



Selected Answers

Topic 1

Lesson 1-1

1. The sum, product, difference, or quotient of real numbers is a real number. Subsets of the real numbers are the set of rational numbers and the set of irrational numbers. The rational numbers include integers, the integers include whole numbers, and the whole numbers include natural numbers. **3.** Rational numbers are a subset of all real numbers because all rational numbers are also real. Rational numbers are not a subset of the irrational numbers because no rational numbers are irrational. **5.** Yes. All the values in D are also in D . **7.** no **9.** 0.6 , $\frac{2}{3}$, $\sqrt{\frac{9}{16}}$ **11. a.** rational **b.** rational **13.** The student should have written $\sqrt{144} = 12$. So, the correct order is $\sqrt{144}$, 68.12 , $\frac{234}{3}$. **15. a.** Sometimes true; positive integers and zero are whole numbers, but negative integers are not. **b.** Always true; natural numbers are a subset of rational numbers. **c.** Never true; although integers and irrational numbers are both subsets of real numbers, they have no elements in common. **17.** rational, real **19.** whole, integers, rational, real **21.** integers, rational, real **23.** 0.16 , $\frac{1}{3}$, $\sqrt{\frac{1}{4}}$ **25.** D **27.** A **29.** Rational; can be expressed as a ratio **31.** Irrational; divisor is irrational

33. Yes; the quotient of a rational number and an irrational number can be rewritten as a ratio with a rational number in the numerator and an irrational number in the denominator, so the quotient will always be irrational. **35.** rational numbers **37.** no; no; no; yes; no; yes **39. Part A** Kimberly; she has the highest free throw percentage. **Part B** Martin; 49.5% is greater than 920, or 45% and 0.448, or 44.8% **Part C** Kimberly, Corey, Martin **Part D** Kimberly; Kimberly makes about 54.8% of her shots, while Corey only makes 52.8%, and Martin only makes 50.8%.

Lesson 1-2

1. Use variables and operations to model situations with algebraic equations. Then use properties and inverse operations to isolate the variable on one side of the equation. The other side of the equation is the solution. **3.** It removes the fractions to make the equation easier to solve. **5.** 2 **7.** $\frac{37}{4}$ **9.** $\frac{50}{21}$, or about 2.38 miles; Answers may vary. Sample: The equation $\frac{d}{2} + 2.25 + \frac{d}{40} = 3.5$ models this situation. Multiplying both sides by the LCD, 40, gives $20d + 90 + d = 140$, which simplifies to $21d = 50$. **11.** -3



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13. 2.76 miles; first convert Parker's running time to hours. Multiply 39 sec by $\frac{1 \text{ min}}{60 \text{ sec}}$ to convert 39 sec into 0.65 min. Then multiply 27.65 min by $\frac{1 \text{ hr}}{60 \text{ sec}}$ to get 0.46 hours. Use the Distance Formula to find the number of miles he ran: $d \approx 6(0.46) = 2.76$ miles. **15.** Both; you can use the Division Property of Equality and divide both sides by $\frac{1}{2}$ (or multiply by 2). You can use the Distributive Property to simplify the left side of the equation, $\frac{1}{2}(2y + 4)$, which becomes $y + 2$. **17.** 5 **19.** 4 **21.** -7 **23.** 2 **25.** $\frac{31}{12}$, or $2\frac{7}{12}$ **27.** $\frac{12}{5}$, or $2\frac{2}{5}$ **29.** $-\frac{96}{25}$, or $-3\frac{21}{25}$ **31.** 4,300 **33.** 3.6 **35.** -80 **37.** 5 **39.** about 18 bonus payments per year; $1,000,000 = 6(20,000) + 8,000b$, where b is the number of bonus payments made over 6 years; so, $b = 110$ payments. So, the player is expected to earn $\frac{110}{6} \approx 18.3$ bonus payments per year on average. **41.** 13.75; Because addition must be done first, the sum $3 + 8$ should be in parentheses: $(3 + 8) \times 5 \div 4$ **43.** B, D **45. Part A** 18 rows of bricks **Part B** $60\frac{3}{8}$ in.

Lesson 1-3

1. You can compare two relationships and find a quantity that makes another quantity equal for each relationship. **3.** Isabel did not consider the case where the differences are equal to zero. The correct approach would have been to apply Distributive Property to

the right hand side to get $x - 2 = -x + 2$, and then continue solving to find that the equation is true for $x = 2$. **5.** $x = 9$ **7.** identity **9.** 4 games **11.** The equation simplifies to $0 = 0$; an infinite number; because there are no variables in the simplified equation and the result is a true statement, any value will make the equation true. **13.** Answers may vary. Sample answer: $x - 3 = x - 3$; It is an identity, so it has an infinite number of solutions. **15.** 8, no values, any value except -8 **17.** -12 **19.** $\frac{34}{9}$ **21.** 7 **23.** -3 **25.** -10 **27.** -5 **29.** no solution **31.** -9 **33.** identity **35.** -2 **37.** identity **39.** 0.2 **41. a.** $50 - 2d = 40 - 1.5d$; twenty 30-day periods **b.** \$10 **43.** Answers may vary. Sample answer: $p + 0.06p$ and $1.06p$; $p + 0.06p = (1 + 0.06)p = 1.06p$ **45. a.** Company A: $500 + 25g$. Company B: $200 + 30g$ **b.** Company A; Cost for Company A is $500 + 25(30) = \$1,250$; Cost for Company B is $200 + 30(50) = \$1,700$. So, A is less expensive. **47.** 48 ft **49.** D

Lesson 1-4

1. Answers may vary. Sample: The resulting equation or formula can be reused, so you need to solve only once and then substitute different values to reuse the equation or formula. **3.** A literal equation is an equation rule involving two or more variables. A formula is a type of literal equation that states a relationship among quantities. **5.** $x = y - 12$ **7.** 43



Selected Answers

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9. $x = \frac{c-b}{a}$, 4; 12 **11.** Answers may vary. Sample: The equation was not solved for x because it appears on each side of the solution; $x = \frac{4}{k+3}$

13. $c = \frac{a}{b}$ **15.** $f = \frac{h}{dg}$ **17.** $y = 4 - \frac{2x}{3}$

19. $b = \frac{1}{2ac}$ **21.** $x = \frac{6a}{5}$ **23.** $h = \frac{3V}{\pi r^2}$

25. $y = \frac{ac}{a-b-c}$ **27.** $G = -\frac{Fr^2}{m}$

29. a. $T = \frac{7}{30}c + 40$ **b.** $c = \frac{30}{7}(T - 40)$

c. 210 chirps **31. a.** $b_1 = \frac{2A}{h} - b_2$

b. 22 ft **c.** Answers may vary. Sample answer: Solve $22 - 2d = 6$; 8 ft

33. $c = \frac{ad}{b}$ **35. Part A** $h = 2r$; the height is 2 times the radius. **Part B** A can that meets the manufacturer's goals will have a label with area $A = \pi r^2$.

Lesson 1-5

1. The Multiplication and Division Properties of Inequality are different from the Multiplication and Division Properties of Equality. When both sides of an inequality are being multiplied or divided by a negative quantity, the inequality symbol is reversed.

3. Answers may vary. Sample: $x > 3$ and $2x > 6$ are equivalent; They have the same solution.

5. $x < 12$



7. $x \leq -1$

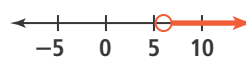


9. $3.75x \geq 1.5$; $x \geq 0.4$ **11. a.** Answers may vary. Sample: $x + 3 > x + 4$; Since solving the inequality gives the false statement $3 > 4$, there is no solution.

b. Answers may vary. Sample: $x + 3 < x + 4$; Since solving the inequality gives the true statement $3 < 4$, the solution is all real numbers.

13. The Distributive Property and the Subtraction Property of Inequality are applied in the same way, but when the Division Property of Inequality is applied, the inequality symbol is reversed.

15. $x > 6$;



17. $x \leq -5$;



19. $x \geq -0.05$;



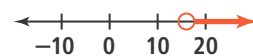
21. $x > 2$;



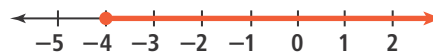
23. $x \geq 3$;



25. $x > 16$;



27. $x > -4$;



29. B **31.** C **33.** $x > 1$

35. $x \geq -7$ **37.** $x > -2.9$ **39.** $x \leq -1.25$

41. no solution **43.** Fill in the circle to represent the solution $x \leq 12$.

45. $55x - 15 < 50x$; $x < 3$; After 3 hours, Aisha will be in front of Luke.

47. $4.25 + 2.25 + 4x \leq 8$; $x \leq 0.375$; Charlie can buy up to 0.375 lb of potato salad. **49.** E



Selected Answers

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Lesson 1-6

1. If the inequalities are joined by *and*, the solution includes only solutions of both inequalities where they overlap. If the inequalities are joined by *or*, the solution includes the solutions of one inequality as well as the solutions of the other inequality. **3.** Answers may vary. Sample: A compound inequality combines or “mixes” two individual inequalities. **5.** $x \leq -4$ or $x \geq -1$

7. $x > 1$ and $x \leq 4$;



9. $10x \geq 12$ and $10x \leq 15$; $x \geq 1.2$ and $x \leq 1.5$; Nadeem will be riding between 1.2 and 1.5 h, inclusive. **11.** The student graphed $x \geq 2$ and $x < 4$. The student should have graphed an open circle on 4 with the arrow pointing right.

13. a. The graph of $x > a$ and $x > b$ has an open circle on a with the arrow pointing right, while the graph of $x > a$ or $x > b$ has an open circle on b with the arrow pointing right. **b.** The graph of $x > a$ and $x > b$ has an open circle on b with the arrow pointing right, while the graph of $x > a$ or $x > b$ has an open circle on a with the arrow pointing right. **c.** The graphs are not different; they are the same. **15.** $x < -2$ or $x > 1$ **17.** $x \geq -0.5$ and $x < 0.25$

19. $x > -4$ and $x < 2$ **21.** $x > 8$

23. $1 \leq x < 3$ **25.** $7 \geq x \geq 5$ **27.** $x \geq 10$ and $x \leq 20$, or $10 \leq x \leq 20$ **29.** $x > 10$ and $x < 20$, or $10 < x < 20$ **31.** Answers may vary. Sample: $x < 20 + 20(30.5)$ or $x > 20 + 20(33.5)$; $x < 630$ or $x > 690$;

Cartons less than 630 ounces and greater than 690 ounces should be opened for inspection. **33.** A, C

35. Part A $500 \leq 12x < 1000$; $41.\bar{6} \leq x < 83.\bar{3}$; A monthly donation from \$41.67 to \$83.33 will put Keenan in the Gold category.

Part B $100 \leq 50 + 3x < 500$; $16.\bar{6} \leq x < 150$; Three donations from \$16.67 to \$150 will put Libby in the Silver category.

Part C $100 \leq 12(50 - x) < 500$; $8.\bar{3} < x \leq 41.\bar{6}$; Paula can reduce her monthly contribution by \$8.34 to \$41.66 dollars per month.

Lesson 1-7

1. One equation or inequality represents the case where the quantity in the absolute value symbols is positive, and the other equation or inequality represents the case where the quantity is negative. **3.** The absolute value of a quantity represents its distance from 0 on the number line, and distance is always positive.

5. $x = -2$, $x = 2$

7. $x \leq -1$ or $x \geq 5$



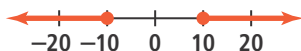
9. minimum: 2.1 hours; maximum: 2.9 hours **11.** $n = 2$ **13.** No, an absolute value equation will not work because the value of x would have to be negative for the perimeter to be 6 ft plus or minus 1.5 ft, and an absolute value expression cannot have a negative value. **15.** $x = -3$, $x = 3$ **17.** $x = -12$, $x = 12$ **19.** $x = -6$, $x = 14$ **21.** $x = -18$, $x = 2$ **23.** no solution **25.** $|5x - 10| = 2.5$; minimum: 1.5 h; maximum: 2.5 h



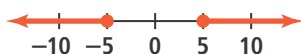
Selected Answers

Topic 1

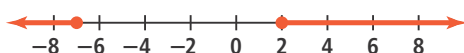
27. $x \leq -10$ or $x \geq 10$



29. $x \leq -5$ or $x \geq 5$



31. $x \leq -7$ or $x \geq 2$



33. $x \leq -7$ or $x \geq -1$



35. B **37.** A **39.** The difference between the actual length of a case x and 125 mm must, at most, be within 0.25 mm. The inequality $|x - 125| \leq 0.25$ can be used to represent this acceptable range of lengths. Therefore, the range of lengths of cases that should be removed can be represented by the absolute value inequality $|x - 125| > 0.25$.

41. $|2.50x - 25| \leq 0.50$; $9.8 \leq x \leq 10.2$; Between 9.8 and 10.2 gallons will be pumped. **43.** A

Topic Review

1. Check students' work. See *Teacher's Edition* for details. **3.** compound inequality **5.** subset **7.** literal equation **9.** Answers may vary. Sample: $\sqrt{2}$ and $\sqrt{8}$ **11.** real number, rational number, integer, whole number, natural number **13.** $\sqrt{\frac{17}{3}}$, $0.\overline{36}$, $\sqrt{15}$ **15.** irrational; 28 is not a perfect square, so the square root of 28 is not rational. **17.** $x = 4$ **19.** $b = \frac{29}{18}$ **21.** $1\frac{1}{3}t + t + 5.5 = 26.5$; Adult ticket = \$12, child's ticket = \$9 **23.** $x = 0$ **25.** $t = 36$

27. The student added 5 instead of subtracting 5 in the last step.

$$a = \frac{3}{4}(b + 5)$$

$$a = \frac{3}{4}b + \frac{15}{4}$$

$$a - \frac{15}{4} = \frac{3}{4}b$$

$$\frac{4}{3}\left(a - \frac{15}{4}\right) = \frac{4}{3}\left(\frac{3}{4}b\right)$$

$$\frac{4}{3}a - 5 = b$$

29. $c = \frac{ab - 2}{3b}$ **31.** $v_f = at + v_i = 14$ ft/s

33. $x > 3$



35. $x < 25$



37. $45(x + 90) < 60x$

$$45x + 4050 < 60x$$

$$4050 < 15x$$

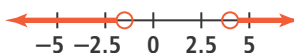
$$270 < x$$

After 270 minutes, or at 1:30 p.m., Yuki will have typed more words than Neil.

39. $x > 4$ or $x < 3$



41. $x > 4$ or $x < -1.5$



43. She can buy 4 to 6 packages of charms. **45.** $x = 2$, $x = -2$

47. $-9 < x < 9$ **49.** $|x - 98.6| \geq 0.5$. $|x - 98.6|$ represents how far away the temperature is from 98.6°F. The acceptable distance from the norm is represented by 0.5. The solutions of the inequality are the temperatures further from the norm than acceptable.

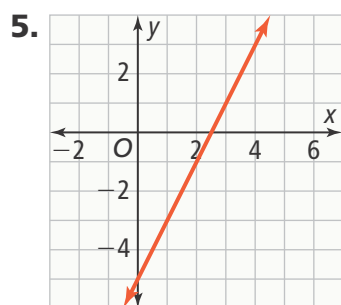


Selected Answers

Topic 2

Lesson 2-1

1. $y = mx + b$. The slope of the line and the y -intercept are given by the slope-intercept form, so the line is easily graphed. **3.** Emaan reverses vertical and horizontal units in the slope when plotting the second point, which should be at (3, 6).

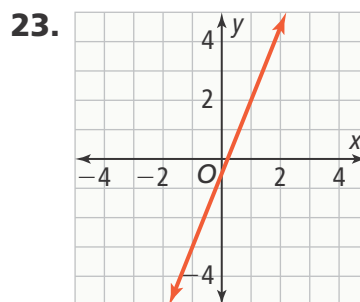
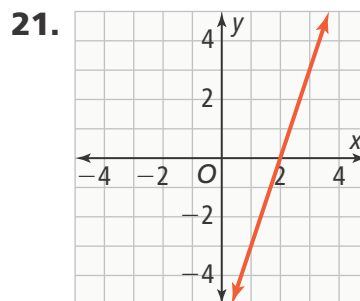
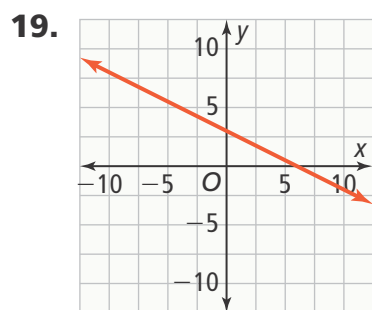


7. slope: -5 ; y -intercept: $-\frac{3}{4}$

9. $y = -2x + 1$ **11.** $y = \frac{4}{3}x - 3$

13. a. Answers may vary. Sample: Allie will move 3 units down and 4 units to the right to find the second point. Carolina will move 3 units up and four units to the left to find the second point. **b.** Yes; they both find two points on the same line using the equation.

15. The y -intercept should be plotted at (0, -6), not (0, 6). The second point would be at (4, -9). **17.** $b = 6$; $n = 2.5$; $p = 4.5$



25. $y = 2x + 3$ **27.** $y = 3x - 3$

29. $y = 2x - 5$ **31.** $y = \frac{8}{3}x - \frac{2}{3}$

33. $y = -1.5x + 4.5$

35. Plan A: $y = -60x + 720$, Plan B: $y = -70x + 840$; The final payment for the two plans happens at the same time. Even though Plan A involves a down payment, the higher weekly payment amount for Plan B causes the balance to decrease at a faster rate. **37.** Luis's ride: $y = -7.5x + 15$; Raul's speed 5 mi/h; Raul's ride: $y = -5x + 10$; both boys arrive at the beach when $y = 0$. **39.** C

Lesson 2-2

1. The point-slope form of a line, $y - y_1 = m(x - x_1)$ reveals the slope m and one point (x_1, y_1) on the line.

3. Denzel did not rewrite $y - 2 = \frac{2}{3}(x + 3)$ as $y - 2 = \frac{2}{3}(x - (-3))$ and used 3 instead of -3 for the x -coordinate to find the first point.

Selected Answers

Topic 2

5. $y - 5 = -3(x - 1)$ 7. $y - 2 = -\frac{4}{3}(x - 4)$
or $y - 6 = -\frac{4}{3}(x - 1)$ 9. $y = -5x + 1$

11. a. $y - 4 = -\frac{3}{10}(x + 5)$ or

$y - 1 = -\frac{3}{10}(x - 5)$ b. Answers may vary.

Sample: $\frac{5}{2}$ c. Answers may vary. Sample: The y-intercept is halfway between the given points, so the y-intercept should be about halfway between the two y-coordinates. It will be between

2 and 3, at about $\frac{5}{2}$. d. $y = -\frac{3}{10}x + \frac{5}{2}$

13. a. $y - b = m(x - 0)$ b. The simplified form of $y - b = m(x - 0)$ is $y = mx + b$ if you solve for y , so slope-intercept and point-slope forms are two ways of representing the same line.

15. $y + 2 = -4(x - 2)$

17. $y - 4 = \frac{2}{3}(x + 1)$

19. $y - 7.5 = 1.5(x - 3.5)$

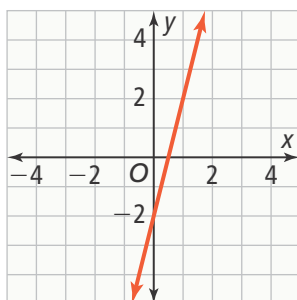
21. $y + 3 = (x - 1)$

23. $y + 7 = (x + 1)$ or $y + 4 = (x - 2)$

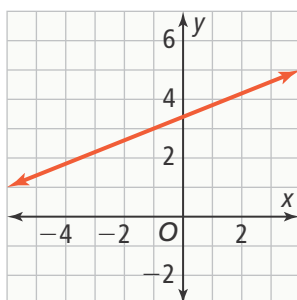
25. $y - 12 = 5(x + 4)$ or $y + 3 = 5(x + 7)$

27. $y + \frac{1}{2} = -(x - 3)$ or $y - \frac{3}{2} = -(x - 1)$

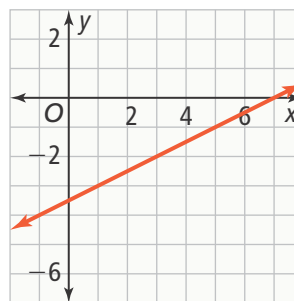
29.



31.



33.



35. $y + 21 = \frac{3}{2}(x + 4)$; $y = \frac{3}{2}x - 15$

37. a. \$608 b. \$76 c. Both forms are useful for finding the amount she pays each week, which is the slope. Only slope-intercept form gives the original amount borrowed as the y-intercept.

39. $\frac{9}{7}$; $(-4, 5)$; Answers may vary.

Sample: $(3, 14)$

41. Part A $y - 3.8 = 0.4(x - 1.5)$; The slope is the rate of increase in elevation: 0.4 m/sec.

Part B 3.2 m; slope-intercept form: $y = 0.4x + 3.2$; The y-intercept is the elevation where the railway initially starts.

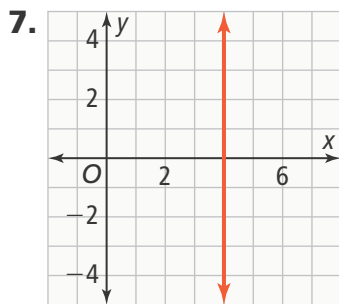
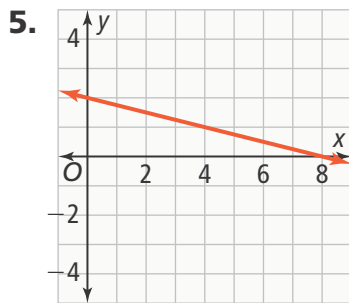
Lesson 2-3

1. The standard form of a linear equation is $Ax + By = C$, where A and B are not both equal to zero and A , B , and C are all integers. Standard form makes it easy to identify intercepts. The equation can be solved for either y or x to find the x - or y -intercepts, and standard form makes it easy to see the constraint by inspection. 3. Malcolm did not use integers for all coefficients. The equation should be $3x + 2y = 8$.



