Name_____ Date _____

Chapter 4

Performance Task

Revolving Doors

Instructional Overview	
Launch Question	Can the rotational symmetry of a revolving door help with balancing the air pressure between the interior and exterior of a building?
Summary	The students start with an application where rotational symmetry is important to design. The students proceed to identify the symmetry and then use it to translate a quadrilateral.
Teacher Notes	This task is more difficult for students than might be expected. They should be encouraged to use graph paper and draw out each step when translating a shape. They can use cut-out shapes to help them see what happens when they rotate or reflect shapes. When the students are asked in Exercise 3 if they have surrounded a certain point, they should check to see if they have successfully done this. If their shapes do not enclose the point, then they should start over.
Supplies	Handouts, graph paper, straightedges
Mathematical Discourse	Where have you seen rotating doors? Is the building that uses them large? Why is that important?
Writing/Discussion Prompt	Where do you see functional designs that have rotational symmetry? Describe at least two objects or examples.

Curriculum Content	
Content Objectives	• Identify and describe rotations. • Create figures which have rotational symmetry. • Use compositions of transformations to describe rigid motion.
Mathematical Practices	Mathematically proficient students use transformations to accurately describe rigid motions.

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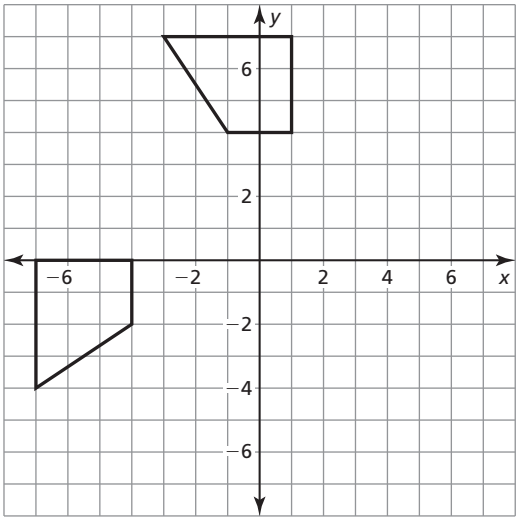
Chapter 4 Performance Task (continued)

Rubric

Revolving Doors	Points
1. a. no; There is no rotation of 180° or less that maps the figure onto itself. b. yes; Rotations of 45°, 90°, 135°, and 180° about the center all map the figure onto itself. The center of symmetry is the center of the circle. c. yes; Rotations of 90° and 180° about the center map the figure onto itself. The center of symmetry is at the intersection of the shapes.	**6** Total possible points **2** for each correct part
2. *Sample answer:*  Because $\frac{360°}{72°} = 5$, there needs to be 5 similar parts that can be rotated; 144°	**3** Total possible points **1** for each correct answer
3.  yes; $(-7, 0), (-4, 0), (-7, -4), (-4, -2)$	**6** Total possible points **2** for each correct answer
4. *Sample answer:* Reflect in the y-axis, rotate around the point $(3, 2)$ 90° counterclockwise, and translate $(x, y) \rightarrow (x + 1, y + 4)$.	**3** Total possible points **1** for each correct transformation
Mathematical Practices: Mathematically proficient students use transformations to accurately describe rigid motions. They practice performing rotations, translations, and reflections of shapes to better understand how revolving doors work.	**3** The student accurately performs rotations, translations, and reflections. Partial credit may be awarded.
Total Points	**21 points**

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Chapter 4

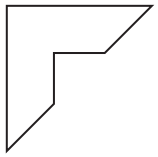
Performance Task (continued)

Revolving Doors

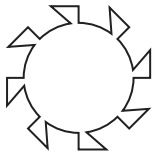
Can the rotational symmetry of a revolving door help with balancing the air pressure between the interior and exterior of a building?

1. When the air pressure on each side of a door is different, there can be difficulty keeping it closed. Revolving doors have rotational symmetry. This allows them to turn and balance the air pressure, which is especially great in high-rise buildings. Determine whether the following figures have rotational symmetry. If so, describe the symmetry and locate the center of symmetry. If not, explain why not.

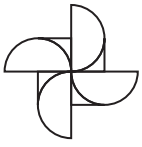
a.



b.



c.



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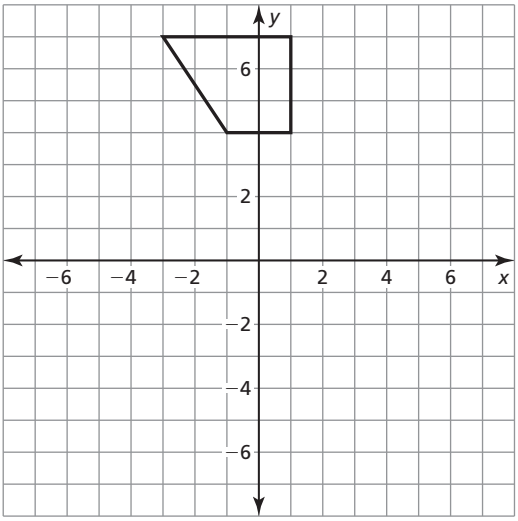
Chapter 4 Performance Task (continued)

2. Create a shape that has $72°$ rotational symmetry. Explain how you figured out how to create the shape. What other degree(s) of rotation(s) would this shape have?

3. For the figure shown, translate $(x, y) \rightarrow (x + 5, y - 2)$. Then reflect in the y-axis. Next, rotate around the point $(-4, 2)$ counterclockwise $90°$. Finally, reflect the figure in the x-axis. Does the shape enclose the point $(-6, -2)$? What are the new coordinates of the vertices?



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Chapter 4 Performance Task (continued)

4. Describe a congruence transformation that maps the quadrilateral $ABCD$ to its image $A'B'C'D'$.