Plot the coordinates from the table in a coordinate plane.

Connect them with a line or smooth curve.

1.

x	1	2	3	4
y	4	8	12	16

2.

x	3	4	5	6
y	2	1	0	−1

3.

x	4	4	4	4
y	2	3	4	5

4.

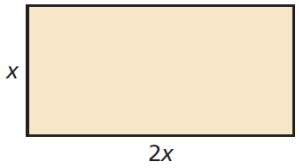
x	5	6	7	8
y	35	28	29	31

Essential Question

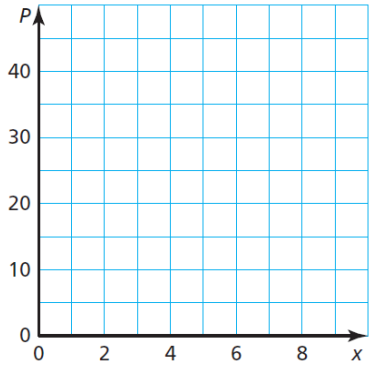
How can you determine whether a function is linear or nonlinear?

Work with a partner. Copy and complete each table for the sequence of similar figures. (In parts (a) and (b), use the rectangle shown.) Graph the data in each table. Decide whether each pattern is linear or nonlinear. Justify your conclusion.

a. perimeters of similar rectangles

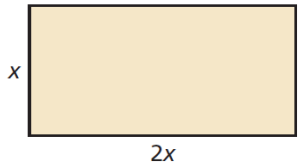


x	1	2	3	4	5
P					

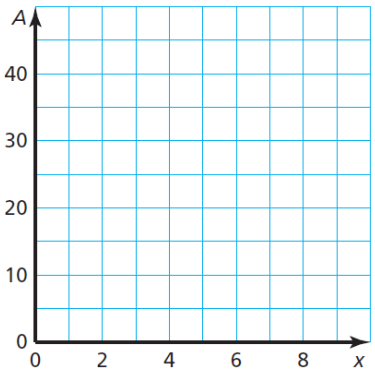


Work with a partner. Copy and complete each table for the sequence of similar figures. (In parts (a) and (b), use the rectangle shown.) Graph the data in each table. Decide whether each pattern is linear or nonlinear. Justify your conclusion.

b. areas of similar rectangles



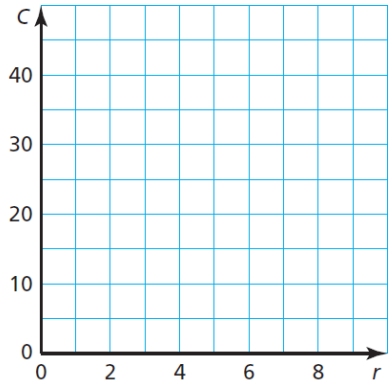
x	1	2	3	4	5
A					



Work with a partner. Copy and complete each table for the sequence of similar figures. (In parts (a) and (b), use the rectangle shown.) Graph the data in each table. Decide whether each pattern is linear or nonlinear. Justify your conclusion.

c. circumferences of circles of radius r

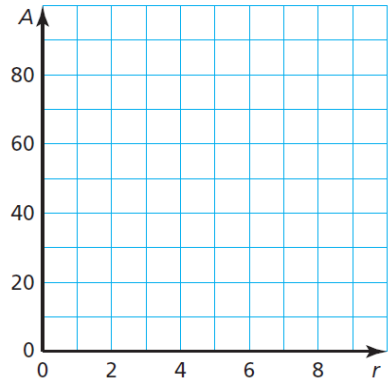
r	1	2	3	4	5
C					



Work with a partner. Copy and complete each table for the sequence of similar figures. (In parts (a) and (b), use the rectangle shown.) Graph the data in each table. Decide whether each pattern is linear or nonlinear. Justify your conclusion.

d. areas of circles of radius r

r	1	2	3	4	5
A					



What You Will Learn

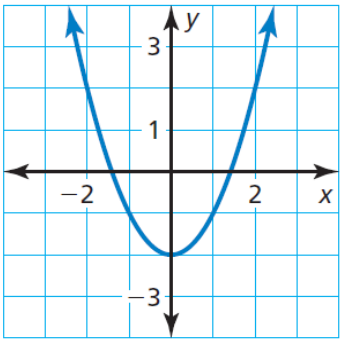
- Identify linear functions using graphs, tables, and equations.
- Graph linear functions using discrete and continuous data.
- Write real-life problems to fit data.

