

Solution to Chapter 11

Section 11.1

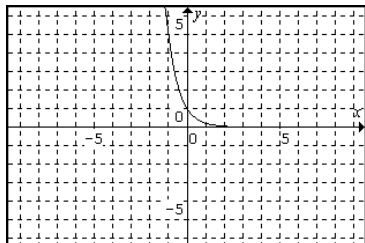
1. $4; \frac{1}{2}; 1; \frac{1}{16}$ 3. $4; \frac{1}{4}; \frac{1}{16}; 1$ 5. $-6; -26; -2; -\frac{26}{25}$ 7. $7.389; 2.718; 1; 0.368$

9. $1.718; 53.598; -0.632; 147.413$ 11. $-0.368; -1; -1; -20.086$ 13. $1; 1.259; 0.050; 316.228$

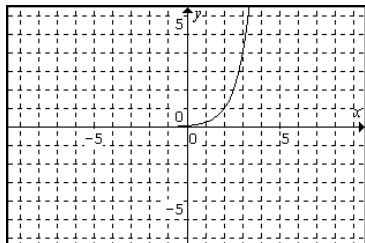
15. $f(t) = 2^{t+1}$ 17. $f(x-1) = 2^x$ 19. $g(x+a) = 5^{2x+2a-1}$ 21. $(g \circ h)(x) = 5^{2x^2+14x-1}$

23. $(h \circ f)(x) = 2^{2x+2} + 7 \cdot 2^{x+1}$ 25. $(g \circ f)(x) = 5^{2^{x+2}} - 1$

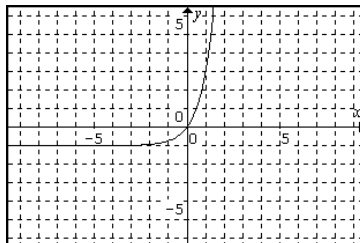
27.



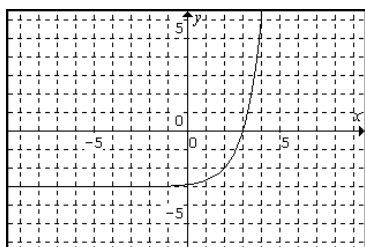
29.



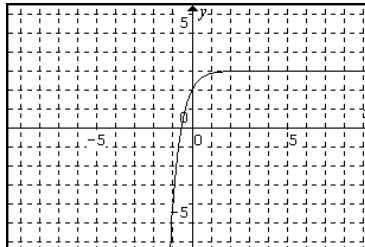
31.



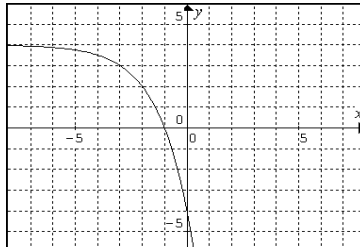
33.



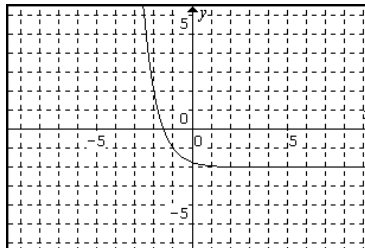
35.



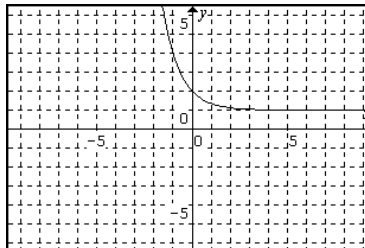
37.



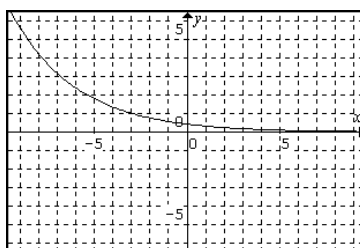
39.



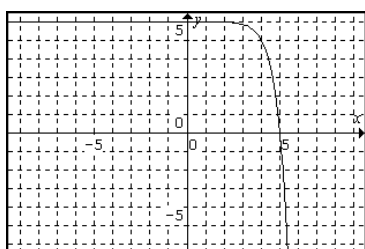
41.



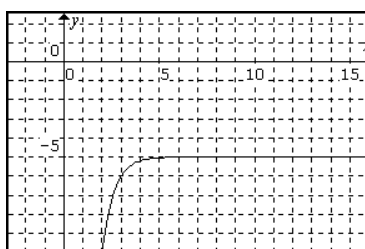
43.



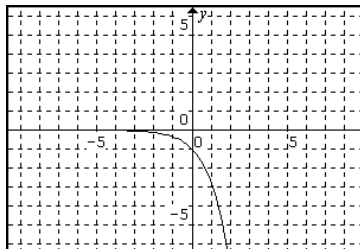
45.



47.



49.



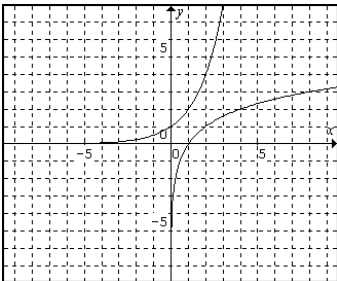
51. \$3266.71 53. 5.8% account compounded quarterly 55. Jordan 57. 2.2% account; \$9.70 more
 59. 73.2% 61. \$5553.78 63. 1616 bacteria; 1667 bacteria 65. 20 spiders; 22 spiders; 74 spiders
 67. 55 g; 0.76 g

Section 11.2

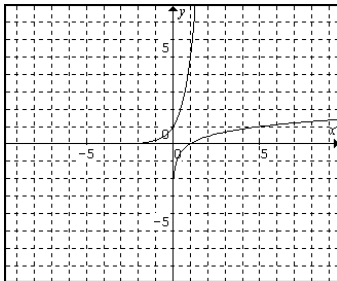
- 1.** 2 **3.** 1 **5.** 3 **7.** 3 **9.** 0 **11.** 2 **13.** 2 **15.** 3 **17.** 3 **19.** 20 **21.** $\frac{1}{2}$ **23.** $\frac{1}{3}$ **25.** $\frac{1}{2}$ **27.** $\frac{1}{3}$
29. 0 **31.** $\frac{1}{4}$ **33.** 0 **35.** 3 **37.** 5 **39.** $-\frac{1}{4}$ **41.** $\frac{7}{12}$ **43.** 8 **45.** 1 **47.** 64 **49.** 216 **51.** 3
53. 2 **55.** $\frac{1}{27}$ **57.** 1 **59.** $\frac{1}{8}$ **61.** $\frac{1}{36}$ **63.** $\frac{9}{4}$ **65.** 125 **67.** 1.099 **69.** 1.114 **71.** -2.638
73. 1.224 **75.** -0.921 **77.** 1.653 **79.** 1,000,000 **81.** $e^6 \approx 403.429$ **83.** 10^{-56} **85.** $e^{-0.36} \approx 0.698$
87. $\frac{\ln 5}{\ln 7} \approx 0.827$ **89.** $\frac{\ln 47}{\ln 3} \approx 3.505$ **91.** $\frac{\ln 7}{\ln 13} \approx 0.759$ **93.** $\frac{\ln 22}{\ln 12} \approx 1.244$ **95.** $\frac{\ln 643}{\ln 7} \approx 3.323$
97. $\frac{\ln 36}{\ln 9} \approx 1.631$ **99.** $\frac{\ln 0.05}{\ln 5} \approx -1.861$ **101.** $\frac{\ln 4.7}{\ln 3.1} \approx 1.368$ **103.** $\frac{\ln 1.7}{\ln 1.3} \approx 2.022$
105. $\frac{\ln 6}{\ln(\frac{1}{2})} \approx -2.585$ **107.** $\frac{\ln(\frac{1}{7})}{\ln(\frac{2}{3})} \approx 4.799$ **109.** $\frac{1}{\ln(\frac{1}{3})} \approx -0.910$ **111.** $\frac{\ln(6.837)}{\ln(1.00034)} \approx 5654.929$
113. $\frac{\ln(3.6573)}{\ln(1.0009957)} \approx 1302.973$ **115.** $\frac{\ln(\frac{1}{3} + e)}{\ln 6} \approx 0.623$ **117.** $\frac{\ln(\ln 3 + 6)}{\ln 3} \approx 1.784$
119. $\log\left(\ln\left(\frac{\ln 15}{\ln 4}\right)\right) \approx -0.174$ **121.** 2 **123.** 0 **125.** 1 **127.** $\log_3(a - b - 1)$ **129.** $\log_2(x + h)$
131. $\ln(x + h + 3)$ **133.** $\log_3(\log_2 x - 1)$