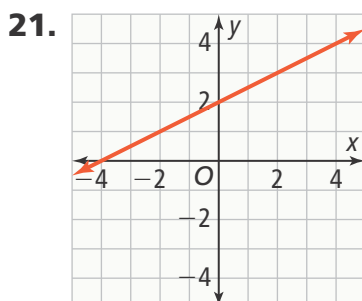
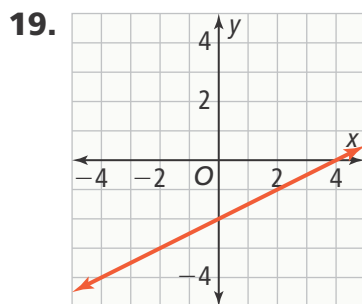
Selected Answers

Topic 2

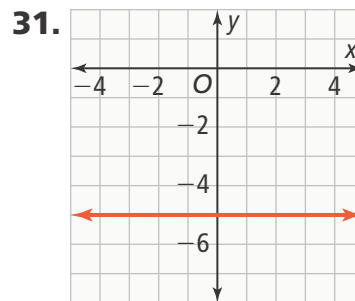
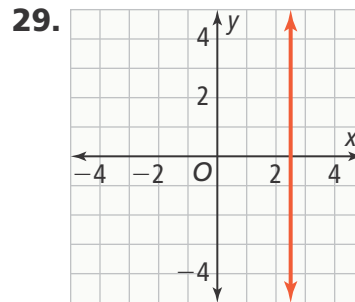


9. $3x + 2y = 12$, where x is pounds of green grapes and y is pounds of red grapes. 11. Darren can solve the second equation for y to verify that it is identical to the first equation.

13. Point B : $(-2, 0)$, point C : $(0, 3)$; Check students' graphs. 15. x -intercept: 5; y -intercept: 2 17. x -intercept: 12; y -intercept: 24



23. D 25. C 27. The graph of $x = 2$ is a graph of the form $Ax + By = C$ when $B = 0$.



33. $4x - y = 18$ 35. $x + 2y = -20$
 37. $2x + 8y = 16$ 39. $-7x + 3y = -21$
 41. 10 lb; 6 lb; $3x + 5y = 30$, where x is pounds of cheddar and y is pounds of Swiss. 43. He can use the equation $12x + 20y = 300$, where x is number of hats and y is number of T-shirts. Because hats and T-shirts cannot be bought in fractions, solutions only correspond to points on the line where x and y are whole numbers. 45. E



Selected Answers

Topic 2

Lesson 2-4

1. In slope-intercept form, the coefficient of x will determine the slope of the line. If the slopes are the same, the lines will be parallel. If the slopes are opposite reciprocals, the lines will be perpendicular.

Otherwise the lines will be neither parallel nor perpendicular. **3.** Slopes of parallel lines are the same; slopes of perpendicular lines are opposite reciprocals. **5.** $y = -\frac{3}{4}x + 6$

7. parallel **9.** $y = -\frac{1}{3}x + \frac{1}{3}$

11. The slope of the line should be $-\frac{1}{4}$

$$\text{Corrected: } y - 5 = -\frac{1}{4}(x - (-8))$$

$$y - 5 = -\frac{1}{4}x - 2$$

$$y - 5 + 5 = -\frac{1}{4}x - 2 + 5$$

$$y - 5 = -\frac{1}{4}x + 3$$

13. a. No, the slopes of adjacent sides must be negative reciprocals. The slope of \overline{AD} is $-\frac{1}{6}$, and the slope of \overline{BA} is 5.

b. You could change D to $(5, 1)$ and C to $(4, -4)$ so that two slopes would be $-\frac{1}{5}$. **15.** $y = \frac{1}{5}x - 5$ **17.** $y = 2$

19. The slope of Line A is 2 and the slope of Line B is $-\frac{1}{2}$. The product of the two slopes is -1 . **21.** $y = -\frac{4}{3}x + 3$

23. $y = -\frac{5}{4}x + 8$ **25.** parallel

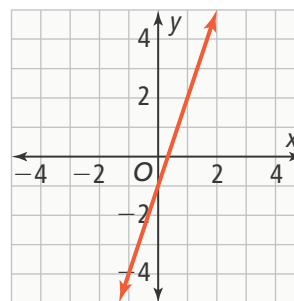
27. perpendicular **29. a.** Sample: $y = -\frac{1}{2}x + 3$ The slope must be $-\frac{1}{2}$.

b. Sample: The artist can determine the equation of each side of the figure. If opposite sides are parallel and adjacent sides are perpendicular, the figure is a rectangle. **31. a.** $y = 125x + 23$ **b.** Yes; the slopes of the lines are the same but the y -intercepts are different, so the lines are parallel. **c.** Since the slopes are the same, Elijah and Aubrey deposit the same amount—\$125—each week. The y -intercepts are different which indicates that Elijah began with \$72 in his account and Aubrey began with \$23 in her account. **33.** A

Topic Review

1. Check students' work. See *Teacher's Edition* for details. **3.** standard form
5. slope-intercept form

7.



9. $y = 3x - 6$ **11.** $y = 50x + 250$, \$300

13. $y - 5 = -3(x + 2)$

15. $y - 4 = -0.5(x - 1.5)$

17. $A = 3$, $B = 5$, $3x + 5y = 15$

19. $y + 5x = 23$ **21.** x -intercept: 24;

y -intercept: 8 **23.** $-\frac{1}{3}$ **25.** $y = \frac{1}{2}x + \frac{1}{2}$

27. $y - 6 = -2(x + 2)$ **29.** parallel



Selected Answers

Topic 3

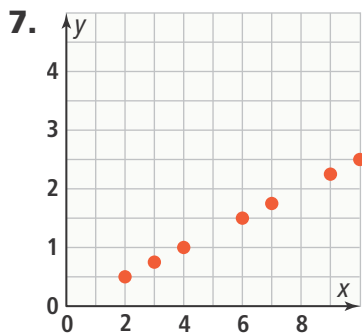
Lesson 3-1

- 1.** A function is a relation for which each input has exactly one output. It is important to know the domain and range to define a function, because only one element of the range can be matched to an element in the domain for the relation to be a function.
- 3.** 2 points: 5 is in the domain and the relation is not a function. 1 point: 5 is in the domain, and the relation may be a function, depending on the other points. no points: 5 is NOT in the domain, but the relation may be a function, depending on the other points.

5.

x	-4	-2	-2	-1	3	3
y	-2	2	1	0	-2	1

$\{(-4, -2), (-2, 2), (-2, 1), (-1, 0), (3, -2), (3, 1)\}$ D: $\{-4, -2, -1, 3\}$
R: $\{-2, 0, 1, 2\}$; not a function



It is a function.

- 9.** Yes; the domain is $\{3, 4, 5, 6, 7\}$, which is only 5 values. The range contains 6 values, so at least one domain value must be paired with more than one range value. The relation is not a function.

11. Both a graph and a table show that a relation is a function because you can see whether any of inputs have more than one output.

13. D: $\{5, 8, 10, 12, 14\}$; R: $\{3, 6, 11\}$;

The relation is a function because each input maps to exactly one

output. **15.** domain: all positive real numbers, range: 565 **17.** domain:

whole numbers; range: whole numbers between 0 and 2,000 **19.** function; not

one-to-one **21.** not a function

23. all whole numbers between 10 and 20, inclusive **25.** Answers may vary.

Sample: (A, half frown), (B, open oval), (C, smile), (D, horizontal line), (F, frown)

	Yes	No
a. Pilar scored 85 and studied for 8 h.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
b. Naida scored 97 and studied for 9 h.	<input checked="" type="checkbox"/>	<input type="checkbox"/>
c. Alex scored 77 and studied for 4.5 h.	<input checked="" type="checkbox"/>	<input type="checkbox"/>
d. Damian scored 80 and studied for 7.5 h.	<input checked="" type="checkbox"/>	<input type="checkbox"/>
e. Dylan scored 90 and studied for 6 h.	<input type="checkbox"/>	<input checked="" type="checkbox"/>

29. Part A

Time (hours)	Cost (\$)
1	10
3	30
11	100
20	100

Part B Yes; cost is a function of time because each time value maps to one and only one cost. **Part C** No; time is not a function of cost because the cost value 100 maps to more than one time value.



Selected Answers

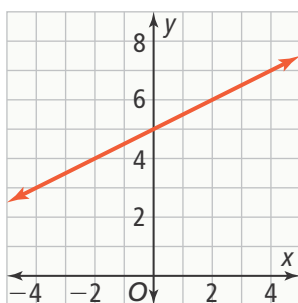
Topic 3

Lesson 3-2

1. It is a function, has a graph that is or falls along a straight line, and can be written in the form $y = mx + b$, where m and b are constants.

3. Answers may vary. Sample: A linear function can be represented by words, rules, tables, or graphs. A linear equation is a first-order equation involving two variables. **5.** $f(2) = 5$; $f(6) = 21$

7.



9. a. $y = \frac{1}{3}x + \frac{7}{3}$ **b.** $\frac{1}{3}$

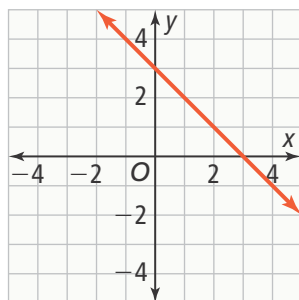
11. a. \$8; $\frac{5}{16}$ lb; $\frac{7}{16}$, $\frac{9}{16}$, $\frac{11}{16}$, and $\frac{13}{16}$

b. $\$8 \times \frac{5}{16} \text{ lb} = \2.50 ; No, the cost of the container does not vary. Answers may vary. Sample: Whether the total weight is 7, 9, 11, or 13 ounces, the charge for the 5-oz container is always $\$8 \times \frac{5}{16} \text{ lb} = \2.50 . **13.** $f(5) = 21$

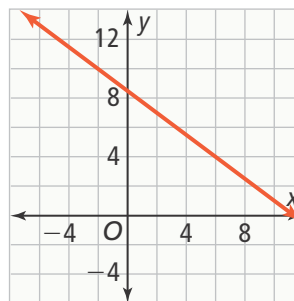
15. $f(5) = 20$ **17.** $f(5) = -9$

19. $y = 5x - 1$ **21.** $y = -\frac{3}{2}x - 1$

23.

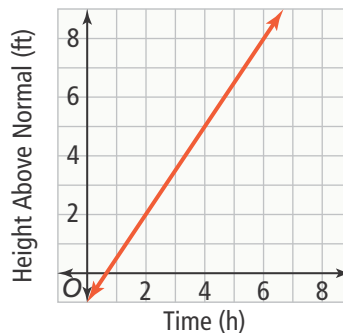


25.



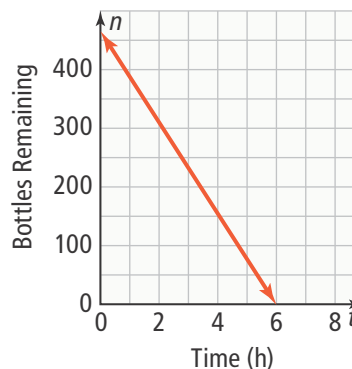
27. D: $\{-2, -1.5, -1, -0.5, 0, 0.5, 1, 1.5\}$
R: $\{-1.5, -1, -0.5, 0, 0.5, 1, 1.5, 2\}$.

29. a. $f(t) = -1 + 1.5t$



b. No. The highest level, after 5 h, is $f(5) = -1 + 1.5(5) = 6.5$ ft.

31. a. D: $\{t \mid 0 \leq t \leq 5.96\}$,
R: $\{n \mid 0 \leq n \leq 465\}$



b. They would run out of water at about 3:58 p.m. because the bottles run out about 5.96 hr after 10 a.m. They sell 78 bottles per hour, and the snack bar is open for 7.5 hours, so they should have at least $78(7.5) = 585$ water bottles at the start of the next business day. **33.** E.



Selected Answers

Topic 3

Lesson 3-3

1. Identifying the transformations of a linear function helps you determine how much to shift the graph of the line horizontally or vertically and whether the slope and y -intercept of the graph will change.

3. When a number is added to the equation $y = f(x)$, the line is shifted vertically, but when a number is added to x , the line is shifted horizontally.

5. shifted 3 units to the left **7.** The slope and y -intercept are scaled by a factor of 4. **9.** The graph is shifted up 75 units. **11.** Translations do not change the slope of the line, so the original line and the translated line are always parallel. **13.** $h(x) = 2x - 6$; $h(x)$ is equal to $f(4x - 6)$. **15.** shifted up 8 units **17.** shifted left 10 units

19. horizontal stretch by a factor of 0.1 **21.** horizontal compression by a factor of 2 **23.** slope and y -intercept scaled by a factor of 3 **25.** slope and y -intercept scaled by a factor of $\frac{1}{6}$ **27.** slope is the same, y -intercept is shifted down 3 units **29.** $k = 3$; vertical translation up **31. a.** $f(x) = 40x + 100$; $g(x) = 80x + 100$ **b.** The slope of g is twice the slope of f , and the y -intercept of g is the same as the y -intercept of f . **33. a.** downward shift **b.** shift to the right **c.** positive slope and y -intercept scaled by a factor of k **d.** positive slope **35.** B

Lesson 3-4

1. An arithmetic sequence is a linear pattern. The graph of an arithmetic sequence is a series of points that lie along a line that can be described by a linear function. **3.** Answers may vary.

Sample: A recursive formula is good to use if you want to describe the pattern of a sequence or if you want to find the next term in a sequence and you know the previous term. **5.** yes

7. $a_n = a_{n-1} + 4$ and $a_1 = 81$

9. $a_n = 5n$; \$55 **11.** Answers may vary.

Sample: The domain of an arithmetic sequence is natural numbers. The domain of a linear function is all real numbers. **13.** Explicit formula, you can use the explicit formula to find the value of the term based on the term number. To use the explicit formula, you would need only to substitute 500 for n . If you used a recursive formula to find the value of the term a_{500} when only knowing a_1 , then you would have to add the common difference 499 times; Yes, if you knew a_{499} , then all you need to do to find a_{500} using a recursive formula is substitute for the value of a_{499} . **15.** No; Answers may vary. Sample: Term numbers are positive integers. Because 2.5 is not a positive integer, it is not a term number in an arithmetic sequence.

Substituting this value into an explicit formula will not give you a term in the sequence. **17.** yes; 14 **19.** no

21. no **23.** yes; -7 **25.** $a_n = a_{n-1} + 7$ and $a_1 = 12$; $a_n = 5 + 7n$



Selected Answers

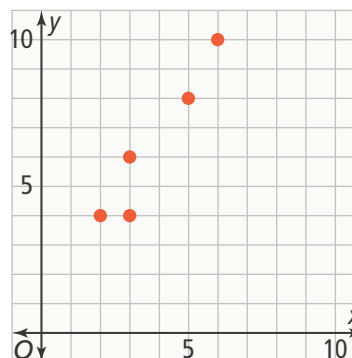
Topic 3

- 27.** $a_n = a_{n-1} - 5$ and $a_1 = 62$;
 $a_n = 67 - 5n$ **29.** $a_n = a_{n-1} - 4$ and
 $a_2 = 12$; $a_n = 20 - 4n$
31. $a_n = -7 + 15n$ **33.** $a_n = 1 - 2n$
35. $a_n = 11 + n$
37. $a_n = a_{n-1} + 8$; $a_1 = 18$
39. $a_n = a_{n-1} + 12$; $a_1 = -17$
41. $a_n = a_{n-1} - 3$; $a_1 = \frac{1}{2}$
43. $a_n = -6 + 7n$; the 50th white key
from the left **45.** 5,500; the level
completed; $a_n = 2,250 + 3,250n$;
 $a_n = a_{n-1} + 3,250$ and $a_1 = 5,500$ **47.** C

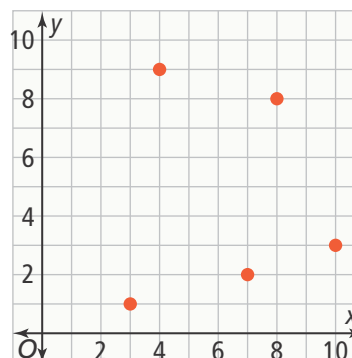
Lesson 3-5

- 1.** A scatter plot helps to show if there is a relationship between the two data variables. **3.** y -values increase **5.** Select two points on the trend line. Use these two points to find the slope of the line. Then use point-slope formula with one of the points on the trend line and the slope to find an equation for the trend line. **7.** negative **9.** No; you need to select two points that lie on the trend line. These points may or may not be given data points. **11.** Although y is increasing, x is decreasing, so the data show negative correlation. **13.** Answers may vary. Sample: A data set where, as x -values increase, y -values stay constant. While these data would show neither a positive nor negative association, a constant trend line would be valid. **15.** negative

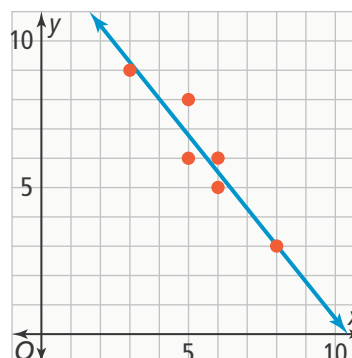
17. positive correlation



19. no association



21. $y = -1.25x + 13$



- 23.** Positive; because the height of a plant increases as the number of days since germination increases, the data would show positive association.



Selected Answers

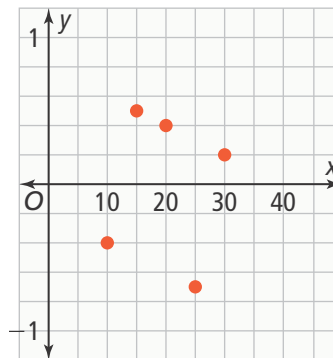
Topic 3

25. Answers may vary. Sample: $y = 0.2x + 0.5$; the increase in feet of maximum recommended viewing distance per increase in inch of screen size **27.** B

Lesson 3-6

1. Look at the correlation coefficient to tell how well the line of best fit models the data. **3.** A correlation coefficient of -0.93 is close to -1 , so it indicates strong negative correlation, not weak correlation. Weak correlation is indicated by a correlation coefficient that is close to 0. **5.** $y = 0.39x + 3.1$
7. about 93 customers **9.** The student switched the order of the data. The student should enter x data in L1 and y data in L2. The line of best fit is $y = 3.94x - 6.86$. **11.** Answers may vary. Sample: In general, the slope of a linear model represents the how the two types of data change in relation to one another. The y -intercept of a linear model represents the starting value, or when the independent variable has a value of 0. **13.** Tavon's model is better than Arthur's because the points on Tavon's residual plot are, on average, closer to the origin than the points on Arthur's residual plot.
15. $y = -5.73x + 197.2$; 88.33
17. strong positive correlation
19. weak negative correlation

21. The model is a good fit.



23. No, there will be exceptions.

25. The slope represents the change in trillions of vehicle-miles traveled each year, and the y -intercept represents the trillions of vehicle-miles traveled in 1975; 3.138 trillion vehicle-miles; 3.858 trillion vehicle-miles **27. a.** strong **b.** neither **c.** strong **d.** weak
29. Part A $y = -2.9x + 7465.2$; $r = -0.83$
Part B $y = -6.42x + 14,347.64$; $r = -0.94$ **Part C** The data from 1940–2010 have a stronger correlation than the data from 1940–2010; Answers may vary. Sample: The correlation coefficient of the data from 1940–2010 is closer to -1 than the correlation coefficient of the data from 1940–1980, so the data from 1940–2010 have a stronger linear relationship than the data from 1940–1980.

Topic Review

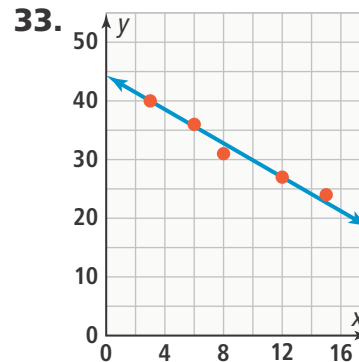
1. Check students' work. See *Teacher's Edition* for details. **3.** residual



Selected Answers

Topic 3

5. line of best fit **7.** domain: $\{0, 2, 4, 5\}$; range: $\{1, 3, 4\}$; The relation is a function because each input has only one output. **9.** All real numbers would not be a reasonable domain because the number of drinks cannot be negative. **11.** The domain should be between zero and a reasonable altitude. **13.** $\{-9, -5, -1, 3, 7\}$
15. The page rate is \$75 per page; Her setup fee is \$35. **17.** It shifts it down 2 units. **19.** The graph of f is translated 3 units to the right. **21.** Each value doubles. **23.** No; $48 - 45 = 3$ and $45 - 41 = 4$, so there is not a common difference. **25.** $a_1 = 2$; $a_n = a_{n-1} + 4$
27. $a_n = 8 + 5(n - 1)$ or $a_n = 5n + 3$; 78 **29.** no association **31.** The line of best fit should be positioned so that the average distance from the data points to the line is as minimal as possible.



Answers may vary. Sample:

$$y = -\frac{13}{9}x + 44\frac{1}{3} \quad \mathbf{35.} \quad y = 1.8x - 27.2; 17.8$$

37. Interpolation and extrapolation are both methods of making predictions about values in a data set. However, interpolation makes a prediction within the known data set while extrapolation makes a prediction outside the known data set.

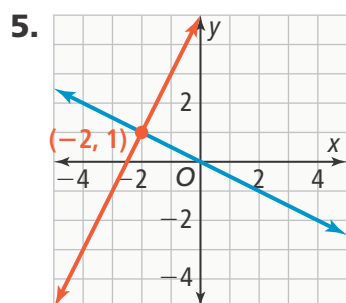


Selected Answers

Topic 4

Lesson 4-1

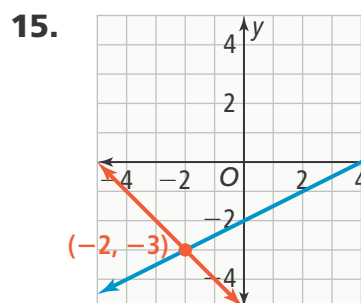
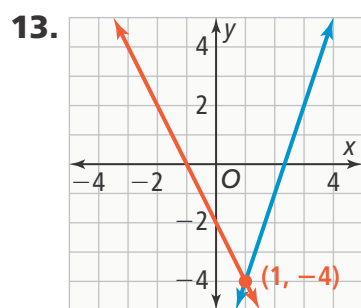
1. Graph the two linear equations, and wherever the graphs intersect is the solution of the system. **3.** The point of intersection lies on both lines, so the x - and y -coordinate of the point satisfy both equations in the system.



7. 1 gallon; Brand B paint and a grid

9. Answers may vary. Sample: $y = \frac{5}{2}x - 4$

11. The student did not rewrite both equations in the same form before drawing the conclusion that the coefficients were the same. The system has exactly one solution: $(0, 9)$.



