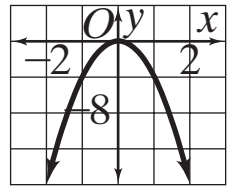
Answers for Lesson 10-1, pp. 553–556 Exercises

1. (2, 5); max.

2. (−3, −2); min.

3. (2, 1); min.

4.



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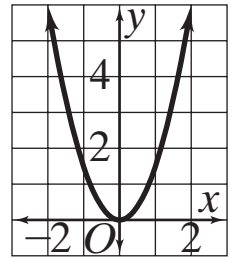

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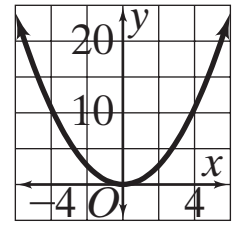

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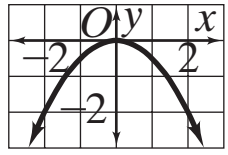

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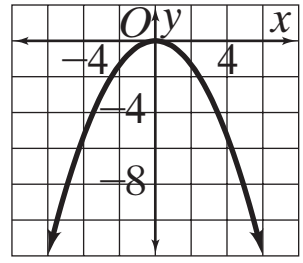
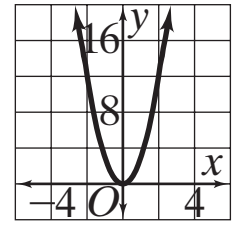


9.



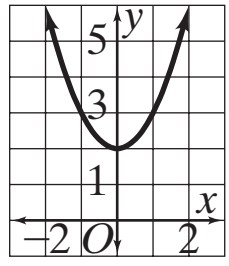
10. $y = \frac{1}{2}x^2, y = 3x^2, y = 4x^2$

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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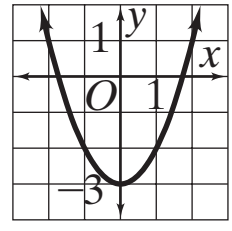

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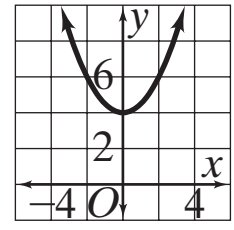

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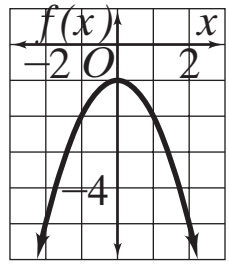

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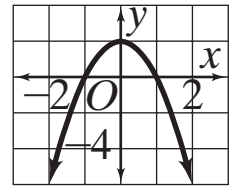

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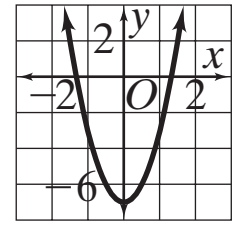

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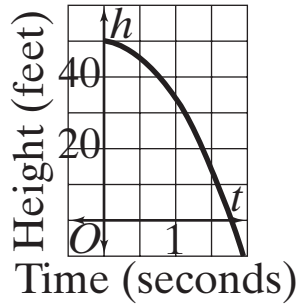


21. E **22.** A **23.** F

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

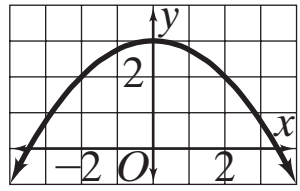
27. The graph of $y = 2x^2$ is narrower.

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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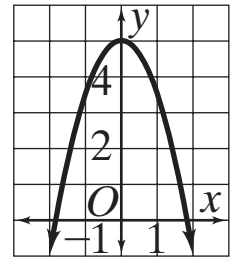

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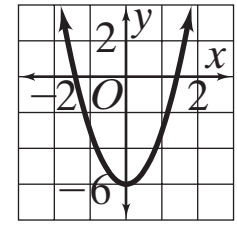

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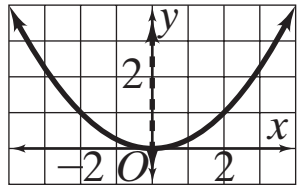

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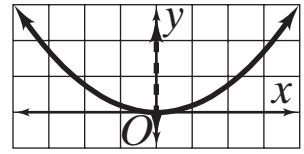

