

## Geometric Transformations – Grade Four

### Ohio Standards Connection

#### **Geometry and Spatial Sense**

##### Benchmark I

Describe, identify and model reflections, rotations and translations, using physical materials.

##### Indicator 7

Identify, describe and use reflections (flips), rotations (turns), and translations (slides) in solving geometric problems; e.g., use transformations to determine if 2 shapes are congruent.

#### **Mathematical Processes**

##### Benchmark J

Read, interpret, discuss and write about mathematical ideas and concepts using both everyday and mathematical language.

### Lesson Summary:

*In this lesson students describe the movement needed to show that two shapes are congruent using superposition. Students move objects and describe the movement using common words such as slide, turn and rotate and mathematical terms translation, rotation and reflection. Kinesthetic activity and writing tasks are included to develop student understanding.*

**Estimated Duration:** Two hours

### Commentary:

The concept of congruency is reinforced through application of geometric transformations. It is important that students are able to manipulate objects to model and describe movements and develop spatial sense. As students have these experiences, new mathematical terminology is introduced and opportunities for using the new language should be provided through oral and written tasks.

### Pre-Assessment:

The task assesses prior knowledge of congruency. Cut two congruent shapes from construction paper. Use an irregular shape.

- Display two congruent shapes. Tell students that the shapes are congruent. Ask them to explain why the shapes are congruent.
- List student responses on the board or chart paper.
- Ask students how they would determine or show that the two shapes are congruent. Responses should include laying one of the shapes directly on top of the other (superposition).
- Have students write what they know about congruent shapes in a journal.

### Scoring Guidelines:

Informally assess students' prior knowledge by listening to discussions and reading journal entries. Provide practice identifying congruent shapes using manipulatives for students who show evidence of misunderstanding.

### Post-Assessment:

Distribute *Transformations Post-Assessment*, Attachment A.

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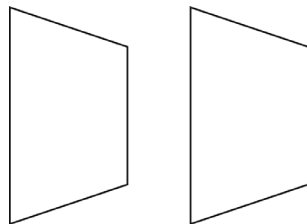
### Scoring Guidelines:

Assess the ability of students to identify and describe transformations that can show two shapes are congruent. An answer key is provided on *Post-Assessment Answer Key*, Attachment B. Use the student responses to determine the level of understanding. Students should be able to identify and describe the three transformations and recognize the terminology.

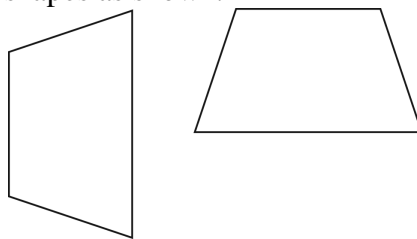
### Instructional Procedures:

#### Part One

1. Distribute two trapezoids from a pattern block set to each student or cut out sets of trapezoids from *Trapezoids*, Attachment F. Display two congruent shapes on the board in the same orientation. For example:



2. Ask students questions and have them describe the movement to superpose one shape over the other. Allow students to use the trapezoid models to model the movement needed.
  - Are these shapes congruent? How do you know?
  - How can you show the shapes are congruent?
  - Describe the movement as this shape is moved to be placed on top of the other. (The shape was slid over to the other.) Slide the shape across the chalkboard.
3. Distribute *Transformations*, Attachment C.
4. Introduce the term *translation*. Write the word on the board and have students write it in the box on top of the first column of Attachment C. Have students describe a translation in their own words and draw an example of a translation in the column. Tell students they can add additional information and pictures about translations throughout the lesson.
5. Show students that the shape can be translated in any direction, up, down, left, right, diagonally. Have them make observations and determine that the orientation of the shape remains the same in a translation.
6. Have the students stand up. Tell them to slide or take a side step to the left. Give them more tasks such as stepping back or to a diagonal. Focus on the orientation of the body, that throughout the movement they face the same direction.
7. Show students the pair of shapes as shown.



8. Have the students describe the movement needed to superpose the two shapes. Responses should include turning or rotating the shape.

