



Selected Answers

Topic 1

Lesson 1-1

2. Recall that the sum (or difference) of two rational numbers is always rational. Assume that the sum of a rational number and an irrational number is rational. That is, *rational number + irrational number = rational number*. Then, *irrational number = rational number – rational number*.

This is always a false statement, so the assumption is also false. Therefore, the sum of a rational number and an irrational number is irrational.

4. Jacinta did not consider the case when the rational number is equal to zero. If the rational number is zero, then zero times any irrational number will be zero, which is rational. **6.** yes **8.** $\frac{41}{3}$, 14, $\sqrt{200}$ **10.** It is irrational.

12. No; an irrational square root times itself gives a rational square.

14. $12\frac{1}{8}$ in. $< x < 12\frac{1}{4}$ in. **16.** rational,

real **18.** whole, integers, rational,

real **20.** irrational, real **22.** $\frac{10}{3}$, 3.5,

$\sqrt{14}$ **24.** C **26.** B **28.** Irrational;

$6 - \sqrt{2}$ is irrational **30.** Rational; can

be expressed as a ratio **32.** Yes; the difference of two rational numbers can be rewritten as a single ratio, so the difference is always rational.

34. no **36.** You do not know the shape of the shed, so length could be real, rational, irrational, integer, a whole number, or some combination of those. If each piece is square, the length is $4 + 5\sqrt{2}$. **38.** B

Lesson 1-2

2. Use the Addition Property of Equality on both sides to get $9x$ alone

on the left side of the equation, and then use the Division Property of Equality on both sides to get x alone on the left side of the equation. Substitute the value of x into the original equation, and then evaluate the expressions on both sides to see that they are equal. **4.** Venetta should have multiplied by $\frac{1.6 \text{ km}}{1 \text{ mi}}$ to convert to kilometers. **6.** -7 **8.** 8.1 or $\frac{81}{10}$

10. Subtraction Property of Equality. Subtracting 3 from both sides isolates the variable term $2x$. Answers may vary. Sample: A first step could be multiplying terms by 2 to remove fractions, then using the Distributive Property to expand the expression $(-1)(x + 3)$. That way, you can combine like terms on the left side before isolating x . **12.** The student made a sign error when distributing -2 in the first step.; $4 = -2x - 6$ should be $4 = -2x + 6$, and the correct solution is $1 = x$. **14.** Recall that any number divided by 0 is undefined. To see why, consider the equation $\frac{a}{0} = x$, where a and x are non-zero real numbers. If a could be divided by 0 to get x , then x times 0 equals a , which is impossible because any number multiplied by 0 is 0. Therefore, c cannot be 0. **16.** -2 **18.** -20 **20.** 6

22. -9 **24.** $-\frac{7}{2}$, or $-3\frac{1}{2}$ **26.** -2

28. $\frac{27}{4}$, or $4\frac{3}{4}$ **30.** $\frac{21}{16}$, or $1\frac{5}{16}$ **32.** 16.5

34. 110.4 **36.** 5 **38.** a. $\frac{d}{20} + \frac{1}{4} + \frac{d}{12} = \frac{1}{3}$

b. $\frac{5}{8}$ mi **40.** $9 + 3b + 2(b - 1) = 67$;

12 bottles **42.** 40 drops; about 0.17%

44. A



Selected Answers

Topic 1

Lesson 1-3

2. Both sides simplify to show that the two expressions are exactly the same. **4.** No. The side on which you choose to isolate the variable does not affect the solution. However, the side you choose can affect the number of steps needed to obtain the solution. **6.** $h = -2$ **8.** no solution **10.** The variable can be on only one side of the equation. For the equation $3x - 3x = 5$, the equation simplifies to $0 = 5$, so there is no solution. **12.** The student made a math error in the first step when distributing 0.15 over the quantity $y - 0.2$. The expression $0.15y - 0.3$ should be $0.15y - 0.03$. The solution is $y = -\frac{153}{35}$. **14.** 6 cm, 13 cm, and 13 cm; 32 cm **16.** 4 **18.** 0 **20.** 7 **22.** 21 **24.** -1 **26.** -8 **28.** identity **30.** identity **32.** no solution **34.** no solution **36.** 4 **38.** $\frac{2}{3}$ **40.** 6 **42.** 15 smaller boxes **44.** About 18.3 seconds; the heights in feet of the washers can be modeled by $21 + \frac{2}{3}t$ and $50 - \frac{11}{12}t$, where t is time in seconds. The washers will reach the same height when $21 + \frac{2}{3}t = 50 - \frac{11}{12}t$, or when $t \approx 18.3$ seconds. **46.** No; although $t = 11$ is a solution to an equation relating the costs of the two gyms, the membership is prepaid for 12 months. So the membership fees are never equal. **48.** C, D, E **50. Part A** 4.875 minutes; 73.125 feet **Part B** No; Benito will finish first. At 4.875 minutes, they will have painted the same number of feet. After that, Benito will paint more

fence in less time because he paints at a faster rate than Tyler. So, Benito will reach the end first. **Part C** Benito will finish first and get to rest for about 2 minutes. Solve the equation $15t = 150$ to find that it takes Benito 10 minutes to finish. Solve the equation $19.5 + 11t = 150$ to find that it takes Tyler about 12 minutes to finish. So Benito will get to rest for about $12 - 10 = 2$ minutes.

Lesson 1-4

2. Answers may vary. Sample: Similar: You use the same properties of equality to solve each. Different: There is a numerical solution for $2x + 1 = 9$, $x = 4$. The solution for $2x + c = d$ is $x = \frac{d-c}{2}$. Substitute 1 and 9 for c and d : $x = \frac{9-1}{2}$. **4.** Dyani should have added $\frac{1}{k}$ instead of 1, then multiplied each side by k . Dyani could also begin by multiplying each side by k , then adding 1 to each side. **6.** $m = \frac{5}{4}n - 7$ **8. a.** $x = \left(\frac{1}{3}\right)(q_1 + q_2 + q_3)$ **b.** $q_3 = 3x - q_1 - q_2 = 3(90) - 85 - 88 = 97$ **10.** $s = \frac{P}{3}$; 3.5 ft by 6.65 ft; 23.275 ft **12.** sometimes, sometimes, always **14.** $y = a - k$ **16.** $x = w(a - b)$, or $x = wa - wb$ **18.** $n = 2x + y$ **20.** $u = \frac{3}{5(y-5)}$ **22.** $m = -\frac{3x}{11}$ **24.** $h = \frac{3V}{\pi r^2} + 1$ **26.** $y = \frac{mx}{3} + b$ **28.** $\ell = \frac{117}{w}$ **30.** $b = 212 - \frac{1.72}{1,000}h$, $h = -\frac{1,000}{1.72}(b - 212)$; $\approx 12,791$ ft **32.** The formula to place in cell A3 is, " $= D3 / (B3 * C3)$ ". **34.** D



Selected Answers

Topic 1

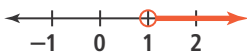
Lesson 1-5

2. Since $x > 0$, the quotient of x and a positive quantity is positive and the inequality symbol stays the same, but the quotient of x and a negative quantity is negative, so the inequality symbol must be reversed. **4.** Rachel reversed the inequality symbol when multiplying by a positive quantity.

6. $x \leq -5$



8. $x > 1$



10. a. $a > b$

$a - b > 0$ Subtract b from each side.

$c(a - b) < 0$ Since c is negative, $c(a - b)$ is negative, and the inequality symbol is reversed.

$ca - cb < 0$ Distributive Property

$ca < cb$ Add cb to each side.

b. $a > b$

$a - b > 0$ Subtract b from each side.

$\frac{a - b}{c} < \frac{0}{c}$ Since c is negative, $\frac{a - b}{c}$ is negative, and the inequality symbol is reversed.

$\frac{a}{c} - \frac{b}{c} < \frac{0}{c}$ Distributive Property

$\frac{a}{c} - \frac{b}{c} < 0$ Simplify.

$\frac{a}{c} < \frac{b}{c}$ Add $\frac{b}{c}$ to each side.

12. The student reversed the inequality symbol when dividing by 3. The

inequality symbol need only be reversed when multiplying or dividing by a negative number; The correct solution is $x > 2$. **14. a.** $a < b$ **b.** No, if $a \geq b$, then $c(a - b) \leq 0$.

16. $x < 50$;



18. $x > -20$;



20. $x < -5$;



22. $x \leq 10.7$;



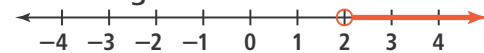
24. $x > -2$;



26. $x < 9$;



28. $x \geq \frac{2}{3}$;



30. D **32.** A **34.** $x > 2$ **36.** $x > 8$

38. $x \leq 2$ **40.** $x \leq 4$ **42.** $x > 8$

44. Extend the graph to include the entire number line to represent the solution all real numbers.

46. $6x + 24 < 7.5x + 15$; $x > 6$; The office will have to buy more than 6 jugs each month for Best Water to cost less than Acme. **48. A. I B. II C. III D. IV**

50. Part A $3.5x \geq 21$; $x \geq 6$; Steve would have to walk at least 6 hours.

Part B $3.2x < 2.4x + 2$; $x < 2.5$; Elijah is behind Mercedes for up to 2.5 hours.



Selected Answers

Topic 1

Part C $3.2x + 42 > 3x + 42.5$; $x > 2.5$;
Elijah is ahead of Aubrey after 2.5 hours.

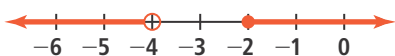
Lesson 1-6

2. The graph of $x > a$ and $x < b$ is similar to the graph of $x > a$ because it may include some of the same values, but it is different because it will include only values that are also less than b .

4. Kona should have graphed $x > 2$ because the inequalities are joined by *or*, not *and*. **6.** $x \geq 2$ and $x < 8$



8. $x < -4$ or $x \geq -2$;



10. If $a > b$, then $c = a$; if $a < b$, then $c = b$; if $a = b$, then $c = a = b$.

12. $x > a$ or $x < b$ **14.** Let Set A be the solution set for $4 < x < 8$. Then Set A = {5, 6, 7}. Let Set B be the solution set for $2 < x < 11$. Then Set B = {3, 4, 5, 6, 7, 8, 9, 10}. Since each element in Set A is also an element of Set B, Set A is a subset of Set B.

16. $x \geq -5$ and $x \leq -1$

18. $x \leq -1.2$ or $x \geq -0.4$

20. $x > 4$ **22.** all real numbers

24. $x < -30$ or $x > -24$ **26.** $6 \leq x \leq 8$

28. $x < 10$ or $x > 20$ **30.** at least 12 and at most 18 pencils

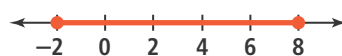
32. $100 \leq 2.5(2x + 7.5) \leq 200$;

$16.25 \text{ ft} \leq x \leq 36.25 \text{ ft}$ **34.** D

Lesson 1-7

2. The methods are similar because the same strategies and properties are used. The methods are different because equations for two cases must be solved when absolute value is involved. **4.** Yumiko should have solved $x < -5$ or $x > 5$. **6.** $x = -4$, $x = 12$

8. $-2 \leq x \leq 8$



10. Subtract 4 from each side to isolate the absolute value expression on one side of the equation. **12.** The student should have rewritten the absolute value inequality with *and* instead of *or*. **14. a.** When solving $|ax| + b = c$, b has to be subtracted from each side of the equation first to isolate the absolute value expression. **b.** When solving $|ax| + b \leq c$, two inequalities are written with *and*, while when solving $|ax + b| \geq c$, two inequalities are written with *or*. **16.** $x = -13$, $x = 13$ **18.** no solution **20.** $x = -5$, $x = 13$ **22.** $x = -2$, $x = 18$ **24.** $x = -3$, $x = 7$ **26.** $|10x - 30| = 3$; minimum: 2.7 s; maximum: 3.3 s

28. $x > -6$ and $x < 6$



30. $x > -1.2$ and $x < 1.2$



32. $-2 < x < 7$

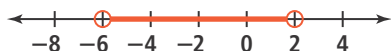




Selected Answers

Topic 1

34. $-6 < x < 2$



36. D 38. C 40. The minimum number of guests is 28. The maximum number of guests is 36. Ashton should reserve 6 tables so that every guest is seated.

42. B, C, E, D, A 44. Part A $|x - 30| = 5$; $x = 25$, $x = 35$; minimum speed:

25 mph; maximum speed: 35 mph

Part B $|x - 35| \leq 2$; $33 \leq x \leq 37$;

The sign blinks when a vehicle is traveling between 33 and 37 mph, inclusive. **Part C** Use the formula

$|x - a| \geq b$, with $a = 20$, and $b = 5$; The absolute value formula to use is the one that represents a compound inequality using *or* because the message should flash at cars traveling under 15 mph *or* over 25 mph.

Topic Review

2. formula **4.** element **6.** set

8. identity **10.** real number, rational number **12.** real number, rational number, integer **14.** $\sqrt{5.65}$, 2.4, $\frac{29}{12}$

16. Property of equality; First you need to add 6 to each side of the equation to isolate the x term **18.** $t = 4.375$
20. $s = 15$ **22.** In the third step, the student multiplied the right side by 10 instead of 100.

$$0.6(y - 0.2) = 3 - 0.2(y - 1)$$

$$0.6y - 0.12 = 3.2 - 0.2y$$

$$100(0.6y - 0.12) = 100(3.2 - 0.2y)$$

$$60y - 12 = 320 - 20y$$

$$60y - 12 + 12 + 20y = 320 + 12 - 20y + 20y$$

$$80y = 332$$

$$y = 4.15$$

24. $b = -2\frac{1}{3}$ **26.** No, he is not correct;

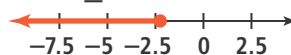
For 10 months, the first option will cost $\$19.99(10) + \$12.80 = \$212.70$.

The second option will cost

$\$21.59(10) = \215.90 . The first option is less expensive. **28.** $y = \frac{k}{x}$ **30.** $d = \frac{8}{33}c$

32. $x \leq -1$ and $x \geq 3$

34. $x \leq -2.25$



36. $x \leq -2$



38. The graph shows $-1 \leq x \leq 3$, not $x > 3$ or $x < -1$.



40. $x \leq -4$



42. $x > 5$



44. First isolate the absolute value expression $|3x|$ by adding 5 to each side of the equation. **46.** $x = 11$, $x = -1$

48. $-4.5 \leq x \leq 7.5$

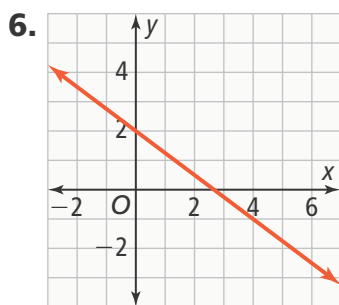


Selected Answers

Topic 2

Lesson 2-1

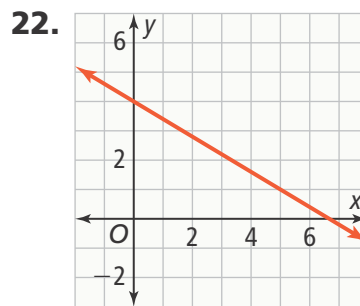
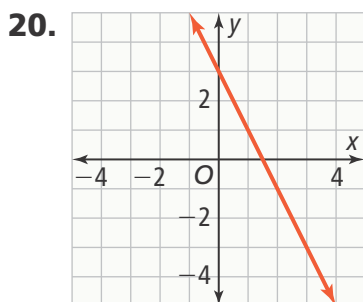
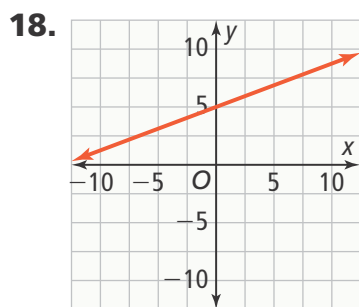
2. Both graphs are lines. They both include the point (0, 1). The graph of $y = 2x + 1$ has a slope of 2, and the y-intercept is 1. The graph of $y = -2x + 1$ has a slope of -2, and the y-intercept is 1. 4. Substitute the coordinates of the two points into the formula $m = \frac{y_2 - y_1}{x_2 - x_1}$.



8. slope: $\frac{1}{4}$; y-intercept: 5

10. $y = \frac{3}{2}x - 2$ 12. $y = 0.6x - 4.4$

14. $y = -1.25x - 4.25$ 16. $y = \frac{-3}{4}x + 5$



24. $y = \frac{-1}{3}x + 1$ 26. $y = -2x + 3$

28. $y = \frac{1}{2}x + 1$ 30. $y = \frac{-1}{2}x + 2$

32. $y = 2x - \frac{3}{4}$ 34. $y = -4x + 25$;

The y-intercept represents the total distance of 25 miles. 36. $y = -6x + 8$

38. D, E 40. Part A $y = \frac{5}{8}x + 15$

Part B The y-intercept gives the level when the dispenser is full, which is 15 inches. Part C No, the level will be at $3\frac{3}{4}$ inches after 18 hours. Substituting 18 for x in the equation gives $y = 3\frac{3}{4}$.

Lesson 2-2

2. Sample: Write the equation of the line in point-slope form. Then substitute a value for x in the equation to find a value for y for the same point. 4. You can use the known point and the slope to write the equation of the line in point-slope form. You can use the known slope, but you will need to find the y-intercept to write the equation of the line in slope-intercept form. 6. $y - 3 = 2(x + 4)$
8. $y - 8 = 6(x + 2)$ or $y + 16 = 6(x + 6)$
10. a. $y + 1 = -2(x - 2)$
b. $y - 1 = \frac{2}{3}(x - 3)$ 12. The x- and y-coordinates are reversed. The point in Step 1 should be plotted at (8, -5), not (-5, 8). Step 2 should plot a point 3 units down and 4 units right from the point (8, -5).

Selected Answers

Topic 2

14. $y - 1 = 2(x - 3)$

16. $y + 8 = -\frac{3}{4}(x - 2)$

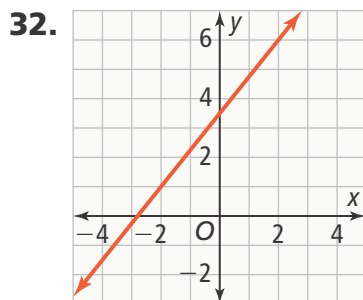
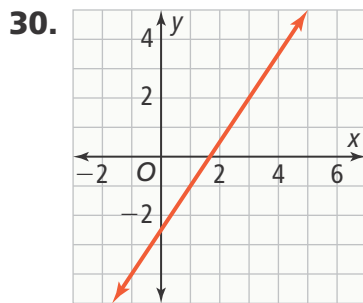
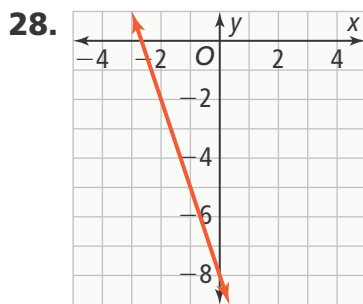
18. $y - 2 = -\left(x + \frac{1}{2}\right)$

20. $y - 4 = -2(x - 2)$

22. $y - 4 = 2(x - 6)$ or $y - 3 = 2(x - 3)$

24. $y + 5 = \frac{3}{2}(x - 3)$ or $y + 8 = \frac{3}{2}(x - 1)$

26. $y + 2 = \frac{8}{5}(x + 4)$ or $y - 6 = \frac{8}{5}(x - 1)$



34. $y - 100 = 3(x - 15)$; $y = 3x + 55$

36. $y - 93.75 = 12.50(x - 5.5)$; Liam can write the equation in slope-intercept form: $y = 12.50x + 25$. The y -intercept models the service fee of \$25.

38. Answers may vary.

Sample: $y - 100 = 1.6(x - 25)$;

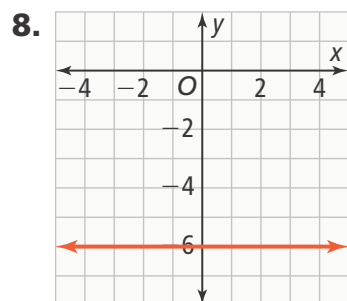
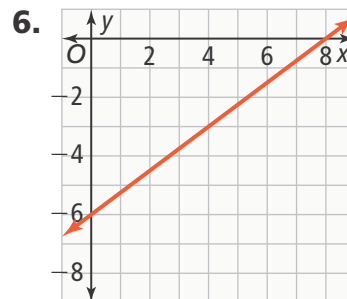
$y = 1.6x + 60$; The cost per invitation is the slope, \$1.60. Slope-intercept form gives information about the set-up fee of \$60 as the y -intercept.

40. A

Lesson 2-3

2. Both are forms of a linear equation. Standard form does not give the y -intercept as slope-intercept form does, but you can find the y -intercept in standard form by setting x to 0 and solving for y . It is easier to find slope using slope-intercept form. Standard form identifies the constraint.

