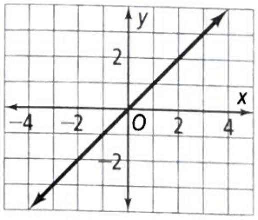
70. $(5x-6)(5x+6)$ **71.** $3n+9$ **72.** It is a perfect-square trinomial. **73.** $3y^2$; 1 **74.** $8m^2$; 3
75. $2d(d+1)(d-1)(3d+2)$ **76.** $(b^2+1)(11b-6)$
77. $(5z^2+1)(9z+4)$ **78.** $3(a^2+2)(3a-4)$

Chapter 9

Get Ready! p. 543

1. -13 **2.** -3.5 **3.** -9 **4.** -0.5 **5.** -23 **6.** -3

7.



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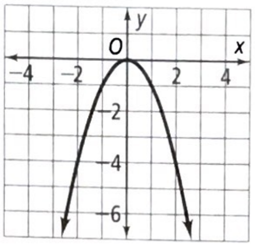

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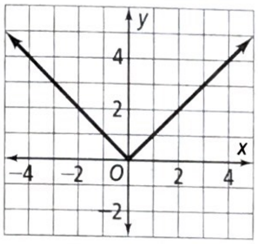

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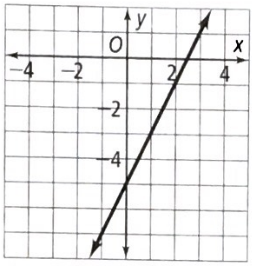

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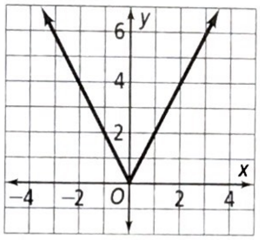

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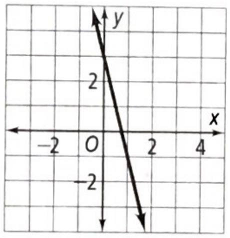
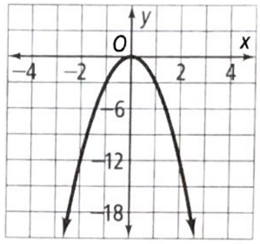


13. -108 **14.** 0 **15.** 49 **16.** 25 **17.** 24 **18.** 144
19. $(2x+1)^2$ **20.** $(5x-3)(x+7)$
21. $(4x-3)(2x-1)$
22. $(x-9)^2$ **23.** $(6y-5)(2y+3)$
24. $(m-9)(m+2)$
25. A quadratic function is of the form $f(x)=ax^2+bx+c$, where $a \neq 0$. **26.** Answers will vary. Sample: You can fold the graph along the axis of symmetry and the two halves of the graph will match. **27.** Answers will vary. Sample: the product of two factors can only be zero if at least one of the factors is zero.

Lesson 9-1 pp. 546–552

Got It? 1. $(-2, -3)$; minimum

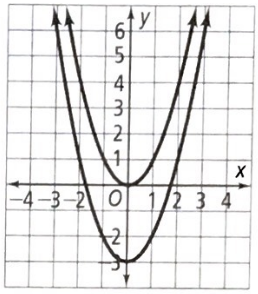
2.



domain: all real numbers, range: $y \leq 0$

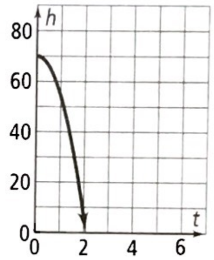
3. $f(x)=-\frac{1}{3}x^2$, $f(x)=-x^2$, $f(x)=3x^2$

4.



Answers will vary. Sample: They have the same shape, but the second parabola is shifted down 3 units.

5a.

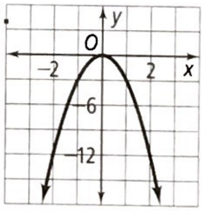


about 2 s

b. domain: $0 \leq t \leq 1.2$; range: $0 \leq h \leq 20$

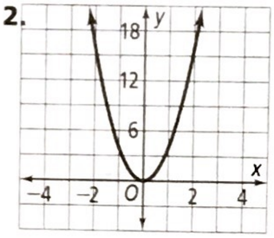
Lesson Check

1.



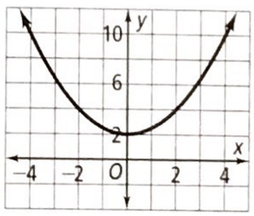
(0, 0)

2.



