Inspect

CCR Performance Tasks

Math Grade 8: Explore Transformations and Symmetry

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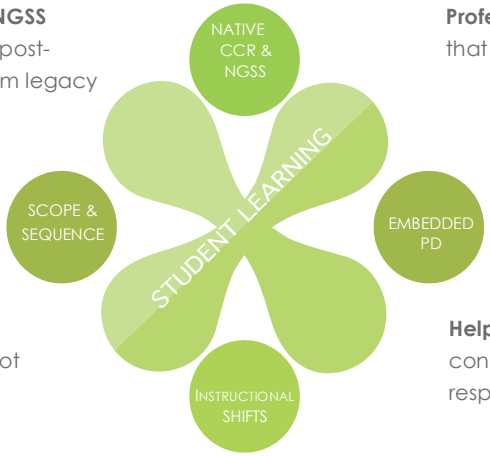

Professional development embedded within content that

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- includes authentic, permissioned texts of appropriate complexity
- and documents student progress using DOK and learning progressions

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CCR Performance Tasks

Math Grade 8: Explore Transformations and Symmetry

Student Test Booklet

Name:

Student Rubric

This problem is meant to test if you can:
• Recognize patterns in the effects of translations on figures with different types of symmetry;
• Recognize and describe various types of symmetry;
• Reflect, rotate, and translate figures;
• Explain whether or not the images are congruent to the original figures;
• Enlarge a figure and explain why the image is similar to the original.

Your teacher will rate your answer as a level 4, 3, 2, 1, or 0. The descriptions below explain the types of answers expected at each level.

Level 4:
Your answer is correct and complete.
Your answer includes:
• Correct drawings and explanations that show specific types of symmetry.
• Correct transformations of a figure.
• Correct and complete explanations of the effects of the transformations on the figure.

Level 3:
Your answer is correct but one or two of your explanations are incomplete.
Your answer includes:
• Correct drawings and explanations that show specific types of symmetry.
• Correct transformations of a figure.
• Correct but incomplete explanations of the effects of the transformations on the figure.

Level 2:
You have shown basic understanding of the task but your answers contain several errors.
Your answer may include:
• Correct drawings that show specific types of symmetry and incomplete explanation that may include some errors.
• Transformations of a figure with several minor or one major error.
• Explanations of the effects of the transformations on the figure that are incomplete and may include errors.

Level 1:
Your answers are incorrect.
Your answer may include:
• Drawings that do not correctly show symmetry and a missing explanation or an explanation that includes one or more major errors.
• Transformations of a figure with multiple errors, including more than one major error.
• Explanations of the effects of the transformations on the figure that are missing or incomplete and include major errors.

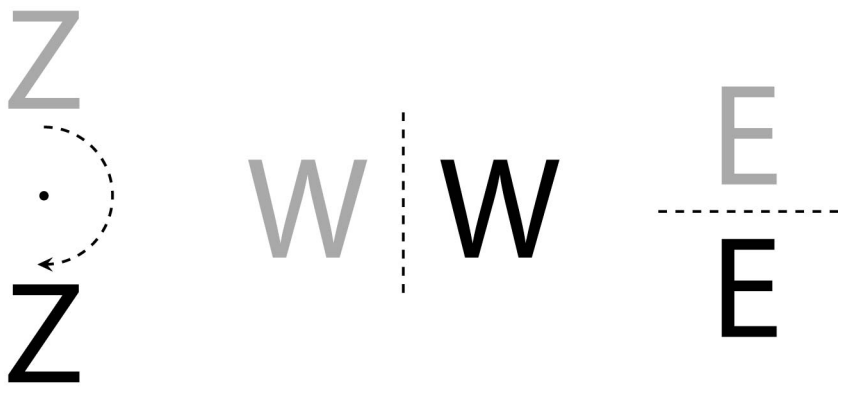
Level 0:
Your answer is not related to the question, the teacher cannot understand your answer, or you do not write anything.

Name:_____

Math Grade 8: Explore Transformations and Symmetry

Complete all the tasks in the test booklet.