4. Answers may vary. Sample: when you are creating a mixture of two items and need to create a given total



10. a. $A = 6$, $B = -8$; $6x - 8y = 24$

b. $A = 8$, $B = 12$; $8x + 12y = 24$



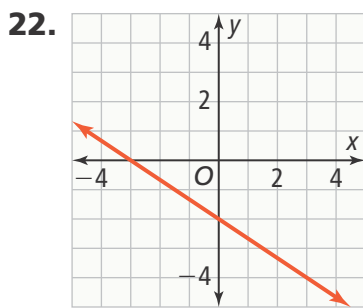
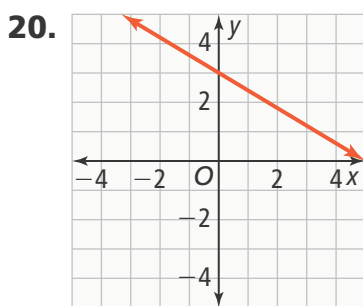
Selected Answers

Topic 2

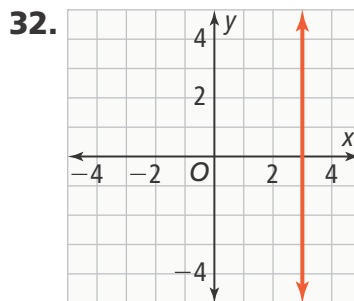
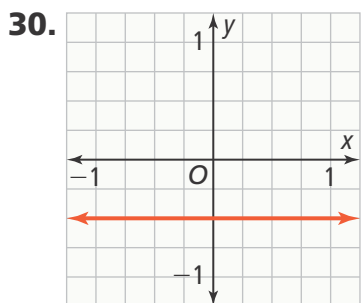
12. The student forgot to keep the negative sign for $-6y$ in step 2. The y -intercept is -2 . **14.** Find slope by solving the linear equation in standard form for y and writing it in slope-intercept form. Slope is $-\frac{A}{B}$, or $-\frac{5}{2}$.

16. x -intercept: -8 ; y -intercept: 6

18. x -intercept: 4 ; y -intercept: -8



24. A **26.** B **28.** The graph of $y = -2$ is a graph of the form $Ax + By = C$ when $A = 0$.



34. $14x - 7y = -3$ **36.** $2x - 3y = -15$

38. $4x + 6y = 24$ **40.** $x = 2$

42. $2x + 4y = 12$, where x is pounds of wheat flour and y is pounds of rye flour.

44. A, B, D **46. Part A** mango and pineapple: $0.5x + 0.75y = 8$;

mango and strawberry: $0.5x + y = 8$;

pineapple and strawberry: $0.75x + y = 8$

Part B mango and pineapple:

$10\frac{2}{3}$ - 16 cups; mango and strawberry:

8 - 16 cups; pineapple and strawberry:

8 - $10\frac{2}{3}$ cups **Part C** mango and pineapple or mango and strawberry;

Since Fatima will be using liquid to double the volume of the smoothies,

she needs at least 12 cups of fruit to make at least 24 cups of smoothies. The

ranges in cups of mango and pineapple and mango and strawberry include

totals of at least 12 cups.

Lesson 2-4

2. Dwayne made the slope opposite but did not write the opposite reciprocal of -2 , which is $\frac{1}{2}$. **4.** No; In order for the lines to be parallel, the slopes must be

the same. The two given lines do not have the same slope. **6.** $y = \frac{4}{3}x - 2$



Selected Answers

Topic 2

8. neither **10.** 4 **12.** 3 **14.** The coefficients of x and y are the same, so you know that when the equations are converted to slope-intercept form, the slopes will be equal. When the slopes are equal, the lines are parallel.

16. $y = 3x + 1$ **18.** $y = -\frac{2}{3}x + 8$

20. $y = \frac{5}{2}x + 12$ **22.** $y = 5$ **24.** parallel

26. perpendicular **28.** Check students' work. **30.** $y - 5 = \frac{-2}{9}(x - 8)$ **32.** C

34. Part A $y = \frac{5}{2}$ **Part B a.** $y = -\frac{2}{3}x + \frac{1}{3}$

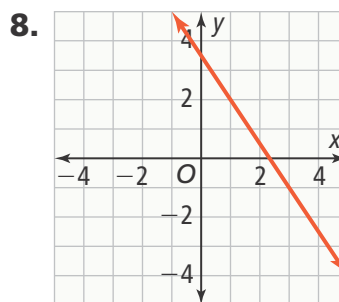
b. $y = \frac{3}{2}x + \frac{31}{2}$ **c.** $y = -\frac{2}{3}x + \frac{40}{3}$

d. $y = \frac{3}{2}x + \frac{5}{2}$ **Part C** Check students' work.

Topic Review

2. reciprocals **4.** parallel

6. point-slope form



10. $y = -\frac{5}{3}x + 6\frac{1}{3}$ **12.** $y + 2 = 0.5(x - 4)$

14. $y - 1 = \frac{3}{8}(x - 3)$

16. $y - 123.75 = -8.25(x - 5)$, \$15.00

18. $y - 4x = -5$

20. x -intercept: 6; y -intercept: -10

22. $1.25x + 1.50y = 25$ **24.** $y = -3x + 7$

26. $y - 7 = -4(x - 1)$ **28.** neither



Selected Answers

Topic 3

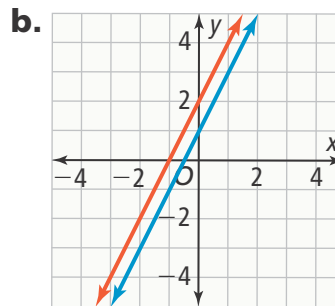
Lesson 3-1

- 2.** Both the domain and range are continuous positive real numbers and 0; the amount of time and of rain can be fractions of whole numbers.
- 4.** Every function is a relation, because any function can be written as a set of ordered pairs. Not every relation is a function, because some relations could have domain values for which there is more than one range value.
- 6.** D: {1, 2, 3, 5, 7, 8}; R: {2, 3, 4, 6, 7, 8, 9}; not a function **8.** **a.** domain: $1 \leq x \leq 3$; range: $0 \leq y \leq 4$ **b.** domain: $x \geq 0$; range: $y \geq 1$ **10.** n can be any value except 1, 2, or 3. **12.** **a.** The relation is not a function because one input value maps to more than one output value. The mapping from y to x may or may not be a function, depending on whether each value of y maps to more than one value of x . **b.** The relation may or may not be a function, depending on whether any x -value maps to more than one y -value. The mapping from y to x is not a function because at least one y -value maps to more than one x -value.
- c.** The relation represents a function because each input maps to exactly one output. The mapping from y to x is also a function because each y -value maps to exactly one x -value. **14.** D: {A, B, C, D}; R: {Rockets, Birds, Pups, Cats, Hawks}; The relation is not a function because the input A maps to more than one output. **16.** domain: whole numbers; range: multiples of 125 **18.** function; one-to-one **20.** not a function **22.** whole numbers less than or equal to 40 **24.** **a.** D: {English, Math,

History, Biology, Biology Lab} R: {0, 45, 60, 90} It is a function. **b.** D: {English, Math, History, Biology, Biology Lab} R: {45, 60} It is a function. **c.** No; Answers may vary. Sample: The element 45 in Week 1 is matched with more than one class time in Week 2. So, class times for Week 2 are not a function of class times for Week 1. **26.** **a.** D: $\{t \mid \frac{1}{2} \leq t \leq 2\}$; R: $\{s \mid 30 \leq s \leq 45\}$ **b.** Answers may vary. Sample: a table **c.** Answers may vary. Sample: The train increases its speed at half an hour and then remains constant, a table is the simplest way to model this information. **28.** E

Lesson 3-2

- 2.** Answers may vary. Sample: A person jogging at a constant rate can be modeled by a linear function. A group of runners jogging at different speeds cannot be modeled by a linear function. **4.** Answers may vary. Sample: Talisa did not convert from minutes to hours correctly. The function should be written as $f(x) = 5x$. **6.** $f(2) = 0$; $f(6) = -4$ **8.** $f(t) = 6t + 24$; 13 ft **10.** **a.** The numbers describing the range of $h(x)$ should each be one greater than the numbers describing the range of $g(x)$.



The range over $0 < x < 5$ is $1 < y < 11$ for $g(x)$ and $2 < y < 12$ for $h(x)$.

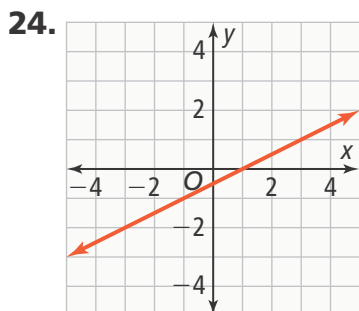
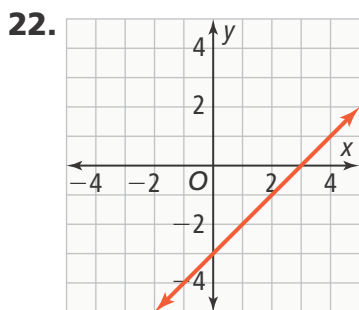
Selected Answers

Topic 3

12. Answers may vary. Sample: When $x = 0$, $y = 10 - 9$, so $y = 1$; $y = 9x + 1$

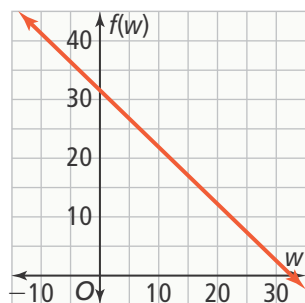
14. $f(5) = -12$ **16.** $f(5) = -0.5$

18. $f(5) = 4$ **20.** $y = -2.5x + 4$



26. Yes, for every unit increase in x -values, the y -values increase at a constant rate. Also, the points in the graph can be connected by a line. So the function shown is linear.

28. $f(w) = -w + 32$

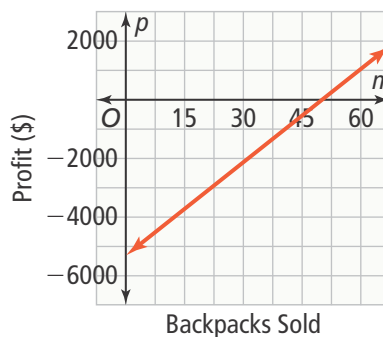


D: $0 < w < 32$; any value outside of this interval would mean the length or width was negative or zero, which is not possible. **30. a.** $f(t) = 30 + 60t$
b. \$815

- 32.**
- I. $f(2) + f(4)$ A. 3.4
 - II. $f(5)$ B. 3.6
 - III. $f(7) - f(6)$ C. 7.2
 - IV. $f(3)$ D. 10.4

34. Part A $c(n) = 5,250 + 54n$,
 $r(n) = 159n$; Subtract costs from revenues: $p(n) = 159n - (5,250 + 54n) = 105n - 5,250$.

Part B



Part C $-\$735$; He does not make a profit.

Lesson 3-3

2. The line has the same slope; it is just shifted vertically or horizontally.

4. Multiplying the output of a linear function by a constant k changes both the slope and the y -intercept because both the x -term and the constant term are multiplied by k . When multiplying the input by a constant k , only the x -term is multiplied by k , so the y -intercept does not change.

6. shifted up 3 units **8.** The slope is scaled by a factor of 4; the y -intercept is not changed. **10.** $4f(x)$ **12.** The student graphed g 4 units to the left of f . The graph of g should be 4 units to the right of f . **14. a.** the graph of f shifted 5 units down; $h(x) = 2x - 4$



Selected Answers

Topic 3

b. the graph of g shifted 4 units up; $h(x) = \frac{1}{3}x + 6$ **c.** the graph of g with the slope and y -intercept scaled by a factor of 3; $h(x) = x + 6$ **d.** the graph of f with the slope and y -intercept scaled by a factor of $\frac{1}{2}$; $h(x) = x + \frac{1}{2}$

16. shifted down 4 units **18.** shifted right 1 unit **20.** vertical stretch by a factor of 5 **22.** vertical stretch by a factor of 8 **24.** slope scaled by a factor of 0.5, y -intercept unchanged **26.** slope scaled by a factor of $\frac{1}{8}$, y -intercept unchanged **28.** slope unchanged, y -intercept shifted up 1 unit **30.** $k = 3$; horizontal translation right **32.** Both are correct. **34.** A **36.** Answers may vary. Sample: Use the line that passes through the points (1, 7) and (2.5, 1). This line has the equation $y = -4x + 11$.

Transformation	Equation
shift down 5 units	$y = -4x + 6$
vertical stretch by 3	$y = -12x + 33$
shift 2 units to the left	$y = -4x + 3$

Lesson 3-4

2. The student confused the values of a_1 and d when writing the formula. The correct formula is

$$a_n = 3 + 5(n - 1) \text{ or } a_n = -2 + 5n.$$

4. A recursive formula defines a term in relation to the previous term in the sequence. An explicit formula defines a term in relation to the term number. Both formulas include the common difference. **6.** no **8.** $a_n = a_{n-1} - 8$ and $a_1 = 47$ **10.** Answers may vary. Sample: It tells you that as the term number increases, the terms' values decrease. **12.** Answers may vary.

Sample: When finding the common difference, the student subtracted the numbers in the wrong order. Instead of subtracting a higher term from a lower term, the student should have subtracted a lower term from a higher term: $22 - 29 = -7$, $15 - 22 = -7$, $8 - 15 = -7$, and $1 - 8 = -7$. So, the common difference is -7 .

14. $a_n = a_{n-1} + 3$; $a_1 = 2$.

16. a. 1, 1, 2, 3, 5, 8 **b.** No, the Fibonacci sequence does not have a common difference. **18.** yes; -13

20. yes; 3 **22.** no **24.** yes; 9

26. $a_n = a_{n-1} + 9$ and $a_1 = -4$;
 $a_n = -13 + 9n$ **28.** $a_n = a_{n-1} + 9$ and
 $a_1 = -15$; $a_n = 24 + 9n$

30. $a_n = a_{n-1} + 5$ and $a_1 = -6$;
 $a_n = -11 + 5n$ **32.** $a_n = 3 + 6n$

34. $a_n = 77 - 21n$ **36.** $a_n = 4 - 7n$

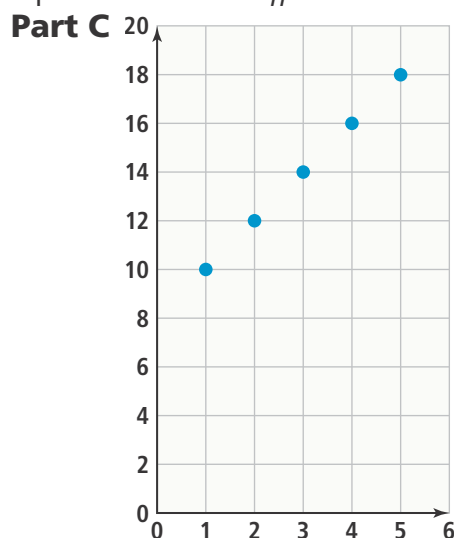
38. $a_n = a_{n-1} - 1$; $a_1 = 107$

40. $a_n = a_{n-1} + 52$; $a_1 = 87$

42. $a_n = a_{n-1} + \frac{1}{4}$; $a_1 = 7\frac{1}{4}$

44. $a_n = 500 - 3n$; 479 tickets

46. n ; 5; 9 **48. Part A** $a_n = a_{n-1} + 2$;
 $a_1 = 10$ **Part B** $a_n = 8 + 2n$





Selected Answers

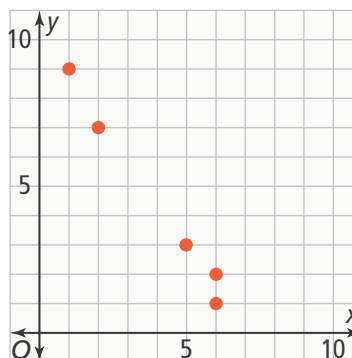
Topic 3

Part D $y = 2x + 8$; one of the formulas found for the sequence; Answer may vary. Sample: Because there are only whole numbers of rows, a formula for a sequence is a better representation. The linear model includes many extra points that do not represent rows.

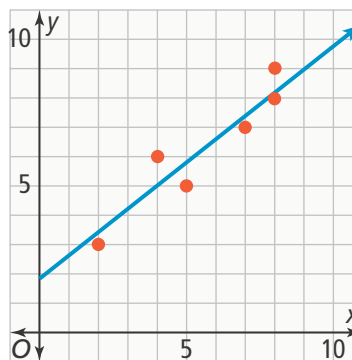
Lesson 3-5

2. The data may show a negative association, but it could also show no association. **4.** No; a trend line just shows the general direction of the data. A good trend line will have about as many data points above the line as below. **6.** positive **8.** Answers may vary. Sample: $y = 5x + 47$; the increase in the number of points scored on the quiz for each additional hour of study **10.** The slope is positive; The slope is negative. **12.** No; the data show no association. A trend line should show the general direction of the data in a scatter plot. If a scatter plot shows no association, there is no general direction of the data, so a trend line is not a good choice for modeling the data. **14.** The y -intercept tells you the value at $x = 0$, or the initial value. Interpreting this value in context can help you decide whether a linear model makes sense. **16.** positive

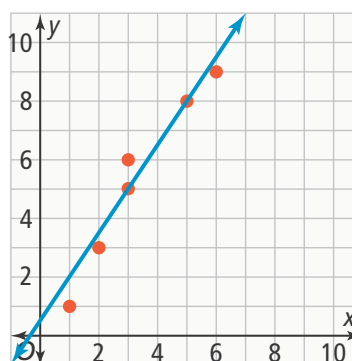
18. negative correlation



20. $y = 0.8x + 1.8$



22. $y = 1.5x + 0.5$



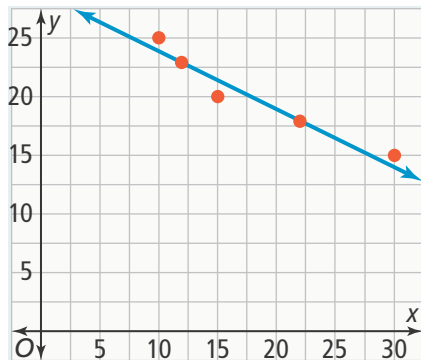
24. Answers may vary. Sample: $y = -7x + 1,120$; The slope represents the change in the number of trees planted per acre as the planting density increases. The y -intercept represents the number of trees that would be planted per acre if there were no spacing. **26.** decrease, increase



Selected Answers

Topic 3

28. Part A



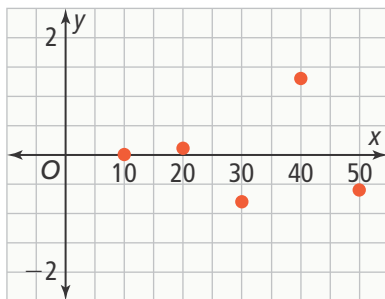
Part B Answers may vary. Sample: $y = -0.5x + 29$; The slope represents the change in the number of kites sold for every dollar increase in price.

Part C Yes; Answers may vary. Sample: People might prefer the design of a certain kite, and so more of that kite might sell than less expensive kites. Yes, you can make scatter plots of many variables, including number of a given design sold vs. price per kite.

Lesson 3-6

2. *Interpolation* is making a prediction about a value within a known range of values. *Extrapolation* is making a prediction about a value outside of a known range of values. **4.** Yes; Answers may vary. Sample: There may be some rare exceptions.

6.



The linear model is a good fit for the data.

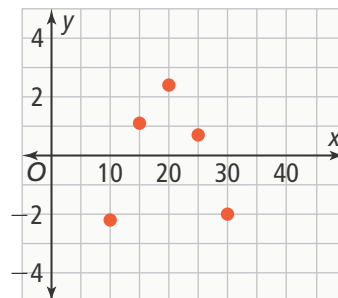
8. No; Answers may vary. Sample: By definition, data that have strong positive *correlation* have a strong linear relationship, so the correlation coefficient would not be as weak as 0.25. However, the data may have strong positive *association* and have a correlation coefficient of 0.25 because the best model might be nonlinear.

10. Interpolation; Answers may vary. Sample: Because interpolation is making a prediction within a known range of data, it is more likely that this data will fit the pattern already observed. Extrapolation is riskier because the pattern may not continue beyond the known range of data.

12. Answers may vary. Sample: Locate the point on the graph that has the x-coordinate you are using to make the prediction. The y-coordinate of this point is the number you are trying to predict.

14. $y = 1.55x + 16.6$; 46.05 **16.** strong negative correlation **18.** weak positive correlation

20. The model is not a good fit.

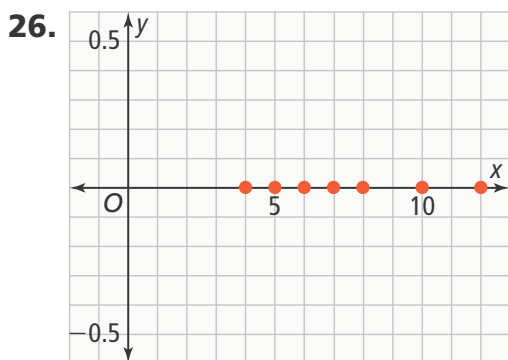




Selected Answers

Topic 3

22. No, to determine whether heating bills and number of pets have a causal relationship, you have to carry out an experiment that can control for other variables that might influence the relationship. **24.** Answers may vary. Sample: The temperature increases and then decreases as the time after midnight increases. A linear model would not be a good fit because a linear model is best for data that have a constant rate of change, not for data that have a rate of change that is positive and then negative.



