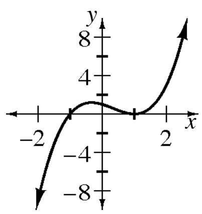
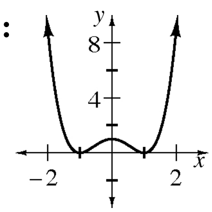
Lesson 9.1.1

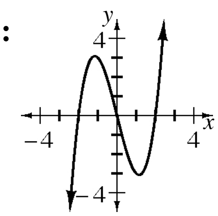
9-8. **a:**



b:



c:



d: parent functions:
(a) $y = x^3$
(b) $y = x^4$
(c) $y = x^3$

9-9. **Functions in parts (a), (b), and (e) are polynomial functions; explanations vary.**

9-10. **a: 0, 1, or ∞; b: 0, 1, or 2; c: 0, 1, 2, 3, or 4; d: 0, 1, 2, 3, or 4 (1 and 3 require the parabola to be tangent to the circle.)**

9-11. **(–2, –1) and (3, 4)**

9-12. **a:**

	1^{st}	2^{nd}	3^{rd}	4^{th}
What g does to x:	adds 1	$(\ \ )^2$	divides by 3	subtracts 2
What g^{-1} does to x:	**adds 2**	**multiplies by 3**	$\sqrt{\ \ }$	**subtracts 1**

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

9-13. **The second graph is shifted up 5 from the first.**

9-14. **a:** $x = -26$; **b:** $x = 10, 3$

9-15. **a:** $4n - 27$, **b: at least 2507 times**

9-16. **a:** $\frac{2}{20} = \frac{1}{10}$, **b:** $\frac{1}{19}$

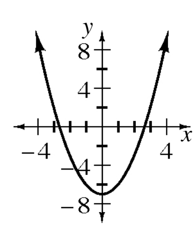
9-17. **a: 60°, 300°; b: 135°, 315°; c: 60°, 120°; d: 150°, 210°**

9-18. **The functions in parts (a), (b), (d), (e), (h), (i), and (j) are polynomial functions.**

9-19. **They are not equivalent. Explanations vary. Students may substitute numbers to check. Also, the second equation can be written** $y = -x + 12$**, which is a line, not a circle.**

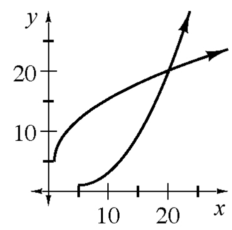
9-20. **a:** $x = 2, 4$; **b:** $x = 3$; **c:** $x = -2, 0, 2$

9-21. **graph shown at right; a: 2; b:** $x = \sqrt{7}, -\sqrt{7}$

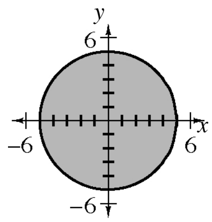


9-22. $x = -1 \pm \sqrt{6}$, **a: 2, b: at** $x \approx 1.45$ **and** $x \approx -3.45$

9-23. $f^{-1}(x) = \frac{1}{3}(\frac{x-5}{2})^2 + 1 = \frac{1}{12}(x-5)^2 + 1$ **for** $x \geq 5$; **graph shown at right**



9-24.



circle of radius 5, centered at origin, with its interior shaded

9-25. **–1 or 5**

9-26. **a:** $y = (3^x) - 4$, **b:** $y = 3^{(x-7)}$

9-27. **a: Repeat the pattern for several cycles; b: 30'; c:** $y = 30\sin x$; **table shown below.**

x (angle)	–90°	–45°	0°	45°	90°	135°	180°	....	270°
y (height)	–30'	**–21.2'**	**0'**	**21.2'**	**30'**	**21.2'**	**0'**		**–30'**

Lesson 9.1.2

9-38. **at** $(-3 \pm \sqrt{5}, 0)$

9-39. **at (74, 0), a double root, and at (–29, 0)**

9-40. **possible answers: a:** $y = x^2 - x - 6$, **b:** $y = 2x^2 + 5x - 3$

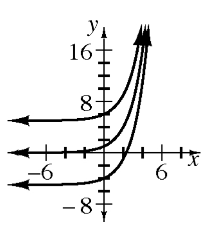
9-41. **a: 2, b: 5, c: 3, d: 6**

9-42. **parabolas: yes, lines: yes, cubics: yes, exponentials: no, circles: no**
Explanations vary.

9-43. **a: 13, 17, and 21; b: arithmetic; c:** $4n - 3$

9-44. **a:** $(x-2)^2 + (y-6)^2 = 4$, **b:** $(x-3)^2 + (y-9)^2 = 9$

9-45.



