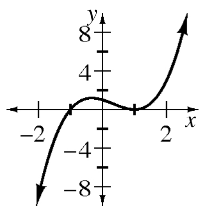
Lesson 8.1.1 (Day 1)

8-8. See graphs and tables below. Parent functions:

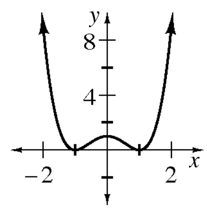
a: $y = x^3$

x	y
–2	–9
–1	0
0	1
1	0
2	3



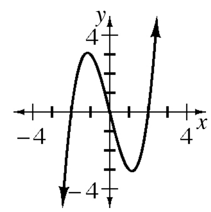
b: $y = x^4$

x	y
–2	9
–1	0
0	1
1	0
2	9



c: $y = x^3$

x	y
–2	0
–1	3
0	0
1	–3
2	0



8-9. Functions in parts (a), (b), and (e) are polynomial functions; explanations vary.

8-10. Graphs will vary.

a: 0, 1, or ∞ **b:** 0. 1, or 2 **c:** 0, 1, 2, 3

d: 0, 1, 2, 3, or 4 (1 and 3 require the parabola to be tangent to the circle.)

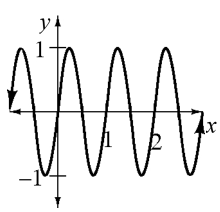
8-11. (–2, –1) and (3, 4)

8-12. **a:** adds 2; multiplies by 3; $\sqrt{\ }$; subtracts 1

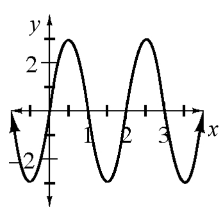
b: $f^{-1}(x) = (\frac{x-3}{2})^2 + 1$, $g^{-1}(x) = \sqrt{3(x+2)} - 1$

8-13. The second graph is shifted up 5 from the first.

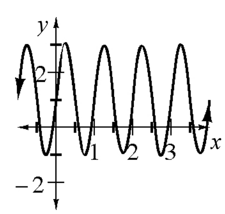
8-14. **a:**



b:



c:



8-15. **a:** $4n - 27$ **b:** At least 2507 times.

8-16. **a:** 60º, 300º **b:** 135º, 315º **c:** 60º, 120º **d:** 150º, 210º

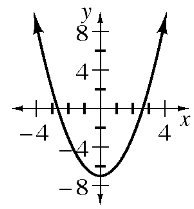
Lesson 8.1.1 (Day 2)

8-17. The functions in parts (a), (b), (d), (e), (h), (i), and (j) are polynomial functions.

8-18. 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.

8-19. **a:** $x = 2$ or $x = 4$ **b:** $x = 3$ **c:** $x = -2$, $x = 0$, or $x = 2$

8-20. See graph at right.

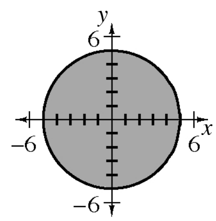


a: 2 **b:** $x = \sqrt{7}, -\sqrt{7}$

8-21. $x = -1 \pm \sqrt{6}$

a: 2 **b:** At $x \approx 1.45$ and $x \approx -3.45$

8-22. See graph at right.



8-23. $x = -1$ or 5

8-24. **a:** $y = \left(3^x\right) - 4$ **b:** $y = 3^{(x-7)}$

8-25. y: –21.2' ; 0'; 21.2'; 30'; 21.2'; 0'; …; –30'

a: Repeat the pattern for several cycles.

b: 30'

c: $y = 30 \sin x$

Lesson 8.1.2

8-36. At $(-3 \pm \sqrt{5}, 0)$.

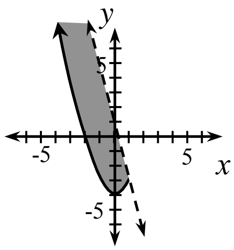
8-37. At (74, 0), a double root, and at (–29, 0).

8-38. Possible Answers: **a:** $y = x^2 + x - 6$ **b:** $y = 2x^2 + 5x - 3$

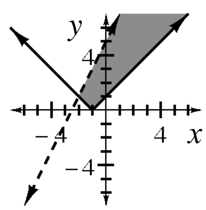
8-39. **a:** 2 **b:** 5 **c:** 3 **d:** 6

8-40. Lines, parabolas (vertically oriented), and cubics are polynomial functions because they can be written in the form $y = ax^n$. Exponentials are not polynomial functions because "x" is the exponent. Circles are not functions.