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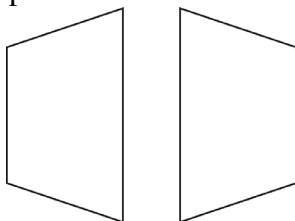
9. Ask students how they knew that it wasn't a translation. Responses should indicate that the shape is not in the same orientation.
10. Direct students to the second column of Attachment C. Write the term *rotation* on the board and have students write *rotation* in the box above the middle column. Tell students that the movement, to superpose the two shapes, is called rotation.
11. Ask students if they have heard of the term rotation. Responses may include spinning a toy top or the sun rotates. Tell students that rotation is the same as turn.
12. Have students describe rotation in their own words in the second column of Attachment C. Tell students to include an illustrative example of a rotation.
13. Have students stand up. Tell them to rotate to the right. Compare the rotation to the translation movement. Responses should indicate that the students are facing a different direction, therefore the orientation changes.
14. Provide examples of pairs of shapes and have students identify the movements needed to superimpose the shapes to determine if they are congruent. Include shapes that are not congruent to reinforce the idea of congruency.
15. Have students add information about translation and rotation to the appropriate columns on Attachment C.

### Instructional Tip:

- Have the students complete several examples of transformations with pattern blocks. Observe students as they translate or rotate and listen to the terms used to describe the movement.

### Part Two

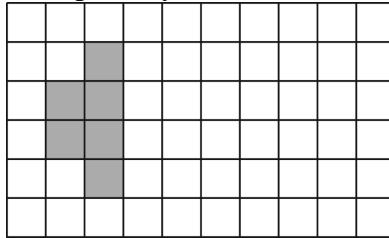
16. Review translation and rotation with the student. Refer students to *Transformations*, Attachment C, for assistance.
17. Show students the two shapes below.



18. Ask students what movement could be used to superpose the two shapes and determine if the shapes are congruent. Allow students to use the trapezoid objects to model the movement. Responses should include flipping one of the shapes over or rotating the shape half way around. If the students use the term turn, ask for another term to describe the movement (rotation).
19. Distribute small mirrors to groups of students. Ask students to place one of the trapezoids in front of the mirror and observe the trapezoid in the mirror. Have students describe and compare the trapezoid in the mirror with the model trapezoid. Descriptions may include the word reflection. Students should observe that the trapezoid looks like it is flipped over or that the side of the trapezoid closest to the mirror looks closest to them in the mirror or reflection.

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20. Write the term reflection on the board and have students write reflection in the box on top of the third column of Attachment C. Have students write a description of reflection in their own words and draw a picture showing an example of a reflection.
21. Organize students into groups of four. Have them share their description of reflections. Then, have them compare translation, rotation and reflection.
22. Distribute a sheet of grid paper to each student. Have the students practice creating reflections using irregular shapes. It is helpful for students to use the grid for accuracy, and to assure that shapes are congruent. This can easily be shown using a transparency on the overhead, then folding the transparency to demonstrate the reflection.



23. Show student pairs of figures on the overhead using, *Overhead Display*, Attachment D. Have students identify the movement needed to superpose the two figures.
24. Distribute *Transformation Practice*, Attachment E for homework or seatwork.

### **Differentiated Instructional Support:**

Instruction is differentiated according to learner needs, to help all learners either meet the intent of the specified indicator(s) or, if the indicator is already met, to advance beyond the specified indicator(s).

- Use different representations of the transformations.
  - Rotations can be demonstrated by taking two congruent shapes and putting a brass fastener through one corner of the shape. Fasten the shape to a sheet of paper. The students can trace the original shape, then turn it and trace it in its new position. This process will allow the kinesthetic learner to physically make the rotations.
  - Reflections can be demonstrated using an actual mirror to show the mirror image.
  - Translations show using magnetic shapes, to emphasize that the shape just slides.
- Explore tessellations, geometric transformations in artwork and architecture.

### **Extensions:**

- Students can create a flip book of the transformations (reflection, rotation, translation)
- Students can create reflections of their name using grid paper and drawing a horizontal line in the middle for the line of reflection or mirror line.

### **Home Connections:**

Have the students create their own transformation pairs on index cards for homework. The front can show the shapes and back should give the name of the transformation. Students can share with their group or the class, and classmates can guess the transformation.