9-46. **a: 30°, 150°; b: 60°, 240°; c: 30°, 330°; d: 225°, 315°**

Lesson 9.1.3

9-56. Stretch factor is -2; $f(x) = -2(x+2)^2(x-1)$.

9-57. a: degree 4, $a_4 = 6$, $a_3 = -3$, $a_2 = 5$, $a_1 = 1$, $a_0 = 8$
b: degree 3, $a_3 = -5$, $a_2 = 10$, $a_1 = 0$, $a_0 = 8$
c: degree 2, $a_2 = -1$, $a_1 = 1$, $a_0 = 0$
d: degree 3, $a_3 = 1$, $a_2 = -8$, $a_1 = 15$, $a_0 = 0$
e: degree 1, $a_1 = 1$
f: degree 0, $a_0 = 10$

9-58. possible equation: $p(x) = 2.5(x+4)(x-1)(x-3)$

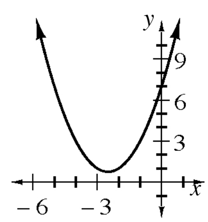
9-59. possible answers: a: $y = 4x^2 + 5x - 6$, b: $y = x^2 - 5$

9-60. $(\pm 6, \frac{1}{2})$

9-61. a: C: (3, 7), r: 5; b: C: (0, –5), r: 4; c: C: (–9, 4), r: $5\sqrt{2}$; d: C: (3, 0), r: 1

9-62. a: $\frac{\log 17}{\log 2}$, b: 242, c: 4, d: 7

9-63. a: $(x+\frac{5}{2})^2 + \frac{3}{4}$, vertex $(-\frac{5}{2}, \frac{3}{4})$
b: (0, 7)
c: (–5, 7), graph shown at right



9-64. $y = 2 + 4\sin x$

Lesson 9.2.1

9-72. a: $-18 - 5i$, b: $1 \pm 2i$, c: $5 + i\sqrt{6}$

9-73. $i^3 = i^2 i = -1i = -i$; 1

9-74. a: –21, b: $-10 + 7i$, c: $-22 + i$

9-75. Yes; substitute it into the equation to check.

9-76. $x = -8$

9-77. Yes; both are $x^2 - 10x + 25$.

9-78. a: $7i$, b: $\sqrt{2}i$ or $i\sqrt{2}$, c: –16, d: $-27i$

9-79. a: $\frac{x+3}{2}$, b: $\sqrt{x-2}+3$

9-80. a: $x \approx 2.24$, b: $x \approx \pm 2.25$

Lesson 9.2.2

9-89. a: $f(x)=x^2+6x+10$, b: $g(x)=x^2-10x+22$, c: $h(x)=x^3+2x^2-7x-14$, d: $p(x)=x^3+2x^2-14x-40$

9-90. a: $b^2-4ac=-7$, complex; b: $b^2-4ac=49$, real

9-91. a: real, b: complex, c: complex, d: real, e: real, f: complex

9-92. a: repeat 1, i, –1, –i, etc; b: 1, i, –i, 1; c: 1; d: i, –1, –i; e: 1, i, –1, –i

9-93. a: 1, b: i, c: –1

9-94. If n is a multiple of 4, the value is 1; if it is 1 more than a multiple of 4, the value is i; if it is 2 more than a multiple of 4, the value is –1; if it 3 more than a multiple of 4, the value is –i.

9-95. a: $y=\log x$, b: $x=2$, c: $y=\log_2(x-2)$ is one possibility.

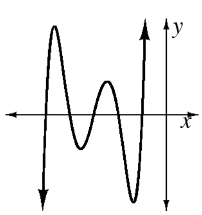
9-96. a: $\frac{1}{16}$, b: $\frac{3}{16}$

9-97. a: $\begin{bmatrix} -8 & 15 \\ 4 & -18 \end{bmatrix}$, b: $\begin{bmatrix} 3 & 1 \\ -1 & -2 \end{bmatrix}$, c: $\begin{bmatrix} 19 & -8 \\ -20 & 11 \end{bmatrix}$, d: $\begin{bmatrix} -1.5 & 2.5 \\ 4.5 & -2 \end{bmatrix}$

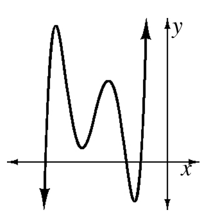
Lesson 9.2.3

9-105. a: three real linear factors (one repeated), therefore two real (one single, one double) and zero complex (non-real) roots; b: one linear and one quadratic factor, therefore one real and two complex (non-real) roots; c: four linear factors, therefore four real and zero complex (non-real) roots; d: two linear and one quadratic factor, therefore two real and two complex (non-real) roots