1 Look at the letters Z, E, and W below. When written as shown below, the letter Z has rotational symmetry: when rotated 180 degrees, it looks exactly the same. Similarly, the letters W and E have reflective symmetry (or line symmetry): when reflected across a line, they look exactly the same. W has vertical line symmetry, because it looks the same when reflected across a vertical line, as shown. E has horizontal line symmetry, because it looks the same when reflected across a horizontal line.



A. Write a three-letter word in which each letter has some type of symmetry. You can use uppercase letters, lowercase letters, or both, and you can write the letters any way you like as long as other people can read them.

Write your word on the grid provided on the last page. Place your word on the left side of the dotted line and below point *A*.

B. What type of symmetry does each letter in your word have? Explain how each letter demonstrates symmetry.

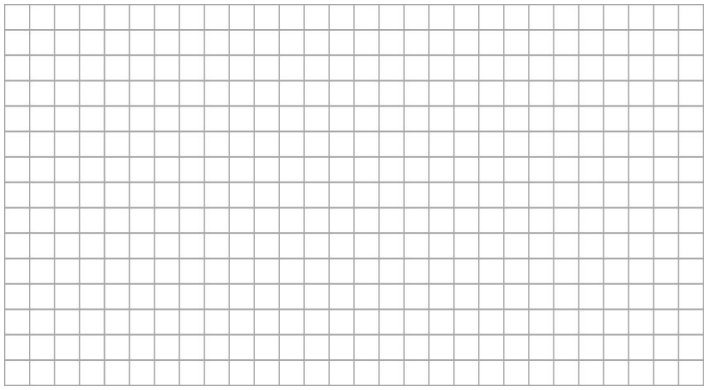
C. On the grid provided on the last page, do the following:

1. Reflect your word across the dotted line. Label it “reflected."
2. Rotate your word 180 degrees about point *A*. Label it “rotated."
3. Translate your word 13 units to the right and 6 units up. Label it “translated.”

Your word can be considered a geometric figure. Are the images of the transformed figure congruent to the original figure? Explain why or why not.

Name:_____

D. Draw your word on the left side of the grid below. On the right side of the grid, draw a larger version of your word that is similar to your original word. Explain how you know that the drawings of the word are similar.



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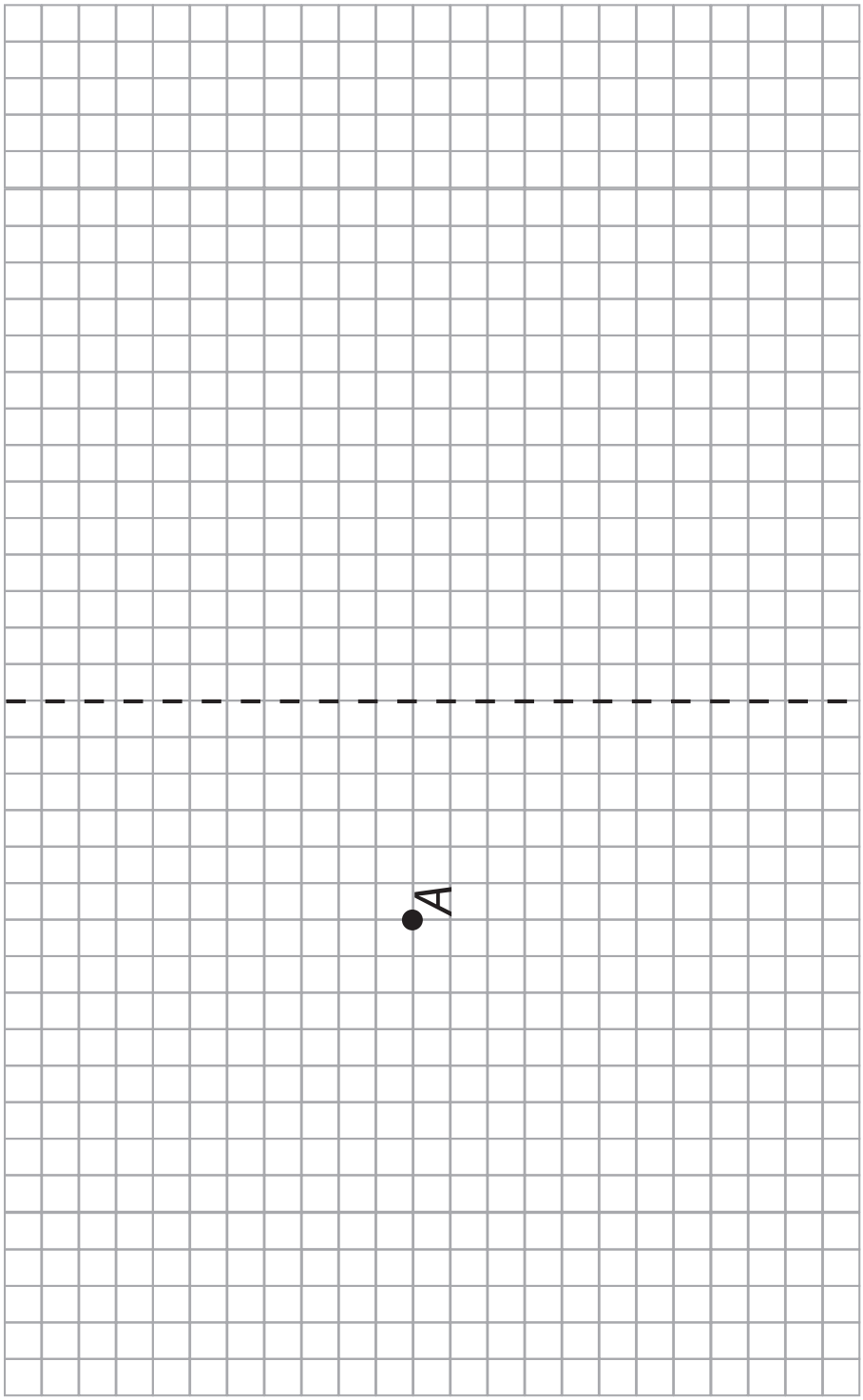
Math Grade 8: Explore Transformations and Symmetry