Identifying Linear Functions

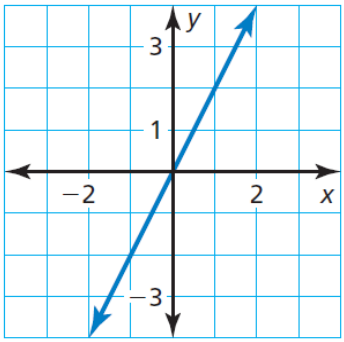
A **linear equation in two variables**, x and y, is an equation that can be written in the form $y = mx + b$, where m and b are constants. The graph of a linear equation is a line. Likewise, a **linear function** is a function whose graph is a nonvertical line. A linear function has a constant rate of change and can be represented by a linear equation in two variables. A **nonlinear function** does not have a constant rate of change. So, its graph is *not* a line.

Does the graph represent a *linear* or *nonlinear* function? Explain.

a.



b.



Does the table represent a *linear* or *nonlinear* function? Explain.

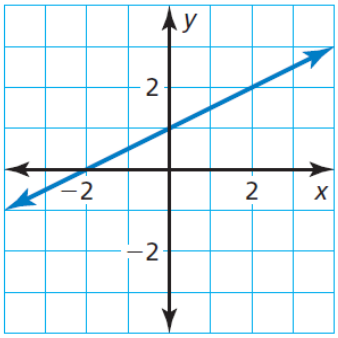
a.

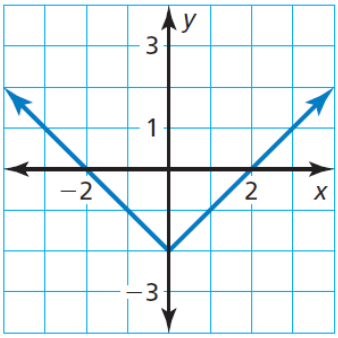
x	3	6	9	12
y	36	30	24	18

b.

x	1	3	5	7
y	2	9	20	35

Does the graph or table represent a *linear* or *nonlinear* function? Explain.

1. 

2. 

Does the graph or table represent a *linear* or *nonlinear* function? Explain.

3.

x	0	1	2	3
y	3	5	7	9

4.

x	1	2	3	4
y	16	8	4	2

Which of the following equations represent linear functions? Explain.

$$y = 3.8, y = \sqrt{x}, y = 3^x, y = \frac{2}{x}, y = 6(x-1), x^2 - y = 0$$

Does the equation represent a *linear* or *nonlinear* function? Explain.

3. $y = x + 9$

4. $y = \frac{3x}{5}$

5. $y = 5 - 2x^2$

Concept Summary

Representations of Functions

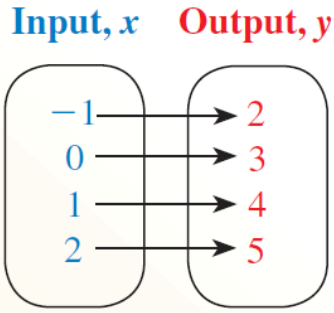
Words An output is 3 more than the input.

