Solution to Chapter 11

Section 11.1

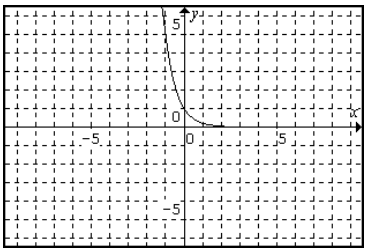
1. 4; $\frac{1}{2}$; 1; $\frac{1}{16}$ **3**. 4; $\frac{1}{4}$; $\frac{1}{16}$; 1 **5**. –6; -26; -2; $-\frac{26}{25}$ **7**. 7.389; 2.718; 1; 0.368

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.



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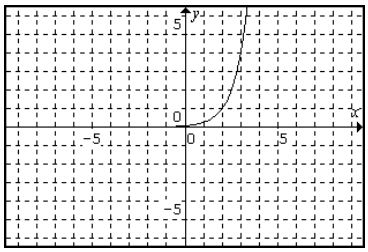

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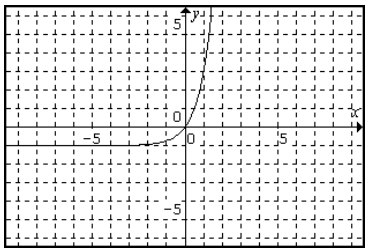

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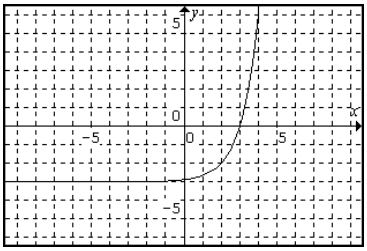

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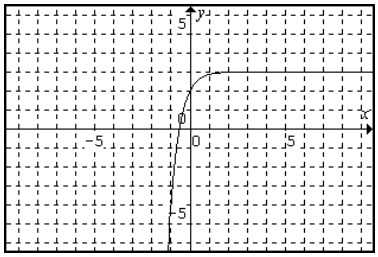

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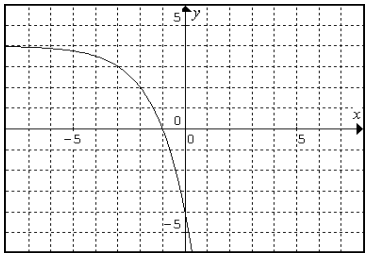

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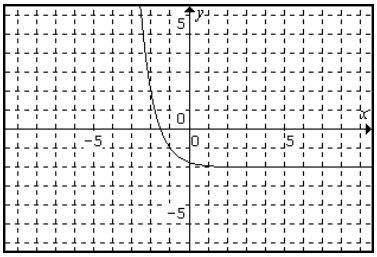

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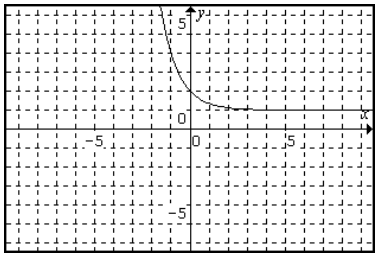

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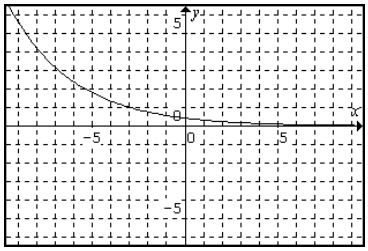

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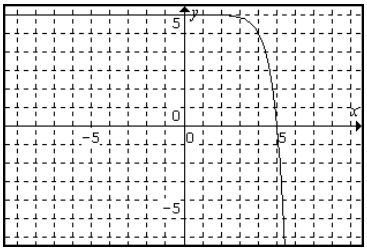

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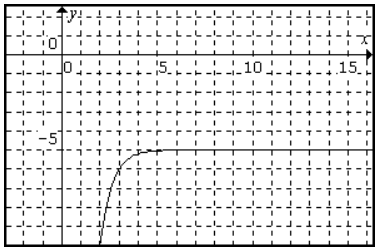