CCR Performance Tasks

Math Grade 8: Explore Transformations and Symmetry

Teacher Guide

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About the Teacher Guide

This document contains support materials for “Grade 8: Explore Transformations and Symmetry.” This includes:

(a) The task
(b) The standards and depth of knowledge level of the task
(c) The scoring rubric
(d) Discussion questions
(e) Extension activities

These specifications have been included to help you connect the task to the Common Core content standards and the standards for mathematical practice. The rubric is designed to help you look for the development of mathematical practices in student work. It is also here to help you look for consistencies in student content errors that can help guide intervention and re-teach strategies.

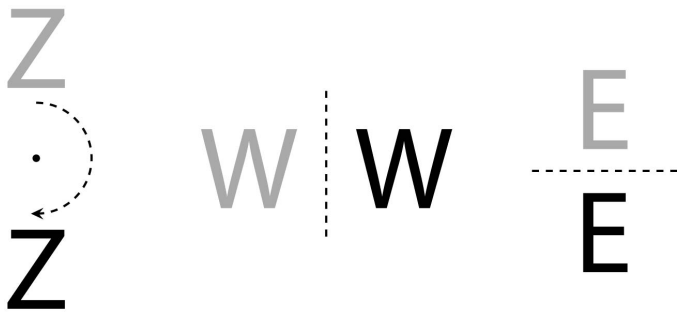
Test Definition File

Item #	Correct Answer	Practice Standard	Content Standards
1	See Scoring Rubric	Mathematical Practice 7	8.G.1, 8.G.2, 8.G.3, 8.G.4

SBAC Claims	PARCC Sub-Claims
1 and 3	A, C, and D

Performance Task

Look at the letters Z, W, and E below. When written as shown below, the letter Z has rotational symmetry: when rotated 180 degrees, it looks exactly the same. Similarly, the letters W and E have reflective symmetry (or line symmetry): when reflected across a line, they look exactly the same. W has vertical line symmetry, because it looks the same when reflected across a vertical line, as shown. E has horizontal line symmetry, because it looks the same when reflected across a horizontal line.



A. Write a three-letter word in which each letter has some type of symmetry. You can use uppercase letters, lowercase letters, or both, and you can write the letters any way you like as long as other people can read them.