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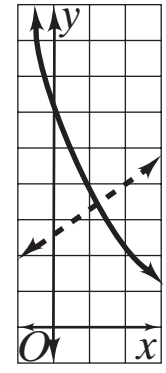

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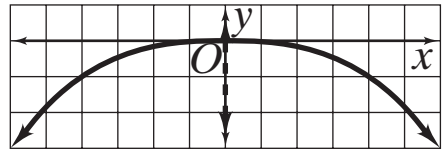
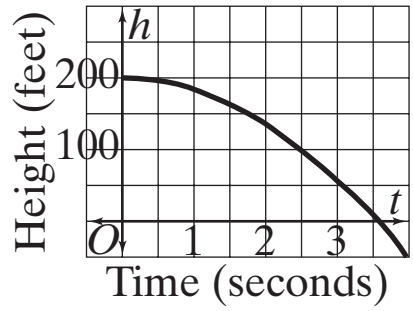


38. a.



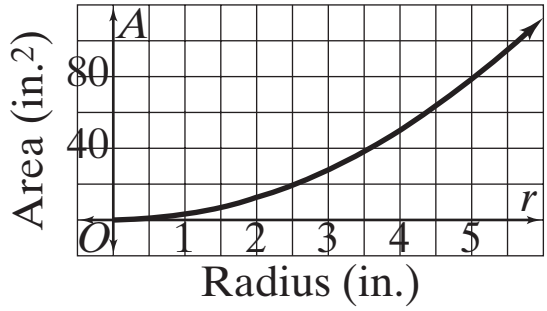
b. 184 ft

c. 56 ft

39. a. $0 < r < 6$

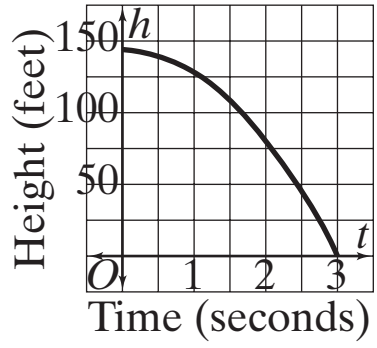
b. $0 < A < 36\pi \approx 113.1$

c.



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

44. a.



b. 16 ft

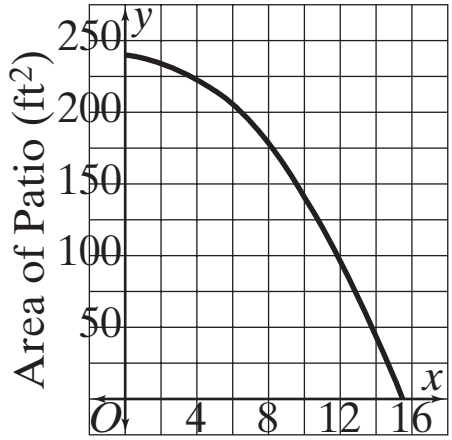
c. No; the apple falls 48 ft from $t = 1$ to $t = 2$, because it is accelerating.

45. B

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.

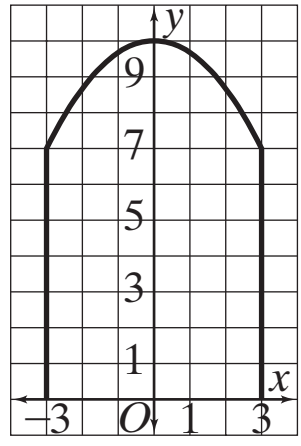
c. $96 < A < 240$; as the side length of the garden increases from 0 to 12, the area of the patio decreases from 240 to 96.

d. about 6 ft

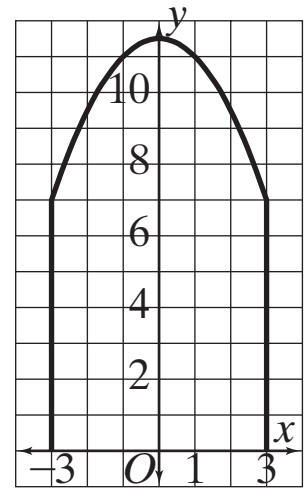
48. a. $a > 0$

b. $|a| > 1$

49. a.



b.



