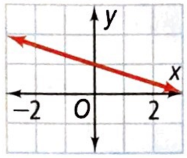
# 4 Chapter Review

## Connecting BIG ideas and Answering the Essential Questions

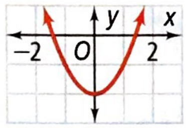
**1 Functions**
A function is a relationship that pairs one input value with exactly one output value. You can use words, tables, equations, sets of ordered pairs, and graphs to represent functions.

**Patterns and Functions (Lessons 4-2 and 4-3)**

Linear




Nonlinear



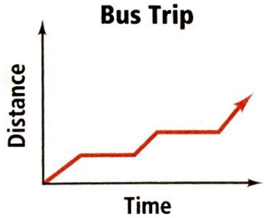

**Function Notation and Sequences (Lessons 4-6 and 4-7)**

| $n$ | $A(n) = 3 + (n - 1)(2)$ | $A(n)$ |
|---|---|---|
| 1 | $3 + (1 - 1)(2)$ | 3 |
| 2 | $3 + (2 - 1)(2)$ | 5 |
| 3 | $3 + (3 - 1)(2)$ | 7 |

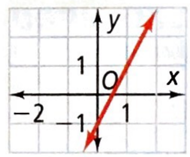
**2 Modeling**
You can use functions to model real-world situations that pair one input value with a unique output value.

**Using Graphs to Relate Two Quantities (Lesson 4-1)**

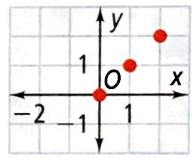
**Bus Trip**




**Graphing a Function Rule (Lesson 4-4)**




Continuous




Discrete

**Writing a Function Rule (Lesson 4-5)**

$C = \frac{1}{4}n + 6$ $\qquad$ $A = s^2$

## Chapter Vocabulary

- arithmetic sequence, p. 275
- common difference, p. 275
- continuous graph, p. 255
- dependent variable, p. 240
- discrete graph, p. 255
- domain, p. 268
- explicit formula, p. 276
- function, p. 241
- function notation, p. 269
- input, p. 240
- independent variable, p. 240
- linear function, p. 241
- nonlinear function, p. 246
- output, p. 240
- range, p. 268
- recursive formula, p. 275
- relation, p. 268
- sequence, p. 274
- term of a sequence, p. 274
- vertical line test, p. 269

**Choose the correct term to complete each sentence.**

**1.** If the value of $a$ changes in response to the value of $b$, then $b$ is the ? .

**2.** The graph of a(n) ? function is a nonvertical line or part of a nonvertical line.

**3.** The ? of a function consists of the set of all output values.

## 4-1 Using Graphs to Relate Two Quantities

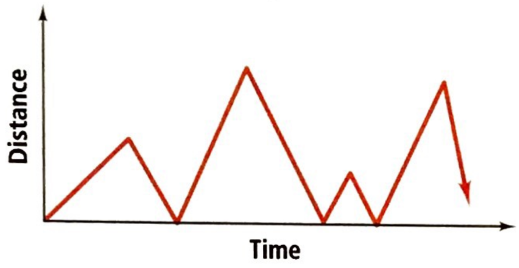
### Quick Review

You can use graphs to represent the relationship between two variables.

### Example

**A dog owner plays fetch with her dog. Sketch a graph to represent the distance between them and the time.**

**Playing Fetch**




### Exercises

4. **Travel** A car's speed increases as it merges onto a highway. The car travels at 65 mi/h on the highway until it slows to exit. The car then stops at three traffic lights before reaching its destination. Draw a sketch of a graph that shows the car's speed over time. Label each section.

5. **Surfing** A professional surfer paddles out past breaking waves, rides a wave, paddles back out past the breaking waves, rides another wave, and paddles back to the beach. Draw a sketch of a graph that shows the surfer's possible distance from the beach over time.

## 4-2 Patterns and Linear Functions

### Quick Review

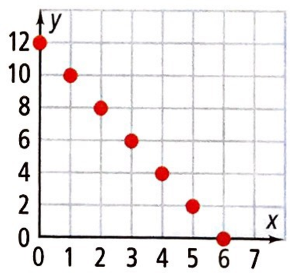
A **function** is a relationship that pairs each **input** value with exactly one **output** value. A **linear function** is a function whose graph is a line or part of a line.

### Example

**The number $y$ of eggs left in a dozen depends on the number $x$ of 2-egg omelets you make, as shown in the table. Represent this relationship using words, an equation, and a graph.**

| Number of Omelets Made, $x$ | 0 | 1 | 2 | 3 |
|---|---|---|---|---|
| Number of Eggs Left, $y$ | 12 | 10 | 8 | 6 |

Look for a pattern in the table. Each time $x$ increases by 1, $y$ decreases by 2. The number $y$ of eggs left is 12 minus the quantity 2 times the number $x$ of omelets made: $y = 12 - 2x$.




### Exercises

**For each table, identify the independent and dependent variables. Represent the relationship using words, an equation, and a graph.**

6. **Paint in Can**

| Number of Chairs Painted, $p$ | Paint Left (oz), $L$ |
|---|---|
| 0 | 128 |
| 1 | 98 |
| 2 | 68 |
| 3 | 38 |

7. **Game Cost**

| Number of Snacks Purchased, $s$ | Total Cost, $C$ |
|---|---|
| 0 | \$18 |
| 1 | \$21 |
| 2 | \$24 |
| 3 | \$27 |

8. **Elevation**

| Number of Flights of Stairs Climbed, $n$ | 0 | 1 | 2 | 3 |
|---|---|---|---|---|
| Elevation (ft above sea level), $E$ | 311 | 326 | 341 | 356 |

## 4-3 Patterns and Nonlinear Functions

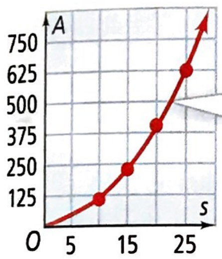
### Quick Review

A **nonlinear function** is a function whose graph is *not* a line or part of a line.

