LESSON MAKER PRO

Motion Keeps Length

Test what stays the same after a transformation.

GRADE 8 · NY-8.G.1.a

NY-8.G.1.a "Verify experimentally lines are mapped to lines, and line segments to line segments of the same length."

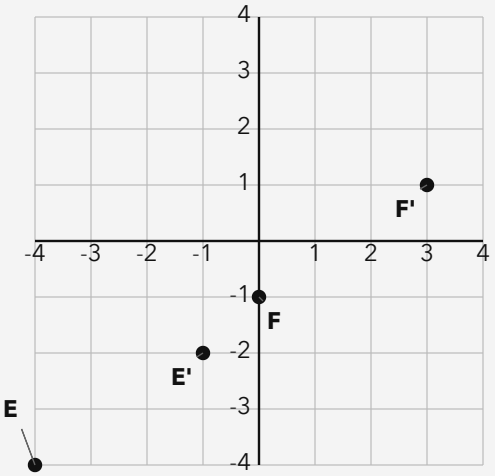
NAME _____ DATE _____

WHAT TO CHECK

A translation, reflection, or rotation sends every point of a line to points on another line. To test a segment, compare its horizontal and vertical changes before and after the move. The length stays the same.

WORKED EXAMPLE

On the grid, compare segment EF with its image E'F'.



1. From E to F, move 4 right and 3 up.
2. EF = sqrt($4^2 + 3^2$) = 5.
3. From E' to F', move 4 right and 3 up.
4. E'F' = 5, so the lengths match.

Answer: EF = 5 units; E'F' = 5 units.

PRACTICE 4 problems

1 A translation maps M(-1, 4) to M' and N(5, 4) to N'. Find M'N'.

ANSWER _____

2 Line y = -2x + 7 is reflected across the y-axis. Write the image line's equation.

ANSWER _____

3 Segment AB has endpoints A(-6, 2) and B(2, 2). It is rotated 180 degrees about the origin. Give A', B', and A'B'.

ANSWER _____

_____

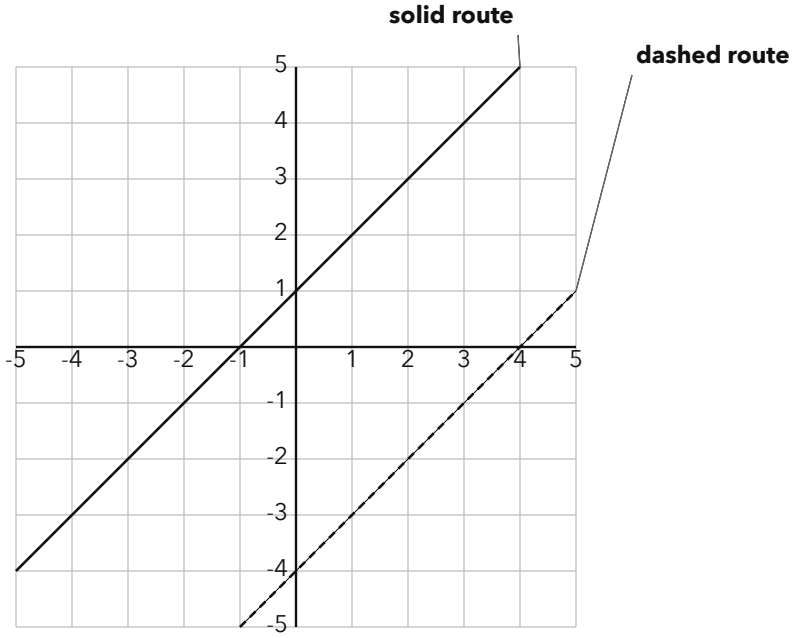
4 Segment QR has endpoints Q(-3, 5) and R(1, 8). Reflect it across the x-axis. Give Q', R', and Q'R'.

ANSWER _____

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APPLY IT Show your work

1 In a game design club, the solid laser route is translated 2 units right and 3 units down to the dashed route. Use the grid. Write the dashed route's equation. What shows it is still a line?