8-41. **a:**

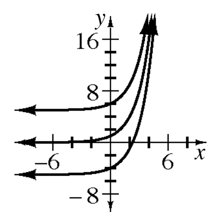


b:



8-42. **a:** $(x-2)^2 + (y-6)^2 = 4$ b: $(x-3)^2 + (y-9)^2 = 9$

8-43. See graph at right.



8-44. **a:** 30º, 150º **b:** 60º, 240º

c: 30º, 330º **d:** 225º, 315º

Lesson 8.1.3

8-54. Stretch factor is –2. $f(x) = -2(x+2)^2(x-1)$

8-55. **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, $a_0 = 10$

8-56. Possible equation: $p(x) = 2.5(x+4)(x-1)(x-3)$

8-57. **a:** $y = 4x^2 + 5x - 6$ **b:** $y = x^2 - 5$

8-58. There is no real solution, because a radical cannot be equal to a negative value.

8-59. **a:** C: (3, 7), r: 5 **b:** C: (0, –5), r: 4
c: $x = 4$ **d:** $x = 7$

8-60. **a:** $x = \frac{\log 17}{\log 2}$ **b:** $x = 242$ **c:** $x = 4$ **d:** $x = 7$

8-61. **a:** $-3 < x < 2$ **b:** $x \le -1$ or $x \ge \frac{7}{3}$

8-62. $y = 2 + 4\sin x$

Lesson 8.2.1

8-70. **a:** $-18-5i$ **b:** $1 \pm 2i$ **c:** $5+i\sqrt{6}$

8-71. $i^3 = i^2 i = -1i = -i$; 1

8-72. **a:** -21 **b:** $-10+7i$ **c:** $-22+i$

8-73. Yes, substitute it into the equation to check.

8-74. $x = -8$

8-75. Yes; both are equivalent to $x^2 - 10x + 25$.

8-76. **a:** $7i$ **b:** $\sqrt{2}i$ or $i\sqrt{2}$ **c:** -16 **d:** $-27i$

8-77. **a:** $\frac{x+3}{2}$ **b:** $\sqrt{x-2}+3$

8-78. **a:** $x \approx 2.24$ **b:** $x \approx \pm 2.25$

Lesson 8.2.2

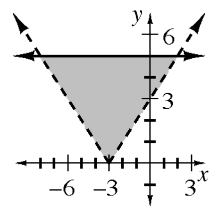
8-87. Possible Functions:

a: $f(x) = x^2 + 6x + 10$ **b:** $g(x) = x^2 - 10x + 22$

c: $h(x) = x^3 + 2x^2 - 7x - 14$ **d:** $p(x) = x^3 + 2x^2 - 14x - 40$

8-88. **a:** $b^2 - 4ac = -7$, complex **b:** $b^2 - 4ac = 49$, real

8-89. See graph at right. Area = 25 sq. units



8-90. **a:** Repeat 1, i, –1, –i, etc. **b:** 1, i, –i, 1

c: 1 **d:** i, –1, –i

e: 1, i, –1, –i

8-91. **a:** 1 **b:** i **c:** –1

8-92. 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.

8-93. **a:** $x = \frac{\log 17}{\log 3}$ **b:** $x = \sqrt[3]{17}$

8-94. **a:** 2 **b:** 4 **c:** 5 **d:** 3 **e:** 1

8-95. **a:** Standard form for y-intercept at (0, 400) and graphing form for vertex at (0.5, 404).

b: 400 ft; 404 ft

8-96. **a:** $y = \log x$ **b:** $x = 2$ **c:** $y = \log_2(x-2)$ is one possibility.

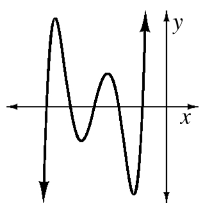
Lesson 8.2.3

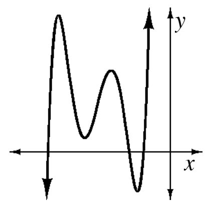
8-104. **a:** three real linear factors (one repeated), therefore two real (one single, one double) and zero complex (non-real) roots

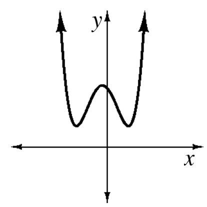
b: one linear and one quadratic factor, therefore one real and two complex (non-real) roots

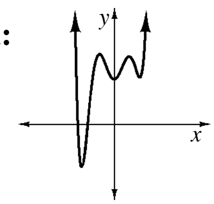
c: four linear factors, therefore four real and zero complex (non-real) roots

d: two linear and one quadratic factor, therefore two real and two complex (non-real) roots

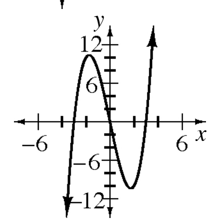
8-105. **a:**


b:


c:


d:


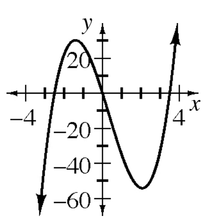
8-106. **a:** (3, 0), (0, 0), and (–3, 0) **b:** See graph at right.

