

Reflections

Lesson Topic _____ **Grade** _____

Reflections and glide reflections

5

Lesson Length _____

50 minutes

NCTM Standards Addressed _____

- Explore congruence and similarity.
- Make and test conjectures about geometric properties and relationships and develop logical arguments to justify conclusions.
- Predict and describe the results of sliding, flipping, and turning two-dimensional shapes.
- Describe a motion or a series of motions that will show that two shapes are congruent.
- Understand such attributes as length, area, weight, volume, and size of angle and select the appropriate type of unit for measuring each attribute.
- Understand that measurements are approximations and understand how differences in units affect precision.
- Select and apply appropriate standard units and tools to measure length, area, volume, weight, time, temperature, and the size of angles.

Sample State Standards Addressed _____

- Select and use appropriate instruments and units for measuring quantities (e.g., perimeter, volume, area, weight, time, temperature).
- Select and use standard tools to measure the size of figures with specified accuracy, including length, width, perimeter, and area.
- Estimate, refine, and verify specified measurements of objects.
- Construct two- and three-dimensional shapes and figures using manipulatives, geoboards, and computer software.
- Represent and use the concepts of line, point, and plane.
- Analyze simple transformations of geometric figures and rotations of line segments.
- Identify properties of geometric figures (e.g., parallel, perpendicular, similar, congruent, symmetrical).

Student Objectives

Students will:

- create a reflection of a polygon using a Mira™
- discover that a line connecting a vertex of a polygon and the corresponding vertex of its reflection is perpendicular to the line of reflection
- discover that the line of reflection bisects a line connecting a vertex of a polygon and the corresponding vertex of its reflection
- discover that a shape and its reflection across a line are congruent
- be able to create a glide reflection of a shape
- discover that a shape and its glide reflection are congruent
- recognize that a glide reflection is a combination of a reflection and a translation.

Grouping for Instruction

- Whole class for launch and closure
- Small groups of four or five for the investigation

Overview of Lesson

Students use a Mira™ to investigate reflections and glide reflections. Students are guided to discover that these transformations are rigid transformations—a reflection or a glide reflection is congruent to the original shape. Students use measurement to discover properties of a shape and its reflection.

Background Information

Students should have been given time to play with a Mira™ prior to starting this lesson. Students need to know how to measure angles using a protractor and how to measure lengths fairly accurately using a ruler. They should be familiar with the concepts of perpendicular lines and the midpoint of a line segment.

Materials and Equipment

- A classroom set of Miras™
- A full-length mirror
- A classroom set of pattern blocks
- An overhead set of pattern blocks
- An overhead projector
- Blank paper
- Rulers
- Protractors
- Transparency of a picture of footprints in the sand

Procedure

A. Motivation and introduction

1. Have several students stand in front of the full-length mirror. “What do you notice about <Josh> and his reflection?”
2. Place a transparency with a line on the overhead. Place an overhead triangle pattern block on one side of the line. Ask a student to place a triangle pattern block showing in the position and orientation it would be if the triangle were “flipped” (reflected) over the line.
3. Ask the class if the student placed the triangle correctly. Ask respondents to explain the reasons for saying the student is or is not correct.
4. Show an overhead transparency of a picture of footprints in the sand. Ask a student to place the transparency with a line so the footprints are equally spaced on each side of the line.
5. Ask the students if the right footprint is a reflection of the left footprint. Get them to explain that it is not a reflection because it is not directly across the line from the left footprint. Explain that a glide reflection is a slide or translation followed by a reflection. Ask a student to show the slide/translation followed by a reflection.
6. Ask the students to look around the room. Is anyone wearing any clothing that includes a reflection or glide reflection? How about a translation?
7. Ask why reflections or glide reflections might be used in clothing.

B. Development (including discussion points and feedback)

1. Place the students in heterogeneous cooperative groups of about four students each.
2. Assign a task to each person in a team (leader, recorder, reporter etc.).
3. Distribute the worksheet “Pattern Blocks, Mira, and Reflections” (page 117).
4. Ask the teams to complete the “Pattern Blocks, Mira, and Reflections” project.
5. Circulate among the groups, guiding them to complete the project, and observing how students work.

C. Summary and closure

1. Ask each group to work together to summarize the concepts that they discussed today, what these concepts mean, and why they are important.
2. Have each group share one statement, and continue going around the room from group to group until all points are made.
3. Guide the discussion to include:
 - translation
 - reflection (flip)
 - line of reflection

- glide reflection
- image
- similar
- congruent.

D. Assignment

Ask each student to find a household item such as a tie or a quilt that shows a reflection or glide reflection. Have them draw a sketch of the pattern. Show the line of reflection on the sketch.

Assessment

Observe the students during the group project. Record how they are working in their group and whether the students can visualize a net from the solid and the solid from a net. You can either grade the group project, the presentations (if they are more formal than implied in the project), or the homework.

Worksheet: Pattern Blocks, Mira™, and Reflections

1. Draw a line down the center of a blank sheet of paper. Place the Mira™ on the line. Place a red trapezoid on one side of the Mira™. Using a pencil draw the perimeter of the trapezoid. Make sure the trapezoid stays in this spot as you draw its reflection. Looking through the Mira™ draw the perimeter of the reflection of the trapezoid. Remove the Mira™ and pattern block leaving the drawing of the original figure, the line of reflection, and the drawing of the figure's reflection. Label the original figure's vertices as shown below. Label the corresponding vertices on the reflection as A', B', C', and D'.

2. Draw the line segment AD -0.0 644 0 TD 0.0514 Tc (') Tj 2.16 0 TD /F0 12 Tf -0.3951 Tc 0.5951 T
AD -0.0 644 0 TD 0.0514 Tc (.) Tj 5286 0 TD /F3 12 Tf 0 Tc 0.024 T

4. Draw the line segment BB' . What is the angle formed by this line segment and the line of reflection?

5. Compare the length of BB' and the distance from B to the line of reflection. What did you discover?

6. Does the same pattern hold for CC' ? For DD' ?

State the pattern in your own words.

7. Are the reflection of the original trapezoid and the original trapezoid **similar** (the same shape)? How do you know?

8. Are the original trapezoid and the reflection of the original trapezoid **congruent** (the same shape and size)? How do you know?

9. On the same sheet of paper create a **glide reflection** (a slide parallel to the line of reflection followed by a flip across the line of reflection) of the original trapezoid by translating the original figure up 2 inches and then reflecting the trapezoid. Is this new figure similar to the original? Justify your answer.

10. Are the original figure and its glide reflection congruent? Justify your answer.

11. Label the vertices of the trapezoid formed by the glide reflection W , X , Y , and Z with W corresponding to A in the original trapezoid, X to B , etc. Draw the line segments AW , BX , CY , and DZ . Does the line of reflection bisect each line segment? How do you know?

12. The reflection of a shape is often called a “flip” of the shape. Why do you think a reflection is often called a flip?

13. The points A' , B' , C' , and D' are called the **images** of the points A , B , C , and D ,