Lesson 2.1.1

2-6. **a:** $y = 0$ or 6 **b:** $n = 0$ or -5 **c:** $t = 0$ or 7 **d:** $x = 0$ or -9

e: There is no constant term when each equation is set equal to zero, so the variable is a common factor after like terms are collected.

2-7. **a:** $(7, -16)$; $y = (x-7)^2 - 16$ **b:** $(2, -16)$; $y = (x-2)^2 - 16$

c: $(7, 9)$; $y = (x-7)^2 - 9$ **d:** $(2, -1)$

2-8. When $x = 2$, $(x-2)^2$ will equal zero and $y = -1$, the smallest possible value for y in the equation. So the y-value of the vertex is the minimum value in the range of the function.

2-9. **a:** $x \approx 5.18$ units **b:** $x \approx 18.66$ units

c: $\theta \approx 24.62°$ **d:** $x = \sqrt{180} = 6\sqrt{5} \approx 13.42$ units

2-10. Ted will solve the system algebraically by setting $18x - 30 = -22x + 50$. The lines intersect at the point $(2, 6)$.

2-11. $x = -4$

2-12. **a:** Hush Puppy: The distribution is left skewed so its center and spread are best described by the median of 58.3 dB and IQR of 25.6 dB; there are no apparent outliers. Quiet Down: Has some potential outliers over 100 dB or is perhaps dual-peaked. The main body of data has a left skew. The center and spread are best described by the median of 54.9 dB and IQR of 25.9 dB.

b: Answers may vary. Unless a student is familiar with the decibel scale a reasonable choice would be the Quiet Down because its mean and median sound levels are less and the IQRs between the two are nearly identical.

c: The Hush Puppy looks better now because those three high readings from the Quiet Down model are a lot more significant. Perhaps the Quiet Down could be redesigned to eliminate those high readings.

Lesson 2.1.2

2-18. Possible equations include $y=-\frac{1}{72}(x-60)^2+50$, $y=-\frac{1}{72}x^2+50$, and $y=-\frac{1}{72}x^2$; The domain and range should include only those values that correspond to the water passing between the boat and the warehouse.

2-19. **a:** Years; 1.06; 120,000; $f(x)=120000(1.06)^x$

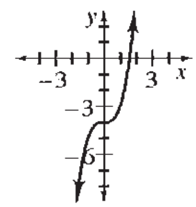
b: Hours; 1.22; 180; $f(x)=180(1.22)^x$

2-20. $x \approx 2.7$ feet, $y \approx 1.3$ feet

2-21. **a:** $x=-\frac{1}{17}\approx -0.059$ **b:** $x=\frac{66}{13}\approx 5.08$ **c:** $x=-1, 3$

2-22. Table and graph shown at right. Sideways S-shaped; increasing; D: $-\infty < x < \infty$, R: $-\infty < y < \infty$, intercepts $(0,-4)$ and $(\sqrt[3]{4},0)$ or $(\approx 1.59, 0)$; continuous; function

x	$h(x)$
−3	−31
−2	−12
−1	−5
0	−4
1	−3
2	4
3	23



2-23. 56 inches

2-24. **a:** $\sqrt{146}\approx 12.1$ **b:** $\sqrt{145}\approx 12.0$ **c:** $\sqrt{50}=5\sqrt{2}\approx 7.1$

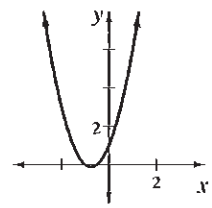
Lesson 2.2.1 Day 1

2-30. **a:** The vertex for the green hose is $(5, 8)$ and for the red hose the vertex is $(3, 7)$. The green hose will go higher.

b: If Maura is standing at $(0, 0)$, $y = -\frac{4}{25}(x-5)^2 + 8$.

c: Standing at $(0, 0)$, domain: $0 \le x \le 10$ and range: $4 \le y \le 8$.

