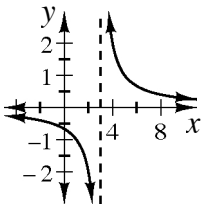
Lesson 7.1.1

7-3. **a:** The shape would be stretched vertically. In other words, there would be a larger distance between the lowest and highest points of each cycle.

b: Each cycle would be longer horizontally. Fewer cycles would fit on a page of the same length.

7-4. See graph at right. domain: $x \neq 3$, range: $y \neq 0$, asymptotes at $x = 3$ and $y = 0$ $f^{-1}(x) = \frac{2}{x} + 3$



7-5. **a:** ≈ 27.04 feet **b:** ≈ 176.88 cm **c:** ≈ 28.94 meters

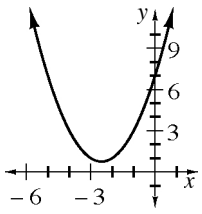
7-6. $30 - 60 : \frac{1}{2}, \frac{\sqrt{3}}{2}$; $45 - 45 : \frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}$

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

7-8. $x = 5, x \approx 19.69$ does not check.

7-9. **a:** $y = \left(x + \frac{5}{2}\right)^2 + \frac{3}{4}$, vertex $\left(-\frac{5}{2}, \frac{3}{4}\right)$ **b:** (0, 7)

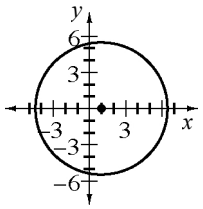
c: (–5, 7); See graph at right.



7-10. No x-intercepts, y-intercept: (0, 88)

7-11. $(x-1)^2 + y^2 = 30$; See graph at right.

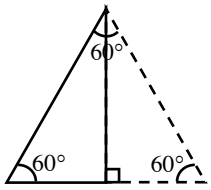
center: (1, 0), intercepts: $(\pm\sqrt{30} + 1, 0)$ and $(0, \pm\sqrt{29})$



Lesson 7.1.2 (Day 1)

7-15. **a:** 30 – 60: hypotenuse: 2, leg: $\sqrt{3}$; isosceles: hypotenuse: $\sqrt{2}$, leg: 1

b: See diagram at right.

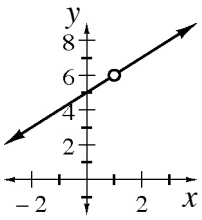


7-16. $\approx 17.46°$

7-17. $x = 2\ , -\frac{5}{2}\ , y = -10$

7-18. **a:** 0 **b:** 3 **c:** 4 **d:** 64

7-19. y : 3; 4; 5; undefined; 7; 8



a: See graph at right. It 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 $(1, 6)$.

7-20. **a:** An exponential function **b:** $y = 60000 + 12000(0.93)^t$

7-21. 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.

7-22. **a:** $x \approx 33.752$ **b:** $x \approx 9.663$

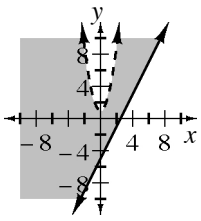
7-23. $x = 18, y = 13, z = 9$

Lesson 7.1.2 (Day 2)

7-24. $-\infty < \theta < \infty$

7-25. $\approx 40.5^\circ$ or 139.5°

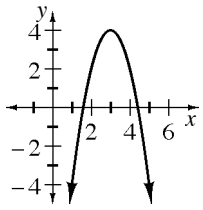
7-26. She should have subtracted $3 \cdot 16 = 48$ to account for the factor of three. The vertex is (4, 7).



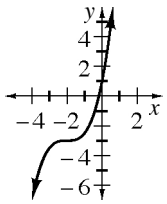
7-27. $\frac{1}{7}$

7-28. See graph above right.

