E Learning DAY 5

South Carolina Mathematics Standard: GS.MGSR.2.1
Transformations: Rotations, Reflections, and Translations

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Part A – E-Learning Lesson Plan

Grade	9–11
Standard	GS.MGSR.2.1 – Describe the results of transformations on a given figure using geometric terminology from the definitions of the transformations.
Learning focus	Apply rotations, reflections, and translations using graph paper, tracing paper, and dynamic geometry software. Discuss orientation and identify what distinguishes the image from the original figure.
Estimated time	50-60 minutes, self-paced
Prerequisite skills	Coordinate plane, ordered pairs, line/point vocabulary, congruence, and basic angle measurement.
Success criteria	I can name a transformation, describe its effect using geometric vocabulary, apply it to a figure, and determine whether orientation is preserved or reversed.

Learning Objectives

I will be able to:

- Define translation, reflection, and rotation.
- Apply transformations to points and polygons on a coordinate plane.
- Use correct terminology such as image, preimage, center of rotation, angle of rotation, line of reflection, and direction.
- Describe orientation and determine whether a transformation preserves or reverses it.
- Use tracing paper or dynamic geometry software to verify a transformation.

Key Vocabulary

Term	Meaning
Transformation	A rule that moves or changes a figure to create an image.
Preimage	The original figure before a transformation.
Image	The resulting figure after a transformation.
Translation	A slide; every point moves the same distance in the same direction.
Reflection	A flip across a line of reflection.
Rotation	A turn around a fixed center through a specified angle and direction.
Orientation	The clockwise/counterclockwise order of the vertices of a figure.
Rigid transformation	A transformation that preserves lengths and angle measures.

Mini-Lesson: How Transformations Work

- Translation: $(x, y) \rightarrow (x + a, y + b)$. The figure slides without turning or flipping. Orientation is preserved.

- Reflection across the x-axis: $(x, y) \rightarrow (x, -y)$. Reflection across the y-axis: $(x, y) \rightarrow (-x, y)$. A reflection reverses orientation.

- Rotation about the origin: 90° counterclockwise: $(x, y) \rightarrow (-y, x)$; 180°: $(x, y) \rightarrow (-x, -y)$; 270° counterclockwise: $(x, y) \rightarrow (y, -x)$. Rotations preserve orientation.

- All three transformations preserve lengths and angle measures, so the original figure and image are congruent. What changes is position and, for reflections, orientation.

E-Learning Sequence

1. Do Now – 5 minutes: On graph paper, plot A(1,1), B(4,1), C(4,3). Predict the result of translating every point 2 units right and 1 unit up.

2. Learn – 15 minutes: Watch/read the mini-lesson. Pause after each transformation and sketch the preimage and image.

3. Explore – 15 minutes: Use graph paper or tracing paper to slide, flip, and turn a triangle. Record the rule, direction/angle, and whether orientation changes.

4. Dynamic Geometry – 10–15 minutes: In a geometry app such as Desmos/Geogebra, create a polygon and apply translation, reflection, and rotation. Compare the preimage and image.

5. Practice – 15–20 minutes: Complete the 15 MCQs and 5 descriptive questions below.

6. Exit Ticket – 5 minutes: A triangle is reflected across the y-axis. Explain what happens to its orientation and give the coordinate rule.

Part B – Student Practice Worksheet

Name: _____ Date: _____ Class: _____

Section 1 – Multiple Choice (15 Questions)

1. Which transformation moves every point the same distance and in the same direction?

- A. Reflection
- B. Rotation
- C. Translation
- D. Enlargement

2. What is the image of P(3, −2) after a translation 4 units right and 3 units up?

- A. (7, 1)
- B. (−1, 1)
- C. (7, −5)
- D. (−1, −5)

3. Which transformation is a flip across a line?

- A. Translation
- B. Reflection
- C. Rotation
- D. Dilation

4. Reflect Q(−5, 2) across the y-axis.

- A. (−5, −2)
- B. (5, 2)
- C. (5, −2)
- D. (−2, 5)

5. Rotate R(2, 4) 90° counterclockwise about the origin.

- A. (4, −2)
- B. (−4, 2)
- C. (−2, −4)
- D. (2, −4)

6. Which transformation preserves orientation?

- A. Reflection only
- B. Translation and rotation
- C. Reflection and rotation
- D. Reflection only at the x-axis

7. A rotation is completely described by its center, angle, and what other information?

- A. Scale factor
- B. Direction
- C. Perimeter
- D. Slope

8. Which coordinate rule represents reflection across the x-axis?

- A. $(x,y) \rightarrow (-x,y)$
- B. $(x,y) \rightarrow (x,-y)$
- C. $(x,y) \rightarrow (y,x)$
- D. $(x,y) \rightarrow (-x,-y)$

9. Triangle ABC is translated. Which statement must be true?

- A. Its side lengths change.
- B. Its angles change.
- C. Corresponding side lengths remain equal.
- D. Its orientation reverses.

10. A figure is rotated 180° about the origin. What happens to (x,y)?

- A. $(-x,-y)$
- B. $(-y,x)$
- C. $(y,-x)$
- D. $(x,-y)$

11. Which term names the original figure before a transformation?

- A. Image
- B. Preimage
- C. Center
- D. Axis

12. A reflection across a vertical line changes a point's position mainly by changing its:

- A. y-coordinate only
- B. x-coordinate relative to the line
- C. angle measure
- D. side length

13. Which transformation is a turn around a fixed point?

- A. Translation
- B. Reflection
- C. Rotation
- D. Slide

14. If a polygon is reflected, which property is generally reversed?

- A. Side lengths
- B. Angle measures
- C. Orientation
- D. Number of vertices

15. A student moves a triangle 3 units left and 2 units down. Which rule describes the translation?

- A. $(x,y)\rightarrow(x+3,y+2)$
- B. $(x,y)\rightarrow(x-3,y-2)$
- C. $(x,y)\rightarrow(x-3,y+2)$
- D. $(x,y)\rightarrow(x+3,y-2)$

Section 2 – Descriptive Questions (5 Questions)

1. Triangle ABC has A(1,1), B(4,1), and C(4,3). Translate the triangle 2 units left and 4 units up. Give the coordinates of A′, B′, and C′ and explain why the orientation is unchanged.

Work/Explanation:

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2. Reflect the triangle with vertices P(−2,1), Q(−5,1), and R(−5,4) across the y-axis. Find the image coordinates and explain how the orientation differs from the original.

Work/Explanation:

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3. Rotate point A(3,−1) and point B(1,−1) 90° counterclockwise about the origin. Find A′ and B′. Describe the transformation using geometric terminology.

Work/Explanation:

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4. On graph paper, draw any quadrilateral. Apply a translation, reflection, and rotation to the same figure. Record the rule for each and state whether orientation is preserved or reversed.

Work/Explanation:

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5. Explain why a translation, reflection, and rotation are called rigid transformations. Include at least two properties that remain unchanged and one property that distinguishes a reflection from the other two.

Work/Explanation:

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Section 3 – Graph Paper Practice

Plot and transform the triangle below. Use a separate coordinate grid if needed.

- A(−1,1), B(2,1), C(1,4)
- a) Translate it 3 units right and 2 units down.
- b) Reflect the original triangle across the x-axis.

- c) Rotate the original triangle 90° counterclockwise about the origin.
- d) For each image, state whether orientation is preserved or reversed.

Digital Learning Suggestion

Students may use DESMOS or GeoGebra or another dynamic geometry tool to construct a polygon and apply Translation, Reflection, and Rotation. Encourage students to drag the original figure and observe that the image changes correspondingly while lengths and angle measures remain unchanged.