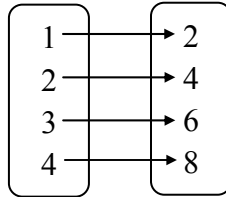


Chapter 5

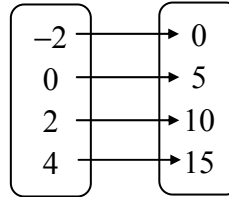
Fair Game Review

Describe the pattern of inputs x and outputs y .

1. Input, x Output, y



2. Input, x Output, y



3.

Input, x	-3	1	5	9	13
Output, y	-4	-1	2	5	8

4.

Input, x	-2	-1	0	1	2
Output, y	2	-5	-12	-19	-26

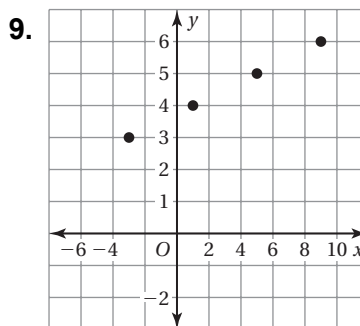
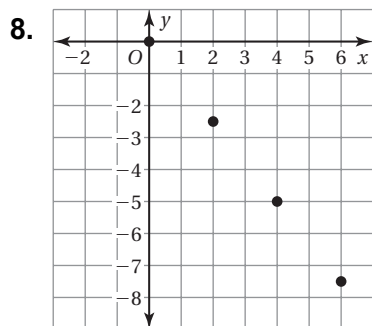
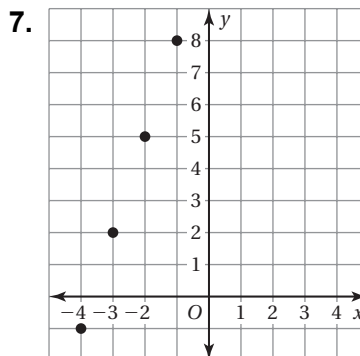
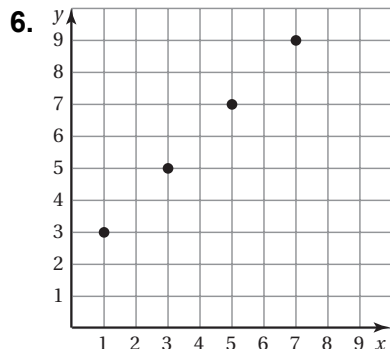
5. The table shows the number of customers y in x hours. Describe the inputs and outputs.

Hours, x	0	1	2	3	4
Customers, y	0	15	30	45	60

Chapter 5

Fair Game Review (continued)

Draw a mapping diagram for the graph. Then describe the pattern of inputs and outputs.



10. In basketball, for each shot you make from inside the three-point circle, you score two points. Draw a mapping diagram for inputs 0, 2, 4, 6, and 8.

5.1**Domain and Range of a Function**

For use with Activity 5.1

Essential Question How can you find the domain and range of a function?**1 ACTIVITY:** The Domain and Range of a Function

Work with a partner. In Activity 1 in Section 2.4, you completed the table shown below. The table shows the number of adult and child tickets sold for a school concert.

input	→	Number of Adult Tickets, x	0	1	2	3	4
output	→	Number of Child Tickets, y	8	6	4	2	0

The variables x and y are related by the linear equation $4x + 2y = 16$.

- a. Write the equation in *function form* by solving for y .
- b. The **domain** of a function is the set of all input values. Find the domain of the function represented by the table.

Domain = _____

Why is $x = 5$ not in the domain of the function?Why is $x = \frac{1}{2}$ not in the domain of the function?

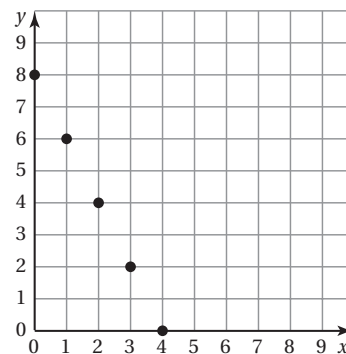
- c. The **range** of a function is the set of all output values. Find the range of the function represented by the table.

Range = _____

5.1 Domain and Range of a Function (continued)

d. Functions can be described in many ways.

- by an equation
- by an input-output table
- in words
- by a graph
- as a set of ordered pairs



Use the graph to write the function as a set of ordered pairs.

2 ACTIVITY: Finding Domains and Ranges

Work with a partner.

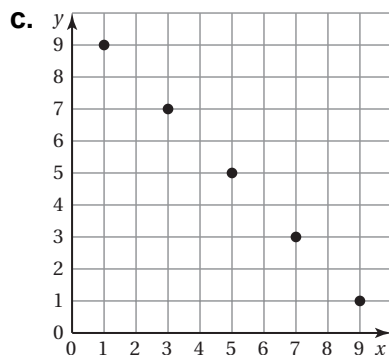
- Complete each input-output table.
- Find the domain and range of each function represented by the table.

a. $y = -3x + 4$

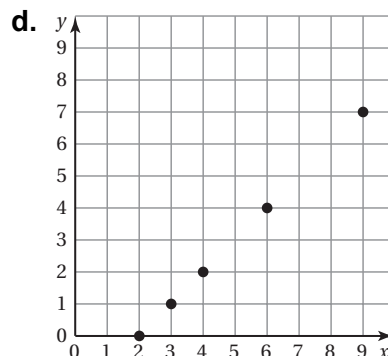
x	-2	-1	0	1	2
y					

b. $y = \frac{1}{2}x - 6$

x	0	1	2	3	4
y					



x					
y					



x					
y					

5.1 Domain and Range of a Function (continued)**What Is Your Answer?**

- 3. IN YOUR OWN WORDS** How can you find the domain and range of a function?