2-31. See graph at right.



a: $(-\frac{1}{2}, 0), (-1, 0), (0, 1)$

b: $x = -\frac{3}{4}$

c: $(-\frac{3}{4}, -\frac{1}{8})$ or $(-0.75, -0.125)$

2-32. Move it up 0.125 units: $y = 2x^2 + 3x + 1.125$

2-33. **a:** $5\sqrt{2}$ **b:** $6\sqrt{2}$ **c:** $3\sqrt{5}$

2-34. **a:** Years; 0.89; 12,250; $f(x) = 12250(0.89)^x$

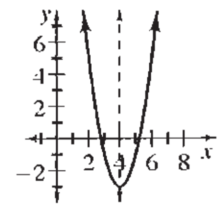
b: Months; 1.005; 1000; $f(x) = 1000(1.005)^x$

2-35. $c + m = 18$ and $\$4.89c + \$5.43m = \$92.07$; 10.5 lbs. of Colombian and 7.5 lbs. of Mocha Java.

2-36. **a:** 1; R: $y \le 3$ **b:** 3; R: $y > 0$ **c:** 2; R; all real numbers

Lesson 2.2.1 Day 2

2-37. See graph at right. Line of symmetry $x = 4$.



2-38. **a:** About $5.41 \cdot 10^{12}$ dollars

b: $y = 2.19(10^{12})(1.0317)^t$

c: A possible assumption is that the rate of change stayed the same over time. This is not very likely given economic cycles.

2-39. **a:** $2\sqrt{6}$ **b:** $3\sqrt{2}$ **c:** $2\sqrt{3}$ **d:** $5\sqrt{3}$

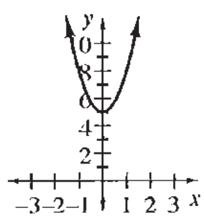
2-40. **a:** $x = 8$ **b:** ≈ 30.8 units

2-41. Perpendicular line is $y = 3x - 5$, and point of intersection is $(3, 4)$. The distance from $(3, 4)$ to $(5, 10)$ is $\sqrt{40} = 2\sqrt{10} \approx 6.32$.

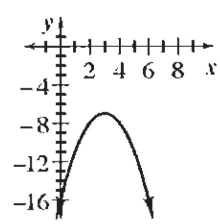
2-42. **a:** $z = 3$ **b:** $z = 1.5$ **c:** $z = 8$ **d:** $z = -3, 2$

2-43. See graphs below.

a: stretched parabola, vertex $(0, 5)$



b: inverted parabola, vertex $(3, -7)$



Lesson 2.2.1 Day 3

2-44. **a:** $y = \frac{1}{x+2}$ **b:** $y = x^2 - 5$ **c:** $y = (x-3)^3$
d: $y = 2^x - 3$ **e:** $y = 3x - 6$ **f:** $y = (x+2)^3 + 3$
g: $y = (x+3)^2 - 6$ **h:** $y = -(x-3)^2 + 6$ **i:** $y = (x+3)^3 - 2$

2-45. He should move it up 6 units or redraw the axes 6 units lower.

2-46. **a:** $(10, 48)$ **b:** $\left(\frac{29}{5}, \frac{9}{5}\right)$

2-47. $m\angle B \approx 40°$; $AB = \sqrt{244} = 2\sqrt{61} \approx 15.6$ cm

2-48. **a:** 3 **b:** $\frac{1}{x^2y^4}$ **c:** $\frac{\sqrt{y}}{x}$

2-49. **a:** $n = -2$ **b:** $x = -4$ or 1

2-50. Smallest: a: 2; b: 0; c: –3; d: none Largest: a: none; b: none; c: none; d: 0

Lesson 2.2.2 Day 1

2-56. **a:** $y = (x-2)^2 + 3$ **b:** $y = (x-2)^3 + 3$ **c:** $y = -2(x+6)^2$

2-57. **a:** D: all real numbers, R: $y \geq 3$
b: D and R: all real numbers
c: D: all real numbers, R: $y \leq 0$

2-58. **a:** $120 **b:** $22,204

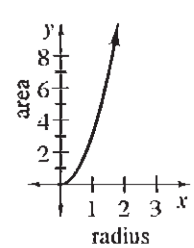
2-59. **a:** $(a,b) = (2, \pm\frac{1}{2})$ **b:** $(a,b) = (\frac{1}{2}, \pm 2)$