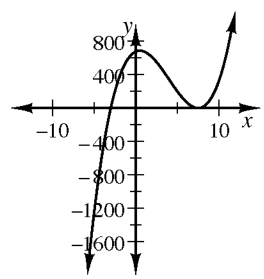


8-107. See graphs below.

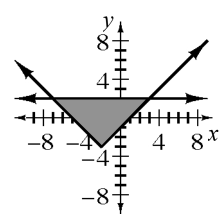
a: x-intercepts $\left(-\frac{5}{2},0\right),(0,0)$, and $\left(\frac{7}{2},0\right)$, y-intercept $(0,0)$

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

a:


b:


8-108. See graph at far right.



8-109. **a:** Platform is 11.27 meters off the ground. $h = -4.9(t-5)^2 + 133.77$; therefore, the maximum height is 133.77 meters. Time when h = 0 is 10.22 sec.

b: $h \approx -4.9(t-10.22)(t+0.22)$. Factored form reveals the intercepts, or how long it took the firework to reach the ground.)

8-110. $b \geq 20$ or $b \leq -20$

8-111. **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: $(3-2i)(2i+3) = 6i - 4i^2 - 6i + 9 = 4 + 9 = 13$

8-112. $\left(\pm 6, \frac{1}{2}\right)$

Lesson 8.3.1

8-120. **a:** –7 **c:** $(x + 7)$ **d:** $(x^2 - 2x - 2)$ **f:** $-7, 1 \pm \sqrt{3}$

8-122. Part (c), because (–2)(3)(–5) = 30 and $(x)(x)(x) = x^3$ not $2x^3$.

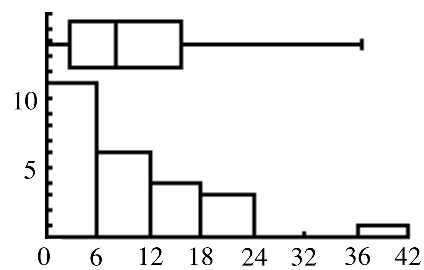
8-123. Part (b), because 5 is a factor of the last term, but 2 and 3 are not.

8-124. $(x-5)(x^2-4x-1)$; zeros: $5,\ 2 \pm \sqrt{5}$

8-125. **a:** $(x-2)(5x+3)$ **b:** $-\frac{3}{5}$, 2 **c:** Explanations will vary.

d: 3 and 2 are factors of 6, while 5 is a factor of the lead coefficient.

8-126. **a:** See the combination histogram boxplot at right. The five number summary (for the box plot) is 0, 2.75, 8, 15.7, 36.5.



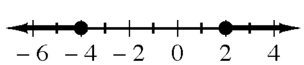
b: The distribution has a right skew and an outlier at 36.5 pounds so the center is best described by the median of 8.0 pounds and the spread by the IQR of 12.95 pounds.

c: The median is better in this case because it is not affected by skewing and outliers.

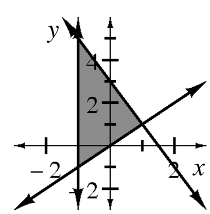
d: The IQR is better in this case because it is less affected by skewing and outliers than the standard deviation.

e: If you remove the outlier from the data the mean drops to 8.7 pounds which is below the profitable minimum. You could suggest running the test a few more weeks because perhaps as people get used to the composting program they will participate even more.

8-127. **a:**

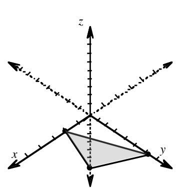


b:



8-128. **a:** See graph below.

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



Lesson 8.3.2 (Day 1)

8-138. **a:** It shows that $(x - 3)$ is a double factor and 3 is a double root.

