9-2 Reflections

Vocabulary

Review

1. Circle the *translation* rule that shows a mapping 2 units left and 1 unit up. Underline the translation rule that shows a mapping 2 units right and 1 unit down.

$(x, y) \rightarrow (x - 2, y + 1)$ $(x, y) \rightarrow (x + 2, y - 1)$ $(x, y) \rightarrow (x - 2, y - 1)$

Vocabulary Builder

reflection (noun) **rih FLEK shun**

Related Words: line of **reflection**

Definition: A **reflection** is a mirror image of an object that has the same size and shape but an opposite orientation.

Math Usage: A **reflection** is a transformation where each point on the preimage is the same distance from the line of reflection as its **reflection** image.

Use Your Vocabulary

Write T for *true* or F for *false*.

_____ **2.** A *reflection* is the same shape as the original figure.

_____ **3.** A *reflection* makes a figure larger.

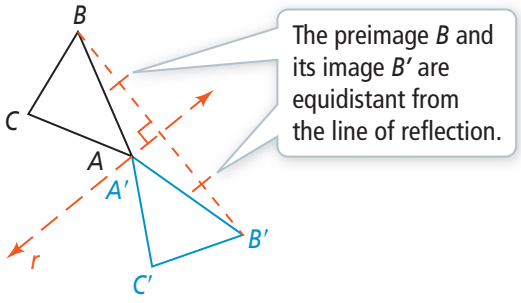
take note

Key Concept Reflection Across a Line

Reflection across a line r, called the line of reflection, is a transformation with these two properties:

- If a point A is on line r, then the image of A is itself (that is, $A' = A$).
- If a point B is not on line r, then r is the perpendicular bisector of $\overline{BB'}$.

A reflection across a line is an isometry.

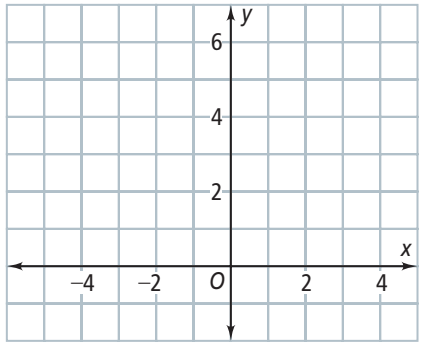


4. Line _____ is the perpendicular bisector of $\overline{CC'}$.

Problem 1 Reflecting a Point Across a Line

Got It? **What is the image of $P(3, 4)$ reflected across the line $x = -1$?**

5. Graph P on the coordinate plane at the right.



6. Describe the line of reflection. Then graph the line of reflection.

_____

_____

7. The distance from point P to the line of reflection is ____ units.

Underline the correct word(s) to complete each sentence.

8. The x-coordinates of P and P' are different / the same.

9. The y-coordinates of P and P' are different / the same.

10. Point P is reflected to the left / right across the line of reflection.

11. Graph the image of $P(3, 4)$ and label it P'.

12. The coordinates of P' are (____, ____).

Problem 2 Graphing a Reflection Image

Got It? **Graph points $A(-3, 4)$, $B(0, 1)$, and $C(4, 2)$. What is the image of $\triangle ABC$ reflected across the x-axis?**

13. The x-axis is the line $y =$ ____.

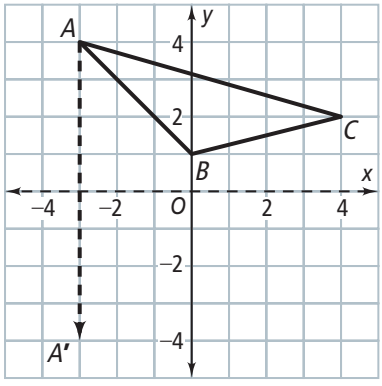
14. Circle the distance in units from point A to the x-axis. Underline the distance from point B to the x-axis. Put a square around the distance from point C to the x-axis.

0 1 2 3 4

15. Point B' is ____ unit(s) below the x-axis.

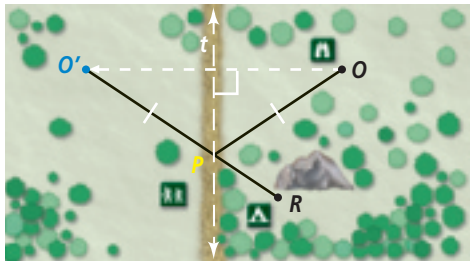
16. Point C' is ____ unit(s) below the x-axis.

17. The arrow shows how to find vertex A'. Graph the image of $\triangle ABC$ and label vertices B' and C' on the coordinate plane below.