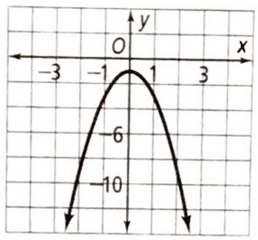
(0, 0)

3.



(0, 2)

4.

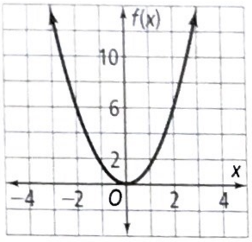


(0, -1)

5. If $a > 0$, the vertex is a minimum. If $a < 0$, the vertex is a maximum. **6.** Answers will vary. Sample: They have the same shape, but the second graph is shifted up 1 unit.

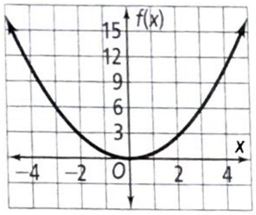
Exercises **7.** (2, 3); maximum **9.** (2, 0); minimum

11.



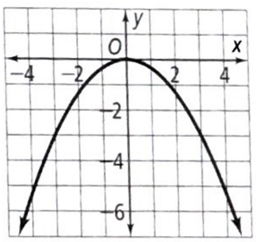
domain: all real numbers; range: $f(x) \geq 0$

13.



domain: all real numbers; range: $f(x) \geq 0$

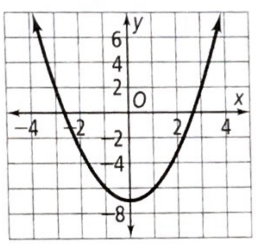
15.



domain: all real numbers; range: $y \leq 0$

17. $f(x) = x^2$, $f(x) = -3x^2$, $f(x) = 5x^2$
19. $f(x) = -\frac{2}{3}x^2$, $f(x) = -2x^2$, $f(x) = -4x^2$

21.



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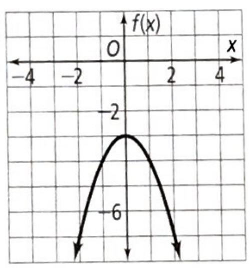

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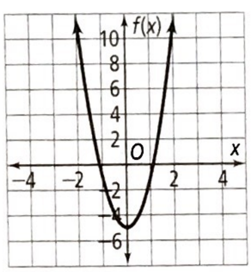
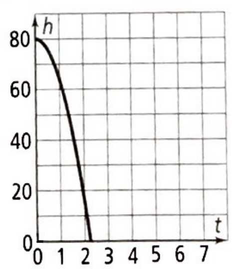


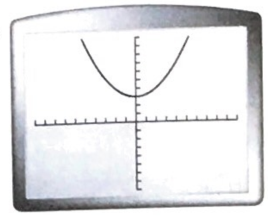
27.



about 2.2 s

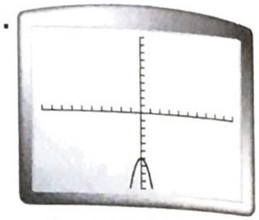
29. domain: all real numbers; range: $f(x) \geq 6$
31. domain: all real numbers; range: $y \leq -9$
33. Answers will vary. Sample: If $a > 0$, the parabola opens upward. If $a < 0$, the parabola opens downward. The vertex of the parabola is $(0, c)$. **35.** A
37a. $g(x) = 3x^2 + 6$; the graph of $g(x)$ is shifted up 4 units and is narrower than the graph of $f(x)$.
b. $h(x) = 9x^2 + 2$; the graph of $h(x)$ is narrower than the graph of $f(x)$. **c.** Multiplying a quadratic function by a number shifts the graph up or down and changes the width of the parabola. Multiplying the x value of a quadratic function by a number only changes the width of the parabola.

39.



vertex: (0, 3)
axis of symmetry: $x = 0$

41.