- 4. The following are general rules for finding a person's foot length.**

To find the length y (in inches) of a woman's foot, divide her shoe size x by 3 and add 7.

To find the length y (in inches) of a man's foot, divide his shoe size x by 3 and add 7.3.

- a.** Write an equation for one of the statements.

- b.** Make an input-output table for the function in part (a).

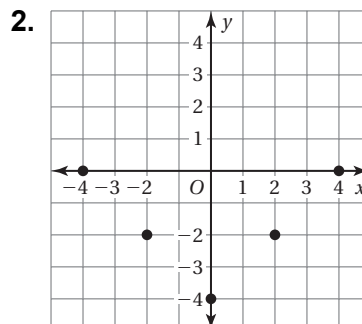
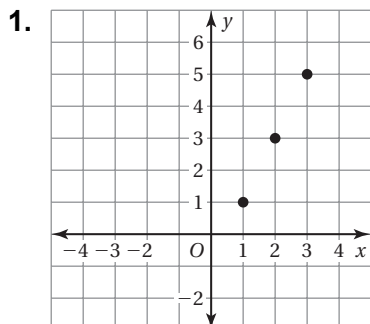
Use shoe sizes $5\frac{1}{2}$ to 12.

- c.** Label the domain and range of the function represented by the table.

5.1**Practice**

For use after Lesson 5.1

Find the domain and range of the function represented by the graph.



Complete the input-output table for the function. Then find the domain and range of the function represented by the table.

3. $y = 2x - 5$

x	-2	-1	0	1
y				

4. $y = -\frac{1}{2}x + 3$

x	0	2	4	6
y				

5. A factory that makes frozen pies produces 300 pies per minute.

a. Write an equation that represents the number y of pies made each hour x .

b. Create an input-output table for the equation in part (a). Use inputs 1, 2, 4, 8, and 10.

c. Find the domain and range of the function represented by the table.

**Extension
5.1**
Practice

For use after Extension 5.1

Determine whether the relation is a function.

1. $(1, -7), (1, -5), (2, -4), (3, -1), (4, 1)$ 2. $(-3, 1), (0, 0), (3, 1), (6, 4), (9, 9)$

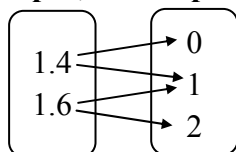
3.

Input	Output
6	5
7	1
8	-3

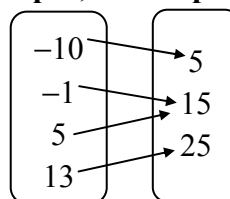
4.

Input	Output
4	1.5
-2	3.0
-2	3.5
0	4.5

5. Input, x Output, y



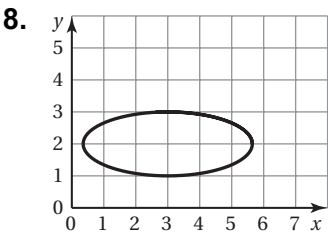
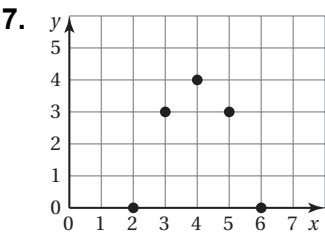
6. Input, x Output, y



Extension5.1

Practice (continued)

Determine whether the graph represents a function.



9. Let x represent the number of each month. (For example, $x = 1$ for January.)
Let y represent the number of days in month x . Do not consider a leap year.

a. Complete the table.

Input, x												
Output, y												

b. Does the relation represent a function? Explain.

c. When you switch the inputs and outputs of this relation, is the resulting relation a function?

5.2

Discrete and Continuous Domains

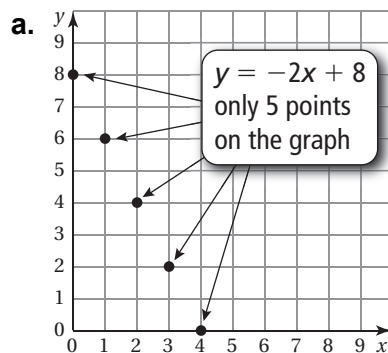
For use with Activity 5.2

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.

