# 2.1 EXERCISES

**HOMEWORK KEY**

○ = **WORKED-OUT SOLUTIONS** on p. WS2 for Exs. 7, 17, and 45

★ = **STANDARDIZED TEST PRACTICE** Exs. 2, 9, 20, 24, 40, 46, and 49

## SKILL PRACTICE

1. **VOCABULARY** Copy and complete: In the equation $y = x + 5$, $x$ is the __?__ variable and $y$ is the __?__ variable.

2. ★ **WRITING** *Describe* how to find the domain and range of a relation given by a set of ordered pairs.

**EXAMPLE 1** on p. 72 for Exs. 3–9

**REPRESENTING RELATIONS** **Identify the domain and range of the given relation. Then represent the relation using a graph and a mapping diagram.**

3. $(-2, 3), (1, 2), (3, -1), (-4, -3)$

4. $(5, -2), (-3, -2), (3, 3), (-1, -1)$

5. $(6, -1), (-2, -3), (1, 8), (-2, 5)$

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

7. $(5, 20), (10, 20), (15, 30), (20, 30)$

8. $(4, -2), (4, 2), (16, -4), (16, 4)$

**9.** ★ **MULTIPLE CHOICE** What is the domain of the relation given by the ordered pairs $(-4, 2)$, $(-1, -3)$, $(1, 4)$, $(1, -3)$, and $(2, 1)$?

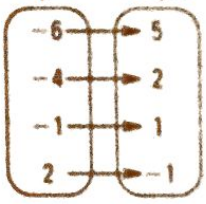
Ⓐ $-3, 1, 2$, and $4$ Ⓑ $-4, -1, 1$, and $2$

Ⓒ $-4, -3, -1$, and $2$ Ⓓ $-4, -3, -1, 1, 2$, and $4$

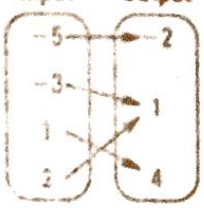
EXAMPLE 2 on p. 73 for Exs. 10–20

**IDENTIFYING FUNCTIONS** Tell whether the relation is a function. *Explain.*

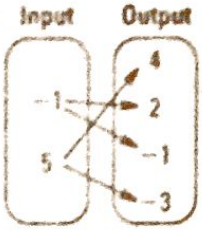
**10.**



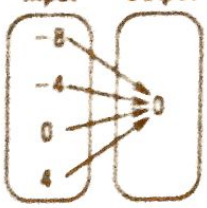

**11.**




**12.**




**13.**




**ERROR ANALYSIS** *Describe* and correct the error in the student's work.

**14.**

The relation given by the ordered paire $(-4, 2)$, $(-1, 5)$, $(3, 6)$, and $(7, 2)$ is not a function because the inpute $-4$ and $7$ are both mapped to the output 2.

**15.**

| x | 0 | 1 | 2 | 1 | 0 |
|---|---|---|---|---|---|
| y | 5 | 6 | 7 | 8 | 9 |

The relation given by the table is a function because there is only one value of x for each value of y.

**IDENTIFYING FUNCTIONS** Tell whether the relation is a function. *Explain.*

**16.** $(3, -2)$, $(0, 1)$, $(1, 0)$, $(-2, -1)$, $(2, -1)$

**17.** $(2, -5)$, $(-2, 5)$, $(-1, 4)$, $(-2, 0)$, $(3, -4)$

**18.** $(0, 1)$, $(1, 0)$, $(2, 3)$, $(3, 2)$, $(4, 4)$

**19.** $(-1, -1)$, $(2, 5)$, $(4, 8)$, $(-5, -9)$, $(-1, -5)$

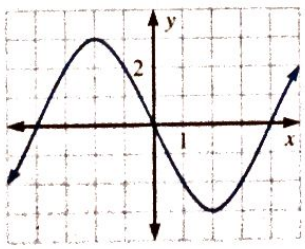
**20.** ★ **MULTIPLE CHOICE** The relation given by the ordered pairs $(-6, 3)$, $(-2, 4)$, $(1, 5)$, and $(4, 0)$ is a function. Which ordered pair can be included with this relation to form a new relation that is also a function?

