Lesson 6.1.1

6-8.  a: Their y- and z-coordinates are zero.  b: Answers will vary.

6-9.  \( x = -2, y = 5 \)

6-10. a: 9  \hspace{1cm} b: 4N – 3, arithmetic

6-11. a: \( x \approx 1.204 \)  \hspace{1cm} b: \( x \approx 1.613 \)  \hspace{1cm} c: \( x = 6 \)  \hspace{1cm} d: \( x \approx 2.004 \)

6-12. a: \( \frac{1}{25} \)  \hspace{1cm} b: \( \frac{x}{y^2} \)  \hspace{1cm} c: \( \frac{1}{x^2y^2} \)  \hspace{1cm} d: \( \frac{b^{10}}{a} \)

6-13. a: \( x \)  \hspace{1cm} b: \( \frac{6}{x^2-3x+2} \)

6-14. a: \( \frac{1}{2} \)
   \hspace{1cm} b: \( -2 \)
   \hspace{1cm} c: The product of the slopes is \( -1 \), or they are negative reciprocals of each other.

6-15. Heather is correct, because a 4% decrease does not “undo” a 4% increase.
Lesson 6.1.2

6-21. \( \text{a: (0, 10, 0), (0, 0, 4)} \quad \text{b: (8, 0, 0), (0, 6, 0), (0, 0, 12)} \)
\( \text{c: (0, 0, 5), (0, 0, -5), (2, 0, 0), (-8, 0, 0)} \quad \text{d: (0, 0, 6)} \)

6-22. A line \( \text{b: They do not intersect.} \quad \text{c: They do not intersect.} \)

6-23. \( \text{a: } y = -2(x + 4)^2 + 2 \quad \text{b: } y = \frac{1}{x-2} \quad \text{c: } y = -x^3 + 3 \)

6-24. It is not the parent. The second equation does not have a vertical asymptote, and it has a maximum value, while \( y = \frac{1}{x} \) does not.

6-25. \( \text{a: } x = \frac{b}{3} \quad \text{b: } x = \frac{b}{5a} \quad \text{c: } x = \frac{b}{1+a} \)

6-26. \( \text{a: No, input equals output only if } x \geq 0. \)
\( \text{b: The output is the absolute value of the input value.} \)
\( \text{c: } n + 2, n^2 - 4, |n| \)
\( \text{d: Because } \sqrt{x^2} = |x|. \)

6-27. It is the \( \log_5(x) \) graph shifted 2 units to the right.
See graph at right.

6-28. \( \text{a: 254,000 people/year} \quad \text{b: 1,574,000 people/year} \quad \text{c: 1960 to 2010} \)

6-29. \( \text{a: } -7 \quad \text{b: } -102 \quad \text{c: } -102 \quad \text{d: } -132 \)
Lesson 6.1.3

6-35. See graph at right.

6-36. Yes.

6-37. Answers will vary.

6-38. \( y \leq -x + 4 \), \( y \geq \frac{1}{3} x \)

6-39. a: \( \frac{x+3}{2x-1} \)  b: \( \frac{1}{x-3} \)

6-40. a: Most solving strategies will yield \( x = 8 \) or \( x = 1 \).
     b: \( x = 1 \) does not check, so it is extraneous.

6-41. a: \( x = -4 \) or \( x = \frac{5}{2} \)  b: \( x = -4, 2, \) or \( 3 \)

6-42. a: Neither  b: Even

6-43. \( x = 3, y = 1, z = 3 \)

Lesson 6.1.4

6-51. \( (1, -2, 4) \)

6-52. a: \( \approx 140,809.30 \)  b: \( \approx 24.2 \) years  c: \( \approx 164,706.25 \)

6-53. \( x = 7 \)

6-54. a: They both equal 16, but this is a special case (for example, \( 5^3 \neq 3^5 \)).

