

4.3 Linear Function Patterns

Essential Question

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

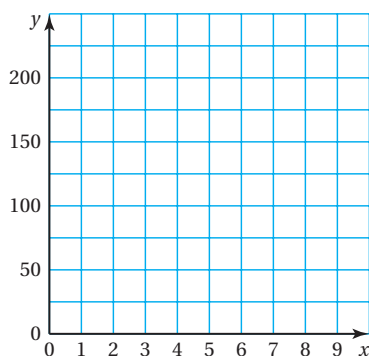
1 ACTIVITY: Finding Linear Patterns

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.

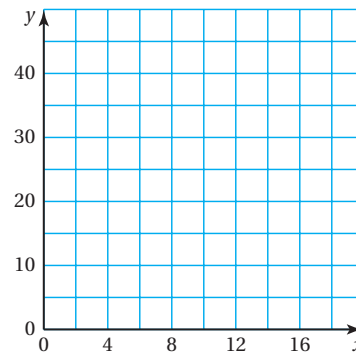
a.

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



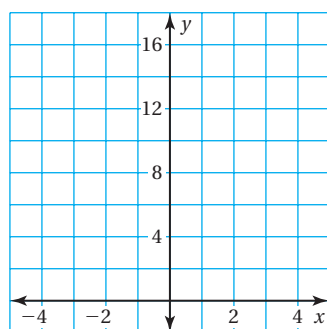
b.

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



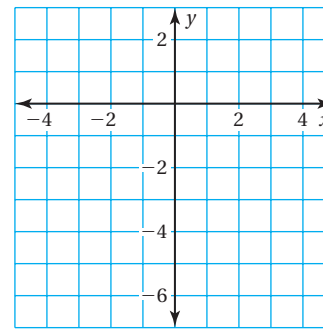
c.

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



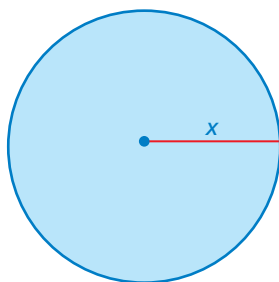
2 ACTIVITY: Finding Linear Patterns

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.

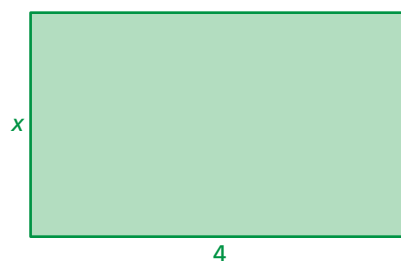
a.

x	1	2	3	4	5
y	2π	4π	6π	8π	10π



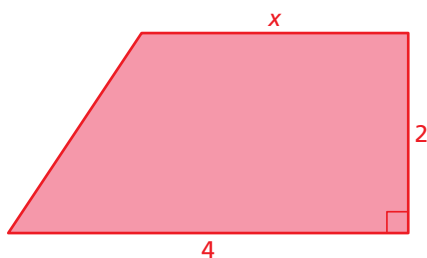
b.

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



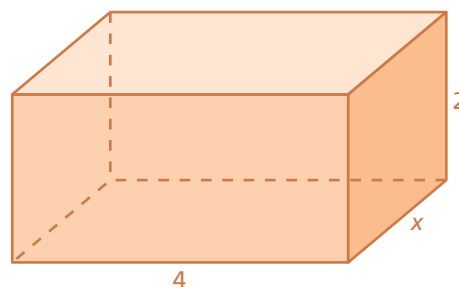
c.

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.

4.3 Lesson

Key Vocabulary

linear function,
p. 164

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

EXAMPLE 1 Finding a Linear Function Using a Graph

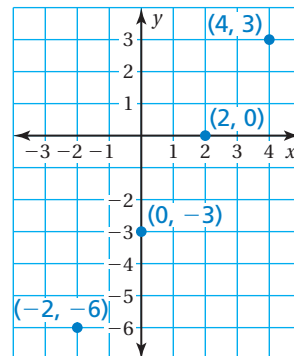
Use the graph to write a linear function that relates y to x .

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



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

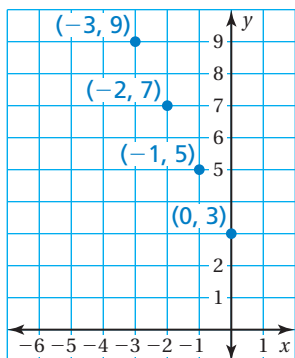
Plot the points in the table.

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.

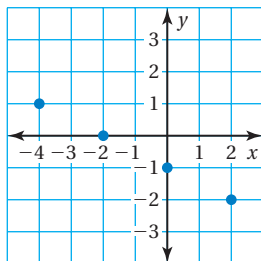
So, the linear function is $y = -2x + 3$.