Ⓐ $(1, -5)$ Ⓑ $(6, 3)$ Ⓒ $(-2, 19)$ Ⓓ $(4, 4)$

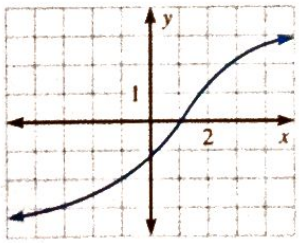
EXAMPLE 3 on p. 74 for Exs. 21–23

**VERTICAL LINE TEST** Use the vertical line test to tell whether the relation is a function.

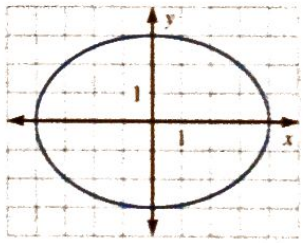
**21.**




**22.**




**23.**




**24.** ★ **SHORT RESPONSE** *Explain* why a relation is not a function if a vertical line intersects the graph of the relation more than once.

EXAMPLE 4 on p. 75 for Exs. 25–33

**GRAPHING EQUATIONS** Graph the equation.

**25.** $y = x + 2$

**26.** $y = -x + 5$

**27.** $y = 3x + 1$

**28.** $y = 5x - 3$

**29.** $y = 2x - 7$

**30.** $y = -3x + 2$

**31.** $y = -2x$

**32.** $y = \frac{1}{2}x + 2$

**33.** $y = -\frac{3}{4}x - 1$

**EVALUATING FUNCTIONS** **Tell whether the function is linear. Then evaluate the function for the given value of $x$.**

**34.** $f(x) = x + 15; f(8)$

**35.** $f(x) = x^2 + 1; f(-3)$

**36.** $f(x) = |x| + 10; f(-4)$

**37.** $f(x) = 6; f(2)$

**38.** $g(x) = x^3 - 2x^2 + 5x - 8; g(-5)$

**39.** $h(x) = 7 - \frac{2}{3}x; h(15)$

**40.** ★ **SHORT RESPONSE** Which, if any, of the relations described by the equations $y = |x|$, $x = |y|$, and $|y| = |x|$ represent functions? *Explain.*

**41.** **CHALLENGE** Let $f$ be a function such that $f(a + b) = f(a) + f(b)$ for all real numbers $a$ and $b$. Show that $f(2a) = 2 \cdot f(a)$ and that $f(0) = 0$.

# Answers for 2.1

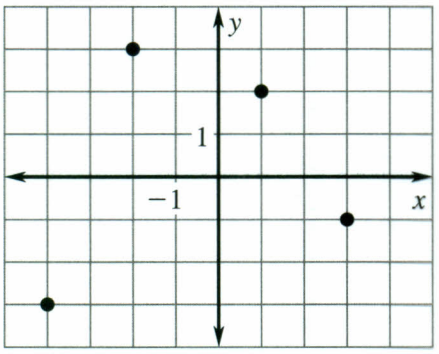
*For use with pages 76–79*

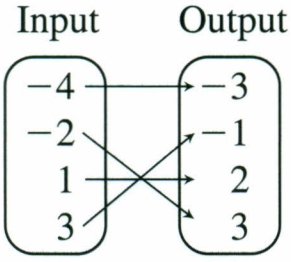
## 2.1 Skill Practice

**1.** independent, dependent

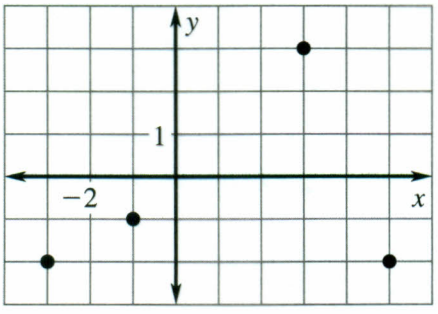
**2.** If $(x, y)$ represents each ordered pair, then each $x$ is part of the domain and each $y$ is part of the range.

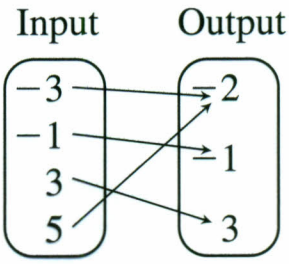
**3.** domain: $-4, -2, 1, 3$
range: $-3, -1, 2, 3$