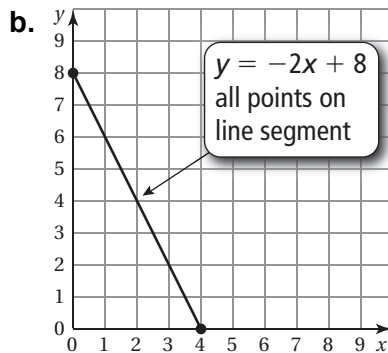
$$4x + 2y = 16 \text{ or } y = -2x + 8$$



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): $0 \leq x \leq 4$

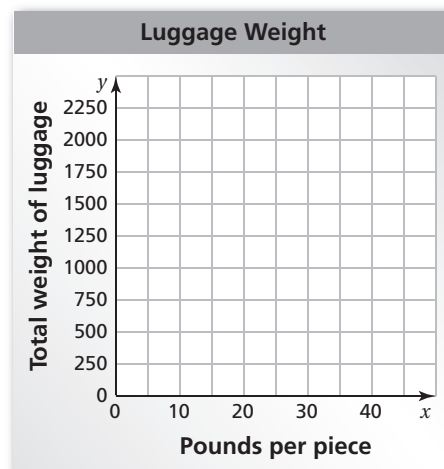
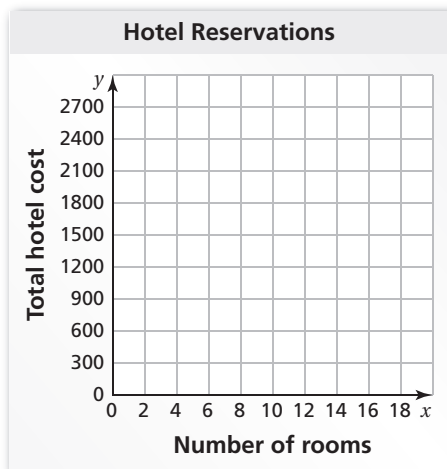
Range (y -values): $0 \leq y \leq 8$

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

5.2 Discrete and Continuous Domains (continued)**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?
- a. 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.
- b. 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.



5.2 Discrete and Continuous Domains (continued)**What Is Your Answer?**

3. **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.

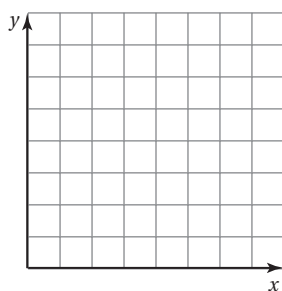
5.2**Practice**

For use after Lesson 5.2

Graph the function. Is the domain discrete or continuous?

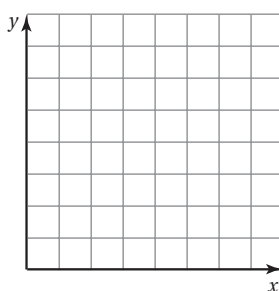
1.

Input Length, x (inches)	Output Area, y (square inches)
2	12
4	24
6	36

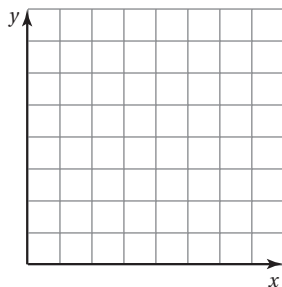


2.

Input Shirts, x	Output Cost, y (dollars)
0	0
1	9.25
2	18.50



3. The function $c = 20 + 10m$ represents the amount of calories you burn after m minutes of exercising. Graph the function using a domain of 0, 5, 10, and 15. Is the domain discrete or continuous?



4. You buy cards to send to family and friends for their birthdays. The function $y = 2.5x$ represents the cost y of the number of cards x you buy.

a. Is 8 in the domain? Explain.

b. Is 40 in the range? Explain.

5.3

Linear Function Patterns

For use with Activity 5.3

Essential Question How can you use a linear function to describe a linear pattern?

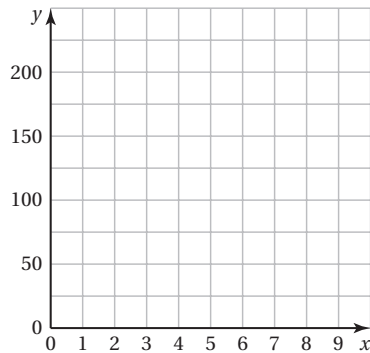
1 ACTIVITY: Finding Linear Patterns

Work with a partner.

- Plot the points from the table in a coordinate plane.
- Write a linear equation for the function.

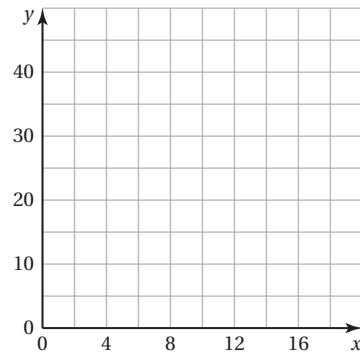
a.

x	0	2	4	6	8
y	150	125	100	75	50



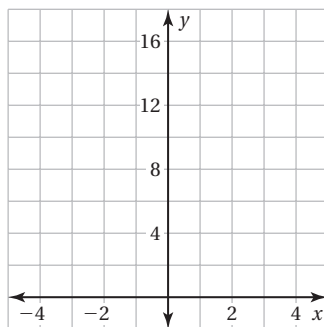
b.

x	4	6	8	10	12
y	15	20	25	30	35



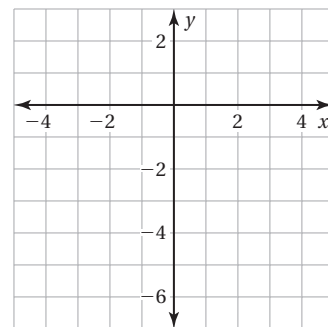
c.

x	-4	-2	0	2	4
y	4	6	8	10	12



d.