Equation $y = x + 3$

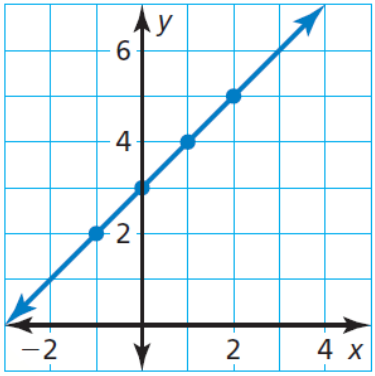
Input-Output Table

Input, x	Output, y
-1	2
0	3
1	4
2	5

Mapping Diagram



Graph

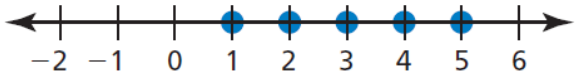


Core Concept

Discrete and Continuous Domains

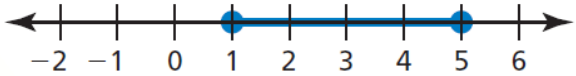
A **discrete domain** is a set of input values that consists of only certain numbers in an interval.

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



The linear function $y = 15.95x$ represents the cost y (in dollars) of x tickets for a museum. Each customer can buy a maximum of four tickets.

a. Find the domain of the function. Is the domain discrete or continuous? Explain.

b. Graph the function using its domain.

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

A cereal bar contains 130 calories. The number *c* of calories consumed is a function of the number *b* of bars eaten.

a. Does this situation represent a linear function? Explain.

b. Find the domain of the function. Is the domain discrete or continuous? Explain.

c. Graph the function using its domain.

9. Is the domain discrete or continuous? Explain.

Input **Number of stories, *x***	1	2	3
Output **Height of building (feet), *y***	12	24	36

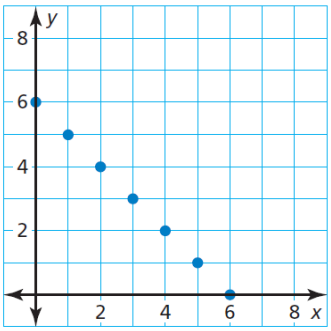
10. A 20-gallon bathtub is draining at a rate of 2.5 gallons per minute. The number *g* of gallons remaining is a function of the number *m* of minutes.

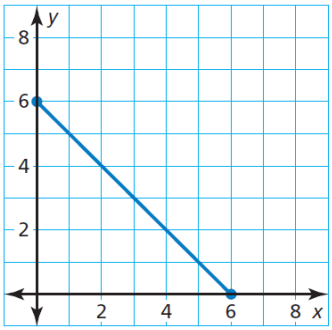
a. Does this situation represent a linear function? Explain.

b. Find the domain of the function. Is the domain discrete or continuous? Explain.

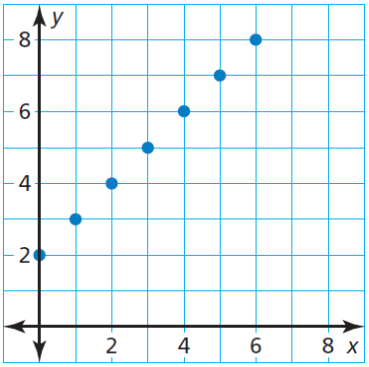
c. Graph the function using its domain.

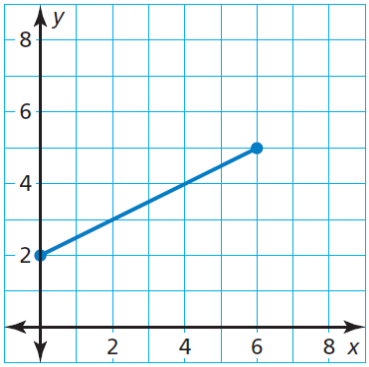
Write a real-life problem to fit the data shown in each graph. Is the domain of each function *discrete* or *continuous*? Explain.

a. 

b. 

Write a real-life problem to fit the data shown in the graph. Is the domain of the function *discrete* or *continuous*? Explain.

11. 

12. 

Exit Ticket: Explain how to determine when a graph has a continuous or discrete domain.