

Performance Assessment Task				
Symmetrical Patterns				
Grade 4				
<p>The task challenges a student to demonstrate understanding of the concept of symmetry. A student must be able to name a variety of two-dimensional shapes. A student must understand line symmetry in order to draw two lines of symmetry in a geometric pattern. A student must make sense of two-dimensional shapes in order to complete a design around a given line of symmetry and identify the names of the shapes in the design.</p>				
Common Core State Standards Math - Content Standards				
<p><b>Geometry</b>  <b>Draw and identify lines and angles, and classify shapes by properties of their lines and angles.</b>            4.G.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.</p>				
Common Core State Standards Math – Standards of Mathematical Practice				
<p><b>MP.5 Use appropriate tools strategically.</b>            Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.</p> <p><b>MP.6 Attend to precision.</b>            Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.</p>				
Assessment Results				
<p>This task was developed by the Mathematics Assessment Resource Service and administered as part of a national, normed math assessment. For comparison purposes, teachers may be interested in the results of the national assessment, including the total points possible for the task, the number of core points, and the percent of students that scored at standard on the task. Related materials, including the scoring rubric, student work, and discussions of student understandings and misconceptions on the task, are included in the task packet.</p>				
Grade Level	Year	Total Points	Core Points	% At Standard
4	2004	8	4	91 %

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## Symmetrical Patterns

This problem gives you the chance to:

- name simple shapes
  - work with symmetry
- 

Saba makes this pattern using shape blocks.

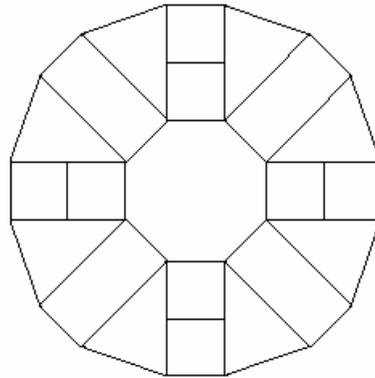
1. Write the names of the shapes she uses.

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2. This pattern is symmetrical.

Draw in two of the lines of symmetry of this pattern.

3. The diagram below shows half of a different symmetrical pattern that Saba makes.

**Draw the other half of her pattern.**

Write the names of the shapes in the pattern.

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line of symmetry



8

<b>Symmetrical Patterns</b>		<b>Test 4 Rubric</b>	
The core elements of performance required by this task are: <ul style="list-style-type: none"> <li>• name simple shapes</li> <li>• work with symmetry</li> </ul> Based on these, credit for specific aspects of performance should be assigned as follows		points	section points
1. Gives correct answers: <b>Square, Rectangle, Triangle, Octagon</b> Allow 1 point for each correct shape. Minus 1 point for each shape after four.		1 x 4	4
2. Correctly draws two lines of symmetry on pattern.		1	1
3. Correctly completes the pattern.  <i>Partial credit</i> Diagram partially correct.  Gives correct answers for correct pattern only: <b>Triangle and Square/Rectangle</b> Accept trapezoid.		2  (1)  1	3
<b>Total Points</b>			<b>8</b>

## Looking at Student Work on Symmetrical Patterns

Student A is able to meet all the demands of the task. Of the students who drew two correct lines of symmetry 11% drew the 2 diagonals and 11% drew a vertical line and a diagonal. 9% of the students drew in all lines of symmetry.

### Student A

#### Symmetrical Patterns

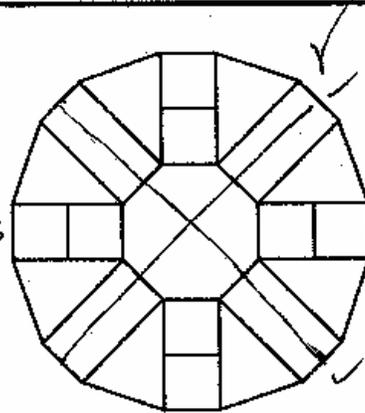
This problem gives you the chance to:

- name simple shapes
- work with symmetry

Saba makes this pattern using shape blocks.

1. Write the names of the shapes she uses.

Squares, Octagon,  
triangles, and rectangles



2. This pattern is symmetrical.

Draw in two of the lines of symmetry of this pattern.

A  
|

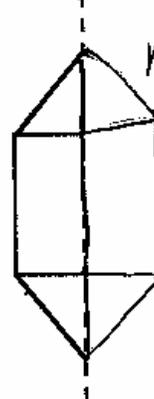
3. The diagram below shows half of a different symmetrical pattern that Saba makes.

Draw the other half of her pattern.

Write the names of the shapes in the pattern.

Squares, and  
rectangles

line of symmetry



2  
|

A

Student B was able to show understanding of all the parts of the task, including an understanding of lines of symmetry. 23% of the students who missed the lines of symmetry only drew the vertical line of symmetry, while no child only drew one line of symmetry with any other orientation.