x	-4	-2	0	2	4
y	1	0	-1	-2	-3



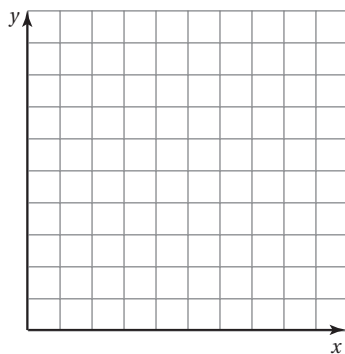
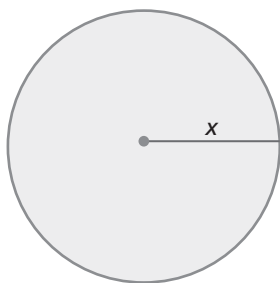
5.3 Linear Function Patterns (continued)**2 ACTIVITY:** Finding Linear Patterns

Work with a partner. The table shows a familiar linear pattern from geometry.

- Write a linear function that relates y to x .
- What do the variables x and y represent?
- Graph the linear function.

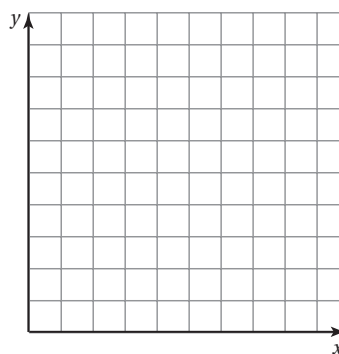
a.

x	1	2	3	4	5
y	2π	4π	6π	8π	10π



b.

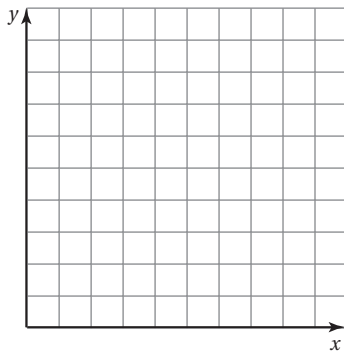
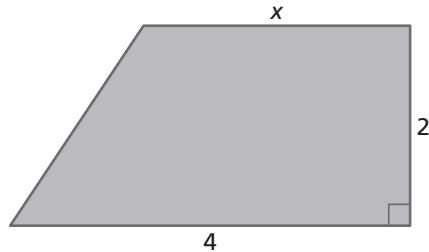
x	1	2	3	4	5
y	10	12	14	16	18



5.3 Linear Function Patterns (continued)

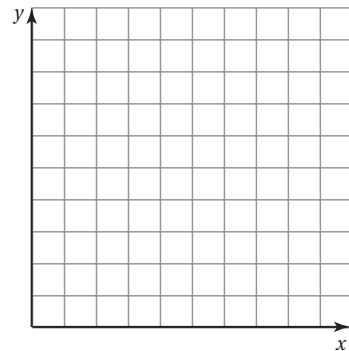
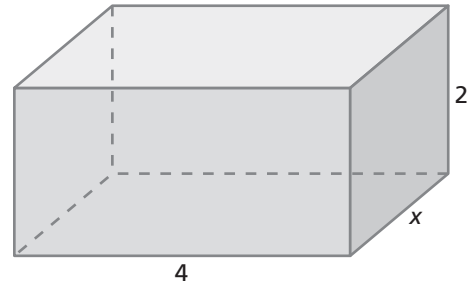
c.

x	1	2	3	4	5
y	5	6	7	8	9



d.

x	1	2	3	4	5
y	28	40	52	64	76



What Is Your Answer?

3. **IN YOUR OWN WORDS** How can you use a linear function to describe a linear pattern?

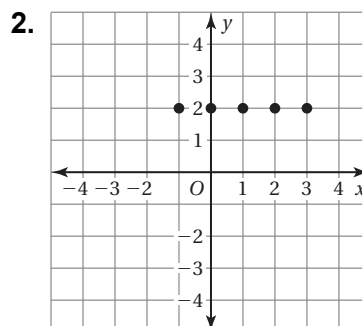
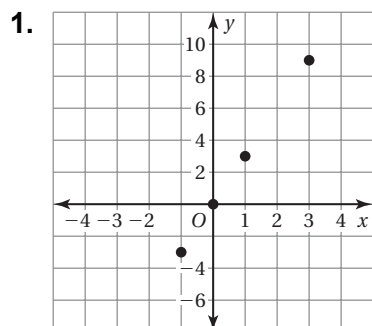
4. Describe the strategy you used to find the linear functions in Activities 1 and 2.

5.3

Practice

For use after Lesson 5.3

Use the graph or the table to write a linear function that relates y to x .



3.

x	0	1	2	3
y	5	7	9	11

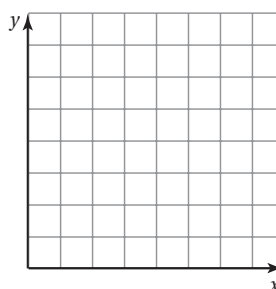
4.

x	-2	0	2	4
y	-1	-2	-3	-4

5. The table shows the distance traveled y (in miles) after x hours.

x	0	2	4	6
y	0	120	240	360

- a. Graph the data. Is the domain discrete or continuous?



- b. Write a linear function that relates y to x .

- c. What is the distance traveled after three hours?

5.4**Function Notation**

For use with Activity 5.4

Essential Question How can you use function notation to represent a function?