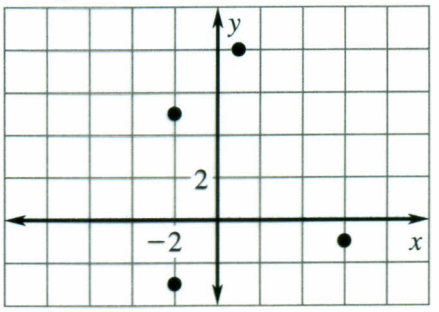



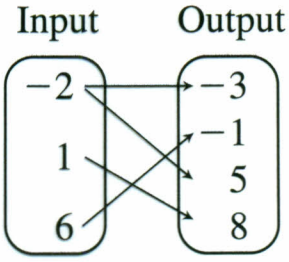

**4.** domain: $-3, -1, 3, 5$
range: $-2, -1, 3$



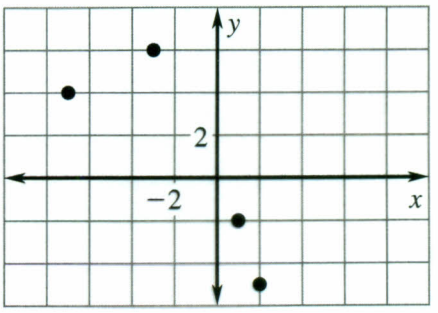



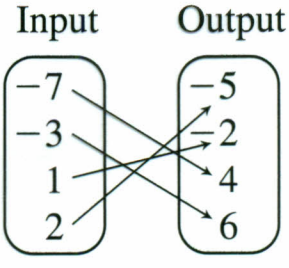

**5.** domain: $-2, 1, 6$
range: $-3, -1, 5, 8$




**6.** domain: $-7, -3, 1, 2$
range: $-5, -2, 4, 6$

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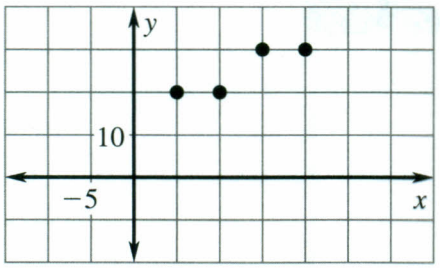
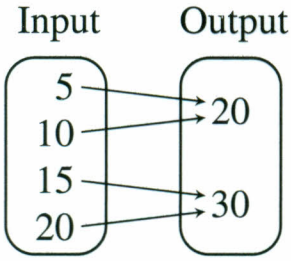
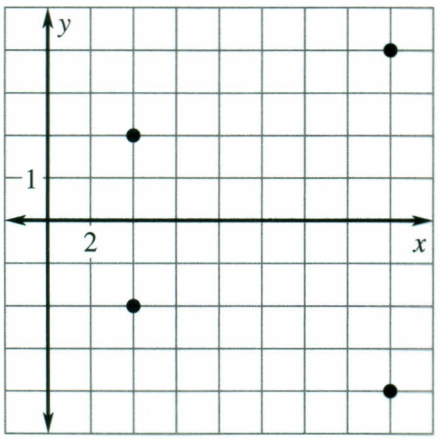
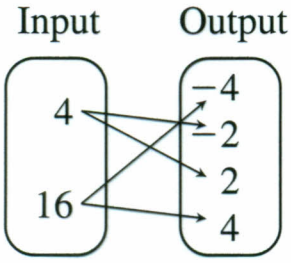
**7.** domain: 5, 10, 15, 20
range: 20, 30




**8.** domain: 4, 16
range: −4, −2, 2, 4




**9.** B

**10.** Yes; each input has exactly one output.

**11.** Yes; each input has exactly one output.

**12.** No; the inputs −1 and 5 have more than one output.

**13.** Yes; each input has exactly one output.

**14.** An output can be mapped to more than once; the relation given by the ordered pairs (−4, 2), (−1, 5), (3, 6), and (7, 2) is a function because each input has exactly one output.

**15.** $x$ is the input and $y$ is the output, so there should be one value of $y$ for each value of $x$; the relation given by the table is not a function because the inputs 1 and 0 each have more than one output.

**16.** Yes, each input has exactly one output.

**17.** No; the input −2 has more than one output.

**18.** Yes; each input has exactly one output.

**19.** No; the input −1 has more than one output.

**20.** B

**21.** function **22.** function

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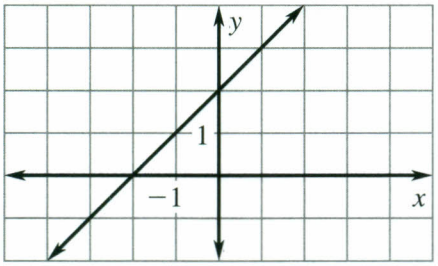
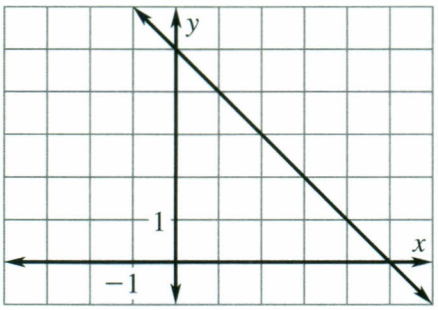
**23.** not a function

**24.** *Sample answer:* The vertical line represents each input, so if the vertical line crosses the graph more than once, then that input has more than one output and is not a function.