### Example

**The area $A$ of a square field is a function of the side length $s$ of the field. Is the function *linear* or *nonlinear*?**

| Side Length (ft), $s$ | 10 | 15 | 20 | 25 |
|---|---|---|---|---|
| Area ($ft^2$), $A$ | 100 | 225 | 400 | 625 |




Graph the ordered pairs and connect the points. The graph is not a line, so the function is nonlinear.

### Exercises

**Graph the function shown by each table. Tell whether the function is *linear* or *nonlinear*.**

**9.**

| $x$ | $y$ |
|---|---|
| 1 | 0 |
| 2 | 1 |
| 3 | 8 |
| 4 | 20 |

**10.**

| $x$ | $y$ |
|---|---|
| 1 | 0 |
| 2 | 4.5 |
| 3 | 9 |
| 4 | 13.5 |

**11.**

| $x$ | $y$ |
|---|---|
| 1 | 2 |
| 2 | 6 |
| 3 | 12 |
| 4 | 72 |

**12.**

| $x$ | $y$ |
|---|---|
| 1 | −2 |
| 2 | −9 |
| 3 | −16 |
| 4 | −23 |

## 4-4 Graphing a Function Rule

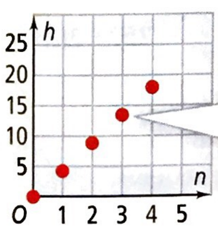
### Quick Review

A **continuous graph** is a graph that is unbroken. A **discrete graph** is composed of distinct, isolated points. In a real-world graph, show only points that make sense.

### Example

**The total height $h$ of a stack of cans is a function of the number $n$ of layers of 4.5-in. cans used. This situation is represented by $h = 4.5n$. Graph the function.**

| $n$ | $h$ |
|---|---|
| 0 | 0 |
| 1 | 4.5 |
| 2 | 9 |
| 3 | 13.5 |
| 4 | 18 |




The graph is discrete because only whole numbers of layers make sense.

### Exercises

**Graph the function rule. Explain why the graph is *continuous* or *discrete*.**

**13. Walnuts** Your cost $c$ to buy $w$ pounds of walnuts at \$6/lb is represented by $c = 6w$.

**14. Moving** A truck originally held 24 chairs. You remove 2 chairs at a time. The number of chairs $n$ remaining after you make $t$ trips is represented by $n = 24 - 2t$.

**15. Flood** A burst pipe fills a basement with 37 in. of water. A pump empties the water at a rate of 1.5 in./h. The water level $\ell$, in inches, after $t$ hours is represented by $\ell = 37 - 1.5t$.

**16.** Graph $y = -|x| + 2$.

# 4-5 Writing a Function Rule

## Quick Review

To write a function rule describing a real-world situation, it is often helpful to start with a verbal model of the situation.

## Example

**At a bicycle motocross (BMX) track, you pay $40 for a racing license plus $15 per race. What is a function rule that represents your total cost?**

| total cost | = | license fee | + | fee per race | • | number of races |
|---|---|---|---|---|---|---|
| $C$ | = | 40 | + | 15 | • | $r$ |

A function rule is $C = 40 + 15 \cdot r$.

## Exercises

**Write a function rule to represent each situation.**

17. **Landscaping** The volume $V$ remaining in a 243-$ft^3$ pile of gravel decreases by 0.2 $ft^3$ with each shovelful $s$ of gravel spread in a walkway.

18. **Design** Your total cost $C$ for hiring a garden designer is $200 for an initial consultation plus $45 for each hour $h$ the designer spends drawing plans.

# 4-6 Formalizing Relations and Functions

## Quick Review

A **relation** pairs numbers in the **domain** with numbers in the **range.** A relation may or may not be a function.

## Example

**Is the relation $\{(0, 1), (3, 3), (4, 4), (0, 0)\}$ a function?**

The $x$-values of the ordered pairs form the domain, and the $y$-values form the range. The domain value 0 is paired with two range values, 1 and 0. So the relation is not a function.

## Exercises

**Tell whether each relation is a function.**

19. $\{(-1, 7), (9, 4), (3, -2), (5, 3), (9, 1)\}$

20. $\{(2, 5), (3, 5), (4, -4), (5, -4), (6, 8)\}$

**Evaluate each function for $x = 2$ and $x = 7$.**

21. $f(x) = 2x - 8$

22. $h(x) = -4x + 61$

23. The domain of $t(x) = -3.8x - 4.2$ is $\{-3, -1.4, 0, 8\}$. What is the range?

# 4-7 Arithmetic Sequences

## Quick Review

A **sequence** is an ordered list of numbers, called terms, that often forms a pattern. A sequence can be represented by a **recursive formula** or an **explicit formula**.

## Example

**Tell whether the sequence is arithmetic.**

5, 2, −1, −4, . . .

−3 −3 −3

The sequence has a common difference of −3, so it is arithmetic.

## Exercises

**For each sequence, write a recursive and an explicit formula.**

24. 3, 8, 13, 18, . . .

25. −2, −5, −8, −11, . . .

26. 4, 6.5, 9, 11.5, . . .

27. 18, 11, 4, −3, . . .

**For each recursive formula, find an explicit formula that represents the same sequence.**

28. $A(n) = A(n - 1) + 3; A(1) = 4$

29. $A(n) = A(n - 1) + 11; A(1) = 13$

30. $A(n) = A(n - 1) - 1; A(1) = 19$