Problem 3 Minimizing a Distance

Got It? Reasoning **The diagram shows one solution of the problem below. Your classmate began to solve the problem by reflecting point *R* across line *t*. Will her method work? Explain.**



Beginning from a point on Summit Trail (line *t*), a hiking club will build a trail to the Overlook (point *O*) and a trail to Balance Rock (point *R*). The club members want to minimize the total length of the two trails. How can you find the point on Summit Trail where the two new trails should start?

You need to find the point P on line t such that the distance $OP + PR$ is as small as possible. In the diagram, the problem was solved by locating O', the reflection image of O across t. Because t is the perpendicular bisector of $\overline{OO'}$, $PO = PO'$, and $OP + PR = O'P + PR$. By the Triangle Inequality Theorem, the sum $O'P + PR$ is least when R, P, and O' are collinear. So, the trails should start at the point P where $\overline{RO'}$ intersects line t.

Place a ✓ in the box if the response is correct. Place an ✗ if it is incorrect.

☐ **18.** When point R is reflected across line t, t is the perpendicular bisector of $\overline{RR'}$.

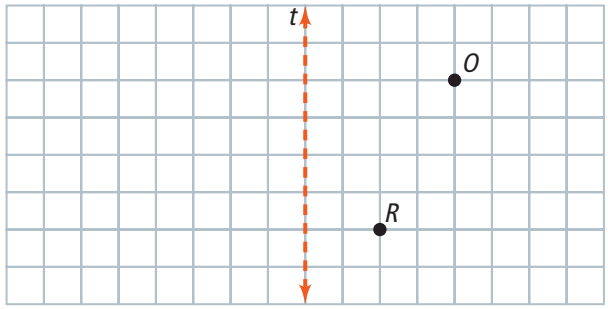
☐ **19.** $PR \neq PR'$

☐ **20.** $RP + PO = R'P + PO$

☐ **21.** Points O, P, and R' are NOT collinear.

☐ **22.** The trails should start at the point P where $\overline{OR'}$ intersects t.

23. Reflect R across line t in the diagram at the right. Label the reflection R'.



24. Draw $\overline{RR'}$.

25. Draw $\overline{R'O}$.

26. Label the point where $\overline{R'O}$ intersects line t as point P. Draw $\overline{PR}$.

27. What do you notice about point P after reflecting R across line t?

_____

_____

28. Will your classmate's method work? Explain.

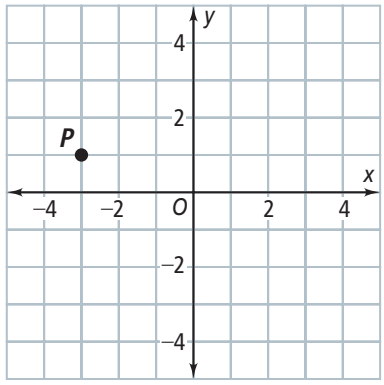
_____

_____

_____

Lesson Check • Do you UNDERSTAND?

What are the coordinates of a point $P(x, y)$ reflected across the y-axis? Across the x-axis?



29. Reflect point P across the y-axis. Label the image P'.

30. Circle the coordinates of point P.

$(3, 1)$ $(-3, -1)$ $(-3, 1)$ $(3, -1)$

31. Circle the coordinates of point P'.

$(3, 1)$ $(-3, -1)$ $(-3, 1)$ $(3, -1)$

32. Describe how the coordinates of P' are different from the coordinates of P.

_____

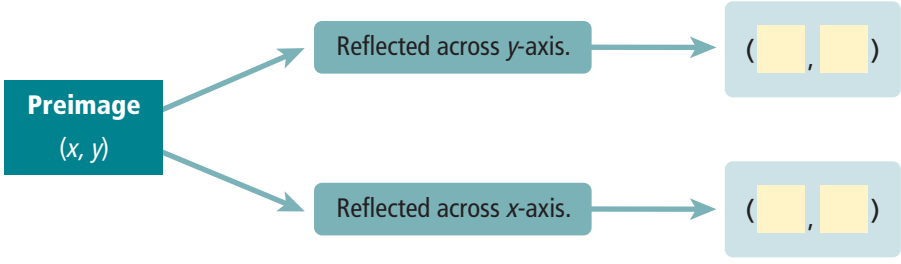
_____

33. Reflect point P across the x-axis. Label the image P''. The coordinates of P'' are (,).

34. Describe how the coordinates of P'' are different from the coordinates of P.

_____

35. Complete the model below to find the coordinates of $P(x, y)$ reflected across the y-axis and across the x-axis.



Math Success

Check off the vocabulary words that you understand.

☐ reflection ☐ line of reflection

Rate how well you can *find reflection images of figures.*