Section 11.3

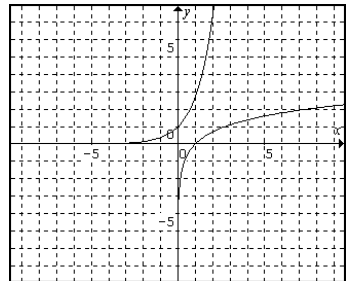
1.



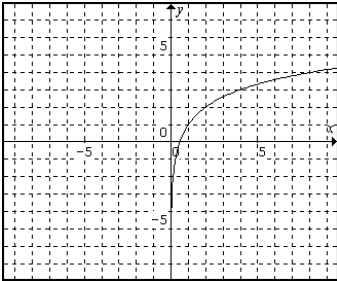
3.



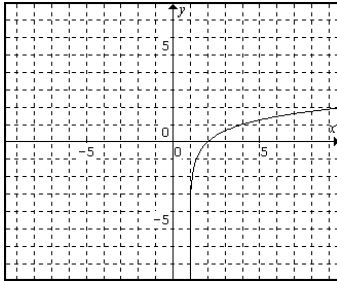
5.



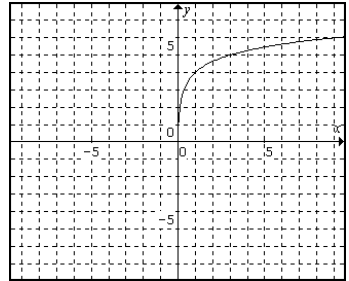
7.



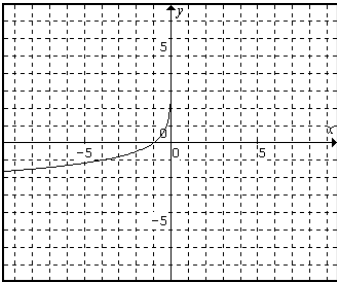
9.



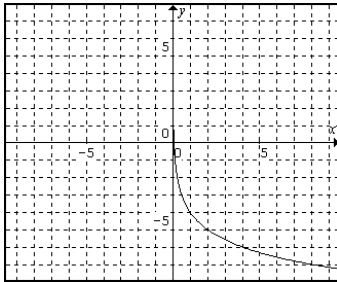
11.



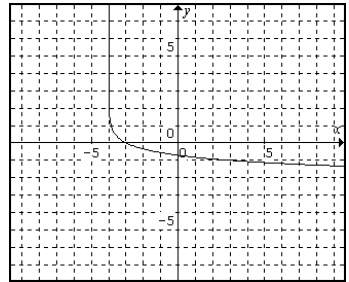
13.



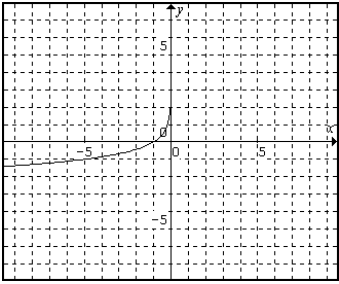
15.



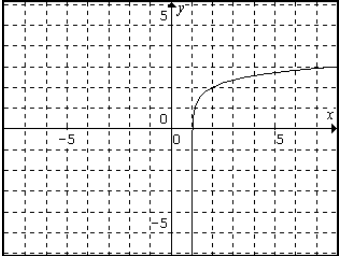
17.



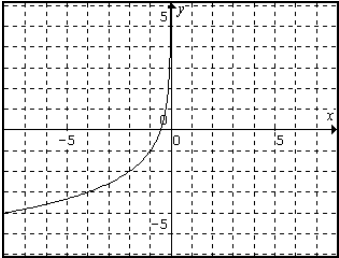
19.



