

# 5-2

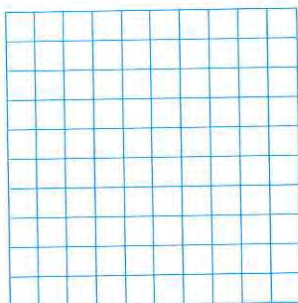
## Piecewise-Defined Functions

### EXPLORE & REASON

In a relay race, each runner carries a baton for an equal distance, with each runner handing off the baton to the next runner.

Path of the Baton		
	Time (min)	Total Distance (mi)
Start	0	0
Runner 1	3	0.25
Runner 2	5.75	0.50
Runner 3	9	0.75
Runner 4	11.50	1.00

- A. Graph the distance traveled by the baton as a function of time. How is the speed of each runner represented in the graph?



- B. Who is the fastest runner?

- C. **Communicate Precisely** How is the graph of this function similar to the graph of a linear function? How is it different? © MP.6

#### HABITS OF MIND

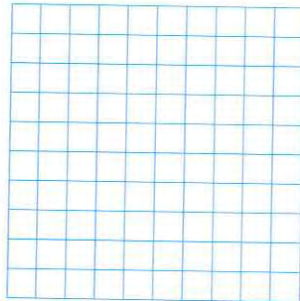
**Use Appropriate Tools** How does making a graph help you understand the function and the situation? Explain. © MP.5

**EXAMPLE 1** **Try It!** Understand Piecewise-Defined Functions

1. Express  $f(x) = -3|x|$  as a piecewise-defined function.

**EXAMPLE 2** **Try It!** Graph a Piecewise-Defined Function

2. Graph the following function.  $f(x) = \begin{cases} x - 2, & x \leq 1 \\ -2x + 3, & x > 1 \end{cases}$

**HABITS OF MIND**

**Communicate Precisely** How does the domain of the function relate to the piecewise-defined function notation? © MP.6

**EXAMPLE 3**  **Try It! Analyze the Graph of a Piecewise-Defined Function**

3. Make a conjecture about why a utility company might charge higher rates for greater levels of water consumption.

**EXAMPLE 4**  **Try It! Apply a Piecewise-Defined Function**

4. What is the difference in cost between one order of 200 wristbands, two orders of 100 wristbands each, and four orders of 50 wristbands each?

**HABITS OF MIND**

**Look for Relationships** How can you tell when the pieces of a piecewise-defined function do not connect? Explain. © MP.7

## Do You UNDERSTAND?

1. **ESSENTIAL QUESTION** What are the key features of piecewise-defined functions?

2. **Construct Arguments** If the domain of a piecewise-defined function  $f$  is all real numbers, must the range of  $f$  also be all real numbers? Explain. © MP.3

3. **Error Analysis** Liz wrote the following piecewise-defined function:

$$f(x) = \begin{cases} x - 3, & x \leq -3 \\ -2x - 4, & x \geq -3 \end{cases}$$

What is the error that Liz made? © MP.3

4. **Reason** How many pieces does the absolute value function have? Explain. © MP.2

## Do You KNOW HOW?

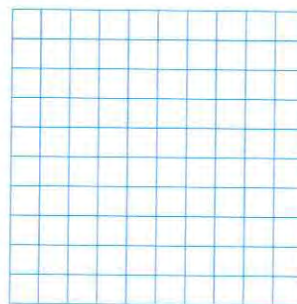
Express each function as a piecewise-defined function.

5.  $f(x) = 5|x|$

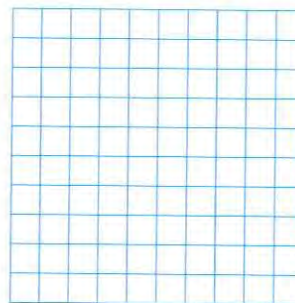
6.  $f(x) = -2|x|$

Graph each function.

7.  $f(x) = \begin{cases} -3x + 1, & x \leq 1 \\ x + 1, & x > 1 \end{cases}$



8.  $f(x) = \begin{cases} 2x - 1, & x < 3 \\ -2x + 4, & x \geq 3 \end{cases}$



9. A function  $f$  is defined by the rule  $-0.5x + 1$  for the domain  $x < 1$  and by the rule  $x$  for the domain  $x \geq 1$ . Write the piecewise-defined function  $f$  using function notation.