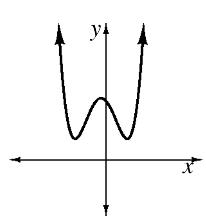
9-106. a:



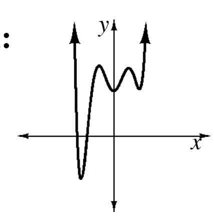
b:



c:

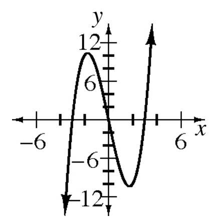


d:

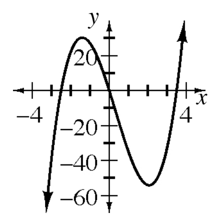


e: (a) 5, (b) 5, (c) 4, (d) 6

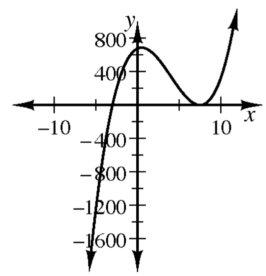
9-107. a: (3, 0), (0, 0), and (–3, 0); b:



9-108. a: x-intercepts $(-\frac{5}{2}, 0)$, $(0, 0)$, and $(\frac{7}{2}, 0)$,
y-intercept $(0, 0)$



b: x-intercepts $(-3, 0)$ and $(\frac{15}{2}, 0)$ (double root),
y-intercept $(0, 675)$

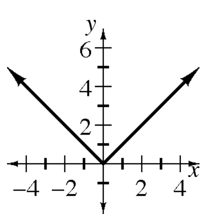


9-109. $x + y = 685$ and $5x + 8.5y = 5000$, so 450 adult tickets would have allowed them to meet their goal.

9-110. $b \geq 20$ or $b \leq -20$

9-111. a: $(i-3)^2 = i^2 - 6i + 9 = -1 - 6i + 9 = 8 - 6i$
b: $(2i-1)(3i+1) = 6i^2 - 3i + 2i - 1 = -6 - i - 1 = -7 - i$
c: $(3-2i)(2i+3) = 6i - 4i^2 - 6i + 9 = 4 + 9 = 13$

9-112. a: $y = |x|$



b: Absolute-value graph; squaring and then square rooting will always return a positive value.

9-113. a: $x^2 - 6x + 9$, b: $2x^2 + 12x + 18$, c: $a^3 - b^3$

Lesson 9.3.1

9-121. a: –7; c: $(x+7)$; d: $(x^2 - 2x - 2)$; f: $-7, 1 \pm \sqrt{3}$

9-122. $1, \frac{1}{2}, -3$

9-123. Part (c), because $(-2)(3)(-5)=30$ and $(x)(x)(x)=x^3$ not $2x^3$.

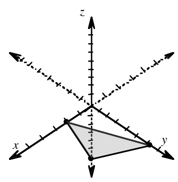
9-124. (b), because 5 is a factor of the last term, but 2 and 3 are not.

9-125. $(x-5)(x^2-4x-1)$; zeros: 5, $2\pm\sqrt{5}$

9-126. a: $(x-2)(5x+3)$; b: $-\frac{3}{5}$, 2; c: Explanations vary; d: 3 and 2 are factors of 6, while 5 is a factor of the lead coefficient.

9-127. (6, –2, –8)

9-128. a:



b: Yes, it is a solution to the equation.

9-129. Fred is correct. Substitute numbers to justify.

9-130. $AC = 10$ inches

Lesson 9.3.2

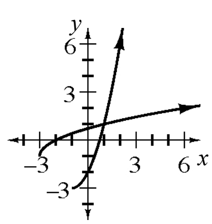
9-140. a: It shows that $(x-3)$ is a double factor and 3 is a double root.
b: $p(x)=(x-3)^2(x^2+2x-1)$, 3, $-1\pm\sqrt{2}$

9-141. a: $x^2-6x+25=0$, b: $x^2-6x+25=0$, c: Answers vary.

9-142. a: $\frac{3+2i}{-4+7i}\cdot\frac{-4-7i}{-4-7i}=\frac{2-29i}{65}$, b: $\frac{2}{65}-\frac{29}{65}i$

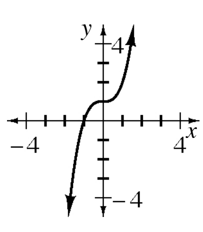
9-143. a: $\frac{12}{5}-\frac{1}{5}i$, b: $-\frac{2}{13}+\frac{11}{13}i$

9-144.