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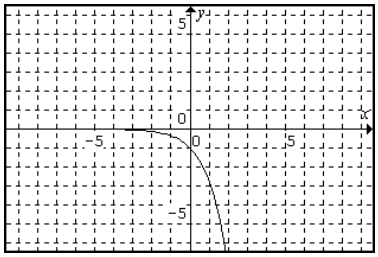


51. $3266.71 **53**. 5.8% account compounded quarterly **55**. Jordan **57**. 2.2% account; $9.70 more

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. $\dfrac{\ln 5}{\ln 7} \approx 0.827$ **89**. $\dfrac{\ln 47}{\ln 3} \approx 3.505$ **91**. $\dfrac{\ln 7}{\ln 13} \approx 0.759$ **93**. $\dfrac{\ln 22}{\ln 12} \approx 1.244$ **95**. $\dfrac{\ln 643}{\ln 7} \approx 3.323$

97. $\dfrac{\ln 36}{\ln 9} \approx 1.631$ **99**. $\dfrac{\ln 0.05}{\ln 5} \approx -1.861$ **101**. $\dfrac{\ln 4.7}{\ln 3.1} \approx 1.368$ **103**. $\dfrac{\ln 1.7}{\ln 1.3} \approx 2.022$

105. $\dfrac{\ln 6}{\ln\left(\frac{1}{2}\right)} \approx -2.585$ **107**. $\dfrac{\ln\left(\frac{1}{7}\right)}{\ln\left(\frac{2}{3}\right)} \approx 4.799$ **109**. $\dfrac{1}{\ln\left(\frac{1}{3}\right)} \approx -0.910$ **111**. $\dfrac{\ln(6.837)}{\ln(1.00034)} \approx 5654.929$

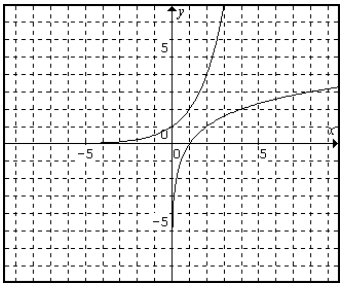
113. $\dfrac{\ln(3.6573)}{\ln(1.0009957)} \approx 1302.973$ **115**. $\dfrac{\ln\left(\frac{1}{3}+e\right)}{\ln 6} \approx 0.623$ **117**. $\dfrac{\ln(\ln 3+6)}{\ln 3} \approx 1.784$

119. $\log\left(\ln\left(\dfrac{\ln 15}{\ln 4}\right)\right) \approx -0.174$ **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.



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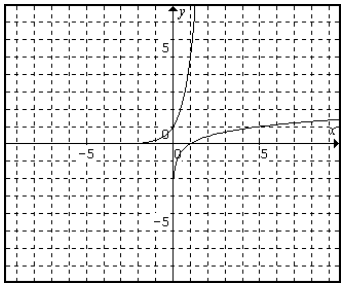

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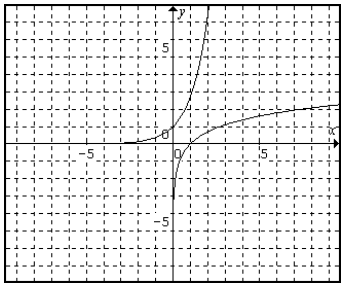

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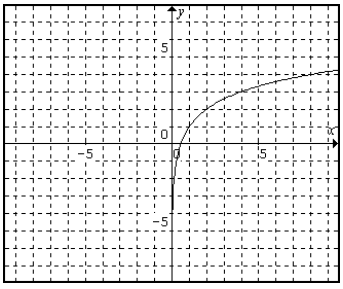

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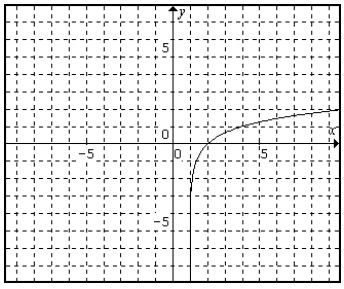

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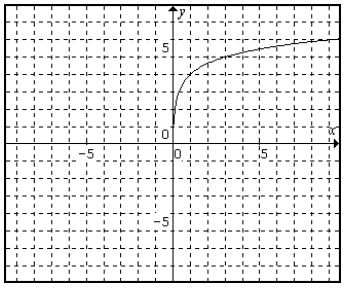

