ALBERT

Name _____ Date _____

Transformations as Functions Worksheet

Geometry · Common Core HSG-CO.A.2

> Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch).

Practice

Builds the skill step by step.

1. A transformation maps $(x, y) \to (x + 3, y - 2)$. What is the image of $(1, 4)$?

2. A transformation maps $(x, y) \to (-x, y)$. What is the image of $(5, -3)$?

3. A transformation maps $(x, y) \to (y, -x)$. What is the image of $(2, 5)$?

4. Which transformation preserves distance?

   A. $(x, y) \to (2x, y)$

   B. $(x, y) \to (x, 3y)$

   C. $(x, y) \to (2x, 2y)$

   D. $(x, y) \to (x + 4, y)$

5. A transformation maps $(x, y) \to (x - 6, y + 1)$. What is the image of $(0, 0)$?

6. A transformation maps $(x, y) \to (x, -y)$. What is the image of $(-4, 7)$?

7. Under $(x, y) \to (x + 2, y + 5)$, the image of point P is (7, 3). What are the coordinates of P?

8. The horizontal stretch $(x, y) \to (3x, y)$ is applied to the segment from (0, 0) to (2, 0). How long is the image segment?

9. Why can a transformation be called a function?

   A. It always moves points to the right.

   B. It never changes any point.

   C. Each point in the plane is an input, and its image is exactly one output point.

   D. It turns numbers into shapes.

10. A transformation maps $(x, y) \to (-y, x)$. What is the image of (3, 1)?

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On Level

Grade-level practice.

1. A translation maps A(2, −1) to A′(−3, 4). Where does the same translation map B(0, 0)?

2. The transformation (x, y) → (x, 2y) is applied to the segment from (1, 1) to (4, 5), which has length 5. What is the exact length of the image segment?

3. Which rule describes a reflection across the line y = x?

   A. (x, y) → (y, x)

   B. (x, y) → (−x, y)

   C. (x, y) → (x, −y)

   D. (x, y) → (−y, −x)

4. Rotate (4, −2) by 180° about the origin. What is the image?

5. Reflect (−3, 6) across the x-axis. What is the image?

6. Which transformation does NOT preserve angle measure?

   A. $(x, y) \to (-y, x)$

   B. $(x, y) \to (2x, y)$

   C. $(x, y) \to (x, -y)$

   D. $(x, y) \to (x + 5, y - 1)$

7. A translation maps $(2, 3)$ to $(-1, 7)$. What is the image of $(5, -5)$ under the same translation?

8. The dilation $(x, y) \to (2x, 2y)$ is applied to a segment of length 3. How long is the image?

9. Reflect $(5, 1)$ across the y-axis, then apply $(x, y) \to (x, y - 4)$. What is the final image?

10. A transformation maps every point P to P′. Which statement means it is a rigid motion?

    A. $P' = P$ for every point

    B. $P'Q' = 2PQ$ for every pair of points

    C. P′ is always to the right of P

    D. $P'Q' = PQ$ for every pair of points P and Q

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Challenge

Multi-step and word problems that stretch it.

1. Rotate (1, 4) by 90° counterclockwise about the origin, then reflect the result across the x-axis. What is the final image?

2. The transformation (x, y) → (−x, y) leaves some points where they are. What x-coordinate do all of those points share?

3. A triangle has an area of 12 square units. The transformation (x, y) → ($\frac{1}{2}$x, y) is applied. What is the area of the image?

4. Applying (x, y) → (x + 1, y) twice is the same as which single rule?

   A. (x, y) → (x + 2, y)

   B. (x, y) → (2x, y)

   C. (x, y) → (x + 1, y + 1)

   D. (x, y) → (x, y)

5. A triangle has vertices (0, 0), (4, 0) and (0, 3). The transformation (x, y) → (3x, y) is applied. What is the exact length of the image's longest side? Write it in simplest radical form.

6. A 90° counterclockwise rotation about the origin maps point (a, b) to (−6, 2). What is (a, b)?

7. Which pair of transformations always gives the same result in either order?

   A. a translation and a rotation

   B. two translations

   C. two reflections across intersecting lines

   D. a reflection and a rotation

8. Reflect (3, −7) across the line y = x. What is the image?

9. Apply (x, y) → (x + 4, y − 1) three times to the point (0, 0). What is the final image?

10. Explain why (x, y) → (x, 3y) is not a rigid motion.