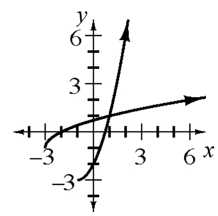
b: $p(x) = (x-3)^2(x^2+2x-1)$; $x = 3,\ -1 \pm \sqrt{2}$

8-139. **a:** $x^2 - 6x + 25 = 0$ **b:** $x^2 - 6x + 25 = 0$ **c:** Answers will vary.

8-140. **a:** $\frac{3+2i}{-4+7i} \cdot \frac{-4-7i}{-4-7i} = \frac{2-29i}{65}$ **b:** $\frac{2}{65} - \frac{29}{65}i$

8-141. **a:** $\frac{12}{5} - \frac{1}{5}i$ **b:** $-\frac{2}{13} + \frac{11}{13}i$

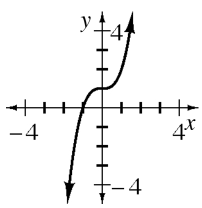
8-142. See graph at right; $\sqrt{x+3} - 1$; $x \geq -3,\ y \geq -1$



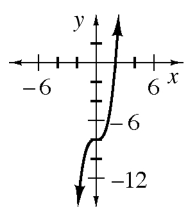
8-143. **a:** See graph below left. $-1,\ \frac{1 \pm \sqrt{3}\ i}{2}$

b: See graph below right. $2,\ -1 \pm \sqrt{3}\ i$

a:



b:

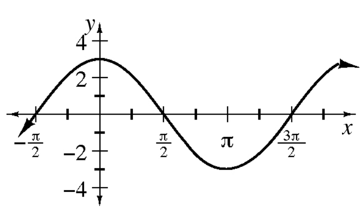


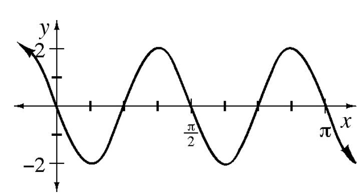
8-144. $(3, 4, -1)$

8-145. $x = \frac{1}{2}$

8-146. **a:** See graph below left, locator $\left(-\frac{\pi}{2}, 0\right)$, period = 2π, amplitude: 3

b: See graph below right, locator (0, 0), period: $\frac{\pi}{2}$, amplitude: 2, inverted





Lesson 8.3.2 (Day 2)

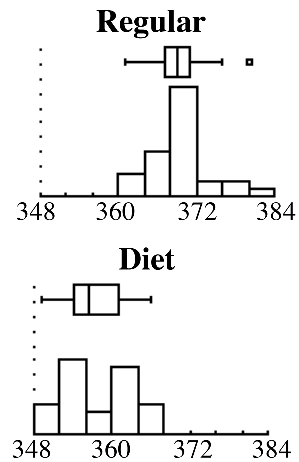
8-147. $p(x) = x^3 + 5x^2 + 33x + 29$

8-148. a: $p(2) = 0$ **b:** $(x - 2)$ **c:** $(x^2 - 4x - 1)$ **d:** $2,\ 2 \pm \sqrt{5}$

8-149. a: $\frac{8}{17} + \frac{15}{17}i$ **b:** $2 + 5i$

8-150. a: Regular: (361, 367, 369 373, 380 grams); Diet (349, 354, 356.5, 361, 366 grams)

b: See histograms at right.



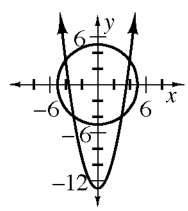
c: Regular: The mean is 369.6 grams, which falls at the middle of the distribution on the histogram. The shape is single-peaked and symmetric, so the mean should be a good measure of the center. There are no outliers, so the standard deviation of 4.34 grams could be used to describe spread.

Diet: The mean is 357.5 grams; this mean also falls at the center of the data on the histogram. The data is double-peaked but still fairly symmetric so the mean could be used to represent the center. There are no outliers so the standard deviation of 5.12 grams could be used to describe spread.

d: The regular cola cans are noticeably heavier (or had more mass) than the diet cans. The lightest regular can is at the third quartile of the diet sample and the median of the regular cans is heavier than the most massive diet can. The spread of each distribution is similar and they are both reasonably symmetric but the diet cans have a double peaked distribution.

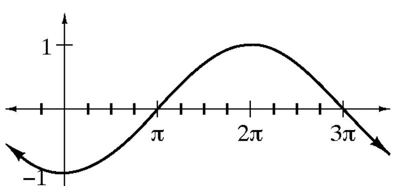
e: Answers will vary.