2-60. **a:** 3 **b:** 4 **c:** 1 **d:** 5 **e:** 2

2-61. **a:** $5i$ **b:** $4i\sqrt{2}$ **c:** $21 + I$ **d:** $8 - i$

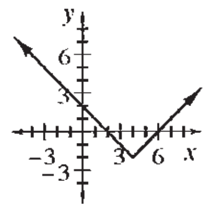
2-62. Since $A = \pi r^2$, $f(r) = \pi r^2$. See graph and table at right. domain: $x \geq 0$, range: $y \geq 0$, x- and y-intercept: $(0, 0)$, no asymptotes, half of parabola: $y = \pi x^2$

x	0	1	2	3	4
y	0	π	4π	9π	16π

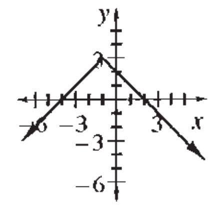


Lesson 2.2.2 Day 2

2-63. a: intercepts $(2,0), (6,0), (0,2)$; vertex $(4,-2)$;
D: all real numbers, R: $y \geq -2$



b: intercepts $(-4,0), (2,0), (0,2)$; vertex $(-1,3)$;
D: all real numbers, R: $y \leq 3$



2-64. a: vertex at $(-3,-8)$, opens upward, vertically stretched.

b: x-intercepts $(-5,0)$ and $(-1,0)$; y-intercept $(0, 10)$

2-65. a: $x = \frac{3 \pm i}{2} = 1.5 \pm 0.5i$ b: $x = \frac{1}{3}$

2-66. a: $y = 3 \cdot 4^x$ b: $y = 2 \cdot 0.5^x$

2-67. a: $6x^3 + 8x^4y$ b: $x^{14}y^9$

2-68. a: No. Reasons vary, but may include: because there is only one height for each x or because it takes larger x-values to get larger y-values.

b: No. Reasons vary, but may include: because the domain is unlimited (any number can be squared).

2-69. a: $\sqrt{58} \approx 7.62$ units b: $-\frac{3}{7}$

Lesson 2.2.3

2-75. **a:** $y + 2 = 5(x - 3)$ **b:** $(0, -17)$ and $(\frac{17}{5}, 0)$

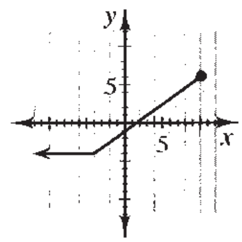
2-76. ≈ 17.74 feet

2-77. **a:** $8\sqrt{3}$ **b:** $3\sqrt{x}$ **c:** 12 **d:** 108

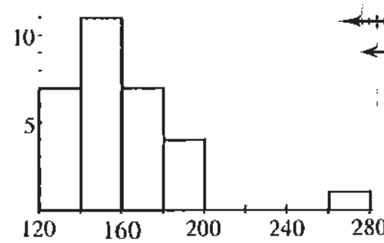
2-78. $(-2, 5)$

2-79. **a:** 1722 **b:** 1368 **c:** $y = 1500(1.047)^{n+3}$

2-80. Possible graph shown at right.



2-81. **a:** See histogram at right.

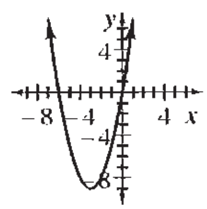


b: There is a lot of variation in the calorie content of a batter fried chicken wings. Chickens are not all the same size and the amount of batter stuck to the wings can also vary.

c: The median and IQR are more appropriate because the distribution is skewed to the right and has an outlier (which increases the mean).

2-82. **a:** neither **b:** neither **c:** even

2-83. See graph at right. intercepts: $(0, 0)$ and $(-6, 0)$; vertex $(-3, -9)$



2-84. **a:** $\frac{2}{25}$ **b:** $\frac{3x^2y^3}{z^4}$

c: $54m^5n$ **d:** $y\sqrt[3]{5x^2z}$

2-85. Answers vary. If the launch point is the origin, then $y = -0.12(x - 50)^2 + 30$.

2-86. $x = 62$

2-87. There are no *real* solutions, but there are two imaginary solutions, $4i$ and $-4i$. Because $i^2 = -1$, it follows that $(4i)^2 = 16i^2 = 16(-1) = -16$, and $(-4i)^2 = 16i^2 = -16$.

