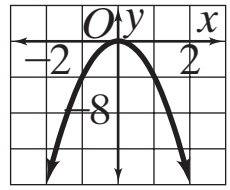
Answers for Lesson 10-1, pp. 553–556 Exercises

1. (2, 5); max.

2. (−3, −2); min.

3. (2, 1); min.

4.



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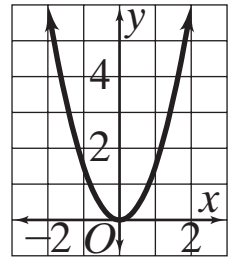

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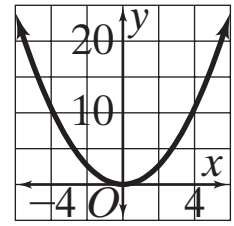

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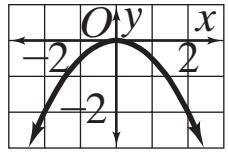

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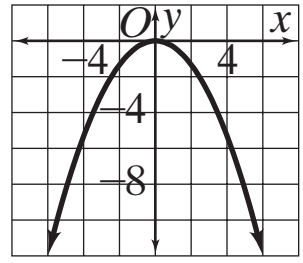

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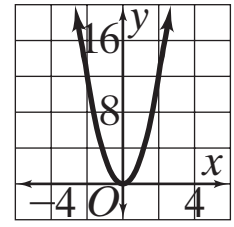


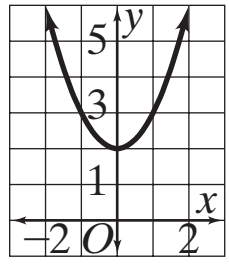
10. $y = \frac{1}{2}x^2, y = 3x^2, y = 4x^2$

11. $f(x) = \frac{1}{3}x^2, f(x) = x^2, f(x) = 5x^2$

12. $y = -\frac{1}{4}x^2, y = -\frac{1}{2}x^2, y = 5x^2$

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

14.



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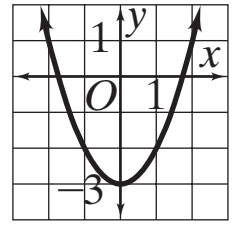

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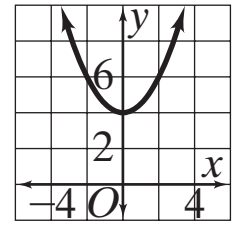

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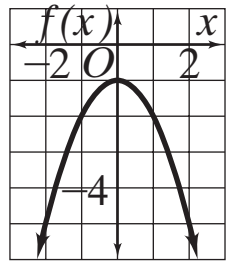

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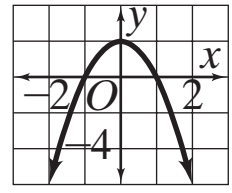

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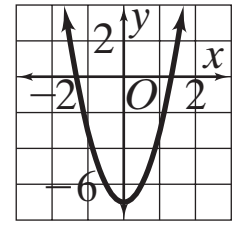

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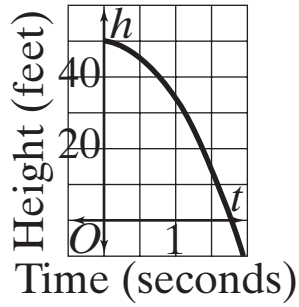


21. E **22.** A **23.** F

24. B **25.** C **26.** D

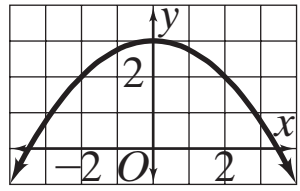
27. The graph of $y = 2x^2$ is narrower.

28. The graph of $y = -x^2$ opens downward.

29. The graph of $y = 1.5x^2$ is narrower.

30. The graph of $y = \frac{1}{2}x^2$ is wider.

31.