6-55. a: \( x = 6.5 \)  b: \( x = -3.75 \) or \( x = 5 \)

6-56. a: \( y = \frac{1}{3} x + 5 \)  b: \( y = 2x + 5 \)  c: \( y = -\frac{1}{2} x + \frac{15}{2} \)  d: \( y = 2x \)

6-57. a: \( y = -x^2 + 4x \)  b: \( y = 5 \pm \sqrt{x - 3} \)

6-58. a: See graph right.
     b: See graph far right.

6-59. 384 feet
Lesson 6.1.5

6-71. $x = -1, y = 3, z = 5$
6-72. $y = 3x^2 - 5x + 7$
6-73. a: $\frac{x+3}{x-4}$ b: $\frac{1}{x(x+2)}$
6-74. a: $y + \frac{x}{2}$ b: $2b + 4a^2$ c: $6x - 1$ d: $xy$
6-75. a: $x = 12^y$ b: $y^x = 17$ c: $2x = \log_{1.75} y$ d: $7 = \log x 3y$
6-76. $x = 14$
6-77. a: $\approx 0.0488$ grams
b: Roughly between 4600 and 6700 depending on how the base is rounded.
c: Never
6-78. a: See graph at right.
b: $x > -2$; $y = |x + 2|$ and $x \leq -2$; $y = (x + 2)^3$
6-79. a: $2^4$ b: $2^{-3}$ c: $2^{1/2}$ d: $2^{2/3}$
6-80. $x = -1, y = 3, z = 6$
6-81. $y = 2x^2 - 3x + 5$
6-82. a: $24 = b^a$ b: $7 = (2y)^3x$ c: $5x = \log_2 3y$ d: $6 = \log_{2q} 4p$
6-83. a: $\frac{3}{x+1}$ b: $\frac{x-4}{x^2-3x+2}$
6-84. Yes, Hannah is correct; $4(x - 3)^2 - 29 = 4x^2 - 24x + 7$ and $4(x - 3)^2 - 2 = 4x^2 - 24 + 34$
6-85. a: $y = 2(x - 2)^2 - 1$, vertex (2, -1), axis of symmetry $x = 2$
b: $y = 5(x - 1)^2 - 12$, vertex (1, -12), axis of symmetry $x = 1$
6-86. See graph at right. $y = \log(x - 6) + 3$
6-87. a: $2a^2 - 4$ b: $18a^2 - 4$ c: $2a^2 + 4ab + 2b^2 - 4$
d: $2x^2 + 28x + 94$ e: $50x^2 + 60x + 14$ f: $10x^2 - 17$
Lesson 6.2.1

6-95.  \( y = 3^x \)

6-96.  In \( 2 = 1.04^x \) the variable is the exponent, but in \( 56 = x^8 \) the exponent is known so you can take the 8th root.

6-97.  \( x > 100 \), because \( 10^2 = 100 \)

6-98.  Answers will vary.

6-99.  a: \( \frac{1}{8} \)   b: \( \frac{1}{x} \)  c: \( m \approx 1.586 \)  d: \( n \approx 2.587 \)  
       e: Answers will vary. \( x = b^{1/a} \)

6-100.  \( 2^{1/2} = \sqrt{2} \) and \( 2^{-1} = \frac{1}{2} \)

6-101.  a: \( -3 < x < 3 \)  b: \( -2 < x < 1 \)  c: \( x \leq -2 \) or \( x \geq 1 \)

6-102.  a: Yes
       b: See graph at right, (it is not a function).
       c: Not necessarily.
       d: Functions that have inverse functions have no repeated outputs; a horizontal line can intersect the graph in no more than one place.
       e: Yes; for example, a sleeping parabola is not a function, but its inverse is a function.

6-103.  a: \( x = -3, y = 5, z = 10 \)
       b: There are infinitely many solutions.
       c: The planes intersect in a line.
Lesson 6.2.2

6-113.  a: 5.717  b: 11.228

6-114.  a: \( \frac{x^2}{x-1} \)  b: \( \frac{b+a}{a-a^2b} \)

6-115. \( \frac{\log_5 7}{\log_5 2} \)

6-116. It is the \( \log_3(x) \) graph shifted 4 units to the left. See graph at right.