17. infinitely many solutions

19. a. 10 weeks b. \$250 each

21. exactly $(0.2, 3.8)$

23. approximately $(-4.615, 7.462)$

25. a. $y = 15 + 32x$

$$y = 35x$$

The solution is $(5, 175)$.

b. The solution means that for 5 jackets, the cost would be \$175 for either company. **c.** Gabriela should buy the jackets from Anastasia's Monograms.

The graph shows that the cost for jackets from Monograms Unlimited overtakes the cost for jackets from Anastasia's Monograms for orders greater than 5 jackets. **27.** two, $(0, 2)$

29. Part A a. $y = \frac{3}{2}x + 1$

$$y = \frac{-9}{2}x + 13$$

b. $y = \frac{3}{2}x + 1$

$$y = \frac{-1}{2}x - 3$$

c. $y = \frac{-1}{2}x - 3$

$$y = \frac{-9}{2}x + 13$$

Part B Answers may vary. Sample: $(2, 4)$, $(-2, -2)$, and $(3, -2)$

Part C The system $y = \frac{3}{2}x + 1$

$$y = -6x + 16$$

produces the solution $(2, 4)$.

$$\text{The system } y = \frac{3}{2}x + 1$$

$$y = -2$$

produces the solution $(-2, -2)$.

$$\text{The system } y = -2$$

$$y = -6x + 16$$

produces the solution $(3, -2)$.

Selected Answers

Topic 4

Lesson 4-2

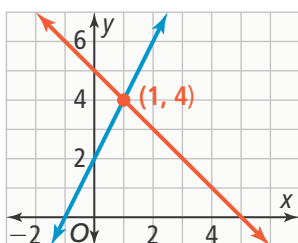
1. Solve one equation for one of the variables. Substitute the expression for that variable into the other equation and solve for the first variable. Then substitute that value into either equation to solve for the second variable. **3.** Only the points on the line are solutions to the system. Points not on the line are not solutions. **5.** (2, 4) **7.** (-4, 5)

9. $x + y = 70$

$$65x + 15y = 2,400$$

43 Limited Edition and 27 Pro NSL soccer balls were sold. **11.** The slopes are equal, but the y -intercepts are not equal. **13.** If the constants are the same, the lines must be the same, so there is an infinite number of solutions. If the constants are different, there are two lines, which means the lines are parallel. **15.** 28° and 62° **17.** (7, 10) **19.** (2, -3) **21.** (2, 2)

23.



25. Answers may vary. Sample: graphing, because the solution has a precise answer **27.** infinitely many solutions **29.** infinitely many solutions **31.** Richard is 22 and Teo is 9. **33.** They scored eight 3-point shots and thirteen 2-point shots.

35. Site A: 376
Site B: 324

37. A

Lesson 4-3

1. Because the Addition Property of Equality says that if you add the same quantity to each side of an equation, then the result is an equivalent equation. **3.** If the two systems can be multiplied by different constants to become the same system, the two systems are equivalent. **5.** (-2, -3) **7.** (-3, -1) **9.** 37 small prints and 15 large prints **11.** In a system with no solution, the values of A and B are the same when none of the numbers in an equation have a common factor. The value of C cannot be the same in both equations. In a system with infinitely many solutions, the values of A , B , and C will be the same when none of the numbers in an equation have a common factor.

13. The student forgot to multiply the right side of the equation by -1 .

The correct answer is

$$2x - y = -1$$

$$-1(x - y) = (-1) \cdot (-4)$$

$$2x - y = -1$$

$$\underline{-x + y = 4}$$

$$x = 3$$

$$2(3) - y = -1$$

$$6 - y = -1$$

$$-y = -7$$

$$y = 7$$

The solution is (3, 7).



Selected Answers

Topic 4

15. $(3, -1)$ **17.** $(4, -2)$ **19.** $(-4, -4)$
21. $(-5, -2)$ **23.** No; there is no number $3x - 9y = 5$ can be multiplied by to equal $6x - 9y = 10$. **25.** Yes; $10x + 6y = 38$ is equivalent to two times $5x + 3y = 19$, and $10x + 20y = 100$ is equivalent to five times $2x + 4y = 20$.

27. Let $x =$ cost of a hat
 Let $y =$ cost of a shirt
 $8x + 3y = 65$
 $2x + 2y = 30$
 Cost of a hat: \$4
 Cost of a T-shirt: \$11

29. Substitution; Substitute $y - 4$ for x in the first equation and solve; $(3, 7)$

31. Elimination; Multiply the first equation by 4 and the second equation by 3. Then add equations to eliminate the y -terms; $(4, -2)$

33. a. Graphing is most efficient if the equations in the system are in slope-intercept form or if there is an integer y -intercept. If the lines intersect, graphing is best when both coordinates of the solution are integers.

b. Substitution is most efficient when one equation or both equations has been solved for either x or y . Substitution is a more efficient method when the solution has rational numbers. **c.** Elimination is most efficient when either the coefficients of the x -terms or y -terms in the equations are opposites and can easily be eliminated. Elimination is also the best method when all variables have a coefficient. Elimination is also more efficient when the solution has rational numbers.

35. 5 **37.** 3, -2

39. Part A Concessions Unlimited:

$$4x + 3y = 12.5$$

$$2x + 5y = 15$$

Snacks To Go:

$$3x + 3y = 10.5$$

$$4x + 2y = 10$$

Part B $(1.25, 2.5), (1.5, 2)$; the solutions represent the costs per granola bar and per drink for each concession stand.

Part C Answers may vary. Sample: Granola bars cost \$1 and drinks cost \$1.50; For one granola bar and one drink, the equation would be $x + y = 2.5$. For one granola bar and two drinks, the equation would be $x + 2y = 4$. So a system of equations would be as follows:

$$x + y = 2.5$$

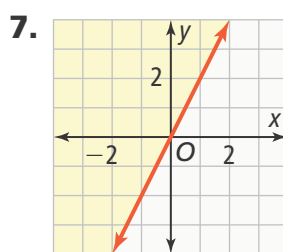
$$x + 2y = 4$$

Part D The solution represents the number of granola bars and drinks that should be purchased so the overall cost is the same at both stands.

Lesson 4-4

1. The shaded region and any point on the graph line, if it is solid, contain all possible solutions to the inequality.

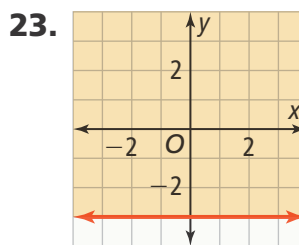
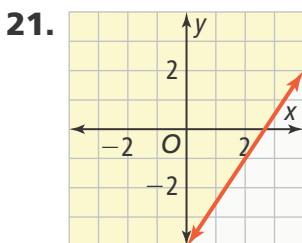
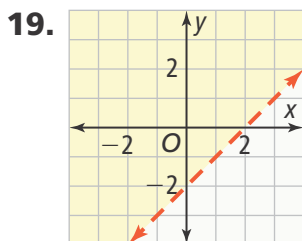
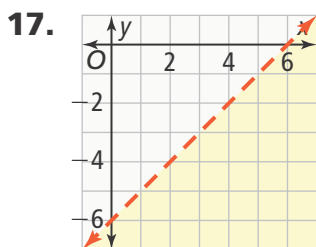
3. an ordered pair (x, y) **5.** no



Selected Answers

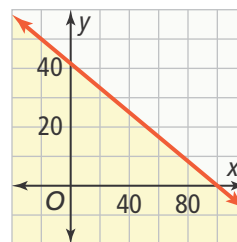
Topic 4

9. $y \leq -x + 2$ **11.** The student thought that $1 \leq 1$ was not a true statement. The statement is true because the symbol is greater than or equal to, and 1 is equal to 1. So, (1, 1) is a solution of the inequality. **13.** Answers may vary. Sample: $y \geq \frac{4}{5}x + \frac{23}{5}$ **15.** When an inequality is solved for y , the border line is determined by the equation that is formed by substituting an equal sign for the inequality sign. Then, use the inequality symbol to determine whether y -values should be greater than the border line or less than the border line. y -values greater than the border line are found above the line and y -values less than the border line are found below the line.

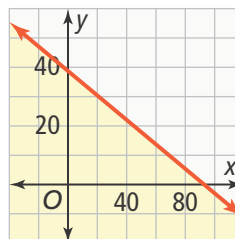


25. $y < \frac{1}{3}x + 2$ **27.** $y \geq -\frac{1}{4}x + 4$

29. a. $25x + 60y \leq 2,500$;



b. $25x + 60y \leq 2,320$;



c. The graph from part (b) is the graph from part (a) shifted down by 3. The y -intercept shifts from $41\frac{2}{3}$ to $38\frac{2}{3}$. Also, the x -intercept shifts from 100 to 92.8. There are fewer possible solutions in the first quadrant when the mover rides than when the mover does not ride.



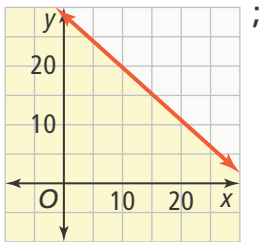
Selected Answers

Topic 4

31. yes; yes; no; yes

33. **Part A** $3.6x + 4y \leq 115$

Part B



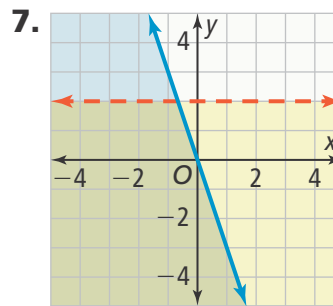
As the number of photos stored increases, the number of songs that can be stored decreases.

Part C No; although you could consider adding negative photos or songs as deleting a photo or song, the graph would not provide a good model of this because it allows only deleting or adding for each type of item. The graph does not include the possibility of deleting some photos and then adding additional photos or deleting some songs and then adding additional songs.

Lesson 4-5

1. The overlapping shaded region contains all possible solutions to the system of inequalities. 3. at least 2

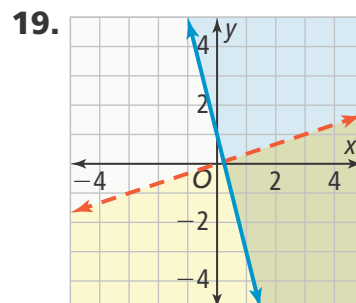
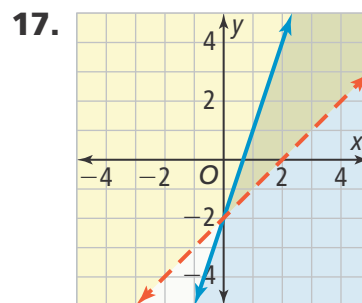
5. $y = -3x + 4$ and $y = 8x + 1$



9. $y < 4$
 $x > -2$

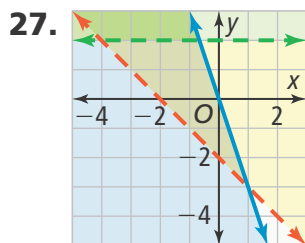
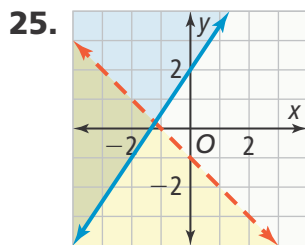
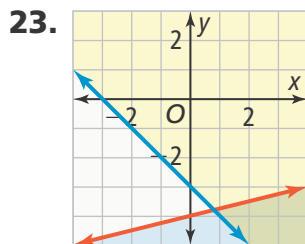
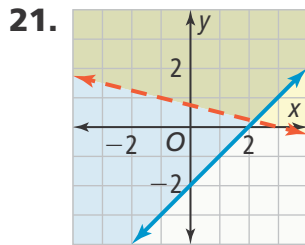
11. The student used the wrong inequality symbol in writing the second inequality. Instead of $y < -2x + 2$, it should be $y > -2x + 2$. 13. $x \geq 0$ and $y \geq 0$; Answers may vary. Sample: These inequalities indicate that all values of x and y must be 0 or positive; thus, they limit the solutions to the first quadrant.

15. Yes; Answers may vary. Sample: $y \geq 1$, $y \leq 3$, $x \geq 1$, $x \leq 3$



Selected Answers

Topic 4



29. $y \geq -\frac{1}{4}x - 2$
 $y < 2x + 4$

31. $y \leq -x + 4$
 $y \geq 4x - 9$
 $x < 2$

33. $x + y \leq 80$ and $10x + 15y \geq 1,000$;
 0 hours babysitting and $66\frac{2}{3}$ hours
 providing tech support



35. Neither graph is correct. The boundary lines for both inequalities in the system have positive slopes, but both graphs show one boundary line with a negative slope. **37. C**

Topic Review

1. Check students' work. See *Teacher's Edition* for details. **3.** linear inequality in two variables **5.** solution of a linear inequality in two variables

7. $(-2.5, 0.4)$ **9.** A+ Food:

$y = 35x + 75$, Super Cater: $y = 38x$;

The solution is $(25, 950)$. This indicates that it costs \$950 to buy 25 gift baskets from both companies.

Kiyo should use A+ Food if she

expects 28 guests. **11.** $(\frac{11}{4}, \frac{5}{2})$

13. approximately $(3.355, 0.388)$

15. infinitely many solutions **17.** 152 boxed action figures, 94 collector pins

19. $(\frac{18}{23}, -\frac{17}{23})$ **21.** No; there is no

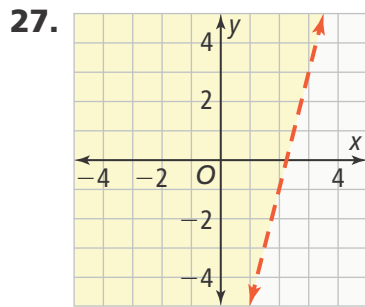
number you could multiply $3x - 4y = -6$ by to get $6x - 8y = 12$.

23. pens = \$3.95/pack,
 paper = \$4.95/pack **25.** no

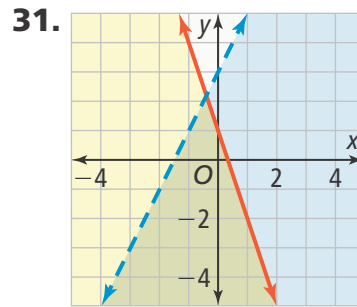


Selected Answers

Topic 4



29. Answers may vary. Sample:
 $y < x + 4$



33. $x \geq 0, y \geq 0$

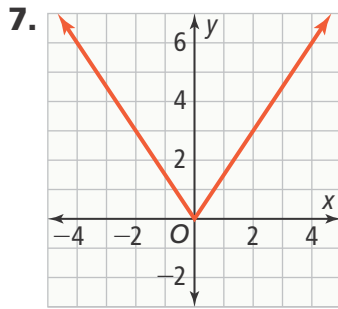
Selected Answers

Topic 5

Lesson 5-1

1. The absolute value function is the function $f(x) = |x|$. Its graph is V-shaped and symmetric about a vertical line of symmetry (the y -axis) containing the vertex (the origin). **3.** Answers may vary. Sample: $(-1, 16)$; $a = 16$

5. Domain: all real numbers;
Range: $y \geq 0$



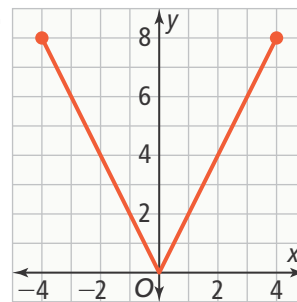
9. $m = 0.6$

11. Answers may vary. Sample:

- Both have linear sections.
- Both have a domain of all real numbers.
- Both have the same values when $x \geq 0$.
- The graph of $f(x) = |x|$ is symmetric about the y -axis, but the graph of $f(x) = x$ is not.
- The graphs have opposite values when $x < 0$.
- The range of $f(x) = |x|$ is $y \geq 0$, but the range of $f(x) = x$ is all real numbers.
- Both have an x -intercept and y -intercept at the origin.
- When $x < 0$ the graph of $f(x) = |x|$ is decreasing, but the graph of $f(x) = x$ is increasing.

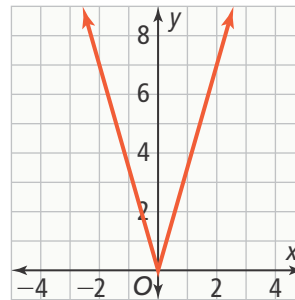
13. -1 and 1 , because the slopes of the two sides of the graph of $g(x) = a|x|$ are $-a$ and a . The product of the slopes must be -1 if there is a right angle at the vertex, so $-a^2 = -1$, so $a = -1$ or $a = 1$.

15. a.



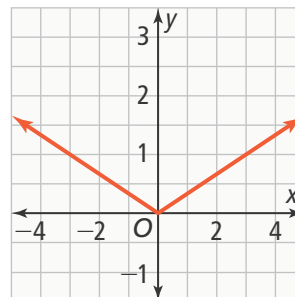
b. 2 c. The rate of change is equal to the coefficient of the absolute value term. **17.** no **19.** no **21.** no

23.



Domain: all real numbers;
Range: $y \geq 0$

25.



Domain: all real numbers;
Range: $y \geq 0$



Selected Answers

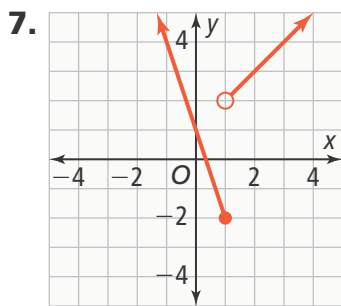
Topic 5

27. $\frac{4}{3}$ ft/s 29. $g(x) = 3|x|$ 31. through A and B: $f(x) = \frac{1}{4}|x|$; through C and D: $g(x) = \frac{3}{2}|x|$ 33. 18 ft 35. D

Lesson 5-2

1. The pieces of a piecewise-defined function are assigned to intervals of the domain with each interval having a different function rule. 3. The value -3 is included in both intervals.

$$5. f(x) = \begin{cases} 5x, & x \geq 0 \\ -5x, & x < 0 \end{cases}$$



$$9. f(x) = \begin{cases} -0.5x + 1, & x < 1 \\ x, & x \geq 1 \end{cases}$$

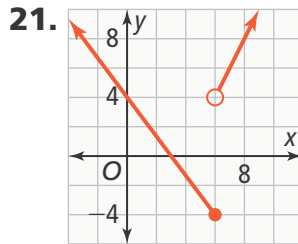
11. Answers may vary. Sample: The intervals that are the domains of the pieces make up the entire domain of the piecewise-defined function with no

overlap. 13. $f(x) = \begin{cases} \frac{1}{2}x + \frac{7}{2}, & x < 1; \\ -2x + 6, & x \geq 1 \end{cases}$

The x -intercepts are -7 and 3 , and the y -intercept is $\frac{7}{2}$. 15. a. The y -intercept is included in the piece of the function that crosses the y -axis, which would be the piece for $x \leq 1$. So, find the y -intercept for the function rule for that piece. b. Identify the piece where $x = 0$ and find the y -intercept of the function rule for that piece.

$$17. f(x) = \begin{cases} x, & x < 0 \\ -x, & x \geq 0 \end{cases}$$

$$19. f(x) = \begin{cases} 1.5x, & x < 0 \\ -1.5x, & x \geq 0 \end{cases}$$



increasing: $x > 6$; decreasing: $x \leq 6$

23. Yes; if she sends 200 messages it will cost \$16.00 and if she sends 201 messages it will cost \$12.06.

$$25. f(x) = \begin{cases} \frac{1}{5}x - \frac{7}{5}, & x \leq 2 \\ \frac{1}{2}x + 1, & x > 2 \end{cases}$$

$$27. \text{ a. } f(x) = \begin{cases} 70x + 122, & x \leq 5 \\ 82x + 62, & x > 5 \end{cases}$$

b. $f(8) = 718$ c. $f(8) - 122$ represents the amount of money Reagan has deposited in his savings account from his summer job for the first eight weeks. 29. all real numbers; all real numbers; three; 4

31. Part A Vic charges $9.5(10) = \$95$. Sue charges $15 + 9(10) = \$105$.

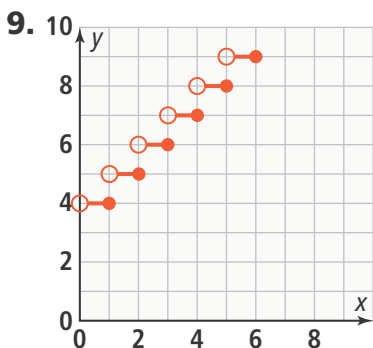
Part B Sue: 10; Vic: 9.622; Over the given interval, Sue's average babysitting rate is \$10 per hour and Vic's average rate is about \$9.63 per hour.

Lesson 5-3

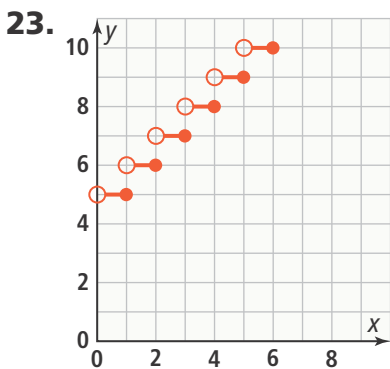
1. Step functions are piecewise-defined functions that have graphs with an infinite number of pieces consisting of horizontal line segments. 3. The values 10 and 20 are each included in two intervals. 5. 6 7. 9

Selected Answers

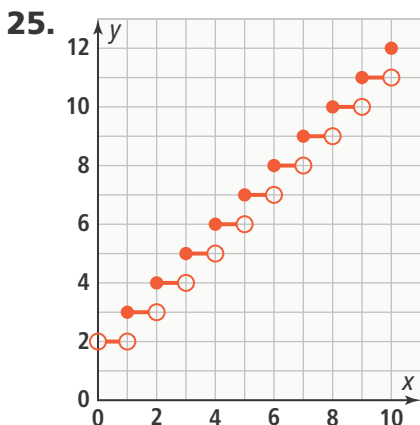
Topic 5



11. The x -values of the pieces of a step function make up the domain; this is because every element in the domain has to be in one of the pieces. **13.** Answers may vary. Sample: At $x = 1$, there is a closed point at $(1, 3)$ and an open point at $(1, 4)$, so you have to determine that the value of the function at $x = 1$ is 3. When finding the value at $x = 1$ on a line, there is only one point to consider at $x = 1$. **15.** 1 **17.** -5 **19.** 7 **21.** 23



$f(x) = \text{ceiling}(x) + 4$



27. a. $f(x) = \begin{cases} 1, & 0 < x \leq 50 \\ 2, & 50 < x \leq 100 \\ 3, & 100 < x \leq 150 \\ 4, & 150 < x \leq 200 \\ 5, & 200 < x \leq 240 \end{cases}$

b. Answers may vary. Sample: You need to assume that there are no other people going on this trip by taking buses other than seniors.
c. 0.05; 0 **d.** The rate of change 0.05 between 40 and 60 students tells you that the number of buses will change for somewhere between 40 and 60 students. The rate of change 0 tells you that the number of buses does not change when the number of students changes from 60 to 80.

