

Solution to Chapter 11

Section 11.1

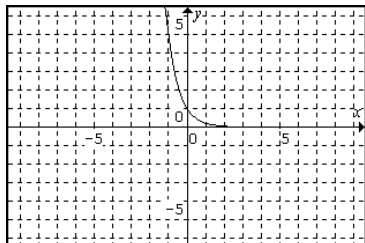
1.  $4; \frac{1}{2}; 1; \frac{1}{16}$     3.  $4; \frac{1}{4}; \frac{1}{16}; 1$     5.  $-6; -26; -2; -\frac{26}{25}$     7.  $7.389; 2.718; 1; 0.368$

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

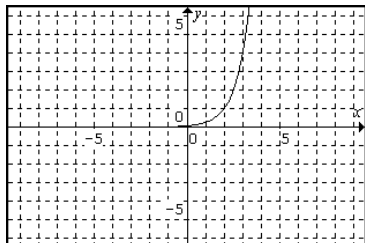
15.  $f(t) = 2^{t+1}$     17.  $f(x-1) = 2^x$     19.  $g(x+h) = 5^{2x+2h-1}$     21.  $(g \circ h)(x) = 5^{2x^2+14x-1}$

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

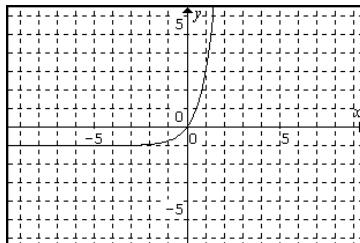
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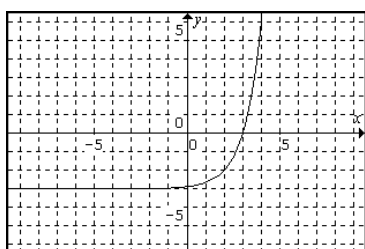
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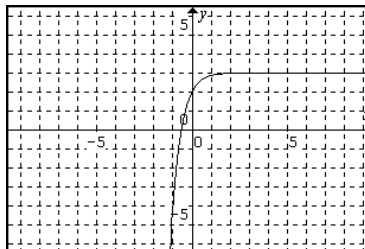
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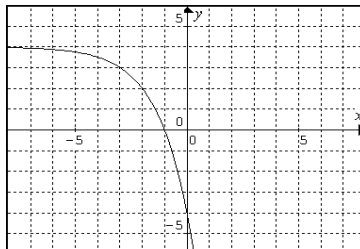
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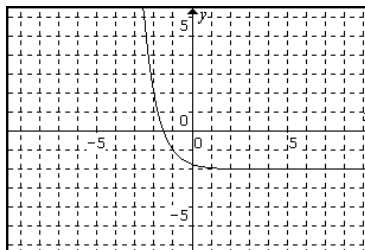
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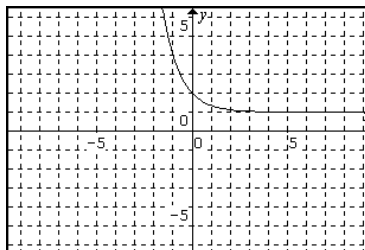
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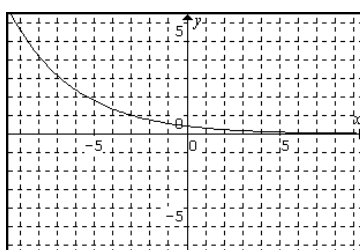
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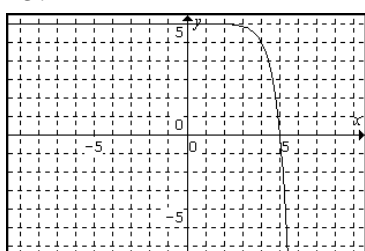
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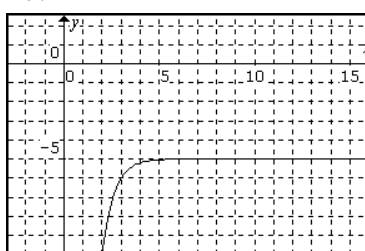
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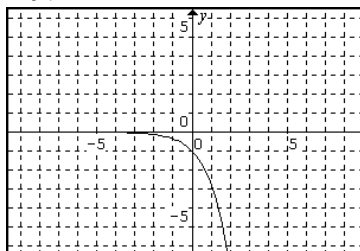
45.



47.



49.



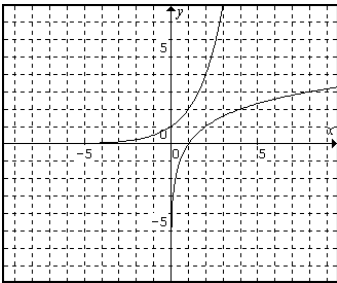
51. \$3266.71    53. 5.8% account compounded quarterly    55. Jordan    57. 2.2% account; \$9.70 more  
 59. 73.2%    61. \$5553.78    63. 1616 bacteria; 1667 bacteria    65. 20 spiders; 22 spiders; 74 spiders  
 67. 55 g; 0.76 g

Section 11.2

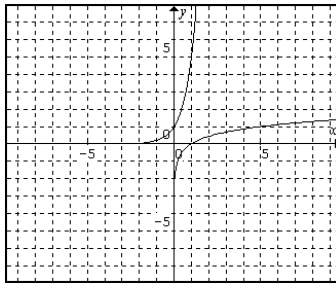
- 1.** 2   **3.** 1   **5.** 3   **7.** 3   **9.** 0   **11.** 2   **13.** 2   **15.** 3   **17.** 3   **19.** 20   **21.**  $\frac{1}{2}$    **23.**  $\frac{1}{3}$    **25.**  $\frac{1}{2}$    **27.**  $\frac{1}{3}$   
**29.** 0   **31.**  $\frac{1}{4}$    **33.** 0   **35.** 3   **37.** 5   **39.**  $-\frac{1}{4}$    **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