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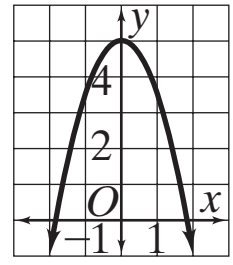

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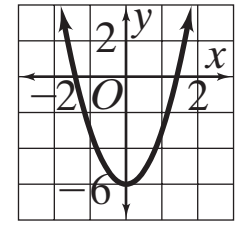

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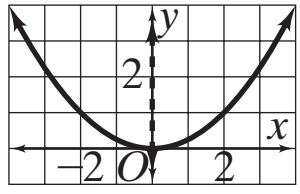

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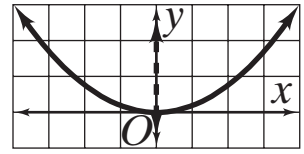

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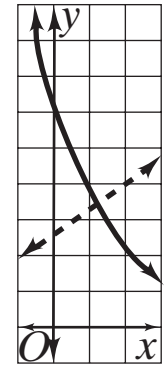

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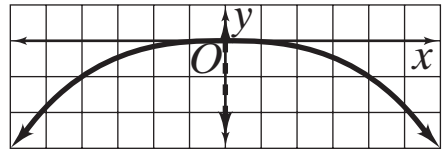

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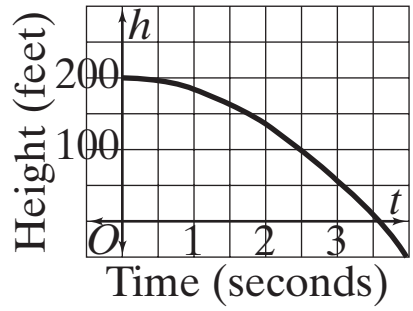
38. a.



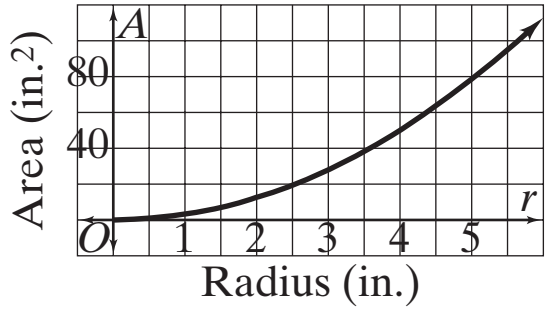
b. 184 ft

c. 56 ft

39. a. $0 < r < 6$

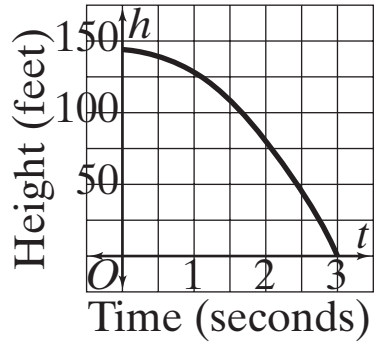
b. $0 < A < 36\pi \approx 113.1$

c.



40. K, L **41.** M **42.** K **43.** M

44. a.



b. 16 ft

c. No; the apple falls 48 ft from $t = 1$ to $t = 2$, because it is accelerating.

45. B

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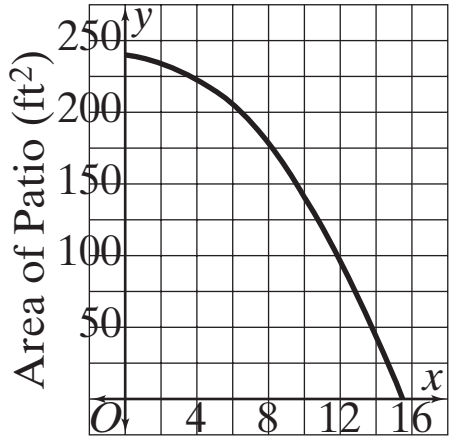
46. a. $c \neq 0$ and a and c have opp. signs.

b. $c \neq 0$ and a and c have the same signs.

47. a.



b. $0 < x < 12$; the side length of the square garden must be less than the width of the patio.

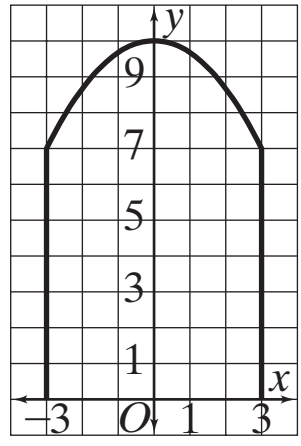
c. $96 < A < 240$; as the side length of the garden increases from 0 to 12, the area of the patio decreases from 240 to 96.

d. about 6 ft

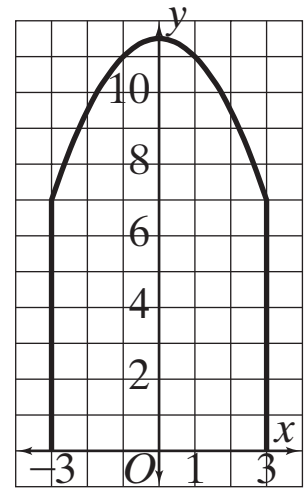
48. a. $a > 0$

b. $|a| > 1$

49. a.



b.



