4.3 Linear Function Patterns

Essential Question How can you use a linear function to describe a linear pattern?
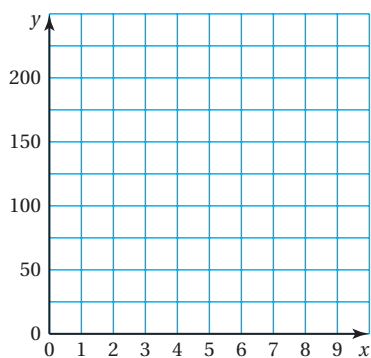
1 ACTIVITY: Finding Linear Patterns

Work with a partner.

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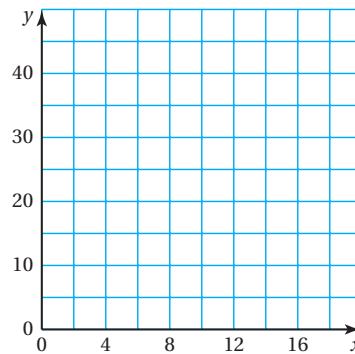- Write a linear equation for the function represented by the graph.
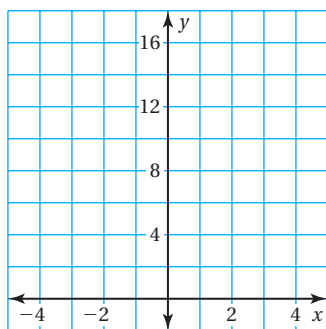
a.

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.

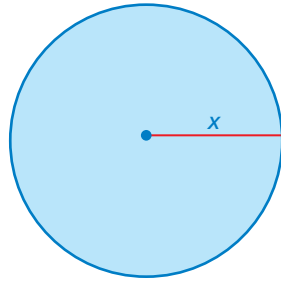| x	−4	−2	0	2	4
y	1	0	−1	−2	−3
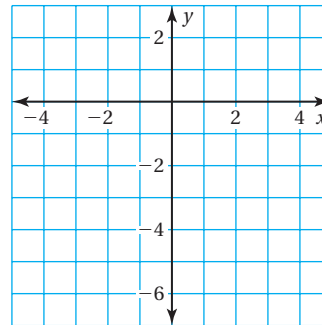
2 ACTIVITY: Finding Linear Patterns

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

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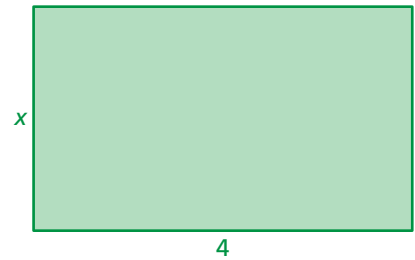- **What do the variables x and y represent?**
- **Graph the linear function.**

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

c.

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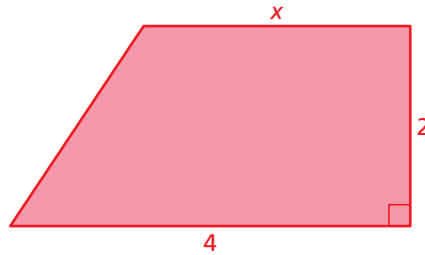
d.

x	1	2	3	4	5
y	28	40	52	64	76
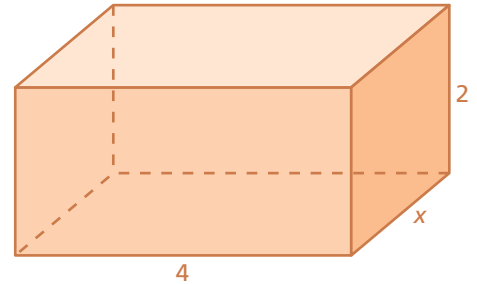
What Is Your Answer?

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.

Practice Use what you learned about linear function patterns to complete Exercises 3 and 4 on page 166.

Check It Out
Lesson Tutorials
BigIdeasMath.com

A **linear function** is a function whose graph is a line.

EXAMPLE 1 Finding a Linear Function Using a Graph
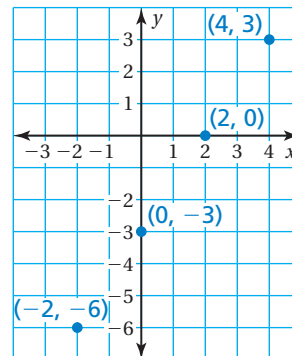
Use the graph to write a linear function that relates *y* to *x*.

The points lie on a line. Find the slope
and *y*-intercept of the line.

$$\text{slope} = \frac{\text{rise}}{\text{run}} = \frac{3}{2}$$

Because the line crosses the *y*-axis at $(0, -3)$,
the *y*-intercept is -3.

So, the linear function is $y = \dfrac{3}{2}x - 3$.

EXAMPLE 2 Finding a Linear Function Using a Table

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

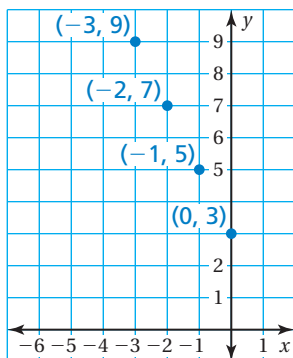| *x*	−3	−2	−1	0
y	9	7	5	3

Plot the points in the table.

The points lie on a line. Find the slope and *y*-intercept of the line.

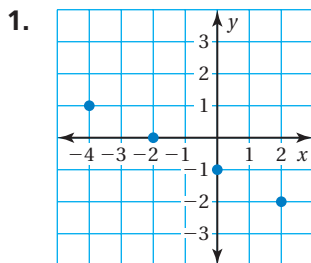$$\text{slope} = \frac{\text{rise}}{\text{run}} = \frac{-2}{1} = -2$$

Because the line crosses the *y*-axis at $(0, 3)$, the *y*-intercept is 3.

So, the linear function is $y = -2x + 3$.

On Your Own

Now You're Ready
Exercises 5–10

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

1.

2.

x	−2	−1	0	1
y	2	2	2	2

Multi-Language Glossary at BigIdeasMath.com.

EXAMPLE **3** **Real-Life Application**

Hours Kayaking, x	Calories Burned, y
2	600
4	1200
6	1800
8	2400

Graph the data in the table. (a) Is the domain discrete or continuous? (b) Write a linear function that relates y to x. (c) How many calories do you burn in 4.5 hours?

a. Plot the points. Time can represent any value greater than or equal to 0, so the domain is continuous. Draw a line through the points.
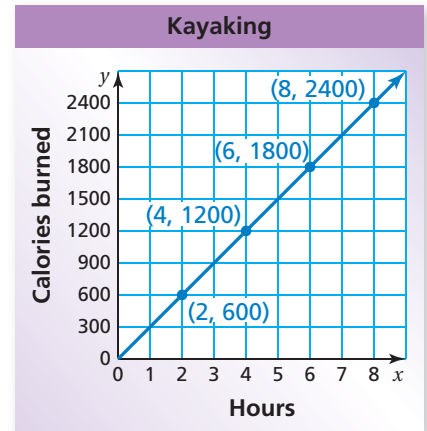
b. The slope is $\dfrac{600}{2} = 300$ and the y-intercept is 0.

∴ So, the linear function is $y = 300x$.

c. Find the value of y when $x = 4.5$.

$y = 300x$	Write the equation.
$= 300(4.5)$	Substitute 4.5 for x.
$= 1350$	Multiply.

∴ You burn 1350 calories in 4.5 hours of kayaking.

On Your Own

Hours Rock Climbing, x	Calories Burned, y
3	1950
6	3900
9	5850
12	7800

3. Graph the data in the table.

  a. Is the domain discrete or continuous?

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

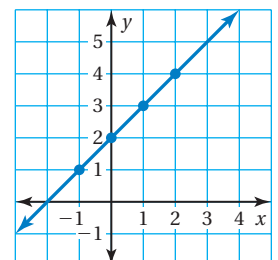 **c.** How many calories do you burn in 5.5 hours?

Summary

Representing a Function

Words An output is 2 more than the input.

Equation $y = x + 2$

Input-Output Table

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

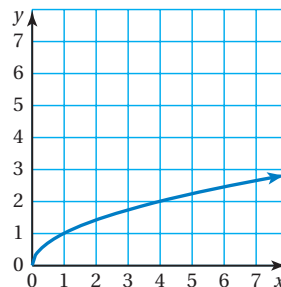**Graph**

Vocabulary and Concept Check

1. **VOCABULARY** Describe four ways to represent a function.

2. **VOCABULARY** Is the function represented by the graph a linear function? Explain.
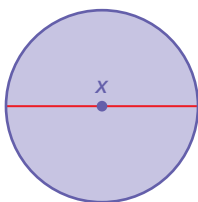

Practice and Problem Solving

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.
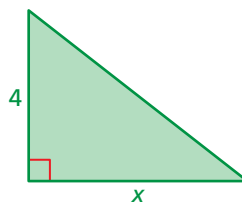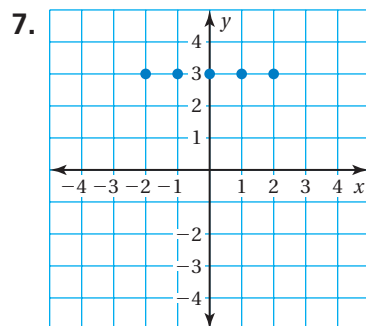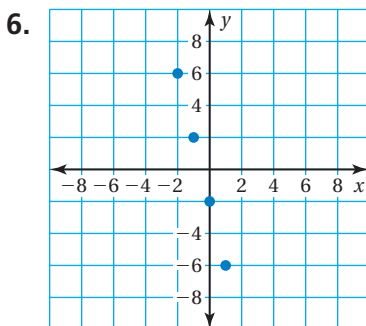
3.

x	1	2	3	4	5
y	π	2π	3π	4π	5π

4.

x	1	2	3	4	5
y	2	4	6	8	10

Use the graph or table to write a linear function that relates _y_ to _x_.

5.

6.

7.
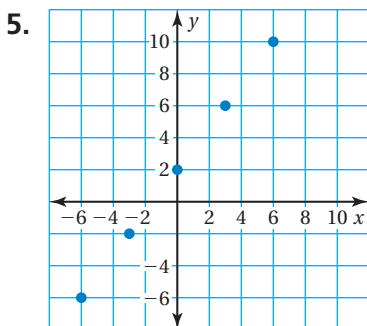
8.

x	−2	−1	0	1
y	−4	−2	0	2

9.

x	−8	−4	0	4
y	2	1	0	−1

10.

x	−3	0	3	6
y	3	5	7	9

11. **MOVIES** The table shows the cost _y_ (in dollars) of renting _x_ movies.

    a. Graph the data. Is the domain of the graph discrete or continuous?

    b. Write a linear function that relates _y_ to _x_.

    c. How much does it cost to rent three movies?

Number of Movies, x	0	1	2	4
Cost, y	0	3	6	12

12. **BIKE JUMPS** A bunny hop is a bike trick in which the rider brings both tires off the ground without using a ramp. The table shows the height y (in inches) of a bunny hop on a bike that weighs x pounds.

Weight, x	19	21	23
Height, y	10.2	9.8	9.4

    a. Graph the data. Then describe the pattern.

    b. Write a linear function that relates the height of a bunny hop to the weight of the bike.

   **c.** What is the height of a bunny hop on a bike that weighs 21.5 pounds?

Years of Education, x	Annual Salary, y
0	28
2	40
4	52
6	64
10	88

13. **SALARY** The table shows a person's annual salary y (in thousands of dollars) after x years of education beyond high school.

    a. Graph the data.

    b. Write a linear function that relates the person's annual salary to the number of years of education beyond high school.

    c. What is the annual salary of the person after 8 years of education beyond high school?

14. **Critical Thinking** The Heat Index is calculated using the relative humidity and the temperature. For every 1 degree increase in the temperature from 94°F to 98°F at 75% relative humidity, the Heat Index rises 4°F.

    a. On a summer day, the relative humidity is 75%, the temperature is 94°F, and the Heat Index is 122°F. Construct a table that relates the temperature t to the Heat Index H. Start the table at 94°F and end it at 98°F.

    b. Write a linear function that represents this situation.

    c. Estimate the Heat Index when the temperature is 100°F.
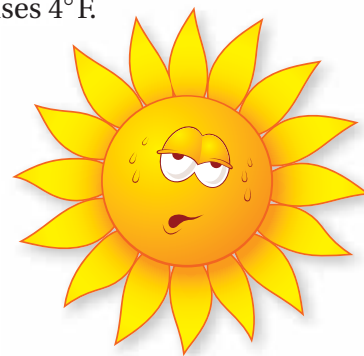
Fair Game Review What you learned in previous grades & lessons

Find the annual simple interest rate. *(Skills Review Handbook)*

15. $I = \$60, P = \$400, t = 3$ years

16. $I = \$45, P = \$1000, t = 18$ months

17. **MULTIPLE CHOICE** You buy a pair of gardening gloves for \$2.25 and x packets of seeds for \$0.88 each. Which equation represents the total cost y? *(Skills Review Handbook)*

    (A) $y = 0.88x - 2.25$ (B) $y = 0.88x + 2.25$

    (C) $y = 2.25x - 0.88$ (D) $y = 2.25x + 0.88$