



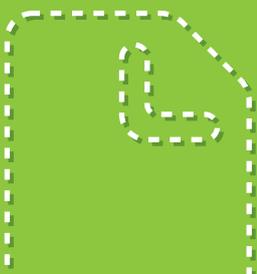
Have fun and learn with

# SYMMETRY SCHOOL



Rotational Symmetry

Lesson Plan



Have fun and learn with  
**SYMMETRY**  
**SCHOOL**

## Lesson Plan: Rotational Symmetry

Symmetry School encourages learners to use their intuition to explore symmetrical puzzles. Through gameplay, learners are aided in developing a foundation in spatial reasoning, problem solving and visualization.

### GRADE LEVEL

Adaptable for grades 3 – 8

### OVERVIEW

Students will use the **Symmetry School: Learning Geometry** iPad app to explore concepts of rotational symmetry. Students will explore rotationally symmetrical patterns, and will develop their spatial sense to create strategies to help them solve problems. Students will also verbalize and make connections between mathematical concepts and problem-solving.

### LEARNING OUTCOMES

- Apply concepts of symmetry to a game environment.
- Use an understanding of rotational symmetry to complete the missing part of a pattern.
- Recognise spatial patterns and relationships and make predictions about them.
- Verbalise and make connections between mathematical concepts and problem-solving.
- Develop a foundation for understanding symmetry at later levels.

## LEARNER BACKGROUND

Students should have a background understanding of basic reflective (line) symmetry and should be able to identify horizontal and vertical lines of symmetry in shapes and patterns.

## VOCABULARY

geometry, symmetry, reflective symmetry, rotational symmetry, reflection, rotation, mirroring, line of symmetry, grid, coordinate, square, counter, quadrant, orientation, clockwise, degrees

## MATERIALS/RESOURCES

- iPad with 'Symmetry School: Learning Geometry' app installed
- Optional: Internet access to 'Symmetry School Online' ([www.spraoischool.com/members/symmetry-school](http://www.spraoischool.com/members/symmetry-school))
- Optional: Interactive whiteboard or LCD projector
- Symmetry School 'Reflective Symmetry: Print Activities – Pack 1' ([www.spraoischool.com/symmetry-school/print-activities](http://www.spraoischool.com/symmetry-school/print-activities))
- Colored pencils, pens or crayons.

## CURRICULUM ALIGNMENT

### **CCSS.Math.Practice.MP1**

Make sense of problems and persevere in solving them.

### **CCSS.Math.Practice.MP4**

Model with mathematics.

### **CCSS.Math.Content.4.G.A.3**

Recognize a line of symmetry for a two-dimensional figure as a line across the figure such that the figure can be folded along the line into matching parts. Identify line-symmetric figures and draw lines of symmetry.

### **CCSS.Math.Content.8.G.A.1**

Verify experimentally the properties of rotations, reflections, and translations.

### **CCSS.Math.Content.8.G.A.2**

Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them.

### **CCSS.Math.Content.8.G.A.3**

Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.

## LESSON ACTIVITIES

### STEP 1

Allow students to play the 'Rotational Symmetry - Easy' level of Symmetry School, either independently or in pairs. Ask students to avoid clicking on the 'Show Me' button, and, instead, problem-solve with their partner or group to solve the initial puzzles.

### STEP 2

Have students pause and meet for a class discussion to explore the terms and concepts used in the game. Ask students about the strategies they used during their gameplay. These might include:

- Placing all counters of a single colour at a time
- Completing a single quadrant at a time
- Visualizing rotating or flipping a quadrant around or across the centre point of the grid
- Counting grid squares or plotting coordinates
- Counting outwards from the centre point or the edge of the board

Encourage the students to build the discussion around these points. Which method of gameplay did the students find most effective? Project the game for the class to see and click on the 'Show Me' button to illustrate the concept of rotational symmetry. Hand out printed worksheets from 'Rotational Symmetry: Print Activities - Pack 1', so that students can color, fold or cut the sheets to model their understanding of the concepts.

### STEP 3

Ask students to move on to the 'Rotational Symmetry - Medium' level of Symmetry School. How does the increased pattern difficulty affect the students' strategies for solving the puzzles?

As students explore the game, walk between groups and ask questions to facilitate their thinking and encourage students to explain their strategies. If students require further guidance in understanding rotational symmetry, demonstrate the concept by folding or cutting printed worksheets from 'Rotational Symmetry: Print Activities – Pack 1'.

#### **STEP 4**

Give students some time to progress to and explore the 'Rotational Symmetry - Hard' level of Symmetry School. How does the introduction of a rotatable shape influence their problem-solving strategies? Challenge the students to complete the games in the minimum available number of moves. Ask the students to share their results with the 'Email Results' feature of the iPad game. Alternatively, use the snapshot feature of the iPad to share student scores.

### **CREATIVE EXERCISE**

#### **EXERCISE 1**

Is it possible to create a pattern that has both reflective *and* rotational symmetry at the same time? Students could attempt this individually using either the printed worksheets or the 'Free Play' mode of Symmetry School on iPads, or as a class using 'Symmetry School Online' on the whiteboard.

#### **EXERCISE 2**

Challenge students to create their own rotationally symmetrical patterns and pictures using either the 'Free Play' mode, or blank printouts of the Freeplay worksheet from 'Rotational Symmetry: Print Activities – Pack 1'.

# Appendix:

## Rotational Symmetry Hints

**Symmetry School** features contextual hints at each difficulty level. These hints offer the student different ways of thinking about solving the puzzle.

### LEVEL: EASY

**Instruction:** Drag the counters onto the grid to make a pattern that rotates symmetrically around the centre point.

- **Hint:** Try rotating all counters of one colour at a time.
- Hint: Try rotating all counters in one row or column at a time.
- Hint: Try to imagine rotating any one of the four sections of the grid  $90^\circ$  around the centre point. Where will the counters be?

### LEVEL: MEDIUM

**Instruction:** Drag the counters onto the grid to make a pattern that rotates symmetrically around the centre point.

- **Hint:** Try to imagine flipping any one of the four sections of the grid diagonally across the centre point. Where will the counters end up?
- **Hint:** Try working out the position of where the counters should be in one section by counting the amount of empty squares in the other sections of the grid.

### LEVEL: HARD

**Instruction:** Drag the counters onto the grid to make a pattern that rotates symmetrically around the centre point.

- **Hint:** Try rotating all counters of one shape at a time.
- **Hint:** Try to imagine flipping any one of the four sections of the grid diagonally across the centre point. Where will the counters end up?
- **Hint:** Try working out the position of where the counters should be in one section by counting the amount of empty squares in the other sections of the grid.



Learn more at: [www.spraoischool.com](http://www.spraoischool.com)

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