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

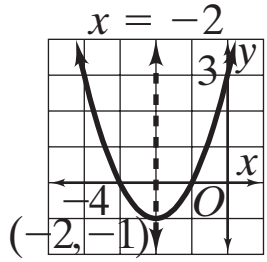
7. C

8. F

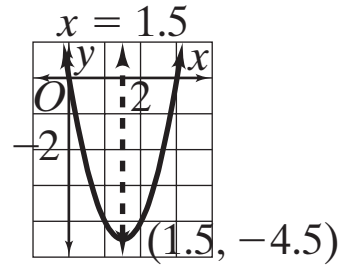
9. A

10. D

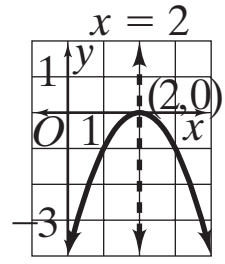
11.



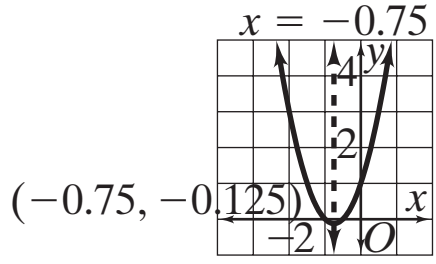
12.



13.



14.



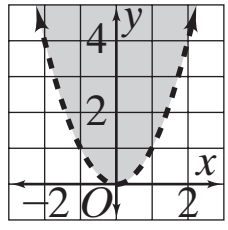
15. **a.** 20 ft

b. 400 ft^2

16. **a.** 1.25 s

b. 31 ft

17.



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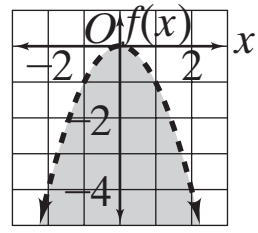
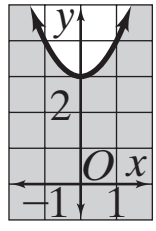


19.



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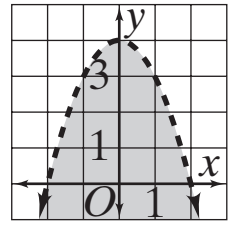
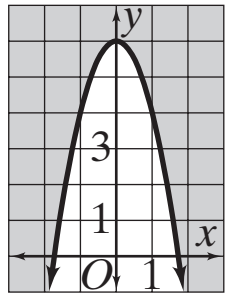
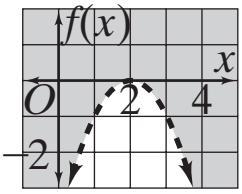


21.

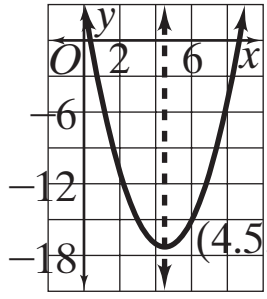


22.



23.

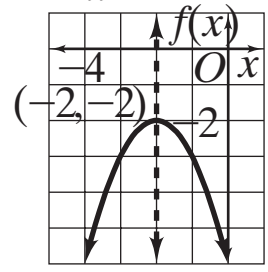
$x = 4.5$



(4.5, −17.25)

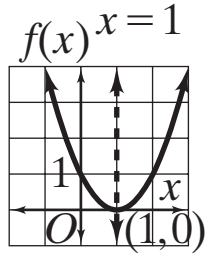
24.

$x = -2$



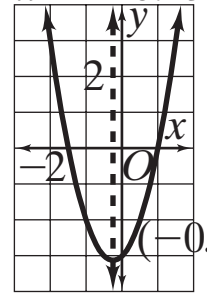
25.

$x = 1$



26.

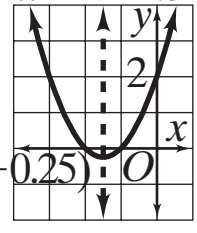
$x = -0.25$



(−0.25, −3.125)

27.

