

Rotations, Reflections, and Translations

Name: _____

Date: _____

Score: _____ / 24

Q Quick Review

A **transformation** moves a figure without bending or breaking it. A **translation** slides every point the same distance in the same direction. A **reflection** flips the figure across a line, like a mirror. A **rotation** turns the figure around a fixed point by some angle. All three are **rigid motions**: they keep every *length* and every *angle* exactly the same, so the new figure is the same size and shape as the original — just in a new spot.

◇ **Example:** Point $P(3, 5)$ is translated 4 units left and 2 units down. Find its new location.

⇒ A translation just shifts the point, so we handle the x and y separately. “4 units left” means subtract 4 from the x -value: $3 - 4 = -1$. “2 units down” means subtract 2 from the y -value: $5 - 2 = 3$. So the point lands at $(-1, 3)$. Notice the figure didn’t shrink or turn — it only slid.

Answer: $P' = (-1, 3)$

PRACTICE

Identify the transformation or find the new location of the point.

- Translate $(2, 3)$ right 5 _____
- Translate $(4, 1)$ up 6 _____
- Translate $(-3, 2)$ left 2 _____
- Translate $(5, -4)$ down 3 _____
- Translate $(0, 0)$ right 7 up 2 _____
- Translate $(6, 6)$ left 4 down 5 _____
- Reflect $(3, 5)$ over the x -axis _____
- Reflect $(-2, 4)$ over the x -axis _____
- Reflect $(3, 5)$ over the y -axis _____
- Reflect $(-6, -1)$ over the y -axis _____
- Reflect $(4, 7)$ over the line $y = x$ _____
- Reflect $(-2, 5)$ over the line $y = x$ _____
- Rotate $(1, 0)$ 90° counterclockwise about origin _____
- Rotate $(0, 1)$ 90° counterclockwise about origin _____
- Rotate $(4, 2)$ 180° about origin _____
- Rotate $(-3, 5)$ 180° about origin _____
- Rotate $(2, 3)$ 90° clockwise about origin _____
- Rotate $(5, -1)$ 90° clockwise about origin _____
- A figure flips across a vertical mirror line. Name it. _____
- A figure turns 45° around a point. Name it. _____

◆ Word Problems

- On a video game grid, a player at $(8, 3)$ moves 5 squares left and 4 squares up to reach a coin. What are the coin’s coordinates?

- A graphic designer reflects a logo placed at $(6, -2)$ across the x -axis to make a mirrored copy. Where is the copy? _____
- A clock’s hour hand tip is at $(0, 4)$. The hand rotates 90° clockwise about the center at the origin. Where is the tip now?

- A robot at $(-3, -3)$ is rotated 180° about the origin during a test. Explain why the robot is still the same size, and give its new position. _____



Answer Keys

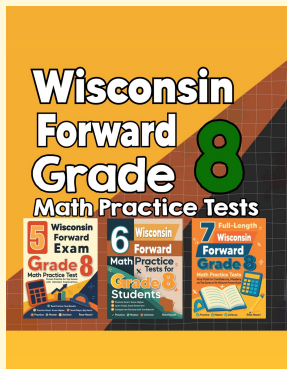
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| <p>1. <input type="text" value="(7, 3)"/></p> <p>2. <input type="text" value="(4, 7)"/></p> <p>3. <input type="text" value="(-5, 2)"/></p> <p>4. <input type="text" value="(5, -7)"/></p> <p>5. <input type="text" value="(7, 2)"/></p> <p>6. <input type="text" value="(2, 1)"/></p> <p>7. <input type="text" value="(3, -5)"/></p> <p>8. <input type="text" value="(-2, -4)"/></p> <p>9. <input type="text" value="(-3, 5)"/></p> <p>10. <input type="text" value="(6, -1)"/></p> <p>11. <input type="text" value="(7, 4)"/></p> <p>12. <input type="text" value="(5, -2)"/></p> | <p>13. <input type="text" value="(0, 1)"/></p> <p>14. <input type="text" value="(-1, 0)"/></p> <p>15. <input type="text" value="(-4, -2)"/></p> <p>16. <input type="text" value="(3, -5)"/></p> <p>17. <input type="text" value="(3, -2)"/></p> <p>18. <input type="text" value="(-1, -5)"/></p> <p>19. <input type="text" value="reflection"/></p> <p>20. <input type="text" value="rotation"/></p> <p>21. <input type="text" value="(3, 7)"/></p> <p>22. <input type="text" value="(6, 2)"/></p> <p>23. <input type="text" value="(4, 0)"/></p> <p>24. <input type="text" value="(3, 3); rotations are rigid motions, so size is unchanged"/></p> |
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Step-by-Step Explanations

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| <p>1. Right 5 adds 5 to the x-value: $2 + 5 = 7$, and y stays 3.</p> <p>2. Up 6 adds 6 to the y-value: $1 + 6 = 7$, and x stays 4.</p> <p>3. Left 2 subtracts 2 from x: $-3 - 2 = -5$; y stays 2.</p> <p>4. Down 3 subtracts 3 from y: $-4 - 3 = -7$; x stays 5.</p> <p>5. Add 7 to x and 2 to y: from the origin we reach $(7, 2)$.</p> <p>6. Subtract 4 from x ($6 - 4 = 2$) and 5 from y ($6 - 5 = 1$).</p> <p>7. Reflecting over the x-axis keeps x and negates y: $(3, -5)$.</p> <p>8. Keep x, flip the sign of y: 4 becomes -4.</p> <p>9. Reflecting over the y-axis keeps y and negates x: $(-3, 5)$.</p> <p>10. Keep y, flip the sign of x: -6 becomes 6.</p> <p>11. Reflecting over $y = x$ swaps the coordinates: $(4, 7) \rightarrow (7, 4)$.</p> <p>12. Swap the coordinates: $(-2, 5) \rightarrow (5, -2)$.</p> <p>13. A 90° counterclockwise turn sends $(x, y) \rightarrow (-y, x)$, so $(1, 0) \rightarrow (0, 1)$.</p> <p>14. Using $(x, y) \rightarrow (-y, x)$: $(0, 1) \rightarrow (-1, 0)$.</p> | <p>15. A 180° rotation sends $(x, y) \rightarrow (-x, -y)$: $(4, 2) \rightarrow (-4, -2)$.</p> <p>16. Negate both coordinates: $(-3, 5) \rightarrow (3, -5)$.</p> <p>17. A 90° clockwise turn sends $(x, y) \rightarrow (y, -x)$: $(2, 3) \rightarrow (3, -2)$.</p> <p>18. Using $(x, y) \rightarrow (y, -x)$: $(5, -1) \rightarrow (-1, -5)$.</p> <p>19. Flipping across a line is a reflection — the figure is mirrored.</p> <p>20. Turning around a fixed point by an angle is a rotation.</p> <p>21. Moving left 5 gives $8 - 5 = 3$ for the x-value, and up 4 gives $3 + 4 = 7$ for the y-value, so the coin is at $(3, 7)$.</p> <p>22. A reflection over the x-axis keeps the x-coordinate and flips the sign of y, so $(6, -2)$ becomes $(6, 2)$.</p> <p>23. A 90° clockwise rotation about the origin sends $(x, y) \rightarrow (y, -x)$, so $(0, 4) \rightarrow (4, 0)$.</p> <p>24. A 180° rotation sends $(x, y) \rightarrow (-x, -y)$, so $(-3, -3) \rightarrow (3, 3)$. Rotations are rigid motions: they keep all lengths and angles, so the robot is unchanged in size.</p> |
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