pp. 99-102 (#6-30, x6; #36-38, #45-46, #51-52, #56-74 evens)

6. $x = 2$ and $x = -2$

12. $x = 10$ and $x = 2$

18. $x = -2 \pm \frac{\sqrt{26}}{2}$

24. The square root of a negative number does not exist; $-2x^2 - 8 = 0$; $-2x^2 = 8$; $x^2 = -4$; The equation has no real solution.

30. $x = 5$ and $x = 6$

36. $x = 2$

37. $x = 3$

38. $x = 4$

45. $x = -0.5$ and $x = -2.5$; *Sample answer:* factoring because the equation can be factored

46. $x = \pm 1.5$; *Sample answer:* square roots because the equation can be written in the form $u^2 = d$

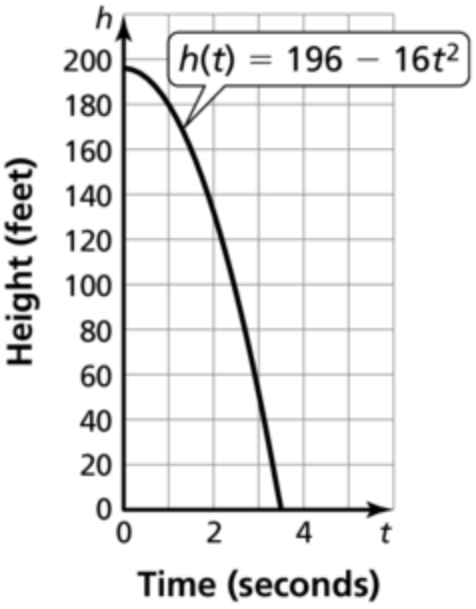
51. $x = 3$ and $x = -2$

52. $x = 1.5$

56. *Sample answer:* $f(x) = x^2 - 20x + 84$

58. \$160; \$25,600

60. **a.** $t = 3.5$ and $t = -3.5$; The zeros represent the time when the rocks were on the ground. Because time must be positive, reject $t = -3.5$, and the rocks hit the ground after 3.5 seconds.



b. The domain represents the time the rocks were in the air and the range represents the height of the rocks while falling.

62. $h(t) = -16t^2 + 40$; about 1.6 sec

64. $x(x + 2) = 143$; 11 and 13 or -13 and -11

66. **a.** positive; The graph does not cross the x-axis.

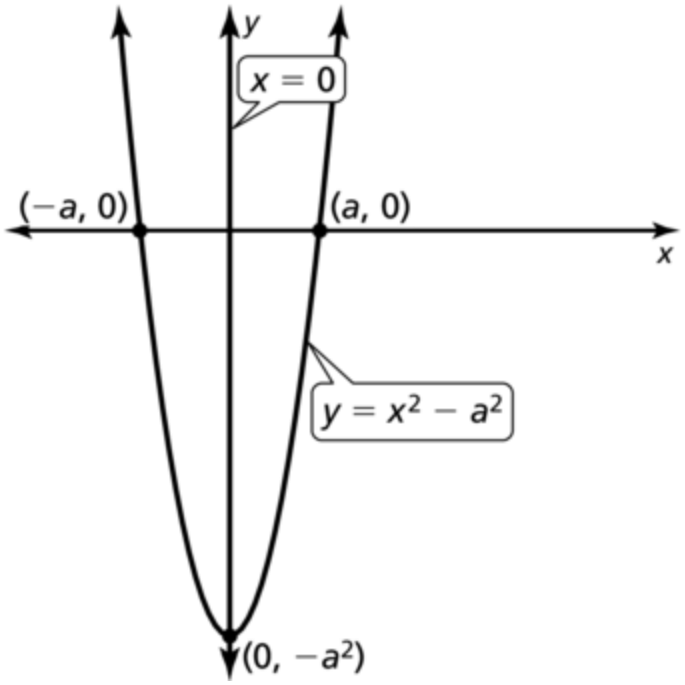
b. yes; The graph opens up towards the x-axis.

68. $(x + 25)(x + 15) = 375 + 329$ or $x^2 + 40x - 329 = 0$; 7 ft

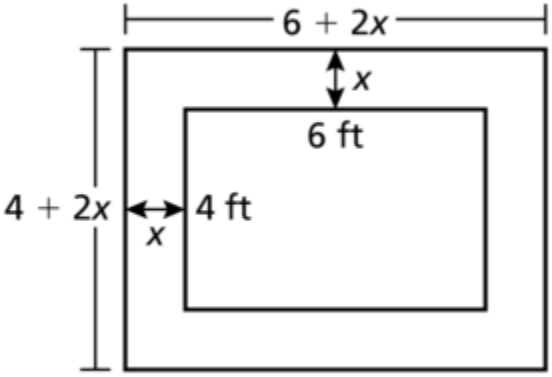
70. **a.** 50 ft

b. 1.77 sec; At time $t = 1.77$ seconds, the height is 0 feet.