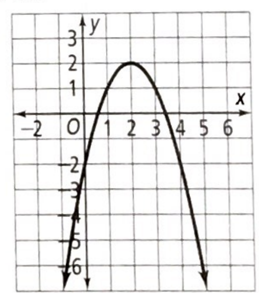
vertex: (0, −6)
axis of symmetry: $x = 0$

43. M **45.** M **47a.** $a > 0$ **b.** $|a| > 1$ **49a.** graph of a parabola in the first quadrant, pointing down, with intercepts (0, 135) and (11.6, 0) and passing through (6, 99). **b.** $0 < x < 9$; the side length of the square window must be less than the width of the wall. **c.** $54 < y < 135$; as the side length of the window increases from 0 to 9, the area of the wall without the window decreases from 135 to 54. **51.** I **53.** F
55. $3r(5r + 1)(2r + 3)$ **56.** $(3q^2 - 2)(5q - 6)$
57. $(7b^3 + 1)(b + 2)$ **58.** 0.75 **59.** −0.4 **60.** $-\frac{3}{8}$
61. $\frac{7}{20}$ **62.** $\frac{1}{8}$ **63.** −2

Lesson 9-2 pp. 553–558

Got It?

1a.

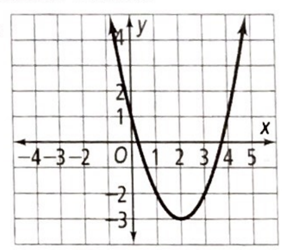


b. Answers may vary. Sample: It is easy to evaluate a quadratic function in the form $y = ax^2 + bx + c$ when $x = 0$.

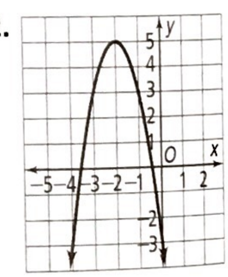
2. 2 s; 69 ft; $5 \leq h \leq 69$

Lesson Check

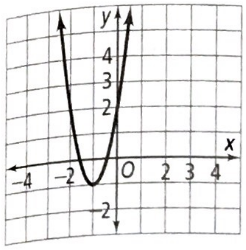
1.



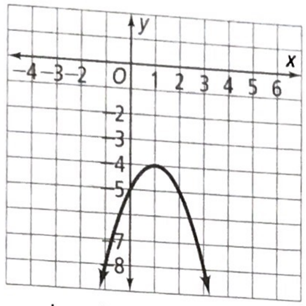
2.



3.



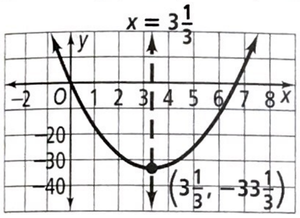
4.



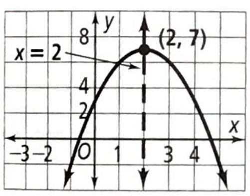
5. If $a > 0$, the graph opens upward and the vertex is a minimum. If $a < 0$, the graph opens downward and the vertex is a maximum. The greater the value of $|a|$, the narrower the parabola is. The axis of symmetry is the line $x = -\frac{b}{2a}$. The x-coordinate of the vertex is $-\frac{b}{2a}$. The y-intercept of the parabola is c. **6.** First graph the vertex and then graph the y-intercept. Reflect the y-intercept over the axis of symmetry to get a third point. Then sketch the parabola through these three points.

Exercises 7. $x = 0$; $(0, 3)$ **9.** $x = -1$; $(-1, -3)$ **11.** $x = 1.5$; $(1.5, -4.75)$ **13.** $x = 0.3$; $(0.3, 2.45)$ **15.** $x = -0.5$; $(-0.5, -6.5)$ **17.** B **19.** A

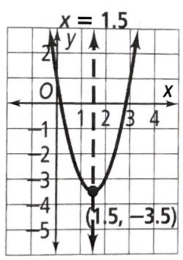
21.



23.



25.



27. 25 ft; 625 ft^2; $0 < A \leq 625$

29a. $(-1, 19)$ **b.** $(-2, -5)$ **31.** \$50

33. The value of b is -6, so $-\frac{b}{2a} = -\left(\frac{-6}{2(-1)}\right) = -\left(\frac{-6}{-2}\right) = -3$. **35a.** 0.4 s **b.** No, the ball does not start at height 0 m.

Lesson 9-3 pp. 561–566

Got It? 1a. ± 4 **b.** no solution **c.** 0 **2a.** ± 6 **b.** no solution **c.** 0 **3a.** 7.9 ft **b.** The solutions of the equation in Problem 3 are irrational numbers, which are difficult to approximate on a graph.