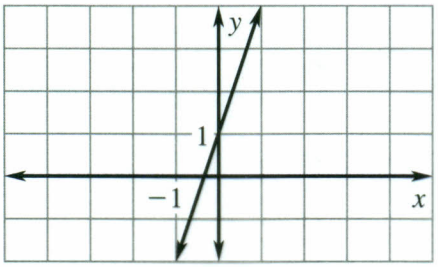
**25.**




**26.**




**27.**

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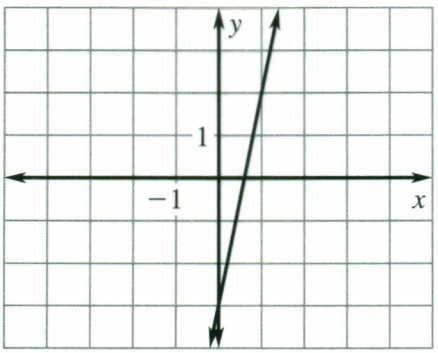


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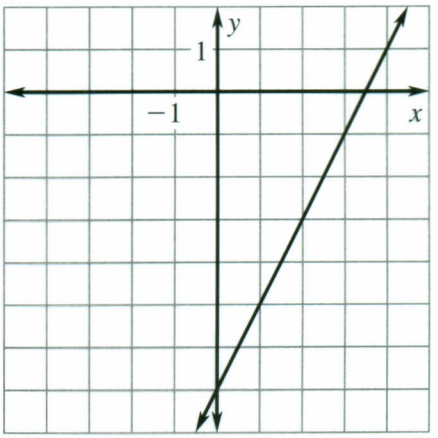


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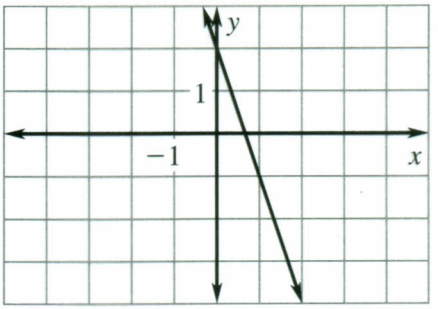


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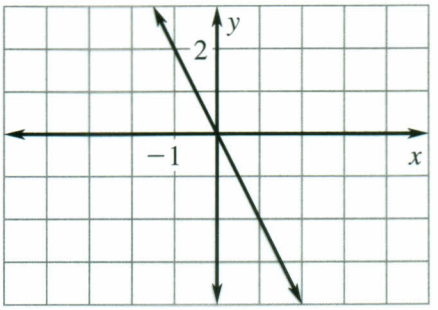


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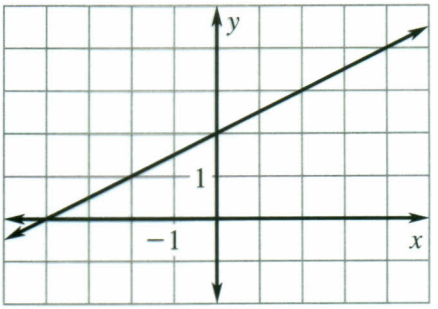


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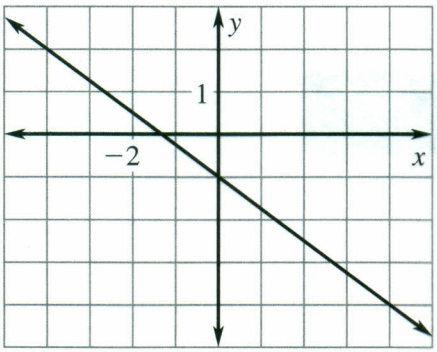
**33.**




**34.** linear; 23

**35.** not linear; 10

**36.** not linear; 14

**37.** linear; 6

**38.** not linear; −208

**39.** linear; −3

**40.** *Sample answer:* This is the only graph that passes the vertical line test.

**41.** $f(2a) = f(a + a) = f(a) + f(a) = 2 \cdot f(a), f(0) = f(0 + 0) = f(0) + f(0) = 2f(0), 2f(0) = f(0), 2f(0) - f(0) = f(0) - f(0), f(0) = 0$

