Chapter 6

Running on Empty: MODELING AND STATISTICAL ANALYSIS

RE-4. Hopefully students will see that since the dashed line is parallel to the model line, the equations will be the same except for a positive vertical shift.

RE-7. The equation will be the same except for a negative vertical shift.

RE-8. a) $x(x + y)(x – y)$ b) $x(x^2 + y^2)$ c) $-4y^2(x^2 + y^2)^{1/2}$

RE-9. $x = \frac{11 \pm \sqrt{201}}{4}$

RE-10. $\tan^{1} 2$ 1.107 radians (63.435˚) or 2.034 radians (116.565˚)

RE-11. a) Exponential is reasonable if it really grows faster and faster. Linear fits well for this data but it does not fit her hypothesis.

b) $y = 12\left(\frac{15}{12}\right)^x$, with x = number of days since Monday.

c) Perfect on Monday and Tuesday; 29.3 instead of 29 on Friday. It fits quite well.

d) The following Wednesday night or Thursday early morning.
Y = 100 when x = 9.502.

RE-12. a) impossible b) -3 c) 1.230...
d) $\frac{3}{4}$ e) $\frac{1}{8}$ f) -1.7645

RE-13. $\frac{2}{\sin^2}$ RE-15. 0, 24, $a(a + 1)(a – 1)$ or $a^3 – a$, $t^3 – 6t^2 + 11t – 6$

RE-16. a) $\frac{1}{2}$ b) $1 \pm \sqrt{21}$

RE-17. a) T = 0.0725P b) 0.0725

RE-18. $f(x) = \frac{3}{4}x^2, \frac{27}{4}$ RE-19. $f(x) = \frac{0.318}{\sqrt[3]{x}}$, -0.123

RE-20. Texas grapefruit is 8 times as big, but only costs 7 times as much.

RE-21. a) $A(d) = \frac{k}{d^2}$ b) It decreases to $\frac{1}{9}$ as much.

RE-22. a) $S(r) = kr^2$ b) k = 4 , SA = 36

RE-23. a) $V = \frac{3}{4}r^2$ b) $\frac{75}{4}$ cubic inches

RE-24. $1352; the area of the living room will be four times the area of Euclid's room and therefore will cost four times as much.

RE-25. a) $y = \frac{2}{x^2\ 3}$ b) $-\frac{1}{3}$, -2, $\frac{8}{11}$, $\frac{2a^2}{1\ 3a^2}$

RE-26. a) $49 - 70\cos + 25\cos^2$ b) $1 + \sin 2$

RE-27. a) $y = 2\sin(x + \frac{}{2})$, $2\cos x$
b) $y = -3 - \sin x$. Other possible answers include $y = -3 + \sin(x -)$ and $y = -3 - \cos(x - \frac{}{2})$.

RE-28. a) $y = 5(2)^x$ b) $y = 5(2^{(x-1)})$ c) $y = 3.5356(1.1225)^x$

RE-29. They should be 37.5 ft wide and 50 ft long. RE-30. -3 x 1

RE-31. a) $\frac{1}{25}\Diamond 5^x$ b) $5\cdot 3^x$ c) $216\cdot 6^x$

RE-32. a) $9v^6w^2$ b) $\frac{d^6}{4c^2}$ c) $\frac{3r}{2s^5}$

RE-33. b) It should go through the origin. c) parabolic
d) Since the area = r^2, the weight should be related to the square of the diameter.
e) $\sqrt{y} = x\sqrt{a}$; right side is linear g) $\sqrt{y} = 0.198x$ h) $y = 0.0392x^2$
i) The model is 50.8, which is very close to the data.

RE-34. $7.84 per lid, costing a total of $784.

RE-36. He could test by graphing both equations, by substituting a number into both or by doing the algebra. His equations are not the same.

RE-37. a) 769.0
b) This would give point values less than zero which are not possible.
c) Jordan, Rodman, or Haley would be reasonable answers.

RE-38. b) all real numbers

RE-39. a) $2 - 2\cos$ b) 4

RE-40 a) $x \geq \frac{9}{4}$ b) $-14 < x < 14$

RE-42. a) $y = \frac{7}{x+6}$ b) $\frac{7}{3}, \frac{7}{6}, \frac{21}{19}, \frac{7a}{1+6a}$

RE-43. a) $x = \log_{1.03} 2$ 23.450 b) same as (a)

RE-43. Solve for x.

RE-44. a) $32p^{36}$ b) $\frac{5y^8}{16x^{14}}$ c) $b^{(2+2n)}$

RE-45. c) $y = 1.883x - 18.694$ d) $y = 0.0392x^2 - 0.00195x + 0.035$
f) (20, 15.71) (40, 62.81)
g) The coefficient of x^2 is correct to three decimal places; the other coefficients are almost small enough to ignore.