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Answers for Lesson 10-2, pp. 560–562 Exercises

1. $x = 0$, $(0, 4)$

2. $x = -1$, $(-1, -7)$

3. $x = 4$, $(4, -25)$

4. $x = 1.5$, $(1.5, -1.75)$

5. B

6. E

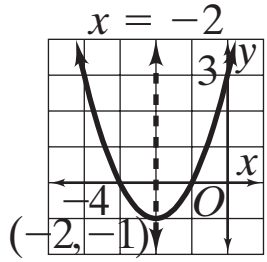
7. C

8. F

9. A

10. D

11.



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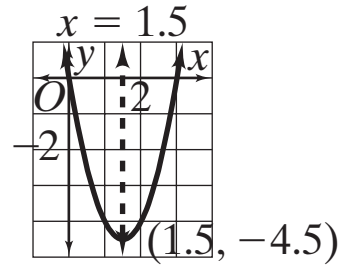

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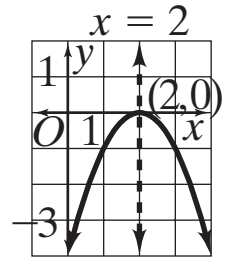

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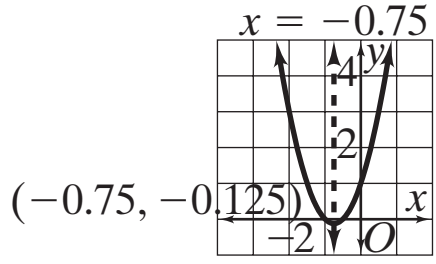


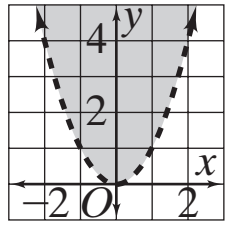
15. **a.** 20 ft

b. 400 ft^2

16. **a.** 1.25 s

b. 31 ft

17.



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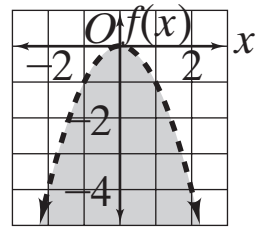

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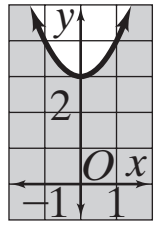

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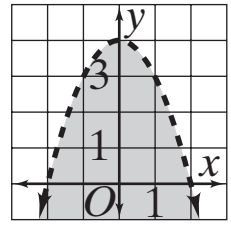

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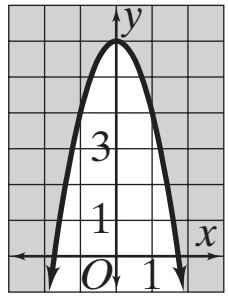

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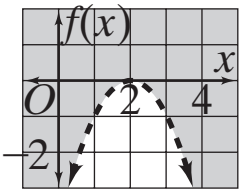
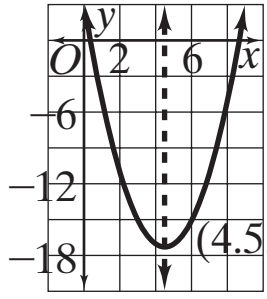


23.

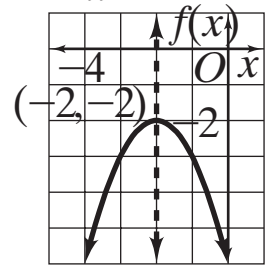
$x = 4.5$



(4.5, −17.25)

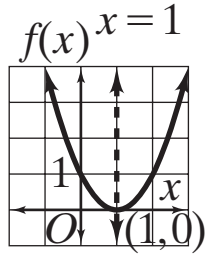
24.

$x = -2$



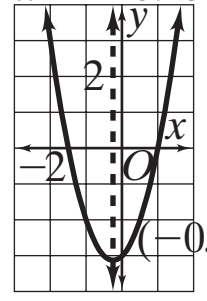
25.

$x = 1$



26.

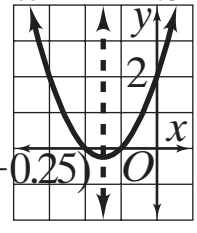
$x = -0.25$



(−0.25, −3.125)

27.

