Extension

Identify Discrete and Continuous Functions

GOAL Graph and classify discrete and continuous functions.

Key Vocabulary
- **discrete function**
- **continuous function**

COMMON CORE

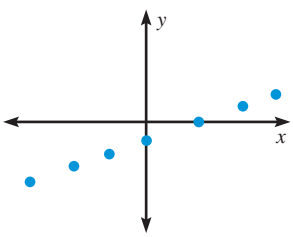
CC.9-12.F.IF.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.*

The graph of a function can consist of individual points, as in the graph at the left below. The graph of a function can also be a line or a part of a line with no breaks, as in the graph at the right below.

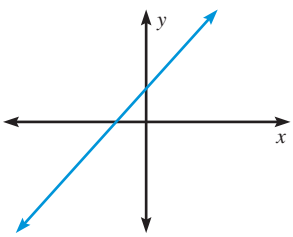
KEY CONCEPT *For Your Notebook*

Identifying Discrete and Continuous Functions

A **discrete function** has a graph that consists of isolated points.



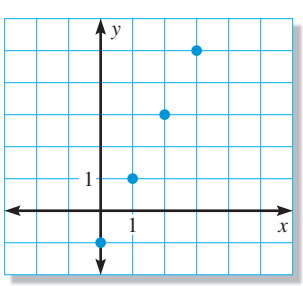
A **continuous function** has a graph that is unbroken.



EXAMPLE 1 Graph and classify a function

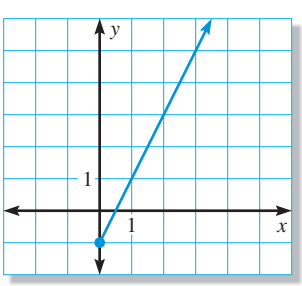
Graph the function $y = 2x - 1$ with the given domain. Classify the function as discrete or continuous.

a. Domain: $x = 0, 1, 2, 3$



The graph consists of individual points, so the function is discrete.

b. Domain: $x \geq 0$



The graph is unbroken, so the function is continuous.

GRAPHS As a general rule, you can tell that a function is continuous if you do not have to lift your pencil from the paper to draw its graph, as in part (b) of Example 1.

EXAMPLE 2 Classify and graph a real-world function

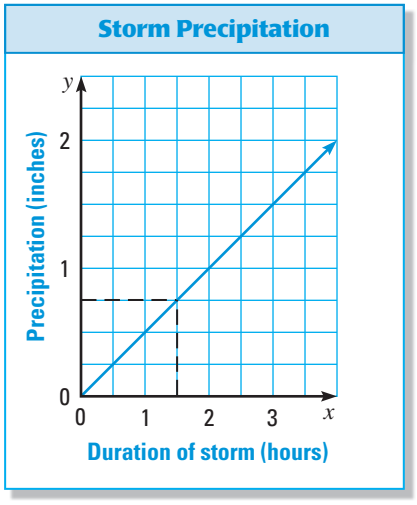
Tell whether the function represented by the table is discrete or continuous. Explain. If continuous, graph the function and find the value of y when $x = 1.5$.

Duration of storm (hours), x	1	2	3
Amount of rain (inches), y	0.5	1	1.5

Solution

Although the table shows the amount of rain that has fallen after whole numbers of hours only, it makes sense to talk about the amount of rain after any amount of time during the storm. So, the table represents a continuous function.

The graph of the function is shown. To find the value of y when $x = 1.5$, start at 1.5 on the x-axis, move up to the graph, and move over to the y-axis. The y-value is about 0.75. So, about 0.75 inch of rain has fallen after 1.5 hours.



PRACTICE

EXAMPLE 1 for Exs. 1–6

Graph the function with the given domain. Classify the function as discrete or continuous.

1. $y = -2x + 3$; domain: $-2, -1, 0, 1, 2$
2. $y = x$; domain: all real numbers
3. $y = -\frac{1}{3}x + 1$; domain: $-12, -6, 0, 6, 12$
4. $y = 0.5x$; domain: $-2, -1, 0, 1, 2$
5. $y = 3x - 4$; domain: $x \leq 0$
6. $y = \frac{2}{3}x + \frac{1}{3}$; domain: $x \geq -2$

EXAMPLE 2 for Exs. 7–9

Tell whether the function represented by the table is discrete or continuous. *Explain*. If continuous, graph the function and find the value of y when $x = 3.5$. Round your answer to the nearest hundredth.

7.

Number of DVD rentals, x	1	2	3	4
Cost of rentals (dollars), y	4.50	9.00	13.50	18.00

8.

Hours since 12 P.M., x	2	4	6	8
Distance driven (miles), y	100	200	300	400

9.

Volume of water (cubic inches), x	3	6	9	12
Approximate weight of water (pounds), y	0.1	0.2	0.3	0.4