**Student B**

**Symmetrical Patterns**

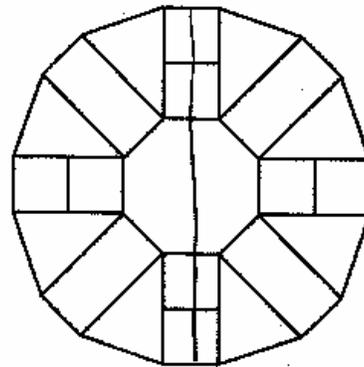
This problem gives you the chance to:

- name simple shapes
- work with symmetry

Saba makes this pattern using shape blocks.

1. Write the names of the shapes she uses.

rectangle ✓ ✓  
 square ✓ ✓  
 octagon ✓ ✓  
 triangle ✓ ✓



2. This pattern is symmetrical.

Draw in two of the lines of symmetry of this pattern. X

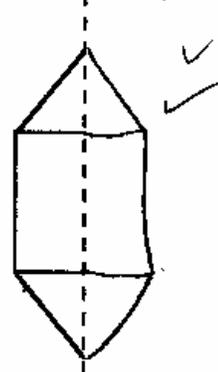
3. The diagram below shows half of a different symmetrical pattern that Saba makes.

Draw the other half of her pattern.

Write the names of the shapes in the pattern.

triangle ✓ ✓  
 square ✓ ✓

line of symmetry



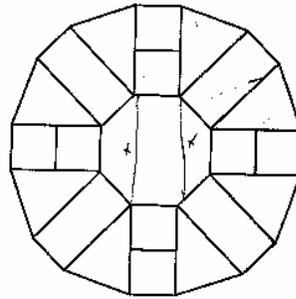
Student C does not appear to understand line of symmetry completely. The Student is able to use the line of symmetry to complete a pattern in part 3, but cannot mark the design with the correct lines in part 2. The student appears to just be adding two lines to complete a design.

**Student C**

Saba makes this pattern using shape blocks.

1. Write the names of the shapes she uses.

Squares ✓ ✓  
triangles ✓ ✓  
rectangles ✓ ✓  
(an) octagon ✓ ✓



2. This pattern is symmetrical.

Draw in two of the lines of symmetry of this pattern.

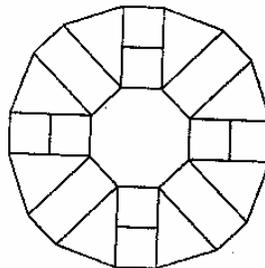
Student D shows many of the typical errors found in student work. Many students think that the pattern is a circle and the octagon is a circle. Many also omit the octagon. 52% of the students who miss the lines of symmetry do not attempt this part of the task. Student D's pattern is common pattern for students.

**Student D**

Saba makes this pattern using shape blocks.

1. Write the names of the shapes she uses.

triangle, rectangle, square  
and circles for the  
middle and everything is  
for the sides



2. This pattern is symmetrical.

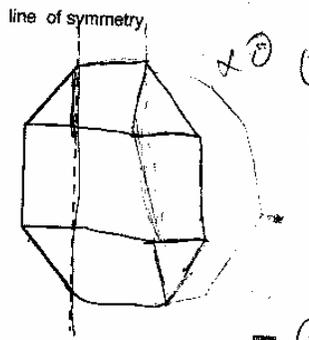
Draw in two of the lines of symmetry of this pattern.

3. The diagram below shows half of a different symmetrical pattern that Saba makes.

Draw the other half of her pattern.

Write the names of the shapes in the pattern.

triangle, rectangle



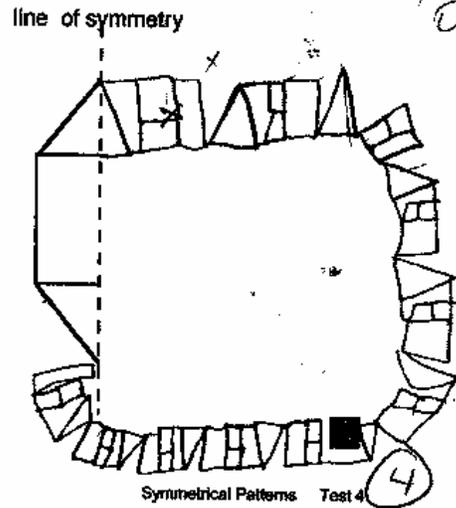
Student E makes the most common error of mistaking the octagon for a hexagon. The student draws the 2 most popular lines of symmetry used by almost 70% of the successful students. In part 3 the student does not use symmetry for making a design.

