

4.2 Discrete and Continuous Domains



STATE STANDARDS

MA.8.A.1.1
MA.8.A.1.5

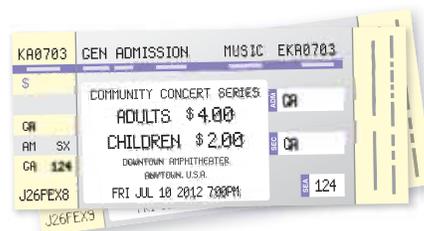
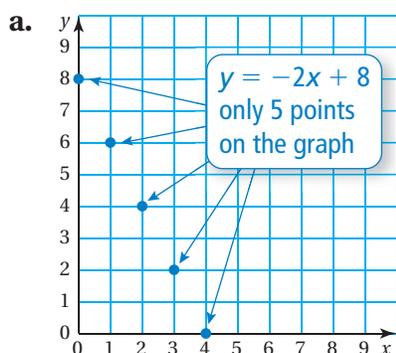
Essential Question

How can you decide whether the domain of a function is discrete or continuous?

1 EXAMPLE: Discrete and Continuous Domains

In Activities 1 and 2 in Section 2.4, you studied two real-life problems represented by the same equation.

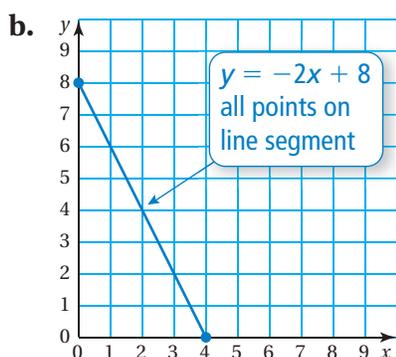
$$4x + 2y = 16 \quad \text{or} \quad y = -2x + 8$$



Domain (x -values): 0, 1, 2, 3, 4

Range (y -values): 8, 6, 4, 2, 0

The domain is **discrete** because it consists of only the numbers 0, 1, 2, 3, and 4.



Domain (x -values): $x \geq 0$ and $x \leq 4$
(All numbers from 0 to 4)

Range (y -values): $y \geq 0$ and $y \leq 8$
(All numbers from 0 to 8)

The domain is **continuous** because it consists of all numbers from 0 to 4 on the number line.

2

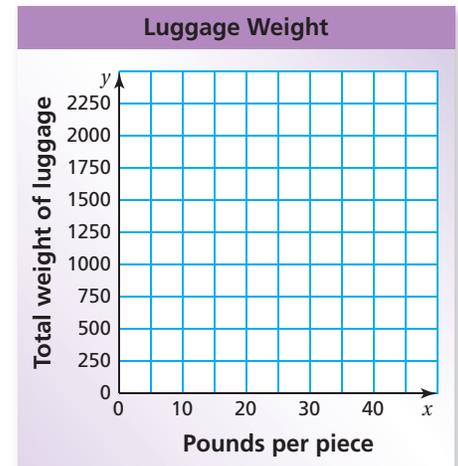
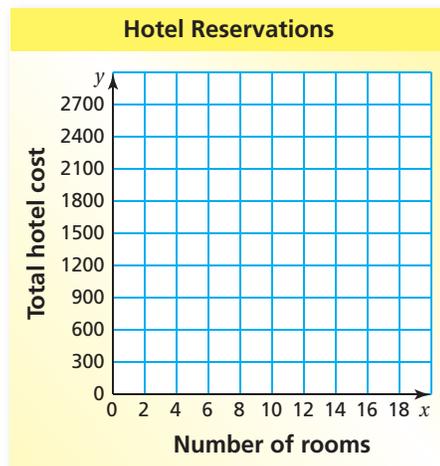
ACTIVITY: Discrete and Continuous Domains

Work with a partner.

- Write a function to represent each problem.
- Graph each function.
- Describe the domain and range of each function. Is the domain discrete or continuous?



- You are in charge of reserving hotel rooms for a youth soccer team. Each room costs \$69, plus \$6 tax, per night. You need each room for two nights. You need 10 to 16 rooms. Write a function for the total hotel cost.
- The airline you are using for the soccer trip needs an estimate of the total weight of the team's luggage. You determine that there will be 36 pieces of luggage and each piece will weigh from 25 to 45 pounds. Write a function for the total weight of the luggage.



What Is Your Answer?

- IN YOUR OWN WORDS** How can you decide whether the domain of a function is discrete or continuous? Describe two real-life examples of functions: one with a discrete domain and one with a continuous domain.

Practice

Use what you learned about discrete and continuous domains to complete Exercises 3 and 4 on page 158.

Key Vocabulary

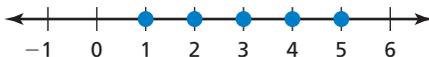
discrete domain,
p. 156
continuous domain,
p. 156

Key Idea

Discrete and Continuous Domains

A **discrete domain** is a set of input values that consists of only certain numbers in an interval.

Example: Integers from 1 to 5



A **continuous domain** is a set of input values that consists of all numbers in an interval.

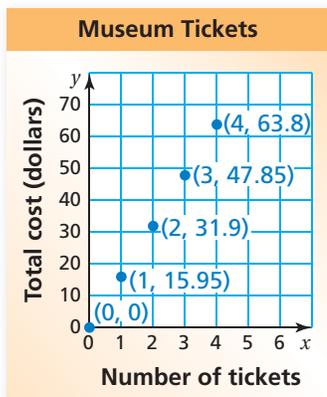
Example: All numbers from 1 to 5.



EXAMPLE 1 Graphing Discrete Data

The function $y = 15.95x$ represents the cost y (in dollars) of x tickets for the South Florida Museum. Graph the function using a domain of 0, 1, 2, 3, and 4. Is the domain of the graph discrete or continuous? Explain.

Make an input-output table.



Input, x	$15.95x$	Output, y	Ordered Pair, (x, y)
0	$15.95(0)$	0	(0, 0)
1	$15.95(1)$	15.95	(1, 15.95)
2	$15.95(2)$	31.9	(2, 31.9)
3	$15.95(3)$	47.85	(3, 47.85)
4	$15.95(4)$	63.8	(4, 63.8)

Plot the ordered pairs. Because you cannot buy part of a ticket, the graph consists of individual points.

∴ So, the domain is discrete.

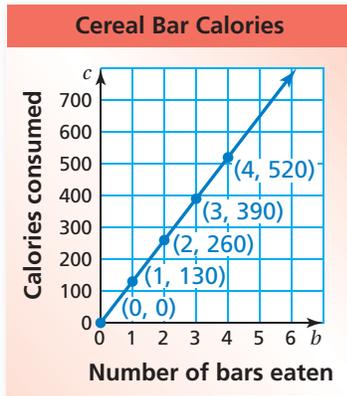
On Your Own

- The function $m = 50 - 9d$ represents the amount of money m (in dollars) you have after buying d DVDs. Graph the function. Is the domain discrete or continuous? Explain.

EXAMPLE 2 Graphing Continuous Data

A cereal bar contains 130 calories. The number c of calories consumed is a function of the number b of bars eaten. Graph the function. Is the domain of the graph discrete or continuous?

Make an input-output table.



Input, b	Output, c	Ordered Pair, (b, c)
0	0	(0, 0)
1	130	(1, 130)
2	260	(2, 260)
3	390	(3, 390)
4	520	(4, 520)

Plot the ordered pairs. Because you can eat part of a cereal bar, b can be any value greater than or equal to 0. Draw a line through the points.

∴ So, the domain is continuous.

EXAMPLE 3 Standardized Test Practice

You conduct an experiment on the speed of sound waves in dry air at 86°F . You record your data in a table. Which of the following is true?

Input Time, t (seconds)	Output Distance, d (miles)
2	0.434
4	0.868
6	1.302
8	1.736
10	2.170

- (A) The domain is $t \geq 2$ and $t \leq 10$ and it is discrete. (B) The domain is $t \geq 2$ and $t \leq 10$ and it is continuous.
- (C) The domain is $d \geq 0.434$ and $d \leq 2.17$ and it is discrete. (D) The domain is $d \geq 0.434$ and $d \leq 2.17$ and it is continuous.

The domain is the set of possible input values, or the time t . The time t can be any value from 2 to 10. So, the domain is continuous.

∴ The correct answer is (B).

On Your Own

Now You're Ready
Exercises 5–8

- A 20-gallon bathtub is draining at a rate of 2.5 gallons per minute. The number g of gallons remaining is a function of the number m of minutes. Graph the function. Is the domain discrete or continuous?
- Are the data shown in the table discrete or continuous? Explain.