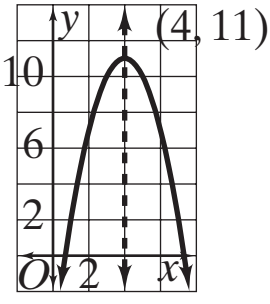
$x = -1.5$



(−1.5, −0.25)

28.

$x = 4$



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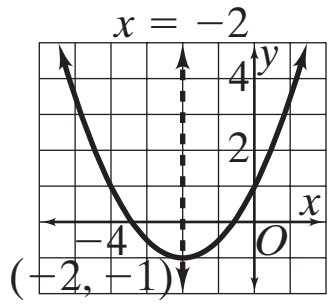
29.



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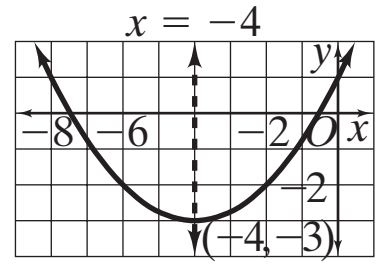

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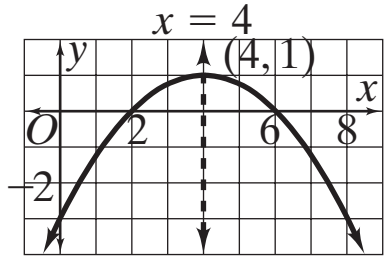


32–34. Answers may vary. Samples are given.

32. $y = 2x^2 - 8x + 1$

33. $y = -3x^2$

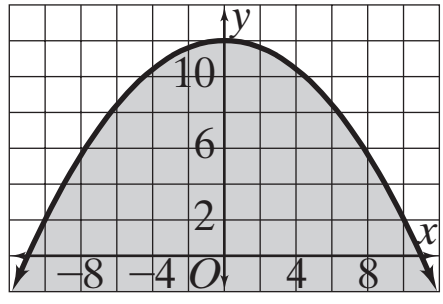
34. $y = 2x^2 + 4$

35. a. 1.3 m

b. 5.0 m

36. a. $y \leq -0.1x^2 + 12$

b.



c. Yes; when $x = 6$, $y = 8.4$, so the camper will fit.

37. C

38. 32 units^2

39. 26 units^2

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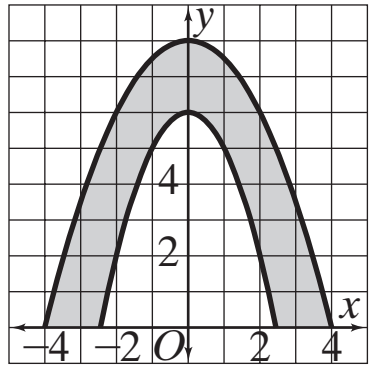
40. Answers may vary. Sample: a affects whether the parabola opens up or down, b affects the axis of symmetry, and c affects the y-intercept.

41. (1.24, 1.37)

42. **a.** 0.4 s

b. No; after 0.6 s, the ball will have a height of about 2.23 m but the net has a height of 2.43 m.

43.



44. **a.** 0.4 s

b. No; it takes about 0.8 s to return to $h = 0.5$ m, so it will take more time to reach the ground.

45. **a.** (0, 2)

b. $x = -2.5$

c. 5

d. $y = x^2 + 5x + 2$

e. Answers may vary. Sample: Test $(-4, -2)$.

$-2 \stackrel{?}{=} (-4)^2 + 5(-4) + 2$

$-2 \stackrel{?}{=} 16 - 20 + 2$

$-2 = -2$ ✓

f. No; you would not be able to determine the b value using the vertex formula.

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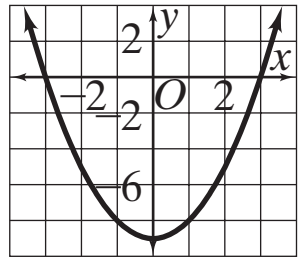
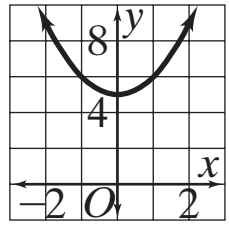
1.



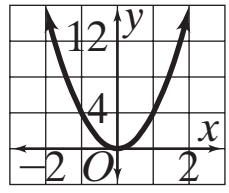
±3

2.



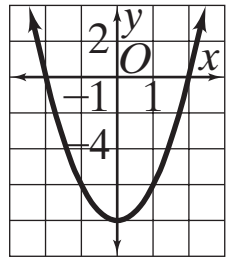
no solution

3.