29. a. $f(x) = -50x + 350$;

$f(x) = \begin{cases} 350, & x = 0 \\ 300, & 0 < x \leq 1 \\ 250, & 1 < x \leq 2 \\ 200, & 2 < x \leq 3 \\ 150, & 3 < x \leq 4 \\ 100, & 4 < x \leq 5 \\ 50, & 5 < x \leq 6 \\ 0, & 6 < x \leq 7 \end{cases}$

b. The first graph and function represent the situation as if money was being withdrawn constantly from Mia's account. The second graph and function represent money being withdrawn once each week. **c.** The first function is easier to use for solving equations. The second function more accurately represents the situation.

31. D



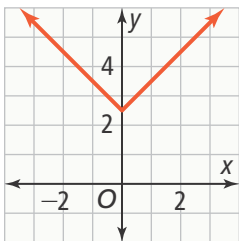
Selected Answers

Topic 5

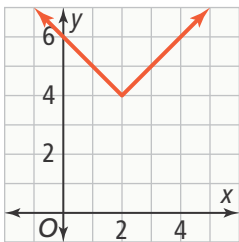
Lesson 5-4

1. Answers may vary. Sample: The values of the constants affect the graphs of piecewise-defined functions in the same way they affect the graphs of linear functions. **3.** No; $f(x) = |4x - 1| = \left|4\left(x - \frac{1}{4}\right)\right| = 4\left|x - \frac{1}{4}\right| \neq 4|x - 1|$

5. (0, 2.5)



7. (2, 4)



9. $f(x) = \frac{1}{2}|x - 2| - 1$

11. a. $f(x) = -2(x + 1) - 7$

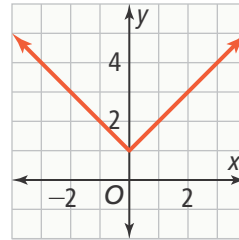
b. $f(x) = a(x - h) + k$ and

$f(x) = -a(x - h) + k$

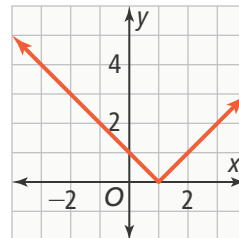
13. The student did not describe the reflection across the x-axis, incorrectly translated the vertex to the right instead of to the left, and implied that only one point was translated. The graph of $y = -0.5|x + 1| + 3$ compresses the graph of $y = |x|$, reflects the graph across the x-axis, and translates the graph left 1 unit and up 3 units.

15. The graph of $Y_2 = \text{INT}(x) - 2$ is a translation 3 units down of the graph of $Y_1 = \text{INT}(x) + 1$.

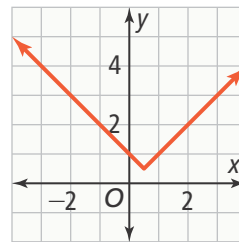
17. (0, 1)



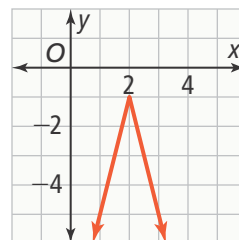
19. (1, 0)



21. (0.5, 0.5)



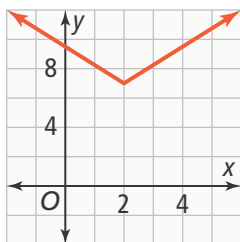
23. The graph of g is a vertical stretch of the graph of f by a factor of 4 that is then reflected across the x-axis and translated 2 units right and 1 unit down.



Selected Answers

Topic 5

25. The graph of g is a vertical stretch of the graph of f by a factor of $\frac{5}{4}$ that is then translated right 2 units and up 7 units.



27. $f(x) = -0.5|x - 4| - 5$

29. $g(x) = |x + 2| - 2$ **31.** $g(x) = -3|x|$

33. $f(x) = -\frac{4.9}{3.85}|x - 3.85| + 4.9$;

D: $0 \leq x \leq 7.7$ **35.** absolute value; -7 ;

-15 ; $(-15, -7)$; -22 ; 0 **37. Part A** If

there are 2 of your opponent's ships on the same horizontal line, you can use the vertical line halfway between them as the axis of symmetry for an absolute value function that passes through both ships. **Part B** Answers may vary. Sample:

$y = |x - 60| + 10$; $y = -|x - 40| + 90$;

$y = 2|x - 50|$; The red ship at $(10, 60)$ is

captured by $y = -|x - 40| + 90$ because

$-|10 - 40| + 90 = -|-30| + 90 = 60$;

The red ship at $(30, 40)$ is captured by

$y = |x - 60| + 10$ because

$|30 - 60| + 10 = |-30| + 10 = 40$;

The red ship at $(60, 70)$ is captured by

$y = -|x - 40| + 90$ because

$-|60 - 40| + 90 = -|20| + 90 = 70$;

The red ship at $(90, 40)$ is captured by

$y = |x - 60| + 10$ because

$|90 - 60| + 10 = |30| + 10 = 40$.

Part C Answers may vary. Sample: Yes;

$y = |x - 60| + 10$ captures the red ship

at $(30, 40)$ and the red ship at $(90, 40)$,

but the red ship at $(30, 40)$ is also

captured by $y = 2|x - 50|$ and the red

ship at $(90, 40)$ is also captured by

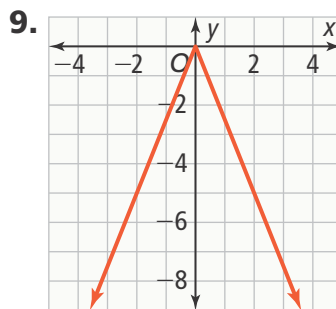
$y = -|x - 40| + 90$.

Topic Review

1. Check students' work. See *Teacher's Edition* for details. **3.** ceiling function

5. piecewise-defined function

7. yes; $(5, 5)$



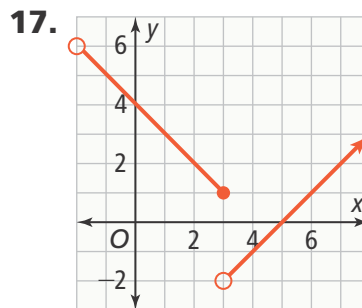
Domain: all real numbers;

Range: $y \leq 0$

11. $(0, 0)$; maximum **13.** Domain: all real numbers; Range: $y \leq 3$;

Vertex: $(0, 3)$

15. $f(x) = \begin{cases} -2x, & x \geq 0 \\ 2x, & x < 0 \end{cases}$



19. $f(x) = \begin{cases} \frac{5}{3}x + 5, & x < 0 \\ -\frac{3}{4}x + 3, & x \leq 0 \end{cases}$

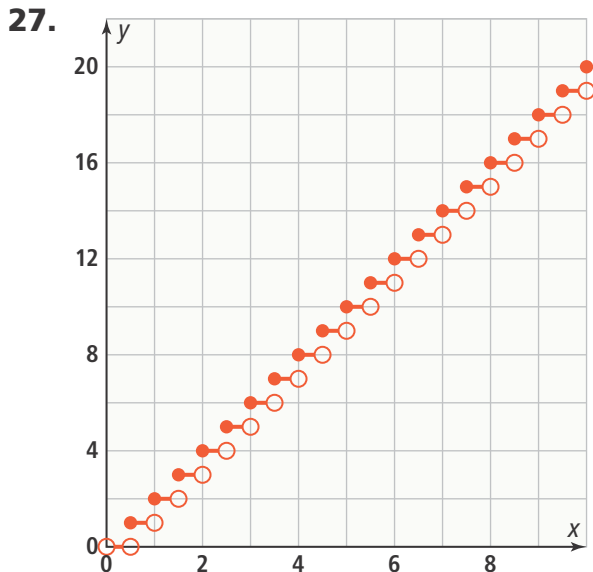
21. 8 **23.** 6

25.  ; $f(x) = [x] + 5$



Selected Answers

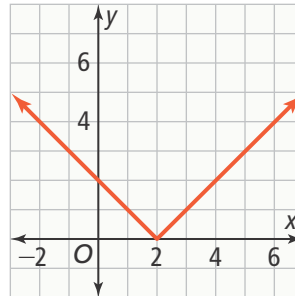
Topic 5



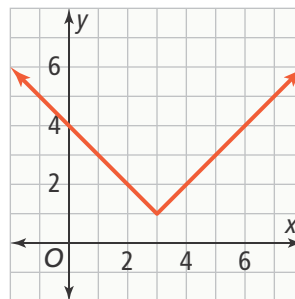
29. $f(x) = \begin{cases} 1, & 0 < x \leq 12 \\ 2, & 12 < x \leq 24 \\ 3, & 24 < x \leq 36 \\ 4, & 36 < x \leq 48 \\ 5, & 48 < x \leq 60 \\ 6, & 60 < x \leq 72 \end{cases}$

This function is like a ceiling function because you have to round up to the nearest full dozen eggs to get the number of cartons needed.

31. $(2, 0)$



33. $(3, 1)$



- 35.** The graph of g is a reflection across the x -axis of the graph of f and translated 2 units right and 1 unit down. **37.** The graph of g is a vertical stretch of the graph of f by a factor of $\frac{3}{2}$ and translated 1 unit right and 8 units down. **39.** $g(x) = 3|x - 4| + 3$
41. $f(x) = |x - 5| + 4$
43. $y = -3|x - 6| + 18$; The domain is $0 \leq x \leq 12$ because the graph is in the first quadrant.



Selected Answers

Topic 6

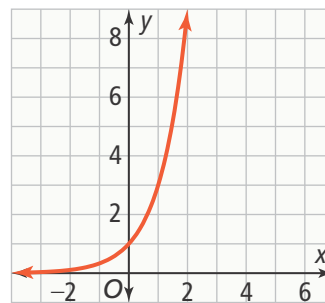
Lesson 6-1

1. The properties of rational exponents are the Power of a Power, Power of a Product, Product of Powers, and Quotient of Powers Properties. These properties can be used to simplify expressions and solve problems involving a power raised to a power, a product raised to a power, or a product or quotient of the same base raised to powers. **3.** $x = y$ **5.** When simplifying expressions, it is easier if the expression is written with rational exponents instead of radicals so that the properties of rational exponents can be applied. **7.** $7^{\frac{1}{2}}$ **9.** $6^{\frac{4}{3}}$ **11.** 2
13. $x = 6$ **15.** $x = 2$ **17.** $x = -3$
19. $\sqrt[3]{2,500}$, $2,500^{\frac{1}{3}}$ **21.** The student did not distribute 3 in $(2^3)^x + 3$ across $x + 3$. The correct solution is $x = -14$.
23. a. Answers may vary. Sample: $a^0 \cdot a^1 = a^{0+1} = a^1 = a$. Since $a^0 \cdot a = a$, the value of a^0 is 1 by the Identity Property of Multiplication.
b. If you are adding two rational exponents when applying the Product of Powers property and the sum is 0, the value of the power is 1, because $a^0 = 1$ **25.** $3^{\frac{1}{2}}$ **27.** $3^{\frac{2}{5}}$ **29.** $a^{\frac{2}{3}}$
31. $x = \frac{60}{7}$ **33.** no solution **35.** $x = -3$
37. $x = -4$ **39.** $x = 1$ **41.** $x = 2$
43. Power of a Power Property
45. approximately 4.54 in.
47. $(x^{\frac{1}{2}})(72^{\frac{1}{2}}) = 110$; Use Power of a Product Property to simplify equation to $72x = 110^2$; $x = 168.06$;
 $x^{\frac{1}{2}} \cong 12.96$ cm **49.** B

Lesson 6-2

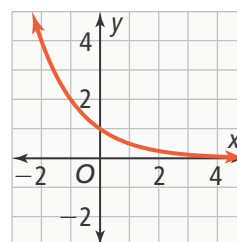
1. An exponential function of the form $f(x) = ab^x$ grows at an increasing rate when $b > 1$ and a decreasing rate when $0 < b < 1$. Exponential functions have an asymptote with equation $y = 0$ if the range is $y > 0$. **3.** Answers may vary. Sample: If $b = 1$, then b^x is always 1, and the function is a horizontal line.

5.



7. $f(x) = 4\left(\frac{1}{2}\right)^x$ **9.** 4 **11.** The student incorrectly multiplied 6 and $\frac{1}{3}$, so the exponent is applied to the product instead of just $\frac{1}{3}$. **13.** No; Answers may vary. Sample: If the base b is greater than 1, then as x increases, b^x increases. In this case, the function increases as x increases. If, however, b is less than 1, then b^x decreases as x increases. In this case, the function decreases as x increases. **15.** y -intercept: 1, domain: all real numbers, range: $y > 0$, asymptote: $y = 0$; The function increases as x increases.

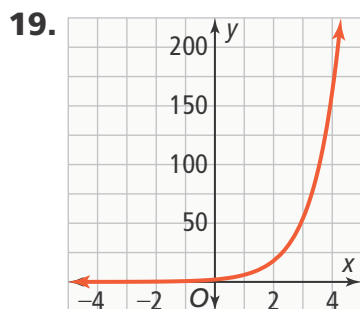
17.





Selected Answers

Topic 6



21. $f(x) = 2(4)^x$ 23. $f(x) = 5(2)^x$

25. exponential; The function decreases by a constant ratio of $\frac{1}{6}$.

27. $f(x) = 7(0.9)^x$; At 10 weeks, the show will have about 2.44 million viewers, so it will be cancelled.

29. 3, $y = 0$, all real numbers, $y > 0$

31. **Part A** Buy new bulbs:

$f(x) = 50x + 6$; Divide existing bulbs:

$f(x) = 6(2)^x$ **Part B** Buy new plants: 506; Divide existing plants: 6,144

Part C Answers may vary. Sample: If the gardener buys new bulbs, there will be 256 plants in 5 years and 756 plants in 15 years. If the gardener divides the bulbs, there will be 192 plants in 5 years and 196,608 plants in 15 years. The number of plants increases very rapidly when existing bulbs are divided, so the gardener may want to revisit the original strategy depending on how many plants are wanted.

Lesson 6-3

1. savings accounts and investments with compounded interest, population growth and decline, the spread of a computer virus or a viral video

3. LaTanya confused growth factor with growth rate. The growth factor is 1.25. The growth rate is 25%.

5. $f(x) = 100(1.05)^x$ 7. $f(x) = 512(0.5)^x$

9. \$29.45 11. $y = 0$; Exponential

growth and decay functions are both modeled with $f(x) = ab^x$. 13. Enter the function on the Y= screen, display the corresponding table, and find the value of x where $y = 15$. 15. $f(x) = 20(1.25)^x$ 17. After 20 years, the investment compounded quarterly will be worth \$668.22 more than the investment compounded annually.

19. $f(x) = 100(0.95)^x$; x is about 10 when $f(x) = 60$

21. $f(x) = 50(0.9)^x$;

the average rate of change over

$1 \leq x \leq 4$ is about -4.065 and the

average rate of change over

$5 \leq x \leq 8$ is about -2.66 . The rate of

change decreases as x increases because it is an exponential decay function.

23. $f(x) = 4(0.5)^x$; decay factor: 0.5

25. $f(x) = 100(0.95)^x$; $g(x) = 20(1.05)^x$;

The functions are equal at about $x = 16$.

27. $f(x) = 500(1.07)^x$; about 45 years;

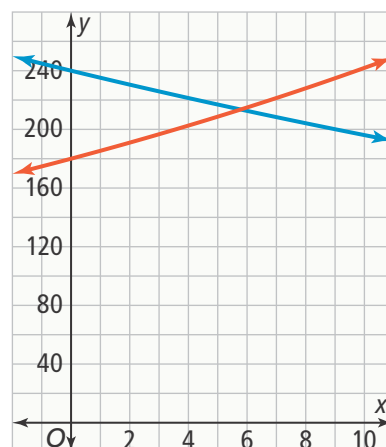
Enter the function in the Y = screen

of a graphing calculator, press 2ND

TABLE, and find the value of x where

$y = 10,000$. 29. $f(x) = 240(0.98)^x$;

$f(x) = 180(1.03)^x$



The number of students in both schools will be about the same in about 6 years. You can find the approximate



Selected Answers

Topic 6

value of x where the graphs of the functions intersect. **31.** D

Lesson 6-4

1. Geometric sequences are exponential functions with a domain of the natural numbers 1, 2, 3, ... instead of the real numbers. **3.** Jamie reversed a_1 and r in the formula. It should be $a_n = 3(1.25)^{n-1}$. **5.** geometric; the common ratio is 0.2. **7.** $a_n = \frac{1}{4}(a_{n-1})$. The initial condition is $a_1 = 640$. **9.** $a_n = 3(a_{n-1})$. The initial condition is $a_1 = 1.25$. **11.** Write the explicit formula $a_n = 3^{n-1}$ or the recursive formula $a_n = 3(a_{n-1})$, $a_1 = 1$. **13.** The student forgot to include the initial condition $a_1 = 210$ in the recursive formula. **15. a.** The n is conventionally used to indicate that the domain of the function is the set of counting or natural numbers 1, 2, 3, ... rather than the real numbers. **b.** While the domain is limited to the natural numbers, the range can include any numbers. The numbers in the sequence are the range of the sequence. **17.** yes; $a_n = 1.5(a_{n-1})$, $a_1 = 8$ **19.** yes; $a_n = 3(a_{n-1})$, $a_1 = \frac{1}{27}$ **21.** no **23.** no **25.** no **27.** $a_n = 10(a_{n-1})$, $a_1 = \frac{1}{5}$ **29.** $a_n = 5(a_{n-1})$, $a_1 = \frac{2}{3}$ **31.** $a_n = 100\left(\frac{4}{5}\right)^{n-1}$ **33.** $a_n = 10\left(\frac{5}{9}\right)^{n-1}$ **35.** $f(n) = 20\left(\frac{3}{4}\right)^{n-1}$ **37.** $f(n) = 4(2)^{n-1}$ **39.** $f(n) = 9\left(\frac{1}{3}\right)^{n-1}$ **41.** $a_n = 20(4)^{n-1}$; $a_n = 4(a_{n-1})$, $a_1 = 20$; Substitute 8 for n in $a_n = 20(4)^{n-1}$: $20(4)^{8-1} = 327,680$; There will be 327,680 shares after 8 hours.

43. $a_n = 3,000,000\left(\frac{1}{3}\right)^{n-1}$; 9 hours
45. D

Lesson 6-5

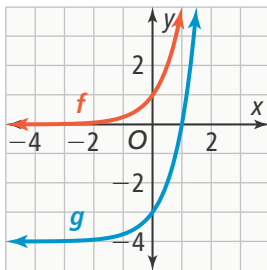
1. When a constant is added to a function, the graph is translated vertically. The graph is translated up if the constant is positive and down if the constant is negative. When a constant is subtracted from the exponent, the graph is translated horizontally. The graph is translated right if the constant is positive and left if the constant is negative. **3.** The graph should be translated up 6 units. **5.** By writing one of the general forms with addition and one with subtraction, the translation is always in the positive direction (up for vertical and right for horizontal) for positive values of k and h , and in the negative direction (down for vertical and left for horizontal) for negative values of k and h . **7.** The graph is translated right 1 unit. **9.** The graph is translated left 1 unit. **11.** The graph is translated left 1 unit. **13.** The graph is translated up 1 unit. **15.** You could identify the number of units the y -intercept of g changes from the y -intercept of f , or you could identify the number of units the asymptote of g changes from the asymptote of f . **17. a.** The graph of g is a translation up 4 units and left 3 units from the graph of f . **b.** The asymptote is affected by only a vertical translation, so it becomes $y = k$. **c.** The domain of the function is the same as the parent function, and the range of the function changes based on the vertical translation. **19.** translation 6 units down **21.** translation 1 unit right **23.** 2



Selected Answers

Topic 6

25.



27. The graph of g is a translation up 3 units from the graph of f :

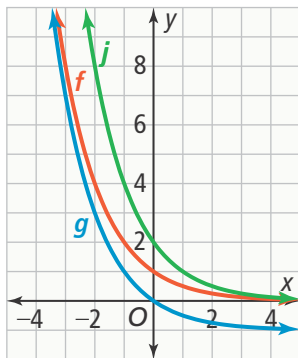
y -intercept: 1; asymptote: $y = 0$;

range: $y > 0$; g : y -intercept: 4;

asymptote: $y = 3$; range: $y > 3$.

29. If h is positive, the graph is a horizontal translation right by h units of the graph of $f(x) = 2^x$. If h is negative, the graph is a horizontal translation left by $|h|$ units of the graph of $f(x) = 2^x$. 31. Enter g in a graphing calculator and examine the table. Note that $g(x - 2) = j(x)$. Therefore, the graph of j is a translation 2 units right of the graph of g . $j(x) = 2^{x-1.5}$.

33. a.



b. y -intercepts: g : 0, j : 2

35. **Part A** The graph will be translated 5 units to the right. **Part B** 15 years; Answers may vary. Sample: If he invests now, it will take 10 years to reach approximately \$1,000. If the graph shifts right 5 units, this same amount will be at $x = 15$. **Part C** The new graph will be a vertical stretch of

the original by a factor of 2. You can look at the new graph to estimate that the value of x at $y = 7,500$ is about $x = 30$. So, it will take about 30 years to reach \$7,500 with an initial investment of \$1,000.

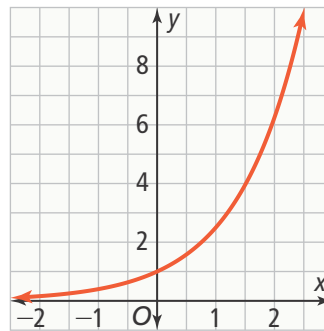
Topic Review

1. Check students' work. See *Teacher's Edition* for details. 3. constant ratio

5. compound interest 7. 8^2 9. $\frac{36}{5}$

11. $\sqrt[3]{64}$, 4

13.



15. $y = 0.5(2)^x$ 17. 6

19. $f(x) = 200(0.85)^x$ 21. \$29,065.89, Annual: \$28,965.96 23. no

25. $a_n = \frac{1}{5}(2)^{n-1}$

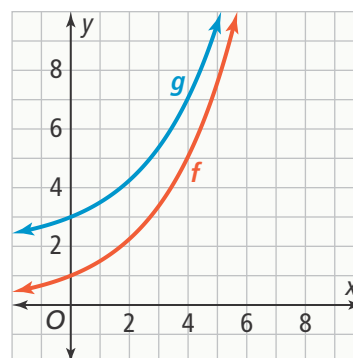
$$a_n = 2(a_{n-1}), a_1 = \frac{1}{5}$$

27. $a_n = 3.5(a_{n-1}), a_1 = 6$

29. translated down 5 units

31. translated right 2 units

33.