RE-46. a) $x \geq 3$, $[3, \bullet)$ b) $x > -\frac{18}{13}$, $(-\frac{18}{13}, \bullet)$

RE-47. a) $(-\bullet, -6]$ $[1, \bullet)$, $-\bullet < x$ -6 or 1 $x < \bullet$
b) $-3 < x < \frac{3}{2}$, $(-3, \frac{3}{2})$

RE-48. a) 35 years b) 14 years c) 10 years d) 7 years
e) The number of years to double is close to 70 divided by the annual percent growth rate.

RE-49 a) [1, 6], 1 x 6 b) $(-\bullet, -3)$ $(1, 2), -\bullet < x < -3$ or $1 < x < 2$

RE-50. a) $\frac{x^2+y^2}{2}$ b) $2x^3(x-2)$ RE-51. $x = \pm 2$ RE-52. $5 + 4 \sin$

RE-53. Calculation:
i) 2.059 ii) 3.322 iii) -5.907 iv) 0.396

RE-54. $x = 10.125$ RE-55. $K > \frac{25}{16}$

RE-56. a) $2q^{-12}$ b) $80x^2y^{16}$ c) b^{4n}

RE-57. a) $x = 0.528$ b) $x = 0.732$

RE-58. a) $\sqrt{68}$ or $2\sqrt{17}$ b) $y + 3 = 4x$, $y - 5 = 4(x - 2)$

RE-59. a) $y = 0.136x + 1.56$ b) $y = 0.134x + 1.66$
c) New Med-Med line is $y = 0.098x + 4.70$;
new regression line is $y = 0.064x + 7.49$

RE-60. a) $r = 1$ RE-61. $r = -1$ when the slope is negative.

RE-62. a) third point on line AB b) points on line AB
c) The points lie on a line with negative slope.

RE-64. a) ? = a + b b) ? = ab c) ? = -a d) ? = $\frac{a}{b}$

RE-65. a) $y = 81 \cdot 3^x$, c = 81, d = 3 b) $y = 16^x$, c = 1, d = 16
c) $y = 5 \cdot 25^x$, c = 5, d = 25 d) $y = 199.5 \cdot 31.6^x$, c = 199.5, d = 31.6

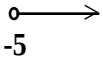
RE-66. a) $y = \frac{11}{2}\sqrt{x}$ b) 0, 11, $11\sqrt{2}$, $\frac{11|a|}{2}$

RE-67. $\frac{1 \pm \cos}{\sin}$ . . . csc – cot or tan $\frac{}{2}$

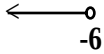
RE-69. a) Could be $y = x^n$ where n = any positive even integer—an infinite number of possibilities.
b) $y = 3(x - 2)^4 - 5$

RE-70. c) $\int_1^5 g(x)\,dx = \int_1^7 f(x)\,dx + 18$ RE-71. 60 miles

RE-72. $y = 35 \cos\left(\frac{x}{40}\right) + 50$

RE-73. a) 

b) 

c) 

d) 

RE-74. 12

RE-75. a) Students should recognize the basic shape of an exponential curve here.
b) 1) $154.138(1.069)^x$ 2) $206.451(1.062)^x$
c) The first equation fits better but it is hard to tell if it is the "best" fit.

RE-76. c) $\log y = 0.0278x + 2.243$ d) $y = 10^{(0.0278x + 2.243)}$
e) $y = 10^{2.243}(10^{0.0278})^x$; $y = 174.985(1.066)^x$
f) 86,189 million barrels

RE-77. 10 ft. by 20 ft. RE-78. sin RE-79. a) $[-\frac{}{5}, \bullet)$ b) $[-\frac{}{2}, 1]$

RE-80. a) $4(3x + y)(3x – y)$ b) $3(2z^2 + w)(2z^2 – w)$

RE-81. a) $x + y + z = 10$ b) $3(2z^2 + w)(2z^2 – w)$ RE-82. 3.399

RE-83. a) 4 and 5 should be multiplied, not added. $\log 4 + \log 5 = \log 20$
b) Base should not change. $\log_3 7 + \log_3 7 = \log_3 49$
c) Log of a product is the SUM of the logs. $\log (4 \cdot 5) = \log 4 + \log 5$
d) No rule for $\log (4 + 5)$

RE-84. 1465.74 square feet

RE-85. Abdul forgot the negative sign for cosine. sin $= \frac{\sqrt{21}}{5}$

RE-86. a) \$22.00 RE-87. n RE-88. a) $\frac{}{6}, \frac{5}{6}$ b) 0 + n

RE-89. b) total oil produced c) It will all be produced sometime in 2003.