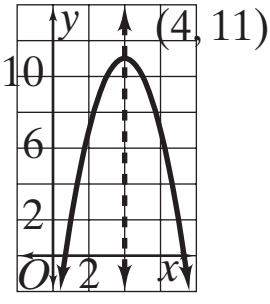
$x = -1.5$



(−1.5, −0.25)

28.

$x = 4$



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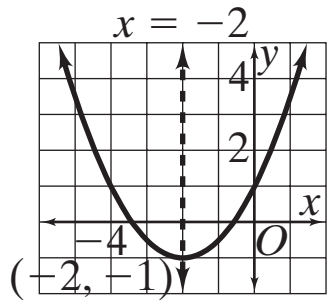
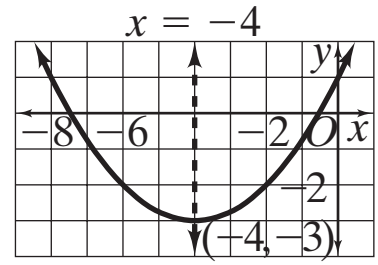
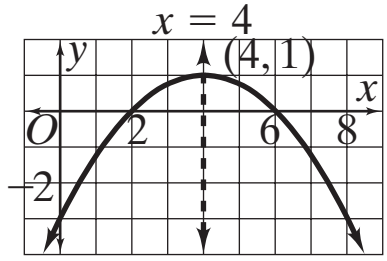


30.



31.



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

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

33. $y = -3x^2$

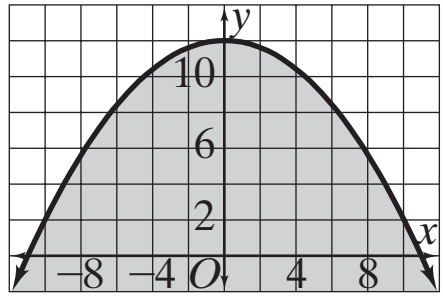
34. $y = 2x^2 + 4$

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

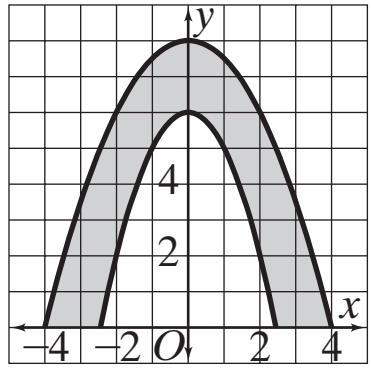
40. Answers may vary. Sample: a affects whether the parabola opens up or down, b affects the axis of symmetry, and c affects the y-intercept.

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 $(-4, -2)$.

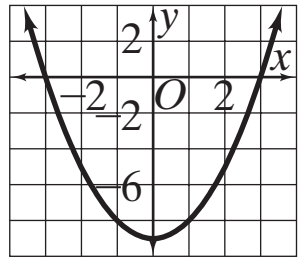
$-2 \stackrel{?}{=} (-4)^2 + 5(-4) + 2$

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

$-2 = -2$ ✓

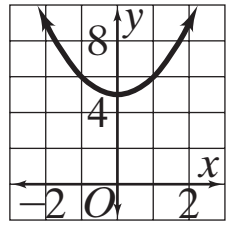
f. No; you would not be able to determine the b value using the vertex formula.

1.



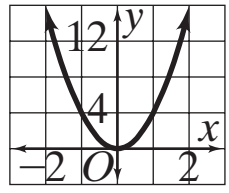
±3

2.



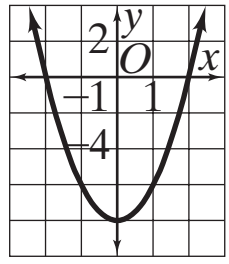
no solution

3.



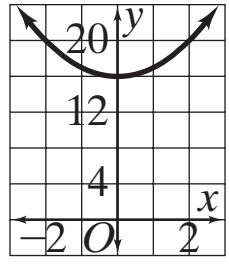
0

4.

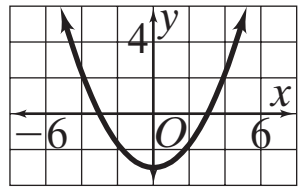


±2

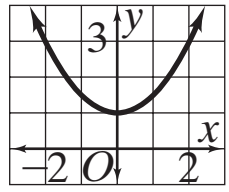
5.