On Your Own

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

Now You're Ready
Exercises 5–10

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.

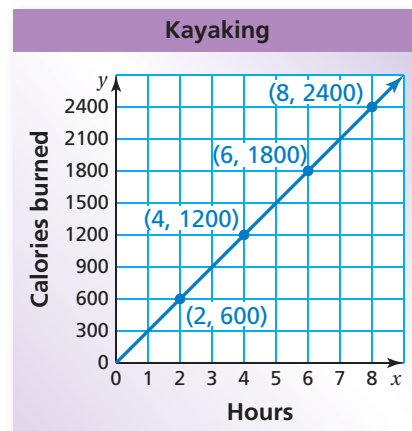
b. The slope is $\frac{600}{2} = 300$ and the y -intercept is 0.

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

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

$$\begin{aligned}
 y &= 300x && \text{Write the equation.} \\
 &= 300(4.5) && \text{Substitute 4.5 for } x. \\
 &= 1350 && \text{Multiply.}
 \end{aligned}$$

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

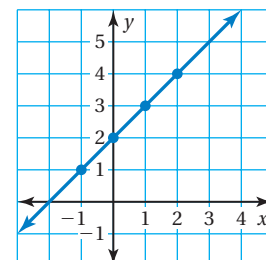
Words An output is 2 more than the input.

Equation $y = x + 2$

Input-Output Table

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

Graph

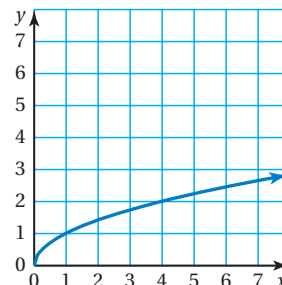


4.3 Exercises



Vocabulary and Concept Check

- VOCABULARY** Describe four ways to represent a function.
- VOCABULARY** Is the function represented by the graph a linear function? Explain.

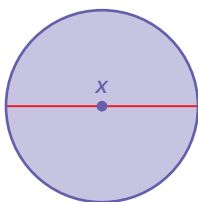


Practice and Problem Solving

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.

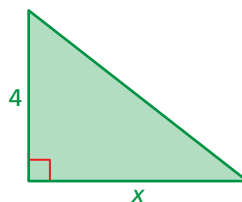
3.

x	1	2	3	4	5
y	π	2π	3π	4π	5π



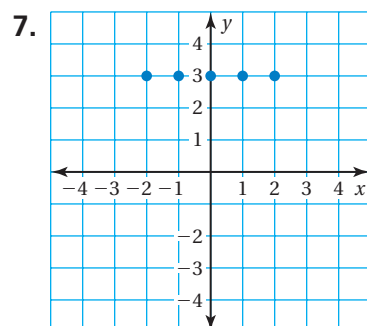
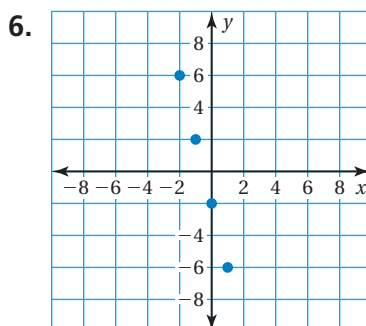
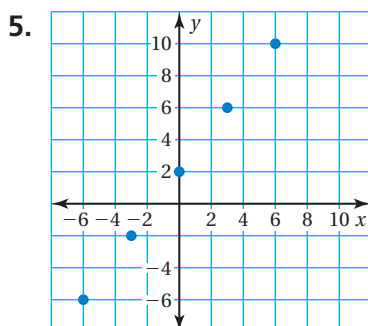
4.

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 .

1 2



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.

- Graph the data. Is the domain of the graph discrete or continuous?
- Write a linear function that relates y to x .
- 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

- Graph the data. Then describe the pattern.
- Write a linear function that relates the height of a bunny hop to the weight of the bike.
- What is the height of a bunny hop on a bike that weighs 21.5 pounds?



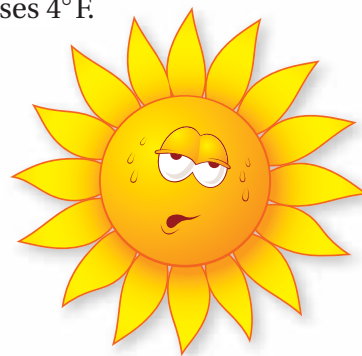
Years of Education, x	Annual Salary, y
0	28
2	40
4	52
6	64
10	88

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

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

- 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 .
- Write a linear function that represents this situation.
- 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) $y = 2.25x + 0.88$