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### **Materials and Resources:**

*The inclusion of a specific resource in any lesson formulated by the Ohio Department of Education should not be interpreted as an endorsement of that particular resource, or any of its contents, by the Ohio Department of Education. The Ohio Department of Education does not endorse any particular resource. The Web addresses listed are for a given site's main page, therefore, it may be necessary to search within that site to find the specific information required for a given lesson. Please note that information published on the Internet changes over time, therefore the links provided may no longer contain the specific information related to a given lesson. Teachers are advised to preview all sites before using them with students.*

*For the teacher:* overhead display, overhead pattern blocks, pairs of cut out shapes

*For the students:* pattern blocks, index cards, mathematics journal/notebook

### **Vocabulary:**

- congruent
- reflection
- rotation
- translation

### **Technology Connections:**

Use software programs that allow students to move shapes to prove congruency and create their own transformations.

### **Attachments:**

- Attachment A, *Post Assessment*
- Attachment B, *Post-Assessment Answer Key*
- Attachment C, *Transformations Chart*
- Attachment D, *Overhead Display*
- Attachment E, *Transformation Practice*

# Geometric Transformations – Grade Four

## Attachment A Post-Assessment

Name \_\_\_\_\_ Date \_\_\_\_\_

**Directions:** Respond to the questions below.

1. How can you tell if two shapes are congruent? Describe how you could prove that two shapes are congruent.

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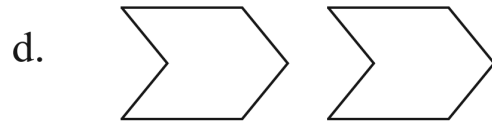


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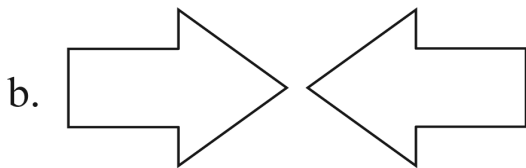
2. Name the transformation shown in each diagram. (reflection, rotation, or translation)




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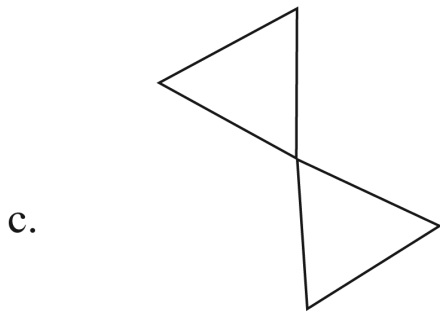

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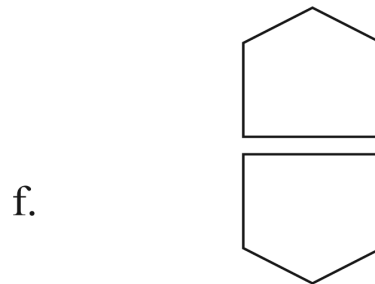

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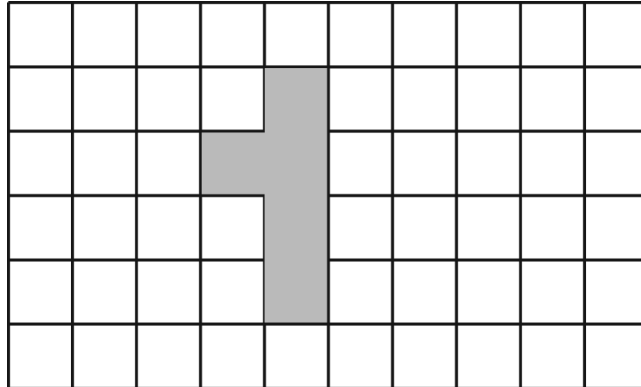



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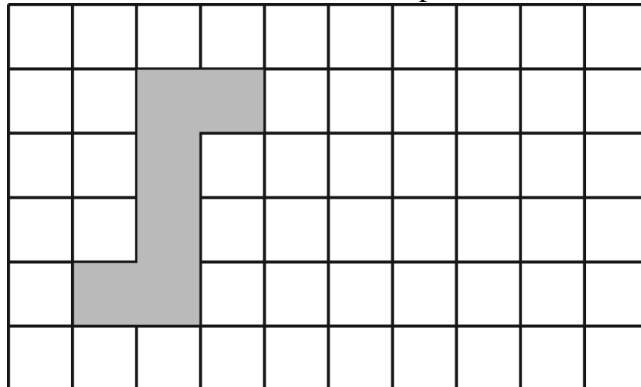
## Attachment A (continued) Post-Assessment

