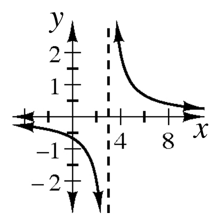
Lesson 8.1.1

8-3. **a: The shape would be stretched vertically. In other words, there would be larger distance between the highest and lowest point of each cycle.**
b: Each cycle would be shorter horizontally. More cycles would fit on the page of the same length.

8-4. **See graph at right.**
domain: $x \neq 3$
range: $y \neq 0$
asymptotes at $x = 3$ **and** $y = 0$
$f^{-1}(x) = \frac{2}{x} + 3$



8-5. **a: 27.04 feet, b: 176.88 cm, c: 28.94 meters**

8-6. $30-60: \frac{1}{2}, \frac{\sqrt{3}}{2}$; $45-45: \frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}$

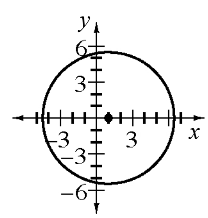
8-7. $y = 6x - x^2$

8-8. $x = 5$ **is the only solution, because** $x \approx 19.69$ **does not check.**

8-9. **a:** $f^{-1}(x) = \frac{x^3+1}{4}$, **b:** $g^{-1}(x) = 7^x$

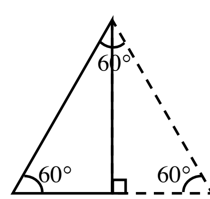
8-10. **no** ***x*****-intercepts,** ***y*****-intercept: (0, 88)**

8-11. **graphing form:** $(x-1)^2 + y^2 = 30$
sketch: shown at right
center: $(1, 0)$
intercepts: $(\pm\sqrt{30}+1, 0)$ **and** $(0, \pm\sqrt{29})$



Lesson 8.1.2

8-15. **a:** $30-60$**: hypotenuse: 2, leg:** $\sqrt{3}$;
isosceles: hypotenuse: $\sqrt{2}$**, leg: 1;**
b: See diagram at right.



8-16. **~17.46°**

8-17. $y = 2(x-1)^2 + 3$**, vertex: (1, 3)**

8-18. $80x + 0.5 = 100x$**, so** $x = \frac{1}{40}$ **of an hour or 1.5 minutes**

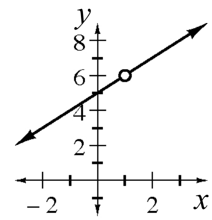
8-19. **a: 0, b: 3, c: 4, d: 64**

8-20. values in table: 3, 4, 5, undefined, 7, and 8

a: The graph (shown at right) is linear. The data does not all connect because $f(1)$ is undefined.

b: $y = x + 5$, $f(0.9) = 5.9$, $f(1.1) = 6.1$, no asymptote

c: The complete graph is the line $y = x + 5$ with a hole at $(1, 6)$.



8-21. a: an exponential function, b: $y = 60000 + 12000(0.93)^t$

8-22. If he drives down the center of the road, the height of the tunnel at the edge of the house is only approximately 23.56 feet. The house will not fit.

8-23. a: $x \approx 33.752$, b: $x \approx 9.663$

8-24. $x = 18$, $y = 13$, $z = 9$

8-25. $-\infty < x < \infty$

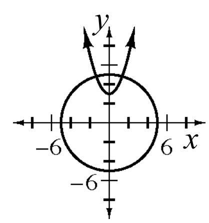
8-26. approximately 40.5° or 139.5°

8-27. She should have subtracted $3 \cdot 16 = 48$ to account for the factor of 3; vertex: $(4, 7)$.

8-28. a: See graph at right.

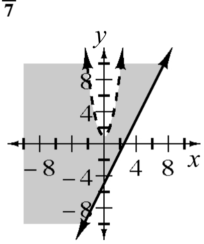
b: approximately $(1.35, 4.82)$ and $(-1.35, 4.82)$;

A 4th-degree equation results from eliminating y to solve for x.



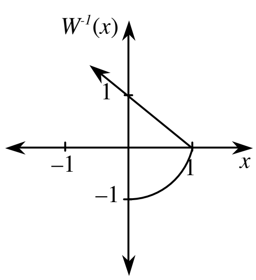
8-29. $\frac{1}{7}$

8-30.



8-31. a: $x = -1.8$, Challenge: $x = \frac{1}{4}$

8-32. a:

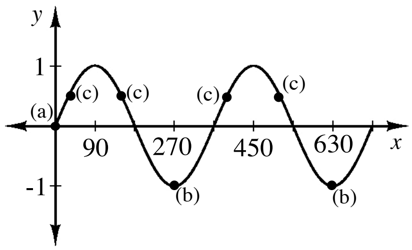


b: No; when the points are interchanged, the input $x = 0$ has two outputs.