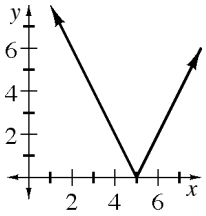
7-29. **a:**



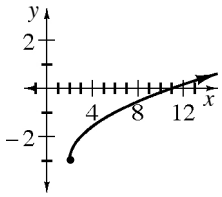
b:



c:

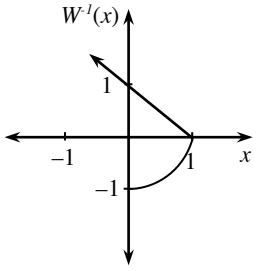


d:



7-30. $x = \frac{3}{2}$ or $-\frac{1}{4}$, $y = -3$

7-31. **a:** See graph at right.

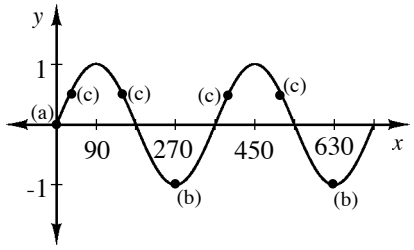


b: No; when the points are interchanged, the input $x = 0$ has two outputs.

7-32. $R + B + G = 40$, $R = B + 5$, $R = 2G$; 18 red, 13 blue and 9 green

Lesson 7.1.3

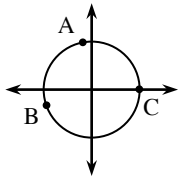
7-36. See graph at right.



7-37. (a): Above ground just past the highest point.

(b): Just below ground.

(c): Back to the starting point. See diagram at right.



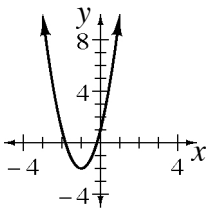
7-38. ≈ 82.4 feet

7-39. **a:** $\log 6 = \log 3 + \log 2 \approx 0.7781$ **b:** $\log 15 = \log 3 + \log 5 \approx 1.1761$

c: $\log 9 = 2\log 3 \approx 0.9542$ **d:** $\log 50 = 2\log 5 + \log 2 \approx 1.6990$

7-40. $x = \frac{-3 \pm \sqrt{6}}{3}$, $y = 1$

7-41. $y = 3(x+1)^2 - 2$; See graph at right.



7-42. $x \le -5$

7-43. No real solution.

7-44. $C + W + P = 40$, $W = C - 5$, $C = 2P$; 18 from California, 13 from Washington, and 9 from Pennsylvania

Lesson 7.1.4 (Day 1)

7-53. $\left(\frac{\sqrt{15}}{4}, \frac{1}{4}\right)$ or $\left(-\frac{\sqrt{15}}{4}, \frac{1}{4}\right)$

7-54. P: $(\cos 50^\circ, \sin 50^\circ)$ or $(\sim 0.643, \sim 0.766)$; Q: $(\cos 110^\circ, \sin 110^\circ)$ or $(\sim -0.342, \sim 0.940)$

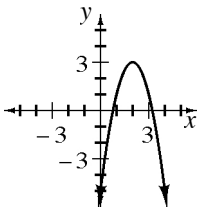
7-55. **a:** 300° **b:** $\frac{1}{2}, \frac{\sqrt{3}}{2}$ **c:** $\left(\frac{1}{2}, -\frac{\sqrt{3}}{2}\right)$

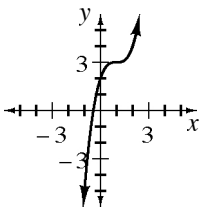
7-56. **a:** 30° **b:** 60° **c:** 67° **d:** 23°

7-57. $x = \frac{11}{5}$

7-58. **a:** downward parabola, vertex (2, 3), see graph above right.

b: cubic, point of inflection (1, 3), see graph below right.





7-59. Solving graphically: $x \approx -3.2$

7-60. **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. $\sim \$1.901 \times 10^{28}$

7-61. All of these problems could be solved using the same system of equations.

Lesson 7.1.4 (Day 2)

7-62. 58º, 122º, 238º, or 302º

7-63. **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.

7-64. **a:** $(0.3420, 0.9397)$ **b:** $(\cos 70°, \sin 70°)$

c: $(\cos 70°)^2 + (\sin 70°)^2 = 0.1170 + 0.8830 = 1$

7-65. Graph 2 is sine, while graph 1 is cosine. Answers will vary.

7-66. **a:** All yes.

b: Answers will vary.

c: $x = (-180° + 360°n)$ for all integers n

7-67. y-intercept: $(0, -17)$, x-intercepts: $(-2 + \sqrt{21}, 0)$ and $(-2 - \sqrt{21}, 0)$

7-68. **a:** $x = -4$ **b:** $x = \frac{5 \pm \sqrt{57}}{4}$ **c:** no solution

d: If $a = \frac{3}{x+2}$, then $a + 5 \neq a$. Or, solving yields $x = -2$, but when substituted, -2 gives a zero denominator.

7-69. $7.07'$

7-70. 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 7.1.5

7-77. **a:** Same; $\frac{\pi}{3}$ and 60° are measures of the same angle.

b: 45°, 135°, 405°, etc.

7-78. **a:** $\frac{\sqrt{2}}{2} \approx 0.707$ **b:** $\frac{\sqrt{3}}{2} \approx 0.866$

7-79. **a:** Set each factor equal to zero to get $x = 0,\ \frac{1}{2}$, or 3.

b: Factor to get $x(x-1)(2x+3) = 0$. $x = 0, 1, -\frac{3}{2}$

7-80. **a:** $x \approx 2.657$ **b:** $x \approx 0.936$ **c:** $x \approx -0.711$

7-81. He should have subtracted $2 \cdot \frac{9}{4} = \frac{9}{2}$ to account for the factor of 2. The vertex is $\left(\frac{3}{2}, -\frac{5}{2}\right)$.

7-82. **a:** $y = 3(x-3)^2 - 1$, vertex: $(3, -1)$, axis of symmetry $x = 3$

b: $y = 3\left(x - \frac{2}{3}\right)^2 - \frac{37}{3}$, vertex: $\left(\frac{2}{3}, -\frac{37}{3}\right)$, axis of symmetry: $x = \frac{2}{3}$

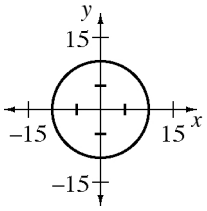
7-83. **a:** $x = 2.5121$ **b:** $x = \sqrt[5]{57y}$

7-84. See graph at right.

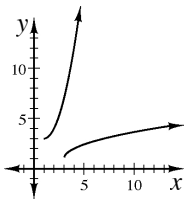
a: No

b: $-10 \le x \le 10, -10 \le y \le 10$

c: $\frac{200\pi}{3} \approx 209.44$ sq. units



7-85. $f^{-1}(x) = (x-1)^2 + 3$ for $x \ge 1$; See graph at right.



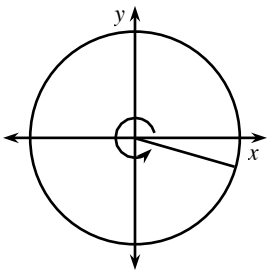
Lesson 7.1.6

7-90. **a:** –0.76 **b:** $-\frac{\sqrt{3}}{2}$

7-91. $\frac{\pi}{6}, \frac{5\pi}{6}$

7-92. $\frac{\pi}{4}, \frac{\pi}{3}, \frac{\pi}{2}, \frac{2\pi}{3}, \frac{3\pi}{4}, \frac{5\pi}{6}, \pi, \frac{7\pi}{6}, \frac{5\pi}{4}, \frac{4\pi}{3}, \frac{3\pi}{2}, \frac{5\pi}{3}, \frac{7\pi}{4}, \frac{11\pi}{6}, 2\pi$

7-93. See diagram at right.



a: A little less than $360°$ (almost $344°$).

b: $\sin 6 \approx -0.3$

7-94. **a:** 1 **b:** $\frac{1}{2}$ **c:** undefined **d:** 9

7-95. ~ 4.73% annual interest

7-96. $\frac{\sin A}{\cos A} = \frac{\frac{3}{\sqrt{10}}}{\sqrt{\frac{91}{100}}} \approx -0.3145$

7-97. **a:** $f^{-1}(x) = \frac{x^3+1}{4}$ **b:** $g^{-1}(x) = 7^x$

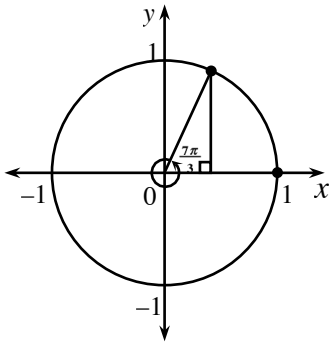
7-98. **a:** $x = 4$ or $x = -2$ **b:** $x \approx 2.81$

Lesson 7.1.7

7-104. $420°$

a: $\frac{\pi}{3} \pm 2\pi n$

b: See diagram at right.



c: $\frac{\sqrt{3}}{2}, \frac{1}{2}, \sqrt{3}$

7-105. **a:** 0 **b:** 0 **c:** –1

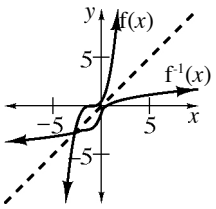
d: 0.5 **e:** 0 **f:** undefined

7-106. Some may set up a proportion, others may use $\frac{\pi}{180}$.

7-107. **a:** $210°$ **b:** $300°$ **c:** $\frac{\pi}{4}$ radians

d: $\frac{5\pi}{9}$ radians **e:** $\frac{9\pi}{2}$ radians **f:** $630°$

7-108. See graph at right.

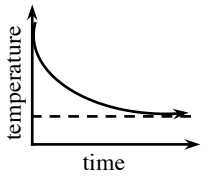


7-109. $f(x) = 2(x-4)^2 + 2$

7-110. **a:** $-\frac{5}{13}$ **b:** $\frac{5}{12}$

7-111. **a:** $a + b$ **b:** $2c$ **c:** $a + 2b$ **d:** $3a + c$

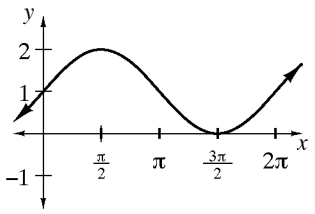
7-112. **a:** See graph at right.



b: Yes, the pizza will never get below room temperature.

Lesson 7.2.1

7-116. **a:** See graph at right.



b: $y = 1 + \sin x$

c: $y : (0, 1),\ x : \left(-\frac{\pi}{2}, 0\right), \left(\frac{3\pi}{2}, 0\right), \left(\frac{7\pi}{2}, 0\right), \ldots$

d: Yes, there are infinitely many, at intervals of 2π.

7-117. **a:** π **b:** $y = \sin(x + \pi)$

7-118. **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.

7-119. $y = 100 \sin\left(x + \frac{\pi}{2}\right) - 50$ or $y = 100 \cos x - 50$

7-120. Only one needs to be a parent, since $y = \sin(x + 90°)$ is the same as $y = \cos x$.

7-121. **a:** $y = 3 \cdot 6^x$ **b:** $y = -2(0.5)^x$

7-122. **a:** $x = \pm\sqrt{\frac{3}{5}}$ **b:** $x = 4, -1$ **c:** $x = 4$

7-123. **a:** $-\sqrt{3}$ **b:** $\frac{\sqrt{3}}{3}$

7-124. $a = -\frac{3}{3125} = -0.00096$, possible equation: $y = -\frac{3}{3125}(x - 125)^2 + 15$

Lesson 7.2.2

7-129. **a:** $y = \sin\left(x - \frac{\pi}{4}\right) + 2$

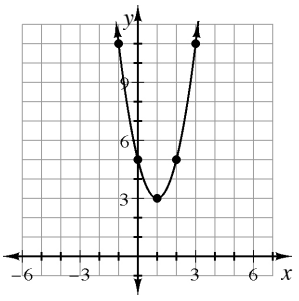
b: $y = 1.5\sin\left(x + \frac{\pi}{2}\right) + 0.5$

c: $y = -\sin\left(x - \frac{\pi}{6}\right) + 2$ or $y = \sin\left(x + \frac{5\pi}{6}\right) + 2$

d: $y = 3\sin\left(x - \frac{2\pi}{3}\right) - 1$ or $y = -3\sin\left(x + \frac{\pi}{3}\right) - 1$

7-130. $360°$ is the period of $y = \cos\theta$, so shifting it $360°$ left lines up the cycles perfectly.

7-131. Graphing form: $y = 2(x-1)^2 + 3$; vertex (1, 3); See graph at right.



7-132. **a:** $x = (0, 0), \left(\frac{5 \pm 3\sqrt{3}}{2}, 0\right)$ and $y = (0, 0)$

7-133. 17.67 years

7-134. **a:** $y = -2\left(x + \frac{1}{4}\right)^2 + \frac{105}{8}$, x = all real numbers, $y = -\infty < y < \frac{25}{8}$; Yes it is a function.

b: $y = -3(x+1)^2 + 15$, domain: all real numbers, range: $-\infty < y < 15$; Yes it is a function.

7-135. $64.16°$, unsafe

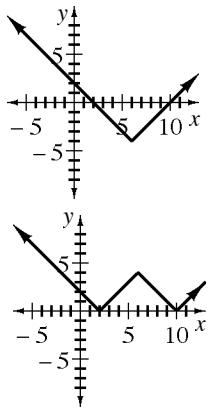
7-136. **a:** 5,000,000 bytes **b:** $\approx$ 12.3 minutes

c: According to the equation, technically never, but for all practical purposes, after 23 minutes.

7-137. See graph at right.

a: The vertex of the graph is at (6, –4) with two rays emanating at slopes of ± 1.

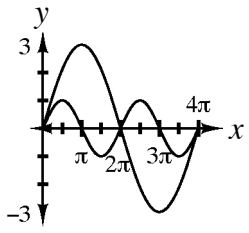
b: See graph at right. Flip all parts of the graph that are below the x-axis above the x-axis.



Lesson 7.2.3

7-144. **a:** Amplitude 3, period 4π

b: See graph at right.



c: The differences are the period and amplitude, and therefore some of the x-intercepts. They have the same basic shape.

7-145. **1,** $\frac{2\pi}{2\pi} = 1$ or $2\pi(1) = 2\pi$

7-146. Colleen's calculator was in radian mode, while Jolleen's calculator was in degree mode. Colleen's calculation is wrong.

7-147. $y = \sin 2(x-1)$ is correct. To shift the graph one unit to the right, subtract 1 from x before multiplying by anything.

7-148. 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 $(2x+7)(x-1) = 0$.
$x = 1$ or $x = -\frac{7}{2}$

7-149. **a:** 3 **b:** 1.5 **c:** 2 **d:** 12

7-150. **a:** $y = 20\left(\frac{1}{2}\right)^x + 5$ **b:** $w = 5.078$

7-151. **a:** Answers vary, if $g(x)$ is linear, tangent lines only.

b: Any line $y = b$ such that $b < -8$.

Lesson 7.2.4

7-158. **a:** Yes **b:** $y = \cos\left(x + \frac{\pi}{2}\right)$ **c:** $y = -\sin x$

7-159. 6 cycles, period: $\frac{\pi}{3}$

7-160. Answers will vary.

7-161. **a:** 180° **b:** 540° **c:** $\frac{\pi}{6}$ radians

d: 45° **e:** $\frac{5\pi}{4}$ radians **f:** 270°

7-162. **a:** $\frac{-\sqrt{2}}{2}$ **b:** $\sqrt{3}$ **c:** $-\frac{1}{2}$ **d:** $\frac{\sqrt{2}}{2}$

e: 1 **f:** $-\frac{1}{\sqrt{3}}$ **g:** $\frac{\pi}{4}$ or $\frac{5\pi}{4}$ **h:** $\frac{3\pi}{4}$ or $\frac{7\pi}{4}$

7-163. $\left(-1, \frac{1}{2}, 2\right)$

7-164. **a:** $x = 0, x = -\frac{1}{2}$, or $x = \frac{5}{3}$

b: $x = 6$ or $x = -1$

c: Answers will vary.

7-165. **a, b, and c:** Answers will vary.

7-166. **a:** About \$564,240 **b:** In 2025 **c:** About \$36,585