Because the residuals are all 0, the data are perfectly linear. **28.** C

Topic Review

2. positive association **4.** sequence
6. correlation coefficient **8.** domain: $\{-5, -1, 0, 2, 4\}$; range $\{-5, -2, 0, 2, 3\}$;
 The relation is a function because each input has only one output. **10.** All real numbers would not be a reasonable domain because the number of pages printed cannot be negative.

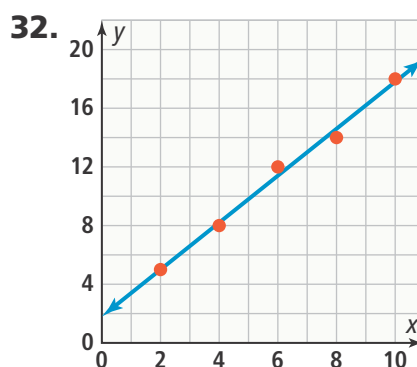
12. The domain should be between zero and the value of the new automobile. **14.** $\{18, 12, 6, 0, -6\}$

16. $y = 85(5.5) + 180 = \$647.5$

18. It moves it up 5 units. **20.** The graph of f is vertically stretched by a factor of 2. **22.** $g(x) = 40x + 80$

24. yes; 11 **26.** $a_1 = -5$; $a_n = a_{n-1} - 3.5$

28. Gabriela will have 186 bracelets left to sell after the fifth day. **30.** negative correlation



Answers may vary. Sample:
 $y = 1.6x + 1.8$ **34.** $y = \frac{20}{3}x - 33\frac{1}{3}$. The slope of the trend line represents the change in recommended distance of a light source for every 1-foot increase in ceiling height. **36.** $y = -0.93x + 91.4$; 68.15 **38.** $y = -0.0095x + 28.8407$; The slope tells you that the winning time decreases by about 0.0095 seconds per year. The y -intercept tells you what the winning time would have been at year 0. According to the model, the winning time in 2010 was 9.7457 seconds, and the winning time in 2020 is predicted to be 9.6507 seconds.

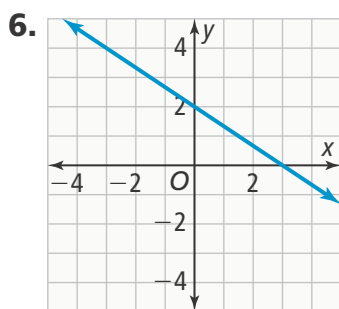


Selected Answers

Topic 4

Lesson 4-1

2. The graph of a system with one solution will be two distinct lines that intersect at one point, while the graph of a system with infinitely many solutions will be one line, and the graph of a system with no solution will be two parallel lines that do not intersect. 4. Reese did not recognize that, while the slopes are the same, the intercepts are also the same, so the lines are coincident and there are infinitely many solutions to the system.



infinitely many solutions

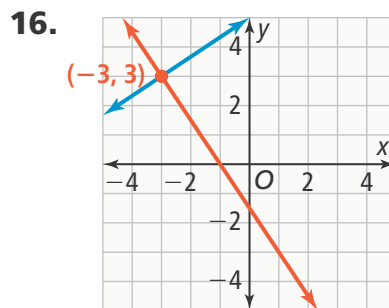
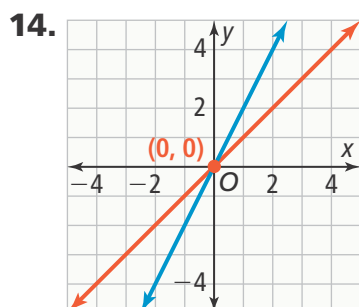
8. a. no solution, b. (2, 2), c. infinitely many solutions

10.

Number of solutions	Slopes	y-intercepts
One solution	Different	Can be any value
Infinitely many solutions	Same	Same
No solution	Same	Different

12. Answers may vary. Sample:

$$y = -\frac{1}{2}x + \frac{7}{2}$$



18. no solution 20. approximately (1.667, 9.333) 22. (-0.5, -2.50)

24. a. The solution of the system is the point where the graphs intersect. The graph shows that the x-coordinate of the intersection point is between $x = 2$ and $x = 3$. b. Answers may vary. Sample: (2.5, 6.25) 26. The solution is precise when it can be substituted back into the equation and yield an exact result. When this cannot happen, the solution is an approximate answer.

28. D

Lesson 4-2

2. Graphing is more useful when none of the equations in the system can be easily solved for one variable, or when you have a graphing tool readily available. 4. If the equations can be rewritten to show that they are equivalent, then there will be infinitely many solutions. If the equations are in the same form, cannot be rewritten to show that they are equivalent, and the coefficients of x are different, then there will be one solution. If the equations are in the same form, are not equivalent, and the coefficients of x are the same and the constants are different, then there will be no solutions.



Selected Answers

Topic 4

- 6.** (1, 2) **8.** infinitely many solutions.
10. substitution, because both equations have y isolated, so they can be set equal to each other
12. The student substituted $2y - 4$ back into the same equation instead of the second equation.

$$5(2y - 4) - 3y = 1$$

$$10y - 20 - 3y = 1$$

$$7y = 21$$

$$y = 3$$

Then substitute $y = 3$ in the first equation to get $x = 2$, so the solution is (2, 3). **14.** width: 14 cm and length: 48 cm **16. a.** Answers may vary. Sample: $5x - 2y = -5$ **b.** Answers may vary. Sample: $10x - 4y = -8$ **18.** (3, 1) **20.** (5, -2.5) **22.** no solution **24.** (1, 4) **26.** no solution **28.** no solution **30. a.** 5 min, **b.** 90 m **32.** -2 and 6 **34. a.** 15 classes **b.** \$120 **36.** 8, -4 **38. Part A** The system with solution (4, 4) is:

$$7x - 4y = 12$$

$$x - 2y = -4$$

The system with solution (-2, 1) is:

$$x - 2y = -4$$

$$2x + y = -3$$

The system with solution (0, -3) is:

$$2x + y = -3$$

$$7x - 4y = 12$$

Part B (-2, 1), (4, 4), (0, -3)

Part C Yes; Sample: The slopes of the lines represented by equations 1 and 2 are negative reciprocals. Lines with slopes that are negative reciprocals are perpendicular and meet at a right angle.

Lesson 4-3

2. He should have multiplied the second equation by a number that would result in a variable being eliminated if the equations were added. For example, if he multiplied by -2 instead, he could have eliminated the y term because $-4y + 4y = 0$.

4. Let x be the width of the rectangle, and y be the length.

$$5x + 2y = 26$$

$$15x - 3y = 6$$

The width is 2 units. The length is 8 units.

6. (6, -7) **8.** no solution **10.** The structure helps you to determine the most effective method for solving the system. For instance, if one of the equations is in y -intercept form, then it would be appropriate to use substitution to solve. If the variables in both equations have the same or opposite coefficients, then elimination might be more straightforward.

$$12. \begin{cases} y = -\frac{3}{2}x + 7 \\ y = \frac{1}{2}x + 1 \end{cases};$$

$$\left(3, \frac{5}{2}\right)$$

14. Using the substitution method is helpful because it takes fewer steps to solve than the elimination method. The first equation is already solved for x , so you can substitute $6 + y$ for x in the second equation and solve for y .

16. (7, 4.5) **18.** (-3, -2) **20.** (-6, 4)

22. (5, 1) **24.** Yes; $4y - 12x = 16$ is equivalent to two times $2y - 6x = 8$.



Selected Answers

Topic 4

26. Let x = cost of a pizza

Let y = cost of a sub sandwich

$$2x + 4y = 62$$

$$4x + 10y = 140$$

Cost of a pizza: \$15

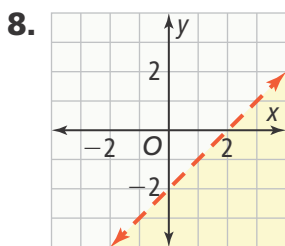
Cost of a sub sandwich: \$8

28. Elimination; Multiply the first equation by -1 and then add equations to eliminate the x -terms; $(-1, -1)$

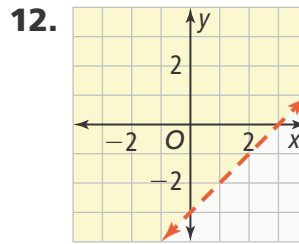
30. Elimination; Multiply the first equation by -2 and then add the equations to eliminate the y -terms; $(2, 8)$ **32.** Both methods will work. By addition, the y -terms will cancel each other out. Multiplying the first equation by -3 and then adding the equations will cancel out the x -terms. Either method will result in a solution of $(-2, \frac{3}{2})$. **34.** $(3.50, 2.75)$, which means that a drink costs \$3.50 and a pretzel costs \$2.75. **36.** \$720 **38.** B

Lesson 4-4

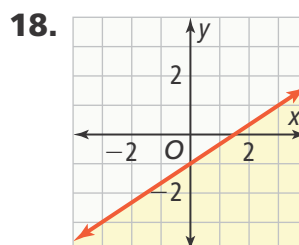
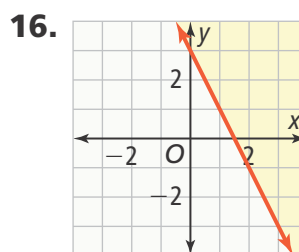
2. infinitely many **4.** The graph of $y < 1$ can be graphed on a coordinate grid. Draw a dashed horizontal line at $y = 1$ and shade below the line. **6.** yes



10. Both; the graph can be represented by the first inequality. Because the second inequality can be rewritten as the first inequality, both inequalities are shown in the graph.

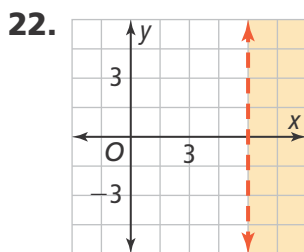
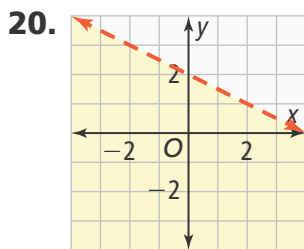


Answers may vary. Sample: The graph of the inequality $x < y + 3$ is the same as the graph of the inequality $y > x - 3$. Both this inequality and $y < x + 3$ have a dashed border line with a slope of 1. The border line for the inequality $y > x - 3$ passes through the point $(0, -3)$, and the border line for the inequality $y < x + 3$ passes through the point $(0, 3)$. The shaded region is above the border line in the inequality $y > x - 3$ and below the border line in the inequality $y < x + 3$. **14.** The graph of a linear inequality in one variable of $x < 4$ is on a number line. There is an open circle over 4 and an arrow pointing to the left. The graph of a linear inequality in two variables of $x < 4$ is a vertical dashed line at $x = 4$ with the half plane to the left of the line shaded.



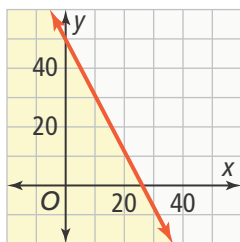
Selected Answers

Topic 4



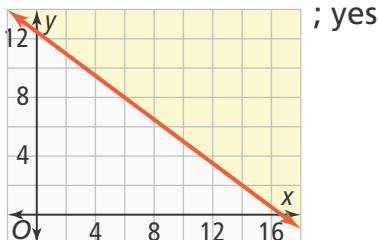
24. $y \leq -3x - 4$ 26. $y > \frac{2}{5}x + 3$

28. a. $23x + 12y \leq 600$;



b. 11 or fewer

30. $6x + 8y \geq 100$;



32. C

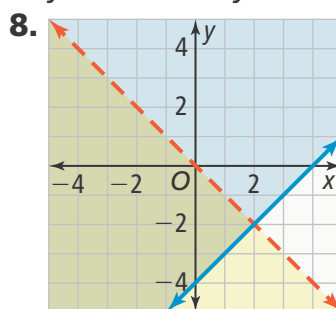
Lesson 4-5

2. (0, 1) is not a solution of the inequality $y > 2x + 1$, so it is not a solution of the system of inequalities. The point lies along the border line of the inequality $y > 2x + 1$, but the border

line is dashed, so points that lie on it are not part of the solution.

4. Answers may vary. Sample: Show it using a graph; it is easier to use a graph because all the solutions are indicated by the graph. Attempting to describe the solutions of a system of inequalities in words is much more complicated.

6. $y = -6x$ and $y = 10x - 3$

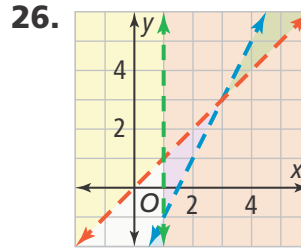
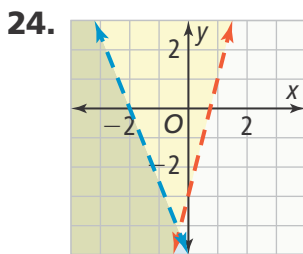
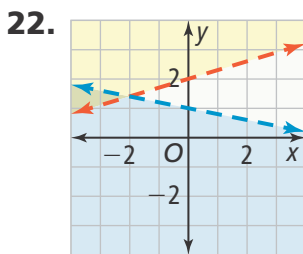
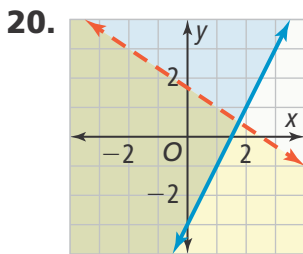
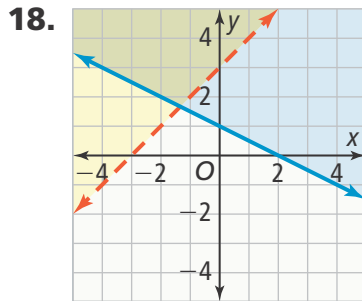
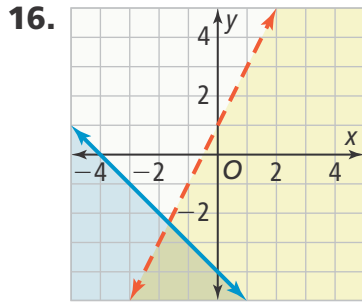


10. Answers may vary. Sample: A real-world situation best described by a system of linear inequalities has multiple constraints. A real-world situation best described by one linear inequality has one constraint.

12. Answers may vary. Sample: A system of two linear inequalities is similar to a system of two linear equations because their solutions are determined by where the graphs of the inequalities or equations in the system intersect or overlap. They are different because a system of linear equations has infinitely many solutions when the two equations in the system are equivalent. A system of linear inequalities can have infinitely many solutions even when the inequalities are not equivalent. 14. Yes; for example, there is no region where all 3 planes overlap for the system $y > x + 2$, $y < x - 2$, $y < x - 4$. So, there is no solution to the system.

Selected Answers

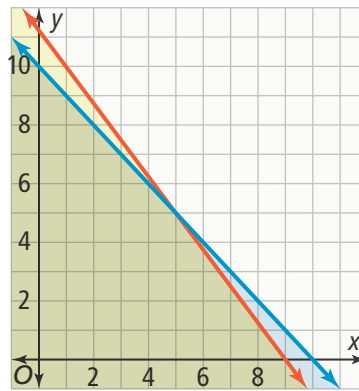
Topic 4



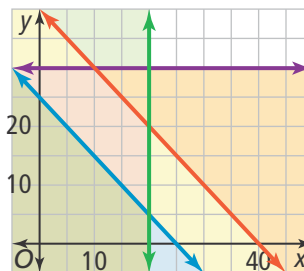
28. $y < -\frac{2}{3}x + 2$
 $y > x - 3$

30. $y \geq 3x$
 $y > -x + 3$

32. $x + y \leq 10$ and $5x + 4y \leq 45$;
 Answers may vary. Sample: 4 in section A and 6 in section B, 5 in section A and 5 in section B, 2 in section A and 8 in section B



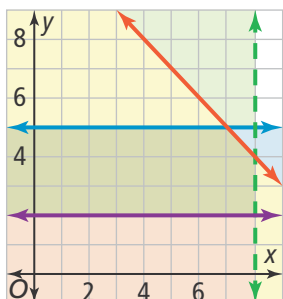
34. $x + y \leq 40$, $x \leq 20$, $y \leq 30$, and $x + y \geq 25$; The system is defined by an additional inequality $x \geq y$. This will reduce the number of possible solutions.



Selected Answers

Topic 4

36. $>$, 2 , \geq **38. Part A** $x + y \leq 12$, $x < 8$, $y \geq 2$, and $y \leq 5$ **Part B** Yes; Answers may vary. Sample: The image on the watch shows that he wants to do cardio between 2 and 5 hours each week, inclusive. So, the minimum hours he will be doing cardio is 2.

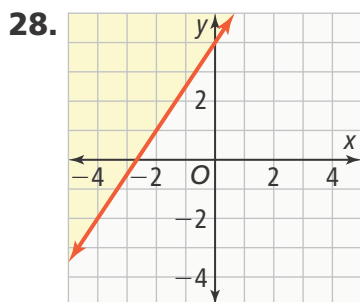


Topic Review

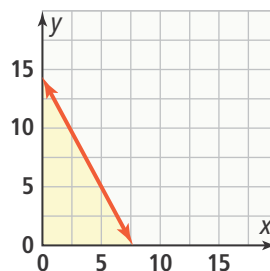
2. system of linear inequalities

4. solution of a system of linear inequalities **6.** $(-1.5, -3.5)$ **8.** no solution **10.** $(\frac{3}{11}, -\frac{7}{11})$ **12.** $(16, 6)$

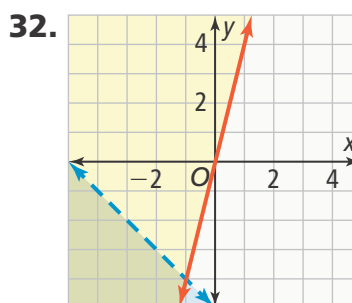
14. no solution **16.** 12 feet long and 8 feet wide **18.** $(-8, -14)$ **20.** Yes; The equation $4x - 6y = 28$ is 2 times the equation $2x - 3y = 14$, and the equation $-15x + 6y = -24$ is -3 times the equation $5x - 2y = 8$. **22.** No; If either the x - or y -value is the same in both equations, then you can eliminate one variable using addition or subtraction. **24.** yes **26.** yes



30. $65x + 35y \leq 500$



4 large gift boxes



34. $x + y \leq 60$

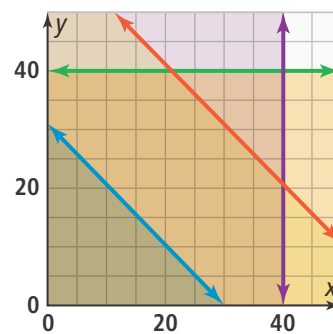
$x + y \geq 30$

$x \geq 0$

$x \leq 40$

$y \geq 0$

$y \leq 40$



The maximum is \$3,300 for 40 necklaces and 20 bracelets.



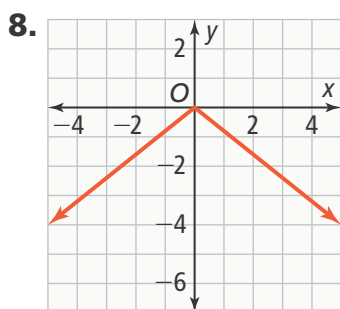
Selected Answers

Topic 5

Lesson 5-1

2. The domain and range of $g(x) = a|x|$ when $0 < a < 1$ is the same as the domain and range of $f(x) = |x|$, because the graph is compressed toward the x -axis. This compression does not change the domain, and does not change the range in this case because the range goes to infinity.

4. If a is negative, then the vertex represents the maximum value of the function g . **6.** Domain: all real numbers; Range: $y \leq 0$

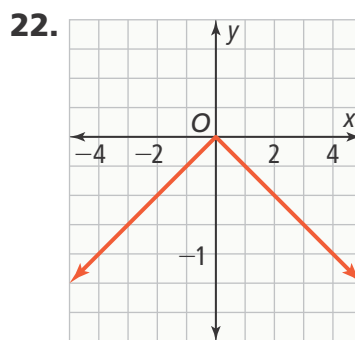


10. The domain remains all real numbers. The range changes from $y \geq 0$ to $y \leq 0$. **12.** The range of the function $f(x) = 10|x|$ is not 10 times the range of $f(x) = |x|$. The range is the same for both functions, $y \geq 0$.

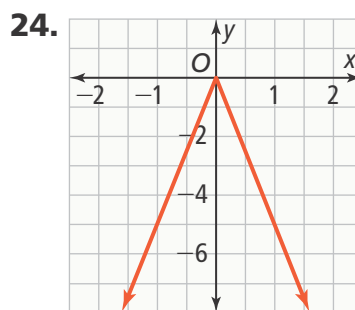
14.

x	$g(x) = a x $
-4	b
-1	a
0	0
1	a
4	b
8	$2b$

16. yes; $(-11, 11)$ **18.** no **20.** yes; $(8, 8)$



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



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

26. 3 mi; he walked 3 miles, because he was 1.5 miles from the water stop at the start and at the finish of the race.