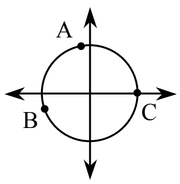
8-33. $R + B + G = 40$, $R = B + 5$, $R = 2G$; 18 red, 13 blue, and 9 red

Lesson 8.1.3

8-37.



8-38.



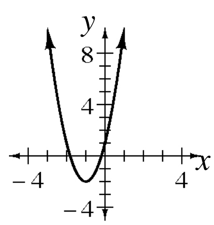
a: above ground just past the highest point
b: just below ground
c: back to the starting point

8-39. ≈ 82.4 **feet**

8-40. **a: no; volume of tall** $\approx 63.24 \text{ in.}^3$**, volume of short** $\approx 81.85 \text{ in.}^3$
b: Now the volumes are the same.

8-41. $x = \frac{-3 \pm \sqrt{6}}{3}$, $y = 1$

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



8-43. $x = -5$

8-44. **no real solution**

8-45. $C + W + P = 40$, $W = C - 5$, $C = 2P$;
18 from California, 13 from Washington, and 9 from Pennsylvania

Lesson 8.1.4

8-53. P: $(\cos 50^\circ, \sin 50^\circ)$ **or** $(\sim 0.643, \sim 0.766)$;
Q: $(\cos 110^\circ, \sin 110^\circ)$ **or** $(\sim -0.342, \sim 0.940)$

8-54. **a:** 300°; **b:** $\frac{1}{2}, \frac{\sqrt{3}}{2}$; **c:** $(\frac{1}{2}, -\frac{\sqrt{3}}{2})$

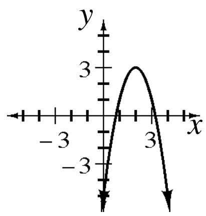
8-55. **a:** 30°, **b:** 60°, **c:** 67°, **d:** 23°

8-56. a: 60, ≈ 51.43; b: $\frac{360}{99+1} \approx 3.6$, $\frac{360}{n+1}$

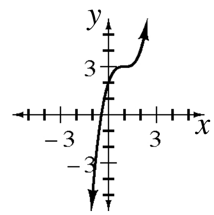
8-57. $x > 0$ and $x \neq 1$

8-58. $x = \frac{11}{5}$

8-59. a: downward parabola, vertex $(2, 3)$



b: cubic, point of inflection $(1, 3)$



8-60. Solve graphically to get $x \approx -3.2$.

8-61. a: $y = 25d + 0.50m$ and $y = 0.03(2)^{m-1}$,
b: R vs. T: \$55 vs. \$15.36, \$60 vs. \$15,728.64, \$100 vs. $\sim \$1.901 \times 10^{28}$

8-62. All of these problems could be solved using the same system of equations.

8-63. 58°, 122°, 238°, or 302°

8-64. a: an angle in the 4th quadrant; b: 270° or -90°; c: an angle in the 3rd quadrant; d: approximately 160°; e: No, an angle with sine equal to 0.9 has cosine equal to ± 0.4359, so the point $(0.8, 0.9)$ is not on the unit circle.

8-65. a: $(0.3420, 0.9397)$, b: $(\cos 70^\circ, \sin 70^\circ)$

8-66. Graph 2 is sine, while graph 1 is cosine. Possible explanations: Since $\sin 0 = 0$, the sine function passes through the origin, and since $\cos 0 = 1$, the cosine graph passes through the point $(0, 1)$.

8-67. a: all yes; b: sample answers: $\pm 180^\circ, \pm 540^\circ, \pm 900^\circ$, etc; c: $x = (-180^\circ + 360^\circ n)$ for all integers n

8-68. a: The more rabbits you have, the more new ones you get. A linear model would grow by the same number each year. A sine function would be better if the population rises and falls, but more data would be needed to apply this model.
b: $R = 80{,}000(5.4772...)^t$
c: ≈ 394 million
d: 1859. It seems okay that they grew to 80,000 in 7 years, *if* they are growing exponentially.
e: No, since it would predict a huge number of rabbits now. The population probably leveled off at some point or dropped drastically and rebuilt periodically.

8-69. a: -4; b: $\frac{5\pm\sqrt{57}}{4}$; c: no solution; d: because if $a=\frac{3}{x+2}$, then $a+5\neq a$ (although students may explain that they solved to get $x=-2$, but when substituted, -2 gives a zero denominator)

8-70. $3x-y=k$; possible answer: $y=-x^2-2$

8-71. 7.07'

8-72. Tess is correct: A sequence has no more than one output for each input. A sequence is a function with domain limited to positive integers.

Lesson 8.1.5

8-78. a: Same, because $\frac{\pi}{3}$ and 60° are measures of the same angle; b: 45°, 135°, 405°, etc.

8-79. a: $\frac{\sqrt{2}}{2}\approx 0.707$, b: $\frac{\sqrt{3}}{2}\approx 0.866$

8-80. Colleen's calculator was in radian mode, while Jolleen's calculator was in degree mode. Colleen's calculation is wrong.

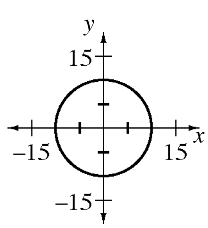
8-81. a: $180°$, b: $540°$, c: $\frac{\pi}{6}$ radians, d: $45°$, e: $\frac{5\pi}{4}$ radians, f: $270°$

8-82. He should have subtracted $2\cdot\frac{9}{4}=\frac{9}{2}$ to account for the factor of 2. The vertex is $(\frac{3}{2},-\frac{5}{2})$.

8-83. a: $y=3(x-3)^2-1$, vertex: $(3,-1)$, axis of symmetry: $x=3$
b: $y=3(x-\frac{2}{3})^2-\frac{37}{3}$, vertex: $(\frac{2}{3},-\frac{37}{3})$, axis of symmetry: $x=\frac{2}{3}$

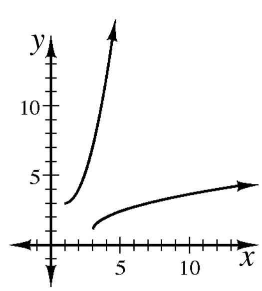
8-84. a: $x\approx 2.5121$, b: $x=\sqrt[5]{57y}$

8-85.



a: no
b: $-10\leq x\leq 10$, $-10\leq y\leq 10$
c: $\frac{200\pi}{3}\approx 209.44$ sq. units

8-86. $f^{-1}(x)=(x-1)^2+3$ for $x\geq 1$; graph:



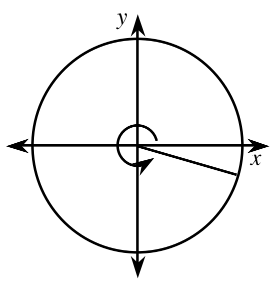
Lesson 8.1.6

8-91. a: -0.76, b: $-\frac{\sqrt{3}}{2} \approx -0.866$

8-92. $\frac{\pi}{6}, \frac{5\pi}{6}$

8-93. $\frac{\pi}{4}, \frac{\pi}{3}, \frac{\pi}{2}, \frac{2\pi}{3}, \frac{3\pi}{4}, \frac{5\pi}{6}, \pi, \frac{7\pi}{6}, \frac{5\pi}{4}, \frac{4\pi}{3}, \frac{3\pi}{2}, \frac{5\pi}{3}, \frac{7\pi}{4}, \frac{11\pi}{6}, 2\pi$

8-94.



a: a little less than $360°$ (almost $344°$)
b: $\sin 6 \approx -0.3$

8-95. a: 1, b: $\frac{1}{2}$, c: undefined, d: 9

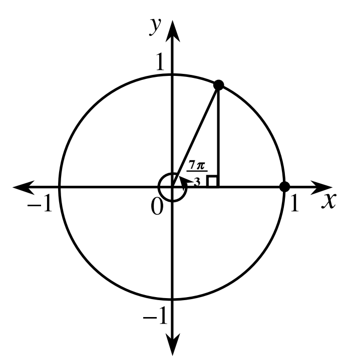
8-96. ~4.73% annual interest

8-97. The width is 1.5 meters, and the outer dimensions are 8 meters by 5 meters.

8-98. a: $x = 4$ or $x = -2$, b: $x \approx 2.81$

Lesson 8.1.7

8-104. a central angle of 420°
a: $\frac{\pi}{3} \pm 2\pi n$
b: diagram shown at right
c: $\frac{\sqrt{3}}{2}, \frac{1}{2}, \sqrt{3}$



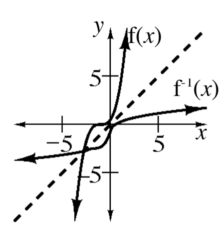
8-105. a: 0, b: 0, c: –1, d: 0.5, e: 0, f: undefined

8-106. Some may set up a proportion; others may use $\frac{\pi}{180}$.

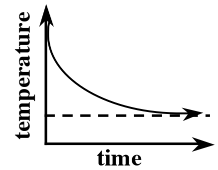
8-107. a: 210°, b: 300°, c: $\frac{\pi}{4}$ radians,
d: $\frac{5\pi}{9}$ radians, e: $\frac{9\pi}{2}$ radians, f: 630°

8-108. a: $\frac{y^8}{x^{12}}$, b: $-18x^3y + 6x^5y^2z$

8-109. $f^{-1}(x) = \sqrt[3]{2x} - 1$; graph shown at right



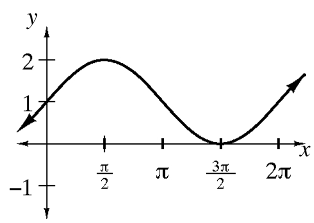
8-110. $f(x) = 2(x-4)^2 + 2$



8-111. a: See graph at right.
b: Yes, the pizza will never get below room temperature.

8-112. $x = \frac{ab-b}{a}$

Lesson 8.2.1



8-116. a: See graph at right.
b: $y = 1 + \sin x$
c: $y: (0, 1)$, $x: (-\frac{\pi}{2}, 0), (\frac{3\pi}{2}, 0), (\frac{7\pi}{2}, 0), \ldots$
d: Yes, there are infinitely many, at intervals of 2π.

8-117. a: π, b: $y = \sin(x + \pi)$

8-118. a: This may go up and down, but the cycles are probably of differing length.
b: This may or may not be periodic.
c: This is probably approximately periodic.

8-119. $y = 100\sin(x + \frac{\pi}{2}) - 50$ or $y = 100\cos x - 50$

8-120. Only one needs to be a parent, since $y = \sin(x + 90°)$ is the same as $y = \cos x$.

8-121. a: $-\sqrt{3}$, b: $-\frac{\sqrt{3}}{3}$

8-122. $a = -\frac{3}{3125} = -0.00096$, possible equation: $y = -\frac{3}{3125}(x-125)^2 + 15$

Lesson 8.2.2

8-127. a: $y = \sin(x - \frac{\pi}{4}) + 2$, b: $y = 1.5\sin(x + \frac{\pi}{2}) + 0.5$, c: $y = -\sin(x - \frac{\pi}{6}) + 2$ or $y = \sin(x + \frac{5\pi}{6}) + 2$, d: $y = 3\sin(x - \frac{2\pi}{3}) - 1$ or $y = -3\sin(x + \frac{\pi}{3}) - 1$

8-128. 360° is the period of $y = \cos\theta$, so shifting it 360° left lines up the cycles perfectly.

8-129. a: $x = 1$ or $x = -4$, b: $x < -\frac{8}{3}$ or $x > 6$, c: any real number

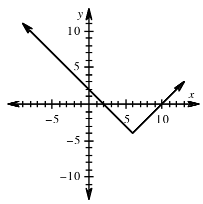
8-130. a: $x = (0, 0)$ and $(\frac{5 \pm 3\sqrt{3}}{2}, 0)$ and $y = (0, 0)$; b: $x = (10, 0)$, no y-intercept

8-131. 17.67 years

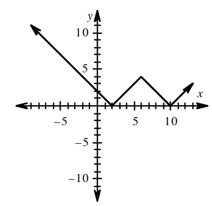
8-132. a: $y = -2(x + \frac{1}{4})^2 + \frac{25}{8}$, x = all real numbers, $y = -\infty < y < \frac{25}{8}$, a function
b: $y = -3(x+1)^2 + 15$, domain: all real numbers, range: $-\infty < y < 15$, a function

8-133. $64.16°$, unsafe

8-134. a: 5,000,000 bytes; b: ≈ 12.3 minutes; c: According to the equation, technically never, but for all practical purposes, after 23 minutes.

8-135. graph: 

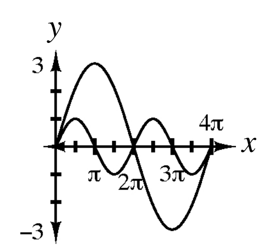
a: the vertex of the graph is at $(6, -4)$ with two rays emanating at slopes of ± 1.
b: See graph at right. Flip all parts of the graph that are below the x-axis above the x-axis.