Selected Answers

Topic 7

Lesson 7-1

1. Adding and subtracting polynomials is similar to adding and subtracting rational numbers, except that you must be careful to only add terms with variables that have the same degree.

3. The standard form of a polynomial arranges the variables in order from the term with highest degree to the term with lowest degree. The degree of the terms (monomials) determines the order. **5.** Answers may vary. Sample: To be like terms, terms must have the same degree AND the same variable.

7. cubic trinomial **9.** $x^3 + 3x^2 - 2x + 6$

11. $7x^2 - 3x - 7$ **13.** The terms with exponents of 2 would become zero, so the trinomial would become a binomial. Since the square terms are zero, only exponents of degree one (linear) remain (e.g., a quadratic trinomial plus a quadratic trinomial can be a linear binomial):

$$(3x^2 + 2x + 9) + (-3x^2 - 5x - 8) = -3x + 1$$

15. The student did not distribute the (-1) to all terms in the second polynomial. They only distributed it to the first term. The second line should read $-5x^2 + 2x - 3 - 3x^2 + 2x + 6$. The answer should be $-8x^2 + 4x + 3$.

17. a. never b. sometimes c. never d. always **19.** 1 **21.** 0 **23.** cubic trinomial

25. quadratic binomial

27. $5x^2 - 6x$ **29.** $-2z$ **31.** $10b - 4$

33. $4y^2 - 3y - 2$ **35.** $6m^2 - 1$

37. $6x^2 + 144x + 864$ **39.** $6x - 20$

41. a. sum and difference: degree 4, trinomial b. sum and difference: degree 4; The number of terms in each would depend on the degrees of the second terms in Polynomials A and B. **43.** C

45. Part A $18x + 8$ **Part B** 10 ft, 9 ft, 14 ft, 7 ft, 24 ft, 16 ft

Lesson 7-2

1. When multiplying polynomials, each term of one polynomial is multiplied by each term of the second polynomial. This is similar to multiplying each place value of one number by each place value of the other number.

When adding the terms from the multiplication of polynomials, only like terms can be combined, which sometimes results in products with two or more terms. However, when multiplying rational numbers, all the numbers are added, resulting in an answer with one term—a constant.

3. The error is that Mercedes also multiplied the exponents. When multiplying terms with variables, the exponents are added, so the answer should be: $4x^6 + 8x^5 - 12x^3$.

5. $-6x^5 + 8x^4 - 16x^3$ **7.** $3x^2 - 2x - 8$

9. $6x^3 - 5x^2 - 16x + 15$

11. $(x + 7)(x + 4)$ **13.** The student multiplied the first terms of each binomial and the second terms of each binomial together instead of distributing each term of the first binomial to each term of the second binomial.

$$2x(4x) + 2x(-1) + 2(4x) + 2(-1)$$

15. No; The product of a monomial and trinomial can never be a binomial. The product will be a trinomial.



Selected Answers

Topic 7

17. Answers may vary. Sample: Find the volume of each rectangular prism by first multiplying the binomials. Then multiply the resulting trinomials by the monomial side. Finally, combine like terms to find the combined volume of the two prisms. **19.** $3y^3 - 2y^2 + 7y$

21. $-10x^6 + 20x^5 - 10x^3$

23.

	$4x$	$+1$
$2x$	$8x^2$	$2x$
$+1$	$4x$	$+1$

The product is $8x^2 + 6x + 1$.

25. $6x^2 + 7x - 20$

27. $2y^3 + 3y^2 - 5y + 12$

29. $-6x^4 + 17x^3 - 16x^2 + 6x$

31. $3x^4 + 7x^3 - 2x^2 + 12x$

33. $18x^2 + 48x - 50$ **35.** Answers may vary. Sample: Change $x^2 + 2x - 4$ to $x^2 + 4x - 4$. The new product is:

$$(2x + 2)(x^2 + 4x - 4)$$

$$= 2x^3 + 8x^2 - 8x + 2x^2 + 8x - 8$$

$$= 2x^3 + 10x^2 - 8.$$

37. $10x^2 + 16x - 24$ **39.** B

Lesson 7-3

1. For the product of the square of a binomial, the middle term is always equal to twice the product of a and b , while for the product of a sum and a difference, the middle terms always cancel, leaving only two terms in the product of the expression, a^2 and b^2 .

3. The terms of the two binomials are the same so that when they are multiplied the products are perfect squares. The middle terms with x have opposite signs and cancel each other, leaving two perfect squares. The second term of the product is always negative. So, the final product is a difference of two perfect squares.

5. $x^2 - 14x + 49$ **7.** $x^2 - 16$

9. $2,916 \text{ cm}^2$

11. $(x + 9)(x + 9) = x^2 + 36x + 81;$

$(x - 7)(x - 7) = x^2 - 14x + 49;$

$(2x - 1)^2 = 4x^2 - 4x + 1$ **a.** All are a trinomial; the first and third terms are perfect squares. **b.** Yes; because the factors are the same, either two negatives or two positives are being multiplied, resulting in a positive answer. **c.** The sign of the second term in the product is the same as the sign of the binomial being squared. **d.** All the exponents are even. **13.** The student only multiplied the first terms together and the last terms together. He did not multiply the first and last terms together. The correct answer is $x^2 + 10x + 25$. **15. a.** Yes; consecutive even numbers are 1 away from an odd number, which is the average between them. You can write their product as the sum and difference of their average and 1. For example; $6 \bullet 8 = (7 - 1)(7 + 1) = 7^2 - 1 = 49 - 1$. So 48 is one less than the perfect square 49. **b.** Yes. In a similar argument, consecutive odd numbers are each 1 away from an even number. For example, $7 \bullet 9 = (8 + 1)(8 - 1) = 8^2 - 1$. So 63 is one less than the perfect square 64. **17.** $25x^2 - 30x + 9$



Selected Answers

Topic 7

- 19.** $x^2 - 26x + 169$ **21.** $9k^2 + 48k + 64$
23. $4a^2 + 12ab + 9b^2$
25. $0.16x^2 + 0.96x + 1.44$ **27.** 5,184
29. $4x^2 - 25$ **31.** $x^4 - 4y^2$
33. $x^2 - 6.25$ **35.** 8,051
37. $(8x + 16)$ square units **39. a.** x by $(x - y)$ and y by $(x - y)$ **b.** $x^2 - xy$ and $xy - y^2$ **c.** The remaining figure is the result of finding the difference between the larger x^2 and the smaller y^2 .
41. yes; no; no; yes; no
43. Part A Answers may vary. Sample: the answers are odd numbers. **Part B** 22, 23 **Part C** The answers are even numbers that increase by 8. **Part D** 24, 26

Lesson 7-4

- 1.** In both instances, the product of the common factors between either the integers or polynomials become the GCF. **3.** 1 **5.** No, while 2 is the GCF of 6 and 8, it is not the GCF of x^6 and x^8 ; x^6 represents 6 factors of x and x^8 represents 8 factors of x , so they have 6 factors of x in common, or x^6 . **7.** x^3y
9. 1 **11.** x^6y^8 **13.** $-3x^2(x^2 - 4x + 7)$
15. $x^8(x^2 + x - 1)$ **17.** $50a^7b^3(2b^2 - 3a)$
19. Answers may vary. Sample: $12x^4 + 32x^3 - 24x^2$
21. $2x(7x^3 - 10x + 5)$ **23.** $(x + 5)$
25. 1: {2x, 3x, 4x, 5xy, 7x, 9y, 12xy, 13x, 15x}; 2x: {2x, 4x, 12xy}; 3: {3x, 9y, 12xy, 15x}; 4x: {4x, 12xy}; 5x: {5xy, 15x}; y: {5xy, 9y}
27. $3ab^2$ **29.** x^2y^3 **31.** $-2y(2y^3 - 3y + 7)$

- 33.** $6x^2y^2(4x - 5y + 2y^2)$ **35.** $6x$ and $x - 3$ **37.** 36 yd **39.** $\frac{10x^2 - 4x}{2x(5x - 2)}$
41. $3x^2$; 9; 3; 6; 2; 12; 2; 6; 2
43. Part A Face A: $3x + 1$ by x ; Face B: $x + 1$ by x ; Face C: $3x + 1$ by $x + 1$
Part B $3x^2 + 4x + 1$
Part C $14x^2 + 12x + 2$
Part D $3x^3 + 4x^2 + x$

Lesson 7-5

- 1.** You can use patterns to determine whether factors are positive or negative, giving you a starting point. **3.** Factor out any common factors. Factoring out any common factors allows you to more clearly see what patterns to use when factoring. **5.** 1 and 16, 2 and 8, 4 and 4 **7.** both negative

9.

Factors of 12	Sum of Factors
-1 and -12	-13
-3 and -4	-7
-2 and -6	-8

- 11.** The binomial factors correspond to the length and width of the rectangle that can be formed by the algebra tiles that represent the trinomial.
13. The student found the factors of b rather than the factors of c . The correct factored form of $x^2 - 11x - 26$ is $(x - 13)(x + 2)$. **15.** Sample: multiply 4 by y^2 . **17.** $(x + 3)$ inches by $(x + 4)$ inches; Answers may vary. Sample: Because the area of a rectangle is the product of its length and its width, factoring the total area into two factors gives you possible dimensions of the rectangle. **19.** $(x + 1)(x + 1)$



Selected Answers

Topic 7

21.

Factors	Sum of Factors
-1×22	21
1×-22	-21
-2×11	9
2×-11	-9

23. $(x - 8)(x - 3)$ 25. $(x - 10)(x - 3)$

27. $(x + 2)(x - 4)$ 29. $(x - 9)(x - 3)$

31. $(x - 14y)(x - 2y)$ 33. $(x + 12)(x + 4)$

35. $(x + 9)(x + 6y)$ 37. **a.** $(x + 8)$ feet by $(x - 5)$ feet **b.** $3x - 2$; Add $(x + 8)$, $(x - 5)$, and $(x - 5)$ to find the total length of rope. No rope is needed for the side along the beach. **c.** 80 ft

39. **I.** $x^2 + 13x + 30$ **A.** $(x - 10)(x + 3)$

II. $x^2 + x - 30$ **B.** $(x - 6)(x + 5)$

III. $x^2 - 7x - 30$ **C.** $(x - 5)(x + 6)$

IV. $x^2 - x - 30$ **D.** $(x + 10)(x + 3)$

41. **Part A** field: $(x + 5)$ by $(x + 90)$;picnic area: $(x + 15)$ by $(x + 30)$;playground: $(x + 15)$ by $(x + 20)$

Part B Find the sum of the areas that are given or use the dimensions you found to find the dimension of the park and then multiply to find the total area. **Part C** $(x + 90)$ ft by $(2x + 20)$ ft

Part D Yes; Sample: You know that $x + 90$ is the same length as $2x + 50$. Set these expressions equal to one another and then solve for x .

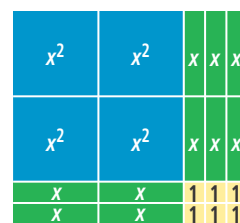
Lesson 7-6

1. In both situations, you are finding factors of ac that sum to b and using those to factor the trinomial. However, when $a = 1$, those factors correspond to the constant terms in the binomial factors. When a does not equal 1, you must first rewrite b and then factor out common factors to arrive at the two binomial factors of the trinomial.

3. Both binomial factors have a constant term of 1. **5.** Since the entire expression can be rewritten in terms of addition, and addition is commutative, the order of the terms does not matter. The factored form will be the same whether Felipe puts $7x$ or $-8x$ first.

7. -1 and 24 , 1 and -24 , -2 and 12 , 2 and -12 , -3 and 8 , 3 and -8 , -4 and 6 , 4 and -6 **9.** no **11.** $18x + 2x$ **13.** $3x + 5$ and $2x - 1$ **15.** -22 , -10 , 22 and 10 **17.** The student used the method for factoring $ax^2 + bx + c$ when $a = 1$ even though a is not equal to 1. The correct factored form of $2x^2 + 11x + 15$ is $(2x + 5)(x + 3)$.

19.



21. $(x + 1)(2x + 5)$ 23. $4(x + 1)(x + 3)$

25. $3(x + 7)(x - 4)$ 27. 2 and 7

Selected Answers

Topic 7

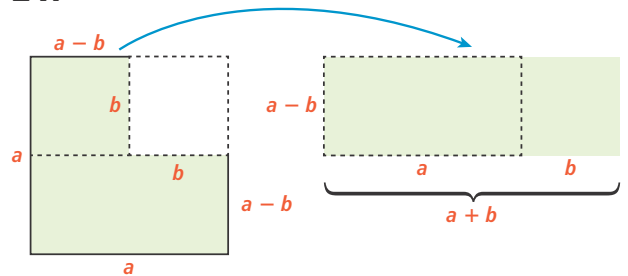
- 29.** -4 and 2 **31.** 5 and -21
33. $(4x + 1)(x + 3)$ **35.** $(2x - 1)(x + 4)$
37. $3x(2x + 1)(x + 1)$
39. $(6x + 5)(2x + 1)$ **41.** $7(3x + 1)(x - 2)$
43. $(9x + 1)(x + 5)$ **45.** $(3x - 2y)(x + y)$
47. $(5x + y)(x - y)$ **49.** $(2x - 3)$ by $(x + 8)$;
 $(2x - 1)$ by $(x + 10)$; $2x^2 + 19x - 10$ ft²
51. a. $(2x + 8)$ in. by $(2x + 10)$ in.
b. 8 in. by 10 in. **c.** The photographer may not know how wide she wants the frames of the photos to be, or she may vary the width of the frame for different photos. **53.** B

Lesson 7-7

- 1.** In a perfect square trinomial, both the first and last term must be perfect squares and the middle term must be twice the product of the square root of the first term and the square root of the last term. In the difference of two squares, both the first term and the second term in the binomial must be perfect squares. **3.** Answers may vary. Sample: Both are the square of an expression. No, for $(ax + b)^2$, where both a and b are not equal to zero, the expanded expression will always be a trinomial. **5.** Factoring out the greatest common factor results in a polynomial with smaller coefficients and/or smaller exponents of the variable(s). This makes it easier to analyze the polynomial or factor it further. **7.** perfect-square trinomial **9.** perfect-square trinomial **11.** perfect-square trinomial **13.** $4(3x + 2)^2$
15. $2(6x + 4)(6x - 4)$ **17.** Answers may vary. Sample: You can use a difference of two squares to rewrite $50^2 - 45^2$ as $(50 - 45)(50 + 45) = 5(95)$.

- 19.** $(2x - y)(2x + y)(4x^2 + y^2)$;
 difference of two squares followed by
 difference of two squares.

21.



- 23.** $3x + 4$; Since the width is twice the length, the rectangle is made of two squares side-by-side. If you divide the area by 2, the resulting expression will be the area of each square, $9x^2 + 24x + 16$, which is a perfect-square trinomial. Factor the perfect-square trinomial to find the length of each square, which is also the length of the rectangle. **25.** 144 **27.** 54 **29.** $(6x + 10)$
31. $(x + 8)^2$ **33.** $(x - 9)^2$
35. $(10x + 6)(10x - 6)$ or $4(5x + 3)(5x - 3)$
37. $8(x - 2)^2$ **39.** $2x(x + 8)^2$
41. $x(7x + 4y)(7x - 4y)$ **43.** $-3x(x - 3)^2$
45. $(x - \frac{1}{2})(x + \frac{1}{2})$
47. $(p - \frac{7}{10})(p + \frac{7}{10})$
49. a. $(x + 16)$ by $(x + 16)$; yes; The factors are equal so the side lengths are the same. **b.** $(x + 2y)$ by $(x - 2y)$; yes, but only when $y = 0$; The factors are equal when $y = 0$. Other than that, they are not equal. **c.** $(x - 10)$ by $(x - 10)$; yes; The factors are equal so the side lengths are the same. **51. a.** $100p^2 - n^2$
b. $10p, 10p, 10p - n, n, n, 10p - n$



Selected Answers

Topic 7

c. $(10p + n)$ by $(10p - n)$; Because the area of the office is $100p^2 - n^2$, you can use the difference of two squares pattern to find the dimensions of a rectangular office with the same area. **53.** C

Topic Review

1. Check students' work. See *Teacher's Edition* for details. **3.** perfect-square trinomial **5.** difference of two squares **7.** linear **9.** cubic **11.** $-x^2 - 12x + 3$
13. $5x$; Answers may vary. Sample: In the sum, the coefficient of the x term is 8. So far, there is only $3x$ represented in the addends, so missing term is $5x$.
15. $x^2 + 2x - 35$ **17.** $20x^2 - 11xy - 3y^2$
19. x ; 8 **21.** $b^2 + 24b + 144$
23. $36x^2 - 81$ **25.** $2.25x^2 - 4$ **27.** 25
29. $3x$ **31.** $7xy^2$ **33.** $3x(5x^2 - 14)$
35. $6a(2a^2 + 3a - 6)$ **37.** Answers may vary. Sample: $9x^6 - 27x^3 + 6x$

39. Sample answer:

Factors	Sum of Factors
-1 and 18	-17
1 and -18	17
-2 and 9	7

41. $(x + 7)(x - 4)$ **43.** $(x + 3y)(x + 15y)$

45.

Factors	Sum of Factors
20 and 1	21
10 and 2	12
5 and 4	9

47. $(3x + 4)(x + 2)$ **49.** $(5x - 3)(x + 2)$

51. $(5x + 4)(2x - 1)$ **53.** 23, -23, 10,

-10, 5, -5, 2, -2 **55.** 64 **57.** $(x + 5)^2$

59. $(x - 9)^2$ **61.** $3(x + 3)^2$ **63.** No, 3 is not a perfect square so it is not a difference of two squares. Also, $3x^2$ and 49 share no common factor.



Selected Answers

Topic 8

Lesson 8-1

- 1.** $f(x) = x^2$; a parabola that opens upward, with axis of symmetry $x = 0$, minimum, vertex, and x - and y -intercepts at $(0, 0)$. The function decreases over the interval $x < 0$ and increases over the interval $x > 0$.
- 3.** The word “parent” is included because all other quadratic functions are related to the parent function.
- 5.** The graph is narrower than the graph of the parent function. **7.** The graph is narrower than the graph of the parent function and opens downward. **9.** 10; the graph of the function opens upward. **11.** The coordinates used to calculate the slope are incorrect. Use $(-4, 8)$ and $(-2, 2)$. The average rate of change is -3 . **13. a.** sometimes true **b.** always true **c.** always true **15.** The graph is wider. **17.** The graph is wider and opens downward. **19.** The graph is narrower. **21.** decreasing: $x < 0$; increasing $x > 0$ **23.** $A(x) = 0.5x^2$; 3.125 units^2 **25.** The average rate of change of g , 24, is 2 times greater than the average rate of change of f , 12.
- 27. a.** 24.36; 34.8 **b.** Between diameters of 6 and 8 inches, the number of calories in a tortilla increased by an average of 24.36 calories per inch of diameter. Between diameters of 9 and 11 inches, the number of calories in a tortilla increased by an average of 34.8 calories per inch of diameter. **c.** As the diameter of a tortilla increases, the number of calories in the tortilla increases more and more rapidly.

- 29. B, C 31. Part A** Design A: $f(x) = 0.03x^2$; Design B: $g(x) = 0.024x^2$; in each function, the value of a is the product of the cost per square inch and 6, because x^2 models the area of a square with side length x , and a cube has 6 square sides. **Part B** The average rate of change is 0.42 for Design A and 0.336 for Design B. This means that for every increase of 1 inch in side length between 6 and 8 inches, the cost of the box increases by \$0.42 using Design A and by \$0.336 using Design B. The average rate of change for Design A is 1.25 times as great as the average rate of change for Design B. **Part C** Answers may vary. Sample: Regardless of the side length, the packaging cost for Design A is 1.25 times as great as the packaging cost for Design B.

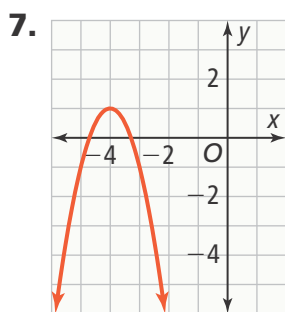
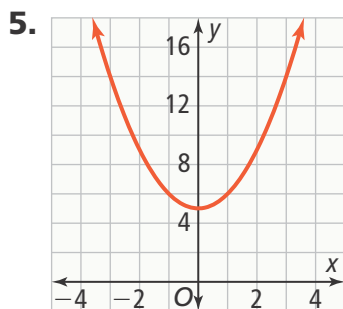
Lesson 8-2

- 1.** You can use the values of h and k from the vertex form to determine the locations of the vertex and the axis of symmetry. You can use the value of a to determine whether the graph opens upward or downward, and use the value of a to locate points on the graph 1 unit to the left of and 1 unit to right of the vertex. **3.** Answers may vary. Sample: The vertex and line of symmetry are the same for both functions. The quadratic function is curved and continuous, while the absolute value function is not.