Name \_\_\_\_\_ Date \_\_\_\_\_

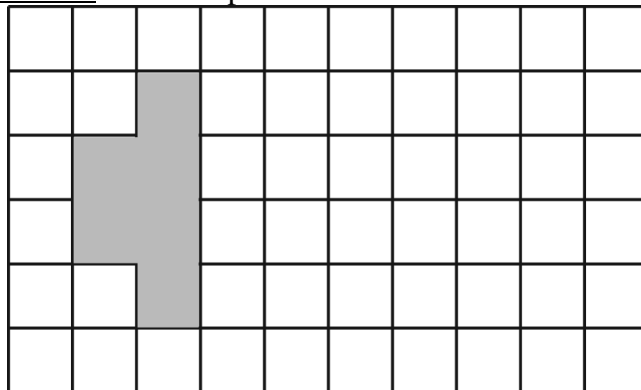
3. On the grid, draw a reflection of the shape by shading the squares.



4. On the grid, shade the translation of the shape.



5. Shade the rotation of the shape below.



6. Explain how you know if the shapes you have shaded above are congruent with the original shape.

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## Attachment B Post-Assessment Answer Key

Total possible points 15

1. How can you tell if two shapes are congruent? Describe how you could prove that two shapes are congruent.

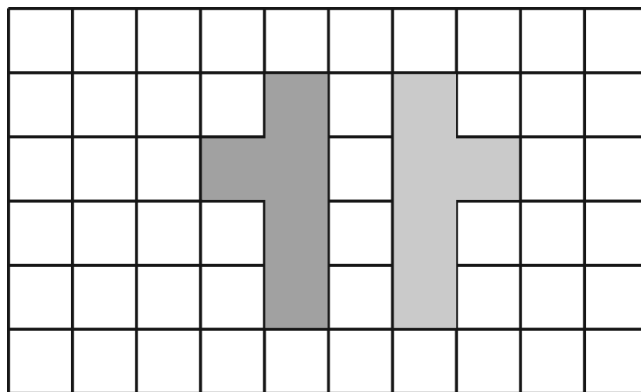
2 points: Explains that congruent means that the shapes are the same size and same shape. Can prove congruency by placing the shapes on top of one another and may describe a transformation that proves congruency.

1 point: Explains that congruent means the same shape and size, but does not give a way to prove congruency, or explanation is not clear.

0 points: Did not attempt to answer, or gave an incorrect response.

2.
  - a. rotation
  - b. reflection
  - c. reflection or rotation
  - d. translation
  - e. rotation
  - f. reflection

3. On the grid, show a reflection of the shape by shading the squares.

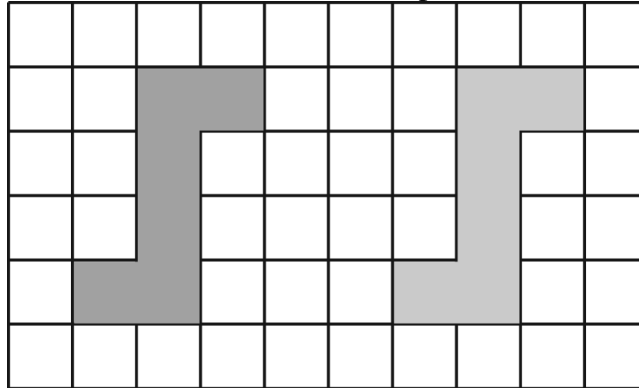


Please note that students may have shaded a reflection that is flipped down.



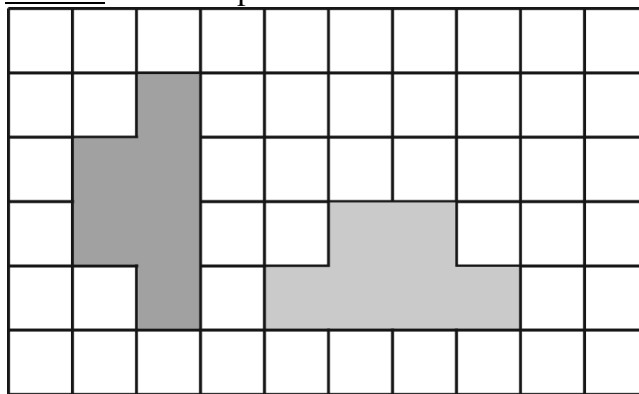
## Attachment B (continued) Post-Assessment Answer Key

4. On the grid, shade the translation of the shape



Students may have shaded the translation of the shape diagonally too.

5. Shade the rotation of the shape below.



The rotation could also be shown as a 180-degree turn

6. Explain how you know if the shapes you have shaded above are congruent with the original shape. (2 point response)

2 points Explains the shaded part has to be the same size and shape, OR that the number of shaded squares is the same as the original and in the same shape.

1 point Explains that the shape was just turned, flipped, or slid, but does not reference size or shape.

0 points Response is missing or incorrect information is given

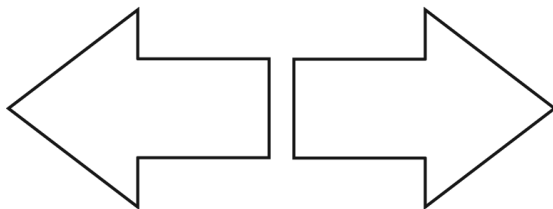
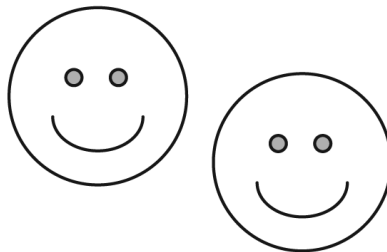
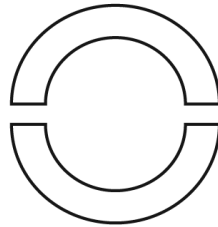
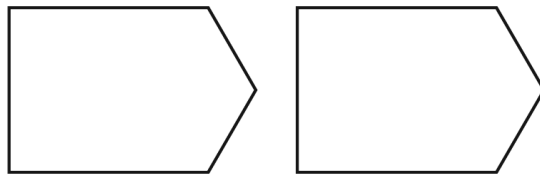
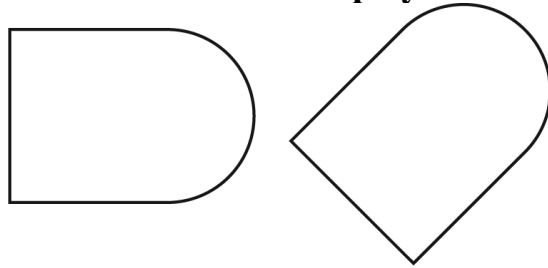
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## Attachment C Transformations Chart

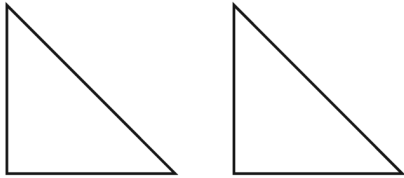
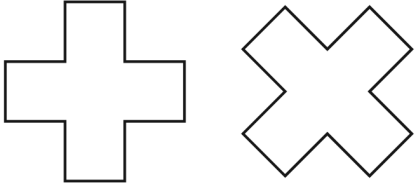
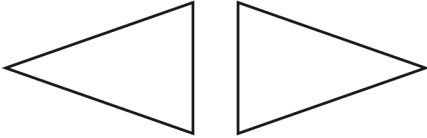
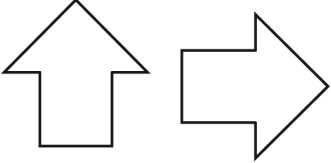
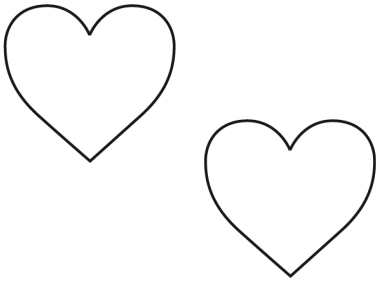
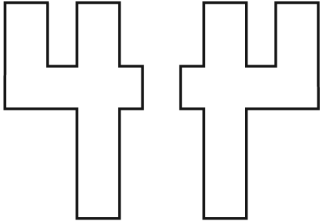
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# Geometric Transformations – Grade Four

## Attachment D Overhead Display



## Attachment E Transformation Practice

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## Attachment F Trapezoid Patterns