72. $(x - 2)(x + 2)$, $(x - 3)(x + 3)$; $(x - a)(x + a)$



74. *Sample answer:*



$(4 + 2x)(6 + 2x) = 48$; $x = 1$; 6 ft by 8 ft

pp. 108-109 (#3-30, x3; #31-32; #33-48, x3)

3. Add the real parts and the imaginary parts separately.

6. $8i$

9. $8i$

12. $18i\sqrt{7}$

15. $x = -2$ and $y = 4$

18. $x = -5$ and $y = -13$

21. $13 + 2i$

24. $-2 - 20i$

27. $4 + 2i$

30. $5 + 9i$

31. **a.** $-4 + 5i$

b. $2\sqrt{2} + 10i$

32. **a.** $z_a = -1 - i$

b. $z_a = -3 + i$

c. $z_a = 2 - 8i$

33. $(12 + 2i)$ ohms

36. $(14 - i)$ ohms

39. $14 - 5i$

42. 106

45. Distributive Property; Simplify; Definition of complex addition; Write in standard form.

48. $2i(-5 + 9i) = -18 - 10i$

pp. 109-110 (#50-76 evens; #77)

50. $x = \pm 7i$

52. $x = \pm i\sqrt{6}$

54. $x = \pm 3i\sqrt{6}$

56. $x = \pm i\sqrt{3}$

58. $x = \pm 5i$

60. $x = \pm 7i\sqrt{2}$

62. $x = \pm 5i\sqrt{2}$

64. Squaring a complex number requires FOIL; $(4 + 6i)(4 + 6i) = 16 + 24i + 24i + 36i^2 = 16 + 48i - 36 = -20 + 48i$

66. no, $\sqrt{-4} \cdot \sqrt{-9} = -6$; Simplifying results in $2i \cdot 3i = 6i^2$. Using $i^2 = -1$ results in -6.

68. functions f and g; function h; Functions f and g have real zeros because their graphs touch the x-axis. Function h has imaginary zeros because its graph does not touch the x-axis.

70. $-18 - 2i$

72. $-24 - 10i$

74. $-2 - i$

76. Method 1 distributes $4i$ to each term, then simplifies. Method 2 factors $4i$ out of each term, combines like terms, and simplifies; *Sample answer:* Method 2; There are fewer computations.

77. **a.** false; *Sample answer:* $(3 - 5i) + (4 + 5i) = 7$

b. true; *Sample answer:* $(3i)(2i) = 6i^2 = -6$

c. true; *Sample answer:* $3i = 0 + 3i$

d. false; *Sample answer:* $1 + 8i$

pp. 116-118 (#4-72, x4; do other even-numbered problems as necessary for additional practice)

4. $r = 4$ and $r = 6$

6. $m = -4 \pm 3\sqrt{5}$

8. $x = 13 \pm i\sqrt{13}$

10. $x = \frac{3}{2}$ and $x = \frac{1}{2}$

12. $100; (x + 10)^2$

14. $121; (t - 11)^2$

16. $144; (x + 12)^2$

18. $\frac{81}{4}; \left(x + \frac{9}{2}\right)^2$

20. $169; (s - 13)^2$

22. $64; x^2 + 16x + 64$

24. $100; x^2 + 20x + 100$

26. $s = -1 \pm \sqrt{7}$

28. $t = 4 \pm \sqrt{21}$

30. $x = -4 \pm 2i$

32. $r = \dfrac{-1 \pm i\sqrt{7}}{2}$

34. $w = \dfrac{3 \pm \sqrt{33}}{2}$

36. $s = -1 \pm i\sqrt{2}$

38. The number was not squared before being introduced into the expression; $x^2 + 30x + c$; $x^2 + 30x + \left(\frac{30}{2}\right)^2$; $x^2 + 30x + 225$

40. E and F; $x^2 - 2ax + a^2 = b^2$; $(x - a)^2 = b^2$; $x - a = \pm b$; $x = a \pm b$

42. factoring; The equation can be factored; $x = -11$ and $x = -2$

44. square roots; The equation can be written in the form $u^2 = d$; $x = 10$ and $x = 4$

46. factoring; The equation can be factored; $x = 8$

48. completing the square; The equation cannot be factored or written in the form $u^2 = d$; $x = -2 \pm \frac{\sqrt{33}}{3}$

50. square roots; The equation can be written in the form $u^2 = d$; $x = \pm\sqrt{5}$

52. $x = -3 + \sqrt{57}$

54. $x = -1 + \sqrt{11}$

56. $g(x) = (x - 2)^2 - 5$; $(2, -5)$

58. $h(x) = (x + 10)^2 - 10$; $(-10, -10)$

60. $f(x) = (x + 3)^2 - 25$; $(-3, -25)$

62. $g(x) = \left(x + \frac{7}{2}\right)^2 - \frac{41}{4}$; $\left(-\frac{7}{2}, -\frac{41}{4}\right)$

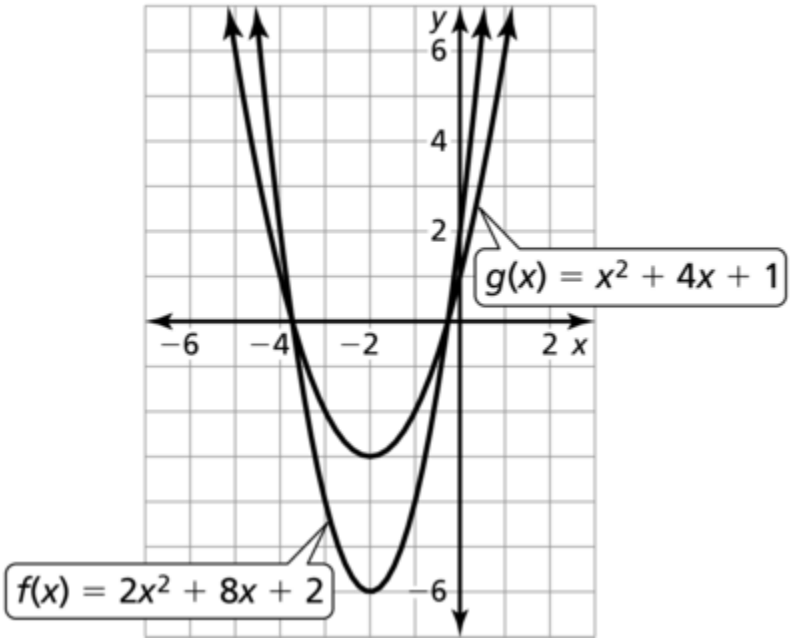
64. 510 ft; 3 sec

66. -3; Substitute the point $(0, 9)$ into the function and solve for h.

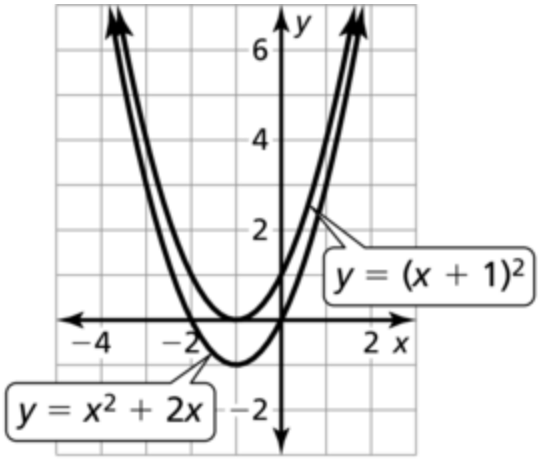
68. **a.** $x(120 - 2x) = 1512$

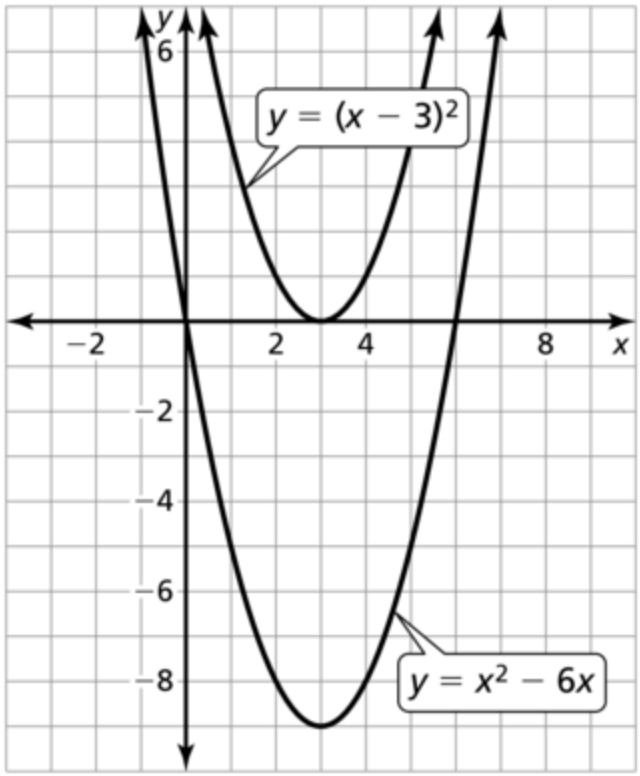
b. 42 ft by 36 ft

70. *Sample answer:* $g(x) = x^2 + 4x + 1$; $x = -2 \pm \sqrt{3}$; *Sample answer:*



72. a.





b. The graph is shifted vertically, but the axis of symmetry does not change.

p. 120 (#1-18, all)

1. $x = 5$

2. $x = 4$ and $x = 2$

3. $x = 2$ and $x = -4$

4. $x = \pm\frac{\sqrt{15}}{\sqrt{2}}$ or $\pm\frac{\sqrt{30}}{2}$; square roots; The equation can be written in the form $u^2 = d$.

5. $x = 1$ and $x = -\frac{2}{3}$; factoring; The equation can be factored.

6. $x = -3 \pm 2\sqrt{2}$; square roots; The equation can be written in the form $u^2 = d$.

7. $x = 2$ and $y = -6$

8. $-2 + 8i$

9. $2 + 16i$

10. $14 - 22i$

11. $\pm i\frac{\sqrt{2}}{3}$; no; The zeros are imaginary, so the graph of the function does not intersect the x-axis.

12. $x = 3 \pm i$

13. $x = -6 \pm 4\sqrt{2}$

14. $x = -3 \pm i$

15. $y = (x - 5)^2 - 21$; $(5, -21)$

16. **a.** 600 ft^2

b. $1064 = (30 + x)(20 + x)$

c. 8 ft

17. $(7 + 3i)$ ohms

18. **a.** 20 ft

b. about 2.12 sec

pp. 127-128 (#4-40, x4 --- do other even-numbered problems as necessary for additional practice --- and #42-46 evens)

4. the Quadratic Formula and completing the square; Complete the square when $a = 1$ and b is an even number; Use the Quadratic Formula when $a \neq 1$, or b is an odd number.