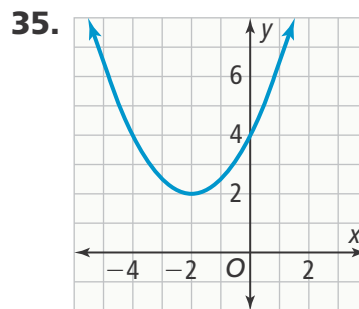
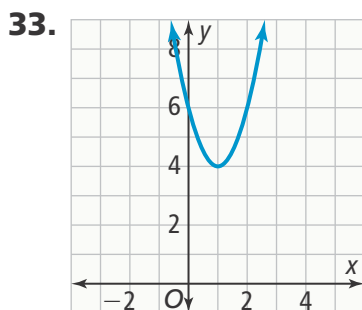


Selected Answers

Topic 8



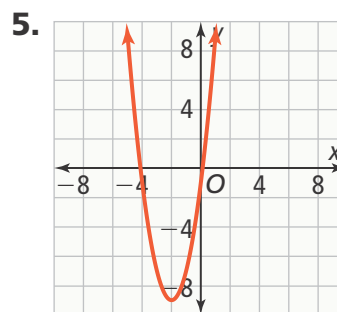
9. $f(x) = -16(x - 1)^2 + 22$ 11. No; because $|a| > 1$, the graph of this parabola is narrower than the graph of the parent function $f(x) = x^2$.
 13. $f(x) = 2(x - 1)^2 - 3$ 15. $(0, 2)$; $x = 0$
 17. $(0, -1)$; $x = 0$ 19. $(0, -2.25)$; $x = 0$
 21. $(0, 7)$; $x = 0$ 23. $(0, -2)$; $x = -2$
 25. $(0.5, 0)$; $x = 0.5$ 27. $f(x) = (x - 2)^2 + 3$
 29. $(-1, 4)$; $x = -1$; opens upward; narrower than the width of the graph of $f(x) = x^2$ 31. $(5, 6)$; $x = 5$; opens downward; wider than the width of the graph of $f(x) = x^2$



37. $f(x) = 2(x + 1)^2 - 4$ 39. $(-1, 42)$ 41. If the player is 2 ft away from the net, the net is located at $x = 1$, and the height of the ball is $f(1) = 7.75$, or 7 ft, 8 in., so the ball will go over the net. If the player hits the ball from 4 feet away, the net is located at $x = 3$, and the height of the ball is $f(3) = 7.75$, or 7 ft, 8 in., so the ball will go over the net. 43. B

Lesson 8-3

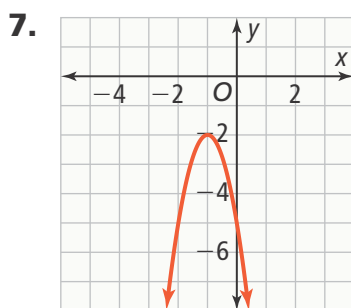
1. The standard form of a function is the expansion of the vertex form.
 3. Square the binomial in the vertex form, multiply using the Distributive Property, and simplify.



axis of symmetry: $x = -2$; y-intercept: -1 ;
 vertex: $(-2, -9)$

Selected Answers

Topic 8



axis of symmetry: $x = -1$; y-intercept: -5 ;
vertex: $(-1, -2)$

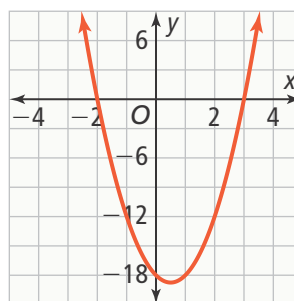
9. No; the maximum height of the balloon is 9 ft. **11.** standard form; c is the y-intercept. **13.** $(1, -2)$; The exact axis of symmetry can be found to be $x = -\frac{-2}{2(1.25)} = 0.8$; Then, substitute 0.8 into $f(x) = 1.25x^2 - 2x - 1$;
 $f(0.8) = 1.25(0.8)^2 - 2(0.8) - 1 = -1.8$;
 $(0.8, -1.8)$ **15.** -6 **17.** -7 **19.** 3
21. 2 ; $x = -2$; $(-2, -6)$ **23.** 0 ; $x = -2$;
 $(-2, -1.6)$ **25.** 12 ; $x = -0.5$; $(-0.5, 10.75)$
27. 12 ; $x = 3$; $(3, 3)$ **29.** g ; minimum of g is -5 ; minimum of f is -4 .
31. g ; maximum of g is 5 ; maximum of f is 4 . **33.** $f(x) = 4x^2 + 8x + 1$
35. $f(x) = -2x^2 + 36x - 147$ **37.** Ball B; 1 m; Answers may vary. Sample: The maximum height is the y-coordinate of the vertex. Substitute $\frac{-b}{2a}$ into function f : $\frac{-b}{2a} = \frac{-14.7}{2(-4.9)} = 1.5$, so 1.5 is the x-coordinate of the vertex, and $f(1.5) = 12$, so the maximum height for Ball A is 12 m. The table shows that function g has symmetry about $x = 1.5$, so $(1.5, 13)$ is the vertex and the maximum height for Ball B is 13 m.

- 39.** 8.5 ft; Sample answer: The lowest point above the ground is the y-coordinate of the vertex. Find the x-coordinate: $\frac{-b}{2a} = \frac{1}{2(0.25)} = \frac{1}{0.5} = 2$. Then find the y-coordinate: $f(2) = 8.5$. **41.** D

Lesson 8-4

- 1.** area and vertical motion problems
3. The object is dropped.
5. $h(t) = -16t^2 + 32t + 20$; 36 ft; 1 s
7. $A(x) = 4x^2 + 30x + 36$
9. a. 650 ft; 6.25 s **b.** 24.25 ft; 1.125 s
11. In a graph of a vertical motion model, the x-axis represents time, not horizontal distance. **13. a.** length: $x + 5$, width: $x - 2$ **b.** Answers may vary. Sample: Since the width, $x - 2$, must be positive, a reasonable domain is $x > 2$, and a reasonable range is $f(x) > 0$.

15. $f(x) = 3x^2 - 3x - 18$



$f(8) = 150$

- 17.** $h(t) = -16t^2 + 200t$; 625 ft
19. $h(t) = -16t^2 + 48t + 6$; 42 ft

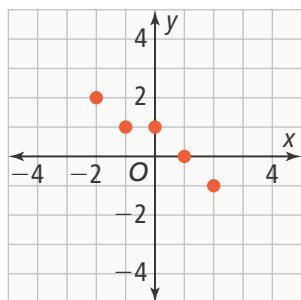


Selected Answers

Topic 8

21.

x	y	$f(x)$	Residual
-2	-6	-8	+2
-1	-1	-2	+1
0	3	2	+1
1	4	4	0
2	3	4	-1



The residuals are on or close to the x -axis, which indicates the function may be a good fit.

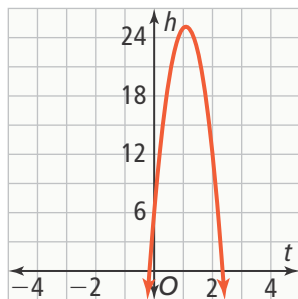
23. $y = .00001x^2 - 0.3791x + 603.8225$

25. Answers may vary. Sample: No; a price of \$15 is too high. Using quadratic regression on a graphing calculator gives the model

$f(x) = -2.57x^2 + 67.57x - 182.8$. The price generating the highest profit is the x -value of the vertex,

which is $\frac{-b}{2a}$, which is about 13.15. So, the price that will maximize profits should be about \$13. **27.** 10, 96, 154, 3.

29. Part A $h(t) = -16t^2 + 35t + 6$



Part B Yes; The maximum height of the ball is about 25 ft, so it will land on the upper deck.

Lesson 8-5

- Look at the first differences, second differences, and the ratios of consecutive terms.
- Data with constant first differences should be modeled with a linear function, not a quadratic function.
- linear
- A flow chart should show the following reasoning. IF the first differences are constant, then the function is linear; ELSE IF the second differences are constant, then the function is quadratic; ELSE IF the common ratios are constant, then the function is exponential; ELSE the function is not linear, quadratic, or exponential.
- For analysis of first differences to give good information, the differences of the related x -values must also be constant. If the student only considers the data for $x = -3, -1, 1,$ and 3 , then a linear, quadratic, or exponential function would not model the data.
- exponential
- quadratic
- linear; $f(x) = 2.5x - 20.02$
- $f(6) = 4.5, f(8) = 6, f(12) = 9;$
 $g(6) = 3.375, g(8) = 6, g(12) = 13.5;$
 $h(6) \approx 3.815, h(8) \approx 5.960, h(12) \approx 14.552$
 - Starting at about $x = 10.3$, function h exceeds functions f and function g .
- The budget will not be sufficient. Using quadratic regression, the function $f(x) = 2.65x^2 + 3.1x - 40$ models the data with correlation coefficient $r = 0.999$. Based on the model, the cost of the 150-meter-wide parking lot is \$60,050.
- A



Selected Answers

Topic 8

23. Part A App A: $f(x) = 3^x$;
 App B: $g(x) = 998x + 50$;
 App C: $h(x) = 100x^2 + 75x + 2,500$;
 App A is exponential because ratios of consecutive y -values are constant, App B is linear because first differences are constant, and App C is quadratic because second differences are constant.

Part B App A will take the greatest amount of time as the number of data items to be analyzed increases; Answers will vary. Sample: The conjecture could be supported using a graph of the three functions.

Topic Review

1. Check students' work. See *Teacher's Edition* for details. **3.** quadratic parent function **5.** standard form of a quadratic function **7.** The graph of coefficient. However, $g(x) = 1.5x^2$ is narrower. **9.** When $a > 0$, the function has a minimum value. When $a < 0$, the function has a maximum value. The maximum or minimum value is always $(0, 0)$.

11. Both graphs open downward and have vertex $(3, 2)$. The graph of f is narrower than the graph of g .

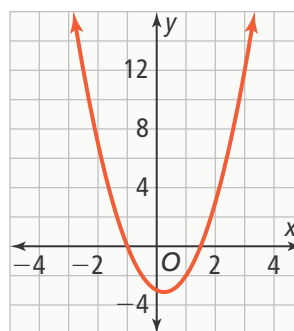
13. $(5, -2)$; $x = 5$ **15.** 5 ; $x = 2$; $(2, 9)$

17. If $a > 0$, then the parabola has a minimum value. If $a < 0$, then the parabola has a maximum value.

19. The ball was tossed at 5 ft.

21. $h(x) = -16x^2 + 18x + 9$; 14.1 ft

23. $f(x) = 2x^2 - x - 3$



The vertex $(0.25, -3.125)$ represents the minimum area of the rectangle when coefficient. However, $x = 0.25$ if the value of $x = 0.25$ is possible for the rectangle, which it is not. The x -intercepts, -1 and 1.5 , represent when the area of the rectangle is 0. domain: $x > 1.5$; range: $y > 0$

25. Determine if the differences in the x -values are constant. **27.** linear



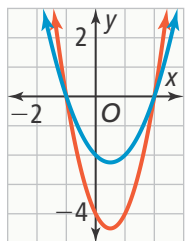
Selected Answers

Topic 9

Lesson 9-1

1. For graphs, the zeros of the related function are the solutions. For tables, the values of x when the function value is 0 are the solutions. If exact values don't give a function value of 0, look where sign changes occur and find approximations. **3.** Eli found the solutions of $x^2 - 100 = 0$. The equation has no solution. **5.** 1 **7.** -1, 3 **9.** -4, 1 **11.** approximately 2.2 **13.** There is no solution.

15. Answers may vary. Sample:



17. 2 **19.** -3, 2 **21.** 2 **23.** 0, 5 **25.** 1, 7 **27.** 1.5, 4 **29.** approximately -2.1, approximately 2.1 **31.** -4 **33.** no solution **35.** No, the solutions to the equation $0.5n^2 + 0.5n = 50$ are not integers, because the related quadratic equation $n^2 + n - 100 = 0$ is not factorable. A solution must be a positive integer for it to be a triangular number.

37. no; yes; yes; no; yes

39. Part A $-16x^2 + 96x + 256 = 0$; $x = -2$, $x = 8$ **Part B** No; -2 is a solution of the equation, but not the problem, because time cannot be negative.

Part C 400 ft; after 3 seconds

Lesson 9-2

1. If a quadratic equation can be factored, you can use the Zero-Product Property. The two linear factors can be set to zero and solved to find the solution(s). **3.** The Zero-Product Property says that for all real numbers a and b , if $ab = 0$, then either $a = 0$ or $b = 0$. If you can factor a quadratic equation that has 0 on one side, then each factor set equal to 0 is a solution. **5.** 10, -20

7. $(x + 16)(x + 2) = 0$; -16, -2 **9.** -1

11. $\frac{5}{2}$, -3 **13.** $(x + 1)(x - 7) = 0$

15. $x - 8$ must be a factor;

Substitute 8 into the quadratic equation and see if it makes the equation true or factor the equation to see if $x - 8$ is a factor.

17. The student did not get 0 on one side of the equation.

$$x^2 + 2x - 3 = 5$$

$$x^2 + 2x - 8 = 0$$

$$(x - 2)(x + 4) = 0$$

$$x - 2 = 0 \text{ or } x + 4 = 0$$

$$x = 2 \text{ or } x = -4$$

19. a. $(x - 2)(x - 6) = 0$; the orange curve, with vertex of (4, -2)

b. $\frac{1}{2}(x - 2)(x - 6) = 0$ **c.** The graph of the second equation is compressed by a factor of $\frac{1}{2}$, which is the constant factor.

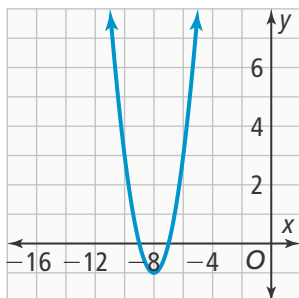
21. $\frac{5}{2}$, $\frac{2}{7}$ **23.** $\frac{8}{3}$ **25.** -2, 7 **27.** $\frac{1}{2}$, 2

29. -3, $-\frac{1}{5}$ **31.** $(24 - 2x)(12 - 2x) = 189$; 1.5 in.

Selected Answers

Topic 9

33. $(x + 7)(x + 9) = 0$; $(-8, -1)$



35. a. $-(x - 3)(x - 8) = 0$ b. $(5.5, 6.25)$

c. Multiply by 16;

$-16(x - 3)(x - 8) = 0$. The equation has the same roots, but the vertex is $(5.5, 16 \cdot 6.25)$, or $(5.5, 100)$.

37. I. B, D; II. A, D; III. B, E; IV. A, B; V. A, C

39. **Part A** Check students' equations.

The starting point of the water is at $(1, 0)$ so the ending point is $(6, 0)$. Both points must satisfy students' equations, and the leading coefficient must be negative. **Part B** The height of the water is the y -value from the vertex based on the equation from Part A. The distance from the edge of the pool to where the water hits the center is 5 ft, or half the width of the pool.

Part C Check students' work.

Lesson 9-3

1. Simplifying radicals creates consistency in your mathematical answers. When answers have a constant form, people can easily see and compare their results.

3. Write the prime factorization:

$$\sqrt{2 \cdot 2 \cdot 2 \cdot 2 \cdot 2}$$

Remove each pair of 2s inside the radicand and write one factor of 2 outside the radicand for each pair.

$$= 2 \cdot \cancel{2} \cdot \cancel{2} \cdot \cancel{2} \cdot \cancel{2} \cdot 2 = 4\sqrt{2}$$

5. No; Since 9 is a factor of 45 and 9 is a perfect square, the radical can be

rewritten as $3\sqrt{5}$. 7. $4\sqrt{5}$ 9. $2x^2\sqrt{10}$

11. $10\sqrt{2}$ 13. $12x^2\sqrt{6x}$ 15. $3x^4\sqrt{70}$

17. The expressions are not equivalent;

$$5\sqrt{28} = 10\sqrt{7} \text{ and } \sqrt{119} = \sqrt{17 \cdot 7}$$

19. $4x^4y^4\sqrt{2}$ 21. In the next-to-last step, 2 was incorrectly removed from the square root.

$$\begin{aligned} &4\sqrt{7 \cdot 2 \cdot 7 \cdot x \cdot x \cdot x \cdot x \cdot x} \\ &= 4 \cdot 7\sqrt{2 \cdot x^2 \cdot x^2 \cdot x} \\ &= 28x^2\sqrt{2x} \end{aligned}$$

23. Radicals are equivalent to exponents: $\sqrt{x} = x^{\frac{1}{2}}$. So multiplying radical expressions is the same as multiplying exponential expressions.

25. a. $2x^2\sqrt[3]{3x^2}$; Factor $\sqrt[3]{24x^8}$.

$$\begin{aligned} &= \sqrt[3]{2^3 \cdot 3 \cdot (x^2 \cdot x^2 \cdot x^2) \cdot x^2} \\ &= 2x^2\sqrt[3]{3x^2} \end{aligned}$$

b. $9x^3\sqrt[4]{3x}$; Factor $\sqrt[4]{3^9x^{13}}$.

$$\begin{aligned} &= \sqrt[4]{(3^2 \cdot 3^2 \cdot 3^2 \cdot 3^2) \cdot 3 \cdot (x^3 \cdot x^3 \cdot x^3 \cdot x^3) \cdot x} \\ &= 9x^3\sqrt[4]{3x} \end{aligned}$$

27. Neither expression can be simplified. 29. $\frac{1}{2}\sqrt{120} = \sqrt{30}$ 31. $4\sqrt{6}$; $3\sqrt{15}$ cannot be simplified. 33. $5\sqrt{10}$

35. $2\sqrt{21}$ 37. $4x^2y\sqrt{2y}$ 39. $2x^4$



Selected Answers

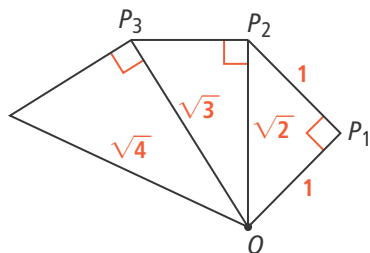
Topic 9

- 41.** $2x^7\sqrt{13x}$ **43.** $5x^2\sqrt{2xy}$ **45.** $48x^9\sqrt{x}$
47. $4x\sqrt{2}$ ft; 30 ft, ≈ 84.9 ft, 90 ft
49. a. $90\sqrt{2}$ ft; 127.3 ft **b.** 6.3 ft; The distance to 2nd base is $127.3 - 60.5 = 66.8$ ft; $66.8 - 60.5 = 6.3$ ft

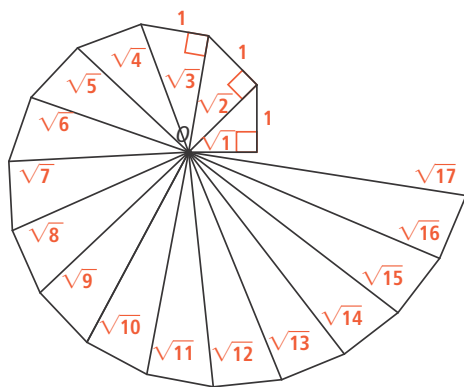
51.

	$\sqrt{48}$	$5x\sqrt{6x^3}$
$\sqrt{12}$	24	$30x\sqrt{2x}$
$2x\sqrt{6x}$	$24x\sqrt{2x}$	$60x^2$
$4x^2\sqrt{2x^5}$	$16x^4\sqrt{6x}$	$40x^4\sqrt{3x}$

53. Part A



Part B



Part C Unsimplified; The radicands each increase by 1, but this is not apparent with simplified square roots.

Lesson 9-4

- 1.** If you have—or can simplify—a quadratic equation so that it is in the form $ax^2 = c$, where there is no linear term, then you can divide both sides by a and take the square root to solve.
3. If there are two solutions, and no real-world context, use \pm . If there are fewer than two solutions, or if a solution such as a negative number does not make sense, do not use it.
5. For both types of equations the last two steps are to divide by a and take the square root of the value. For equations in the form $ax^2 \pm b = c$, you first need to add or subtract b to or from c . **7.** no solution **9.** $x = \pm\sqrt{6}$
11. $x = \pm\frac{3\sqrt{10}}{2}$ **13.** $x = \pm\frac{7}{2}$ **15.** $x = \pm 3$
17. $x = 5\sqrt{2}$ **19.** The equation has no solution; The square root of a negative number is undefined. **21.** The student took the square root of 4 in the next to last step and did not include \pm .

$$-4x^2 + 19 = 3$$

$$-4x^2 + 19 - 19 = 3 - 19$$

$$-4x^2 = -16$$

$$x^2 = 4$$

$$x = \pm 2$$

23. ± 16 **25.** no solution

27. $\pm\sqrt{91} \approx \pm 9.54$ **29.** ± 5

31. $\pm 10\sqrt{10}$ **33.** ± 1 **35.** ± 5 **37.** ± 4

39. 0 **41.** $\pm\sqrt{10} \approx \pm 3.16$ **43.** $10\sqrt{10}$ ft;
 $6x = 189.74$ ft; $2x = 63.25$ ft



Selected Answers

Topic 9

45. Solve algebraically using square roots:

$$x^2 - 900 = 0$$

$$x^2 = 900$$

$$\sqrt{x^2} = \pm\sqrt{900}$$

$$x = \pm 30$$

Solve using the table function on a graphing calculator:

Enter $y = x^2 - 900$ into a graphing calculator.

Use the table function to find the values for which $y = 0$.

$$x = \pm 30$$

47. a. $-16t^2 + 67 - 3 = 0$

b. $2 s$; $-16t^2 + 67 - 3 = 0$,

so $-16t^2 = -64$; $t^2 = 4$, $t = 2$

49. 48 ft **51.** B

Lesson 9-5

1. The technique of completing the square can be applied to any quadratic equation with integer coefficients that has real number solutions. This includes finding solutions that are not rational.

3. The student neglected to add 16 to the right side, so the equation is no longer equivalent to the original equation. **5.** It is easier to write the trinomial as a binomial squared when the coefficient of a is 1. **7.** 1

9. $x = -4 \pm \sqrt{15}$ **11.** $x = 2 \pm \sqrt{11}$

13. $y = 5(x - 1)^2 + 2$

15. a. 16; $x^2 + 8x + 16$; $(x + 4)^2$

b. 169; $x^2 + 26x + 169$; $(x + 13)^2$

17. The student added 9 to the left side of the equation instead of adding 18.

The correct answer is $y = 2(x + 3)^2 - 17$.

19. $1 \pm \sqrt{7}$; -1.8 and 3.7 **21.** 121;

$(x + 11)^2$ **23.** 6.26; $(x - 2.5)^2$ **25.** 576;

$(x - 24)^2$ **27.** $2 \pm \sqrt{34}$ **29.** -5 and 7

31. $-1.5 \pm \sqrt{13.25}$ **33.** -2 and 7

35. 6.4 **37.** $y = (x + 6)^2 - 9$; $(-6, -9)$

39. $y = (x - 7)^2 - 50$; $(7, -50)$

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

43. $y = -4(x - 2)^2 + 21$; $(2, 21)$

45. $f(x) = -(x + 5)^2 + 4$; yes **47.** 4 m;

The vertex form of the function is

$f(x) = (x - 2)^2 + 4$. So the vertex is $(2, 4)$.

This means that the lowest point of the dish is 4 m above the ground. The graph of the parabola has points $(0, 8)$

and $(4, 8)$, so the width of the dish at

8 m off the ground is 4 m. **49.** 12.3 cm;

65.2 cm **51. Part A** $w = 0.5625h$;

$A = (0.5625h + 0.4)(h + 1.2)$

Part B 5.23 in. **Part C** 5.23 in. and

2.94 in.; 6.43 in. and 3.34 in.

Lesson 9-6

1. Use the quadratic formula when you cannot factor easily and when completing the square would result in many fractions. **3.** The discriminant tells you the number of roots.