## 2.1 Problem Solving

**42.** No; the inputs 24, 25, and 26 have more than one output.

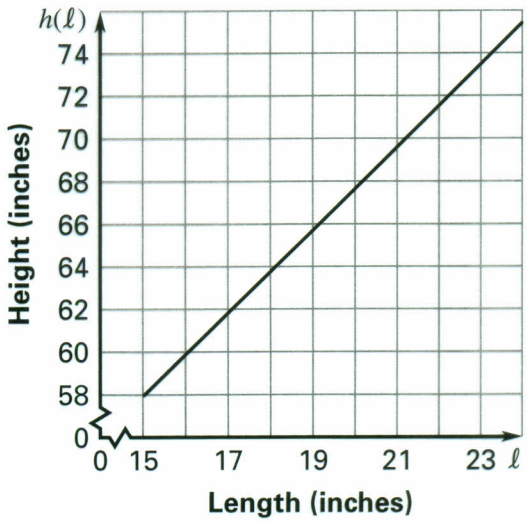
**43.** Yes; each input has exactly one output.

**44.** 64; $V(4)$ represents the volume of a cube with edge length of 4.

**45.** about 905; $V(6)$ represents the volume of a sphere with radius 6.

**46.** domain: $0 \le t \le 5$, range: $140.7 \le w(t) \le 172$; over the years 1999–2004, the watermelon acreage ranged from a low of 140,700 in 2004 to a high of 172,000 in 1999..

**47. a.**




domain: $15 \le \ell \le 24$, range: $57.95 \le h(\ell) \le 75.5$

**b.** 59 in. or 4 ft 11 in.

**c.** 21.7 in.

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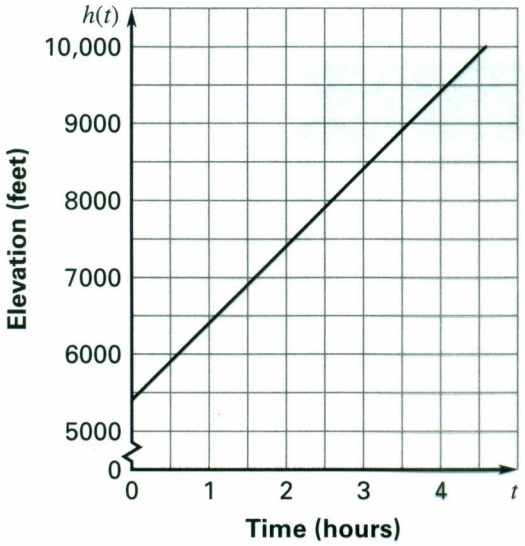
**48.**




domain: $0 \le t \le 4.7$
range: $5400 \le h(t) \le 10{,}100$; 8900 ft

**49. a.** domain: 11,350,000, 12,280,000, 12,420,000, 15,980,000, 18,980,000, 20,850,000, 33,870,000
range: 20, 21, 27, 31, 34, 55

**b.** Yes; each input $p$ has exactly one output.

**c.** No; the input 21 has more than one output.

**50. a.** Yes. *Sample answer:* For each merchandise cost, there is exactly one shipping cost.

**b.** No. *Sample answer:* For each shipping cost, there are many possible merchandise costs.

## 2.1 Mixed Review

**51.** $-\frac{1}{2}$ **52.** $-4$

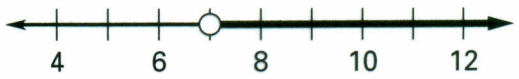
**53.** $-\frac{1}{2}$ **54.** $\frac{1}{2}$

**55.** 5 **56.** $-6$

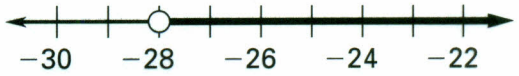
**57.** $-2$ **58.** $-1\frac{2}{3}$

**59.** $5\frac{1}{3}$ **60.** $1\frac{3}{4}$

**61.** $x > 7$

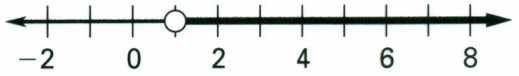



**62.** $x > -28$

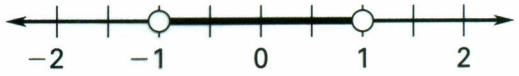



**63.** $x \ge 4$

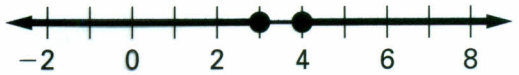
**64.** $x > 1$




**65.** $-1 < x < 1$




**66.** $x \le 3$ or $x \ge 4$

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