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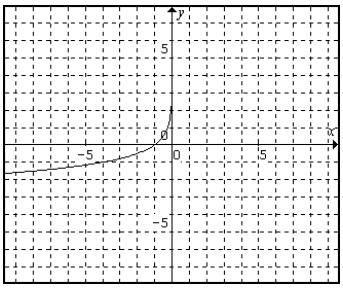

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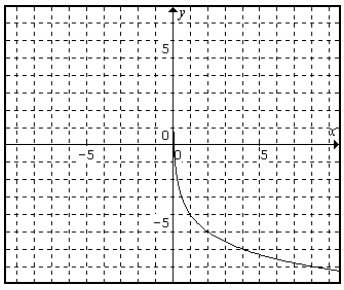

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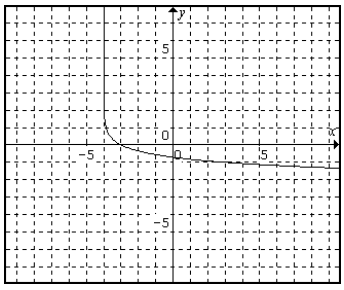

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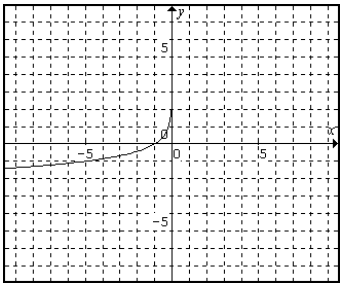

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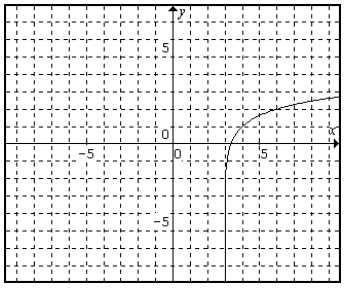

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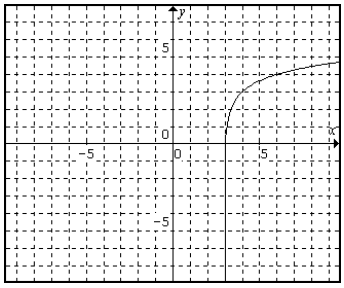

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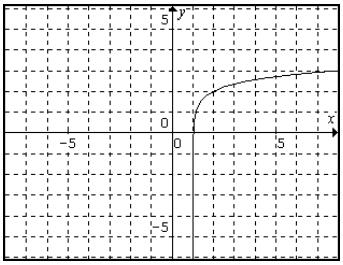

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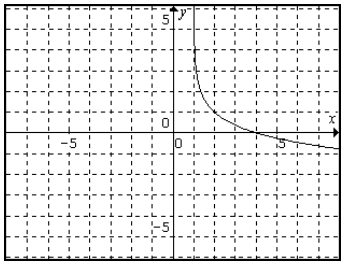

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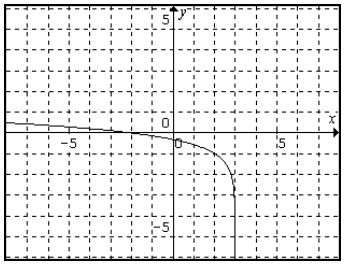

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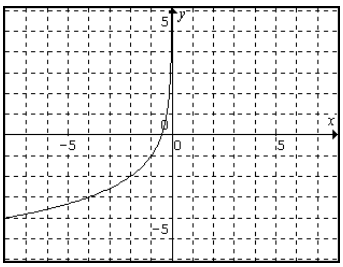

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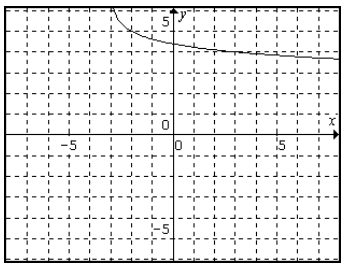

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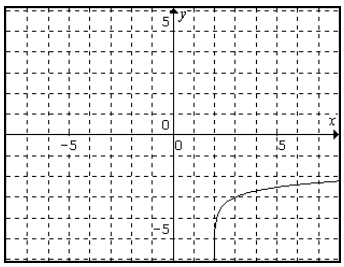

