

# Transformations on the Coordinate Plane

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Score: \_\_\_\_\_ / 24

## Q Quick Review

A **transformation** moves a point or shape to a new spot. A **translation** slides a point: moving right adds to  $x$ , left subtracts from  $x$ , up adds to  $y$ , and down subtracts from  $y$ . A **reflection** flips a point over a line, like a mirror. Reflecting over the  $x$ -axis keeps  $x$  the same and flips the sign of  $y$ :  $(x, y) \rightarrow (x, -y)$ . Reflecting over the  $y$ -axis keeps  $y$  the same and flips the sign of  $x$ :  $(x, y) \rightarrow (-x, y)$ . Take it one coordinate at a time and you will not get mixed up.

◇ **Example:** The point  $(3, 2)$  is translated 5 units right and 3 units up. What are its new coordinates?

⇒ Handle the  $x$ -coordinate first. Moving 5 units right means adding 5 to the  $x$ -value:  $3 + 5 = 8$ . Now the  $y$ -coordinate. Moving 3 units up means adding 3 to the  $y$ -value:  $2 + 3 = 5$ . Put the two new coordinates together to get the image point  $(8, 5)$ .

**Answer:**  $(8, 5)$

## PRACTICE

Find the new coordinates after each transformation. Write answers as ordered pairs.

- |                                      |       |                                           |       |
|--------------------------------------|-------|-------------------------------------------|-------|
| 1. Translate $(1, 1)$ right 4        | _____ | 11. Reflect $(4, 2)$ over the $x$ -axis   | _____ |
| 2. Translate $(2, 3)$ up 5           | _____ | 12. Reflect $(3, 5)$ over the $x$ -axis   | _____ |
| 3. Translate $(6, 4)$ left 2         | _____ | 13. Reflect $(6, 1)$ over the $x$ -axis   | _____ |
| 4. Translate $(5, 7)$ down 3         | _____ | 14. Reflect $(2, -4)$ over the $x$ -axis  | _____ |
| 5. Translate $(2, 2)$ right 3 up 4   | _____ | 15. Reflect $(5, 2)$ over the $y$ -axis   | _____ |
| 6. Translate $(8, 5)$ left 5 down 2  | _____ | 16. Reflect $(3, 7)$ over the $y$ -axis   | _____ |
| 7. Translate $(0, 0)$ right 6 up 6   | _____ | 17. Reflect $(8, 4)$ over the $y$ -axis   | _____ |
| 8. Translate $(4, 9)$ left 4 down 9  | _____ | 18. Reflect $(-6, 3)$ over the $y$ -axis  | _____ |
| 9. Translate $(3, 1)$ right 7 down 1 | _____ | 19. Reflect $(7, -2)$ over the $x$ -axis  | _____ |
| 10. Translate $(10, 2)$ left 3 up 5  | _____ | 20. Reflect $(-4, -5)$ over the $y$ -axis | _____ |

## ◆ Word Problems

21. On a game board, a player's piece is at  $(4, 3)$ . The player moves it 6 spaces right and 2 spaces up. What is the piece's new position? \_\_\_\_\_
22. A drone is at the point  $(7, 5)$  on a map grid. It flies 3 units left and 5 units down. Where is the drone now? \_\_\_\_\_
23. A designer places a logo at  $(6, 4)$  and wants its mirror image across the  $y$ -axis for the opposite page. What are the coordinates of the reflected logo? \_\_\_\_\_
24. A boat marker is at  $(5, 8)$  on a chart. The chart is flipped over the  $x$ -axis to show the view from below. What are the new coordinates of the marker? \_\_\_\_\_