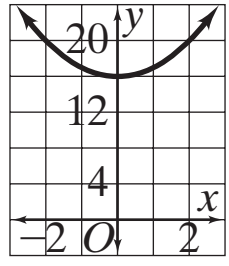
0

4.



±2

5.



no solution

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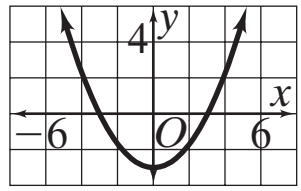
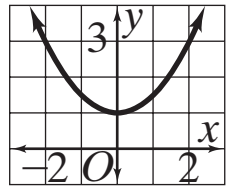
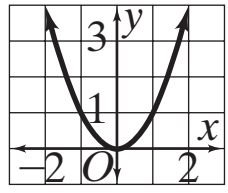
6. 

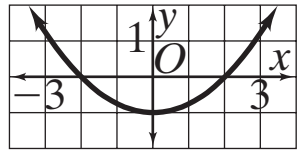
± 3

7. 

no solution

8. 

0

9. 

± 2

10. ± 7

11. ± 21

12. ± 15

13. 0

14. no solution

15. $\pm \frac{5}{2}$

16. $\pm \frac{1}{4}$

17. ± 2

18. $\pm \sqrt{27}$

19. $x^2 = 256$; 16 m

20. $x^2 = 90$; 9.5 ft

21. $\pi r^2 = 80$; 5.0 cm

22. **a.** 6.0 in.

b. The length of a radius cannot be negative.

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23. none

24. two

25. one

26. 10.4 in. by 10.4 in.

27. **a.** 11.3 ft

b. 16.0 ft

c. No; the radius increases by about 1.4 times.

28. no solution

29. $\pm\frac{3}{7}$

30. $\pm\frac{1}{6}$

31. ± 2.8

32. ± 0.4

33. ± 3.5

34. 3.5 s

35. 121

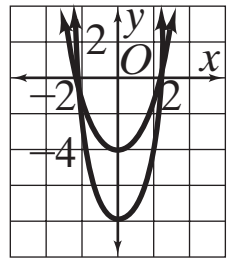
36. **a.** $n > 0$

b. $n = 0$

c. $n < 0$

37. Answers may vary. Sample: Michael subtracted 25 from the left side of the equation but added 25 to the right side.

38. **a.** 2, −2; 2, −2



b. If you multiply the first equation by 2 on both sides, you get the second equation.

39. **a.** square: $4r^2$, circle: πr^2

b. $4r^2 - \pi r^2 = 80$

c. 9.7 in., 19.3 in.

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40. Answers may vary. Sample:

a. $5x^2 + 10 = 0$, no solution

b. $2x^2 + 0 = 0$, $x = 0$

c. $-20x^2 + 80 = 0$, $x = \pm 2$

41. 6.3 ft

42. 11.0 cm

43. **a.** 0.2 m

b. 2.5 s

c. 3.0 s

d. Shorten; as ℓ decreases, t decreases.

44. **a.** -7

b. $(-7, 0)$

c. Answers may vary. Sample: $h = 5, -5, (-5, 0)$

d. $(4, 0)$; the vertex is at $(-h, 0)$.

45. 28 cm

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Answers for Lesson 10-4, pp. 574–575 Exercises

1. 3, 7

2. −4, 4.5

3. 0, −1

4. 0, 2.5

5. $-\frac{2}{7}, -\frac{4}{5}$

6. $\frac{7}{4}, -\frac{8}{3}$

7. −2, −5

8. −3, −4

9. 1, −4

10. −2, 7

11. 0, 8

12. 5, 11

13. −2, 5

14. 3, −4

15. −3, −5

16. −4, 7

17. 0, 6

18. 1, 2.5

19. $-5, -\frac{1}{3}$

20. −2.5, 2.5

21. 5 cm

22. 5

23. 6 ft × 15 ft

24. base: 10 ft
height: 22 ft

25. 2 and 3 or 7 and 8

26. $2q^2 + 22q + 60 = 0$; −6, −5

27. $6n^2 - 5n - 4 = 0; \frac{4}{3}, -\frac{1}{2}$

28. $4y^2 + 12y + 9 = 0; -\frac{3}{2}$

29. $a^2 + 6a + 9 = 0$; −3

30. $2t^2 + 11t + 12 = 0$; −1.5, −4

31. $x^2 - 10x + 24 = 0$; 4, 6

32. 8 in. × 10 in.

