- Write the formula on chart paper: Order of rotational symmetry = 360° / angle between identical parts.
- Prepare the order table for common shapes on chart paper or be ready to build it on the board.
- Have the digital textbook open: Section 2.3.3 Rotational Symmetry.
- Prepare exit ticket handouts with 5 questions.
- Optional: Bring pictures of real-life objects with rotational symmetry (wheels, flowers, logos, snowflakes).

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

Opening Hook (2 minutes)

[DO] Hold up a picture of a flower with 5 petals (or a 5-pointed star).

[SAY] "Look at this flower. If I rotate it around its centre, will it look the same at some point before I complete a full turn?"

[WAIT] Expected: "Yes!" "It will look the same."

[SAY] "Exactly! Some shapes have a special property called ROTATIONAL SYMMETRY. Today, we're going to discover how many times a shape looks the same during one complete turn."

[ASK] "Can you think of other objects that would look the same if you rotated them? Maybe a wheel? A clock?"

[WAIT] Expected: "Wheels." "Clock." "Snowflake." "Logo."

[SAY] "Great examples! Let's investigate this property mathematically."

Anchor Activity Launch (3 minutes)

[DO] Distribute printed star figures, construction paper, push pins, and scissors to each group.

[SAY] "Here's your challenge: You have a 5-pointed star. Your job is to find out how many times this star looks EXACTLY the same when you rotate it one full turn."

[SAY] "Here's what you'll do:"

[SAY] "Step 1: Trace the star onto your construction paper and cut it out carefully."

[SAY] "Step 2: Place your tracing on top of the printed star."

[SAY] "Step 3: Push a pin through the centre of both so the tracing can rotate freely."

[SAY] "Step 4: Slowly rotate the tracing. Every time it looks EXACTLY like the original, count it."

[SAY] "Step 5: Record your count in the table."

[SAY] "Work in your groups. You have 8 minutes."

Student Work Time (8 minutes)

[DO] Circulate among groups.

[ASK] To a group rotating the star: "How many times has it fit so far?"

[WAIT] Expected: "Three times." "Five times."

[ASK] "Did you count the starting position?"

[WAIT] Expected: "Yes!" or "Oh, we forgot!"

[SAY] "Make sure you count the starting position as the first time it fits."

[ASK] To another group: "Why do you think the star fits 5 times?"

[WAIT] Expected: "Because it has 5 points." "The points are evenly spaced."

[SAY] "Excellent observation! The number of identical parts is connected to how many times it fits."

[DO] For struggling groups: "Let's do it together. Start here — that's 1. Now rotate slowly. Stop! Does it look the same? Yes — that's 2. Keep going."

[DO] For early finishers: "What if you had a square instead of a star? How many times would it fit?"

Class Sharing (2 minutes)

[SAY] "Let's share your results. How many times did the star fit onto itself?"

[WAIT] Expected: "5 times."

[SAY] "And why do you think it's 5?"

[WAIT] Expected: "Because it has 5 points." "The points are evenly spaced."

[SAY] "Perfect! You've discovered the ORDER of rotational symmetry. Let's formalise this concept."

Phase 2: Structured Instruction (10 minutes)

Formalising the Concept (4 minutes)

[SAY] "You discovered that the star fits onto itself 5 times in one complete turn. This number has a special name."

[WRITE] "Order of Rotational Symmetry = the number of times a figure fits onto itself in one complete turn (360°)."

[SAY] "For the 5-pointed star, the order of rotational symmetry is 5."

[SAY] "Now, there's a formula we can use when we know the angle between the identical parts."

[WRITE] "Order of rotational symmetry = 360° / angle between the identical parts"

[SAY] "For the star, the angle between each point is 360° / 5 = 72°. If we use the formula: Order = 360° / 72° = 5. It matches!"

Building the Reference Table (4 minutes)

[SAY] "Let's build a table of common shapes and their orders of rotational symmetry."

[WRITE] Build the table on the board:

[WRITE] "Equilateral triangle — Order 3 — Angle 120°"

[WRITE] "Square — Order 4 — Angle 90°"

[WRITE] "Regular pentagon — Order 5 — Angle 72°"

[WRITE] "Regular hexagon — Order 6 — Angle 60°"

[WRITE] "Regular octagon — Order 8 — Angle 45°"

[WRITE] "Circle — Order Infinite — Any angle"

[SAY] "Notice the pattern: a regular polygon with n sides has order n rotational symmetry."