## Answer Keys

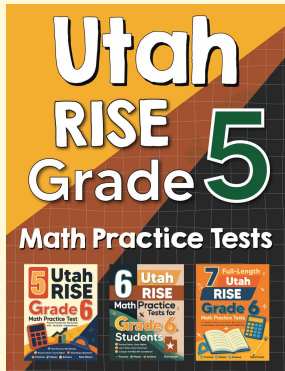
- |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
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| <p>1. <span style="border: 1px solid black; border-radius: 5px; padding: 2px;">(5, 1)</span></p> <p>2. <span style="border: 1px solid black; border-radius: 5px; padding: 2px;">(2, 8)</span></p> <p>3. <span style="border: 1px solid black; border-radius: 5px; padding: 2px;">(4, 4)</span></p> <p>4. <span style="border: 1px solid black; border-radius: 5px; padding: 2px;">(5, 4)</span></p> <p>5. <span style="border: 1px solid black; border-radius: 5px; padding: 2px;">(5, 6)</span></p> <p>6. <span style="border: 1px solid black; border-radius: 5px; padding: 2px;">(3, 3)</span></p> <p>7. <span style="border: 1px solid black; border-radius: 5px; padding: 2px;">(6, 6)</span></p> <p>8. <span style="border: 1px solid black; border-radius: 5px; padding: 2px;">(0, 0)</span></p> <p>9. <span style="border: 1px solid black; border-radius: 5px; padding: 2px;">(10, 0)</span></p> <p>10. <span style="border: 1px solid black; border-radius: 5px; padding: 2px;">(7, 7)</span></p> <p>11. <span style="border: 1px solid black; border-radius: 5px; padding: 2px;">(4, -2)</span></p> <p>12. <span style="border: 1px solid black; border-radius: 5px; padding: 2px;">(3, -5)</span></p> | <p>13. <span style="border: 1px solid black; border-radius: 5px; padding: 2px;">(6, -1)</span></p> <p>14. <span style="border: 1px solid black; border-radius: 5px; padding: 2px;">(2, 4)</span></p> <p>15. <span style="border: 1px solid black; border-radius: 5px; padding: 2px;">(-5, 2)</span></p> <p>16. <span style="border: 1px solid black; border-radius: 5px; padding: 2px;">(-3, 7)</span></p> <p>17. <span style="border: 1px solid black; border-radius: 5px; padding: 2px;">(-8, 4)</span></p> <p>18. <span style="border: 1px solid black; border-radius: 5px; padding: 2px;">(6, 3)</span></p> <p>19. <span style="border: 1px solid black; border-radius: 5px; padding: 2px;">(7, 2)</span></p> <p>20. <span style="border: 1px solid black; border-radius: 5px; padding: 2px;">(4, -5)</span></p> <p>21. <span style="border: 1px solid black; border-radius: 5px; padding: 2px;">(10, 5)</span></p> <p>22. <span style="border: 1px solid black; border-radius: 5px; padding: 2px;">(4, 0)</span></p> <p>23. <span style="border: 1px solid black; border-radius: 5px; padding: 2px;">(-6, 4)</span></p> <p>24. <span style="border: 1px solid black; border-radius: 5px; padding: 2px;">(5, -8)</span></p> |
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### Step-by-Step Explanations

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| <p>1. Moving right adds to <math>x</math>: <math>1 + 4 = 5</math>. The <math>y</math>-value stays 1.</p> <p>2. Moving up adds to <math>y</math>: <math>3 + 5 = 8</math>. The <math>x</math>-value stays 2.</p> <p>3. Moving left subtracts from <math>x</math>: <math>6 - 2 = 4</math>. The <math>y</math>-value stays 4.</p> <p>4. Moving down subtracts from <math>y</math>: <math>7 - 3 = 4</math>. The <math>x</math>-value stays 5.</p> <p>5. Add to both: <math>2 + 3 = 5</math> and <math>2 + 4 = 6</math>.</p> <p>6. Subtract from both: <math>8 - 5 = 3</math> and <math>5 - 2 = 3</math>.</p> <p>7. Add to both: <math>0 + 6 = 6</math> and <math>0 + 6 = 6</math>.</p> <p>8. Subtract from both: <math>4 - 4 = 0</math> and <math>9 - 9 = 0</math>.</p> <p>9. Add to <math>x</math>: <math>3 + 7 = 10</math>. Subtract from <math>y</math>: <math>1 - 1 = 0</math>.</p> <p>10. Subtract from <math>x</math>: <math>10 - 3 = 7</math>. Add to <math>y</math>: <math>2 + 5 = 7</math>.</p> <p>11. Reflecting over the <math>x</math>-axis keeps <math>x</math> and flips <math>y</math>: <math>(4, -2)</math>.</p> <p>12. Keep <math>x</math>, flip the sign of <math>y</math>: <math>(3, -5)</math>.</p> <p>13. Keep <math>x</math>, flip the sign of <math>y</math>: <math>(6, -1)</math>.</p> <p>14. Keep <math>x</math>, flip the sign of <math>y</math>: <math>-4</math> becomes 4, giving <math>(2, 4)</math>.</p> | <p>15. Reflecting over the <math>y</math>-axis keeps <math>y</math> and flips <math>x</math>: <math>(-5, 2)</math>.</p> <p>16. Keep <math>y</math>, flip the sign of <math>x</math>: <math>(-3, 7)</math>.</p> <p>17. Keep <math>y</math>, flip the sign of <math>x</math>: <math>(-8, 4)</math>.</p> <p>18. Keep <math>y</math>, flip the sign of <math>x</math>: <math>-6</math> becomes 6, giving <math>(6, 3)</math>.</p> <p>19. Keep <math>x</math>, flip the sign of <math>y</math>: <math>-2</math> becomes 2, giving <math>(7, 2)</math>.</p> <p>20. Keep <math>y</math>, flip the sign of <math>x</math>: <math>-4</math> becomes 4, giving <math>(4, -5)</math>.</p> <p>21. Moving right adds to <math>x</math>: <math>4 + 6 = 10</math>. Moving up adds to <math>y</math>: <math>3 + 2 = 5</math>. The new position is <math>(10, 5)</math>.</p> <p>22. Moving left subtracts from <math>x</math>: <math>7 - 3 = 4</math>. Moving down subtracts from <math>y</math>: <math>5 - 5 = 0</math>. The drone is at <math>(4, 0)</math>.</p> <p>23. Reflecting over the <math>y</math>-axis keeps <math>y</math> the same and flips the sign of <math>x</math>: 6 becomes <math>-6</math>, giving <math>(-6, 4)</math>.</p> <p>24. Reflecting over the <math>x</math>-axis keeps <math>x</math> the same and flips the sign of <math>y</math>: 8 becomes <math>-8</math>, giving <math>(5, -8)</math>.</p> |
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