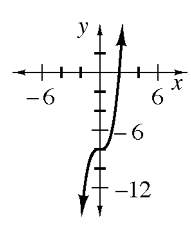
$\sqrt{x+3}-1$; $x\ge -3$, $y\ge -1$

9-145. a:



-1, $\frac{1\pm\sqrt{3}\,i}{2}$

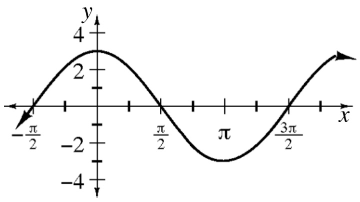
b:



2, $-1\pm\sqrt{3}\,i$

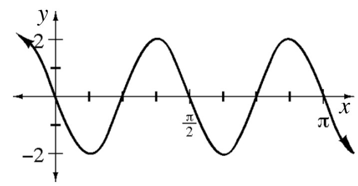
9-146. (3, 4, –1)

9-147. a:



locator $(-\frac{\pi}{2}, 0)$
period = 2π
amplitude = 3

b:



locator (0, 0)
period = $\frac{\pi}{2}$
amplitude = 2
inverted

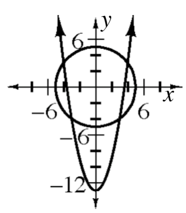
9-148. $p(x) = x^3 + 3x^2 + 25x + 29$

9-149. a: direct substitution; b: $(x-2)$; **c:** $(x^2 - 4x - 1)$; **d:** $2,\ 2 \pm \sqrt{5}$

9-150. a: $\frac{8}{17} + \frac{15}{17}i$, **b:** $5 - 2i$

9-151. a: (–15, 40), b: (3, 4) and (5, 0)

9-152.



a: 4, b: $(\pm 4, 3)$ **and** $(\pm 3, -4)$

9-153. a: 4 (1 is extraneous), b: $\frac{1}{4}$

9-154. a: $\sqrt{20} = 2\sqrt{5}$, **b:** $\sqrt{(x-2)^2 + (y-3)^2}$

9-155. a: $\frac{2\pi}{3}, \frac{4\pi}{3}$; **b:** $\frac{\pi}{6}, \frac{7\pi}{6}$; **c:** $0, \pi$; **d:** $\frac{\pi}{4}, \frac{7\pi}{4}$

9-156. a: $-\frac{1}{5} - \frac{7}{5}i$, **b:** $1 - 2i$

9-157. At 6 years, it will be worth $23,803.11. At 7 years it will be worth $25,707.36.

9-158. a: $x = \frac{5}{9}$, **b:** $x = 3$, **c:** $x = 48$, **d:** $x \approx 1.46$

9-159. Students should show the substitution of the coordinates of the point into both equations to verify.

9-160. $x = 2$ **or** $x \approx 1.1187$

9-161. a: $\frac{1}{2}$, b: $\frac{1}{4}$, c: $\frac{5}{6}$, d: $\frac{1}{2}$, e: $\frac{1}{16}$, f: $\frac{4-\pi}{4}=1-\frac{\pi}{4}$

9-162. When you find the complement of the angle, the *x*- and *y*-values reverse.

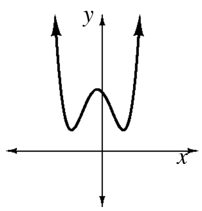
9-163. a: 4 units, b: 2, c: 3

9-164. a: $\frac{\pi}{3}$, b: $\frac{5\pi}{12}$, c: $\frac{7\pi}{6}$, d: $\frac{5\pi}{4}$

Lesson 9.3.3

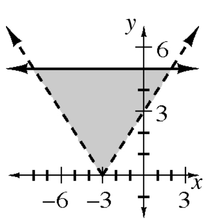
9-169. (0, 0), (3, 0), and (–0.5, 0)

9-170.



9-171. a: $(x+\sqrt{10})(x-\sqrt{10})$, b: $(x-\frac{3+\sqrt{37}}{2})(x-\frac{3-\sqrt{37}}{2})$, c: $(x+2i)(x-2i)$, d: $(x-(1+i))(x-(1-i))$

9-172.



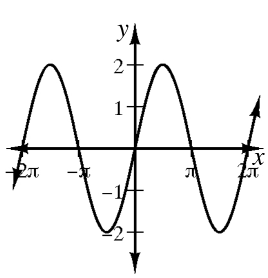
area = 25 sq. units

9-173. It is not; $16+8\neq 32-40$.

9-174. Solving algebraically yields $x=1$, for which value the equation is undefined, so the equation has no solution.

9-175. a: $y=x^2+1$, b: $y=x^2-2x-1$

9-176. a:



b: