Transformations on the Coordinate Plane

Coordinate transformations: Models and calculations

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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'.

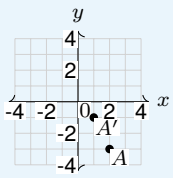
Worked example

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

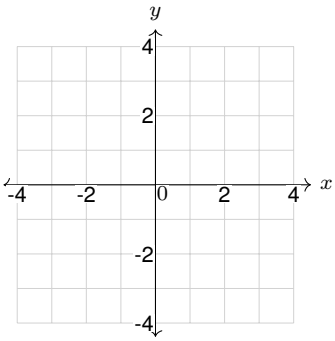
Answer: A′$(1, -1)$.



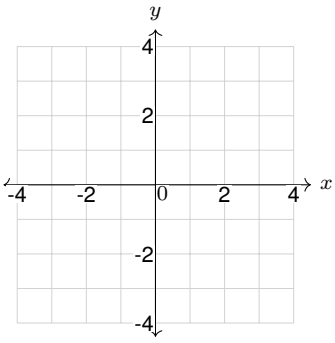
Practice Problems

Show your thinking.

1. Move this segment. Start with A$(-2, 1)$, B$(1, 1)$; translate by $(2, 1)$. Plot the original and image, labeling image points with primes.

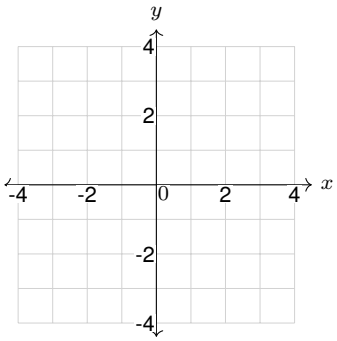


2. Use a horizontal mirror. Start with C$(1, 3)$, D$(3, 1)$; reflect across the horizontal axis. Plot the original and image, labeling image points with primes.



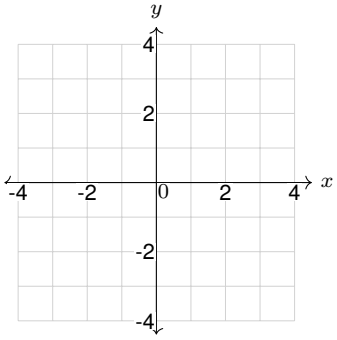
3. Use a vertical mirror. Start with E$(-3, 2)$, F$(-1, 4)$; reflect across the vertical axis. Give the image coordinates.

4. A robot makes a fixed move. Start with P$(0, -2)$; translate by $(-3, 3)$. Plot the original and image, labeling image points with primes.



5. Explain which coordinate changes. Start with Q$(2, -1)$; reflect across the horizontal axis. Give the image coordinates.

6. A student changes both signs for a vertical reflection. Repair the image. Start with R$(-2, -3)$; reflect across the vertical axis. Plot the original and image, labeling image points with primes.



Answer Key

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

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. A: $(-2 + (2), 1 + (1)) = (0, 2)$.
2. B: $(1 + (2), 1 + (1)) = (3, 2)$.

Problem 2

1. C: keep $x = 1$ and change y to $-(3) = -3$, giving $(1, -3)$.
2. D: keep $x = 3$ and change y to $-(1) = -1$, giving $(3, -1)$.

Problem 3

1. E: change x to $-(-3) = 3$ and keep $y = 2$, giving $(3, 2)$.
2. F: change x to $-(-1) = 1$ and keep $y = 4$, giving $(1, 4)$.

Problem 4

1. P: $(0 + (-3), -2 + (3)) = (-3, 1)$.
2. Undo the translation: $(-3 - (-3), 1 - (3)) = (0, -2)$.

Problem 5

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

Problem 6

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

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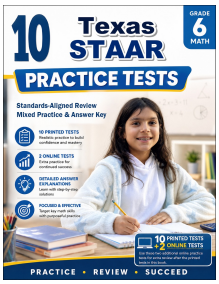

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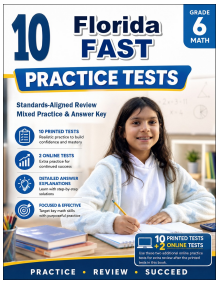

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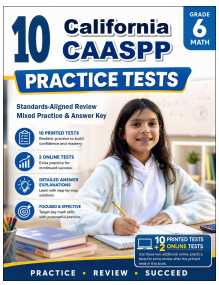

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