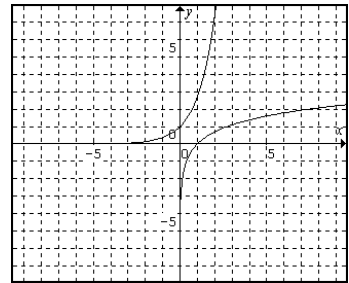
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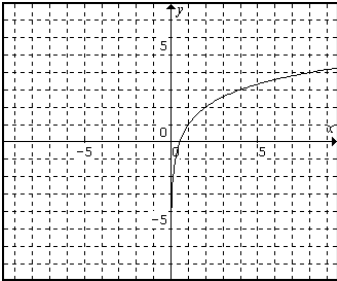
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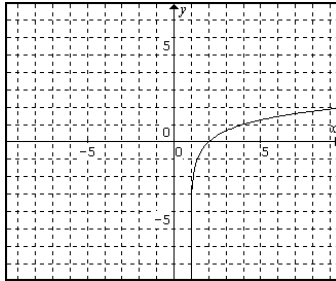
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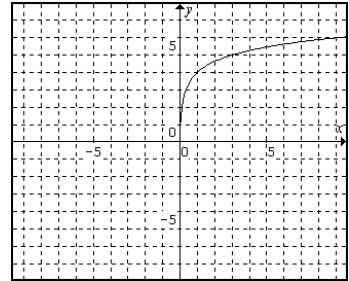
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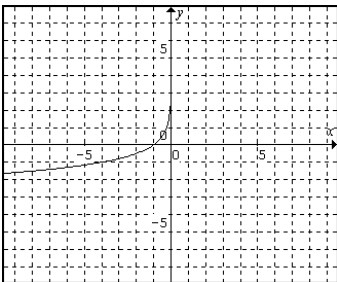
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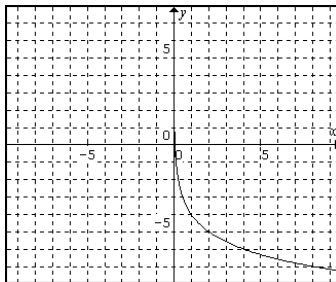
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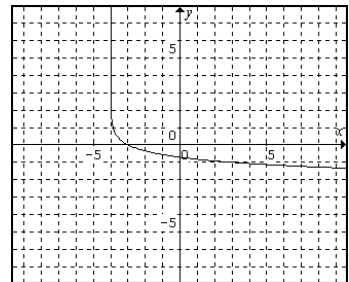
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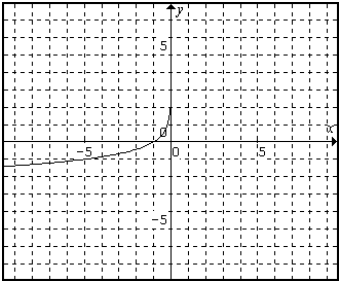
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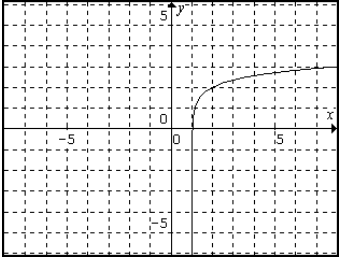
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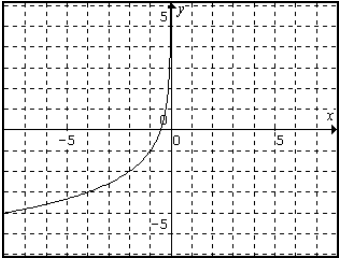
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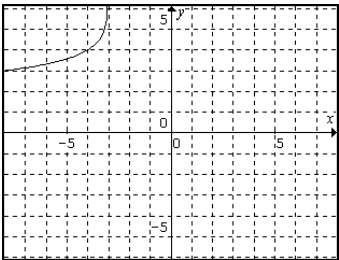
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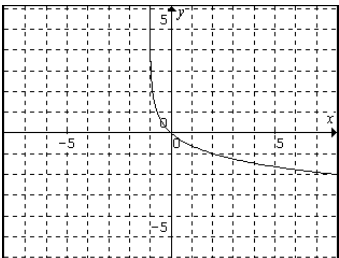
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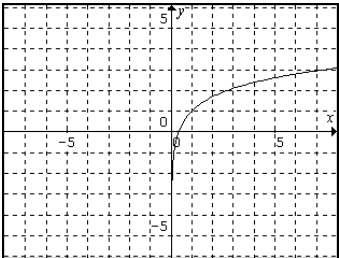
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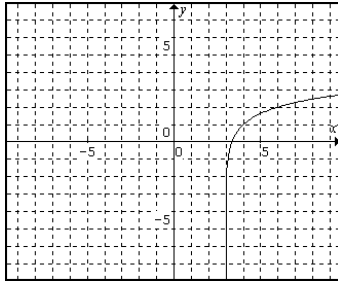
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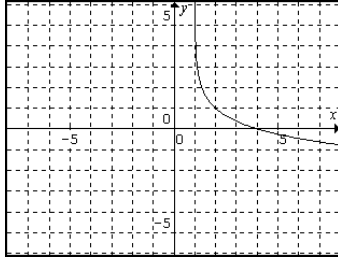
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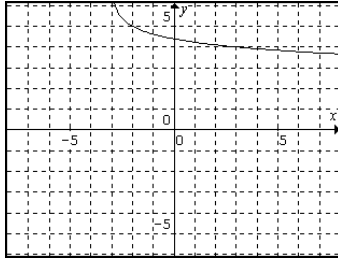
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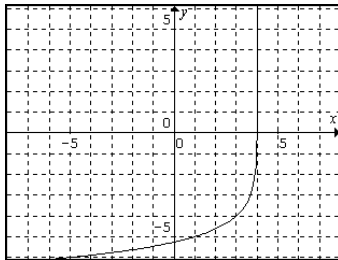
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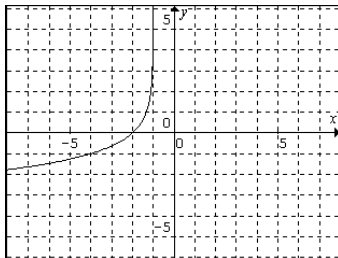
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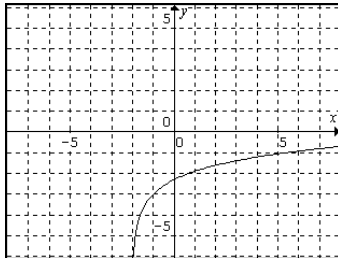
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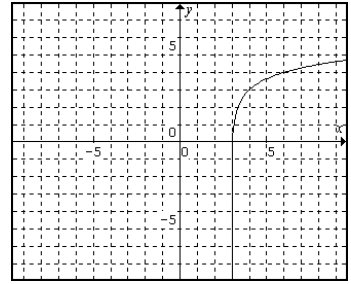
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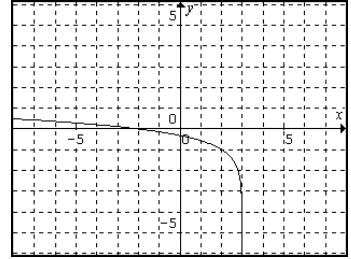
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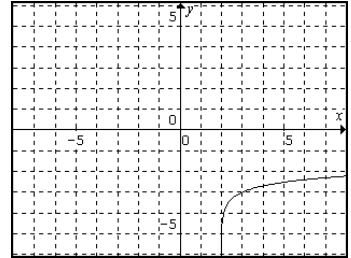
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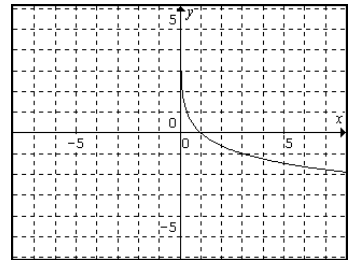
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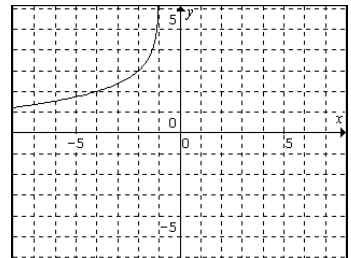
35.



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/m<sup>2</sup> 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 2005; 2027  
 53. 4430 people in 2020; 2039 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