Lesson Check 1. ± 5 **2.** ± 2 **3.** ± 12 **4.** ± 15 **5.** The zeros of a function are the x-intercepts of the function. Example: $y = x^2 - 25$ has zeros ± 5. **6.** Answers will vary. Sample: When an equation has noninteger solutions, it is almost always easier to use square roots to find its solutions. **7.** a and c have opposite signs; $c = 0$; a and c have the same sign.

Exercises 9. no solution **11.** ± 2 **13.** ± 3 **15.** 0 **17.** no solution **19.** ± 3 **21.** ± 18 **23.** 0 **25.** $\pm\frac{5}{2}$ **27.** ± 2 **29.** ± 4 **31.** ± 3 **33.** Let x = length of side of a square, then $x^2 = 75$; 8.7 ft **35.** 7.1 ft **37.** 0 **39.** 1 **41.** $n > 0$; $n = 0$; $n < 0$ **43.** no solution **45.** $\pm\frac{1}{6}$ **47.** ± 0.4 **49.** 144 **51.** When you subtract 100 from each side, you get $x^2 = -100$, which has no solution. **53.** 6.3 ft **55a.** = 6(A2)^2 − 24 **b.** ± 2; the solution(s) of the quadratic equation is (are) the x-value(s) in column A that make(s) the value in column B equal 0. **c.** Answers may vary. Sample: Find each instance of a sign change in column B. The solution(s) lie(s) between the corresponding x-values in column A. **57.** 28 cm

Lesson 9-4 pp. 568–572

Got It? 1a. $-1, 5$ **b.** $-\frac{3}{2}, 4$ **c.** $-\frac{1}{2}, -14$ **d.** $\frac{2}{7}, \frac{4}{5}$ **2a.** $-2, 7$ **b.** $-5, 4$ **c.** $\frac{3}{2}, 6$ **3a.** -7 **b.** The quadratic polynomials are perfect squares. **4.** 17 in. by 23 in.

Lesson Check 1. 4, 7 **2.** $-9, 6$ **3.** $\frac{8}{3}, 3$ **4.** 2.5 ft by 4 ft **6.** To solve the equation, you first factor the quadratic expression, then set each factor equal to 0, and solve. **7.** No, if $ab = 8$, then there are infinitely many possible values of a and b, such as $a = 2$ and $b = 4$ or $a = -1$ and $b = -8$.

Exercises 9. $-\frac{5}{4}, -7$ **11.** 0, 2.5 **13.** $\frac{7}{4}, -\frac{8}{3}$ **15.** $-8, 4$ **17.** $-1.5, 12$ **19.** $-\frac{5}{4}, 8$ **21.** $-3, 7$ **23.** 1.5, 4 **25.** $\pm\frac{4}{3}$ **27.** 4 ft by 6 ft **29.** $\{-4, -2\}$ **31.** $\{-5, -2\}$ **33.** $q^2 + 7q - 18 = 0$; $-9, 2$ **35.** $x = 2$ and $x = 1$; the x-intercepts of the parabola are the same as the zeros of the function. **37.** 2; $\pm k$ **39.** 0, 4, 6 **41.** 0, 3 **43.** $-5, -1, 1$ **45.** $-3, -2, 3$

Lesson 9-5 pp. 576–581

Got It? 1. 100 **2a.** $-2.21, -6.79$ **b.** No, there are no factors of 15 with a sum of 9. **3a.** $(-2, 6)$ **b.** $(-6, 2)$ **4.** 5.77 ft

Lesson Check 1. $-18, 10$ **2.** $-11, 15$ **3.** $-21, 14$ **4.** $-9, 7.5$ **5.** Answers will vary. Samples are given. **a.** factoring; $k^2 - 3k - 304 = (k - 19)(k + 16)$ **b.** completing the square **6.** Answers will vary. Sample: You have to know how to solve using square roots in order to solve by completing the square. There are more steps involved in completing the square.

Exercises 7. 81 **9.** 225 **11.** $\frac{289}{4}$ **13.** $-16, 9$ **15.** $-10.24, -5.76$ **17.** $-10.12, -1.88$ **19.** $(-2, -20)$

21. (1, −324) **23.** (−1, −29) **25.** −1.65, 3.65 **27.** −1.96, 2.56 **29.** −7, 1 **31.** about 13.3 **33a.** $75 - 2w$ **b.** 11.6 ft or 25.9 ft **c.** 51.9 ft or 23.1 ft **35.** no solution **37.** 2.27, 5.73 **39.** no solution **41.** −0.11, 9.11 **43.** She forgot to divide each side by 4 to make the coefficient of the x^2-term 1.