5. Completing the square is better than using the quadratic formula when $a = 1$ and b is an even number, so the number to complete the square is a positive integer. **7.** $a = -1$, $b = 31$, $c = 7$ **9.** $a = 1$, $b = 1$, $c = -1$ **11.** 0

13. 2 **15.** The student used a plus sign instead of a plus or minus sign. In addition to the solution $x = 0.39$, there is also the solution $x = -3.39$.



Selected Answers

Topic 9

17. Shift the parabola down by 3 units. Then it will cross the x -axis twice, which means it will have 2 roots. When a quadratic function has 2 roots, the discriminant is positive. **19.** $x \approx 0.45$ and $x \approx 5.55$ **21.** $x \approx 1.24$ and $x \approx -7.24$ **23.** $x = -1$ and $x = 3.5$ **25.** $x \approx 0.28$ and $x \approx -4.73$ **27.** $x \approx -0.88$ and $x \approx 1.71$ **29.** 273; 2 **31.** 12; 2 **33.** 0; 1 **35.** -183; 0 **37.** 2 real solutions; greater than 0 **39.** The discriminant must be greater than 0. The graph of the function that models the height of an object over time is a parabola that opens down. Because a height of 0 represents the ground, eventually the object will hit the ground. Unless the object is launched from the ground, one of the roots will be negative, which can be discarded in the context of the problem since time is not negative. **41. a.** $1,250 = -5n^2 + 85n + 1,000$ **b.** $x = 3.78$, $x = 13.22$; The two prices that will result in the student council exactly meeting their goal are \$11.78 and \$21.22. **43.** D

Lesson 9-7

1. It is similar because you can use the same methods to solve: graphing, elimination, or substitution. It is different because linear-quadratic systems have 0, 1, or 2 solutions. Linear systems have 0, 1, or infinitely many solutions. **3.** It is composed of a linear equation and a quadratic equation, each in two variables.

$$\begin{aligned} \mathbf{5.} \quad y &= x^2 + 2x \\ y &= 3 \end{aligned}$$

$$\begin{aligned} \mathbf{7.} \quad y &= 2x^2 - 5 \\ y &= x + 7 \end{aligned}$$

9. (0, 1) and -4, 5) **11.** (-5, -6) and (0, -1) **13.** The system has only one solution because the graphs of the two equations have only one point of intersection. **15.** While using the elimination method, the student subtracted an x -term from an x^2 -term. Instead of getting $0 = -x^2 + 2$, the student should have gotten $0 = 2x^2 - 3x + 2$. Use the quadratic formula to solve. Because the discriminant of the equation is negative (-7) the equation and the system have no solutions.

$$\begin{aligned} \mathbf{17.} \quad y &= x^2 + 2 \\ y &= \frac{1}{3}x + 3 \end{aligned}$$

$$\mathbf{19.} \quad x = 1 \text{ or } x = -\frac{1}{2}$$

$$\mathbf{21.} \quad x = 2 \quad \mathbf{23.} \quad y = 4x^2 - 2, y = -\frac{2}{3}x + 2;$$

$$(-1.087, 2.725) \text{ and } (0.920, 1.387)$$

$$\mathbf{25.} \quad (0, 1) \text{ and } (2, -13) \quad \mathbf{27.} \quad (1, 19)$$

$$\mathbf{29.} \quad (0, -3) \text{ and } (2, -11)$$

$$\mathbf{31.} \quad (0.255, 14.740), \text{ and } (11.745, 3.250)$$

$$\begin{aligned} \mathbf{33.} \quad y &= -16x^2 + 30 \\ y &= 0; \text{ about } 1.37 \text{ seconds} \end{aligned}$$

$$\begin{aligned} \mathbf{35. a.} \quad y &= -\frac{1}{7}x^2 + 2x + 10 \\ y &= 2x + 3; -\frac{1}{7}x^2 + 2x + 10 = 2x + 3 \end{aligned}$$

b. day 7 **c.** 17 people rock climbing and 17 people zip lining **37.** A

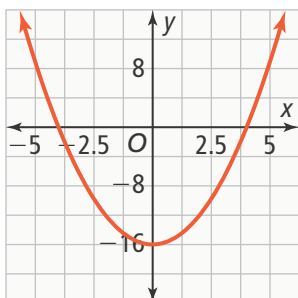
Topic Review

1. Check students' work. See *Teacher's Edition* for details. **3.** completing the square **5.** Product Property of Square Roots

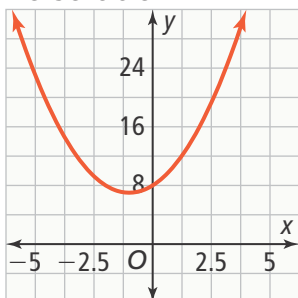
Selected Answers

Topic 9

7. -4, 4



9. no solution



11. -8, 8

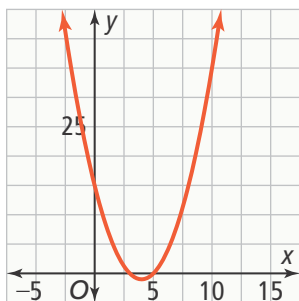
x	-8	-4	-2	0	2	4	8
$f(x)$	0	-48	-60	-64	-60	-48	0

13. 7,000 video games; about 3,838 video games or about 10,162 video games

15. $x = -2$ or $x = 5$

17. $x = -1.5$ or $x = 5$

19. $(x - 3)(x - 5) = 0$; vertex is $(4, -1)$



21. $2\sqrt{105}$ 23. $7x\sqrt{15}$ 25. The expressions are equal. 27. $8\sqrt{6l}$, 109.1 in./s 29. no solution 31. -0.8, 0.8 33. -20, 20

35. -5, 13

$$(x - 4)^2 - 81 = 0$$

$$(x - 4)^2 = 81$$

$$\sqrt{(x - 4)^2} = \sqrt{81}$$

$$x - 4 = \pm 9$$

$$x = \pm 9 + 4$$

$$x = 13 \text{ or } x = -5$$

37. 81, $(x + 9)^2$ 39. 56.25, $(x - 7.5)^2$

41. $-9 + \sqrt{105}$, $-9 - \sqrt{105}$ 43. $-11 + \sqrt{82}$, $-11 - \sqrt{82}$ 45. Completing the square

provides an exact solution. You cannot factor the equation, and graphing does not provide an exact solution. The solutions are $4.5 + \sqrt{35.25}$ and $4.5 - \sqrt{35.25}$.

47. $x = 2$ and $x = \frac{6}{5}$

49. $x = -0.63$ and $x = -2.37$

51. 2 solutions 53. no solution

55. The solutions of the related equation are approximately 1.87 and -5.87. The negative solution is discarded because a height cannot be negative. The only possible value is 5.87. 57. $(0.5, 2)$ and $(-1, -1)$ 59. $(-8, 0)$ and $(-3, -5)$ 61. $(-5, 15)$ 63. $(3.5, 12)$, $(-5, -5)$ 65. \$3



Selected Answers

Topic 10

Lesson 10-1

1. The graph of the square root function and its translations are one branch of a parabola with a horizontal axis of symmetry. The domain and range always have a minimum value.

3. The ordered pairs have the values reversed. If $x = 12$, then $y = \sqrt{36} = 6$, so $(12, 6)$ satisfies the function. Similarly, if $x = 27$, then $y = \sqrt{81} = 9$, so $(27, 9)$ satisfies the function.

5. It is a vertical translation of the graph of f by 2 units down. **7.** It is a vertical translation of the graph of f by 5 units up. **9.** 0.14

11. 0.45 **13.** The expression under the radical is $x + 3$, so the radicand has a minimum value when $x = -3$. That means the x -intercept is at the point $(-3, 0)$ and the graph is a translation of $f(x) = \sqrt{x}$ by 3 units to the left.

15. a. For f , the average rate of change is 0.2; for g , the average rate of change is -0.2 . **b.** The two values are opposites. **c.** -0.32 **17. a.** The steps are to multiply 10 by 2 to get 20, find the square root of 20, and then divide that value by 7.

b. The steps are to multiply 10 by 2 to get 20, divide that value by 7, and then find the square root of the result.

19. x -intercept = 9; y -intercept does not exist **21.** x -intercept = 77;

y -intercept -7 **23.** It is a horizontal translation of the graph of f by 11 units to the left. **25.** It is a horizontal translation of the graph of f by 3 units to the left and a vertical translation

by 6 units down. **27.** $g(x) = \sqrt{x - \frac{1}{2}}$

29. 0.39; 3.89; 3.50

31. 1.732; 3.6056; 0.375 **33.** domain: $x \geq 0$; range: $y \geq 0$ **35.** domain: $x \geq 3.5$; range: $y \geq 0$ **37.** 70, 65, 74, 85

39. about 897 mi **41.** D

Lesson 10-2

1. domain: $-\infty < x < \infty$; range: $-\infty < y < \infty$; increasing everywhere (no max/min values); intercepts axes at $(0, 0)$, rotational symmetry about the origin **3.** One graph is the reflection of the other across the x -axis.

5. The graphs have the same shape; the graph of f is the result of shifting the graph of g down 3 units.

7. about 0.109 **9.** The graph crosses the axes at the origin, $(0, 0)$, so the x -intercept and the y -intercept are the same. **11.** Hugo incorrectly factored out a 3. The correct common factor is $\sqrt[3]{3}$. **13.** The smaller interval provides the better approximation.

15. a. translation down 2 units

b. translation right 3 units and up 5 units **c.** translation left 1 unit

17. domain: $-\infty < x < \infty$;

range: $-\infty < y < \infty$; x -intercept and y -intercept: $(0, 0)$; rotational symmetry about the origin **19.** domain:

$-\infty \leq x \leq \infty$; range: $-\infty \leq y \leq \infty$;

x -intercept: $(-2, 0)$; y -intercept: $(0, \sqrt[3]{2})$; rotational symmetry about the point $(-2, 0)$ **21.** shift up

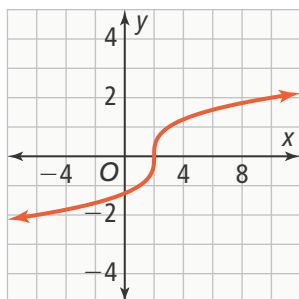
2 units **23.** shift left 7 units

25. shift left $\frac{1}{2}$ unit and down $\frac{3}{4}$ unit

Selected Answers

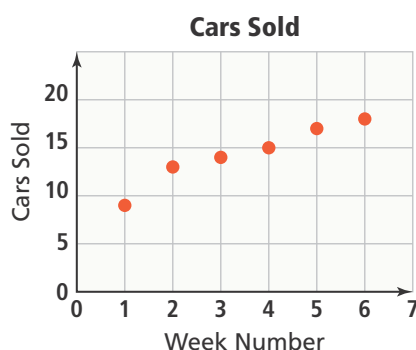
Topic 10

27.


 $3 \leq x \leq 10$ when $1 \leq g(x) \leq 2$

29. 0.102 31. 0.540 33. <

35.



$$f(x) = 10\sqrt[3]{x}$$

Sales will continue to increase, but at a decreasing rate. **37. a.** $x^3 = 102,714$

b. about 46.8 in. **c.** the box; about 170 in.² more surface area **39.** B

Lesson 10-3

1. the domain and range of the function, the maximum and minimum values, asymptotes, the axis of symmetry, and end behavior **3.** Both types of functions change direction from increasing to decreasing or from decreasing to increasing. Both have an axis of symmetry, and the end behaviors of both graphs go in the same direction. **5.** domain: $(-\infty, \infty)$, range: $[0, \infty)$; minimum value is 0 when $x = -1$; no maximum value; axis of symmetry: $x = -1$; as $x \rightarrow -\infty$, $y \rightarrow \infty$; as $x \rightarrow \infty$, $y \rightarrow \infty$

7. The radicand must be nonnegative:

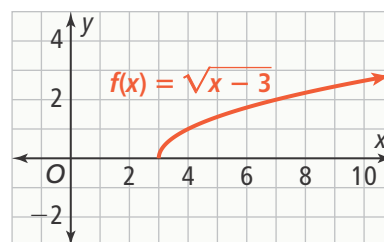
$2x - 5 \geq 0$, so $x \geq \frac{5}{2}$. The domain is $[\frac{5}{2}, \infty)$. The radical indicates the positive root, so it will not be less than 0. All values of f , then, must be less than or equal to 4. The range is $(-\infty, 4]$

9. The student is distracted by the large constant. As $x \rightarrow \infty$, the leading term $-x^2$ will, from some point on, be less than $-1,000,000$. Looking at the leading term shows $x \rightarrow \infty$, $y \rightarrow -\infty$.

11. No, the left side of the function is a mirror image of the side to the right of the axis of symmetry. Because the domain is the set of all real numbers, there is no vertical asymptote. Since $y \rightarrow \infty$ when $x \rightarrow \pm\infty$, the graph must change directions at some point, having a minimum value. The range cannot be the set of all real numbers.

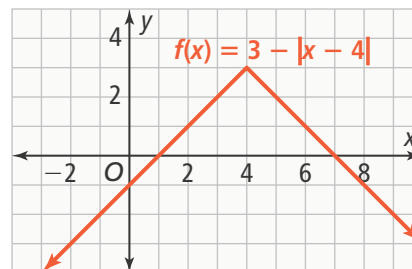
13. $a = -1$, $b = 0$

15.



domain: $[3, \infty)$, range: $[0, \infty)$

17.



domain: $(-\infty, \infty)$, range: $(-\infty, 3]$

19. no maximum or minimum value



Selected Answers

Topic 10

21. minimum is -8 when $x = 0$;
no maximum value **23.** no axis
of symmetry

25. As $x \rightarrow -\infty$, $y \rightarrow \infty$; as $x \rightarrow \infty$, $y \rightarrow -\infty$.

27. As $x \rightarrow -\infty$, $y \rightarrow 0$; as $x \rightarrow \infty$, $y \rightarrow -\infty$.

29. As $x \rightarrow -\infty$, $y \rightarrow -\infty$; as $x \rightarrow \infty$, $y \rightarrow -\infty$

31. A = Miami (relatively steady high
temperatures all year)

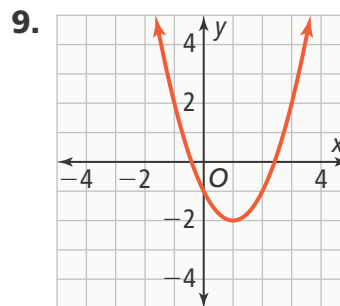
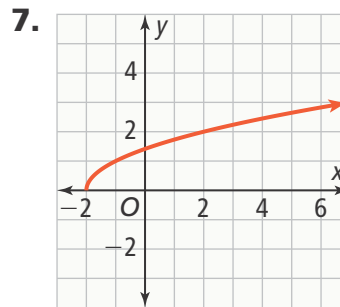
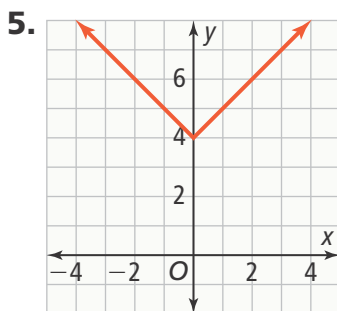
B = Kansas City (max is highest of the
four, min is less than Miami's)

C = New York City (max/min values are
lower than those for KC)

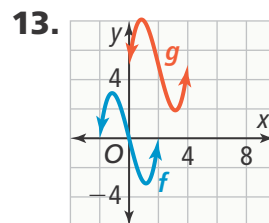
D = Anchorage (lowest max temp/
lowest min temp) **33.** Axes of
symmetry will save Yumiko work
because she can draw half of the image
and then reflect it. Maximum and
minimum values might be helpful in
setting up edges of shapes. **35.** D

Lesson 10-4

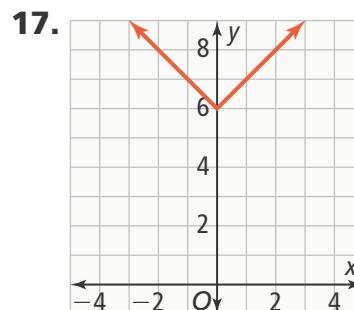
1. Yes; subtracting h from the function
input shifts the graph of the function
horizontally h units. Adding k to the
function output shifts the graph of the
function vertically k units. **3.** Ashton is
not correct. $y = \sqrt{x}$ has domain
 $0 \leq x < \infty$. The graph of $y = \sqrt{x-3}$ is
graph of $y = \sqrt{x}$ shifted right 3 units, so
the new domain is $3 \leq x < \infty$.



11. $y = |x + 3| + 2$



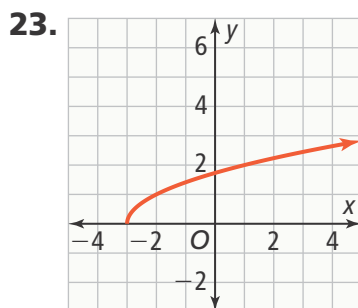
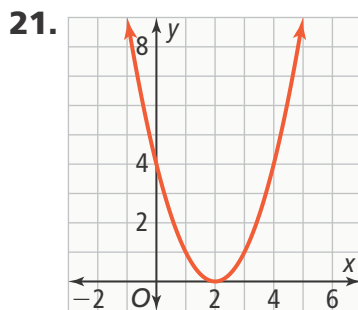
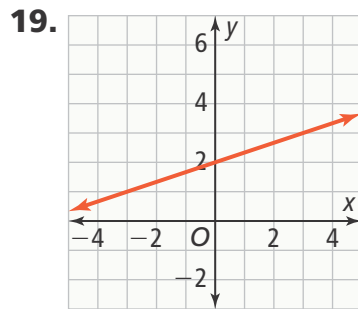
15. If the graph is shifted the same
integer number of units either up and
right or down and left, the graph will
appear unchanged. The new function is
 $f(x) = |x - a| + a$, where a is an integer.



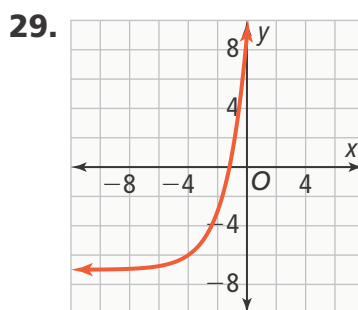


Selected Answers

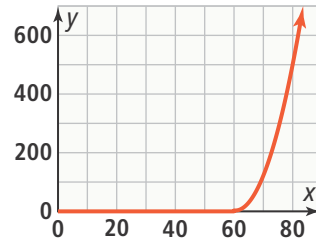
Topic 10



25. $y = (x - 1)^2$ 27. $y = |x + 10|$



31. The delay represents a translation 60 units right.



33. A, C 35. **Part A** 44.6 yards

Part B 54.0 yards

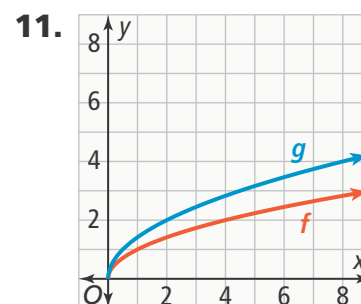
Part C $g(x) = -\frac{1}{100}(x - 9.4)^2 + 12$

Lesson 10-5

1. Multiplying the output by a constant either stretches or compresses the graph of the function vertically.

Multiplying the input by a constant either stretches or compresses the graph of the function horizontally.

3. A vertical stretch causes the graph of a function to stretch away from the x -axis, and a horizontal stretch causes the graph of a function to stretch away from the y -axis. 5. yes 7. horizontal compression 9. horizontal compression



Based on the way the functions are written, it is a horizontal compression. But if you take the square root of 2 and put it in front of the radical, then it looks like a vertical stretch.

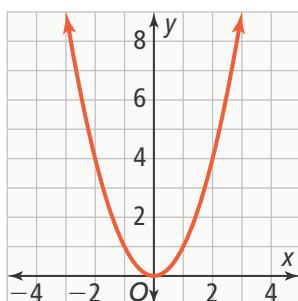


Selected Answers

Topic 10

- 13.** When the input is multiplied by $k > 1$, it is a horizontal compression, not a horizontal stretch. **15.** $g(x) = -x^2 + 3$
17. $g(x) = \sqrt{2x}$ **19.** vertical stretch
21. vertical compression **23.** horizontal stretch **25.** vertical stretch
27. reflection across $y = 2$; $k = -1$
29. $g(x) = -3\sqrt{x}$

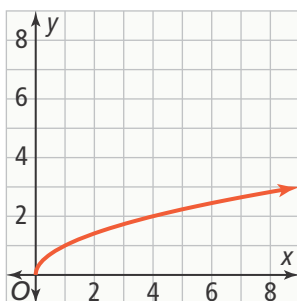
31. a.



The graph is compressed horizontally.

b. $s = \sqrt{A}$

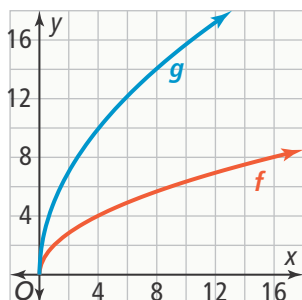
c.



d. The graph is compressed vertically.

33. $g(x) = -|2x + 5|$ **34.** A

35. Part A



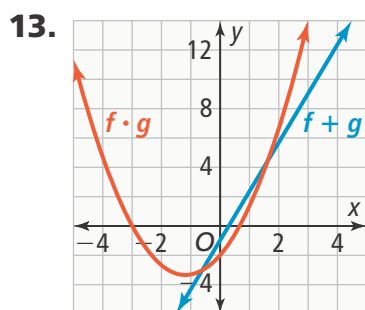
Part B $g(x) = \sqrt{6.125}f(x)$ **Part C** The period is longer on the moon than on Earth for a pendulum with the same length. **Part D** The graph of g can be described as either a vertical stretch away from the x -axis or a horizontal compression toward the y -axis.

Lesson 10-6

- 1.** Functions can be added, subtracted, and multiplied in the same way as numbers, however, it is important to apply the operation to all terms in the expression. **3.** Graph the combined function. If there are restrictions on the x -values of the graph, then the domain is restricted. If the graph of the function does not pass through all y -values, then the values it does not pass through are not in the range.
- 5.** $(f + g)(x) = 2x^2 - x + 1$
7. $(f - g)(x) = 3x^2 - 2x - 7$
9. $(f \cdot g)(x) = 3x^4 - 12x^3 - 2x^2 + 8x$
11. When adding polynomials and functions, you combine any like terms. However, functions can include terms that cannot appear in a polynomial, such as radicals and terms with the variable in the exponent. Adding two polynomials results in another polynomial. Adding two functions results in another function, but not necessarily a type of function that matches either of the two original functions.