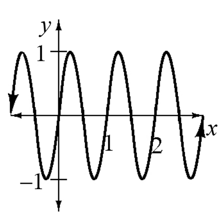
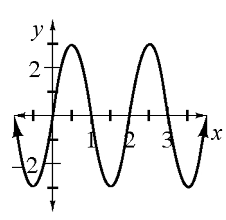
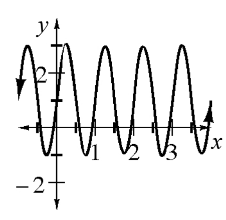
8-136. a: $x \approx 13.542$, b: $x \approx 68.770$

Lesson 8.2.3

8-143. a: amplitude 3, period 4π
b: graph shown at right
c: The differences are the period and amplitude, and therefore some of the x-intercepts. They have the same basic shape.



8-144. 1, $\frac{2\pi}{2\pi} = 1$, or $2\pi(1) = 2\pi$

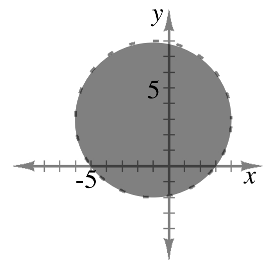
8-145. a: 
b: 
c: 

8-146. a: 2, b: 4, c: 5, d: 3, e: 1

8-147. $y = \sin 2(x-1)$ is correct. To shift the graph one unit to the right, subtract 1 from x before multiplying by anything.

8-148. **They are both wrong. The equation needs to be set equal to zero before the Zero Product Property can be applied. $2x^2+5x-3=4$ is equivalent to $(2x+7)(x-1)=0$. Solutions: $x=1$ or $x=-\frac{7}{2}$.**

8-149. **$(x+1)^2+(y-3)^2<25$, circle, not a function, center: $(-1,3)$, radius: 5, domain: $-6<x\le 4$, range: $-2<y<8$, graph shown at right**



8-150. **a: $\frac{1}{5}$, b: 3, c: 27, d: $\frac{1}{8}$**

8-151. **a: Answers vary. If *g(x)* is linear, tangent lines only.**
b: Any line $y=b$ such that $b<8$.

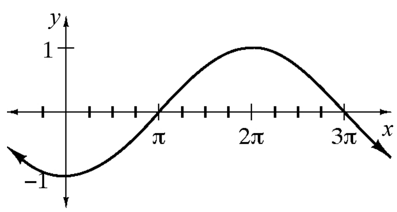
Lesson 8.2.4

8-158. **a: yes, b: $y=\cos(x+\frac{\pi}{2})$, c: $y=-\sin x$**

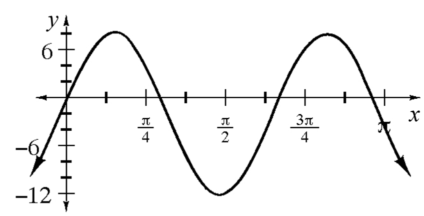
8-159. **6 cycles, period: $\frac{\pi}{3}$**

8-160. **Answers may vary, but $y=7\sin(\frac{x}{4})$ works.**

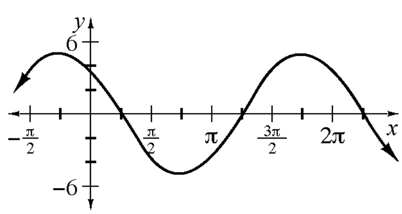
8-161. **a:**



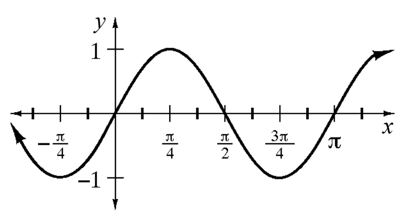
b:



c:



d:



8-162. **a: $\frac{-\sqrt{2}}{2}$, b: $\sqrt{3}$, c: $-\frac{1}{2}$, d: $\frac{\sqrt{2}}{2}$, e: 1, f: $-\frac{1}{\sqrt{3}}$ or $-\frac{\sqrt{3}}{3}$, g: $\frac{\pi}{4}$ or $\frac{5\pi}{4}$, h: $\frac{3\pi}{4}$ or $\frac{7\pi}{4}$**

8-163. **a: $x=0$, $x=-\frac{1}{2}$, or $x=\frac{5}{3}$; b: $x=6$ or $x=-1$**

8-164. **Answers vary, but possibilities are:**
a: $y=-x^2-2$, b: $y=(x-3)^2$, c: $y=-(x+1)(x+3)$

8-165. **a: about \$564,240, b: in 2025, c: about \$36,585**