Lesson 9-1

For Items 1–4, a square is drawn in the coordinate plane, with vertices as shown in the diagram. Then the square undergoes a rigid motion.

1. The function that describes the rigid motion could be $(x, y) \rightarrow$  
   A. $(2x, y)$  
   B. $(x - 3, y)$  
   C. $(y, -2x)$  
   D. $(x, 3)$.

2. If the point $(0, 3)$ is mapped to $(0, 0)$, what could be the image of $(3, 0)$?  
   A. $(0, 0)$  
   B. $(0, 3)$  
   C. $(3, -3)$  
   D. $(-3, 3)$.

3. The length of the diagonal of the square is $3\sqrt{2}$. Can you determine the length of the diagonal of the image of the square? Explain.

4. Draw the transformations of the square described by these functions. Classify each as rigid or non-rigid.  
   a. $(x, y + 2)$  
   b. $(x + 3, y - 3)$  
   c. $\left(2x, \frac{1}{2}y\right)$.

Lesson 9-2

For Items 5 and 6, a down arrow is drawn with its tip at $(2, 0)$. Then it undergoes a translation described by the directed line segment $(-3, 1)$.

5. The image of the tip of the arrow is at point  
   A. $(2, 1)$  
   B. $(-1, 1)$  
   C. $(2, -3)$  
   D. $(-3, 2)$.

6. The image of the arrow points in which direction?  
   A. down  
   B. left  
   C. right  
   D. diagonal.

7. The diagram shows regular pentagon $ABCDE$.  
   a. Draw the translation $T_{\vec{u}}$. Label the images of each vertex.  
   b. Is it possible for a translation to map more than one point of the pentagon onto another point of the pentagon? Explain.

ACTIVITY 9 Continued

ACTIVITY PRACTICE

1. B  
2. C  
3. Rigid motions preserve distances within a figure, so the length of the diagonal of the image is also $3\sqrt{2}$.
4. Check students’ drawings.  
   a. a square with vertices $(0, 2), (3, 2), (0, 5),$ and $(3, 5)$  
   b. a square with vertices $(3, -3), (3, 0), (6, -3), (6, 0)$  
   c. a rectangle with vertices $(0, 0), (6, 0), (0, 1.5), (6, 1.5)$

5. B  
6. A  
7. Check students’ drawings.  
   a.
8. The reflection would be across any of the lines of symmetry of the square, such as \( y = 1.5, x = 1.5, \ y = x, \) or \( x + y = 3. \)

9. Draw four lines that are parallel to line \( l \) and perpendicular to \( AB \), as shown in the diagram. Then the square is reflected across the \( x \)-axis.

10. Describe a reflection of the square that would map it onto itself.

11. Both the reflection and the rotation map the square onto itself. However, each maps the square in a different way. The rotation maps opposite diagonals onto each other. The reflection maps in a vertical direction only.

12. If the tip of the arrow moves to \((0, 2)\), what is the center of rotation?
   \[ \text{A.} \ (2, 2) \quad \text{B.} \ (2, 4) \quad \text{C.} \ (0, 2) \quad \text{D.} \ (0, 0) \]

13. How many possible centers of rotation will produce an image of a left-pointing arrow?
   \[ \text{A.} \ \text{zero} \quad \text{B.} \ \text{one} \quad \text{C.} \ \text{two} \quad \text{D.} \ \text{infinite} \]

14. Describe the rotational and reflectional symmetry of these shapes.
   \[ \text{a.} \ \text{ellipse} \quad \text{b.} \ \text{right isosceles triangle} \]
   \[ \text{c.} \ \text{letter S} \quad \text{d.} \ \text{plus sign} \]

15. Figure \( A \) is a square that is centered at the origin \( O \). A student claims that the reflection \( r_{xy} \) and the rotation \( R_{90^\circ} \) transform the square in the same way. Critique this claim.