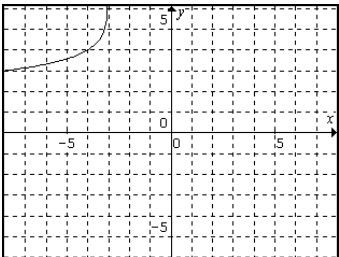
25.



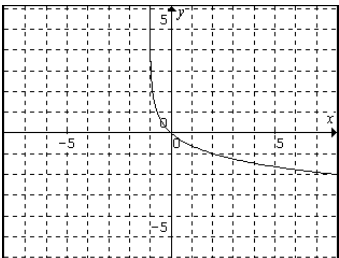
31.



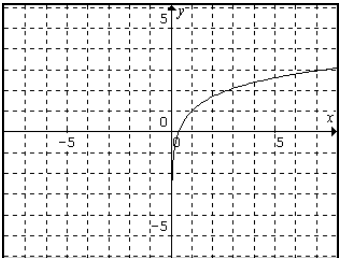
37.



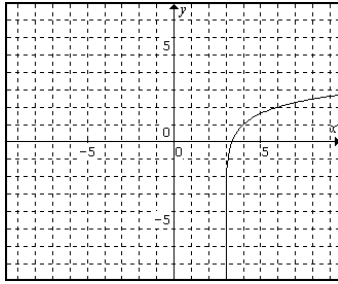
43.



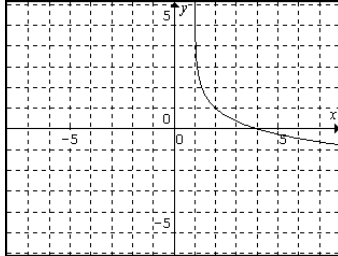
49.



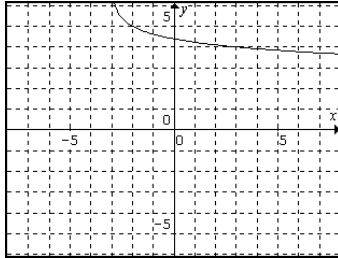
21.



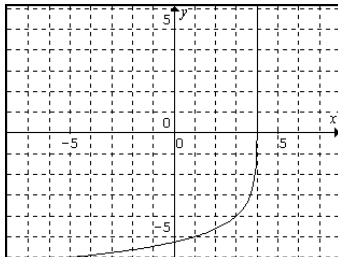
27.



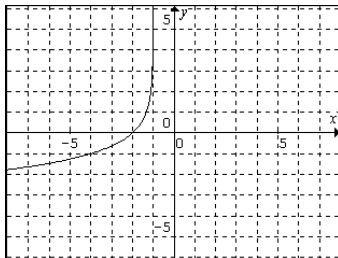
33.



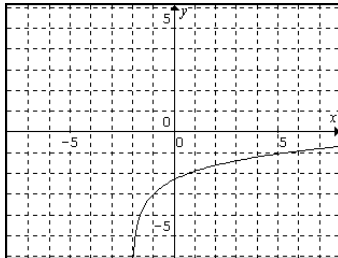
39.



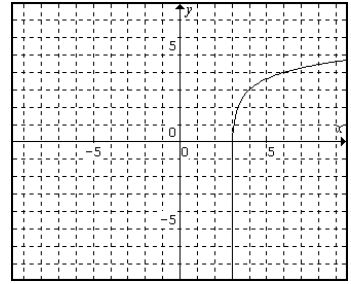
45.



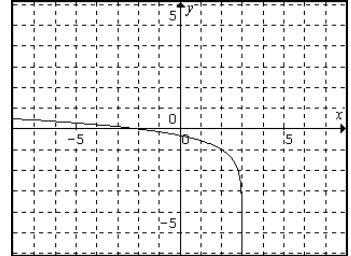
51.



