Transformations on the Coordinate Plane

Coordinate transformations: Mistakes and missing information

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QUICK REVIEW

A translation by (a, b) changes (x, y) to $(x + a, y + b)$. A reflection across the horizontal axis gives $(x, -y)$; across the vertical axis it gives $(-x, y)$. Translations and reflections preserve lengths. Label image points with primes, such as A'.

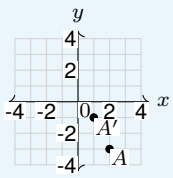
Worked example

Point A is at $(2, -3)$. Move it 1 unit left and 2 units up. Plot the original and label the image A'.

1. A: $(2 + (-1), -3 + (2)) = (1, -1)$.

2. Undo the translation: $(1 - (-1), -1 - (2)) = (2, -3)$.

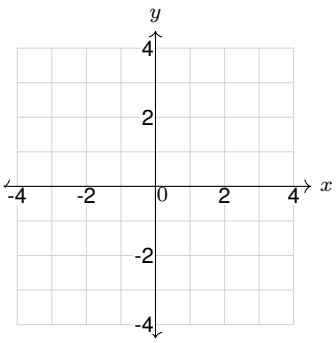
Answer: A′$(1, -1)$.



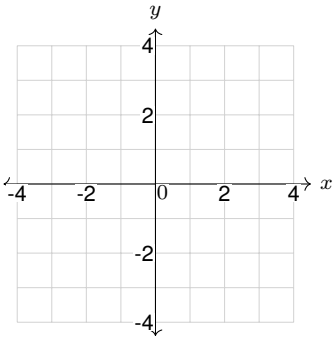
Practice Problems

Show your thinking.

1. A student swaps the horizontal and vertical moves. Find the correct image. Start with A$(2, 1)$; translate by $(-3, 2)$. Plot the original and image, labeling image points with primes.

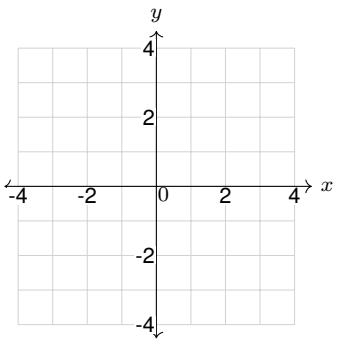


2. A student changes the horizontal coordinate instead. Correct it. Start with B$(1, -3)$; reflect across the horizontal axis. Plot the original and image, labeling image points with primes.



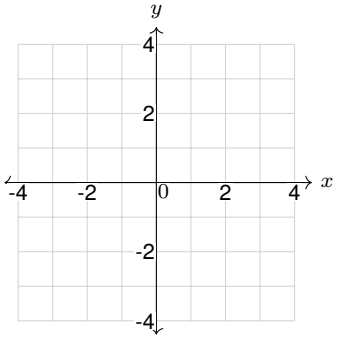
3. C prime is $(4, 1)$ after reflection across the y-axis. Find the original point C and verify by reflecting it again.

4. A segment is moved down as well as right. Recover both endpoints. Start with D$(-1, 2)$, E$(2, 2)$; translate by $(1, -3)$. Plot the original and image, labeling image points with primes.



5. Explain why this point does not move under the reflection. Start with F$(0, 3)$; reflect across the vertical axis. Give the image coordinates.

6. Design the mirrored segment. Start with G$(-2, -1)$, H$(1, -1)$; reflect across the horizontal axis. Plot the original and image, labeling image points with primes.



Answer Key

1. A′$(-1, 3)$.
2. B′$(1, 3)$.
3. C$(-4, 1)$.
4. D′$(0, -1)$; E′$(3, -1)$.
5. F′$(0, 3)$.
6. G′$(-2, 1)$; H′$(1, 1)$.

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. A: $(2 + (-3), 1 + (2)) = (-1, 3)$.
2. Undo the translation: $(-1 - (-3), 3 - (2)) = (2, 1)$.

Problem 2

1. B: keep $x = 1$ and change y to $-(-3) = 3$, giving $(1, 3)$.
2. The perpendicular distance to the mirror stays 3 units on both sides.

Problem 3

1. A reflection across the vertical axis keeps the height $y = 1$.
2. It reverses the horizontal coordinate, so $x = -4$. Reflecting $(-4, 1)$ gives $(4, 1)$ again.

Problem 4

1. D: $(-1 + (1), 2 + (-3)) = (0, -1)$.
2. E: $(2 + (1), 2 + (-3)) = (3, -1)$.

Problem 5

1. F: change x to $-(0) = 0$ and keep $y = 3$, giving $(0, 3)$.
2. The perpendicular distance to the mirror stays 0 units on both sides.

Problem 6

1. G: keep $x = -2$ and change y to $-(-1) = 1$, giving $(-2, 1)$.
2. H: keep $x = 1$ and change y to $-(-1) = 1$, giving $(1, 1)$.

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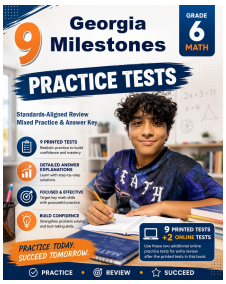

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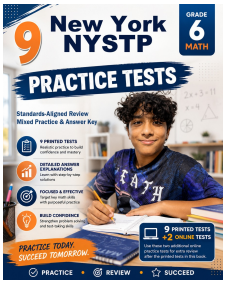

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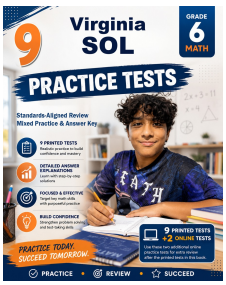

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