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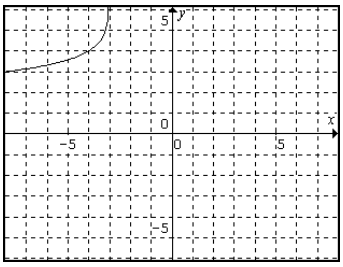

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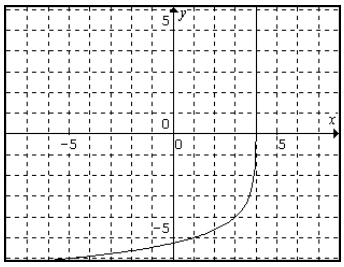

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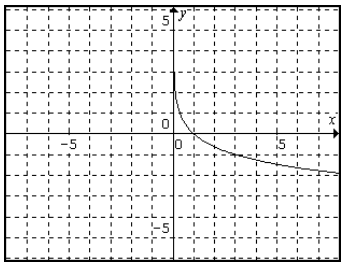

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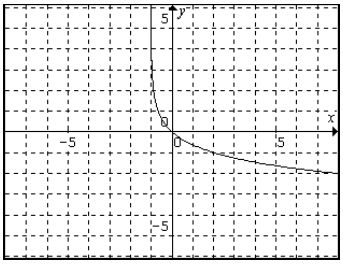

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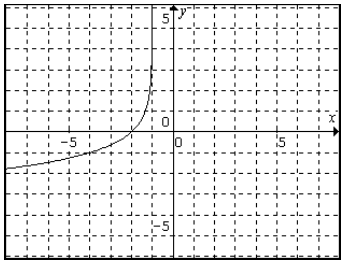

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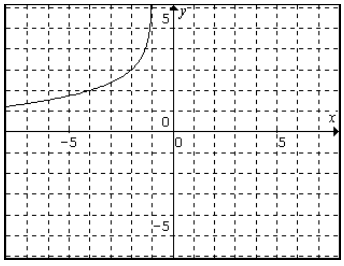

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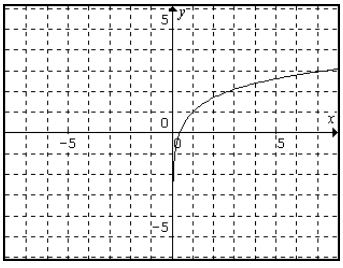

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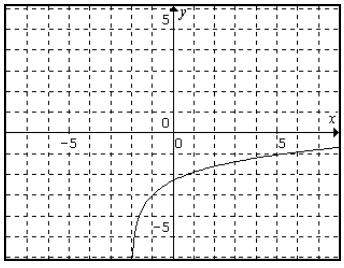

Section 11.4

1. $\log_2 xy$ **3.** $\log_5 v^3$ **5.** $\ln\left(\frac{x}{y}\right)$ **7.** $\log_4\left(p^2(q+1)\right)$ **9.** $\ln\left(\frac{x}{y^4}\right)$ **11.** $\log_5\left(b^4c^2\right)$ **13.** $\log_2\left(\frac{3(x+4)}{y}\right)$

15. $\ln\left(x^2y^3z\right)$ **17.** $\log_7\left(\frac{nt^2}{81}\right)$ **19.** $\log_2\left(\frac{\sqrt{x}}{(y+1)^2}\right)$ **21.** $\ln\left(\frac{\sqrt[4]{x-y}}{y^3}\right)$ **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.** $t=\dfrac{\ln\left(\frac{2}{41}\right)}{12\ln(1.05)}\approx -5.159$

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: $\left(\dfrac{\ln\left(\frac{3}{4}\right)}{\ln 7},0\right)\approx(-0.1478,0)$; 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. $t=\dfrac{\ln\left(\frac{A}{P}\right)}{r}$ **85.** $k=\dfrac{\ln\left(\frac{y}{C}\right)}{t}$ **87.** $H^+=10^{-pH}$ **89.** $k=\dfrac{-\ln\left(\frac{T-T_S}{D}\right)}{t}$ **91.** $d=\dfrac{c-x}{\ln\left(\frac{a-y}{b}\right)}$

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^2 **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