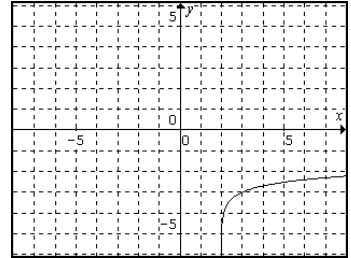
23.



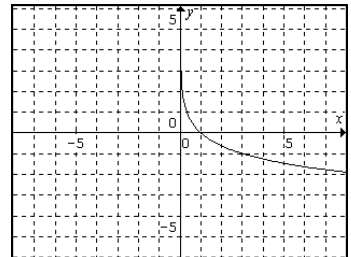
29.



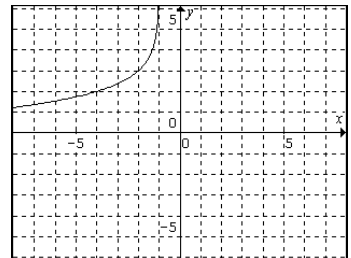
35.



41.



47.



Section 11.4

1. $\log_2 xy$ 3. $\log_5 v^3$ 5. $\ln\left(\frac{x}{y}\right)$ 7. $\log_4(p^2(q+1))$ 9. $\ln\left(\frac{x}{y^4}\right)$ 11. $\log_5(b^4c^2)$ 13. $\log_2\left(\frac{3(x+4)}{y}\right)$
 15. $\ln(x^2y^3z)$ 17. $\log_7\left(\frac{nt^2}{81}\right)$ 19. $\log_2\left(\frac{\sqrt{x}}{(y+1)^2}\right)$ 21. $\ln\left(\frac{\sqrt[3]{x-y}}{y^3}\right)$ 23. $\log_2\left(\frac{m^2\sqrt[3]{n}}{l^6}\right)$ 25. $\ln\left(\sqrt{\frac{xy}{z}}\right)$
 27. $\log_3\left(\frac{l^3\sqrt[3]{w}}{h^2}\right)$ 29. $\log_5\left(\frac{(p+q)^4}{r(q-r)}\right)$ 31. $\log_4\left(\frac{\sqrt[3]{5(x+y)}}{49}\right)$ 33. $\log_4\left(\frac{\sqrt[3]{xy}}{a^2b^2}\right)$ 35. $\log_2\left(\frac{m^8\sqrt[3]{x}}{n^2}\right)$ 37. $\ln\left(\frac{y\sqrt{xy}}{\sqrt[3]{z}}\right)$
 39. $\ln\left(\frac{(a+1)(d-2)^3}{(c+2)^3\sqrt[3]{b-1}}\right)$ 41. $\log_2 x + \log_2 y$ 43. $3\log_4 x$ 45. $\ln x - \ln y$ 47. $2\log_5 x + \log_5 y$
 49. $\ln x - 2\ln y$ 51. $\log_3 u + 2\log_3 v - \log_3 w$ 53. $\log_7 x - \log_7 y - \log_7 z$ 55. $\frac{1}{2}\log_2(x+y)$
 57. $\ln x + \frac{1}{2}\ln y$ 59. $\log_3 u + \frac{1}{2}\log_3 v - 2\log_3 w$ 61. $\frac{1}{3}\log_4 x + \frac{1}{3}\log_4 y - \log_4 z$
 63. $\frac{1}{3}(\ln x + \ln y - \ln a - \ln b)$ 65. $1 - \frac{1}{2}\log_3(x+1)$ 67. $2 + \log_4 u + \log_4(u+v)$ 69. $\log_2(x+1) - \frac{1}{3}$
 71. $\frac{1}{2} + \frac{1}{2}\ln(x+1)$ 73. $3 + 2\log_6(x+h)$ 75. $2\ln(x-1)$ 77. $1 + \ln(x+2) + \ln(x-2)$
 79. $2\log_2(x-1) - 4$ 81. $a+b$ 83. $3a+c$ 85. $\frac{1}{2}a - 3b - c$ 87. 2.808 89. -2.022