By naming a function f , you can write the function using **function notation**.

$$f(x) = 2x - 3 \quad \text{Function notation}$$

This is read as “ f of x equals $2x$ minus 3.” The notation $f(x)$ is another name for y . When function notation is used, the parentheses do not imply multiplication. You can use letters other than f to name a function. The letters g , h , j , and k are often used to name functions.

1 ACTIVITY: Matching Functions with Their Graphs

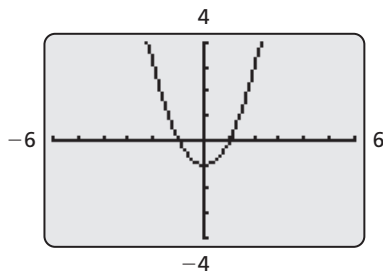
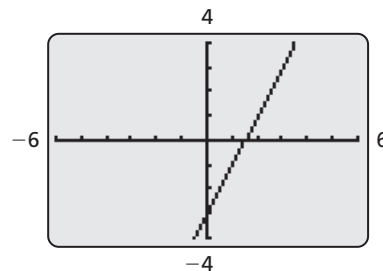
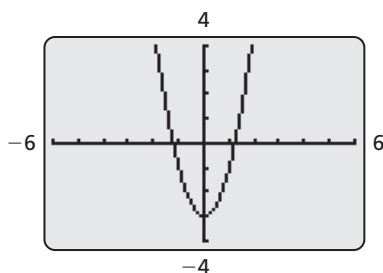
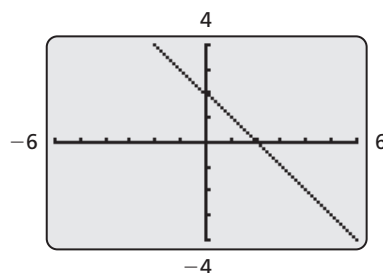
Work with a partner. Match each function with its graph.

a. $f(x) = 2x - 3$

b. $g(x) = -x + 2$

c. $h(x) = x^2 - 1$

d. $f(x) = 2x^2 - 3$

A.**B.****C.****D.**

5.4 Function Notation (continued)**2 ACTIVITY:** Evaluating a Function

Work with a partner. Consider the function

$$f(x) = -x + 3.$$

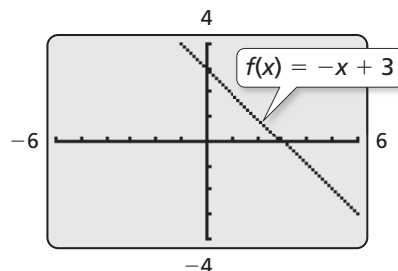
Locate the points $(x, f(x))$ on the graph.
Explain how you found each point.

a. $(-1, f(-1))$

b. $(0, f(0))$

c. $(1, f(1))$

d. $(2, f(2))$

**3 ACTIVITY:** Comparing Graphs of Functions

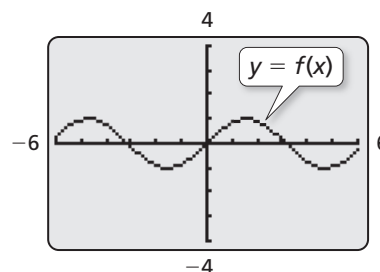
Work with a partner. The graph of a function from trigonometry is shown at the right. Use the graph to sketch the graph of each function. Explain your reasoning.

a. $g(x) = f(x) + 2$

b. $g(x) = f(x) + 1$

c. $g(x) = f(x) - 1$

d. $g(x) = f(x) - 2$



5.4 Function Notation (continued)**What Is Your Answer?**

- 4. IN YOUR OWN WORDS** How can you use function notation to represent a function? How are standard notation and function notation similar? How are they different?

Standard Notation

$$y = 2x + 5$$

Function Notation

$$f(x) = 2x + 5$$

- 5.** Use what you discovered in Activity 3 to write a general observation that compares the graphs of

$$y = f(x) \quad \text{and} \quad y = f(x) + c.$$

5.4**Practice**

For use after Lesson 5.4

Find the value of x so that the function has the given value.

1. $g(x) = 8x - 11; g(x) = 5$

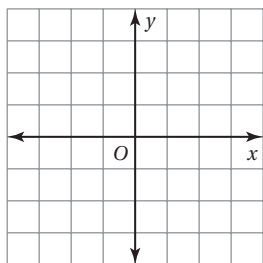
2. $v(x) = -2x - 2; v(x) = 12$

3. $k(x) = \frac{3}{2}x + 7; k(x) = -2$

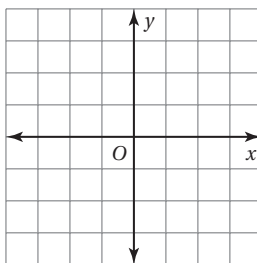
4. $j(x) = -4x + 9; j(x) = 8$

Graph the linear function.

5. $f(x) = -3x + 1$



6. $h(x) = \frac{1}{4}x - 2$



7. You have \$124. You earn \$22 each time you mow your neighbor's lawn.
The function $s(x) = 22x + 124$ represents your total savings.

a. What will your savings be after you mow 5 times?

b. How many times do you have to mow to save a total of \$300?