**Student E**

**Draw the other half of her pattern.**

**Write the names of the shapes in the pattern.**

~~rectangle, triangle, square,~~  
~~rectangle, triangle, square~~



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Page 5

Symmetrical Patterns Test 4

**Teacher Notes:**

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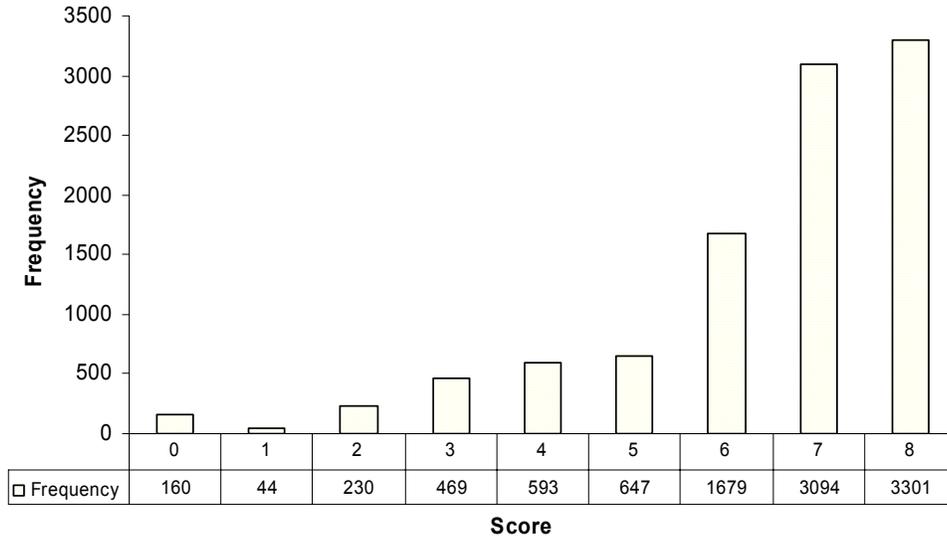
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Frequency Distribution for each Task – Grade 4  
Grade 4 – Symmetrical Patterns

**Symmetrical Patterns**

Mean: 6.43, S.D.: 1.78



Score:	0	1	2	3	4	5	6	7	8
% <=	1.6%	2.0%	4.2%	8.8%	14.6%	21.0%	37.4%	67.7%	100.0%
% >=	100.0%	98.4%	98.0%	95.8%	91.2%	85.4%	79.0%	62.6%	32.3%

The maximum score available for this task is 8 points.  
The cut score for a level 3 response, meeting standards, is 4 points.

Most students (about 96%) could identify three shapes in the pattern. Many students (91%) could name all 4 shapes include the hexagon with no extras. A majority of students (79%) could name the three shapes in the pattern, complete a pattern when shown half, and name the shapes needed to complete the new design. 32% of the students could meet all the demands of the task including drawing in two lines of symmetry for a given pattern. Less than 2% of the students scored no points on this task. Only 1/3 of the students with this score attempted the task.

## Symmetrical Patterns

Points	Understandings	Misunderstandings
0		2/3 of the students with this score did not attempt the task.
3	Students could generally name three shapes, usually the triangle, square, and rectangle.	Most students omitted octagon or thought it was a hexagon. Some thought either the center or the outside of the design was a circle.
4	Most students with this score could name all 4 shapes in the design with no extras or name 3 shapes and draw in 2 lines of symmetry.	For students who missed the lines of symmetry, 52% did not attempt that part of the task and 30% drew only the vertical line of symmetry.
6	Students with this score generally could name 3 shapes in the drawing, complete the pattern, and name the shapes needed for the new design.	Students still had trouble with the octagon and drawing the lines of symmetry.
7		35% of the students with this score missed the lines of symmetry. 53% of the students with this score did not identify the octagon.
8	Students could identify shapes in a pattern, including an octagon, draw in at least two lines of symmetry in a design, complete a figure given half and name the shapes in the new design. Some students drew in all 4 lines of symmetry.	

### Teacher Notes:

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*Based on teacher observations, this is what fourth graders knew and were able to do:*

- Identify common shapes, like triangles, squares, and rectangles
- Draw a symmetrical pattern
- Find a vertical line of symmetry

*Areas of difficulty for fourth graders, fourth grade students struggled with:*

- Distinguishing between octagon and hexagon
- Finding more than one line of symmetry for a shape

## Questions for Reflection on Symmetrical Patterns:

- Some students need more work with spatial visualization. How many of your students thought there was a circle in the design in part 1?
- How many of your students forgot to include the triangle in part 1? What might have led to this mistake?
- To check for understanding requires going at an idea from several directions. Many students only drew the vertical line of symmetry. What might these students know and not know about symmetry?
- Most students only drew the horizontal and vertical lines of symmetry. What might these students know and not know about symmetry? What might you like to ask next to check for depth of knowledge about symmetry?
- How many of your students drew lines of symmetry within the individual pieces in the design? What is the big idea they are missing?
- How many of your students drew in lines unrelated to symmetry? What further experiences do this students need to develop the concept?
- In part 3 of the task, understanding of symmetry is being checked in a different way. Can students use a line of symmetry to complete a pattern?
- Do you think the results would have been different if the line of symmetry was horizontal or diagonal? What are some further tasks you might want to give students to check depth of knowledge on symmetry?

## Teacher Notes:

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## Implications for Instruction:

Students need exposure to the names and attributes of more complex shapes, like hexagon and octagon. Students need to be able to draw lines of symmetry on complex figures. Students need experiences with a variety shapes, making certain that not all shapes have lines of symmetry only the vertical or horizontal axes. Using mirrors to help see how the line of symmetry divides shapes into matching parts is a good tool for developing this skill. Students should also have many experiences drawing reflections along a line of symmetry.