28. $\frac{4}{3}$ ft/s **30.** $g(x) = -4|x|$ **32.** -20; the rate means that the bicyclist is traveling toward the sandwich shop at a speed of 20 mi/h. **34.** Downward; 100 or -100

36. Part A $y = 2|x|$ when $x < 0$

Part B The vertex is $(0, 0)$; increasing for $x > 0$, decreasing for $x < 0$, min. value 0

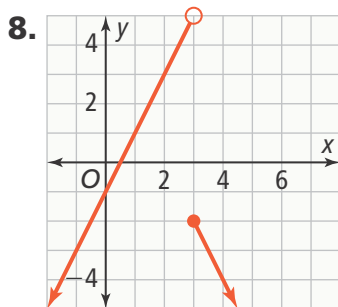
Selected Answers

Topic 5

Part C (40, 0); the lizard is at (−100, 200) and the mosquito is at (200, 200). To determine where the new path intersects the x-axis, consider the triangles formed by the new path, the vertical line from the lizard to the x-axis, the vertical line from the mosquito to the x-axis, and the x-axis. The triangles would be similar. If d is the horizontal distance from the lizard to the axis of symmetry, then $\frac{200}{300} = \frac{d}{350 - d}$. Solving for d , $d = 140$, so the coordinates of the vertex is are (40, 0). **Part D** Sample answer: The new slope is $\frac{300 - 0}{250 - 40} = \frac{10}{7}$. Since it hits the x-axis at (40, 0), a new function must be $y = \frac{10}{7}|x - 40|$.

Lesson 5-2

2. No; f could have pieces like the absolute value function, leaving some of the real numbers out of the range of f . **4.** 2; The interval $x < 0$ has the rule $f(x) = -x$. The interval $x \geq 0$ has the rule $f(x) = x$. **6.** $f(x) = \begin{cases} 2x, & x < 0 \\ -2x, & x \geq 0 \end{cases}$



10. You can write the function using the absolute value symbol as $f(x) = |x|$ or as the piecewise-defined function

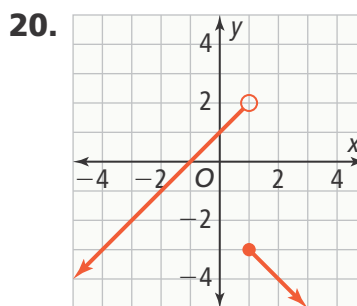
$$f(x) = \begin{cases} x, & x \geq 0 \\ -x, & x < 0 \end{cases}$$

12. The student swapped the intervals for the two rules. The interval should be $x \geq 0$ for $3x$, and $x < 0$ for $-3x$.

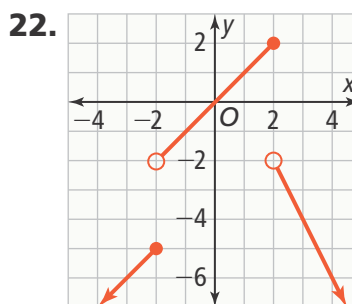
14. a. $y < 4$ **b.** Yes; Answers may vary. Sample: If $n = 4$, the range of f is $y < 3$.

$$16. f(x) = \begin{cases} 6x, & x \geq 0 \\ -6x, & x < 0 \end{cases}$$

$$18. f(x) = \begin{cases} \frac{1}{2}x, & x \geq 0 \\ -\frac{1}{2}x, & x < 0 \end{cases}$$



increasing: $x < 1$; decreasing: $x \geq 1$



increasing: $x \leq 2$;
decreasing: $x > 2$

$$24. f(x) = \begin{cases} -\frac{3}{5}x - \frac{4}{5}, & x < 2 \\ \frac{5}{2}x - 7, & x \geq 2 \end{cases}$$

$$26. f(x) = \begin{cases} 1.25x + 3, & 1 \leq x \leq 25 \\ x, & x > 25 \end{cases}$$

Yes; if she buys a card for 22 rides, it would cost her \$30.50, but if she buys a card for 26 rides, it would cost her \$26.

28. \$76.56 **30.** D

Selected Answers

Topic 5

Lesson 5-3

2. Both can be represented as piecewise-defined functions that round to integer values. Ceiling functions round up to the nearest integer, while floor functions round down to the nearest integer.

4. $0 \leq x < 0.5$, $0.5 \leq x < 1.5$,
 $1.5 \leq x < 2.5$, $2.5 \leq x < 3.5$, $3.5 \leq x \leq 4$

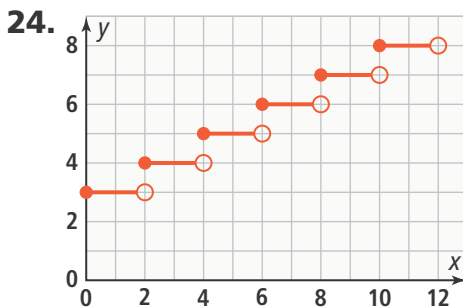
6. 12 8. 5 10. The INT function is exactly the same as the floor function; there is no difference between them.

12. Kenji used the next lower multiple of 3 for the value of the function in each piece. The function values 3, 6, 9, and 12 should be replaced by 6, 9, 12, and 15, respectively.

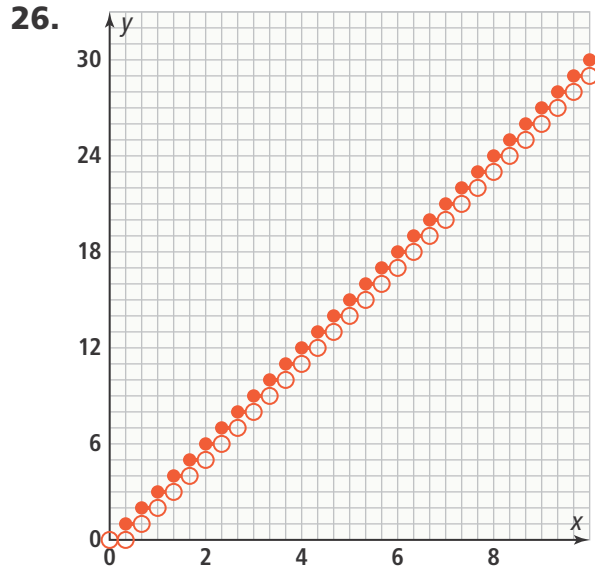
14. a. $f(4.6) = 4$; $f(5) = 5$; $f(-6.5) = -7$

$$b. f(x) = \begin{cases} -4, & -4 \leq x < -3 \\ -3, & -3 \leq x < -2 \\ -2, & -2 \leq x < -1 \\ -1, & -1 \leq x < 0 \\ 0, & 0 \leq x < 1 \\ 1, & 1 \leq x < 2 \\ 2, & 2 \leq x < 3 \\ 3, & 3 \leq x < 4 \end{cases}$$

16. 6 18. 14 20. 33 22. -9

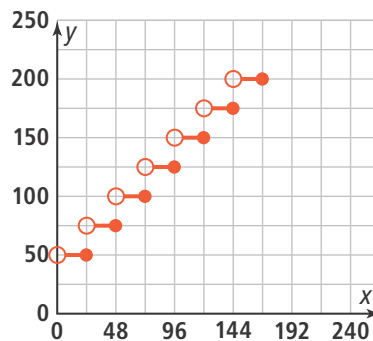


$$f(x) = \text{floor} \left(\frac{x}{2} \right) + 3$$



28. Nan will pay \$25 more. Amit will pay \$175 and Nan will pay \$200 because the parking time of 144 hours is in a different interval from 145 hours.

Hours (x)	Cost (f(x))
$0 < x \leq 24$	50
$24 < x \leq 48$	75
$48 < x \leq 72$	100
$72 < x \leq 96$	125
$96 < x \leq 120$	150
$120 < x \leq 144$	175
$144 < x \leq 168$	200



Selected Answers

Topic 5

30.

x	$f(x)$
$0 < x \leq 1$	15
$1 < x \leq 2$	22.5
$2 < x \leq 3$	30
$3 < x \leq 4$	37.5
$4 < x \leq 5$	45
$5 < x \leq 6$	52.5

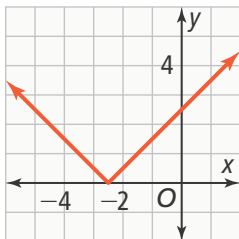
32. Part A $t(x) = \begin{cases} 0.00, & x = 0 \\ 1.25, & 0 < x \leq 40 \\ 1.75, & 40 < x \leq 75 \\ 1.90, & 75 < x \leq 85 \\ 2.25, & 85 < x \leq 120 \\ 2.50, & 120 < x \leq 150 \end{cases}$

Part B $g(x) = \frac{7}{60}x$ Part C \$16.25

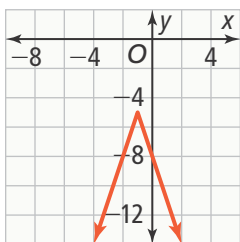
Lesson 5-4

2. The value of h does not affect the domain or the range. If the value of a is positive, the value of k changes the range to $y \geq k$. If the value of a is negative, the range is $y \leq k$. 4. Multiply the function rule by -1 , so $f(x) = -3|x + 2| - 1$.

6. $(-2.5, 0)$



8. $(-1, -5)$



10. Answers may vary. Sample:

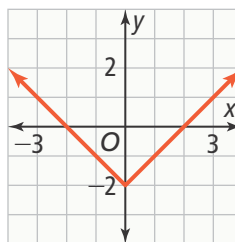
$f(x) = |x + 1| + 3$; $g(x) = 2|x + 1| + 3$

12. $Y_2 = Y_1 - 6$ 14. $Y_1 = |x - 3|$;

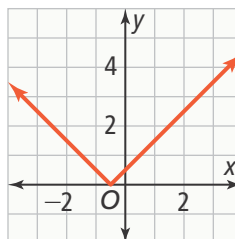
$Y_2 = |x - 3| + 4$; $Y_3 = 2|x - 3|$;

$Y_4 = -|x - 3|$; The graph of Y_2 is the translation of the graph of Y_1 up 4 units; The graph of Y_3 is the vertical stretch of the graph of Y_1 by a factor of 2; The graph of Y_4 is a reflection of the graph of Y_1 across the x -axis.

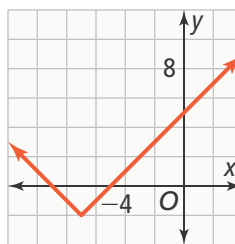
16. $(0, -2)$



18. $(-0.5, 0)$



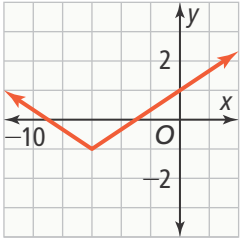
20. $(-7, -2)$



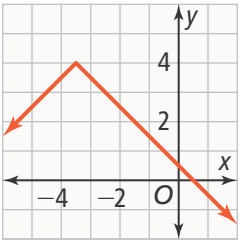
Selected Answers

Topic 5

22. The graph of g is a vertical compression of the graph of f by a factor of $\frac{1}{3}$ that is then translated 6 units left and 1 unit down.



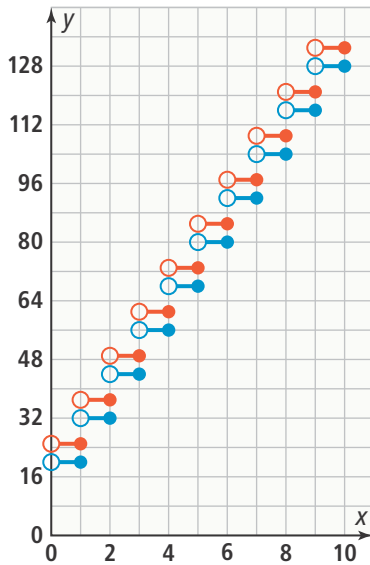
24. The graph of g is a reflection of the graph of f across the x -axis that is then translated left 3.5 units and up 4 units.



26. $f(x) = 3|x + 1| - 5$

28. $g(x) = |x - 1| + 2$ **30.** $g(x) = -|x| + 4$

32. a.



b. \$61

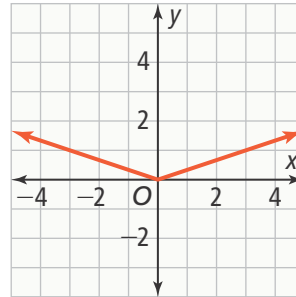
34. $y = -\frac{6}{5}|x - 5| + 6$; $D: 0 \leq x \leq 10$

36. A

Topic Review

2. axis of symmetry **4.** absolute value function **6.** yes; $(-8, 8)$ **8.** no

10.



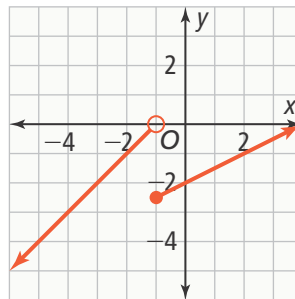
Domain: all real numbers;

Range: $y \geq 0$

12. $(0, 0)$; minimum

14. $f(x) = \begin{cases} 4x, & x \geq 0 \\ -4x, & x < 0 \end{cases}$

16.



18. The signs were reversed, and the point $x = 0$ was not included in the domain;

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

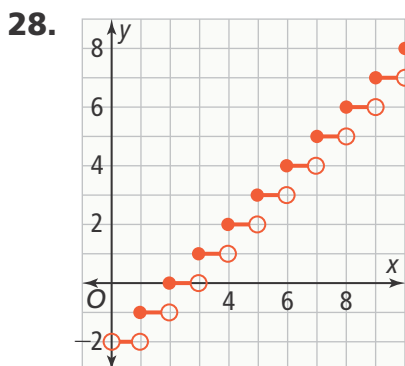
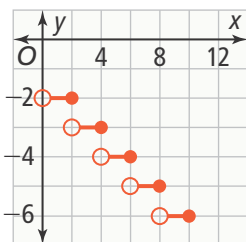
20. $f(x) = \begin{cases} 35x + 5, & x \leq 10 \\ 30x, & x > 10 \end{cases}$

22. 3 **24.** 0

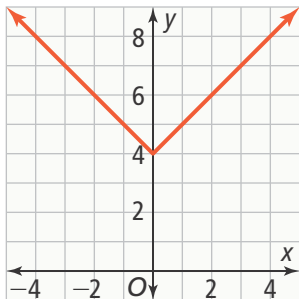
Selected Answers

Topic 5

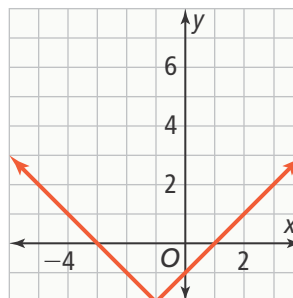
26. $f(x) = -\left\lceil \frac{x}{2} \right\rceil - 1$



30. (0, 4)



32. (-1, -2)



34. The graph of g is a vertical stretch of the graph of f by a factor of 2 and translated 6 units left and 1 unit down.

36. The graph of g is a vertical compression of the graph of f by a factor of 0.5, reflected across the x -axis, and translated 4 units up.

38. $g(x) = -0.5|x + 3| - 2$ 40. Answers may vary. Sample: $f(x) = |x - 2| - 1$; $f(x) = 2|x - 2| - 1$ 42. $f(x) = |x + 3| + 3$



Selected Answers

Topic 6

Lesson 6-1

2. $\sqrt{15}$, $15^{\frac{1}{2}}$ 4. Corey reversed the numbers in the numerator and denominator of the exponent. It should be $4^{\frac{2}{3}}$. 6. Rational exponents can be written as radical expressions. Properties of exponents apply to both rational and whole number exponents.

8. $15^{\frac{1}{2}}$ 10. 2 12. $8^{\frac{3}{2}}$ 14. $x = \frac{80}{7}$ 16. $x = 2$

18. $x = -11$ 20. The rational exponent increases as m increases. 22. Yes;

$\left(\frac{16}{4}\right)^{\frac{1}{2}} = \frac{16^{\frac{1}{2}}}{4^{\frac{1}{2}}} = \frac{4}{2} = 2$ 24. a. $625^{\frac{1}{4}}$ b. You

could find the square root of 625, which is 25, then find the square root of 25, which is 5. Or, you could evaluate

$625^{\frac{1}{4}}$. c. $625^{\frac{1}{4}} = (5^4)^{\frac{1}{4}} = 5$ 26. $7^{\frac{1}{3}}$ 28. $2^{-\frac{5}{4}}$

30. $b^{\frac{a}{2}}$ 32. $x = 4$ 34. $x = 4$ 36. $x = -2$

38. $x = \frac{9}{5}$ 40. $x = 3$ 42. $x = \frac{1}{4}$

44. Quotient of Powers Property 46. 9

48. I. $\sqrt[4]{2^5}$ A. $2^{\frac{1}{5}}$
 II. $\sqrt{5}$ B. $2^{\frac{5}{4}}$
 III. $\sqrt[5]{2^4}$ C. $2^{\frac{4}{5}}$
 IV. $\sqrt[5]{2}$ D. $2^{\frac{1}{2}}$

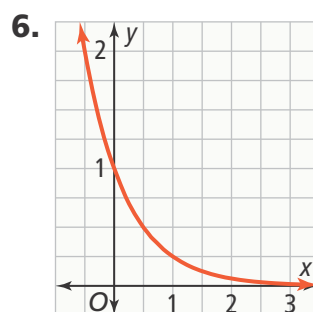
50. Part A $a = 0$, $b = \frac{1}{3}$, $c = 1$, $d = 2$

Part B $16^0 + 16^{\frac{1}{4}} + 16^{\frac{3}{4}} + 16^{\frac{3}{2}} = 75$

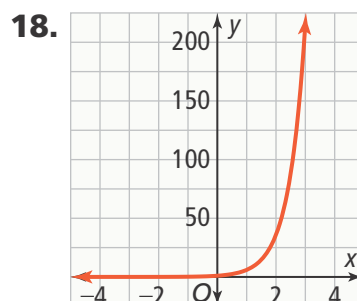
Part C The equation is true for any integer values of x that can be written as a power with a base of 2. If $x = 2^y$, where y is a rational number not equal to zero, then $2 = x^{\frac{1}{y}}$. You can substitute $x^{\frac{1}{y}}$ for 2 in the equation $2^0 + 2^1 + 2^3 + 2^6 = 75$ and simplify to get the required equation.

Lesson 6-2

2. If $b > 1$, the graph will increase from left to right. If $0 < b < 1$, the graph will decrease from left to right. 4. Martin reversed a and b in $f(x) = ab^x$. The function has a y -intercept of 2 and has a constant ratio of 4.

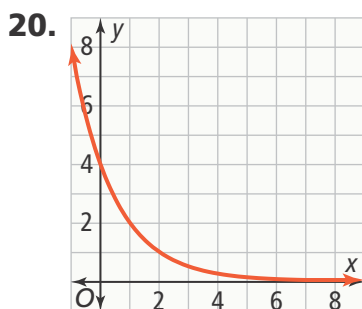


8. $f(x) = 3(2)^x$ 10. Yes, the graph of $f(x) = ab^x$ is always getting closer and closer to the x -axis but never reaches it. 12. Answers may vary. Sample: The y -intercept will increase for $a > 4$ and decrease for $1 < a < 4$. The descent of the graph will be steeper for $a > 4$ and less steep for $1 < a < 4$. 14. Answers may vary. Sample: The value of the function is negative for all values of x . The asymptote remains at $y = 0$, but the graph approaches $y = 0$ from below the x -axis instead of above it. 16. y -intercept: 1, domain: all real numbers, range: $y > 0$, asymptote: $y = 0$; The function decreases as x increases.



Selected Answers

Topic 6



22. $f(x) = 4\left(\frac{1}{3}\right)^x$ 24. linear; The function increases by a constant value of 4.

26. $f(x) = 10^x$; Find the ratio of $f(x)$ for $x = 8.1$ to $f(x)$ for $x = 7.8$; The intensity of the New Madrid earthquake is about twice the intensity of the San Francisco earthquake. 28. $f(x) = 2,000(5)^x$; 6 days. 30. E

Lesson 6-3

2. Simple interest increases the account value by a fixed amount over time, so it is modeled by a linear function.

Compound interest increases the account value by a fixed ratio, so it is modeled by an exponential function.

4. The growth factor $(1 + r)$ is the b term in the exponential function. For there to be growth, b has to be greater than 1. For example, if a population grows by 25% per year, then each year the population is 125% of the previous year's population. Therefore, you multiply by 1.25, or $1 + r$.

6. $f(x) = 1,250(1.25)^x$

8. $f(x) = 10,000(0.88)^x$

10. The value of a is the initial amount and b is equal to the growth factor

$(1 + r)$. 12. The original equation should be $A = 1000\left(1 + \frac{0.04}{2}\right)^{2t}$ because the interest is compounded 2 times per year.

14. a. As n increases, the growth factor decreases because the value of the fraction added to 1 decreases as its denominator increases. b. 4,469.54; 4,475.28; 4,475.40; 4,475.47; 4,475.47

c. Although the growth factor decreases as n increases, the value of the function increases because the value of the exponent increases.

16. $f(x) = 100(1.25)^x$ 18. After 5 years, the investment compounded semiannually will be worth \$17.58 more than the investment compounded annually. 20. $f(x) = 5,000(0.7)^x$; x is about 11 when $f(x) = 100$

22. $f(x) = 25(0.8)^x$; The average rate of change over $2 \leq x \leq 4$ is about -2.88 and the average rate of change over $6 \leq x \leq 8$ is about -1.18 . The rate of change decreases as x increases.

24. $f(x) = 100(1.1)^x$; growth factor: 1.1

26. $f(x) = 40(1.25)^x$; $g(x) = 10,000(0.84)^x$; The functions are equal at about $x = 14$. 28. Joshua: $f(t) = 500(1.03)^{2t}$; Felix: $f(t) = 1,000(1.03)^{2t}$; Joshua's money will double first. For Joshua, $f(10) \cong 1,000$. For Felix, $f(12) \cong 2,000$.

30. growth, growth, decay, decay, growth

32. Part A A: $f(x) = 10,000(1.04)^x$; B: $f(x) = 10,000(1.01)^{4x}$; C: $f(x) = 10,000(1.042)^x$

Part B Investment C

Part C Investment C will reach \$1,000,000 in 56 years, while Investment B will take 58 years and Investment A will take 59 years.



Selected Answers

Topic 6

Lesson 6-4

2. Both geometric and arithmetic sequences have the natural numbers as their domains, but geometric sequences have a common ratio while arithmetic sequences have a common difference.

4. Yes, there is a common ratio of x .

6. The sequence is neither arithmetic or geometric. **8.** $a_n = 2.5(a_{n-1})$. The initial condition is $a_1 = 2$. **10.** $f(n) = 25(1.8)^{n-1}$

12. Answers may vary. Sample:

Geometric sequences with common ratio $r > 1$ are similar to exponential growth functions but with the domain limited to natural numbers. Sequences with a common ratio of $0 < r < 1$ are similar to exponential decay functions, also with the domain limited to natural numbers. **14.** You can divide each term by the preceding term to see if there is a common ratio. **16. a.** $a_n = 80(0.95)^{n-1}$

b. $a_{10} = 80(0.95)^{10-1} = 50.42$ cm **18.** yes; $a_n = \frac{1}{2}(a_{n-1})$, $a_1 = 3$ **20.** no **22.** yes;

$a_n = \frac{4}{3}(a_{n-1})$, $a_1 = 2$ **24.** yes; $a_n = 4(a_{n-1})$, $a_1 = \frac{1}{2}$ **26.** yes; $a_n = 5(a_{n-1})$, $a_1 = \frac{4}{5}$

28. $a_n = 6(a_{n-1})$, $a_1 = 1.1$ **30.** $a_n = 8(a_{n-1})$, $a_1 = 0.4$ **32.** $a_n = 1(8)^{n-1}$ **34.** $a_n = 7(6)^{n-1}$

36. $f(n) = 7(3)^{n-1}$ **38.** $f(n) = 99\left(\frac{2}{3}\right)^{n-1}$

40. $f(n) = 18(3)^{n-1}$ **42.** $a_n = 16(1.5)^{n-1}$; $a_n = 1.5(a_{n-1})$, $a_1 = 16$; The number of participants will not reach 1,000 in 10 years: $a_n = 16(1.5)^{n-1} = 16(1.5)^{10-1} = 615.09375$. **44.** no; yes; yes; no

46. Part A Pattern A: $a_n = 5(a_{n-1})$. The initial condition is $a_1 = 1$.

Pattern B: $a_n = 5(a_{n-1})$. The initial condition is $a_1 = 4$.

Part B Because the sequences are the same except for their initial condition, the value of a_n in Pattern B is 4 times the value of a_n in Pattern A. **Part C** $\frac{x}{4}$; Pattern B always has 4 times as many dots as Pattern A when they are at the same loop number.

Lesson 6-5

2. In both cases, the effect is a translation, but k translates the graph vertically, and h translates the graph horizontally. **4.** The graph is below the graph of $f(x) = 2^x$ rather than above it.

6. The graph is translated up 1 unit.

8. The graph is translated down 4 units.

10. The graph of g is a translation down 3 units from the graph of the general exponential function $f(x) = 2^x$, and the graph of j is a translation up 1 unit from the graph of the general exponential function f . So the graph of g is a translation down 4 units from the graph of j . **12.** The graph is translated right 1 unit. **14.** The graph is translated down 1 unit. **16.** In order to determine whether the translation is left or right, the student needs to know the sign of h .

18. a.

x	$f(x) = 4\left(\frac{1}{2}\right)^x$	$g(x) = 4^x$
-1	$\frac{1}{2}$	$\frac{1}{4}$
-2	$\frac{1}{4}$	$\frac{1}{16}$
0	1	1
2	4	16
4	16	256

f is a horizontal compression by $\frac{1}{2}$.

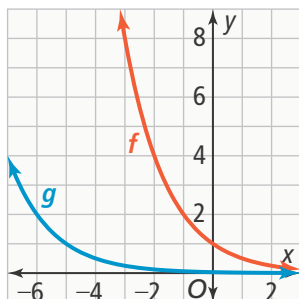


Selected Answers

Topic 6

- b.** (0,1) **c.** Both graphs have an asymptote of $y = 0$. **20.** translation 4 units left **22.** translation up $\frac{3}{4}$ units **24.** -1

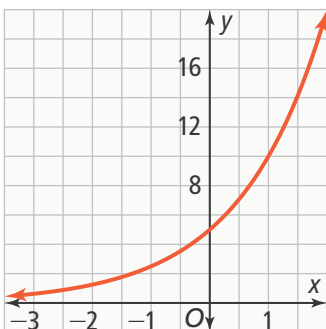
26.



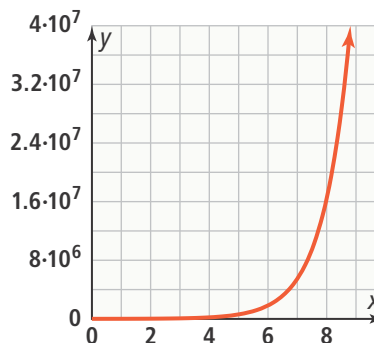
- 28.** f : y -intercept: 1; asymptote: $y = 0$; range: $y > 0$; g : y -intercept: 8; asymptote: $y = 0$; range: $y > 0$
30. The graph of f is a horizontal shift of the parent function, while the graph of g is a vertical shift of the parent function. **32. a.** The new graph will be a vertical stretch of the original graph by a factor of 1.5. The starting value of a in $f(x) = ab^x$ is the same as k in the form $kf(x)$. **b.** The new graph will be a vertical stretch of the original graph by a factor of 2. **34.** D

Topic Review

- 2.** exponential growth **4.** geometric sequence **6.** asymptote **8.** $12^{\frac{1}{3}}$ **10.** $\frac{4}{7}$
12. Bicycle = 2^8 ,
 Car = $2^{16} = 2^{8+8} = 2^8 2^8 = \text{Bicycle} \times 2^8$
14.



16. $y = 2500(3)^x$



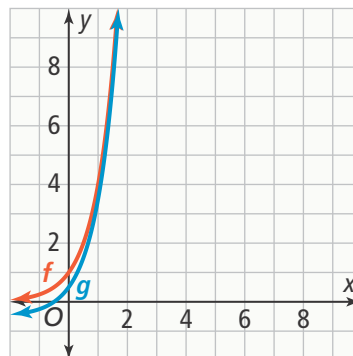
Month 9: 49,207,500

- 18.** $f(x) = 50(1.15)^x$
20. \$19,663.40, Annual: \$19,546.74
22. $a_n = 5\left(\frac{1}{2}\right)^{n-1}$
 $a_n = \frac{1}{2}(a_{n-1}), a_1 = 5$
24. $a_n = 8(2)^{n-1}$
 $a_n = 2(a_{n-1}), a_1 = 8$
26. $a_n = 4(a_{n-1}), a_1 = 2.2$
28. $a_n = 40(1.5)^{n-1}$
 $a_n = 1.5(a_{n-1}), a_1 = 40$

Yes; in two weeks, or 14 days, there will be about 7,785 signatures.

- 30.** translated up 10 units
32. translated left 3 units

34.





Selected Answers

Topic 7

Lesson 7-1

2. The prefix *mono-* means one; *bi-* means two; *tri-* means three. Therefore, a *monomial* has one term; *binomial* has two terms; *trinomial* has three terms. **4.** $x + x$ is similar to combining two of the same item, which is $2x$. The term, x^2 , can be interpreted as $x \cdot x$, which refers to the area of a square.

6. linear binomial **8.** $-y^2 + 2y - 3$

10. $3x^2 - 3x - 7$ **12.** $10x^2 + 76x + 144$

14. The student did not put the polynomial in standard form before naming it and named it by the first term. In standard form, the polynomial is $5x^4 - 2x^3 - 3x$, so it is a fourth degree trinomial.

16. a. $(-6x + 7) + (2x - 6) = -4x + 1$

b. $(a^2 + 3a + 1) - (-3a^2 + 5a + (-6))$

18. a. Yes; the integers are closed under addition. **b.** No; the positive integers are not closed for subtraction. **20.** 2 **22.** 3

24. cubic trinomial **26.** fourth degree polynomial **28.** $-4y^2 + 3y + 5$

30. $4x^2 + 3x + 10$ **32.** $-15x^3 - x^2 + 8x + 4$

34. $12a^2 - 2a$ **36.** $8x$ **38.** $18x + 16$ in.

40. $2x^2 + 17x + 36$

42. $20x^2 + 22x + 30$ sq. units **44.** D

Lesson 7-2

2. When using the Distributive Property, each term of a second polynomial is multiplied by the terms in the first polynomial. This is similar to using a table since each term in a column is multiplied by every term in a row. **4.** The exponents are added when multiplying, resulting in a degree of the product that is different from either of the factors. **6.** $2x^2 - 2x - 8$

8. $20y^3 + 7y^2 - 11y + 2$ **10.** $8x^2 + 12x - 8$

12. The first term of the product is the product of the first terms in each binomial. The coefficient of the second term of the product is the sum of the coefficients of second terms in the binomials. The last term of the product is the product of the last terms in each binomial.

14.

	x^2	$+3x$	-2
$3x$	$3x^3$	$9x^2$	$-6x$
$+4$	$4x^2$	$12x$	-8

The product is $3x^3 + 13x^2 + 6x - 8$. The like terms are on the diagonals of the table from bottom left to top right.

16. $x^2 + 7x + 12$ **18.** $6x^3 - 24x^2 - 18x$

20. $-3x^4 + 6x^3 - 12x^2$

22.

	x	-6
$3x$	$3x^2$	$-18x$
$+4$	$4x$	-24

The product is $3x^2 - 14x - 24$.

24. $x^2 - 3x - 18$ **26.** $2x^2 - 13x - 24$

28. $6x^3 - 29x^2 + 30x - 7$

30. $-4x^4 + 6x^3 + 16x^2 - 3x - 7$

32. $(4x^3 - 2x^2 - 12x + 6) - (x^2 + 2x)$
 $= 4x^3 - 3x^2 - 14x + 6$

34. $27x^3 + 54x^2 + 36x + 8$

36. $4x^2 + 38x + 78$ **38.** $4x^2 + 11x + 19$

40. Part A $10x^2 + 38x + 30$ **Part B** 5 cm

Lesson 7-3

2. She did not multiply 3 and x and -3 and x correctly so their sum would be zero. The correct answer is $x^2 - 9$.



Selected Answers

Topic 7

- 4.** When the terms are distributed, the middle term will be zero. When the first term of each binomial is multiplied by the second term of each binomial the products are opposites. This eliminates one of the terms so instead of a trinomial, the product is a binomial. **6.** $4x^2 + 20x + 25$ **8.** $9y^2 - 25$ **10.** 864 cm^2 **12. a.** $m = 9$, **b.** $m = 2$; $n = 3$ **14.** $(96 - 95) = 1$, so you will multiply the sum of the two numbers by 1, which will equal the sum. **16.** $y^2 + 18y + 81$ **18.** $a^2 + 22a + 121$ **20.** $p^2 + 30p + 225$ **22.** $x^2 - 8xy + 16y^2$ **24.** $\frac{4}{25}x^2 + \frac{4}{25}x + \frac{1}{25}$ **26.** 3,136 **28.** $x^2 - 144$ **30.** $9a^2 - 16b^2$ **32.** $\frac{1}{16}x^2 - \frac{4}{9}$ **34.** 896 **36. a.** $(x + 6)^2 - x^2$, **b.** 180 cm^2 **38.** $A = 12\pi x + 36\pi$ **40. a.** $1176x^2 + 1344x + 384$ **b.** $2,744x^3 + 4,704x^2 + 2,688x + 512 \text{ ft}^3$ **42.** C

Lesson 7-4

- 2.** The variable with the least exponent is a factor of any terms with common variables that have greater exponents. **4.** Andrew is removing a $3xy$ from each term and putting the remainder as the second factor. Multiplying $3xy(x - 2y)$ will not give the third term of the original equation. The correct answer is $3xy(x - 2y + 1)$. **6.** 5 **8.** $4a^2$ **10.** $4a^4b$ **12.** $2ab(5a + 6b)$ **14.** $5x^2y(3x - 2y^2)$ **16.** $1(3x^3y^2 - 9xz^4 + 8y^2z)$ **18.** $8xy^2$
The answer has a coefficient that is a multiple of 4 but not 12. It must have both an x and y variable. The exponent for x must be 1; however the exponent for y can be any whole number.

- 20.** The student did not take out the correct GCF. All terms of the trinomial also have a b . The correct answer is $5ab(2a^2 - ab - 3)$. **22.** Sometimes; an example of when it would not be a multiple of 6 is $4x^2 + 6x + 9y^2 + 12y$. **24.** x^ny^{n-2} ; $x^ny^{n-2}(xy^2 + 1)$ **26.** $4y$ **28.** 1 **30.** $3x(4x - 5)$ **32.** $1(3m^2 - 10m + 4)$ **34.** Width: $3xy^2$, Length: 3 and $4xy$ **36.** $5ab$ and $2ab^2 + 3b + 4a$ **38.** $V = \pi r^2 h - \left[3\left(\frac{4}{3}\pi r^3\right)\right]$
 $V = \pi r^2 h - [4\pi r^3]$
 $V = \pi r^2(h - 4\pi r)$ **40.** $24x^2 - 6\pi x^2$; yes there is enough dough **42.** D

Lesson 7-5

- 2.** When c is negative in $x^2 + bx + c$, then factors have opposite signs. **4.** Answers may vary. Sample: Look at the binomial factors of the polynomial $(x + n)$ and $(x + m)$. When you multiply them you get $x^2 + mx + nx + mn$, so c in the trinomial $x^2 + bx + c$ is equivalent to mn . **6.** -1 and 21 , 1 and -21 , -3 and 7 , 3 and -7 **8.** opposite signs **10.** Factoring a trinomial is like factoring a number because in both cases you are writing an expression as a product. They are different because the factors of a trinomial are variable expressions and the factors of a number are numbers. **12.** $x^2 + 7x - 18$ factors into $(x + 9)(x - 2)$ and $x^2 - 7x - 18$ factors into $(x - 9)(x + 2)$. The signs of the binomial factors are opposite. **14.** 6, 9, -6 , -9



Selected Answers

Topic 7

16. If the sign of the last term is positive you are looking for either two positive or two negative factors. If the sign of the last term is negative you are looking for one positive and one negative factor. **18.** $(x + 1)(x + 6)$

20.

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

22. $(x + 11)(x + 4)$ **24.** $(x + 5)(x - 3)$

26. $(x + 6)(x + 3)$ **28.** $(x + 6y)(x + y)$

30. $(x + 8)(x + 2)$ **32.** $(x - 11y)(x + y)$

34. $(x - 16)(x + 3)$ **36.** $x, (x + 1), (x + 2)$; One dimension is x units.

Another dimension is one unit greater and the third dimension is two units greater. **38.** Sarah cuts 2 in. from one side and 6 in. from the other. **40.** A

Lesson 7-6

2. For the trinomial to be factorable, b must equal the sum of two of the factors of ac ; sometimes this is $a + c$, but not always. **4.** Yes, you can rewrite b and then factor out common factors of the first two terms and the last two terms. This will give you the factors of the trinomial. **6.** 1 and 8, 2 and 4 **8.** yes; 5 **10.** $7x + 10x$ **12.** $5x + 2$ and $x + 3$ **14.** In both situations, the common factor must be a factor of all parts. In factoring a trinomial, the parts are the terms of the trinomial. In factoring a fraction, the parts are the numerator and denominator. **16.** ac

18. No, in this trinomial, $ac = -36$.

The factors of -36 are: -1 and 36 , 1 and -36 , -2 and 18 , 2 and -18 , -3 and 12 , 3 and -12 , -4 and 9 , 4 and -9 , -6 and 6 . None of these pairs of factors sum to 7, the value of b .

20. $(px + n)(qx + m)$

22. $(3x + 1)(2x + 1)$ **24.** $2(x - 15)(x - 1)$

26. $6(x + 4)(x - 2)$ **28.** -1 and 12

30. 4 and 15 **32.** 3 and 8

34. $(3x - 14)(2x + 1)$

36. $(4x + 3)(3x + 1)$ **38.** $(4x + 1)(2x - 3)$

40. $4x(2x + 1)(2x + 3)$

42. $(8x - 1)(2x + 3)$

44. $2x(3x - 2)(4x + 1)$

46. $(2x + 5y)(x + 2y)$

48. $2(x + 2y)(x + 3y)$

50. $2x, (2x + 1), (x + 2)$; 6 by 7 by 5; 432 m^3 **52.** $ac; b$

54. Part A $6x + 9$ inches, **Part B** 9 in.^2 , **Part C** 12 in.

Lesson 7-7

2. This trinomial fits the pattern of a perfect square trinomial, not a difference of two squares. **4.** In both patterns, two of the terms must be perfect squares. In a perfect square trinomial there are three terms and in a difference of two squares there are two terms. **6.** difference of two squares **8.** perfect-square trinomial **10.** difference of two squares **12.** $(7x + 5)(7x - 5)$ **14.** $3x(x - 2)^2$ **16.** $x + 11$ **18.** No; Answers may vary. Sample: Because the second term of 50 is not a perfect square, a difference of two squares pattern does not apply. Additionally, the two terms have no common factors.



Selected Answers

Topic 7

20. The student used the wrong pattern for factoring. Instead, the student should use the pattern for a difference of two squares. The factored form of the expression is $(x + 6)(x - 6)$.

22. First, use the pattern for a perfect square trinomial to get $(x^2 - 4)^2$. Then apply a difference of two squares pattern to each of the factors to get $(x + 2)(x - 2)(x + 2)(x - 2)$, or $(x + 2)^2(x - 2)^2$.

24. Answers may vary. Sample: Determine if $\frac{a}{b}$ is the quotient of two perfect squares and can be factored as the difference of two squares;

$$a^2 - \frac{a}{b} = \left(x - \frac{\sqrt{a}}{\sqrt{b}}\right)\left(x + \frac{\sqrt{a}}{\sqrt{b}}\right).$$

26. 25 **28.** 48 **30.** $(12x - 1)$

32. $(x + 5)(x - 5)$ **34.** $(x - 7)^2$

36. $(4x + 5)^2$ **38.** $(4x + 9y)(4x - 9y)$

40. $7xy(x + 3y)(x - 3y)$ **42.** $(11x + 5)^2$

44. $16(2xy + 3z)(2xy - 3z)$ or $(8xy + 12z)(8xy - 12z)$

46. $\left(x - \frac{1}{3}\right)\left(x + \frac{1}{3}\right)$ **48.** $\left(x + \frac{1}{2}\right)\left(x + \frac{1}{2}\right)$

50. $(7x + 5y)$ by $(7x - 5y)$; One side length is $10y$ longer than the other;

52. I. C; II. B; III. D; IV. A;

54. Part A You could subtract the smaller area from the larger area.

Part B You could factor each trinomial. Then write the difference of the areas as a difference of squares. Factor the binomial and then simplify. **Part C** $32x^2 - 228x + 28$ in.² **Part D** Check students' answers.

Topic Review

2. Closure Property **4.** monomial

6. standard form of a polynomial

8. constant **10.** $7x - 4$ **12.** $8b^4 + 8b^2 - 6$

14. $5x^2 + 19x + 51$ **16.** $6x^2 - 13x - 5$

18. $x^3 + x^2 - 13x - 4$

20. $27x^3 - 27x^2 + 9x - 1$

22. $16x^2 + 8x + 1$ **24.** $9x^2 - 16y^2$

26. $9a^2 - 30ab + 25b^2$ **28.** Surface area:

$150x^2 - 120x + 24$ sq. ft., Volume:

$125x^3 - 150x^2 + 60x - 8$ ft³ **30.** bc

32. 6 **34.** $6y(y^4 - 7y^2 + 3)$

36. $7ab(7a^4 b^2 - 2ab + 5)$

38. $2x$; $2x(7x - 8)$

40. $(x + 8)(x + 4)$ **42.** $(x + 3)(x - 16)$

44. Both have the same factors of 7 and 3, but with different signs. The first expression has binomial factors $(x + 7)(x - 3)$ and the second expression has binomial factors $(x - 7)(x + 3)$.

