

Move It Precisely

Use geometry rules to track figures through transformations.

HIGH SCHOOL • HSG-CO.A.4

CCSS.Math.Content.HSG-CO.A.4 "Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments."

NAME _____

DATE _____

TRANSFORMATION RULES

A translation moves every point by the same directed segment, so a segment and its image are parallel and congruent. A reflection line is the perpendicular bisector of the segment joining a point to its image. A rotation moves points along circles centered at the center of rotation, through the same angle.

WORKED EXAMPLE

Translate $P(-8, 5)$ by vector $\langle 3, -6 \rangle$.

1. Add 3 to the x-coordinate: $-8 + 3 = -5$.
2. Add -6 to the y-coordinate: $5 + (-6) = -1$.
3. Write the image as $P'(-5, -1)$.

Answer: $P'(-5, -1)$

PRACTICE 6 problems

- 1** Translate $A(2, -4)$ by vector $\langle 7, 2 \rangle$.

ANSWER _____

- 2** Reflect $B(-2, 7)$ across the x-axis.

ANSWER _____

- 3** $C(4, -9)$ maps to $C'(-4, -9)$ in a reflection.
Name the reflection line.

ANSWER _____

- 4** Point $D(7, -4)$ is rotated 90 degrees counterclockwise about the origin. Find D' .

ANSWER _____

- 5** Point $E(7, -2)$ is rotated 90 degrees counterclockwise about the origin. Find E' .

ANSWER _____

- 6** Point $F(-7, 2)$ is rotated 180 degrees about the origin. Find F' .

ANSWER _____

APPLY IT Show your work

- 1** A student club is designing a festival-map icon with vertices $M(4, -7)$, $N(9, -7)$, and $O(9, -2)$. The icon is translated 2 units left and 9 units up. What are the coordinates of M' , N' , and O' ?

WORK SPACE

ANSWER _____

- 2** For an esports team banner, the point $R(7, -4)$ is reflected across the y -axis to make a matching design. What are the coordinates of R' , and what is the relationship between RR' and the y -axis?

WORK SPACE

ANSWER _____

CHALLENGE One step up

CHALLENGE

Point $T(2, -7)$ maps to $T'(7, 2)$. Is this a 90-degree counterclockwise rotation about the origin? Explain using coordinates and a circle or angle fact.

PART 1 • PRACTICE

#	PROBLEM	ANSWER
1	Translate A(2, -4) by vector $\langle 7, 2 \rangle$.	A'(9, -2)
2	Reflect B(-2, 7) across the x-axis.	B'(-2, -7)
3	C(4, -9) maps to C'(-4, -9) in a reflection. Name the reflection line.	the y-axis
4	Point D(7, -4) is rotated 90 degrees counterclockwise about the origin. Find D'.	D'(4, 7)
5	Point E(7, -2) is rotated 90 degrees counterclockwise about the origin. Find E'.	E'(2, 7)
6	Point F(-7, 2) is rotated 180 degrees about the origin. Find F'.	F'(7, -2)

PART 2 • APPLY IT

1. **M'(2, 2), N'(7, 2), O'(7, 7)** Subtract 2 from each x-coordinate and add 9 to each y-coordinate. Every vertex moves by the same vector, $\langle -2, 9 \rangle$.
2. **R'(-7, -4); RR' is perpendicular to the y-axis, and the y-axis bisects RR'.** A reflection across the y-axis changes the sign of the x-coordinate. The y-axis passes through the midpoint of R and R' and is perpendicular to the segment joining them.

CHALLENGE

Yes. The rule $(x, y) \rightarrow (-y, x)$ sends (2, -7) to (7, 2), and both points are on a circle centered at the origin with radius $\sqrt{53}$ and a central angle of 90 degrees.

Accept coordinate pairs with or without parentheses if the ordered coordinates are clear. For reflection relationships, accept equivalent wording that states the mirror line is the perpendicular bisector of the segment joining corresponding points.