8-151. See graph at right. **a:** 4 **b:** $(\pm 4, 3)$ and $(\pm 3, -4)$

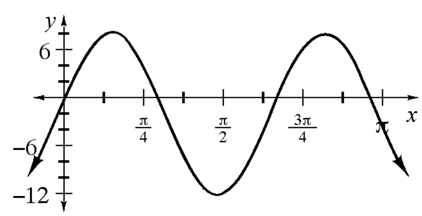


8-152. a: $x = 4$ (1 is extraneous) **b:** $x = \frac{1}{4}$

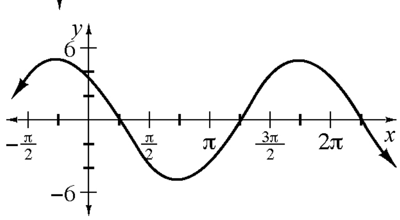
8-153. a:



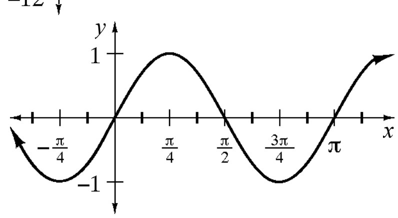
b:



c:



d:



8-154. a: $x = 2, (x - 2)$ **b:** $x = 2, -3 \pm 2i$; $(x-2)\left(x-(-3+2i)\right)\left(x-(-3-2i)\right)$

8-155. a: $x = \frac{2\pi}{3}, \frac{4\pi}{3}$ **b:** $x = \frac{\pi}{6}, \frac{7\pi}{6}$ **c:** $x = 0,\ \pi$ **d:** $x = \frac{\pi}{4}, \frac{7\pi}{4}$

Lesson 8.3.2 (Day 3)

8-156. **a:** $-\frac{1}{5}-\frac{7}{5}i$ **b:** $1-2i$

8-157. At 6 years, it will be worth $23,803.11. At 7 years it will be worth $25,707.36.

8-158. **a:** $x=\frac{5}{9}$ **b:** $x=3$ **c:** $x=48$ **d:** $x\approx 1.46$

8-159. Students should show the substitution of the coordinates of the point into both equations to verify.

8-160. $x=2$ or $x\approx 1.1187$

8-161. **a:** $x\approx 781.36$ **b:** $x=6$ **c:** $x=1,\frac{1}{5}$ **d:** $x=0, 1, 2$

8-162. When you find the complement of the angle, the x and y values reverse.

8-163. **a:** $\sqrt{-7}\cdot\sqrt{-7}=i\sqrt{7}\cdot i\sqrt{7}=i^2\sqrt{49}=-7$

b: She multiplied $\sqrt{-7}\cdot\sqrt{-7}$ to get $\sqrt{49}=7$.

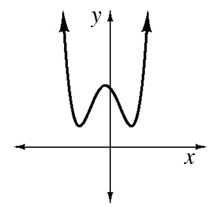
c: $\sqrt{-7}$ is undefined in relation to real numbers, and is only defined as the imaginary number $\sqrt{7}i$, so it must be written in its imaginary form before operations such as addition or multiplication can be performed.

d: a and b must be non-negative real numbers.

8-164. **a:** $\frac{\pi}{3}$ **b:** $\frac{5\pi}{12}$ **c:** $\frac{7\pi}{6}$ **d:** $\frac{5\pi}{4}$

Lesson 8.3.3

8-169. $(0,0)$, $(3,0)$, and $(-0.5,0)$



8-170. See graph at right.

8-171. **a:** $(x+\sqrt{10})(x-\sqrt{10})$ **b:** $\left(x-\frac{3+\sqrt{37}}{2}\right)\left(x-\frac{3-\sqrt{37}}{2}\right)$

c: $(x+2i)(x-2i)$ **d:** $(x-(1+i))(x-(1-i))$

8-172. **a:** real **b:** complex **c:** complex

d: real **e:** real **f:** complex

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

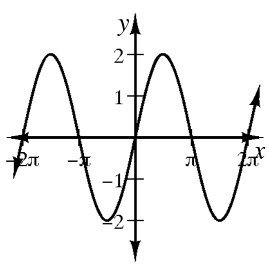
8-174. **a:** $x = 5$ or 1 **b:** $x = 4$ or 0 **c:** $x = 7$ **d:** $x = 1$

8-175. **a:** 24

b: $(x^3-3x^2-7x+9)\div(x-5)=(x^2+2x+3)$ with a remainder of 24.

8-176. **a:** $y = x^2+1$ **b:** $y = x^2-2x-1$

8-177. **a:**



b: