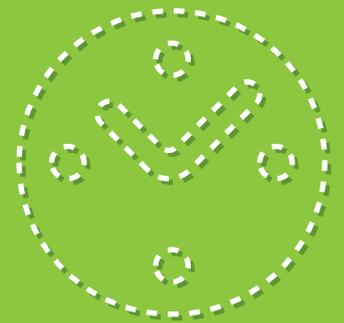




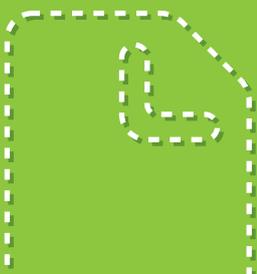
Have fun and learn with

SYMMETRY SCHOOL



Reflective Symmetry

Lesson Plan



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SCHOOL

Lesson Plan: Reflective 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 reflective symmetry. Students will explore symmetrical patterns using both vertical and horizontal lines of symmetry, 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 reflective 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)
- Optional: Interactive whiteboard or LCD projector
- Symmetry School 'Reflective Symmetry: Print Activities – Pack 1' (www.spraoischool.com/symmetry-school/for-teachers)
- 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 'Reflective 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 row or column at a time
- Imagining folding the board in half
- Counting grid squares or plotting coordinates
- Counting outwards from the line of symmetry 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 reflective symmetry. Hand out printed worksheets from 'Reflective Symmetry: Print Activities – Pack 1', so that students can color and fold the sheets to model their understanding of the concepts.

STEP 3

Ask students to move on to the 'Reflective Symmetry - Medium' level of Symmetry School. How does the introduction of a second, horizontal line of symmetry change 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. Students may need some guidance in understanding how to extend the concept to two lines of symmetry; demonstrate horizontal and vertical lines of symmetry by folding printed worksheets from 'Reflective Symmetry: Print Activities – Pack 1'.

STEP 4

Give students some time to progress to and explore the 'Reflective 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

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

Ideas include:

- Ask students to create symmetrical pictures based on objects, objects from the environment, or seasonal themes.
- Ask students to create half of a pattern or picture and then swap their game with a partner to complete the other half.
- Ask students to create symmetrical objects (building, vehicles, trees, etc.) for a Symmetrical City. Print out the students' designs and create a 'Symmetrical City' wall display.
- Ask students to create symmetrical patterns with two lines of symmetry. Print out the students' designs and use each pattern grid to create a larger mosaic pattern.

Appendix:

Reflective 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 is symmetrical about the line of symmetry.

- **Hint:** Try mirroring all counters of one colour at a time.
- **Hint:** Try mirroring all counters in one row or column at a time.
- **Hint:** Try to imagine folding the board along the line of symmetry. What squares on the empty side of the grid will the counters touch?
- **Hint:** Try counting grid squares outwards from the line of symmetry. How many squares from the line of symmetry is the counter?

LEVEL: MEDIUM

Instruction: Drag the counters onto the grid to make a pattern that is symmetrical about both lines of symmetry.

- **Hint:** Try mirroring all counters in any one of the four sections of the grid at a time.

- **Hint:** Try mirroring all counters across only one of the lines of symmetry first.
- **Hint:** Try counting grid squares outwards from each line of symmetry. How many squares from each line of symmetry is the counter?
- **Hint:** Try working out the position of counters by counting the squares on the grid.

LEVEL: HARD

Instruction: Drag the counters onto the grid to make a pattern that is symmetrical about both lines of symmetry.

- **Hint:** Try counting grid squares outwards from each line of symmetry. How many squares from each line is the counter?
- **Hint:** Try working out the position of the counters by counting the squares on the grid.
- **Hint:** Try mirroring all counters of one shape at a time.



Learn more at: www.spraoischool.com

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