47. −0.45, 4.45 **49a.** $3 \pm \sqrt{5}$ **b.** (3, −5) **c.** Answers will vary. Sample: p is the x–coordinate of the vertex and $-q$ is the y-coordinate of the vertex. **51.** 0.0215 **53.** 2 **55.** 4.5 **57.** −6, −5 **58.** $\pm\frac{8}{3}$ **59.** $-\frac{1}{6}, \frac{5}{2}$ **60.** m^{12} **61.** $-\frac{1}{b}$ **62.** t^{13} **63.** y^{29} **64.** 81 **65.** 0 **66.** −15

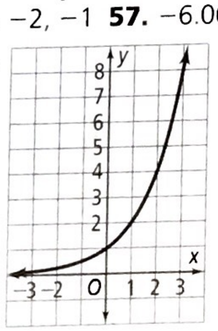
Lesson 9-6 pp. 582–588

Got It? 1. −3, 7 **2.** 144.8 ft **3a.** Factoring; the equation is easily factorable. **b.** Square roots; there is no x-term. **c.** Quadratic formula, graphing; the equation cannot be factored. **4a.** 2 **b.** 2; if $a > 0$ and $c < 0$, then $-4ac > 0$ and $b^2 - 4ac > 0$.

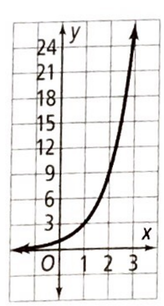
Lesson Check 1. $-4, \frac{1}{3}$ **2.** −0.94, 1.22 **3.** 2 **4.** If the discriminant is positive, there are 2 x-intercepts. If the discriminant is 0, there is 1 x-intercept. If the discriminant is negative, there are no x-intercepts. **5.** Factoring because the equation is easily factorable; quadratic formula or graphing because the equation cannot be factored. **6.** If you complete the square for $ax^2 + bx + c = 0$, you will get the quadratic formula.

Exercises 7. −1.5, −1 **9.** −3, 1.25 **11.** $-\frac{5}{6}, \frac{10}{3}$ **13.** $-11, 4\frac{2}{3}$ **15.** −2.6, 12 **17.** −2.56, 0.16 **19.** −0.47, 1.34 **21.** −2.26, 0.59 **23.** Quadratic formula, completing the square, or graphing; the coefficient of the x^2-term is 1, but the equation cannot be factored. **25.** Quadratic formula, graphing; the equation cannot be factored. **27.** Factoring; the equation is easily factorable. **29.** 0 **31.** 0 **33.** 2 **35.** ±4 **37.** ±1.73 **39.** 2 **41.** No, there are no real-number solutions of the equation $(14 - x)(50 + 5x) = 750$. **43.** Find values of a, b, and c such that $b^2 - 4ac > 0$. **45a.** 16; 1, 5 **b.** 81; −5, 4 **c.** 73; −0.39, 3.89 **d.** Rational; if the discriminant is a perfect square, then its square root is an integer, and the solutions are rational. **47.** never **49.** always **51.** I **53.** G **55.** 1.54, 8.46 **56.** −2, −1 **57.** −6.06, 0.06

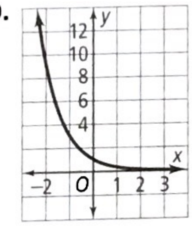
58.



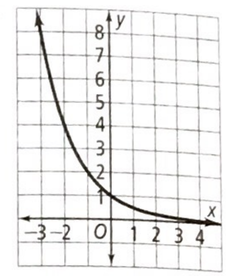
59.



60.



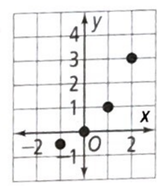
61.



Lesson 9-7 pp. 589–594

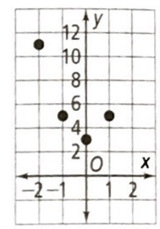
Got It?

1a.



exponential

b.



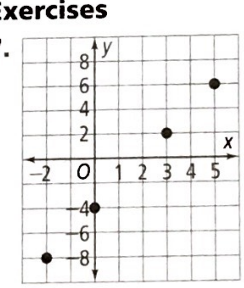
quadratic

2. exponential **3.** Answers will vary. Sample: linear; $y = 480.7x + 18{,}252.4$

Lesson Check 1. quadratic **2.** linear **3.** exponential **4.** No, a function cannot be both linear and exponential. **5.** Graph the points, or test ordered data for a common difference (linear function), a common ratio (exponential function), or a common second difference (quadratic function).

