Rotations, Reflections, and Translations

Investigate mistakes and missing measures

Name _____ **Date** _____ **Score** _____ / 6

QUICK REVIEW

Translations use $(x, y) \mapsto (x + a, y + b)$. Reflections in the x- and y-axes use $(x, -y)$ and $(-x, y)$. About the origin, rotations of 90° counterclockwise, 90° clockwise, and 180° use $(-y, x)$, $(y, -x)$, and $(-x, -y)$. These rigid motions preserve lengths and angles; a reflection reverses orientation. Apply rules to every vertex.

Worked example

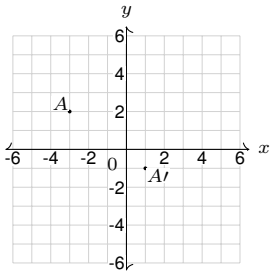
Reflect $E(-3, 2)$ across the x-axis, then translate 2 units right. Find the final point.

1. The reflection keeps $x = -3$ and changes the sign of y: $(-3, 2) \mapsto (-3, -2)$.
2. The translation adds 2 only to the first coordinate: $(-3 + 2, -2) = (-1, -2)$.
3. Thus $E'' = (-1, -2)$; the second move does not change its distance below the x-axis.
Answer: $E'' = (-1, -2)$

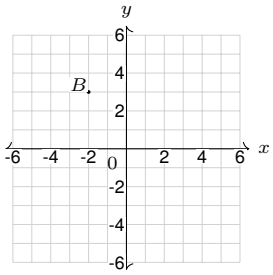
Practice Problems

Show your thinking.

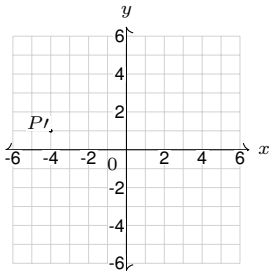
1. $A(-3, 2)$ translates to $A\prime(1, -1)$. Find the translation rule and check it.



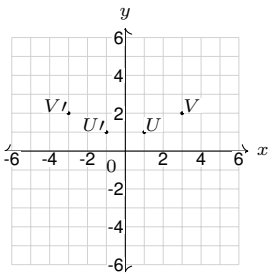
2. Kai says reflecting $B(-2, 3)$ across the x-axis gives $(2, 3)$. Correct the error and plot the image.



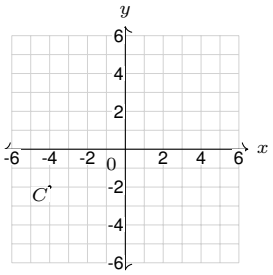
3. A 90° counterclockwise rotation sends P to $P\prime(-4, 1)$. Recover and plot P.



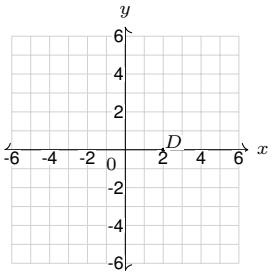
4. Can a translation send $U(1, 1)$ to $U\prime(-1, 1)$ and $V(3, 2)$ to $V\prime(-3, 2)$? Explain.



5. Lee says a half-turn sends $C(-4, -2)$ to $(-2, -4)$. Correct Lee and verify the midpoint.



6. $D(2, 0)$ stays fixed under reflection across one coordinate axis. Which axis? Contrast a 180° rotation.



Answer Key

1. $(x, y) \mapsto (x + 4, y - 3)$
2. $B\prime = (-2, -3)$
3. $P = (1, 4)$
4. No; the vectors differ.
5. $C\prime = (4, 2)$
6. x-axis; the half-turn gives $(-2, 0)$.

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. The horizontal change is $1 - (-3) = 4$ and the vertical change is $-1 - 2 = -3$.

2. Substitute the source: $(-3 + 4, 2 - 3) = (1, -1)$, which matches both target coordinates.

3. The translation is right 4, down 3; one unchanged coordinate alone would not be enough to check it.

Problem 2

1. Kai changed x from -2 to 2, which describes reflection across the y-axis instead.

2. For the requested reflection, $(-2, 3) \mapsto (-2, -3)$; the vertical distances are both 3.

3. The correct point is $B\prime = (-2, -3)$, directly below B, not across the other axis.

Problem 3

1. The image satisfies $(-y, x) = (-4, 1)$, so $-y = -4$ and $x = 1$.

2. Solving gives $y = 4$ and hence $P = (1, 4)$. Check: $(1, 4) \mapsto (-4, 1)$.

3. Thus $(1, 4)$ is the original; undo the 90° counterclockwise turn with a clockwise turn, not another counterclockwise turn.

Problem 4

1. The first required vector is $(-1 - 1, 1 - 1) = (-2, 0)$.

2. The second required vector is $(-3 - 3, 2 - 2) = (-6, 0)$, not $(-2, 0)$.

3. The vectors $(-2, 0) \neq (-6, 0)$ rule out one translation. Both pairs instead fit y-axis reflection, $(x, y) \mapsto (-x, y)$.

Problem 5

1. Lee swapped coordinates. A half-turn negates both: $(-4, -2) \mapsto (4, 2)$.

2. The correct midpoint is $((-4 + 4)/2, (-2 + 2)/2) = (0, 0)$, the rotation center.

3. Therefore plot $(4, 2)$. Lee's point has midpoint $(-3, -3)$ and fails the center check.

Problem 6

1. Reflecting in the x-axis gives $(2, -0) = (2, 0)$, so D stays fixed.

2. Reflecting in the y-axis gives $(-2, 0)$; a half-turn also gives $(-2, -0) = (-2, 0)$.

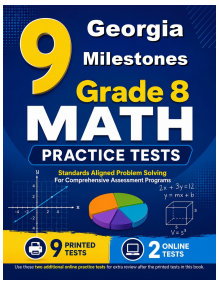
3. Only the x-axis reflection returns $(2, 0)$ to itself. A point on an axis need not be fixed by other motions.

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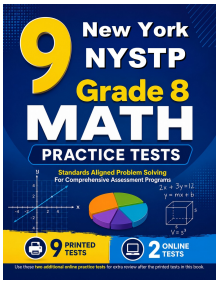
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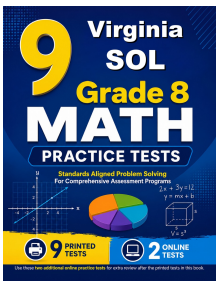
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