33. **a.** 2 s
b. about 19 ft

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34. Answers may vary. Sample: To solve a quadratic equation, write the equation in standard form, factor the quadratic expression, use the Zero-Product Property, and solve for the variable.

$$x^2 + 8x = -15$$
$$x^2 + 8x + 15 = 0$$
$$(x + 3)(x + 5) = 0$$
$$x + 3 = 0 \text{ or } x + 5 = 0$$
$$x = -3 \quad \text{or} \quad x = -5$$

35. Answers may vary. Sample:
$x = 6, a = 2, b = 1; x = 3, a = 1, b = 11$

36. Answers may vary. Sample:

$$x^2 - 2x - 8 = 0$$
$$(x - 4)(x + 2) = 0$$
$$x - 4 = 0 \text{ or } x + 2 = 0$$
$$x = 4 \quad \text{or} \quad x = -2$$

37. **a.** $0, 1; -1, 0$

b. 0

38. $0, 4, 6$

39. $0, 1, 4$

40. $0, 3$

41. $0, 7, -10$

42. $0, 1, 9$

43. $0, 4, -5$

44. 4

45. Answers may vary. Samples:

a. $x^2 - 3x - 40 = 0$

b. $x^2 - x - 6 = 0$

c. $2x^2 + 19x - 10 = 0$

d. $21x^2 + x - 10 = 0$

46. $-1, 1, -5$

47. $-2, 2, -1$

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Answers for Lesson 10-5, pp. 582–584 Exercises

1. 49 **2.** 16 **3.** 400

4. 9 **5.** 144 **6.** 324

7. 4, −12 **8.** 13.06, −3.06 **9.** −5, −17

10. 1.24, −7.24 **11.** 9, −29 **12.** 19, −17

13. 7, −5 **14.** −2.17, −7.83 **15.** 11, 1

16. 1.19, −4.19 **17.** 4.82, −5.82 **18.** 22, −31

19. 1 **20.** 4 **21.** $\frac{81}{100}$

22. 2.16, −4.16 **23.** 5, −1 **24.** 7, −2

25. **a.** $(2x + 1)(x + 1)$

b. $2x^2 + 3x + 1 = 28$

c. 3

26. −0.27, −3.73 **27.** −3, −4 **28.** 4, −10

29. 6, 2 **30.** 8.32, 1.68 **31.** no solution

32. 9.37, −1.87 **33.** 8.12, −0.12 **34.** −4, −5

35. **a.** $\ell = 50 - 2w$

b. $w(50 - 2w) = 150$; 21.5, 3.5

c. 7 ft × 21.5 ft or 43 ft × 3.5 ft

d. No; the answers in part (b) were rounded.

36. The student did not divide each side of the equation by 4.

37. Answers may vary. Sample: Add 1 to each side of the equation, and then complete the square by adding 225 to each side of the equation. Write $x^2 + 30x + 225$ as the square $(x + 15)^2$ and add 1 and 225 to get 226. Then take square roots and solve the resulting equations.

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38. Answers may vary. Sample:

$$x^2 + 10x - 50 = 0$$
$$x^2 + 10x = 50$$
$$x^2 + 10x + 25 = 50 + 25$$
$$(x + 5)^2 = 75$$
$$x + 5 = \pm\sqrt{75}$$
$$x + 5 \approx \pm 8.7$$
$$x + 5 \approx 8.7 \text{ or } x + 5 \approx -8.7$$
$$x \approx 3.7 \quad \text{or} \quad x \approx -13.7$$

39. 5.16, −1.16 **40.** 6.83, 1.17 **41.** 5.6 ft by 14.2 ft

42. **a.** $6x^2 + 28x$

b. $6x^2 + 28x = 384$

c. 13 in. × 6 in. × 6 in.

43. **a.** $A = \frac{7}{2}x^2 + 5x + 1$

b. about 6.86

c. 207.5 ft^2

44. **a.** $3 \pm \sqrt{5}$ **b.** (3, −5)

c. Answers may vary. Sample: p is the x-coordinate of the vertex.