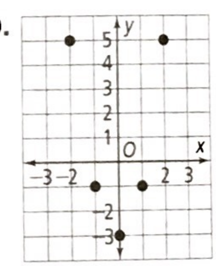
Exercises

7.



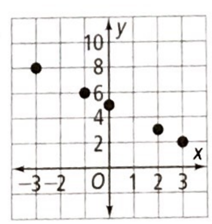
linear

9.



quadratic

11.



linear

13. linear

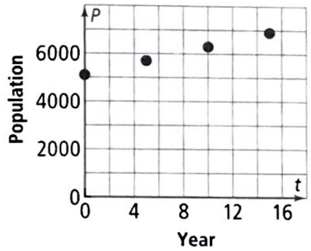
15. quadratic; $y = 3x^2$

17. linear; $y = -0.5x + 2$

19. exponential; $y = 540(1.03)^x$

21b. The second common difference is twice the coefficient of the x^2-term. **c.** When second differences are the same, the data are quadratic. The coefficient of the x^2-term is one-half the second difference.

23. Answers will vary. Sample: (0, 5), (2, 13), (4, 29), (6, 53)

25a. 

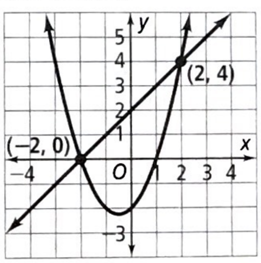
linear

b. The population changes by 600 every 5 years; the y-values have a common difference, so a linear model works best. **c.** $p = 120t + 5100$ **d.** 8700 **e.** $70t + 3800$ **27a.** 6, 12, 18, 24; 6, 6, 6 **b.** 6 **c.** Yes, the first differences are constant for linear functions, the second differences are constant for quadratic functions, and the third differences are constant for cubic functions. **29.** I **31.** $(5x + 2)(2x - 1)$ **32.** -1.5, 0.5 **33.** -3.83, 1.83 **34.** 0.13, 2.54 **35.** (6, 4) **36.** (2, 7) **37.** (1, -2)

Lesson 9-8 pp. 596–601

Got It? 1a. (-2, 9), (1, 3) **b.** no solution **2.** Day 5; 234 people **3.** (-6, -42), (7, 114) **4a.** (-2, 2), (1, -1) **b.** Substitution; substitute $-x$ for y in the first equation.

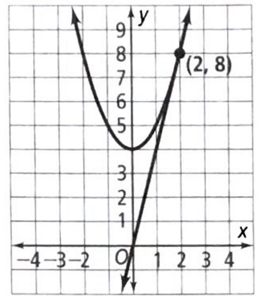
Lesson Check

1. 

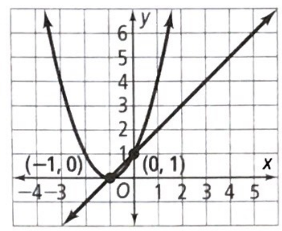
(2, 4), (-2, 0)

2. (6, 10), (-7, 192) **3.** (1, 4), (4, 1) **4.** (1, 4) **5.** (-3, -3), (-1.5, -1.5) **6a.** Answers may vary. Sample: $y = x^2 + x - 2$, $y = -x + 1$ **b.** Answers may vary. Sample: $y = x^2 - x$, $y = x - 1$ **c.** Answers may vary. Sample: $y = x^2 + x - 2$, $y = x - 5$
7. In both cases, you can use graphing, substitution, or elimination. If you don't use graphing, you must know how to solve a quadratic equation in order to solve a linear-quadratic system.

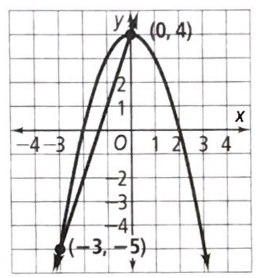
Exercises

9. 

(2, 8)

11. 

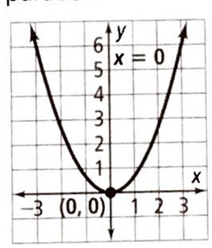
(0, 1), (-1, 0)

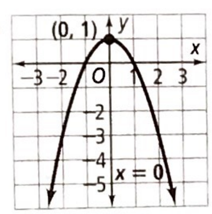
13. 