[ASK] "What about a rectangle that's NOT a square?"

[WAIT] Expected: "Order 2?" "It looks the same when rotated 180°."

[SAY] "Correct! A rectangle has order 2. It fits at 0° and 180°."

Important Notes (2 minutes)

[SAY] "Three important points:"

[WRITE] "1. All shapes have at least order 1 rotational symmetry (the original position)."

[WRITE] "2. Regular polygons with n sides have order n."

[WRITE] "3. A circle has infinite rotational symmetry because it looks the same at any angle."

[SAY] "Shapes with NO rotational symmetry other than order 1 are called asymmetric."

Phase 3: Practice and Application (10 minutes)

Worked Example: Using the Formula (2 minutes)

[SAY] "Let's work through the textbook example. A figure has an angle of 45° between its identical parts. What is its order of rotational symmetry?"

[SAY] "Which formula do we use?"

[WAIT] Expected: "Order = 360° / angle."

[SAY] "Correct!"

[WRITE] "Order = 360° / 45°"

[WRITE] "Order = 8"

[SAY] "So the figure has order 8 rotational symmetry. It fits onto itself 8 times in one full turn."

Student Practice (5 minutes)

[SAY] "Now try these problems on your own."

[WRITE] "Problem 1: A regular hexagon has 6 sides. What is its order of rotational symmetry?"

[WRITE] "Problem 2: A shape has order 10. What is the angle between the identical parts?"

[WRITE] "Problem 3: Which letters have rotational symmetry? H, N, Z, A, B"

[SAY] "Work individually first, then check with your partner. 4 minutes."

[WAIT] 4 minutes.

[SAY] "Let's check. Problem 1: hexagon?"

[WAIT] Expected: "Order 6."

[SAY] "Correct! A regular hexagon has 6 identical parts, so order 6."

[SAY] "Problem 2: Order 10, find the angle?"

[WAIT] Expected: "360° / 10 = 36°."

[SAY] "Perfect! The angle is 36°."

[SAY] "Problem 3: Which letters?"

[WAIT] Expected: "H, N, Z."

[SAY] "Exactly! H, N, and Z all have order 2 rotational symmetry. They look the same when rotated 180°."

Real-Life Connection (3 minutes)

[DO] Show pictures of real-life objects: wheel, flower, snowflake, logo.

[ASK] "Can you identify the order of rotational symmetry for each?"

[WAIT] Expected: "Wheel with 5 spokes — order 5." "Flower with 6 petals — order 6." "Snowflake — order 6."

[SAY] "Excellent! Rotational symmetry is everywhere in nature and design."

Phase 4: Assessment — Exit Ticket (5 minutes)

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

[SAY] "Question 1: Define the order of rotational symmetry."

[SAY] "Question 2: A figure has an angle of 30° between its identical parts. What is its order?"

[SAY] "Question 3: State the order for: (a) equilateral triangle, (b) square, (c) regular pentagon."

[SAY] "Question 4: Which letters have rotational symmetry? A, B, H, N, Z"

[SAY] "Question 5: Give two real-life examples with their order."

[DO] Collect exit tickets as students finish.

Answer Key:

- 1. The number of times a figure fits onto itself in one complete turn (360°).
- 2. Order = 360° / 30° = 12.
- 3. (a) 3, (b) 4, (c) 5.
- 4. H, N, Z have rotational symmetry (order 2).
- 5. Wheel with 5 spokes — order 5. Flower with 6 petals — order 6.

Differentiation Notes

Struggling Learners:

Provide pre-cut figures with centre marked. Use simple shapes: triangle, square, pentagon. Count together as a class. Provide reference card with formula. Allow tracing paper instead of push pins. Pair with stronger students.

On-Level Learners:

Complete all practice problems. Identify order for regular polygons. Find angle given order. Identify letters with rotational symmetry. Recognise real-life examples.

Advanced Learners:

Investigate relationship between sides and order. Explore irregular shapes (rectangle, parallelogram). Design logo with order 8. Investigate 3D rotational symmetry (cube axes). Prove angle sum formula for regular n-gon.

Post-Lesson Reflection

1. Did the tracing and rotating activity help students discover the order of rotational symmetry?

2. Were students able to count the number of times the shape fit accurately?

3. Did students understand the formula: Order = 360° / angle?

4. Were students able to apply the formula to solve problems?

5. Did students recognise rotational symmetry in real-life objects?

6. What common errors arose (e.g., not counting starting position, confusing with line symmetry)?

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