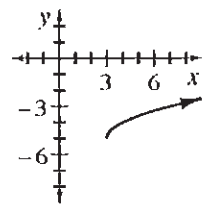
2-88. $\frac{1}{2}$ no matter where X is placed.

Lesson 2.2.4 Day 1

2-95. **a:** odd **b:** even **c:** even

2-96. Perpendicular line is $y=-\frac{1}{2}x+7$. Intersection is at $(1.6, 6.2)$. Distance from $(4, 5)$ to $(1.6, 6.2)$ to is $\sqrt{7.2}\approx 2.68$ units.

2-97. See graph at right. Half of a sleeping parabola; point $(3, -5)$; x-intercept: $(28, 0)$; increasing ; D: $x \geq 3$, R: $y \geq -5$



locator

2-98. $f(x) = x^2 + 1$

2-99. **a:** $y=\frac{1}{3}x-4$ **b:** $y=\frac{6}{5}x-\frac{1}{5}$

c: $y = (x+1)^2 + 4$ **d:** $y = x^2 + 4x$

2-100. $(a + b)^2 = a + 2ab + b^2$, substitute numbers, etc.

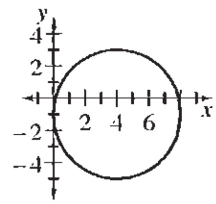
2-101. **a:** $-18-5i$ **b:** $1 \pm 2i$ **c:** $5+i\sqrt{6}$

Lesson 2.2.4 Day 2

2-102. **a:** The graph is a circle. It is in the form $(x-h)^2+(y-k)^2=r^2$.

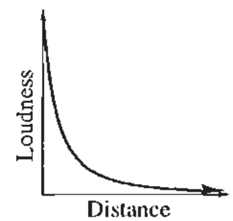
b: The circle's center is at $(4,-1)$ and the radius is 4.

c: See graph at right.



2-103. **a:** $y=-\frac{5}{9}(x-3)^2+5$ **b:** $x=-\frac{3}{25}(y-5)^2+3$

2-104. **a:** See graph at right. Note that this graph is not very intuitive—a distance verses loudness graph starts high and decreases. Many students will graph a bell shape. If so, this is a good time to do some whole-class graphical interpretation. The bell shape could be argued as appropriate if the student sees his or her position as the origin and the negative side of the x-axis as representing direction. Students should talk about what they are visualizing. Seeing themselves with the distance first decreasing then increasing is different from the way distance is usually graphed on the x-axis, small to large.



b: Loudness depends on distance, so distance is the independent variable and loudness is the dependent variable.

2-105. **a:** $x=\frac{2\pm\sqrt{-76}}{-10}=-\frac{1}{5}\pm\frac{\sqrt{19}}{5}i$ **b:** $x=\frac{1\pm\sqrt{73}}{4}\approx-1.89$ or 2.39

2-106. **a:** $(5x-1)(5x+1)$ **b:** $5x(x+5)(x-5)$

c: $(x+9)(x-8)$ **d:** $x(x-6)(x+3)$

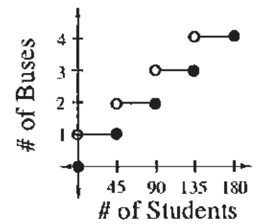
2-107. **a:** $x=70°$, ll lines -> alt. int. $\angle$s = ; $y=50°$, corr. $\angle$s =

b: $x=105°$, ext. $\angle$

2-108. **a:** $x=36$ **b:** $x=\sqrt{800}=20\sqrt{2}\approx28.28$

Lesson 2.2.5 Day 1

2-117. See graph at right.



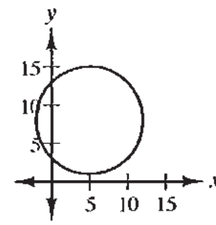
2-118. **a:** 1.03

b: $f(n) = 10.25(1.03)^n$

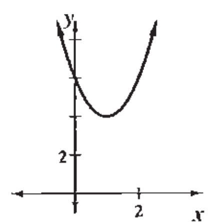
c: \$13.78

2-119. **a:** The graph will be a circle with a center at (5, 8) and a radius of 7.

b: See graph at right.