Selected Answers

Topic 10



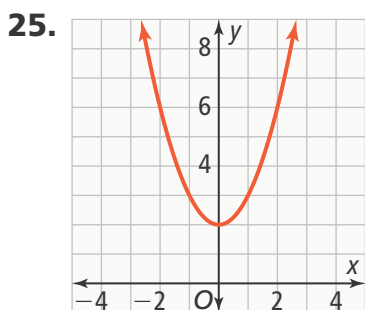
15. Sample: $f(x) = x + 3$, $g(x) = x + 1$,
 $(f \cdot g)(x) = x^2 + 4x + 3$. The domain and
 range of f and g are all real numbers.
 The domain for $f \cdot g$ also includes all
 real numbers, but the range changes.
 The range of $f \cdot g$ is $y \geq -1$.

17. $(f + g)(x) = 2x - 3\sqrt{x} + 4$

19. $(f - g)(x) = 7^x - 5x^2 + 2x + 4$

21. $(f \cdot g)(x) = -18x^3 - 45x^2 - 4x + 2$

23. $(f \cdot g)(x) = 7x\sqrt{5x} + 2\sqrt{5x}$



The domain of $f + g$ is the same as the
 domain of f and the domain of g . The
 range of $f + g$ is $y \geq 2$, but the range of
 f is 4 and the range of g is $y \geq -2$.

27. a. $f(x) = 75x + 50$ b. $g(x) = 36x$

c. $(f - g)(x) = 75x + 50 - 36x = 39x + 50$

29. a. $f(r) = 2\pi r^2$ b. $g(r) = 40\pi r$

c. $(f + g)(r) = 2\pi r^2 + 10\pi r$ 31. B

Lesson 10-7

1. Sometimes when solving problems,
 you know data that is the output of
 a function. It may be easier to write
 the inverse of the function and use
 the data as the input instead. 3. No;
 the function $y = x^2$ does not have an
 inverse function unless the domain is
 restricted.

5.

x	y
0	3
1	1
2	-1
3	-3

x	y
3	0
1	1
-1	2
-3	3

7. $f^{-1}(x) = 0.5x - 5.5$ 9. The inverse of a
 function is similar to inverse operations
 because both are, in some ways, the
 "opposite" of the original function
 or operation. They are different
 because inverse functions involve
 switching the input and output, and
 inverse operations are used along
 with the properties of equality to solve
 equations. 11. a. yes; $f^{-1}(x) = \frac{x}{5}$

b. No; restrict the domain to
 nonnegative numbers. c. No; restrict
 the domain to nonnegative numbers.

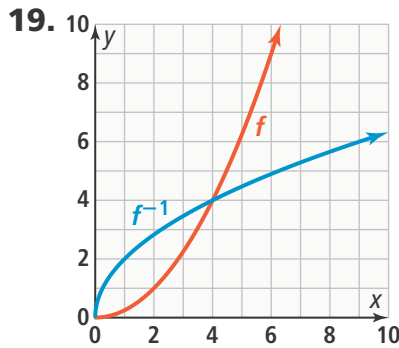
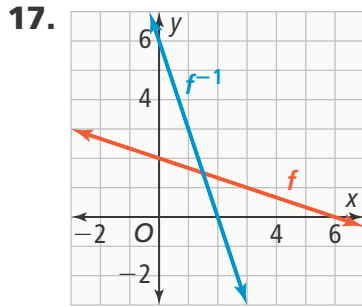
13. $f^{-1}(x) = 0.5(x^2 + 1)$, $x \geq 0$; I found
 my answer by writing the equation
 represented by the graph and then
 finding its inverse algebraically.

15.

x	y
11	0
15	1
19	2
23	3

Selected Answers

Topic 10



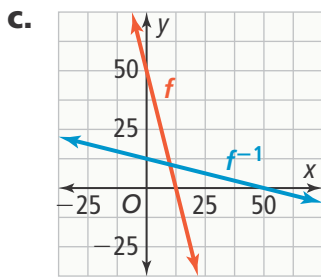
21. no **23.** $f^{-1}(x) = -0.2x - 2.2$

25. $f^{-1}(x) = \frac{x-12}{7}$

27. $f^{-1}(x) = \sqrt{x-7}$ **29.** $y = 4x - 400$;

\$4,600 **31. a.** $f(x) = 50 - 4x$

b. $f^{-1}(x) = -0.25x + 12.5$



d. f^{-1} ; The inverse function gives the number of games played as a function of the amount of money left on the card.

33.

- I.** $f(x) = 4x - 8$ ~~**A.** $f(x)^{-1} = \frac{1}{2}\sqrt{x}$~~
- II.** $f(x) = 0.25x - 2$ ~~**B.** $f(x)^{-1} = 0.25x + 2$~~
- III.** $f(x) = 4x^2, x \geq 0$ ~~**C.** $f(x)^{-1} = 4x + 8$~~
- IV.** $f(x) = 2x^2, x \geq 0$ **D.** $f(x)^{-1} = \sqrt{\frac{1}{2}x}$

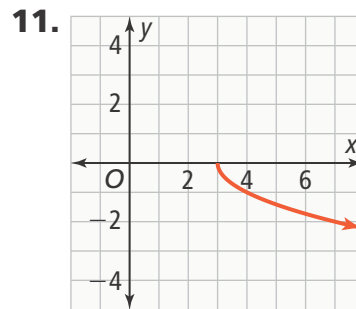
35. Part A $y = 75x + 90$; $y = 40x + 25$

Part B $y = 155x + 140$; $y = \frac{x-140}{155}$

Part C 8 months

Topic Review

- 1.** Check students' work. See *Teacher's Edition* for details.
- 3.** inverse of a function
- 5.** The graph of g is a vertical translation of 4 units up of the graph of f .
- 7.** The graph of g is a horizontal translation of 1 unit right and a vertical translation of 5 units down of the graph of f .
- 9.** $g(x) = \sqrt{x} - 5$

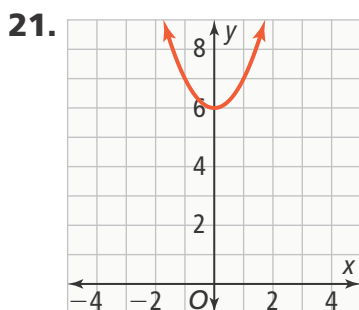


The domain is $x \geq 3$. The range is $y \leq 0$.

- 13.** The graph is a horizontal translation of 5 units left.
- 15.** The graph is a horizontal translation of 1 unit right and a vertical translation of 2 units up.
- 17.** 0.09 **19.** 0.63, 0.18

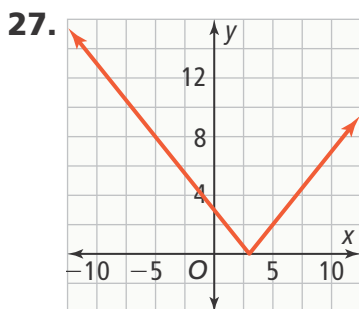
Selected Answers

Topic 10



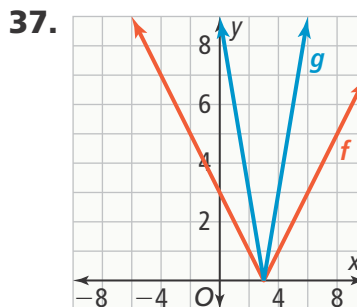
The domain is the set of all real numbers; the range is all real numbers greater than or equal to 6.

23. As $x \rightarrow \infty$, $j(x) \rightarrow -\infty$, and as $x \rightarrow -\infty$, $j(x) \rightarrow 0$. **25.** f is a quadratic function that opens upward. As $x \rightarrow \infty$, $f(x) \rightarrow \infty$, and as $x \rightarrow -\infty$, $f(x) \rightarrow \infty$.



29. $g(x) = (x - 5)^2$ **31.** $g(x) = -x^2 - 5$

33. vertical stretch **35.** horizontal compression



The graph of g is a vertical stretch and a horizontal compression of f . If a graph is vertically stretched, then it is also horizontally compressed. Conversely, if a graph is vertically compressed, then it is also horizontally stretched.

39. $(f + g)(x) = 3x^2 + 7x - 8$

41. $(f + g)(x) = -x + \sqrt{2x} + 4$

43. $(f \cdot g)(x) = 15x^3 + x^2 - 2x$

45. $(f \cdot g)(x) = 6\sqrt{3}x^{\frac{3}{2}} - 5\sqrt{3x}$

47. Answers may vary. Sample:

$f(x) = 2x$, $g(x) = 3x$, $(f \cdot g)(x) = 6x^2$

49.

x	y
3	0
5	1
8	2
11	3

51. $f^{-1}(x) = \frac{x+7}{4}$ **53.** $f^{-1}(x) = \frac{x^2+3}{2}$

55. The student added 3 when solving the equation, instead of subtracting 3.

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

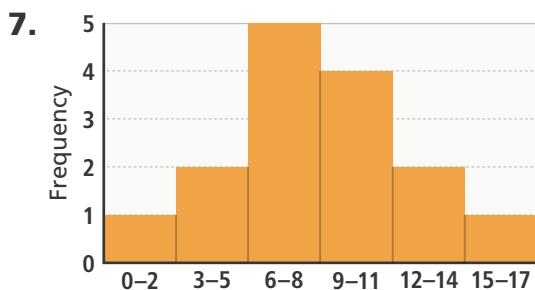


Selected Answers

Topic 11

Lesson 11-1

1. dot plots, histograms, and box plots all show the spread of a data set. Dot plots reveal individual data values, histograms reveal frequencies organized by intervals, and box plots reveal the median, quartiles, minimum, and maximum. **3.** histogram; A histogram groups data values into bins, or intervals, before displaying frequencies. **5.** yes; no; yes; You can tell maximum and minimum values from a dot plot because individual values are displayed, and a box plot shows maximum and minimum values. You cannot tell in a histogram because individual values are not displayed within each bar.

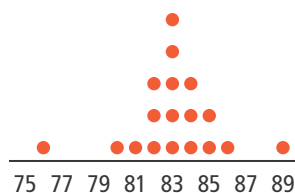


The data are fairly evenly distributed.

9. box plot; **8** **11.** histogram; **4**

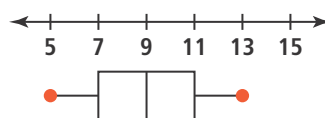
13. Answers may vary. Sample: test scores for a class; Since dot plots reveal individual data values, you would choose a dot plot if you wanted see how many people got a specific test score. **15. a.** No, individual values are not displayed in the box plot. **b.** No, individual values are not displayed in the box plot, so there is not a way to determine the frequencies for each bin in a histogram.

17. 5; A dot plot shows individual data values.

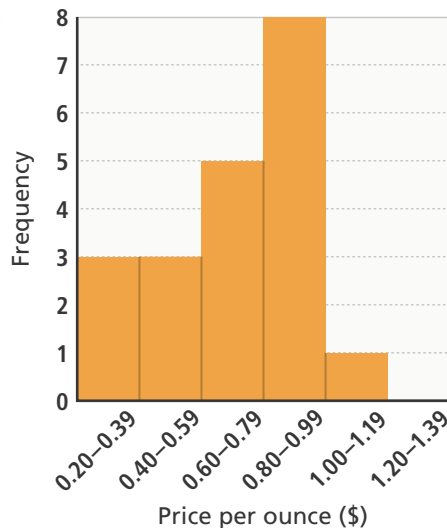


19. dot plot; You need to see individual data values to count how many are greater than any given value. **21.** box plot; A box plot reveals quartiles.

23. 7



25.



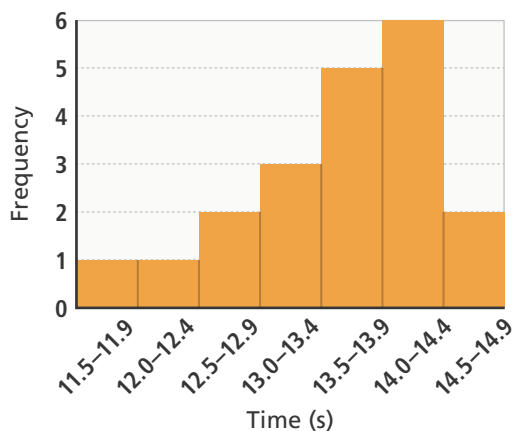
Lucy's price is lower than 70% of the other prices.

Selected Answers

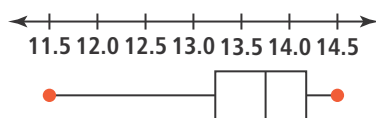
Topic 11

27. yes; no; no; yes

29. Part A Dot plots and histograms are best for displaying the shape of a distribution. For these data, a dot plot will be too spread out, so use a histogram.

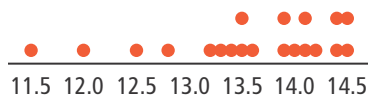


Part B A box plot is best for displaying the spread of data above and below the median.



Part C A histogram is best for grouping data by intervals; see Part A.

Part D A dot plot is the best display to use; to find the mean, he must know the individual data values.



Lesson 11-2

1. Measures of center show where a data set is clustered, while measures of spread show the amount of variability in a data set. Both types of measures should be considered when comparing data sets. **3.** Since the mean is the average value, it is affected by outliers. The MAD shows how closely the data are clustered about the mean, so it can indicate the existence of values that are far from the mean. **5.** Data Set A: 87; Data Set B: 83.2 **7.** Data Set A: 87; Data Set B: 87 **9.** The ranges and IQRs are very close and the medians are equal, so medians, IQRs, and ranges are better measures of center and spread for comparing data sets A and B.

11. Since the means are the same but the median is much smaller in one data set, that data set must include some large values that pull the mean higher.

13. Both are measures of spread. The IQR measures the spread of the middle 50% of data values about the median, while the range measures the spread of the entire data set. **15.** Data Set A Mean: 5; MAD: 0.5; Median: 5; IQR: 1 Data Set B Mean: 5; MAD: 1.375; Median: 5; IQR: 2

The means are the same, but the MAD for Data Set B is larger, so Data Set B is more spread out around the mean. The medians are the same, but the IQR for Data Set B is larger, so the middle 50% of Data Set B is more spread out. The mean and MAD are better measures; the mean is generally preferred over the median when both data sets are evenly spread about the mean.



Selected Answers

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17. Data Set A Mean: 74; MAD: 1.73; Median: 74; IQR: 4; Data Set B Mean: 79; MAD: 1.73; Median: 79; IQR: 4; For both sets, the mean is equal to the median; the data are evenly distributed. The mean and median of Data Set B is 5 units greater than the mean and median of Data Set A, but the MADs and IQRs are the same; the sets have similar variance. The mean and MAD are better measures because the mean is generally preferred over the median when the data are centered about the mean.

19. The mean score on this year's exam was 85, with a mean average deviation of 4.9. The mean score was higher than last year's score, but there was also greater spread about the mean this year. **21.** The data for the second machine are not centered about the mean, so use the median and IQR to compare. Machine A has a median of 12.0, with an IQR of 0.25. Machine B has a median of 11.95, with an IQR of 0.4. The median weights are either equal to or very close to the advertised weight, but the high variability in Machine B indicates that it may have a problem. **23.** D

Lesson 11-3

1. The shape of a data set can help you understand relationships between measures of center and spread.

For example, when the data are symmetrically distributed, the mean and median are about the same.

However, the mean is less than the median if the data are skewed left and greater if the data are skewed right.

3. no the display for a normal distribution is symmetric about the mean.

5. symmetric the mean and the median are both about 12.

7. Suppose two data sets have the same mean and median. If a much lower data value is substituted for one of the data values in the lower half of the ordered set, then the median will stay the same, but the mean will decrease.

9. The display represents a data set that is skewed right.

11. a. Both displays are symmetrical about the mean, and both have the same spread, but Display A is 25 units to the left of Display B on a number line.

b. Answers may vary. Sample: If Set B did not have the same shape as Set A, you could form a new Set B by subtracting 25 from every data value in Set A. Then Display B would have the same shape as Display A.

13. Both data sets are symmetric and have the same mean and median, but Data Set B has a greater MAD. **15.** The data display is skewed left. The mean amount raised is less than the median.



Selected Answers

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17. The display for Year 1 is skewed right, so the mean house price was greater than the median house price. The display for Year 2 is close to symmetrical, so the mean house price and the median house price were about the same. **19.** The display for Test 1 is symmetrical, so the mean and median are close to equal. The median is about 525, Q1 is 400, and Q3 is 600. A student who takes Test 1 is likely to get a score between 400 and 600 and is also likely to score close to the mean score of 525. For Test 2, the median is about 450, Q1 is 400, and Q3 is 525. These are lower than the scores for Test 1, so a person who takes Test 1 is more likely to get a higher score. Also, the display for Test 2 is skewed to the right, so the mean is greater than the median. A student who takes Test 2 is less likely to have a score close to the mean than a student who takes Test 1. **21.** D

Lesson 11-4

1. A data set can be analyzed by looking at the difference between the greatest and least values as well as patterns in how close or far data fall from the mean. **3.** Marisol is incorrect. Standard deviation measures variation from the mean. **5.** Sample A has a range of 4, and Sample B has a range of 9. So the spread of Sample B is greater.

7. Although the standard deviation for Sample A is smaller than the standard deviation for Sample B, the mean for Sample A is also smaller than Sample B. Therefore, you cannot use the standard deviation alone to compare the spread of one set to the other. **9. a.** Since the means of data sets are equal, you can infer that the data set with the greater standard deviation is more spread out. **b.** The shape of the histogram for the second set is wider and flatter.

11. Yes; 2 standard deviations below the mean and above the mean includes data values from about 4.28 to about 22. Therefore 8.7 falls within 2 standard deviations of the mean.

13. Data Set A: mean: 4.25, standard deviation: 2.49; Data Set B: mean: 5.50, standard deviation: 2.67; The means and the sample standard deviations of both sets are close to equal, so the sets have similar variability.

15. Data Set A: mean: 9.06, standard deviation: 2.35; Data Set B: mean: 9.06; standard deviation: 3.49; The means are about the same, but the sample standard deviation for Data Set B is greater than the sample standard deviation for Data Set A, so the data from Data Set B have greater variability. You can also verify this by observing that the data in the dot plot for Data Set B have a greater spread. **17.** 0–7 and 17–30



Selected Answers

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19. Finishing times under 2:32:37 are more than 2 standard deviations below the mean finishing time. The histogram bar for finishing times between 2 and 3 hours represents about 25,000 runners, so there would be no more than 25,000 runners who had finishing times less than 2 standard deviations below the mean. **21.** 700; about 1,950 **23.** C

Lesson 11-5

1. You can calculate joint and marginal frequencies, joint and marginal relative frequencies, and conditional relative frequencies. If conditional relative frequencies in a table are not all about the same, associations between variables may be statistically significant. **3.** Conditional relative frequencies are the ratio of a joint frequency and the marginal frequency of the corresponding row or column, depending on which parameter, or condition, you are using.

5.

	Item A	Item B	Totals
Male	20	5	25
Female	10	15	25
Totals	30	20	50

7.

	Item A	Item B	Totals
Male	0.8	0.2	1.0
Female	0.4	0.6	1.0

Yes; it is reasonable to conclude that males prefer Item A more than females do because 80% of males prefer Item A, while only 40% of females prefer Item A.

9. Yes; an equal number of juniors and seniors were surveyed, so percentages can be compared without calculating conditional relative frequencies. The table shows that a greater percentage of juniors prefer Item B and a greater percentage of seniors prefer Item A.

11. Each marginal relative frequency is the sum of the joint frequencies in the corresponding row or column.

13.

	Song A	Song B	Totals
Teen	30	5	35
Adult	10	15	25
Totals	40	20	60

Yes; the marginal frequencies show that more people surveyed prefer Song A.

15.

	Song A	Song B	Totals
Teen	0.86	0.14	1.00
Adult	0.40	0.60	1.00

Yes; 86% of teens prefer Song A while only 40% of adults do.



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17.

High School Graduate?	Choice A	Choice B	Totals
Yes	16 0.08	96 0.48	112 0.56
No	64 0.32	24 0.12	88 0.44
Totals	80 0.40	120 0.60	200 1.00

19.

High School Graduate?	Choice A	Choice B
Yes	0.2	0.8
No	0.8	0.2
Totals	1.00	1.00

21. No; of those who prefer Choice A, only 20% are high school graduates.

23. the ratio of graduates who prefer Choice B to the overall number of respondents who chose B

25.

Blooms?	No Plant Food	Plant Food	Totals
< 14	5	3	8
≥ 14	7	9	16
Totals	12	12	24

Blooms?	No Plant Food	Plant Food
< 14	0.42	0.25
≥ 14	0.58	0.75
Totals	1.00	1.00

Calculating the conditional relative frequencies by columns shows that, of the 12 plants grown without the new food, 58% had satisfactory blooms. Of the 12 plants grown with the new food, 76% had satisfactory blooms. It is reasonable to infer that there is a significant association between using the plant food and the number of blooms the plant will produce.

27. A, C, D

29. Part A

By how many points did your score increase?			
	< 50	≥ 50	Totals
Prep Course	5	20	25
No Prep Course	45	30	75
Totals	50	50	100



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Part B No; you could calculate conditional relative frequencies by rows to show that 80% of students who took the prep course scored 50 points or higher on the retest, compared to only 40% of students who did not take the prep course.

By how many points did your score increase?			
	< 50	≥ 50	Totals
Prep Course	0.20	0.80	1.00
No Prep Course	0.60	0.40	1.00

Topic Review

1. Check students' work. See *Teacher's Edition* for details. **3.** joint frequencies **5.** conditional relative frequency **7.** You would use a dot plot when you want to know individual data values or see clusters, gaps, and outliers. **9.** You would use a histogram because it shows the frequency of data values within an interval. **11.** The data are skewed right.

13. This year's mean is 80.2 points and the MAD is 5.67. This year's team had a higher average score but last year's team was more consistent in scoring near the mean. **15.** skewed left **17.** The distance from the minimum value to the middle 50% of the data is greater than the distance from the middle 50% to the maximum value of the data. This indicates that a small value skewed the data to the left and that the mean is smaller than the median. **19.** No; 70.5 is greater than $50.5 + 9.6 + 9.6$. **21.** more than \$24,550; 2.5% of accounts would meet the requirement

23.

Where do you get most of your news?			
Age	TV	Internet	Totals
≤30	25%	40%	65%
>30	15%	20%	35%
Totals	40%	60%	100%

No, most people from each age group prefer to get their news from the Internet compared to TV (60% vs. 40%).