

Distance Detectives

Decide which transformations keep lengths unchanged.

HIGH SCHOOL • MA.912.GR.2.2

MA.912.GR.2.2 "Identify transformations that do or do not preserve distance."

NAME _____

DATE _____

DISTANCE RULES

Translations, rotations, and reflections preserve distance, so every segment keeps the same length. A dilation multiplies lengths by the absolute value of its scale factor, so it preserves distance only when the scale factor is 1 or -1.

WORKED EXAMPLE

Segment AB has A(2,4) and B(5,8).
Reflect it across the y-axis. Does the reflection preserve distance?

1. $AB = \sqrt{(5 - 2)^2 + (8 - 4)^2}$.

2. $AB = \sqrt{3^2 + 4^2} = 5$.

3. A'(-2,4) and B'(-5,8), so $A'B' = \sqrt{(-5 + 2)^2 + (8 - 4)^2} = 5$.

Answer: Yes. The reflected segment is also 5 units long.

PRACTICE 5 problems

- 1** A figure is translated 9 units left. Does this transformation preserve all distances?

ANSWER _____

- 2** A figure is turned a quarter-turn about the origin. Does this transformation preserve all distances?

ANSWER _____

- 3** A figure is dilated with scale factor 6. Does this transformation preserve all distances?

ANSWER _____

- 4** A figure is reflected across the x-axis. Does this transformation preserve all distances?

ANSWER _____

- 5** An 11-unit segment is dilated with scale factor 9. Find the image length. Does the dilation preserve distance?

ANSWER _____

APPLY IT Show your work

- 1** An album-cover graphic has a diagonal of 10 cm. A music app rotates the graphic one quarter-turn. What is the diagonal length after the rotation? Does the rotation preserve distance?

WORK SPACE

ANSWER _____

- 2** A digital design tool enlarges a 12-cm logo edge using a dilation with scale factor 10. What is the image edge length? Does the dilation preserve distance?

WORK SPACE

ANSWER _____

CHALLENGE One step up

CHALLENGE

A dilation has scale factor k . It sends a segment of length d to a segment of length $|k|d$. For which values of k does the dilation preserve distance? Explain.

PART 1 • PRACTICE

#	PROBLEM	ANSWER
1	A figure is translated 9 units left. Does this transformation preserve all distances?	Yes.
2	A figure is turned a quarter-turn about the origin. Does this transformation preserve all distances?	Yes.
3	A figure is dilated with scale factor 6. Does this transformation preserve all distances?	No. Each distance is multiplied by 6.
4	A figure is reflected across the x-axis. Does this transformation preserve all distances?	Yes.
5	An 11-unit segment is dilated with scale factor 9. Find the image length. Does the dilation preserve distance?	99 units; no.

PART 2 • APPLY IT

- 10 cm; yes.** A rotation keeps every length unchanged, so the diagonal remains 10 cm.
- 120 cm; no.** Multiply 12 by 10 to get 120 cm. The length changes, so distance is not preserved.

CHALLENGE

$k = 1$ or $k = -1$. Distance is preserved when $|k|d = d$, so $|k| = 1$.

Accept equivalent wording such as “keeps lengths the same” for preserves distance. For the challenge, students must name both 1 and -1 and connect them to an absolute scale factor of 1.