6. $x = -1$

8. $x = \dfrac{1 \pm i\sqrt{5}}{6}$

10. $x = 3$ and $x = -5$

12. $x = \dfrac{-3 \pm \sqrt{41}}{4}$

14. $x = \dfrac{2 \pm i\sqrt{26}}{5}$

16. $x = -11$

18. $w = \dfrac{7 \pm i\sqrt{47}}{8}$

20. -23; two imaginary: $x = \dfrac{1 \pm i\sqrt{23}}{2}$

22. 52; two real: $x = 1 \pm \sqrt{13}$

24. 0; one real: $p = -9$

26. -47; two imaginary: $x = \dfrac{-1 \pm i\sqrt{47}}{4}$

28. A

30. D; The discriminant is zero, so the graph has only one x-intercept.

32. B; The discriminant is positive, so the graph has two x-intercepts. The y-intercept is -35.

34. The equation was not written in standard form when the quadratic equation was used;
$x^2 + 6x + 8 = 2$; $x^2 + 6x + 6 = 0$;

$$x = \frac{-6 \pm \sqrt{6^2 - 4(1)(6)}}{2(1)} = \frac{-6 \pm \sqrt{12}}{2} = \frac{-6 \pm 2\sqrt{3}}{2}$$
$$= -3 \pm \sqrt{3}$$

36. *Sample answer:* $a = 2$ and $c = 3$; $2x^2 + 6x + 3 = 0$

38. *Sample answer:* $a = 1$ and $c = 9$; $x^2 - 6x + 9 = 0$

40. *Sample answer:* $a = 4$ and $c = 5$; $4x^2 - 4x + 5 = 0$

42. $11x^2 - 15x + 10 = 0$

44. $2x^2 + 9x - 7 = 0$

46. $-x^2 - 2x + 3 = 0$

pp. 128-130 (#52, 56, 60-64, 67, 69, 71-73)

52. $x = -4 \pm \sqrt{29}$; *Sample answer:* completing the square; $a = 1$ and b is an even number.

56. $x = \frac{31 \pm \sqrt{737}}{2}$; *Sample answer:* Quadratic Formula; b is not an even number, the equation cannot be factored, and it cannot be easily written in the form $u^2 = d$.

60. $x \approx 3.51$

61. about 5.67 sec

62. no; yes; For $ax^2 + 5x + c = 0$ to have one real solution, $ac = \frac{25}{4}$; For any nonzero number a, $c = \frac{25}{4a}$.

63. about 0.17 sec

64. **a.** about 0.35 sec

b. *Sample answer:* square roots; The equation can be written in the form $u^2 = d$.

67. **a.** about 0.97 sec

b. the first bird; The second bird will reach the water after about 0.98 second.

69. 3.5 ft

71. **a.** $x = 6$, $x = -3$, $x = 5$, and $x = -2$

b. $x = \pm 3$

72. your friend's; Completing the square will require factoring out a 4 from the first two terms, resulting in a decimal coefficient with the linear term.

73. Add the solutions to get $\frac{-b}{a}$, then divide the result by 2 to get $-\frac{b}{2a}$; Because it is symmetric, the vertex of a parabola is in the middle of the two x-intercepts and the x-coordinate of the vertex is $-\frac{b}{2a}$.

pp. 136-137 (#4, 8, 12, 16-40 evens)

4. (3, 5)

8. no solution

12. no solution

16. (7, 0) and (0, 7)

18. (3, −23)

20. (0, −3) and (1, −6)

22. (2, 6) and (3, 10)

24. (2, 1) and (−1, −2)

26. A; The system has no solution because the graphs do not intersect. Also, when using substitution or elimination, the result is a quadratic equation with imaginary solutions.

28. no solution

30. (−2, −2) and (−4, −2)

32. about (−2.59, 3.34) and about (−5.41, 14.66)

34. (4, −5)

36. (−1, 9) and (7, 9); For these x-values, each equation has the same y-value.

38. no solution; *Sample answer:* substitution because the first equation can be substituted into the second equation

40. (−4, −2) and (4, −2); *Sample answer:* elimination because the equations are arranged with like terms in the same column

pp. 137-138 (#42-58 evens, #59-60, 64-66)

42. about (3.43, 10.57); *Sample answer:* substitution because the second equation can be substituted into the first equation

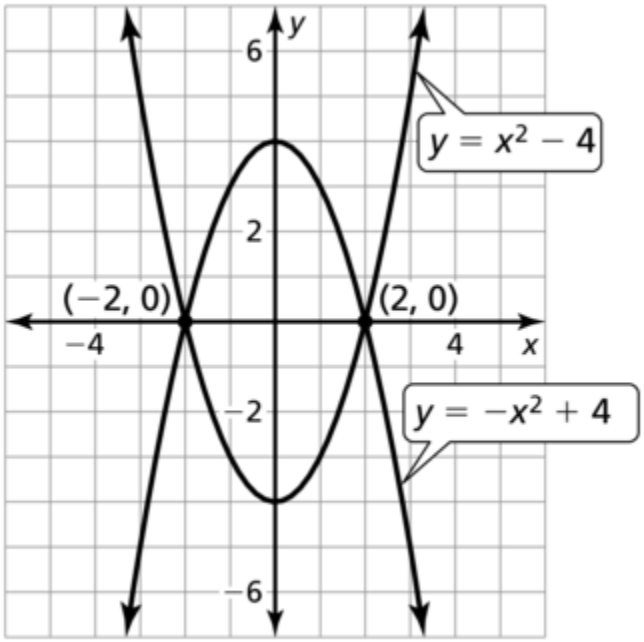
44. $x \approx 2.44$ and $x \approx 6.56$

46. $x = -3$ and $x = -5$

48. no solution

50. from $(-18, 36)$ to $(36, 18)$, a length of $\sqrt{3240} \approx 56.9$ miles

52. *Sample answer:* $y = x^2 - 4$; $y = -x^2 + 4$;



$(2, 0)$ and $(-2, 0)$

54. your friend; $(3, -3)$ and $(-3, 3)$ are solutions to Equation 1 but not Equation 2.

56. If (x, y) is a solution, then $(-x, -y)$ must be a solution. The solutions will always be reflections in the origin.

58. (0, 0) and (2, 3); Translate 2 units up.

59. **a.** circle: $x^2 + y^2 = 1$, Oak Lane: $y = -\frac{1}{7}x + \frac{5}{7}$

b. $(-0.6, 0.8)$ and $(0.8, 0.6)$

c. about 1.41 mi

60. (0, 2)

64. $y \geq -x + 1$

65. $y < x - 2$

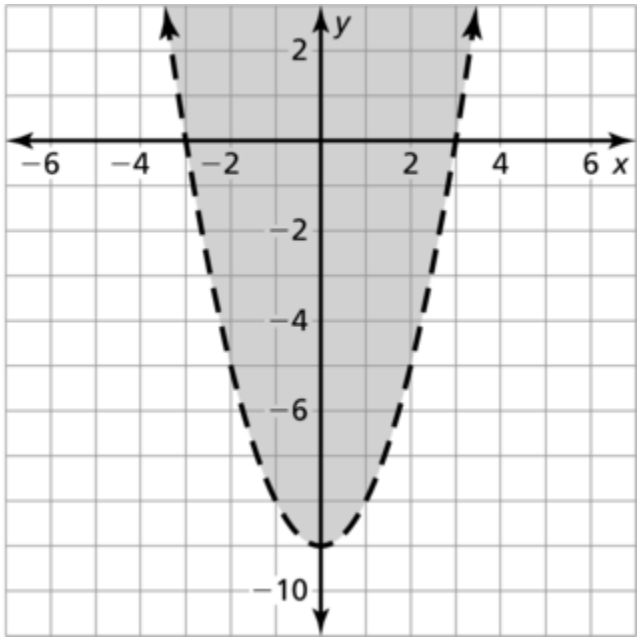
66. $y > 2x - 3$

pp. 144-145 (#3-24 x 3; #28-42 evens)

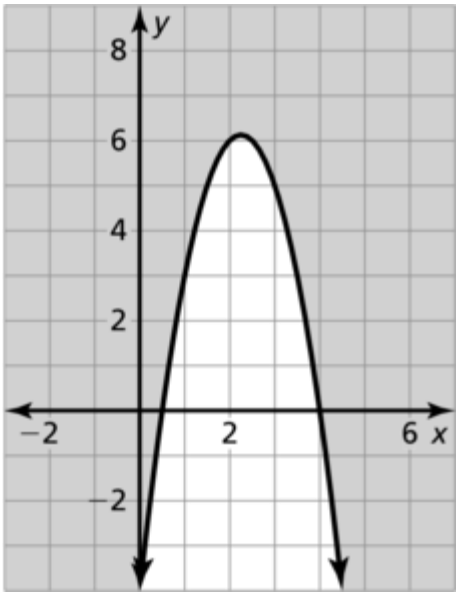
3. C; The x-intercepts are $x = -1$ and $x = -3$. The test point $(-2, 5)$ does not satisfy the inequality.

6. D; The x-intercepts are $x = -1$ and $x = -3$. The test point $(-2, 5)$ satisfies the inequality.

9.

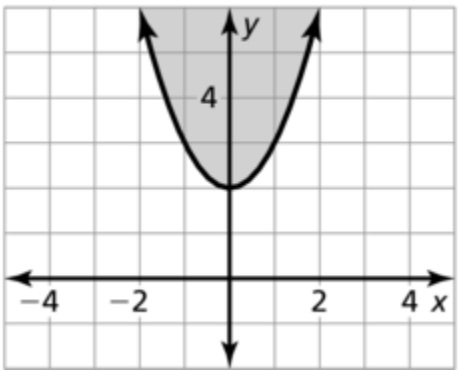


12.



15. $y > f(x)$

18. The wrong side of the parabola is shaded.



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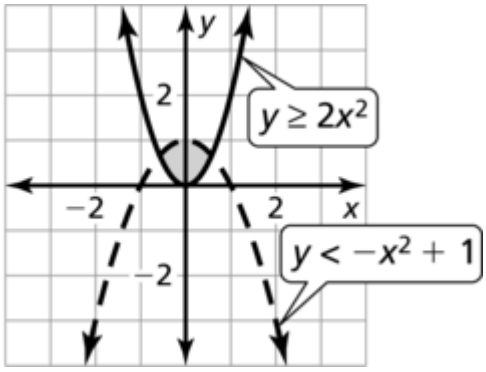

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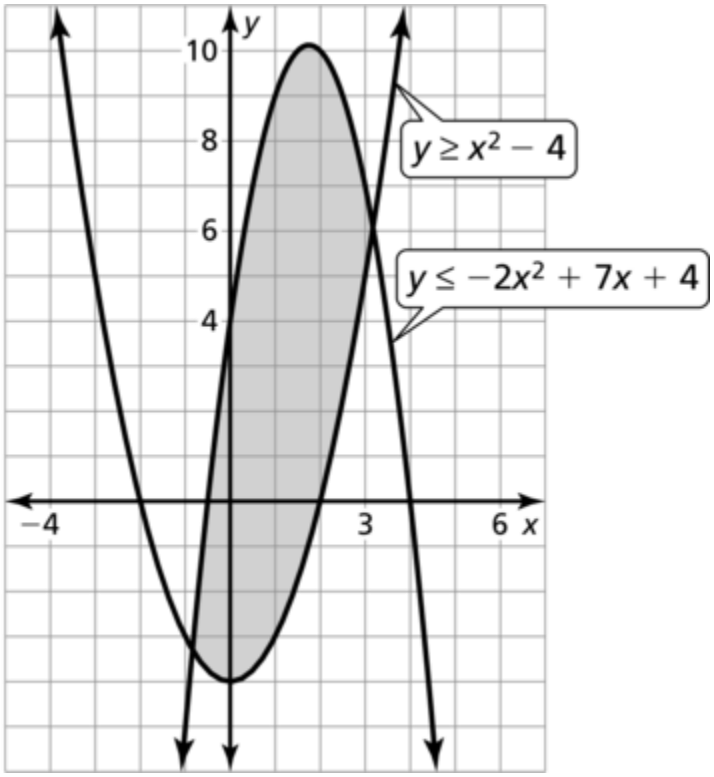


28. $-9 < x < -1$

30. $x < 1$ or $x > \frac{10}{3}$

32. $x \leq -3.5$ or $x \geq 1.5$

34. about $x \leq 0.26$ or $x \geq 7.74$

36. about $x < 0.59$ or $x > 3.41$

38. about $-5.45 < x < 0.55$

40. about $-2.26 < x < 0.59$

42. $x \leq -6$ or $x \geq \frac{2}{3}$

pp. 145-146 (#43-44, 46, 48-53)

43. **a.** $x_1 < x < x_2$

b. $x < x_1$ or $x > x_2$

c. $x_1 < x < x_2$

44. at least 70 ft and at most 130 ft

46. 4; $T(x) > 1000$ when $x > 3.1$.

48. **a.** *Sample answer:* (2, 0) and (3, 1)

b. no; The lines are dashed.

c. no; Because both points are points of intersection, they are either both solutions or both not solutions.

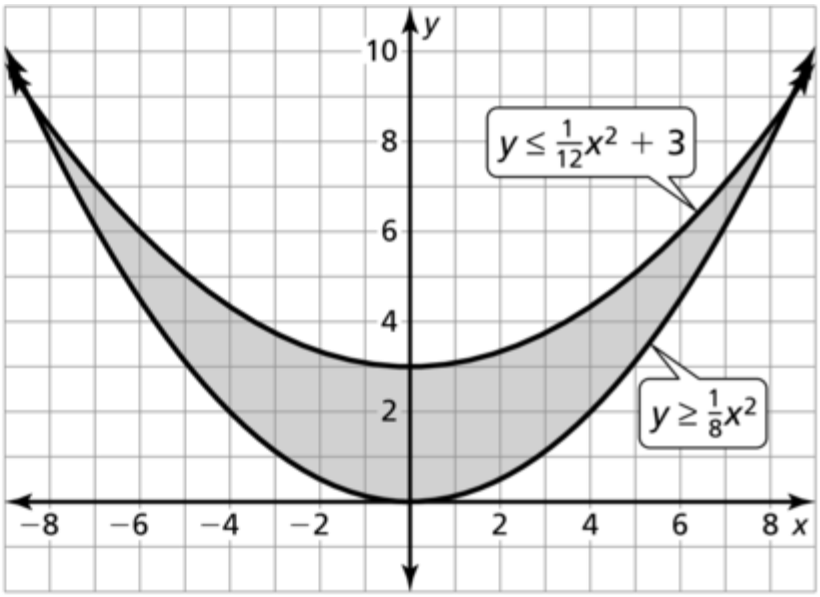
49. $0.00170x^2 + 0.145x + 2.35 > 10$, $0 \le x \le 40$; after about 37 days; Because $L(x)$ is a parabola, $L(x) = 10$ has two solutions. Because the x-value must be positive, the domain requires that the negative solution be rejected.

50. your friend; Any points with negative y-coordinates are solutions.

51. **a.** $\frac{32}{3} \approx 10.67$ square units

b. $\frac{256}{3} \approx 85.33$ square units

52. *Sample answer:*



The intersection of $y \leq \frac{1}{12}x^2 + 3$ and $y \geq \frac{1}{8}x^2$ create a shape similar to a smile, which could be used by a company that sells toothpaste.

53. **a.** yes; The points on the parabola that are exactly 11 feet high are (6, 11) and (14, 11). Because these points are 8 feet apart, there is enough room for a 7-foot wide truck.

b. 8 ft

c. about 11.2 ft

pp. 148-150 (#2-34 evens --- do odd-numbered problems as necessary for additional practice)

2. $x = \pm 2$

3. $x = 2$ and $x = -8$

4. $x = 6$ and $x = 2.5$

5. $(2x + 18)(2x + 35) = 1260$; $x = 5$; 28 ft by 45 ft

6. $x = 9$ and $y = -3$

7. $5 - 3i$

8. $11 + 10i$

9. $-62 + 11i$

10. $x = \pm i\sqrt{3}$

11. $x = \pm 4i$

12. 148 ft

13. $x = -8 \pm \sqrt{47}$

14. $x = \dfrac{-4 \pm 3i}{2}$

15. $x = 3 \pm 3\sqrt{2}$

16. $y = (x - 1)^2 + 19$; $(1, 19)$

17. $x = \dfrac{5 \pm \sqrt{17}}{2}$

18. $x = 0.5$ and $x = -3$

19. $x = \dfrac{6 \pm i\sqrt{3}}{3}$

20. 0; one real solution: $x = -3$

21. 40; two real solutions: $x = 1 \pm \sqrt{10}$

22. 16; two real solutions: $x = -5$ and $x = -1$

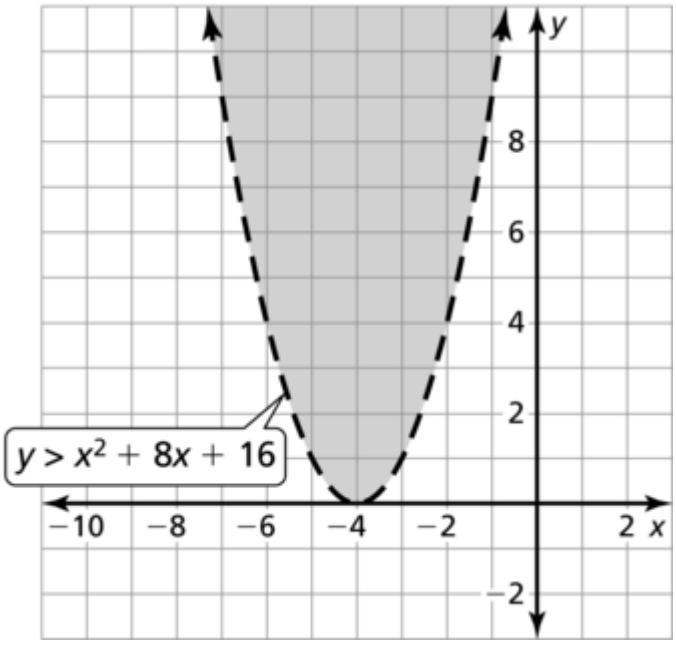
23. $(-2, 6)$ and $(1, 0)$; *Sample answer:* substitution because both equations are already solved for y

24. $(4, 5)$; *Sample answer:* elimination because adding the like terms eliminates y

25. about $(-0.32, 1.97)$ and $(0.92, -1.77)$; substitution because elimination is not a possibility with no like terms

26. about $(-0.14, -1.77)$ and $(1.77, -1.53)$

27.



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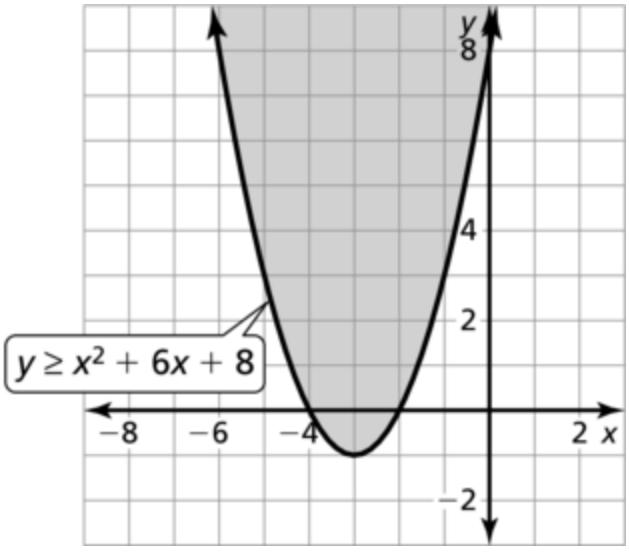

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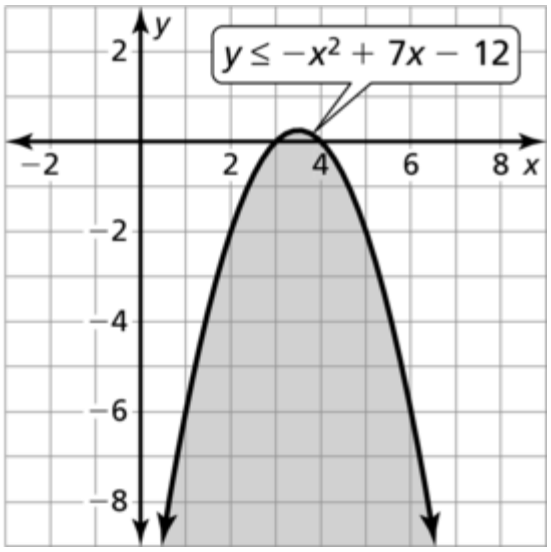