RE-90. a) no b) linear c) $y = 292.679x – 4695.143$

RE-91. a) 1497.6 billion barrels or 1,497,600 MBBL = 1.4976×10^{12} barrels.
b) 19,304 million barrels c) $292.679x + 19,304.51$
d) $0.5x(19304.5 + 292.68x + 19304.5) = 146.34x^2 + 19304.5x$
e) about 54.8 years or towards the end of 2036

RE-92. a) 3 b) 257 c) 8 d) 25 e) x^2 f) $10x^3$

RE-93. a) $x < 1$ or $3 < x < 5$ b) $-3 < x < 5$

RE-94. a) $d = 0.2f$ b) 15 pounds

RE-95. a) $\sin^2$ b) sin c) 2

RE-96. a) 41.8°, 138.2° b) 45°, 135°, 225°, 315° c) 180°

RE-97. a) $f^{-1}(x) = 5 – x^3$ RE-98. a) $\frac{2}{3}$ b) $\frac{5}{8}$

RE-99. a) $(x + y)(m + x + y)$ b) $(c + a – b)(c – a + b)$
c) $(a – 2)(a^2 + 2a + 4)$ d) $x(x + 5)^2$

RE-100. a) $y = \frac{k_1}{x^3}$, $x = \frac{k_2 z^2}{w}$ b) $y = \frac{k_3 w^3}{z^6}$
c) y varies directly with the cube of w and inversely with the sixth power of z.
d) $y = \frac{135w^3}{z^6}$

RE-101. b) y = 0.066x – 12.504; the correlation factor is 0.988, which would look like a good fit.

RE-102. c) No, because the result is not a line. The curve was not straightened.

RE-103. a) Changed to exponent form or did the inverse of log. b) $x^{a+b} = x^a \cdot x^b$
c) a log x = log x^a d) 10^x and log x are inverses so $10^{\log x} = x$

RE-104. a) $[-2, \frac{10}{3}]$ b) $(-\infty, -1)$ $(4, \infty)$

RE-105. a) k = 4, when x = 0, y = k b) $y = 10 \cdot x^{1.5} + 4$ c) 1254

RE-106. $y = \frac{k}{x^3}$ RE-107. The model is a good fit and it has a negative slope.

RE-108. $186.2(0.1479)^x$

RE-109. Change window; zoom feature; trace and look at coordinates.

RE-110. a) It's a hemisphere
b) A quarter of a sphere, like an orange wedge
c) An eighth of a sphere

RE-111. a) One is a number, and one is an argument. b) cos is a constant

RE-112. b) m = log d and b = log c c) $10^m = d$ and $10^b = c$

RE-113. $p^w = k$ RE-114. $\log_c z = j$ RE-115. 600 miles

RE-116. c) slope = d and y-intercept = log c

RE-117. b) y = 1.4999x – 2.95 or log y = 1.4999 log x – 2.95 c) Yes. r = 0.99999
d) log c = -2.95, d = 1.5. Equation: $y = 0.00112x^{1.5}$

RE-118. 418.3 Earth years RE-119. a) 2x – 3y = -14 b) y = 2x + 8

RE-120. a) $y = \frac{3 \pm i\sqrt{3}}{2}$ b) $y = \frac{i \pm i\sqrt{13}}{2}$ RE-121. a RE-122. -sin

RE-124. a) $x^2 + 2xy + y^2$ b) Cannot be simplified c) $\frac{3}{w^2}$ d) $\frac{ab}{a+b}$

RE-125. a) $\frac{\sqrt{3}}{2}$ b) $-\frac{\sqrt{2}}{2}$ c) $\sqrt{3}$ d) undefined

RE-126. a) 2 b) 4 c) 5 d) 3 e) 1

RE-127. a) 5 b) 128 c) $x < -9$

RE-128. $-17 - 2i$ RE-130. $y = 4x^{-2}$ RE-131. $y = 3(1.1)^x$

RE-135. $y = 5(0.803)^x - 5$ RE-136. a) about \$225.37 b) $y = 200(1.01)^x$ where x = months since May and y = total owed

RE-137. a) exponential b) It is equivalent to a vertical stretch.
c) Because of room temperature, assuming the room she is in isn't freezing.
d) $y = 84.843(0.973^x) + 68$

RE-138. a) $\frac{3x+1}{2}$ b) $x^2 + 4$

RE-139. $y = \frac{1}{x^2} - 4$, with asymptotes $x = 0$ and $y = -4$ RE-140. $\sum_{n=1}^{72} 1.5 + 0.5n$

RE-141. a) $\log_5 3$ b) $\log 60 - \log 17$
c) Log laws don't help. Logs are being divided, not subtracted.
(The change of base law will help, but we haven't done it yet.)
d) Impossible. Arguments are being subtracted, not divided. (log 8 is correct, but no log law is used.) e) Impossible. Bases are different.
f) $\log_3 625$ g) $\log 18 - \log 7$ i) $\log 700$

RE-142. 2 is the period of $y = \cos x$, so shifting it 2 left lines up the graphs perfectly.

RE-144. a) $\frac{P}{n}$ b) $\frac{c}{n}$ c) $\boxed{\frac{p}{c}}$ d) $\frac{c}{p}$ e) $\frac{n}{c}$ f) $\frac{n}{p}$