Write your word on the grid provided on the last page. Place your word on the left side of the dotted line and below point *A*.

B. What type of symmetry does each letter in your word have? Explain how each letter demonstrates symmetry.

C. On the grid provided on the last page, do the following:

1. Reflect your word across the dotted line. Label it “reflected.”
2. Rotate your word 180 degrees about point *A*. Label it “rotated.”
2. Translate your word 13 units to the right and 6 units up. Label it “translated.”

Your word can be considered a geometric figure. Are the images of the transformed figure congruent to the original figure? Explain why or why not.

D. Draw your word on the left side of the grid below. On the right side of the grid, draw a larger version of your word that is similar to your original word. Explain how you know that the drawings of the word are similar.

Standards Alignment

Practice Standards

MP7 > DOK 3

Look for and make use of structure. -- Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see 7×8 equals the well remembered $7 \times 5 + 7 \times 3$, in preparation for learning about the distributive property. In the expression $x^2 + 9x + 14$, older students can see the 14 as 2×7 and the 9 as $2 + 7$. They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see $5 - 3(x - y)^2$ as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers x and y.

Content Standards

8.G.1

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

- Lines are taken to lines, and line segments to line segments of the same length.
- Angles are taken to angles of the same measure.
- Parallel lines are taken to parallel lines.

8.G.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.

8.G.3

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

8.G.4

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

SBAC Claims

Mathematics Claim #1:
Concepts and Procedures. Students can explain and apply mathematical concepts and interpret and carry out mathematical procedures with precision and fluency.

Mathematics Claim #3:
Communicating Reasoning. Students can clearly and precisely construct viable arguments to support their own reasoning and critique the reasoning of others.

PARCC Sub-Claims

Sub-Claim A:
Major Content with Connections to Practices. The student solves problems involving the Major Content for her grade/course with connections to the Standards for Mathematical Practice.

Sub-Claim C:
Highlighted Practice MP.3, 6 with Connections to Content: expressing mathematical reasoning. The student expresses grade/course-level appropriate mathematical reasoning by constructing viable arguments, critiquing the reasoning of others, and/or attending to precision when making mathematical statements.

Sub-Claim D:
Highlighted Practice MP.4 with Connections to Content: modeling/application. The student solves real-world problems with a degree of difficulty appropriate to the grade/course by applying knowledge and skills articulated in the standards for the current grade/course (or, for more complex problems, knowledge and skills articulated in the standards for previous grades/courses), engaging particularly in the Modeling practice, and where helpful making sense of problems and persevering to solve them (MP.1), reasoning abstractly and quantitatively (MP.2), using appropriate tools strategically (MP.5), looking for and making use of structure (MP.7), and/or looking for and expressing regularity in repeated reasoning (MP.8).

Scoring Rubric

4 Point Response:
The response demonstrates a high level of understanding. A level 4 response demonstrates:

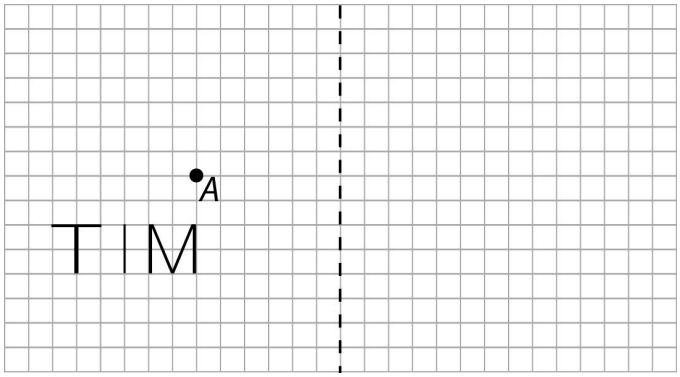
- A strong understanding of various types of symmetry, and the ability to recognize and describe symmetry;
- The skill to correctly transform figures using rotation, reflection, and translation;
- A strong ability to dilate a figure;
- A strong ability to explain the congruency or similarity of figures using the properties of transformations.