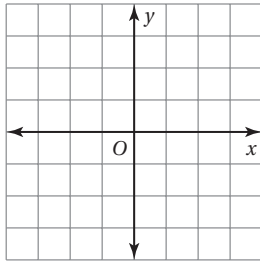
Extension 5.4

Practice

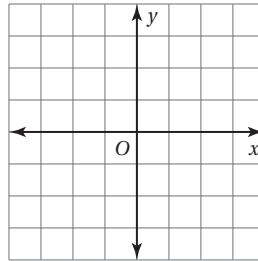
For use after Extension 5.4

Graph the function. Describe the domain and range.

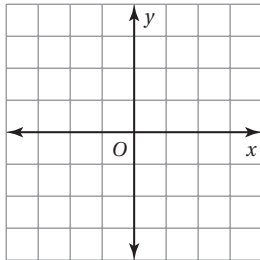
$$1. y = \begin{cases} x - 1, & \text{if } x \leq 0 \\ 2x, & \text{if } x > 0 \end{cases}$$



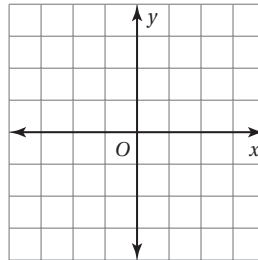
$$2. y = \begin{cases} -3, & \text{if } x \leq -1 \\ -\frac{1}{3}x + 1, & \text{if } x > -1 \end{cases}$$



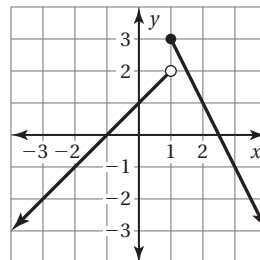
$$3. y = \begin{cases} 3, & \text{if } x \leq -1 \\ -2x, & \text{if } -1 < x < 1 \\ 3x - 6, & \text{if } x \geq 1 \end{cases}$$



$$4. y = \begin{cases} -2x - 4, & \text{if } x \leq -2 \\ 4x + 1, & \text{if } -2 < x \leq 1 \\ x, & \text{if } x > 1 \end{cases}$$



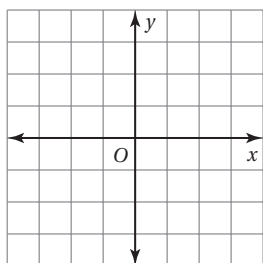
5. Write a piecewise function for the graph.



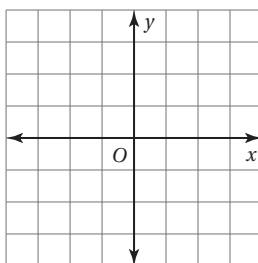
Extension
5.4**Practice (continued)**

Graph the function. Compare the graph to the graph of $y = |x|$. Describe the domain and range.

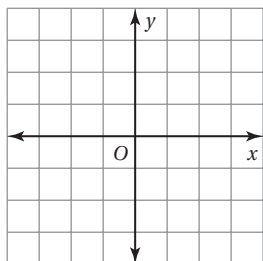
6. $y = |x| - 2$



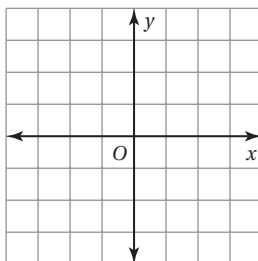
7. $y = |x + 3|$



8. $y = -\frac{1}{3}|x|$



9. $y = |x - 1| - 4$



Write an equation for the given translation of $y = |x|$.

10. 3 units right

11. 2 units down and 8 units left

5.5

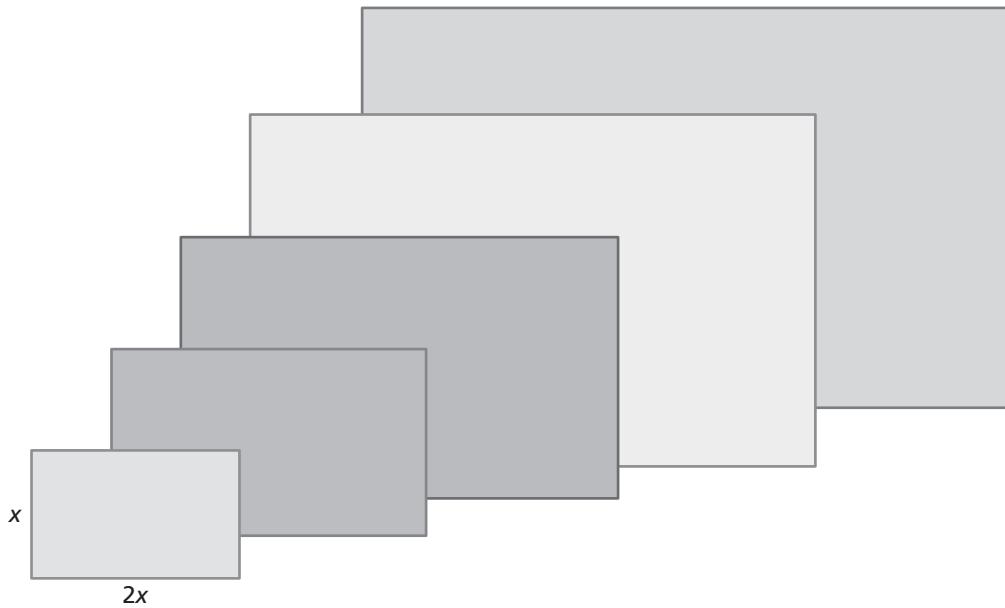
Comparing Linear and Nonlinear Functions

For use with Activity 5.5

Essential Question How can you recognize when a pattern in real life is linear or nonlinear?