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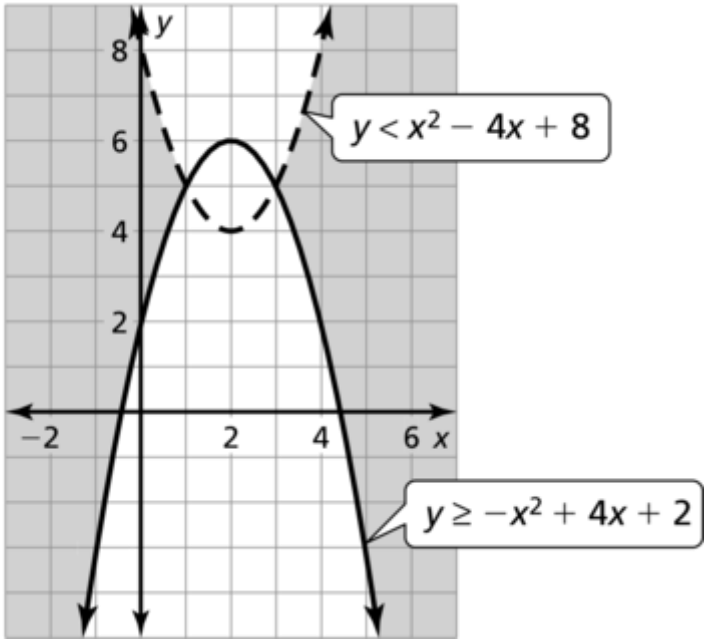

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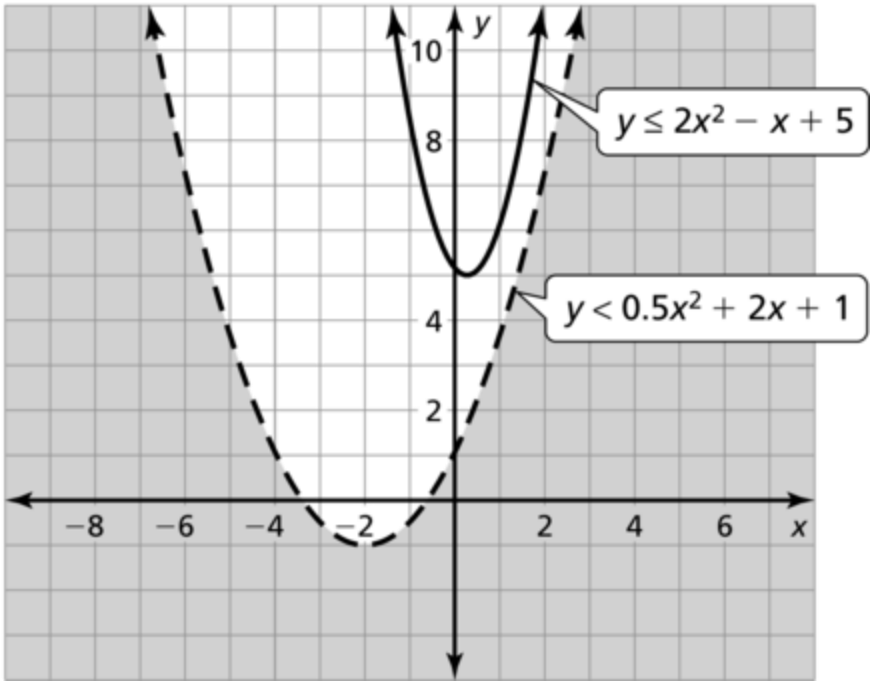

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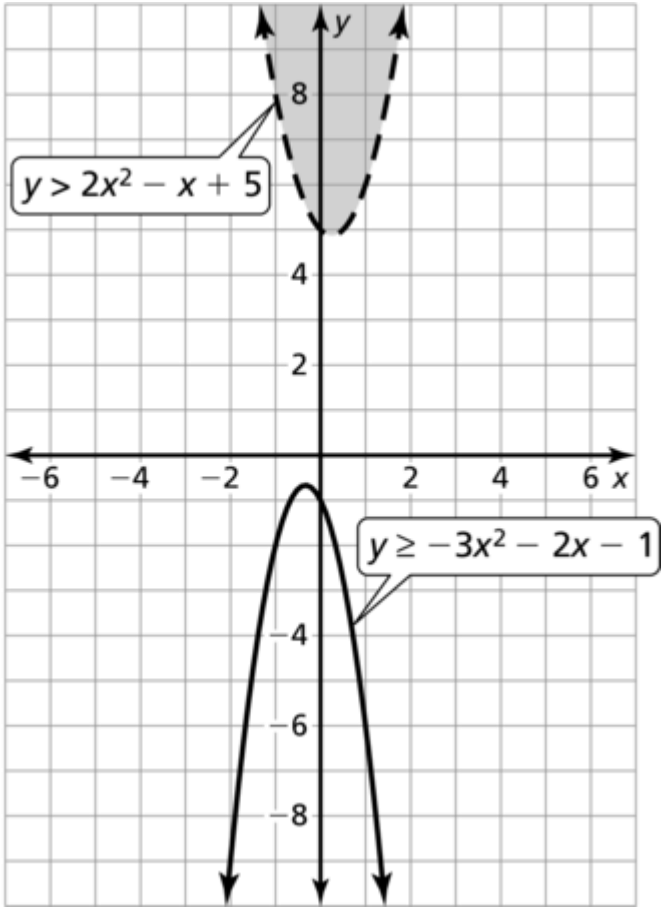

33. $x \leq -5$ or $x \geq 4$

34. $x < -7$ or $x > -3$