A level 4 response is characterized by:

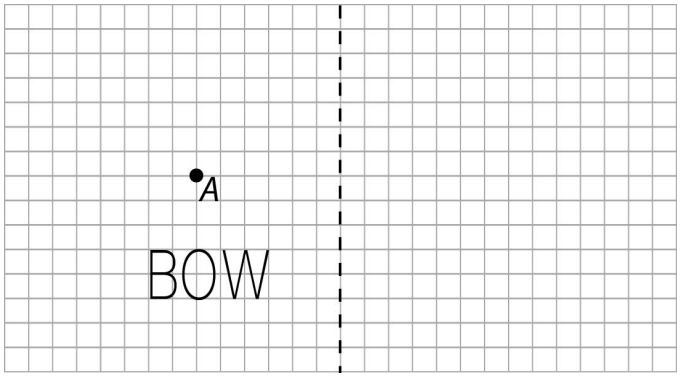
- A drawing of a word that includes three letters, each with some type of symmetry, as well as a valid explanation for how each letter exhibits symmetry;
- A rotation, reflection, and translation of the word drawn correctly on the grid;
- A correct and complete explanation for why the image of a figure that has been rotated, reflected, or translated is congruent to the original figure;
- A correct enlarged drawing of the word, with a justification of how the figures are similar based on angle measures and segment lengths or based on a series of transformations which take the original figure to the image.

A sample level 4 response follows.

Part A, sample response 1:



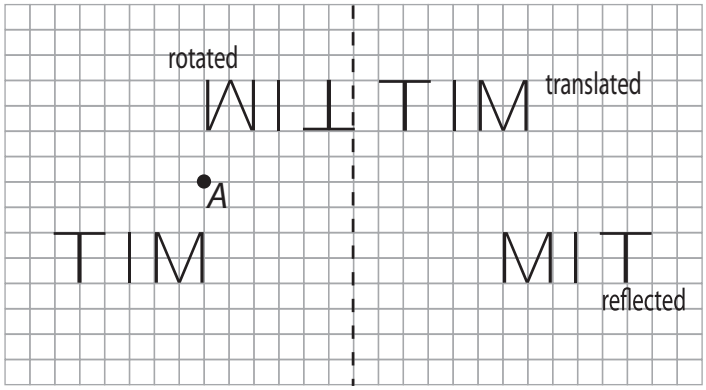
Part A, sample response 2:



Part B, sample response 1: “If you fold T, I, and M down the middle, both sides look the same, so each letter has vertical line symmetry.”

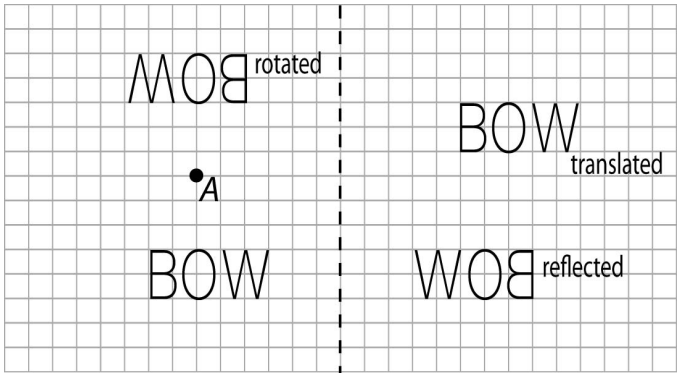
Part B, sample response 2: “The letter B has horizontal line symmetry: if you fold it top to bottom, both sides look the same. The letter W has vertical line symmetry: if you fold it down the middle, both sides look the same. And the letter O has rotational symmetry, because it looks the same if you rotate it 180 degrees about its center. As it turns out, the letter O also has vertical and horizontal line symmetry, because both sides look the same if it’s folded top to bottom or down the middle.”