2-120. See graph at right.



a: $y = 2x^2 - 4x + 6$

b: There is no difference, but the explanations vary.

c: $y = x^2$

d: $y = x^2$

2-121. **a:** 30° **b:** 22.6°

2-122. Answers will vary.

2-123. **a:** $x = 14$ **b:** $x = \frac{-5 \pm 4i\sqrt{6}}{11}$

Lesson 2.2.5 Day 2

2-124. **a:** 254,000 people/year **b:** 1,574,000 people/year **c:** 1960 to 2010

2-125. **a:** Tables or graphs should be the same.

b: See sample work at right.

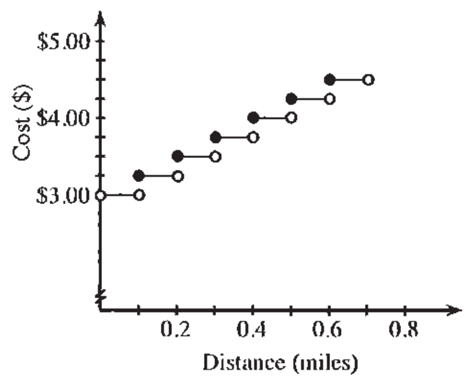
c: Students could point out that the a ends up being the coefficient of x^2 after the binomial is squared.

$$y = 3(x-1)^2 - 5$$
$$y = 3(x^2 - 2x + 1) - 5$$
$$y = 3x^2 - 6x + 3 - 5$$
$$y = 3x^2 - 6x - 2$$

2-126. **a:** $6\sqrt{x} + 3\sqrt{y}$ **b:** 32

c: 5 **d:** $\frac{\sqrt{3}}{2}$

2-127. See graph at right. The domain is all positive numbers (or $x > 0$). The range is all real numbers 3 or greater that are multiples of 0.25.



2-128. **a:** $x = -2$ or 3 **b:** $x = \frac{12 \pm \sqrt{304}}{10} = \frac{6 \pm 2\sqrt{19}}{5} \approx -0.54$ or 2.94

c: $x = -4 \pm 2i$ **d:** $y = -\frac{3}{2}$ or 4

2-129. See graph at right.

a: $y = 2x$: $(0, 0)$; $y = -\frac{1}{2}x + 6$: $(0, 6), (12, 0)$

b: It should be a triangle with vertices $(0, 0)$, $(12, 0)$, and $(2.4, 4.8)$.

c: Domain $0 \le x \le 12$; Range $0 \le y \le 4.8$

d: $A = \frac{1}{2}(12)(4.8) = 28.8$ square units

2-130. **a:** 4 **b:** –30 **c:** 12

d: $-2\frac{1}{4}$ **e:** $x = -4, \frac{1}{3}$

Lesson 2.3.1

2-136. Hannah is correct. $4(x-3)^2-29=4x^2-24x+7$ and $4(x-3)^2-2=4x^2-24x+34$

2-137. **a:** $y=2(x-2)^2-2$, vertex $(2,-1)$, line of symmetry $x=2$

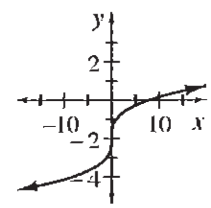
b: $y=5(x-1)^2-12$, vertex $(1,-12)$, line of symmetry $x=1$

2-138. Answers vary. Show that $f(x)=f(-x)$ in each of the representations.

2-139. Maximum profit is \$25 dollars per day for either company. To expect a maximum profit, Math Starz will sell their apps for \$5, which is less than the \$8 sales price that Comet Math sets to expect a maximum profit.

2-140. This is a scalene triangle, because the sides have lengths $\sqrt{29}\approx 5.39$, $\sqrt{17}\approx 4.12$, and $\sqrt{20}=2\sqrt{5}\approx 4.47$.

2-141. See graph at right. Answers vary. The intercepts are $(0,-2)$ and $(8,0)$. Domain: all real numbers; Range: all real numbers



2-142. **a:** No, incorrect vertex order.

b: Yes, by SAS $\cong$.

c: No, incorrect vertex order.

d: Yes, congruent parts of congruent triangles are congruent.