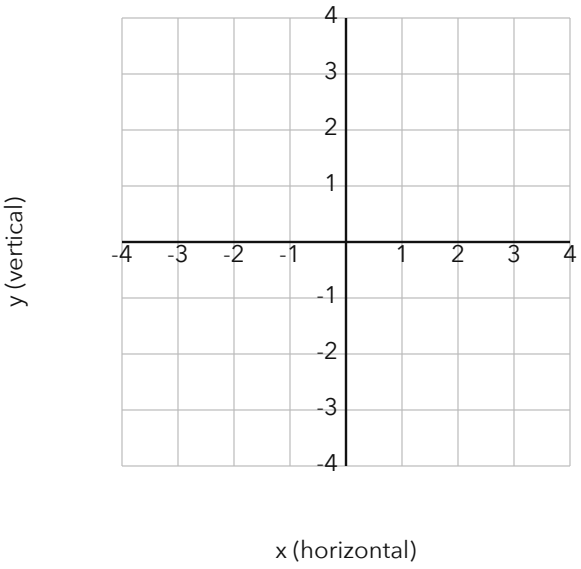
ANSWER _____

2 A robotics team shifts a sensor path with endpoints (2, -1) and (8, 7). How long is the path before and after the shift?

WORK SPACE

ANSWER _____

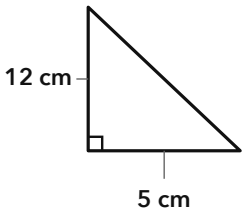
3 Run a transformation experiment. Your teacher supplies tracing paper, a ruler and a pencil. On the blank grid plot A(-3, 1), M(-1, 1) and B(1, 1); draw the line through them and mark segment AB. Trace the axes, origin and three points. Rotate the tracing paper 90° counterclockwise about the origin, keeping the origin fixed, and transfer the three image points to the grid as A′, M′ and B′. Use a straightedge to test whether the images lie on one line. Measure AB and A′B′ with the same ruler; record both lengths in centimeters and in grid units. Attach your tracing and explain what your observed results show.



ANSWER _____

CHALLENGE One step up

The triangular patch in the figure is rotated 90 degrees. A student says its image hypotenuse is 13 cm. Is the student correct? Explain.



WORK SPACE AND ANSWER

ANSWER KEY # Motion Keeps Length

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	A translation maps M(-1, 4) to M' and N(5, 4) to N'. Find M'N'.	**6 units**
2	Line y = -2x + 7 is reflected across the y-axis. Write the image line's equation.	**y = 2x + 7**
3	Segment AB has endpoints A(-6, 2) and B(2, 2). It is rotated 180 degrees about the origin. Give A', B', and A'B'.	**A'(6, -2), B'(-2, -2); A'B' = 8 units**
4	Segment QR has endpoints Q(-3, 5) and R(1, 8). Reflect it across the x-axis. Give Q', R', and Q'R'.	**Q'(-3, -5), R'(1, -8); Q'R' = 5 units**

PART 2 · APPLY IT

1. **y = x - 4; both routes have slope 1.** A right 2, down 3 translation changes y = x + 1 to y = x - 4. Equal slopes show that the image is also a line.
2. **10 units before; 10 units after.** The changes are 6 horizontally and 8 vertically, so the length is $\sqrt{6^2 + 8^2} = 10$. A shift is a translation, so the image path is also 10 units.
3. **A′(-1, -3), M′(-1, -1), B′(-1, 1) lie on one vertical line. AB and A′B′ both span 4 grid units and have equal measured centimeter lengths within drawing tolerance.** Provide tracing paper and a ruler. Check the actual quarter-turn about the fixed origin, transferred points and straightedge test, not coordinates alone. Original y=1 maps to x=-1. Record the two actual ruler measurements; the printed centimeter scale varies, so do not prescribe a centimeter number. Both segments span four equal grid intervals. A finite point test supports the line-preservation property but is not an exhaustive proof for all points.

CHALLENGE

Yes. The original hypotenuse is $\sqrt{5^2 + 12^2} = 13$ cm, and a rotation preserves segment length.

Accept equivalent equations for the reflected and translated lines. For written explanations, require that the student identifies the preserved length or equal slopes for a line image. Apply 3 requires an actual traced rotation, transferred image and recorded before/after ruler measurements plus straightedge collinearity observation. B′ coincides with M at (-1,1); accept a shared label. Allow reasonable drawing and measuring error.

Motion Keeps Length

Apply 3: original horizontal line y=1 and rotated vertical line x=-1; AB and A′B′ each span 4 grid units.