Part C, sample 1:



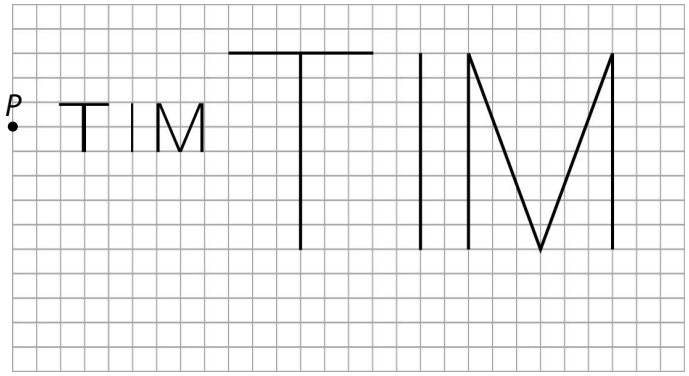
“The images of the transformed figure are congruent to the original figure. The transformations of reflection, rotation, and translation do not change the lengths of lines or measures of angles. Since the lengths of lines and measure of angles are the same, the figures are congruent.“

Part C, sample 2:



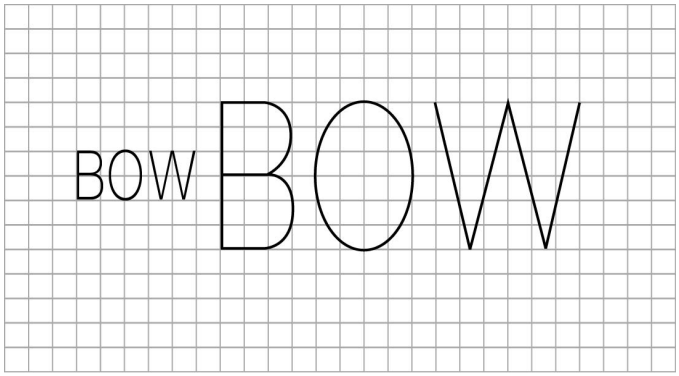
“The transformed images of BOW are all congruent to the original BOW. When I did the transformations (reflection, rotation, and translation), I didn’t change any of the lengths of any lines or the measures of any angles. Since the lines and angles weren’t changed, the figures are congruent.“

Part D, sample 1:



"If I enlarge the original figure about point P using a scale factor of 4 and then translate the image down 1 unit, I get the image I drew which is similar to the original."

Part D, sample 2:



"The bigger BOW is exactly 3 times the size of the smaller BOW. For example, the top half of the B is only 1 unit tall in the smaller BOW, but it is 3 units tall in the bigger BOW, and the O in the smaller BOW is about 1.5 units wide, but it's about 4.5 units wide in the bigger BOW. And the angles of the W have exactly the same degree measure in both figures, which must be the case if they're similar."

3 Point Response:

The response demonstrates a strong understanding, but the work contains minor errors. A level 3 response demonstrates:

- An understanding of various types of symmetry, and the ability to recognize and describe symmetry.
- The skill to correctly transform figures using rotation, reflection, and translation, though the transformations may contain at most one minor error (for instance, translating the figure too far to the left);
- An ability to correctly explain the congruency of the transformed figures and their images, although the explanation is incomplete;
- An ability to enlarge a figure and explain how the new figure is similar to the original, although the explanation is incomplete. For example, the student may explain that the segments are proportional but not explain that the corresponding angles have equal measures.

2 Point Response:

The response demonstrates a basic but incomplete understanding. A level 2 response demonstrates:

- A basic understanding of various types of symmetry, and a rudimentary ability to recognize and describe symmetry, possibly with minor errors in the explanation;
- The skill to transform figures using rotation, reflection, and translation, though possibly with several minor errors (for instance, translating the figure too far to the left or rotating about a point other than point *A*);
- An ability to recognize the congruency of the transformed figures and their images, although the explanation may be incomplete and include errors;
- An ability to enlarge a figure;
- A weak ability to explain why two figures are similar. The explanation may be vague or missing.

1 Point Response:

The response demonstrates minimal understanding. A level 1 response demonstrates:

- An insufficient understanding of various types of symmetry, and an inability to recognize and describe symmetry, with major errors in the explanation;
- A basic skill to transform figures using rotation, reflection, and translation, though possibly with several errors (for instance, translating the figure too far to the left or rotating about a point other than point *A*);
- An inability to recognize and explain the congruency of the transformed figures and their images, with an explanation that is missing or incomplete and includes major errors;
- An inability to enlarge a figure or explain how the new figure is similar to the original.

0 Point Response:

There is no response, or the response is off topic.