6-117. 16.5 months; 99.2 months

6-118. They are correct. Vertex: (2.5, –23.75), line of symmetry: \( x = 2.5 \).

6-119.  a: \( f(x) = 4(x-1.5)^2 - 3 \), vertex (1.5, –3), line of symmetry \( x = 1.5 \)

b: \( g(x) = 2(x+3.5)^2 - 20.5 \), vertex (–3.5, –20.5), line of symmetry \( x = -3.5 \)

6-120.  a: Consider only \( x \geq -2 \) or \( x \leq -2 \).

b: Depending on the original domain restriction, \( y = \sqrt{\frac{x+7}{3}} - 2 \) or \( y = -\sqrt{\frac{x+7}{3}} - 2 \).

c: \( x \geq -7 \) and \( y \geq -2 \) or \( x \geq -7 \) and \( y \leq -2 \).

6-121.  a: \( \frac{6x-21}{x^2-3x-4} \)  b: \( \frac{5}{x^2-9} \)

6-122.  a: 20, 100, 500  b: \( n = 7 \)

c: No, because there are no terms between the 6th term (62,500) and the 7th term (312,500).
Lesson 6.2.3

6-127. a: \( y = 40(1.5)^x \)

b: When \( x = -9 \), or 9 days before the last day of October (October 22).

6-128. Possible answer: \( 4^{(x+1)} = 6 \)

6-129. Answers will vary.

6-130. The graph should show a decreasing exponential function which will have an asymptote at room temperature.

6-131. \( y = x^2 - 6x + 8 \)

6-132. a: \( x \geq \frac{1}{2} \) and \( y \geq 3 \)

b: \( g(x) = \frac{(x-3)^2+1}{2} \)

c: \( x \geq 3 \) and \( y \geq \frac{1}{2} \)

d: \( x \)

e: \( x \) (They are the same, because \( f \) and \( g \) are inverses.)

6-133. a: \( x \approx 6.24 \)

b: \( x = 5 \)

6-134. a: \((x-1)^2 + y^2 = 9\)

b: \((x+3)^2 + (y-4)^2 = 4\)

6-135. a: \( x + 5 \)

b: \( a + 5 \)

c: \( x - y \)

d: \( \frac{x^2+1}{x^2-1} \)

6-136. a: \( p^{-1}(x) = \sqrt[3]{\frac{x}{3} - 6} \)

b: \( k^{-1}(x) = \sqrt[3]{\frac{x-6}{3}} \)

c: \( h^{-1}(x) = \frac{x+1}{x-1} \)

d: \( j^{-1}(x) = \frac{3x-2}{x} = -\frac{2}{x} + 3 \)
Lesson 6.2.4

6-138. a: Decreasing by 20% means you multiply by 0.8 each time, and the presence of a multiplier implies exponential.
   b: \( y = 23500(0.8^x) \)  c: $9625.60
   d: \( \approx 6.12 \) years  e: $42,926.44

6-139. a: \( x = \frac{1}{2} \)  b: \( x > 0 \)  c: \( x = 10^{23} \)

6-140. a: \( x = 2.236 \)  b: \( x = 4.230 \)  c: \( x = 0.316 \)
   d: \( x = 2.021 \)  e: \( x = 3.673 \)

6-141. a: 16  b: 12  c: \( 12^4 = 20736 \)  d: 54
   e: No, they are not inverses (if they were, then the answers to parts (c) and (d) would have to be 2).

6-143. \( c(x) = x^2 - 5 \)

6-144. \( x = 17 \)

6-145. a: \( \frac{2(x+1)}{x+3} \)  b: \( \frac{3x^2-5x-3}{(2x+1)^2} \)

6-146. a: \( 30^\circ \)  b: \( 22.6^\circ \)

6-147. \( y \leq -\frac{3}{4}x + 3, y \geq -\frac{3}{4}x - 3, x \leq 3, x \geq -3 \)