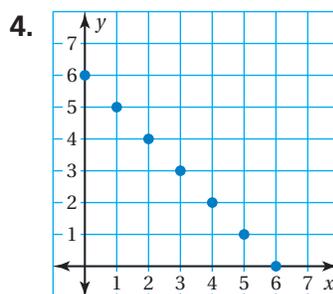
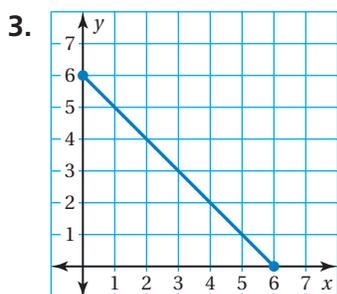
Number of Stories	1	2	3	4	5
Height of Building (feet)	12	24	36	48	60

Vocabulary and Concept Check

- VOCABULARY** Describe the difference between a discrete domain and a continuous domain.
- WRITING** Describe how you can use a graph to determine whether a domain is discrete or continuous.

Practice and Problem Solving

Describe the domain and range of the function. Is the domain discrete or continuous?



Graph the function. Is the domain of the graph discrete or continuous?

1 2

5.

Input Bags, x	Output Marbles, y
2	20
4	40
6	60

6.

Input Years, x	Output Height of a Tree, y (feet)
0	3
1	6
2	9

7.

Input Width, x (inches)	Output Volume, y (cubic inches)
5	50
10	100
15	150

8.

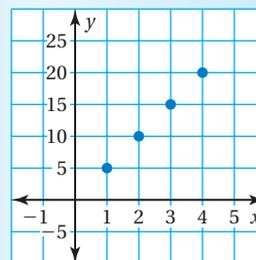
Input Hats, x	Output Cost, y (dollars)
0	0
1	8.45
2	16.9

9. **ERROR ANALYSIS** Describe and correct the error in classifying the domain.

10. **YARN** The function $m = 40 - 8.5b$ represents the amount m of money (in dollars) that you have after buying b balls of yarn. Graph the function using a domain of 0, 1, 2, and 3. Is the domain discrete or continuous?



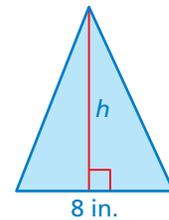
The domain is continuous.



11. **REASONING** The input of one function is *length*. The input of another function is *number of shirts*. Which function has a continuous domain? Explain.

12. **DISTANCE** The function $y = 3.28x$ converts length from x meters to y feet. Graph the function. Is the domain discrete or continuous?

13. **AREA** The area A of the triangle is a function of the height h . Graph the function. Is the domain discrete or continuous?



14. **PACKING** You are packing books into boxes. The function $y = 20x$ represents the number y of books that will fit into x boxes.

- Is 4 in the domain? Explain.
- Is 60 in the range? Explain.

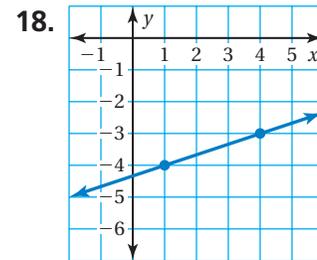
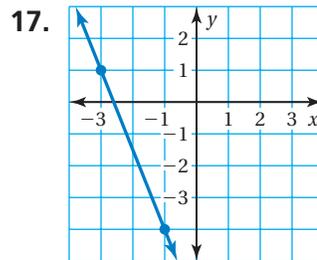
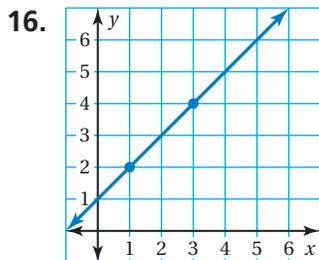
15. **Reasoning** You want to fill a 2-foot shelf with framed pictures. There are x pictures in 4-inch frames and y pictures in 8-inch frames.

- Write a function for this situation.
- Graph the function.
- Is the domain discrete or continuous?



Fair Game Review what you learned in previous grades & lessons

Find the slope of the line.



19. **MULTIPLE CHOICE** What is the y -intercept of the graph of the linear equation?

- | | |
|--------|--------|
| (A) -4 | (B) -2 |
| (C) 2 | (D) 4 |