Discussion Questions

Use the following questions to stimulate discussion:

1. What types of symmetry do you see in this room?

Possible Response: *Answers will vary, as several different examples likely exist in your classroom. Possibilities include tiles on the floor that are reflected, rotated, or translated from one position to another; bricks on the wall that appear to be translations of one another; and windows that appear to be reflected about a jamb.*

2. Which letters of the alphabet have rotational symmetry? Which letters demonstrate other types of symmetry?

Possible Response: *The letters with rotational symmetry will vary depending on how they are written and whether uppercase or lowercase is used, but most people write H, I, N, O, S, X, and Z so that they look the same when rotated. Uppercase letters with horizontal symmetry include B, C, D, E, H, I, K, O, and X, and uppercase letters with vertical symmetry include A, H, I, M, O, T, U, V, W, X, and Y.*

3. How could you show that a letter (or figure) has rotational, vertical, or horizontal symmetry?

Possible Response: *A letter has rotational symmetry if you give it a turn and it looks the same. A letter has vertical line symmetry if you fold it down the middle and both sides look the same. A letter has horizontal line symmetry if you fold it top to bottom and both halves look the same.*

4. What types of transformations result in an image that is congruent to the original figure?

Possible Response: *Rotations, reflections, and translations result in images that are congruent to the original because the lengths of the sides stay the same and the measures of the angles stay the same.*

5. How do you know if two shapes are similar?

Possible Response: *Similar shapes have the same shape but different size. Any segments within the figure (sides, arcs, etc.) will be in proportion, but angle measures of corresponding parts will be exactly the same.*

Extension Activities

1. Further developing understanding of symmetry by investigating corporate logos.

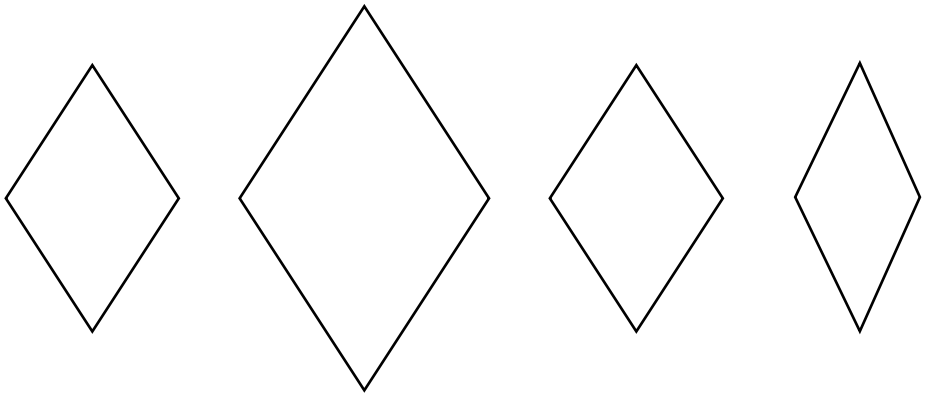
   A. Develop a list of companies whose logos are symmetric, and describe the symmetry in each of them. This task can be DOK 4 if students do independent research to find the company logos and report findings back to the class.

   Samples:
   - The logo for xpedx is rotationally symmetric, and it looks the same when rotated 180^{o}.
   - The logo for Sun Microsystems looks the same when rotated 90^{o}.
   - The McDonald's "golden arches" logo is vertically symmetric.
   - The Mercedes Benz logo is rotationally and vertically symmetric, though not horizontally symmetric; it has 120^{o} rotational symmetry.

2. Developing a deeper understanding of similarity and congruence by measuring figures.

   A. Distribute several figures to students, some of which are similar and congruent, and some of which are not. Direct students to measure the segments and angles that comprise the figures and compare the measurements. If all angle measures and segment lengths are the same, the figures are congruent; if the angle measures are the same but the segment lengths are in proportion, the figures are similar; otherwise, the figures are neither congruent nor similar.

   Sample: The following set of four figures could be used to explore congruence and similarity.



   The first and third figures have the same segment lengths and angle measures, so they are congruent. Both of those figures are similar to the second figure; the angle measures are the same, and the side lengths are in proportion. Although the fourth figure has segment lengths that are equal to the first and third figures, its angle measures are different from the others, so it is not similar or congruent to any of them.