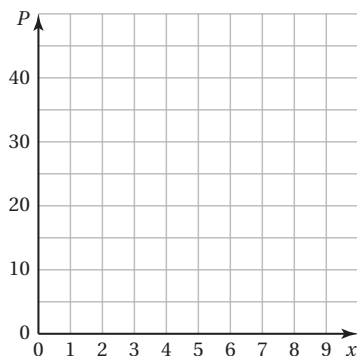
1 ACTIVITY: Finding Patterns for Similar Figures

Work with a partner. Complete each table for the sequence of similar rectangles. Graph the data in each table. Decide whether each pattern is linear or nonlinear.



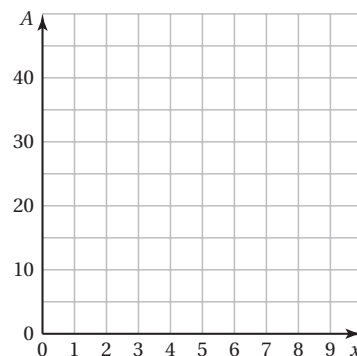
a. Perimeters of Similar Rectangles

x	1	2	3	4	5
P					



b. Areas of Similar Rectangles

x	1	2	3	4	5
A					



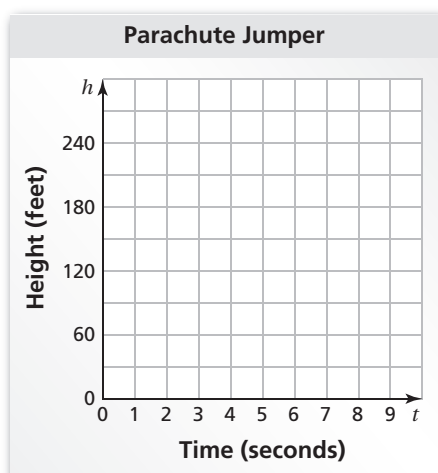
5.5 Comparing Linear and Nonlinear Functions (continued)**2 ACTIVITY:** Comparing Linear and Nonlinear Functions

Work with a partner. The table shows the height h (in feet) of a falling object at t seconds.

- Graph the data in the table.
- Decide whether the graph is linear or nonlinear.
- Compare the two falling objects. Which one has an increasing speed?

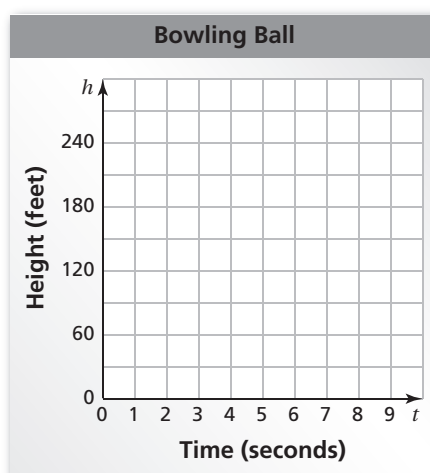
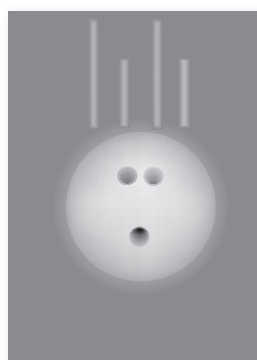
a. Falling parachute jumper

t	0	1	2	3	4
h	300	285	270	255	240



b. Falling bowling ball

t	0	1	2	3	4
h	300	284	236	156	44



5.5 Comparing Linear and Nonlinear Functions (continued)**What Is Your Answer?**

3. **IN YOUR OWN WORDS** How can you recognize when a pattern in real life is linear or nonlinear? Describe two real-life patterns: one that is linear and one that is nonlinear. Use patterns that are different from those described in Activities 1 and 2.

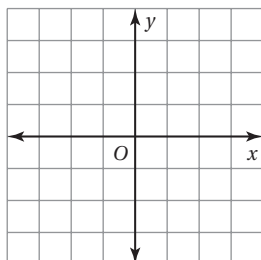
5.5**Practice**

For use after Lesson 5.5

Graph the data in the table. Decide whether the function is *linear* or *nonlinear*.

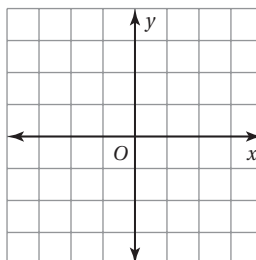
1.

x	-2	0	2	4
y	4	0	4	16

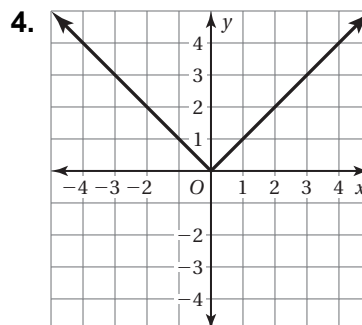
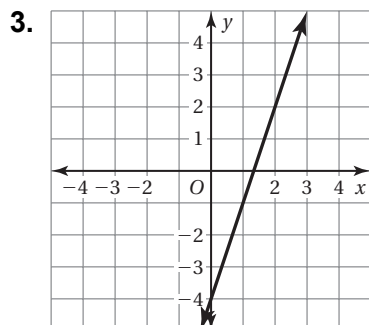


2.

x	-1	0	1	2
y	-1	1	3	5



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



5. The table shows the area of a square with side length x inches. Does the table represent a linear or nonlinear function? Explain.

