4.7 Piecewise Functions
For use with Exploration 4.7

Essential Question  How can you describe a function that is represented by more than one equation?

1 EXPLORATION: Writing Equations for a Function

Work with a partner.

a. Does the graph represent \( y \) as a function of \( x \)? Justify your conclusion.

b. What is the value of the function when \( x = 0 \)? How can you tell?

c. Write an equation that represents the values of the function when \( x \leq 0 \).
\[ f(x) = \underline{\quad} \text{, if } x \leq 0 \]

d. Write an equation that represents the values of the function when \( x > 0 \).
\[ f(x) = \underline{\quad} \text{, if } x > 0 \]

e. Combine the results of parts (c) and (d) to write a single description of the function.
\[ f(x) = \begin{cases} \underline{\quad} & \text{if } x \leq 0 \\ \underline{\quad} & \text{if } x > 0 \end{cases} \]
4.7 Piecewise Functions (continued)

2 EXPLORATION: Writing Equations for a Function

Work with a partner.

a. Does the graph represent \( y \) as a function of \( x \)? Justify your conclusion.

b. Describe the values of the function for the following intervals.

\[
f(x) = \begin{cases} 
\text{______}, & \text{if } -6 \leq x < -3 \\
\text{______}, & \text{if } -3 \leq x < 0 \\
\text{______}, & \text{if } 0 \leq x < 3 \\
\text{______}, & \text{if } 3 \leq x < 6 
\end{cases}
\]

Communicate Your Answer

3. How can you describe a function that is represented by more than one equation?

4. Use two equations to describe the function represented by the graph?
4.7 Notetaking with Vocabulary
For use after Lesson 4.7

In your own words, write the meaning of each vocabulary term.

piecewise function

step function

Core Concepts

Piecewise Function

A piecewise function is a function defined by two or more equations. Each “piece” of the function applies to a different part of its domain. An example is shown below.

\[ f(x) = \begin{cases} 
  x - 2, & \text{if } x \leq 0 \\
  2x + 1, & \text{if } x > 0 
\end{cases} \]

- The expression \( x - 2 \) represents the value of \( f \) when \( x \) is less than or equal to 0.
- The expression \( 2x + 1 \) represents the value of \( f \) when \( x \) is greater than 0.

Notes:
4.7 Notetaking with Vocabulary (continued)

Extra Practice

In Exercise 1–9, evaluate the function.

\[ f(x) = \begin{cases} 
3x - 1, & \text{if } x \leq 1 \\
1 - 2x, & \text{if } x > 1 
\end{cases} \]

\[ g(x) = \begin{cases} 
3x - 1, & \text{if } x \leq -3 \\
2, & \text{if } -3 < x < 1 \\
-3x, & \text{if } x \geq 1 
\end{cases} \]

1. \( f(0) \)  
2. \( f(1) \)  
3. \( f(5) \)

4. \( f(-4) \)  
5. \( g(0) \)  
6. \( g(-3) \)

7. \( g(1) \)  
8. \( g(3) \)  
9. \( g(-5) \)

In Exercise 10–13, graph the function. Describe the domain and range.

10. \( y = \begin{cases} 
-4x, & \text{if } x \leq 0 \\
4, & \text{if } x > 0 
\end{cases} \)

11. \( y = \begin{cases} 
4 - x, & \text{if } x < 2 \\
x + 3, & \text{if } x \geq 2 
\end{cases} \)
4.7 Notetaking with Vocabulary (continued)

12. \[ y = \begin{cases} 
2x, & \text{if } x < -2 \\
2, & \text{if } -2 \leq x < 2 \\
-2x, & \text{if } x \geq 2 
\end{cases} \]

13. \[ y = \begin{cases} 
-1, & \text{if } x \leq -1 \\
0, & \text{if } -1 < x < 2 \\
1, & \text{if } x \geq 2 
\end{cases} \]

In Exercise 14 and 15, write a piecewise function for the graph.

14. [Graph]

15. [Graph]

16. A postal service charges $4 for shipping any package weighing up to but not including 1 pound and $1 for each additional pound or portion of a pound up to but not including 5 pounds. Packages 5 pounds or over have different rates. Write and graph a step function that shows the relationship between the number \( x \) of pounds a package weighs and the total cost \( y \) for postage.