46.

Factors	Sum of Factors
-1 and 30	29
1 and -30	-29
-2 and 15	13
2 and -15	-13
-3 and 10	7
3 and -10	-7
-5 and 6	1
5 and -6	-1

48. $(4x + 5)(x - 2)$ **50.** $(3x + 2)(2x + 3)$

52. $(16x + 6)(x + 1)$ **54.** $(6x - 3)$ m by $(x + 5)$ m. The new dimensions would be $(6x + 2)$ m by $(x + 10)$ m. The new area is $6x^2 + 62x + 20$ m². **56.** 98

58. $(x + 11)(x - 11)$ **60.** $(3x + 7y)(3x - 7y)$

62. $4(x - 7)^2$ **64.** The playground is $(6x + 4y)$ ft long and $(6x - 4y)$ ft wide. The length is $8y$ ft longer than the width. You would need to subtract $4y$ from the length and add $4y$ to the width for the playground to be a square.



Selected Answers

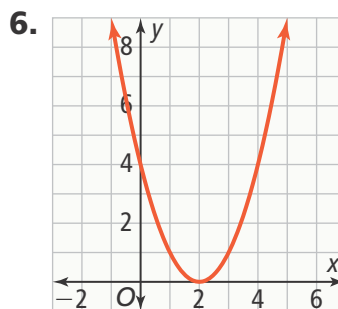
Topic 8

Lesson 8-1

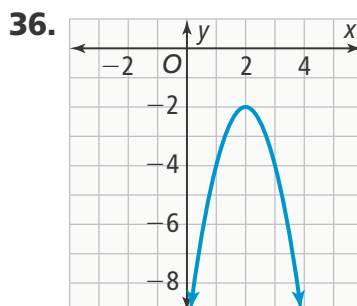
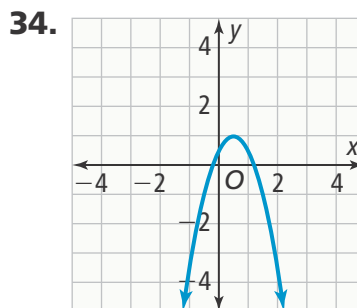
2. The graphs of both functions have axis of symmetry $x = 0$ and vertex and x - and y -intercepts at $(0, 0)$. The graph of $f(x) = ax^2$ becomes narrower as $|a|$ becomes greater, and for $a < 0$, the graph opens downward. **4.** The sign of the y -value is incorrect. The point should be $(-2, -52)$. **6.** The graph is wider than the graph of the parent function. **8.** The graph is wider than the graph of the parent function and opens downward. **10.** $-1 < a < 0$ **12.** increasing: $x > 0$; decreasing: $x < 0$ **14.** The graph is narrower. **16.** The graph is narrower and opens downward. **18.** The graph is wider. **20.** decreasing: $x > 0$; increasing: $x < 0$ **22.** $A(x) = x^2$; 169 units² **24.** The average rate of change of g , 1.5, is 3 times greater than the average rate of change of f , 0.5. **26.** $f(x) = 9x^2$; $x \geq 0$; 144 carrots **28.** $(-7, 2)$; The ramp is a parabola symmetric about the y -axis. So, if $(7, 2)$ is on the skateboard ramp design, then $(-7, 2)$ is also on the parabola. **30.** A

Lesson 8-2

2. No; the axis of symmetry for f is $x = 1$, and the axis of symmetry for g is $x = 2$. **4.** No; the vertex of a function in vertex form is (h, k) , so the vertex is $(-2, 6)$.



8. $f(x) = 2(x + 1)^2 - 3$ **10.** The coordinates of the vertex are (h, k) . From the graph, $h = 3$ and $k = -2$; $f(x) = (x - 3)^2 - 2$ **12.** The vertex should be plotted at $(1, 6)$, not $(-1, 6)$. **14. a.** The graph of h is a translation 3 units left and 3 units up of the graph of $f(x) = x^2$. **b.** $h(x) = (x + 3)^2 + 3$ **16.** $(0, -5)$; $x = 0$ **18.** $(0, 0.5)$; $x = 0$ **20.** $(0, 50)$; $x = 0$ **22.** $(1, 0)$; $x = 1$ **24.** $(6, 0)$; $x = 6$ **26.** $(4, 0)$; $x = 4$ **28.** $f(x) = (x + 3)^2 - 1$ **30.** $(3, -3)$; $x = 3$; opens upward; same width as the width of the graph of $f(x) = x^2$ **32.** $(-2, -5)$; $x = -2$; opens downward; narrower than the width of the graph of $f(x) = x^2$





Selected Answers

Topic 8

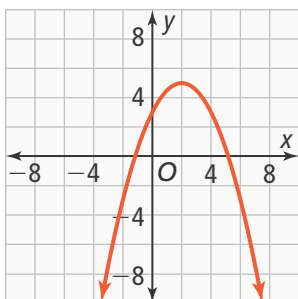
38. $f(x) = -3(x - 2)^2 + 5$

40. a. $b(x) = a(x - 28.5)^2 + k$; The x -coordinate of the vertex can be determined, but the y -coordinate of the vertex and the value of a cannot be determined because only the x -intercepts are given. **b.** Answers may vary. Sample: $k = 10$, so $a \approx -0.01231$; The value of k represents the maximum height of the ball, the x -intercepts represent when the ball is on the ground, and the value of a shows that the arc of the ball opens downward. **42.** C, E **44. Part A** 6 m **Part B** 600 m; The height of the cable is 60 m at both of the towers, and $x = 0$ and $x = 600$ when $f(x) = 60$, so the towers are 600 m apart.

Lesson 8-3

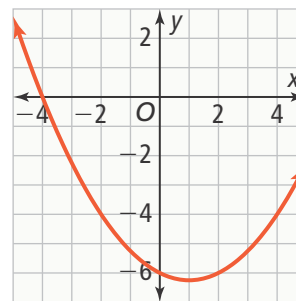
2. Both functions are in standard form and have graphs that are parabolas. Each parabola has an axis of symmetry of $x = -\frac{b}{2a}$. The function f has y -intercept of c , while the function g has y -intercept 0. **4.** The sign is incorrect. The axis of symmetry is $x = 1$. Sage may have forgotten to include the negative sign in $x = -\frac{b}{2a}$.

6.



axis of symmetry: $x = 2$; y -intercept: 3;
vertex: (2, 5)

8.



axis of symmetry: $x = 1$; y -intercept: -6 ;
vertex: (1, -6.25) **10.** $b = 4$; $-\frac{b}{2a} = 1$;
 $a = 2$, so solve $\frac{b}{2(2)} = 1$ for b .

12. The student did not correctly use the Distributive Property to multiply $2 \cdot (x^2 + 6x + 9)$. **14. a.** $x = 1$ **b.** (1, -2) **c.** -1 **d.** $x > 1$ **16.** -0.7 **18.** 5 **20.** 2

22. -3 ; $x = 1$; (1, -1) **24.** -5 ; $x = -1$;
(-1 , -4) **26.** 5; $x = -1.5$; (-1.5 , -4)

28. 40; $x = 4$; (4, 72) **30.** f ; minimum of f is -4 ; minimum of h is -3.75 .

32. h : maximum of h is 4.375; maximum of f is 4. **34.** $f(x) = 0.1x^2 - 0.4x + 0.3$

36. $f(x) = -x^2 - 6x - 1$ **38.** 1 ft; (10, 12)

40. A, B, C, E **42. Part A** Model A: \$5; Model B: \$6; Answers may vary. Sample: Maximum revenues are at the vertex. The x -coordinate of the vertex gives the number of \$1 price increases needed to maximize revenue. The price to maximize revenue would be \$1 times x -coordinate of the vertex plus \$2.

Part B \$11; The points are symmetric about $x = 9$, so (9, 605) is the vertex, and $\$9 + \$2 = \$11$.

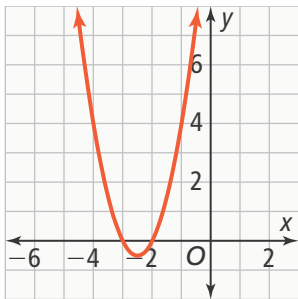


Selected Answers

Topic 8

Lesson 8-4

- 2.** The equation models the height at time t of an object launched at an initial vertical velocity of b ft/s from a height of c ft. **4.** Chen switched the values of b and c . The function should be $h(t) = -16t^2 + 16t + 6$.
- 6.** $h(t) = -16t^2 + 120t + 50$; 275 ft; 3.75 s
- 8.** The graph of the residuals consists of 5 points on the x -axis, which means that the function models the data exactly. **10.** The value of R^2 is not close to 1, so the function does not model the data closely. The data may not be quadratic. **12.** The initial velocity is the value of b in the standard form of the quadratic function being graphed, and $\frac{-b}{2a}$ is the t -coordinate of the vertex, which represents the amount of time to reach the maximum height.
- 14.** $f(x) = 2x^2 + 10x + 12$

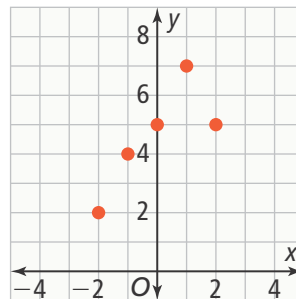


$$f(8) = 220$$

- 16.** $h(t) = -16t^2 + 32t + 75$; 91 ft
- 18.** $h(t) = -16t^2 + 50t + 5$; 44.0625 ft

20.

x	y	$f(x)$	Residual
-2	13	11	+2
-1	8	4	+4
0	6	1	+5
1	9	2	+7
2	12	7	+5



All the residuals are positive, which indicates the function may not be a good fit.

- 22.** $y = 0.2943x^2 - 4.1451x + 15.3726$
- 24.** $h(t) = -16t^2 + 200$; 56 ft
- 26.** $f(x) = -1.25x^2 + 75x + 60$; \$1,060.00
- 28.** D

Lesson 8-5

- 2.** quadratic or exponential **4.** quadratic
- 6.** The profit is decreasing. The average rate of change is -175 from $x = 120$ to $x = 140$ and -375 from $x = 140$ to $x = 160$. The rate of change for the quadratic function decreases as x increases, because the maximum profit occurs when $x = 112.5$.



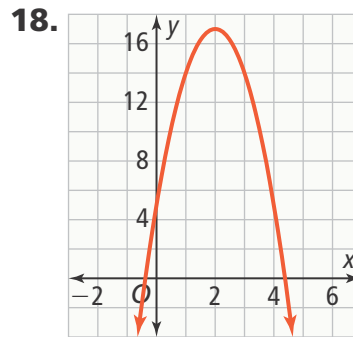
Selected Answers

Topic 8

8. For the first three tables, the second difference is twice the value of the leading coefficient. For the last table, the second difference is eight times the value of the leading coefficient. However, the difference in consecutive x -values is 2, not 1 as in the other tables. **10. a.** Plan A is better for the first 14 months, and then Plan B is better. **b.** Plan B is better in the long run, because Plan B increases at a far greater rate. **12.** quadratic **14.** linear **16.** quadratic; $f(x) = -x^2 + 8x - 19$ **18.** No; a linear regression model for this data predicts that after 10 years, the population will be about 885,400 people, so the city will not need a new water plant. **20.** Carmen should use Plan B. Plan A is modeled by $f(x) = 10,000(0.9)^x$ and Plan B is modeled by $g(x) = -500x + 10,000$. After 20 years, he will pay off the loan with Plan B, while he will still owe \$1,215.77 with Plan A. **22.** C

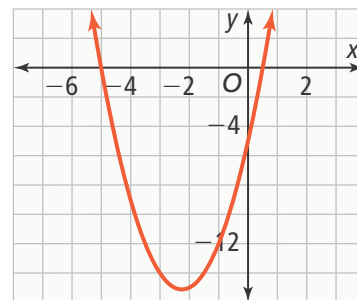
Topic Review

2. parabola **4.** vertical motion model **6.** quadratic regression **8.** The graph of $h(x) = -9x^2$ is narrower and opens downward. **10.** artificial turf: $A(x) = 15x^2$; sod: $s(x) = 0.15x^2$; The graph of A is narrower than the graph of s since the cost per square foot of artificial turf is greater than the cost per square foot of sod. **12.** $(-8, 1)$; $x = -8$ **14.** The maximum height is 15 meters, which occurs 2.5 seconds after the rock is thrown. **16.** 1; $x = \frac{7}{6}$; $(\frac{7}{6}, \frac{61}{12})$



20. $h(x) = -16x^2 + 54x + 7$; 52.6 ft

22. $f(x) = 2x^2 + 9x - 5$



The vertex is $(-2.25, -15.125)$, which represents the minimum area of the rectangle when $x = -2.25$ if the value of $x = -2.25$ is possible for the rectangle, which it is not. The x -intercepts represent when the area of the rectangle is 0. x -intercepts: $(-5, 0)$, $(0.5, 0)$; y -intercept: $(0, -3)$
domain: $x > 0.5$; range: $y > 0$

24. Solve for t using the formula $t = -\frac{b}{2a}$.

26. quadratic



Selected Answers

Topic 9

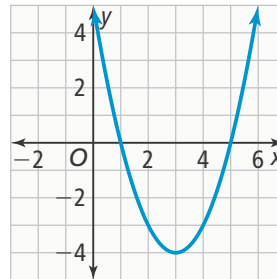
Lesson 9-1

- 2.** If the sign of the function value never changes, there is no solution. There is a solution if the sign does change, and you can use smaller and smaller intervals to approximate it.
- 4.** The two x -intercepts; Substitute each value into the quadratic equation and see if the equation is true. If it is, the value is a solution. **6.** $-3, 2$
- 8.** no solution **10.** no solution
- 12. a.** Graph $f(x) = x^2 + 2x - 24$. The intercepts are the solutions.
- b.** The values of x for $y = x^2 + 2x - 24$ when $y = 0$ are the solutions. **14.** A quadratic equation can have 1 solution. For example, $x^2 = 0$ has only 0 as a solution. **16.** 2, because there is one zero between 1 and 2, and the left side of the curve goes to infinity, so there must be another zero **18.** no solution
- 20.** $-11, 11$ **22.** no solution **24.** $-1, 7$
- 26.** approximately -1.4 , approximately 1.4
- 28.** approximately -0.9 , approximately 2.6
- 30.** $-4, 4$ **32.** approximately -2.6 , approximately -0.4
- 34. a.** 3,000 units **b.** 0 units, 6,008 units **36. a.** 0.97 s **b.** 0 s, 0.63 s **38.** B

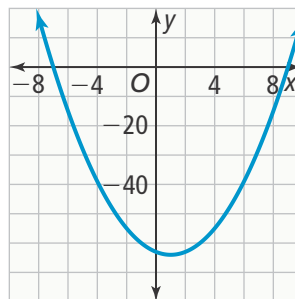
Lesson 9-2

- 2.** All terms of $4x^2 + 10x - 14 = 0$ are multiples of 2. When 2 is divided out, the equation is the same as $2x^2 + 5x - 7 = 0$. So the solutions of both equations are the same. **4.** 1, a perfect-square trinomial has 2 identical factors that each have the same solution when set equal to 0. **6.** $\frac{4}{3}, 4$
- 8.** $(x + 3)(x - 7) = 0$; $-3, 7$ **10.** $-1, 9$
- 12.** $\frac{9}{5}, 2$

14. $(x - 5)(x - 1) = 0$; $(3, -4)$



- 16. a.** For the opposite roots, multiply $(x - r)$ and $(x + r)$. The equation will have a quadratic term and a constant term only. **b.** For the double root, square $(x - r)$. The equation will be a trinomial square. **18.** First factor out a common factor of 2 to get $2(x^2 + 4x + 3)$. Then factor the trinomial to obtain $2(x + 3)(x + 1)$. **20.** 5, -2
- 22.** $-2, 2$ **24.** -1 **26.** 0, -7 **28.** $-\frac{5}{2}, 1$
- 30.** $(x + 9)(x + 16) = 198$; 2 cm
- 32.** $(x + 7)(x - 9) = 0$; $(1, -64)$



34. $(x + 4)(x - 3) = 0$ **36. a.** the Pythagorean Theorem

b. $x^2 + (x - 3)^2 = 15^2$
 $x^2 + x^2 - 6x + 9 = 225$
 $2x^2 - 6x - 216 = 0$
 $x^2 - 3x - 108 = 0$
 $(x - 12)(x + 9) = 0$
 $x = 12$ or $x = -9$

A negative value does not make sense, so the pole is 12 ft high. **c.** 12 ft **38.** D



Selected Answers

Topic 9

Lesson 9-3

2. For two positive numbers, the square root of the product equals the product of the square roots. **4.** Rikki simplified $\sqrt{3}$ to equal 3, but $\sqrt{3}$ cannot be simplified. The product $\sqrt{3x^3} \cdot \sqrt{x}$ is $\sqrt{3 \cdot x \cdot x \cdot x \cdot x}$, which is $x^2\sqrt{3}$. **6.** Write the prime factorization of the radicand. Remove any pairs of factors inside the radicand, writing one factor outside of the radicand for each pair. Once all pairs have been removed from the radicand, multiply the factors outside the radicand to find the coefficient. Then multiply the factors remaining in the radicand to find the final, simplified rational expression. **8.** $x^3\sqrt{x}$ **10.** $x^2\sqrt{11x}$ **12.** $16\sqrt{2}$ **14.** $8x^5$ **16.** The expressions are not equivalent; $\sqrt{72} = 6\sqrt{2}$ and $2\sqrt{50} = 10\sqrt{2}$ **18.** $10x^4$ **20. a.** The square root simplifies completely, and the simplified answer is x with an exponent of $\frac{n}{2}$. **b.** The square root does not simplify completely. The radicand is \sqrt{x} . **22.** $591x^{15}y^3$ **24.** 1; 1; 2; 1; 1 **26.** $\sqrt{108} = 6\sqrt{3}$ **28.** $40\sqrt{42}$ cannot be simplified; $42\sqrt{40} = 84\sqrt{10}$ **30.** $2\sqrt{17}$; $6\sqrt{2}$ **32.** $\sqrt{210}$ **34.** $6\sqrt{3}$ **36.** $7x^4\sqrt{2}$ **38.** $10x\sqrt{2x}$ **40.** $6x$ **42.** $9m^{10}\sqrt{2m}$ **44.** $9x^6\sqrt{2}$ **46.** $2x\sqrt{10}$ ft; 30 ft, 90 ft, approximately 94.9 ft **48. a.** $d\sqrt{d}$ **b.** 29.28 years;
 $\sqrt{d^3} = \sqrt{857.375} \approx 29.28$ $d\sqrt{d} = 9.5\sqrt{9.5}$
 $\approx 9.5 \cdot 3.08 \approx 29.28$

50. a. $2h$ $h^2 + (1.732h)^2$,
so $h = \sqrt{h^2 + (1.732h)^2} \approx \sqrt{h^2 + 3h^2} \approx \sqrt{4h^2} \approx 2h$ **b.** $6h$ **52.** C

Lesson 9-4

2. no solutions; If you divide both sides by a , you will get x^2 on one side and a negative number on the other.
4. No; there are 2 solutions, -7 and 7 .
6. $x = \pm 20$ **8.** $x = \pm \frac{20\sqrt{3}}{3}$ **10.** $x = \pm 2\sqrt{3}$
12. $x =$ no solution **14.** $x = \pm\sqrt{30}$
16. $x = 7$ **18.** $(-3.74, 7)$, $(3.74, 7)$;
 $\frac{1}{2}x^2 = 7$ **20. a.** when c divided by a is the square of a rational number
b. when c divided by a is nonnegative but not the square of a rational number
c. when c is 0 **d.** when c divided by a is negative

22. a.
 $(x - 5)^2 - 100 = 0$
 $(x - 5)^2 = 100$
 $(x - 5) = \pm 10$
So $(x - 5) = 10$ or $(x - 5) = -10$
 $x - 5 = 10$ or $x - 5 = -10$
 $x = 15$ or $x = -5$

b. Get the variable expression $(x - d)^2$ by itself by adding c to both sides, then take the square root of both sides, simplify each resulting expression, and use the Zero Product Property to solve.

24. ± 12 **26.** no solution **28.** ± 0.5
30. 0 **32.** $\pm 2\sqrt{2}$ **34.** no solution
36. $\pm\sqrt{155}$ **38.** $\pm \frac{8\sqrt{3}}{3}$ **40.** $\pm 4\sqrt{15}$
42. $\pm 2\sqrt{2} \approx \pm 2.83$ **44.** $25\sqrt{2}$ ft; $6x = 212.13$ ft; $2x = 70.71$ ft **46.** 93.9 ft
48. 5 mi **50.** $2\sqrt{103}$, $2\sqrt{103}$
52. Part A 120 mi; 216 mi
Part B $x^2 + 120^2 = 216^2$; $x \approx 180$ mi
Part C 1.5 h



Selected Answers

Topic 9

Lesson 9-5

2. When you add 25 to $x^2 + 10x$, the binomial becomes a perfect square trinomial. **4.** It is like completing the square because you write one side as a perfect square trinomial. It is different because you are dealing with a function instead of an equation and so are not finding solutions.

6. 169 **8.** 81 **10.** $x = 6 \pm \sqrt{38}$

12. $y = (x + 2)^2 - 9$

14. $y = (x + 4)^2 - 31$ **16.** completing the square; The trinomial is not factorable, and the solutions are not integers, so to find the exact solutions, you will need to use completing the square.

18. There is no solution because $(x + 2)^2 = -8$ and the square root of a negative number is undefined.

20. 64; $(x + 8)^2$ **22.** 225; $(x - 15)^2$

24. 72.25; $(x + 8.5)^2$ **26.** $-3 \pm \sqrt{153}$

28. $-8 \pm \sqrt{5}$ **30.** $0.3 \pm \sqrt{3.09}$

32. -7 and 1 **34.** 2.47

36. $y = (x + 2)^2 - 7$; (-2, -7)

38. $y = (x - 3)^2 + 3$; (3, 3)

40. $y = 3(x - 1)^2 - 5$; (1, -5)

42. $y = -(x + 4)^2 + 9$; (-4, 9)

44. $y = (x + 3)^2 - 6$; no **46.** about 7.08 ft by 7.08 ft **48. a.** The vertex form of the function is

$$h = -16\left(t - \frac{v_0}{32}\right)^2 + \left(h_0 + \frac{(v_0)^2}{64}\right).$$

This means that the maximum height occurs at $h_0 + \frac{(v_0)^2}{64}$.

b. no; The maximum height increases by a factor of 4 because the initial velocity is squared. So if the initial velocity is doubled, the maximum height is multiplied by 4. **50.** B

Lesson 9-6

2. $4ac$; When the discriminant is 0, there is one real solution. For the discriminant $b^2 - 4ac$ to be 0, b^2 must equal $4ac$. **4.** Although the equation has no x -term, you can still use the quadratic formula. Just use $b = 0$.

6. $a = 4$, $b = 2$, $c = -1$ **8.** $a = 2$, $b = -10$, $c = -3$ **10.** 2 **12.** 1 **14.** Both are formulas with several variables.

Both can be used to find a value. The formula for area gives you a measurement. The quadratic formula gives you solutions of an equation.

16. a. factoring; The terms in this equation have a common factor.

b. square root; In this equation, there is no x -term, so taking the square root of both sides after isolating the x^2 -term is efficient. **c.** quadratic formula; The left side of the equation is not factorable. Although you could use completing the square to solve this equation, it would involve many fractions. So, using the quadratic formula is easier. **18.** If the discriminant is 0, then the vertex lies on the x -axis. The only way for a parabola to cross the x -axis only once is if it has one root and a discriminant of 0.

20. $x \approx 0.36$ and $x \approx -19.36$

22. $x \approx -0.26$ and $x \approx 0.55$

24. $x \approx -0.82$ and $x \approx 9.82$ **26.** $x = -1$

28. $x \approx -1.65$ and $x \approx 3.65$ **30.** -127; 0

32. 0; 1 **34.** -47; 0 **36.** 529; 2

38. 1 real solution; equal to 0

40. a. $-16x^2 + 64x + 5 = 20$ **b.** 2

c. $x = 0.25$ and $x = 3.75$



Selected Answers

Topic 9

42. yes; yes; no; no; no

44. Part A Check students' answers.

Part B 3.29 seconds

Part C 3.23 seconds

Part D Check students' answers.

Lesson 9-7

2. Linear-quadratic systems can have only 0, 1, or 2 solutions. So the student incorrectly calculated the number of solutions. **4.** $y = x^2 - 3$ and $y = 7$; To rewrite an equation as a system, set each side of the original equation as a separate equation equal to y .

6. $y = x^2 - 5$
 $y = x$

8. $y = x^2 - 2x + 3$
 $y = x + 4$

10. $(-1, 2)$ **12.** A linear-quadratic system includes a parabola and a line, but a linear system includes the graphs of two lines. They are similar because the graphs of the equations can intersect at their solutions.

14. a. Check students' work. **b.** Check students' work. **c.** Check students' work. **16.** Look at the terms in the equations of the system. If the equations would be easy to graph and intersect at grid lines, then graphing is a good choice. Elimination is a good choice when it will reduce the number of terms you have to deal with. Substitution works in any situation.

18. $x = -6$ and $x = 3$ **20.** no solutions

22. $y = -0.5x^2 + 3$, $y = 0.75x + 2$;
 $(-2.351, 0.238)$ and $(0.851, 2.638)$

24. $(-2, -4)$ and $(1, 2)$ **26.** $(2, -15)$
and $(16, -1)$ **28.** no solution

30. $(0, -5)$ **32.** low ropes course: \$17; high ropes course: \$85 **34.** 4; Write a system of equations and then solve. The solutions are $(-2, 2)$ and $(4, 8)$. Because time cannot be negative, discard $(-2, 2)$. The solution $(4, 8)$ tells you that in 4 minutes both the car and the truck will be 8 miles from the stop sign. This is when the car will pass the truck. **36.** $(-1, -2)$, $(4, -12)$

38. Part A $y = 0.25x^2 + 3$

$$y = 0.5x + 5; 4 \text{ days}$$

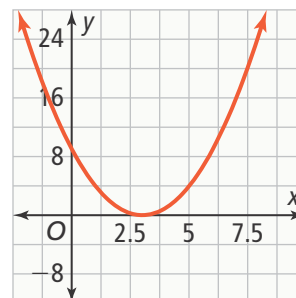
Part B 1; Although the system has 2 solutions, only the solution with a positive x -value makes sense in this situation. **Part C** no; The graphs of these two equations never intersect, so there is no solution. This means that the songs are never played the same number of times on the same day.

Topic Review

2. standard form of a quadratic equation **4.** zeros of a function

6. Zero-Product Property

8. 3

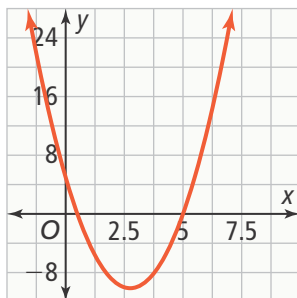




Selected Answers

Topic 9

10. $\frac{1}{2}, 5$

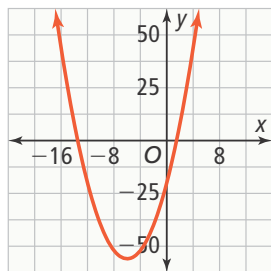


12. $-2, 8$

x	-2	0	2	4	6	8
$f(x)$	0	-16	-24	-24	-16	0

14. $x = -3$ **16.** $x = 0$ or $x = 12$

18. $(x - 10)(x - 2) = 0$; vertex is $(-6, -56)$



20. The student did not change the sign when finding the value of x .

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

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

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

$$x = 2$$

The solution is $x = 2$.

22. $8\sqrt{21}$ **24.** $16x^6\sqrt{3}$

26. The expressions are not equal;

$$\sqrt{135x^4y^3} = 3x^2y\sqrt{15y}$$

28. $-17, 17$

30. $-\sqrt{155}, \sqrt{155}$ **32.** $-8, 8$ **34.** $-5, 5$

36. $\sqrt{74}$ km **38.** $9, (x - 3)^2$

40. $144, (x + 12)^2$

42. $5 + \sqrt{71}, 5 - \sqrt{71}$

44. $-7 + \sqrt{34}, -7 - \sqrt{34}$ **46.** $x = 1$ and

$x = -2.5$ **48.** $x = 0.15$ and $x = -2.15$

50. 2 solutions **52.** 1 solution

54. The student had the wrong sign for c .

$$a = 3, b = -5, c = -8$$

$$x = \frac{-5 \pm \sqrt{(-5)^2 - 4(3)(-8)}}{2(3)}$$

$$= \frac{-5 \pm \sqrt{121}}{6}$$

$$x = 1 \text{ or } x = -2.67$$

56. no solution **58.** $(4, -8)$

60. no solution **62.** $(0, 1)$

64. Answers may vary.

Sample: $y = x - 4$



Selected Answers

Topic 10

Lesson 10-1

2. a. No; multiplying the radical by 2 changes the shape of the graph. **b.** Yes; the graph of g is the graph of f shifted 2 units left and 3 units down. **4.** The domain is $x \geq -3$. **6.** It is a horizontal translation of the graph of f by 5 units right. **8.** It is a horizontal translation of the graph of f by 7 units left. **10.** 0.18

12. domain: $x \geq -7$; range: $y \leq 0$

14. $f(x) = -\sqrt{2x - 7} + 2$

16. The domain is restricted because the radicand cannot be negative. Since the value of the radicand cannot be negative, the value of the function is restricted, which restricts the range.

18. x -intercept = 4; y -intercept = -2

20. x -intercept = -9; y -intercept = 3

22. It is a vertical translation of the graph of f by 11 units up. **24.** It is a horizontal translation of the graph of f by 2 units to the right and a vertical translation by 5 units up.

26. $g(x) = \sqrt{x} + 6$ **28.** $g(x) = \sqrt{x + 1} - 2$

30. 2.824; 3.317; 0.163 **32.** $\frac{1}{7}$

34. domain: $x \geq -11$; range: $y \geq 0$

36. domain: $x \geq 4$; range: $y \geq 0$

38. a.

x	1	10	15	18.5	25	50
d	1.41	10.05	15.03	18.53	25.02	50.01

b. $d = \sqrt{x^2 + 1}$, so $10.2 = \sqrt{x^2 + 1}$. Then $104.04 = x^2 + 1$, $x^2 = 103.04$, and $x = 10.15$ mi. They have already hiked 5 mi, so they need to travel another 5.15 mi. **40.** A, B, E

42. Part A 0.1478 **Part B** 0.1458

Part C 0.1457; 0.1457 **Part D** The two points are getting closer and closer to $x = 15$, with one point on either side of $x = 15$. As the points get closer and closer together, with one point on each side of $x = 15$, the rate of change for the function is stabilizing at about 0.0728.

Lesson 10-2

2. Timothy limits his view to what the calculator displays. He does not realize that the function increases without bound as x increases and decreases without bound as x decreases.

Therefore, the range is all real

numbers. **4.** domain: $-\infty < x < \infty$;

range: $-\infty < y < \infty$ **6.** The minimum is $\sqrt[3]{-3} \approx -1.44$ when $x = -2$; the

maximum is 2 when $x = 9$. **8.** g is translated 4 units to the right of f .

10. The rates of change are the same.

12. approximately 0.397; The rate of change is the same for $-4 \leq x \leq 0$ as for $0 \leq x \leq 4$ due to rotational symmetry.

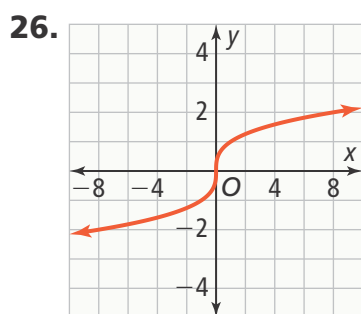
14. Just like the cube root function, the cube function has 180° rotational symmetry about the origin. Also, the cube function is always increasing. So, when the endpoints of one interval are the same distance apart as the endpoints of another interval and have the same absolute value, but are on opposite sides of 0, the cube function has the same rate of change over those intervals. For example, the average rate of change is the same over $-4 \leq x \leq -2$ and $2 \leq x \leq 4$.



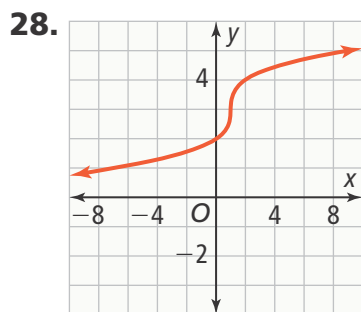
Selected Answers

Topic 10

- 16.** domain: $-\infty < x < \infty$;
range: $-\infty < y < \infty$;
x-intercept: $(3, 0)$; y-intercept: $(0, -\sqrt[3]{3})$
rotational symmetry about the point $(3, 0)$ **18.** domain: $-\infty \leq x \leq \infty$;
range: $-\infty \leq y \leq \infty$; x-intercept: $(1, 0)$;
y-intercept: $(0, -1)$; rotational symmetry about the point $(0, -1)$
20. shift right 3 units **22.** shift down 10 units **24.** shift left 4 units and down 8 units



$$1 \leq x \leq 8 \text{ when } 1 \leq f(x) \leq 2$$



$$0 \leq x \leq 9 \text{ when } 2 \leq p(x) \leq 5$$

30. 0.397 **32.** > **34.** > **36.** $S(C) = 12 \sqrt[3]{\frac{C}{3}}$

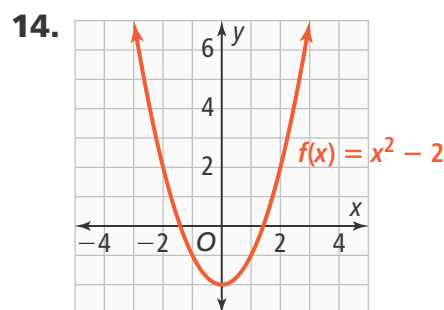
38. B, C **40. Part A** $r = \sqrt[3]{\frac{3V}{4\pi}}$

Part B Sample: $1 \leq r \leq 4$;

$4 \leq V \leq 270$ **Part C** about 2.58 inches

Lesson 10-3

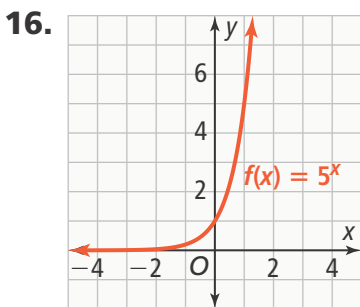
- 2.** There is no value x with $-2^x = 0$. As $x \rightarrow -\infty$, $f(x) \rightarrow 0$, but the function value is never equal to 0, so there is no maximum. **4.** domain: $[5, \infty)$, range: $[0, \infty)$; minimum value is 0 when $x = 5$; no maximum value; no axis of symmetry; as $x \rightarrow \infty$, $y \rightarrow \infty$ **6.** domain: $(-\infty, \infty)$, range: $(-\infty, 2]$; no minimum value; maximum value is 2 when $x = -6$; axis of symmetry: $x = -6$; as $x \rightarrow -\infty$, $y \rightarrow -\infty$; as $x \rightarrow \infty$, $y \rightarrow -\infty$ **8.** $f(x) = 8$ when $x = 512$, and $f(x) = -8$ when $x = -512$. Restrict the domain to be $[-512, 512]$. **10.** If the line $y = 3$ is an axis of symmetry for a graph, then any point above the axis must have a matching point below. So, for example, if $(1, 4)$ is a point on the graph, then the point $(1, 2)$ must also be on the graph. The graph cannot represent a function. **12.** Libby is not correct. The exponential function $y = -2^x$ meets these criteria, but has range $(-\infty, 0]$.



domain: $(-\infty, \infty)$, range: $[-2, \infty)$

Selected Answers

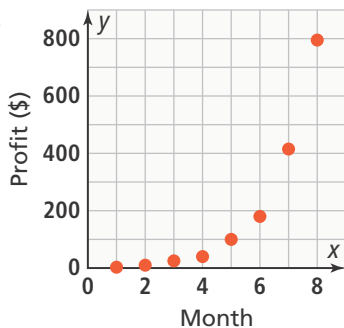
Topic 10



domain: $(-\infty, \infty)$, range: $(0, \infty)$

18. maximum is 3 when $x = 0$; no minimum value
 20. no maximum or minimum value
 22. $x = 2$
 24. $x = 2$
 26. As $x \rightarrow -\infty, y \rightarrow \infty$; as $x \rightarrow \infty, y \rightarrow \infty$.
 28. As $x \rightarrow -\infty, y \rightarrow \infty$; as $x \rightarrow \infty, y \rightarrow \infty$.
 30. As $x \rightarrow \infty, y \rightarrow \infty$
 32. domain: $(0, 12]$, range: $(0, 648]$ (x cannot be 0 or negative, and probably won't be greater than 12 inches. The range is determined using endpoints of the domain.)
 34. A, C, D

36. Part A

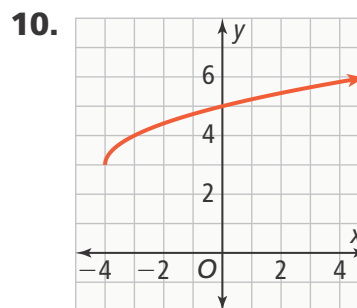
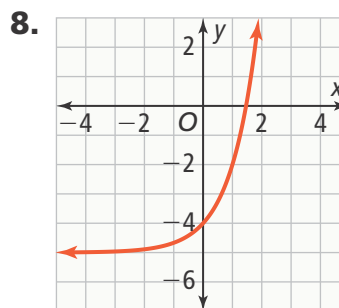
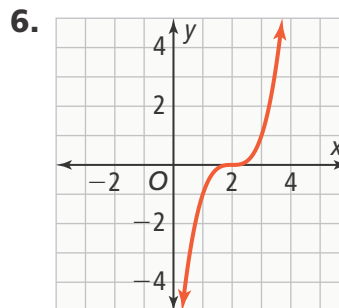


Jack's business growth so far is roughly exponential. **Part B** The growth of the exponential function begins slowly but then increases more and more rapidly. The function has no maximum, but this may not be relevant, because Jack's profits will likely begin to level off.

Part C Let x = number of months in business. $P(x) = 2^x$ predicts $P(20) = 2^{20} = \$1,048,576/\text{month}$. This is not likely—the fast growth at the beginning will probably level out rather than continue.

Lesson 10-4

2. Rewrite the function as $y = (x + 4)^2$. Shift the graph of the function $y = x^2$ to the left 4 units. 4. The output is the result after the function has been evaluated. Adding a number to the output only changes the y -value, shifting the graph of the function vertically.

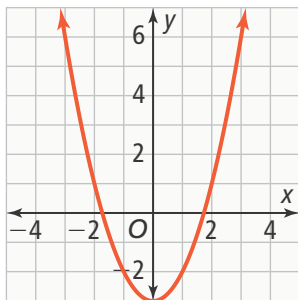
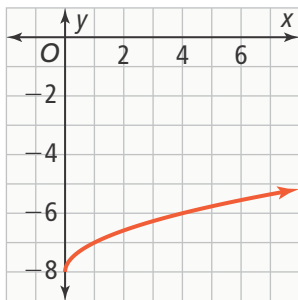
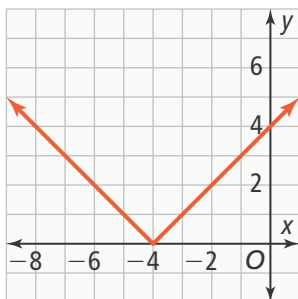
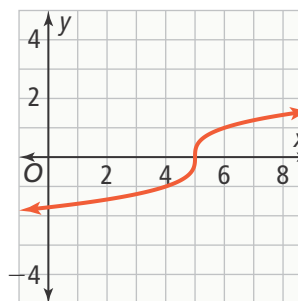




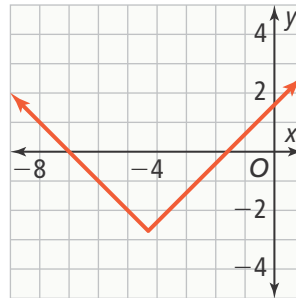
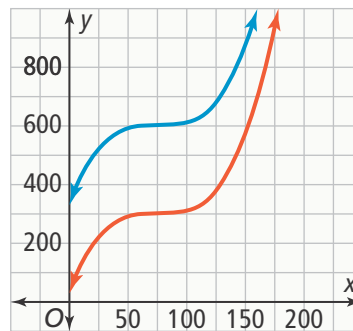
Selected Answers

Topic 10

12. $f(x) = 5$ is a horizontal line, so the horizontal shift will not change the graph of the function. For this function, $y = f(x - h) + k$ shifts the line $y = 5$ vertically k units. **14.** Victor is not correct. He cannot remove -2 from the absolute value input. **16.** $h = -3, k = 1$

18.**20.****22.****24.**

26. $y = \sqrt[3]{x + 6}$ **28.** $y = \sqrt{x - 5}$

30.**32. a.****b.** \$600 **34.** C

Lesson 10-5

2. The student confused a vertical compression with a horizontal compression. Because the output of the function is being multiplied by a constant, the direction is vertical.

4. $f(kx)$, for $0 < k < 1$ **6.** no

8. vertical stretch **10.** yes; the function $y = mx + b$ is a horizontal stretch or compression of the function $y = x + b$.

12. $\frac{1}{3}$ **14. a.** vertical compression

b. vertical stretch **c.** horizontal stretch

16. $g(x) = -|2x + 5|$ **18.** $g(x) = x - 4$

20. horizontal stretch **22.** horizontal compression **24.** vertical compression

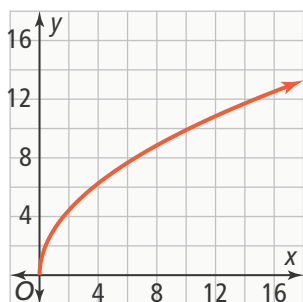


Selected Answers

Topic 10

26. horizontal compression **28.** vertical stretch; $k = 2$ **30.** The output could be multiplied by a constant $k > 1$, which would stretch the graph away from the x -axis. Alternatively, the input could be multiplied by a constant $k > 1$, which would compress the graph toward the y -axis.