Section 11.5

1. $x = \frac{\ln 5}{\ln 2} \approx 2.322$ 3. $x = 81$ 5. $x = \frac{\ln 6}{\ln 7} - 1 \approx -0.0792$ 7. $x = e^6 - 3 \approx 400.4$ 9. $x = \frac{\ln 6}{7} \approx 0.256$
 11. $x = e^{-2} + 2 \approx 2.135$ 13. $x = \frac{\ln 2}{\ln(0.1)} \approx -0.3010$ 15. $x = \frac{e-3}{2} \approx -0.1409$ 17. $x = \frac{e^3-3}{2} \approx 8.543$
 19. $x = \frac{\ln(17/5)}{3\ln 2} \approx 0.589$ 21. $x = \ln(12) \approx 2.485$ 23. $x = \ln\left(\frac{27}{2}\right) \approx 2.603$ 25. $t = \frac{\ln\left(\frac{2}{41}\right)}{12\ln(1.05)} \approx -5.159$
 27. $t = \frac{\ln 3}{2\ln(1.0275)} \approx 20.25$ 29. $x = e^2 - 1 \approx 6.389$ 31. No Solution 33. $x = \frac{\ln 12}{3\ln 6} \approx 0.462$
 35. $x = e^{-\frac{3}{2}} - 1 \approx -0.777$ 37. $x = 999$ 39. $x = 3$ 41. $x = 3$ 43. $x = 7$ 45. $t = \frac{\ln 2}{-2} \approx -0.3466$
 47. $x = e^{18} \approx 65659969$ 49. $x = 2\ln(75) \approx 8.635$ 51. $x = 2$ 53. $x = 1 + \sqrt{1+e} \approx 2.928$
 55. $x = \frac{1}{2}$ 57. $x = \frac{-1+\sqrt{5}}{2} \approx 0.618$ 59. $x = \ln 5 \approx 1.609$ 61. $x = 3$ 63. $x = \frac{1+e^2}{e^2-1} \approx 1.313$
 65. $x = \frac{1+\sqrt{33}}{2} \approx 3.372$ 67. x-int: (0,0); y-int: (0,0) 69. no x-int; y-int: (0,3e) \approx (0,8.155)
 71. x-int: $\left(\frac{\ln\left(\frac{3}{4}\right)}{\ln 7}, 0\right) \approx (-0.1478, 0)$; y-int: (0,1) 73. x-int: (1.992,0); y-int:
 (0, $-\log_5 2 - 3$) \approx (0, -3.431)
 75. $f^{-1}(x) = \log_3(x+1)$ 77. $f^{-1}(x) = 3^x - 1$ 79. $f^{-1}(x) = \log_5(x-3) + 4$ 81. $f^{-1}(x) = \frac{1}{3}e^{-(x+4)}$
 83. $t = \frac{\ln\left(\frac{A}{P}\right)}{r}$ 85. $k = \frac{\ln\left(\frac{y}{t}\right)}{t}$ 87. $H^+ = 10^{-pH}$ 89. $k = \frac{-\ln\left(\frac{T-T_s}{D}\right)}{t}$ 91. $d = \frac{c-x}{\ln\left(\frac{a-y}{b}\right)}$
 93. $x = b^{\frac{y-k}{a}} + h$

Section 11.6

1. \$8109.31; \$8110.40 3. \$108060.84 5. 7.6% 7. 14.4 years 9. 60.6 years
 11. 5.3% account; 20.8 years 13. $10^{8.6} I_0$ 15. 16 times 17. 7.04 19. 0.0000001 moles/liter
 21. 10,000,000 23. 77dB 25. 1 watt/m² 27. 110 dB 29. 7.9 times
 31. 3.3 g 33. 3352 years 35. 30072 years 37. 0.007 g; 24 days 39. 1.69 g 41. 38.2 years
 43. 98.8% 45. 43.9 years 47. 6.7 million 49. 214 million 51. 11.1 million in 2025; 2047
 53. 4430 people in 2030; 2049 55. 52744 people in 2030; 2027 57. 2.3 hours 59. 2021
 61. 50° 63. 47 minutes 65. 3.7 years 67. 11 days 69. 5.5 min; 13500 ft 71. 86 ft
 73. 65%; 60%; 463 months 75. 405 people; 5.2 hours