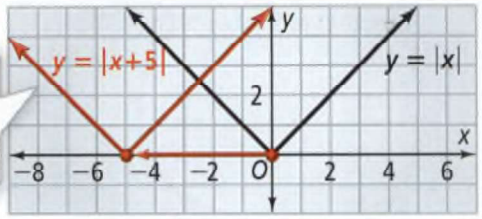
Problem 3 Graphing a Horizontal Translation

What is the graph of $y = |x + 5|$?

Think

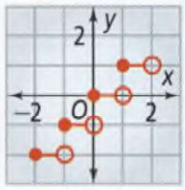
How can you check that the graph is correct?
You can use the equation to check that points on the graph are solutions.

Draw the graph of $y = |x + 5|$ by translating $y = |x|$ *left* 5 units.



Got It? **3.** What is the graph of $y = |x - 5|$?

The absolute value function is an example of a piecewise function. A **piecewise function** is a function that has different rules for different parts of its domain. For example, when $x \geq 0$, $|x| = x$. When $x < 0$, $|x| = -x$. Another example of a piecewise function is a step function. A **step function** is a function that pairs every number in an interval with a single value. The graph of a step function can look like the steps of a staircase.

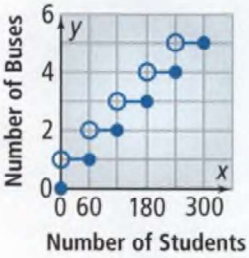


Each piece of the graph is a horizontal segment that is missing its right endpoint, indicated by an open circle.

Problem 4 Graphing a Step Function

Transportation **A school will charter buses so that the student body can attend a football game. Each bus holds a maximum of 60 students. Make a graph that models the relationship between the number of students x that go to the game by bus and the number of buses y that are needed.**

You will need 0 buses for 0 students. As the number of students increases, the number of buses goes up by 1 every time the number of students exceeds a multiple of 60. Draw a closed circle when the endpoints are part of the graph, and then draw an open point when they are not.



Got It? **4.** Make a graph that models the relationship between the number of students x that go to the game by bus and the number of buses y that are needed if each bus holds a maximum of 50 students.

Lesson Check

Do you know HOW?

1. How is the graph of $y = |x| - 8$ different from the graph of $y = |x|$? How is it the same?
2. What is the equation for the translation of $y = |x|$ 9 units up?
3. What is the graph of $y = |x + 7|$?

Do you UNDERSTAND? MATHEMATICAL PRACTICES

4. **Compare and Contrast** How are the graphs of $y = |x| - 4$ and $y = |x - 4|$ the same? How are they different?
5. **Error Analysis** A student is graphing the equation $y = |x - 10|$ and translates the graph of $y = |x|$ 10 units left. Describe the student's error.

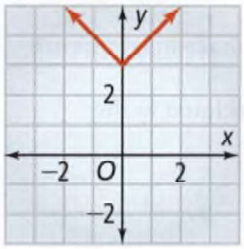
Practice and Problem-Solving Exercises

MATHEMATICAL PRACTICES

A Practice

Describe how each graph is related to the graph of $y = |x|$. See Problem 1.

6.



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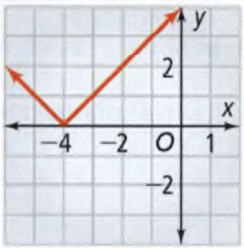

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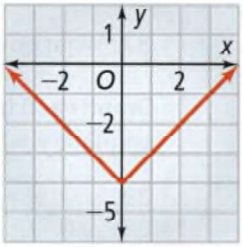


Graph each function by translating $y = |x|$. See Problem 2.

9. $y = |x| - 3$ **10.** $y = |x| + 7$ **11.** $y = |x| + 3$

12. $y = |x| - 6$ **13.** $y = |x| + 6$ **14.** $y = |x| - 2.5$

Graph each function by translating $y = |x|$. See Problem 3.

15. $y = |x - 3|$ **16.** $y = |x + 3|$ **17.** $y = |x - 1|$

18. $y = |x + 6|$ **19.** $y = |x - 7|$ **20.** $y = |x + 2.5|$

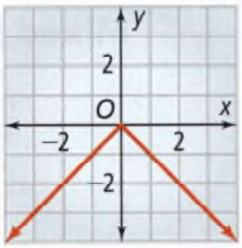
21. Postage The table lists postage for letters weighing as much as 3 oz. You want to mail a letter that weighs 2.7 oz. Graph the step function. How much will you pay in postage? See Problem 4.

First-Class Postage

Weight x	Price y
$0 <$ Weight < 1 oz	\$.44
1 oz $\leq$ Weight < 2 oz	\$.61
2 oz $\leq$ Weight ≤ 3 oz	\$.78

B Apply

At the right is the graph of $y = -|x|$. Graph each function by translating $y = -|x|$.



22. $y = -|x| + 3$ **23.** $y = -|x| - 3$

24. $y = -|x + 3|$ **25.** $y = -|x - 3|$

Write an equation for each translation of $y = -|x|$.

26. 2 units up **27.** 2.25 units left

28. 15 units down **29.** 4 units right

30. Writing Explain how the relationship between $y = |x|$ and $y = |x| + k$ is similar to the relationship between $y = mx$ and $y = mx + b$.