(0, 4), (-3, -5) **15.** (2, 4), (-1, 1) **17.** Day 13, 2451 players of each type **19.** (6, -2), (-9, -47) **21.** (9, -71), (-11, -91) **23.** (-4, -41), $\left(\frac{1}{3}, \frac{7}{3}\right)$ **25.** no solution **27.** (2, -5), (-4, 1)
29. (-3, 0), (-6, -3) **31.** $y = 2x + 2$ **33.** The system has no solution. **35a.** 7.4 **b.** 7.8 **c.** (1.61, 0), (1.61, 3.22), (-1.61, 3.22), (-1.61, 0) **d.** 10.38 **37.** B **39.** B **41.** Given (x, y), where x is the number of balls and y is the weight of the box, you have the points (4, 5) and (10, 11). The slope of the line that passes through these two points is $\frac{11 - 5}{10 - 4} = \frac{6}{6} = 1$. An equation of the line is $y - 5 = 1(x - 4)$, or $y = x + 1$. The equation of the line in standard form is $x - y = -1$. **42.** quadratic; $y = 0.2x^2$ **43.** exponential; $y = 4(2.5)^x$ **44.** linear; $y = -4.2x + 7$ **45.** 14 **46.** $\frac{5}{7}$ **47.** 1.2 **48.** 9 **49.** 0.6 **50.** 20

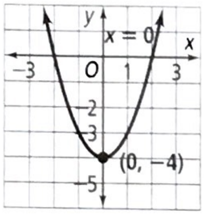
Chapter Review pp. 603–606

1. parabola **2.** axis of symmetry **3.** discriminant **4.** vertex

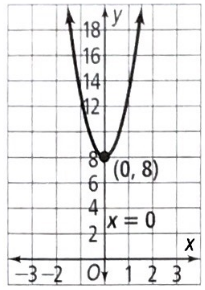
5. 

6. 

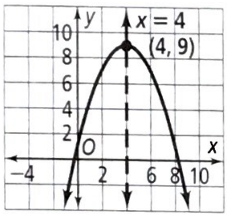
7.



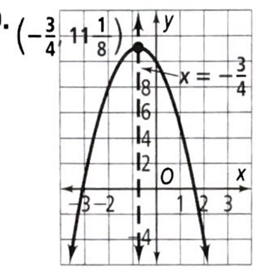
8.



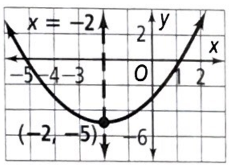
9.



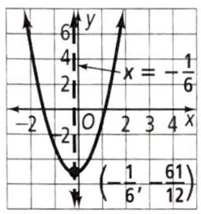
10.



11.

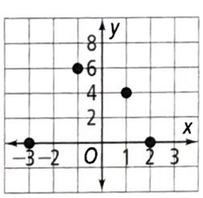


12.



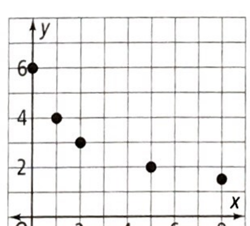
13. Answers will vary. Sample: $y = -x^2$ **14.** Answers will vary. Sample: $y = x^2$ **15.** Answers will vary. Sample: $y = x^2$ **16.** Answers will vary. Sample: $y = 0.5x^2$ **17.** ± 2 **18.** ± 5 **19.** 0 **20.** no solution **21.** $\pm\frac{2}{3}$ **22.** ± 4 **23.** −3, −4 **24.** 0, 2 **25.** 4, 5 **26.** $-3, \frac{1}{2}$ **27.** $-\frac{2}{3}, \frac{3}{2}$ **28.** 1, 4 **29.** 2.3 in. **30.** −6.74, 0.74 **31.** 0.38, 2.62 **32.** −2, −1.5 **33.** −9.12, −0.88 **34.** −1.65, 3.65 **35.** 1.26, 12.74 **36.** 7.6 ft by 15.8 ft **37.** 6.4 in. by 13.8 in. **38.** two **39.** two **40.** −1.84, 1.09 **41.** −2.5, 4 **42.** 7.87, 0.13 **43.** −0.25, 0.06 **44.** ± 5; square roots because there is no *x*-term **45.** 3; factoring because it is easy to factor **46.** 1.5 s

