

Coordinate Motion Lab

Use functions to track points and compare transformations.

HIGH SCHOOL • HSG-CO.A.2

CCSS.Math.Content.HSG-CO.A.2 "Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs..."

NAME _____

DATE _____

TRANSFORMATION FUNCTIONS

A transformation is a function that sends each input point to one output point. Translations, reflections, and rotations preserve distance and angle. A horizontal stretch changes horizontal positions by a scale factor, so it does not preserve all distances and angles when the scale factor is not 1.

WORKED EXAMPLE

Use $T(x, y) = (x + 8, y - 5)$ to find the image of $P(-3, 7)$.

1. Find the new x-coordinate: $-3 + 8 = 5$.
2. Find the new y-coordinate: $7 - 5 = 2$.
3. Write the output point as $P'(5, 2)$.

Answer: $P'(5, 2)$

PRACTICE 6 problems

- 1** Use $R(x, y) = (x - 4, y + 6)$ to find the image of $A(10, 11)$.

ANSWER _____

- 2** Point $B(-1, 12)$ maps to $B'(11, 16)$ by a translation. Write the translation rule.

ANSWER _____

- 3** Point $C(4, -6)$ is reflected across the y-axis. Find C' and state whether the reflection preserves distance and angle.

ANSWER _____

- 4** A horizontal stretch maps (x, y) to $(4x, y)$. Find the image of $D(1, -1)$. Does this transformation preserve distance and angle?

ANSWER _____

- 5** Rotate $E(6, 10)$ 90 degrees counterclockwise about the origin. Find E' and state whether the rotation preserves distance and angle.

ANSWER _____

- 6** A dilation centered at the origin has scale factor $1/4$. Find the image of $F(16, 4)$. Does this dilation preserve distance? Does it preserve angle?

ANSWER _____

APPLY IT Show your work

- 1** A student council is updating a coordinate-grid map for a school event. A booth is at (16, 11), and the whole map shifts 6 units left and 4 units up. What are the booth's new coordinates? Will the booth's shape and size stay the same?

WORK SPACE

ANSWER _____

- 2** A video editor uses the function $h(x, y) = (4x, y)$ to widen a sticker graphic. A point on the sticker is at (6, -1). What is its image? Will the sticker's outline always remain congruent to the original?

WORK SPACE

ANSWER _____

CHALLENGE One step up

CHALLENGE

Point Q(12, 9) is translated 6 units left and 4 units up. Then its image is horizontally stretched by a factor of 4 about the y-axis. Write one function rule for the combined transformation, find Q', and explain whether the combined transformation preserves distance and angle.

PART 1 • PRACTICE

#	PROBLEM	ANSWER
1	Use $R(x, y) = (x - 4, y + 6)$ to find the image of $A(10, 11)$.	A'(6, 17)
2	Point $B(-1, 12)$ maps to $B'(11, 16)$ by a translation. Write the translation rule.	$(x, y) \rightarrow (x + 12, y + 4)$
3	Point $C(4, -6)$ is reflected across the y-axis. Find C' and state whether the reflection preserves distance and angle.	C'(-4, -6); yes, it preserves distance and angle.
4	A horizontal stretch maps (x, y) to $(4x, y)$. Find the image of $D(1, -1)$. Does this transformation preserve distance and angle?	D'(4, -1); no, it does not preserve distance and angle.
5	Rotate $E(6, 10)$ 90 degrees counterclockwise about the origin. Find E' and state whether the rotation preserves distance and angle.	E'(-10, 6); yes, it preserves distance and angle.
6	A dilation centered at the origin has scale factor $1/4$. Find the image of $F(16, 4)$. Does this dilation preserve distance? Does it preserve angle?	F'(4, 1); it does not preserve distance, but it does preserve angle.

PART 2 • APPLY IT

- (10, 15); yes, the shape and size stay the same.** Subtract 6 from the x-coordinate and add 4 to the y-coordinate. This translation preserves distance and angle.
- (24, -1); no, the outline will not always remain congruent.** Multiply the x-coordinate by 4 and keep the y-coordinate unchanged. A horizontal stretch does not preserve all distances and angles.

CHALLENGE

$(x, y) \rightarrow (4x - 24, y + 4)$; Q'(24, 13); it does not preserve distance and angle because the horizontal stretch changes horizontal lengths by a factor of 4.

Accept equivalent function notation and correctly ordered coordinate pairs. Translations, reflections, and rotations preserve both distance and angle; dilations preserve angle but not distance unless the scale factor is 1.