Rotations, Reflections, and Translations

Models and mappings

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

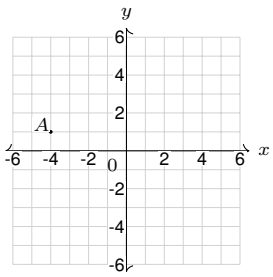
3. Thus $E'' = (-1, -2)$; the second move does not change its distance below the x-axis.

Answer: $E'' = (-1, -2)$

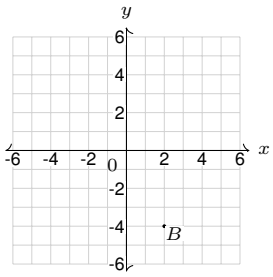
Practice Problems

Show your thinking.

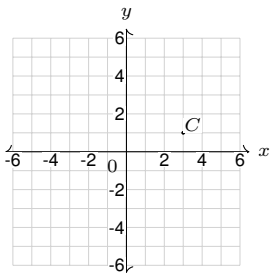
1. Translate $A(-4, 1)$ right 3 and down 2. Plot and label $A\prime$.



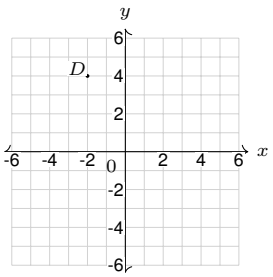
2. Reflect $B(2, -4)$ across the y-axis. Plot its image.



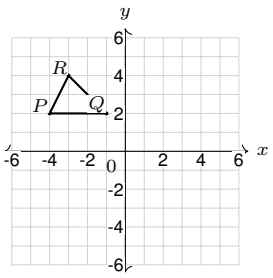
3. Rotate $C(3, 1)$ 90° counterclockwise about the origin. Plot the image.



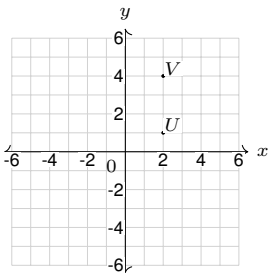
4. Rotate $D(-2, 4)$ 180° about the origin. Plot the image.



5. Reflect triangle PQR across the x-axis. List and plot all image vertices.



6. Rotate segment UV 90° clockwise about the origin. List and plot its endpoints.



Answer Key

1. $A\prime = (-1, -1)$
2. $B\prime = (-2, -4)$
3. $C\prime = (-1, 3)$
4. $D\prime = (2, -4)$
5. $P\prime = (-4, -2),\ Q\prime = (-1, -2),\ R\prime = (-3, -4)$
6. $U\prime = (1, -2),\ V\prime = (4, -2)$

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. The horizontal move adds 3: $-4 + 3 = -1$. The point moves toward the y-axis.

2. The vertical move subtracts 2: $1 - 2 = -1$. Together the rule is $(x, y) \mapsto (x + 3, y - 2)$.

3. Plot $A\prime = (-1, -1)$, one unit left and one unit below the origin.

Problem 2

1. A y-axis reflection uses $(x, y) \mapsto (-x, y)$, so $(2, -4) \mapsto (-2, -4)$.

2. The horizontal distances are $|2| = |-2| = 2$ and both heights are -4.

3. Therefore plot $B\prime = (-2, -4)$ on the opposite side of the y-axis.

Problem 3

1. Use $(x, y) \mapsto (-y, x)$: substitute $x = 3$ and $y = 1$ to get $(-1, 3)$.

2. The squared distance stays $3^2 + 1^2 = 10 = (-1)^2 + 3^2$, as a rotation requires.

3. Plot $C\prime = (-1, 3)$ in quadrant II; the turn is counterclockwise, not clockwise.

Problem 4

1. A half-turn uses $(x, y) \mapsto (-x, -y)$, so $(-2, 4) \mapsto (2, -4)$.

2. The midpoint of the pair is $((-2 + 2)/2, (4 - 4)/2) = (0, 0)$.

3. Thus $D\prime = (2, -4)$ lies directly opposite D through the origin, as required.

Problem 5

1. For $P(-4, 2)$ and $Q(-1, 2)$, change only y: $P\prime = (-4, -2)$ and $Q\prime = (-1, -2)$.

2. For $R(-3, 4)$, the same rule gives $R\prime = (-3, -4)$. The horizontal base remains $|-1 - (-4)| = 3$.

3. Join $(-4, -2), (-1, -2), (-3, -4)$. The triangle has the same size but is flipped below the axis.

Problem 6

1. A clockwise quarter-turn uses $(x, y) \mapsto (y, -x)$, so $U(2, 1) \mapsto (1, -2)$.

2. Substitute $V(2, 4)$ to obtain $V\prime = (4, -2)$. The original vertical length is $4 - 1 = 3$.

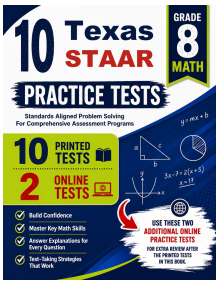
3. The new horizontal length is $4 - 1 = 3$; draw the segment between the two image endpoints.

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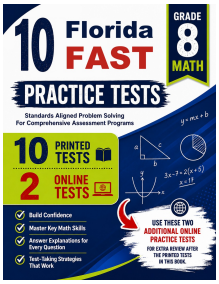
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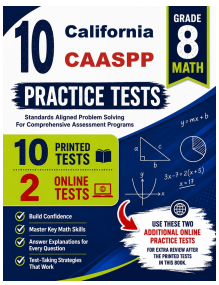
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