47.



quadratic

48.



exponential

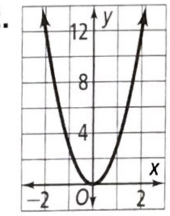
49. $y = 3x - 2$ **50.** $y = 5(2)^x$ **51.** (−1, 8), (2, −1) **52.** (0, −1), (1, −2) **53.** (−1, −1), (1, 1) **54.** (−2, −4), (3, 6) **55.** (−8, 3), (12, 123) **56.** (7, −2), (9, 6) **57.** (−7, −45), (−4, −21) **58.** (−13, 64), (3, −16) **59.** (6, 69) (10, 145) **60.** (−9, 33), (−12, 63) **61.** If you look at the graph and see how many times the graphs intersect, that is how many solutions the system will have.

Chapter 10

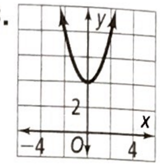
Get Ready! p. 611

1. 6 **2.** 18 **3.** 4.5 **4.** 8 **5.** 10 **6.** 4 **7.** 12 **8.** 14 **9.** $-2h^2 + 5h + 12$ **10.** $9b^4 - 49$ **11.** $-15x^2 - 11x - 2$

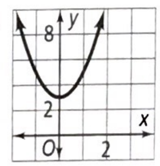
12.



13.



14.



15. 2 **16.** 2 **17.** 0 **18.** 1 **19.** 2 **20.** 2 **21.** They both contain the same radical expression, $\sqrt{3}$.

22. I would be rich.

Lesson 10-1 pp. 614–618

Got It? 1. 15 cm **2.** 9 **3a.** no; $20^2 + 47^2 \neq 52^2$ **b.** yes; $(2a)^2 + (2b)^2 = 4a^2 + 4b^2 = 4(a^2 + b^2) = 4c^2 = (2c)^2$

Lesson Check 1. 39 **2.** 7 **3.** yes; $12^2 + 35^2 = 37^2$ **4.** If you are a student, then you study math. **5.** The value of 13 should have been substituted for *c* since it is the hypotenuse. The correct equation is $12^2 + x^2 = 13^2$; $x = 5$.

Exercises 7. 8 **9.** 12 **11.** 17 **13.** 4.5 **15.** 6.1 **17.** 41 **19.** 8.5 **21.** 1.2 mi **23.** yes **25.** no **27.** yes **29.** 10 ft **31.** yes **33.** yes **35.** yes **37.** 719 ft **39.** Yes; $50^2 + 120^2 = 130^2$, so the triangle formed by the forces is a right triangle. **41a.** $a^2 + 2ab + b^2$ **b.** c^2 **c.** $\frac{1}{2}ab$ **d.** $a^2 + 2ab + b^2 = 4\left(\frac{1}{2}ab\right) + c^2$; $a^2 + b^2 = c^2$; it is the Pythagorean Theorem.

Lesson 10-2 pp. 619–625

Got It? 1. $6\sqrt{2}$ **2.** $-4m^5\sqrt{5m}$ **3a.** $18\sqrt{3}$ **b.** $3a^2\sqrt{2}$ **c.** $210x^3$ **d.** yes; $\sqrt{14t^2} = t\sqrt{14}$ **4.** $w\sqrt{17}$ **5a.** 4 **b.** $\frac{3}{a}$ **c.** $\frac{5y\sqrt{y}}{z}$ **6a.** $\frac{\sqrt{6}}{3}$ **b.** $\frac{\sqrt{10m}}{6m}$ **c.** $\frac{\sqrt{21s}}{3}$

Lesson Check 1. $7\sqrt{2}$ **2.** $4b^2\sqrt{b}$ **3.** $12m^2$ **4.** $\frac{\sqrt{15}}{x}$ **5.** $\frac{\sqrt{15}}{3}$ **6.** $\frac{\sqrt{3n}}{n}$ **7a.** Yes; there are no perfect-square factors in 31, there are no fractions in the radicand, and there are no radicals in the denominator. **b.** No; there is a fraction in the radicand. **c.** No; 25 is a perfect-square factor of 175. **8.** Answers may vary. Sample: $\frac{3}{\sqrt{12}} = \frac{3}{2\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \frac{3\sqrt{3}}{6} = \frac{\sqrt{3}}{2}$;