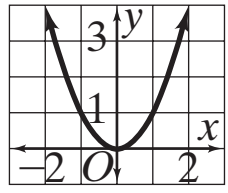
no solution

6. 

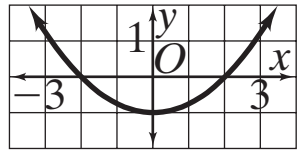
± 3

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.

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

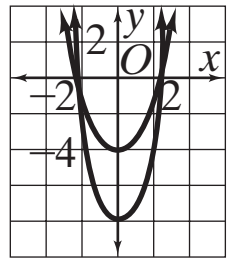
36. **a.** $n > 0$

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.

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

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

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. $-2, 2, -1$

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.

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.

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

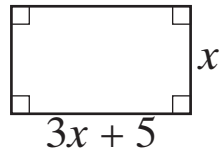
34. **a.** 7 ft × 8 ft **b.** $x(x + 1) = 60$, 7.26 ft × 8.26 ft

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

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

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.

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

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

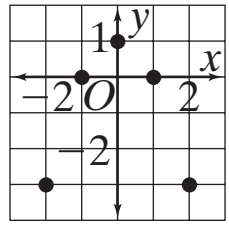
37. Answers may vary. Sample: Use values for a, b, and c such that the discriminant is positive.

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

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

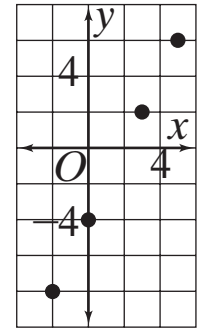
42. $y = 2x^2 + 8x + 10$ has a vertex closer to the x-axis; its discriminant is closer to zero.

1.



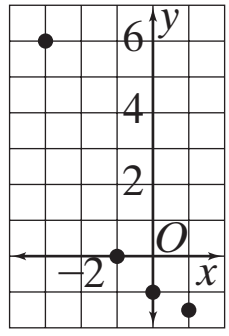
quadratic

2.



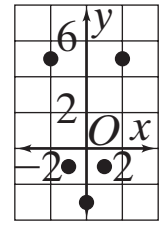
linear

3.



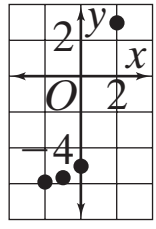
exponential

4.



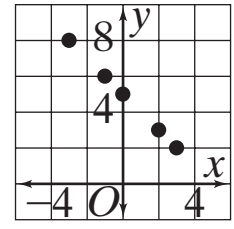
quadratic

5.



exponential

6.



linear

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

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

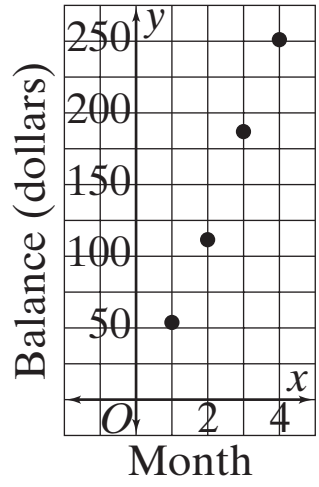
9. quadratic; $y = 2.8x^2$

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

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

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

13. a.



linear

b. 65, 64, 64; yes

c. 64

d. $y = 64x - 5$

14. a. exponential

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

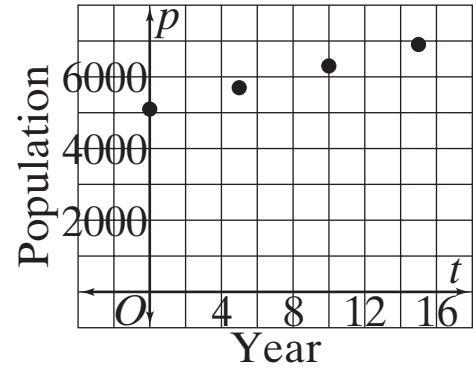
15. a. 41, 123, 206

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. $p = 120t + 5100$

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.

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.