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Answers for Lesson 10-6, pp. 588–590 Exercises

1. $-1, -1.5$ **2.** $2.8, -6$ **3.** 1.5

4. $-0.67, -15$ **5.** $6.67, -0.25$ **6.** $-4, -9$

7. $2.67, -16$ **8.** $13, -8.5$ **9.** $16, -2.4$

10. $0.07, -2.67$ **11.** $10.42, 1.58$ **12.** $0.04, -14.33$

13. $1.14, -0.77$ **14.** $2.20, -3.03$ **15.** $3.84, -0.17$

16. **a.** $0 = -16t^2 + 10t + 3$

b. $t \approx 0.8$; 0.8 s

17. **a.** $0 = -16t^2 + 50t + 3.5$

b. $t \approx 3.2$; 3.2 s

18. Completing the square or graphing; the x^2 term is 1 but the equation is not factorable.

19. Factoring or square roots; the equation is easily factorable and there is no x term.

20. Quadratic formula; the equation cannot be factored.

21. Quadratic formula; the equation cannot be factored.

22. Factoring; the equation is easily factorable.

23. Quadratic formula; the equation cannot be factored.

24. $6, -6$ **25.** $0.87, -1.54$ **26.** $1.41, -1.41$

27. $1.28, -2.61$ **28.** 2 **29.** $3, -3$

30. $1.72, -0.39$ **31.** $1.4, -1$ **32.** $2.23, -1.43$

33. about 2.1 s

34. **a.** 7 ft × 8 ft **b.** $x(x + 1) = 60$, 7.26 ft × 8.26 ft

35. Answers may vary. Sample: You solve the linear equation using transformations and you solve the quadratic equation using the quadratic formula.

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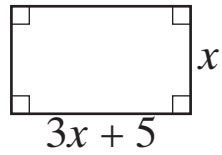
36. 7.40 ft and 5.40 ft

37. 13.44 cm and 7.44 cm

38. Answers may vary. Sample: A rectangle has length x. Its width is 5 feet longer than three times the length. Find the dimensions if its area is 182 ft^2.



7 ft × 26 ft

39. if the expression $b^2 - 4ac$ equals zero

40. B

41. **a.** Check students' work.

b. 356.9 million

c. 2007

42. **a.** $s = -\frac{b}{a}$

b. 6.5

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Answers for Lesson 10-7, pp. 594–595 Exercises

1. A **2.** C **3.** B

4. 0 **5.** 1 **6.** 2

7. 2 **8.** 2 **9.** 2

10. 0 **11.** 2 **12.** 2

13. 1 **14.** 2 **15.** 0

16. none **17.** No; the discriminant is negative.

18. **a.** yes

b. no

c. no

d. no

19. 0 **20.** 0 **21.** 2

22. 2 **23.** 0 **24.** 2

25. **a.** $S = -0.75p^2 + 54p$

b. no

c. \$36

d. If a product is too expensive, fewer people will buy it.

26. **a.** $k > 4$

b. $k = 4$

c. $k < 4$

27. **a.** A2 ^ 2 − 4;
A2 ^ 2 − 8

b. $|b| < 2$

28. no

29. Answers may vary. Sample: Kenji used $c = 1$ instead of $c = -1$.

30. **a.** 16; 5, 1

b. 81; 4, −5

c. 73; 3.89, −0.39

d. Rational; the square root of a discriminant that is a perfect square is a pos. integer.

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31. no **32.** no **33.** yes; 1, −1.25

34. yes; $-1, \frac{2}{3}$ **35.** no **36.** yes; 2.5, −1

37. Answers may vary. Sample: Use values for a, b, and c such that the discriminant is positive.

38. never **39.** sometimes **40.** always

41. 2; since the parabola crosses the x-axis once, it must cross again.

42. $y = 2x^2 + 8x + 10$ has a vertex closer to the x-axis; its discriminant is closer to zero.

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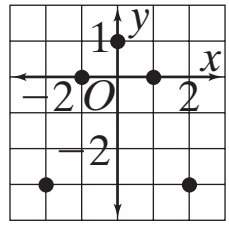
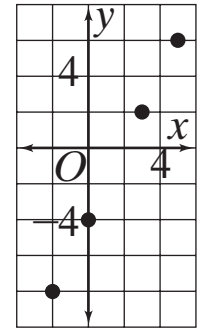
1.



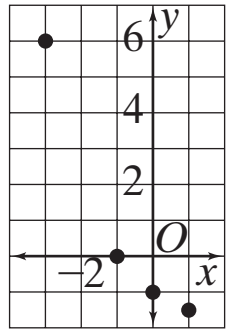
quadratic

2.



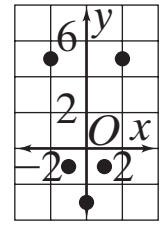
linear

3.



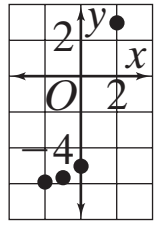
exponential

4.



