

Extension

Use after Lesson 2.7

Use Piecewise Functions



GOAL Evaluate, graph, and write piecewise functions.

Key Vocabulary

- piecewise function
- step function

A **piecewise function** is defined by at least two equations, each of which applies to a different part of the function's domain. One example of a piecewise function is the absolute value function $f(x) = |x|$, which can be defined by the equations $y = -x$ for $x < 0$ and $y = x$ for $x \geq 0$. Another example is given below.

$$g(x) = \begin{cases} 2x - 1, & \text{if } x \leq 1 \\ 3x + 1, & \text{if } x > 1 \end{cases}$$

The equation $y = 2x - 1$ gives the value of $g(x)$ when x is less than or equal to 1, and the equation $y = 3x + 1$ gives the value of $g(x)$ when x is greater than 1.

EXAMPLE 1 Evaluate a piecewise function

Evaluate the function $g(x)$ above when (a) $x = 1$ and (b) $x = 5$.

Solution

- a. $g(x) = 2x - 1$ **Because $1 \leq 1$, use first equation.**
 $g(1) = 2(1) - 1 = 1$ **Substitute 1 for x and simplify.**
- b. $g(x) = 3x + 1$ **Because $5 > 1$, use second equation.**
 $g(5) = 3(5) + 1 = 16$ **Substitute 5 for x and simplify.**

EXAMPLE 2 Graph a piecewise function

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

Solution

STEP 1 To the left of $x = -2$, graph $y = -\frac{3}{2}x - 1$. Use an open dot at $(-2, 2)$ because the equation $y = -\frac{3}{2}x - 1$ does not apply when $x = -2$.

STEP 2 From $x = -2$ to $x = 1$, inclusive, graph $y = x + 1$. Use solid dots at $(-2, -1)$ and $(1, 2)$ because the equation $y = x + 1$ applies to both $x = -2$ and $x = 1$.

STEP 3 To the right of $x = 1$, graph $y = 3$. Use an open dot at $(1, 3)$ because the equation $y = 3$ does not apply when $x = 1$.