32. a.

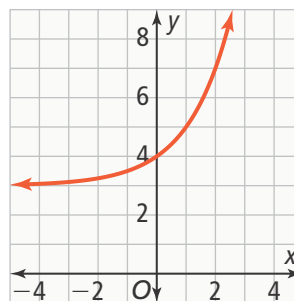


b. domain and range: $[0, \infty)$
c. about 9.9 m/s **34. A**

Lesson 10-6

- 2.** Distributive Property **4.** The two functions can be combined, but none of the terms of the two functions can be combined. **6.** $(f + g)(x) = x^2 + 3^x$
8. $(f - g)(x) = 6x - \sqrt{2x} + 5$
10. $(f \cdot g)(x) = 6x(8)^x$
12. Sample: $f(x) = \sqrt{x}$ and $g(x) = x^2$
14. The student did not multiply all the terms in the second function by the terms in the first function. The correct product of the two functions is $(f \cdot g)(x) = 2x^4 + 5x^3 - 3x^2 + 2x - 1$.
16. $(f + g)(x) = 6x^3 + x^2 + 4x + 2$
18. $(f - g)(x) = 2x^3 + 2x^2 - 8x - 18$
20. $(f \cdot g)(x) = 9x^3 + 34x^2 - 71x + 14$
22. $(f \cdot g)(x) = 5x^2(3^x) - 2(3^x)$

24.



The domain of $f + g$ is the same as the domain of f and the domain of g . The range of $f + g$ is $y > 3$, but the range of f is 3 and the range of g is $y > 0$.

- 26.** $f(x) = 1.5x + 5$ **28. a.** $f(x) = 200$; constant **b.** $g(x) = -20x^2 + 80x + 40$
c. \$6.24 **30.** B, C **32. Part A** Let g be the number of gallons of gasoline in the car. Then $d(g) = 28g$ is the number of miles the car can travel on g gallons of gasoline. Let x be the number of barrels of crude oil. Then $g(x) = 19x$ is the number of gallons of gasoline produced by x barrels of crude oil.
Part B composition; domain and range of both d and g : $[0, \infty)$; the domain and range of the combined function are the same as the domain and range of the component functions.
Part C 1,117,200 miles total; if the two cars traveled the same distance, each could have traveled 558,600 miles.

Lesson 10-7

2. The graph of the inverse of a function is a reflection across the line $y = x$, not across the x -axis. **4.** No; if a function crosses the x -axis twice, then it is not a one-to-one function. Therefore, it does not have an inverse function.



Selected Answers

Topic 10

6.

x	y
0	0
1	8
2	16
3	24

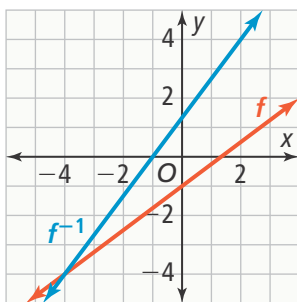
x	y
0	0
8	1
16	2
24	3

8. $f^{-1}(x) = x^2$, $x \geq 0$ **10.** The student switched $-x$ and y instead of x and y . The correct answer is $f^{-1}(x) = -x + 4$. **12.** Yes; for example, the relation $y = \pm\sqrt{x}$ has $y = x^2$ as its inverse, which is a function. **14.** $f^{-1}(x) = -x$; If you reflect $y = -x$ across the line $y = x$, you get $y = -x$.

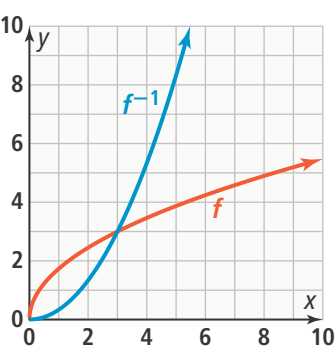
16.

x	y
3	0
4	1
7	2
12	3

18.



20.



22. yes **24.** $f^{-1}(x) = \frac{10}{7}x - \frac{40}{7}$

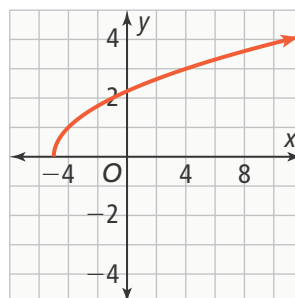
26. $f^{-1}(x) = \frac{\sqrt{x}}{3}$ **28.** $f^{-1}(x) = \frac{x^2 - 1}{4}$, $x \geq 0$

30. $s = \frac{P}{4}$; you could answer a question about the side length of a square based on its perimeter. **32. a.** The radius and area of a circle must be positive numbers, so the domain is restricted to $r > 0$ for the area function, and $A > 0$ for the inverse. **b.** $r = \sqrt{\frac{A}{\pi}}$ **c.** about 4 inches **34.** A

Topic Review

2. cube root function **4.** square root function **6.** The graph of g is a horizontal translation of 8 units right of the graph of f . **8.** The graph of g is a horizontal translation of 2 units left and a vertical translation of 8 units down of the graph of f . **10.** $h(x) = \sqrt{x + 2}$ **12.** about 9 knots **14.** The graph is a vertical translation of 4 units up. **16.** The graph is a horizontal translation of 1.5 units left and a vertical translation of 2.5 units down. **18.** 0.12 **20.** $x = 12\sqrt[3]{\frac{C}{5}}$

22.



The domain is the set of all real numbers greater than or equal to -5 ; the range is all real numbers greater than or equal to 0.

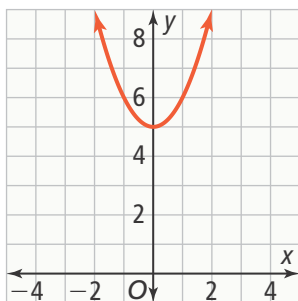


Selected Answers

Topic 10

24. As $x \rightarrow \infty$, $d(x) \rightarrow \infty$, and as $x \rightarrow -\infty$, $d(x) \rightarrow \infty$. **26.** The maximum value for h is 116 feet. The axis of symmetry is $x = 1.5$. The maximum value for g is 170 feet. The axis of symmetry is $x = 3.06$.

28.



30. Since the graph of f is a horizontal line, the graph is not affected by horizontal translations. So, the value of h has no effect on the graph. The value of k shifts the graph up or down k units. **32.** $g(x) = -|2x - 1|$

34. horizontal stretch

36. vertical stretch

38. He could vertically compress the graph using the function $g(x) = kf(x)$, where $|k| < 1$. For example, he could use the function $g(x) = 0.5(x^2 - 3)$. He could horizontally stretch the graph using the function $g(x) = f(kx)$, where $|k| > 1$. For example, he could use the function $g(x) = (2x^2) - 3$.

40. $(f + g)(x) = 4x^2 - 13x - 2$

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

44. $(f \cdot g)(x) = x^3 - 2x^2 - 13x + 20$

46. $(f \cdot g)(x) = 2^{x+2} x^2 - 3x(2^x) - 2^{x+3}$

48. $(R - C)(x) = -5x^2 + 21x - 9$; \$9

50.

x	y
2	0
4	2
8	2
16	3

52. $f^{-1}(x) = \sqrt{\frac{x+8}{3}}$, $x \geq -8$

54. $f^{-1}(x) = \frac{x-5}{2}$

56. $s = \sqrt{\frac{A}{6}}$; you could use this equation to find the side length of a cube where you know the surface area of the cube.

Selected Answers

Topic 11

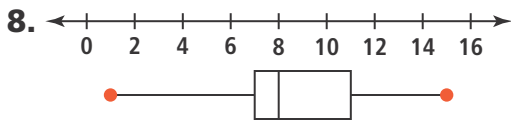
Lesson 11-1

2. A dot plot reveals individual values, while a box plot does not. Both displays reveal the distribution of the data set. **4.** No; you can determine the median from a box plot, but individual values are not revealed, so you cannot determine the mean.

6.



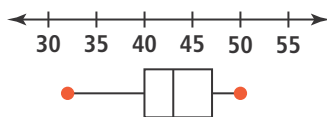
Most of the data are clustered between 7 and 10.



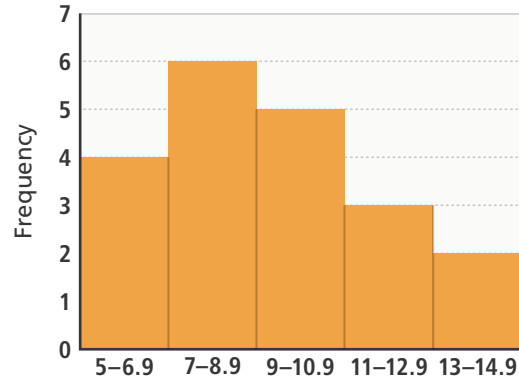
The median is 8, and 50% of the data are between 7 and 11.

10. dot plot; **10** **12.** 9 and 12; The middle 50% of the data values are between the first and third quartiles. **14.** The median cannot be determined from the histogram because individual values are not displayed within each bar.

16. 43; A box plot shows the median.

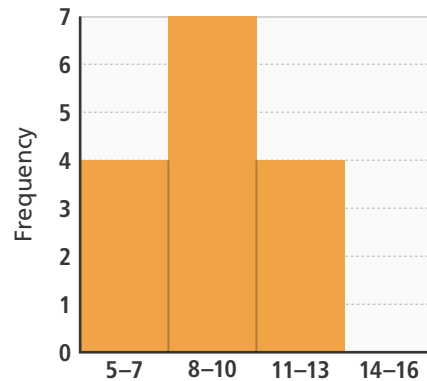


18. 6; A histogram organizes using intervals.

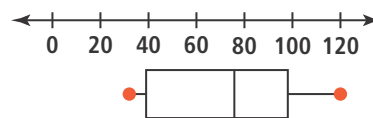


20. histogram; A histogram organizes data by equal-sized intervals.

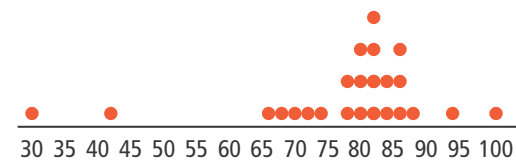
22. 7



24. between \$39 and \$98



26. 8 competitors scored higher than Aaron did.



28. C

Selected Answers

Topic 11

Lesson 11-2

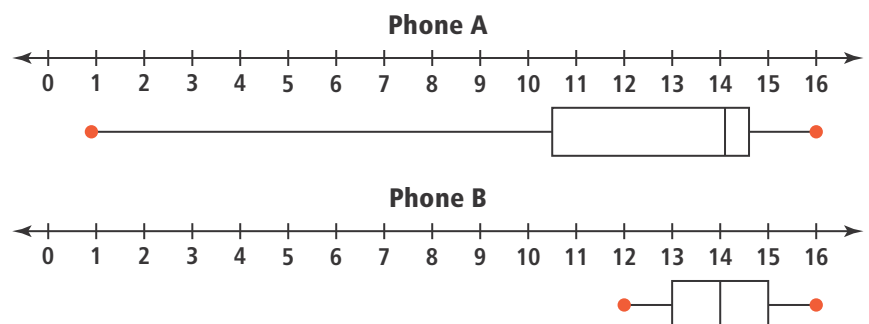
2. Answers may vary. Sample: The MAD and the IQR both measure the spread of a data set. The MAD measures the spread around the mean, while the IQR measures the spread around the median. **4.** No, the median is the middle value of an ordered set of data. Unless there are only two values in both sets of data, it is unlikely that the medians of the sets would be the same just because the maximums and minimums are the same. **6.** Data Set A: about 3.47; Data Set B: about 4.96 **8.** Data Set A: 6; Data Set B: 8 **10.** 12; The data are symmetrical and are centered about the mean, so the mean and median are about the same. **12.** The data are skewed right so the mean is greater than the median. **14. a.** The first data set is more spread out from the median while the second data set is more clustered about the median. **b.** No, all the individual data values are needed. **16.** Data Set A Mean: 3.4; MAD: 0.5; Median: 3.2; IQR: 0.4 Data Set B Mean: 3; MAD: 0.5; Median: 3.2; IQR: 0.4 The mean is not equal to the median in either set, so the data are not evenly

distributed for either set. The MADs and the IQRs are the same for both sets, so they have similar variance. The median and IQR are better measures because the data sets are not centered about the mean. **18.** The data somewhat support the claim. The minimum and maximum number of apps are the same for both groups, and 50% of both groups have between 21 and 31 apps. However, the median number of apps on students' phones is 5 greater than the median number of apps on adults' phones. The researcher could argue that, on average, students have more apps on their phones than adults have.

20. Parker's team has a median of 75 points per player, with an IQR of 54 points. The opposing team has a median of 74 points per player, with an IQR of 3 points. Parker's team has a greater median number of points, but the spread around the median number of points is much bigger. There is a lot of variability in the points Parker's team may score. **22.** B, C

24. Part A Rounded to the tenth: Phone A mean: 12.4; MAD: 2.5; Phone B mean: 13.9; MAD: 0.8 **Part B** Phone A median: 14.1; IQR: 4.1; Phone B median: 14.0; IQR: 2

Part C





Selected Answers

Topic 11

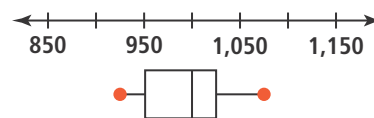
Part D Phone B; The median battery life for Phone A is greater by only 0.1 hours or 6 minutes. The mean for Phone B is greater by 1.5 hours. In addition, there is less spread in hours of battery life for Phone B.

Lesson 11-3

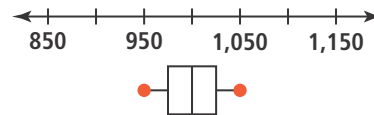
2. All three displays show the shape of a data set. Dot plots and histograms show the shape, or frequency, vertically; a box plot shows the shape with a box and whiskers. **4.** Skewed left; the mean is less than the median. **6.** Skewed right; the mean is greater than the median. **8.** The mean of the first data set is greater than the mean of the second data set. **10.** On average, the values in the second set deviate more from the mean, so the second display is more spread out than the first. **12.** Answers may vary. Sample: Data Set A: 0, 1, 1, 1, 2, 2, 2, 2, 3, 3, 3, 4 Data Set B: 0, 0, 1, 1, 1, 2, 2, 3, 3, 3, 4, 4 **14.** Data Set A is skewed left, while Data Set B is skewed right. The mean of Data Set A is less than the median, while the mean of Data Set B is greater than the median. **16.** The graph is skewed right. The mean score is greater than the median score. **18.** Both displays look the same for heights greater than 66 inches. However, the first display is close to being symmetrical about 67 inches because there were more students with heights shorter than 66 in that sample. **20.** A, B **22. Part A** Test 1 mean: 1,000; MAD: 40; median: 1,000; IQR: 100; Test 2 mean: 1,000; MAD: about 16.7; median: 1,000; IQR: 50

Part B The mean and median are the same for each data set, so a box plot will show if the middle 50% of values are in the acceptable range of plus or minus 50 hours.

Test 1



Test 2



Part C The data from both tests are symmetrical with a median of 1,000. Fifty percent of the lights from Test 1 lasted between 950 and 1,150 hours. So, only 50% of the lights from Test 1 were within the acceptable range of 1,000 hours plus or minus 50 hours. All of the lights from Test 2 were within the acceptable range.

Lesson 11-4

2. Find the mean. Find the differences between each data value and the mean. Square the differences. For the sample standard deviation, divide the sum of the squares by the number of data values minus 1. For the population standard deviation, divide the sum of the squares by the number of data values. Take the square root of the result. **4.** The mean increases by 10, while the range and standard deviation stay the same. The variability of a data set is not affected by adding the same amount to each value.



Selected Answers

Topic 11

- 6.** Sample A: 1.25; Sample B: 2.92
8. 8.65 through 13.45 **10.** The student forgot to square the differences before finding the sum. **12. a.** 90.8 **b.** 14.6
c. 61.6 and 120 **14.** Data Set A: mean: 40.23, standard deviation: 22.42; Data Set B: mean: 39.98, standard deviation: 6.82; The means are about the same, but the sample standard deviation for Data Set A is much greater than the sample standard deviation for Data Set B, so the data from Data Set A have greater variability. **16.** 8–16 **18.** 15–21
20. With the new plant food, the mean number of blooms is about 17, or 3 blooms greater than last year, and the population standard deviation is about 4 blooms, or 2 blooms greater than last year. So both the mean and variability are greater with the new food. Because both the mean and standard deviation are greater, there is a greater chance of having more blooms more of the time, but because the standard deviation is greater, there is also a chance of having fewer blooms some of the time.
22. no; yes; no; no
24. Part A Men: 11.6; Women: 11.4; The spread of the average driving distances is about the same for men and women. **Part B** Men: 3.6; Women: 3.3; The variability of average driving distances about the mean is approximately the same for men and women.

Part C The histograms would have similar shapes; however, the histogram for the women would be shifted about 40 units to the left on the number line from the histogram for the men.

Lesson 11-5

2. Joint and marginal frequencies both organize the data by categories. Joint frequencies show totals for row and column variables combined, while marginal frequencies show totals for each row variable and each column variable. **4.** Zhang cannot be correct. A marginal relative frequency is a decimal between 0 and 1. She may be confusing marginal relative frequency and marginal frequency, which could have a value of 10.

6.

	Item A	Item B	Totals
Male	0.4	0.1	0.5
Female	0.2	0.3	0.5
Totals	0.6	0.4	1.0

8.

	Item A	Item B
Male	0.67	0.25
Female	0.33	0.75
Totals	1.0	1.0

Yes; it is reasonable to conclude that a customer who prefers Item B is more likely to be female because of the customers who prefer Item B, 75% are female, while only 25% are male.



Selected Answers

Topic 11

10. The student did not take into account that more male than female students were surveyed. The student should have calculated conditional relative frequencies to find that the same percentage (50%) of each group of students prefers math.

12. a.

	Pass	Fail	Totals
< 3 h	4	6	10
≥ 3 h	18	2	20
Totals	22	8	30

b. Yes; the association appears to be significant because the conditional relative frequencies for rows are all different.

	Pass	Fail	Totals
< 3 h	0.4	0.6	1.0
≥ 3 h	0.9	0.1	1.0

14. No; the marginal frequencies show that 35 teens were surveyed and 25 adults were surveyed. So, more teens participated in the survey.

16.

	Song A	Song B
Teen	0.75	0.25
Adult	0.25	0.75
Totals	1.00	1.00

Yes; 75% of the members who prefer Song B are adults.

18.

High School Graduate?	Choice A	Choice B	Totals
Yes	0.14	0.86	1.00
No	0.73	0.27	1.00

20. Choice B; Of the high school graduates, 14% prefer Choice A and 86% prefer Choice B. **22.** the ratio of non-graduates who prefer Choice A to the total number of respondents

24. No; calculating conditional relative frequencies for rows shows that 80% of voters support the referendum regardless of income.

Do you support the referendum?

Income	Yes	No	Totals
≤ \$100,000	0.8	0.2	1.00
> \$100,000	0.8	0.2	1.00

26. Yes; calculating conditional relative frequencies for rows shows that 29% of respondents between 18 and 24 years old have never flown on a commercial airline, while only 15% of respondents 25 years or older have flown on a commercial airline.

Have you ever flown on a commercial airline?

Age	Yes	No	Totals
18–24 yrs	0.71	0.29	1.00
25+ yrs	0.85	0.15	1.00

28. C

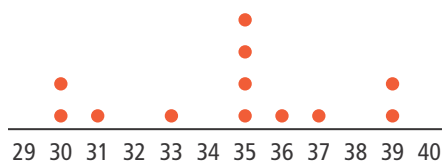


Selected Answers

Topic 11

Topic Review

2. standard deviation **4.** normal distribution **6.** Answers may vary. Sample: You would use a box plot when you want to know the median of the data, as well as the maximum and minimum values. **8.** A dot plot is a good display to use when you want to know how many times a specific value occurs in a set of data; the value 35 occurs 4 times.



10. A dot plot because it shows the frequency of specific values. **12.** Data Set A: mean ≈ 4.563 , MAD ≈ 1.883 ; Data Set B: mean ≈ 5.313 , MAD ≈ 2.023 Data Set B has a higher mean, but there is more variance from the mean than Data Set A. Data Set A: median = 4, IQR = 3.5; Data Set B: median = 6, IQR = 4.5 Data Set B has a higher median. The middle 50% of data in Data Set A is closer to the median than in Data Set B. The median is the best way to compare the data sets as most of the values are close to the median.

14. The graph of the first data set is skewed right, and the graph of the second data set is skewed left. **16.** symmetric **18.** The graph for the first month is more symmetric than the graph for the second month. There were more cars priced over \$25,000 sold in the first month, and there was an increase in cars priced between \$20,000 to \$24,000 in the second month. **20.** Sample A: mean = 13.25, sample standard deviation ≈ 3.24 ; Sample B: mean ≈ 12.38 , sample standard deviation ≈ 3.85 ; Sample A shows less variability from the mean.

22.

	Action	Comedy	Totals
Male	40	10	50
Female	10	20	30
Totals	50	30	80

Yes, as there were 50 people who preferred action movies and only 30 who preferred comedies.