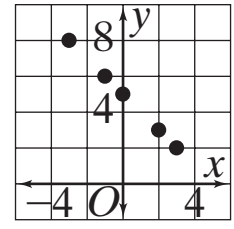
quadratic

5.



exponential

6.



linear

7. quadratic; $y = 1.5x^2$

8. linear; $y = 2x - 5$

9. quadratic; $y = 2.8x^2$

10. exponential; $y = 1 \cdot 1.2^x$

11. exponential; $y = 5 \cdot 0.4^x$

12. linear; $y = -\frac{1}{2}x + 2$

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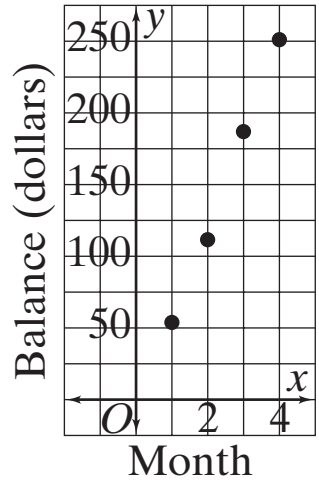
13. a.



linear

b. 65, 64, 64; yes

c. 64

d. $y = 64x - 5$

14. a. exponential

b. $y = 16{,}500 \cdot 0.88^x$

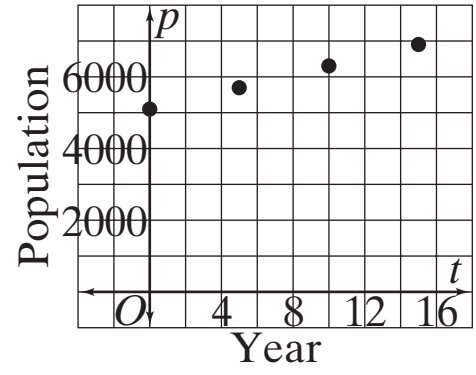
15. a. 41, 123, 206

b. 82, 83

c. $d = 41t^2$

d. 256.25 cm

16. a.



linear

b. 5 years

c. 600, 600, 600; 120, 120, 120

d. $p = 120t + 5100$

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17. a. 5

b. 398, 429, 407, 389; 79.6, 85.8, 81.4, 77.8

c. about 81.2

d. $p = 81.2t + 4457$

e. 6893 million, or about 6.9 billion

18. Answers may vary. Sample: Linear data have a common first difference, quadratic data have a common second difference, and exponential data have a common ratio.

19. $y = 0.875x^2 - 0.435x + 1.515$

20. $y = 1.987 \cdot 0.770^x$

21. $y = 2.125x^2 - 4.145x + 2.955$

22. $y = -0.336x^2 - 0.219x + 4.666$

23. $y = -1.1x + 3.5$

24. $y = 0.102 \cdot 2.582^x$

25. a. i.

x	y			
1	−2			
		3		
2	1		2	
		5		2
3	6		2	
		7		2
4	13		2	
		9		
5	22			

ii.

x	y		
1	3		
		9	
2	12		6
		15	
3	27		6
		21	
4	48		6
		27	
5	75		

iii.

x	y		
1	−1		
		7	
2	6		8
		15	
3	21		8
		23	
4	44		8
		31	
5	75		

b. The second common difference is twice the coefficient of x^2.

c. When second differences are the same, the data are quadratic. You can determine the coefficient of x^2 by dividing the second difference by 2.

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26. Answers may vary.

Sample:

x	y
0	5
2	13
4	29
6	53

27. **a.** quadratic

b. Answers may vary. Sample: $d = 13.6t^2$

c. 54.5 ft

28. Check students' work.

29. **a.** 1.85, 1.28, 1.45, 1.43

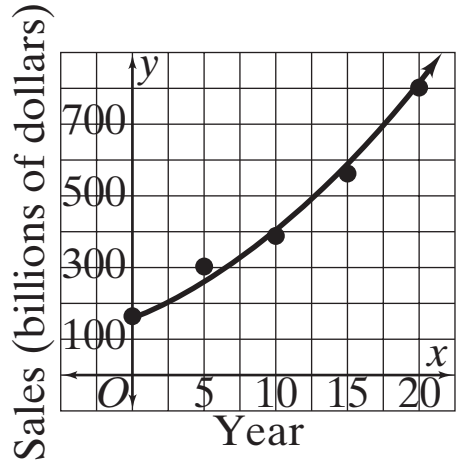
b. 139, 85, 174, 240

c. −54, 89, 66

d. 1.85; the ratio is much greater than the other ratios.

e. Yes; if consecutive first differences decrease, a second difference will be negative.

f.



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