Side Length, x	1	2	3	4
Area, A	1	4	9	16

5.6

Arithmetic Sequences

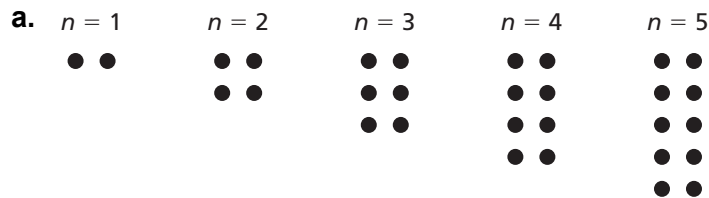
For use with Activity 5.6

Essential Question How are arithmetic sequences used to describe patterns?

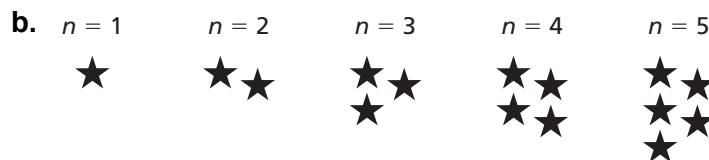
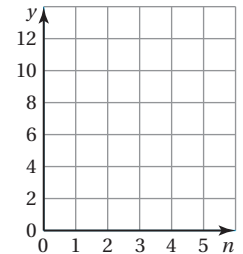
1 ACTIVITY: Describing a Pattern

Work with a partner.

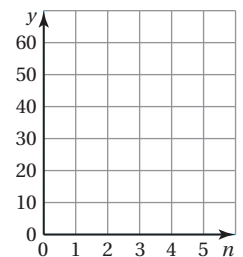
- Use the figures to complete the table.
- Plot the points in your completed table.
- Describe the pattern of the y -values.



Number of Rows, n	1	2	3	4	5
Number of Dots, y					

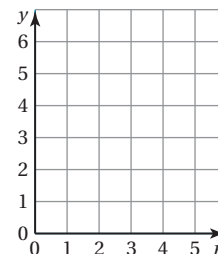


Number of Stars, n	1	2	3	4	5
Number of Sides, y					

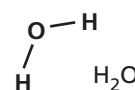
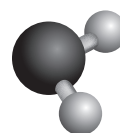


5.6 Arithmetic Sequences (continued)c. $n = 1$ $n = 2$ $n = 3$ $n = 4$ $n = 5$ 

n	1	2	3	4	5
Number of Circles, y					

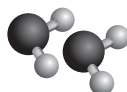
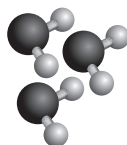
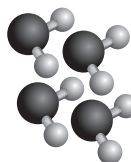
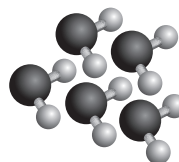
**2 ACTIVITY:** Using a Pattern in Science to Predict

Work with a partner. In chemistry, water is called H_2O because each molecule of water has 2 hydrogen atoms and 1 oxygen atom.



Molecule of Water

- Use the figures to complete the table.
- Describe the pattern of the y -values.
- Use your pattern to predict the number of atoms in 23 molecules.

 $n = 1$  $n = 2$  $n = 3$  $n = 4$  $n = 5$ 

Number of Molecules, n	1	2	3	4	5
Number of Atoms, y					

5.6 Arithmetic Sequences (continued)**3 ACTIVITY:** Writing a Story

Work with a partner.

- Describe the pattern in the table.
- Write and illustrate a story using the numbers in the table.
- Graph the data shown in the table.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
12	20	28	36	44	52	60	68	76	84	92	100

What Is Your Answer?

4. **IN YOUR OWN WORDS** How are arithmetic sequences used to describe patterns? Give an example from real life.

5.6**Practice**

For use after Lesson 5.6

Write the next three terms of the arithmetic sequence.

1. First term: 3

Common difference: 12

2. First term: 5

Common difference: 1.3

Find the common difference of the arithmetic sequence.

3. 4, 8, 12, 16, ...

4. 6.3, 7, 7.7, 8.4, ...

5. 200, 500, 800, 1100, ...

Write the next three terms of the arithmetic sequence.

6. 1, 10, 19, 28, ...

7. $8\frac{2}{3}$, 9, $9\frac{1}{3}$, $9\frac{2}{3}$, ...

8. 10, 25, 40, 55, ...

Determine whether the sequence is arithmetic. If so, find the common difference.

9. 3, 6, 12, 24, ...

10. $0, \frac{5}{6}, 1\frac{2}{3}, 2\frac{1}{2}, \dots$

11. An amusement park charges \$45 per person for admission. A season pass costs \$112 per person.

- Write the first five terms of an arithmetic sequence that represents the total cost of admission for the number of visits in a season.
- How many times does a person have to visit the park for a season pass to be the better deal? Explain.