

§3.4 p253 #9, 15, 19, 29, 35, 37, 45, 49, 53, 59, 77, 81, 85, 93, 110

$$(9) 4^x = 16 \Rightarrow x = 2$$

$$(15) e^x = 2 \Rightarrow x = \ln 2 \approx .693$$

$$(19) \log_4 x = 3 \Rightarrow 4^3 = x \Rightarrow x = 64$$

$$(29) 9(3^x) = 20 \Rightarrow 3^x = 5 \Rightarrow \log_3 5 = x \\ \Rightarrow x \approx 1.465$$

$$(35) 3^{2x} = 80 \Rightarrow \log_3 80 = 2x \\ \Rightarrow x = \frac{\log_3 80}{2} \approx 1.994$$

$$(37) 5^{-t/2} = 0.20 \Rightarrow -t/2 = \log_5 0.20 \\ \Rightarrow t = 2$$

$$(45) 3(5^{x-1}) = 21 \Rightarrow 5^{x-1} = 7 \Rightarrow (x-1)\ln 5 = \ln 7 \\ \Rightarrow x = \frac{\ln 7}{\ln 5} + 1 \approx 2.209$$

$$(49) 500e^{-x} = 300 \Rightarrow e^{-x} = \frac{3}{5} \Rightarrow -x = \ln \frac{3}{5} \\ \Rightarrow x \approx .511$$

$$(53) 4(2^{3x-1}) - 7 = 9 \\ 2^{3x-1} = \frac{8}{3} \\ \Rightarrow 3x = \frac{\ln 8/3}{\ln 2} + 1 \\ x \approx .805$$

$$(3x-1)\ln 2 = \ln \frac{8}{3}$$

$$\textcircled{59} \quad \frac{500}{100 - e^{x/2}} = 20$$

$$25 = 100 - e^{x/2}$$

$$e^{x/2} = 75$$

$$\frac{x}{2} = \ln 75$$

$$x = 2 \ln 75 \approx 8.635$$

$$\textcircled{77} \quad \ln 2x = 2.4 \Rightarrow e^{2.4} = 2x$$

$$\Rightarrow x = \frac{e^{2.4}}{2} \approx 5.512$$

$$\textcircled{81} \quad 3 \ln 5x = 10$$

$$\ln 5x = 10/3$$

$$\Rightarrow e^{10/3} = 5x$$

$$x = \frac{e^{10/3}}{5} \approx 5.606$$

$$\textcircled{85} \quad 7 + 3 \ln x = 5 \Rightarrow \ln x = -\frac{2}{3} \Rightarrow e^{-2/3} = x \approx 0.513$$

$$\textcircled{93} \quad \ln(x+5) = \ln(x-1) - \ln(x+1) = \ln \frac{x-1}{x+1}$$

$$x+5 = \frac{x-1}{x+1} \Rightarrow x^2 + 6x + 5 = x - 1$$

$$\Rightarrow x^2 + 5x + 6 = 0$$

$$(x+3)(x+2) = 0$$

$$x = -3, -2 \quad \text{but these make } x-1 < 0, \text{ so}$$

no sol'n

$$\textcircled{110} \quad \text{a) } 600 = 5000 \left(1 - \frac{4}{4te^{-.002x}} \right)$$

$$\frac{3}{25} = 1 - \frac{4}{4te^{-.002x}} \Rightarrow \frac{4}{4te^{-.002x}} = \frac{22}{25}$$

$$4te^{-.002x} = \frac{50}{11}$$

$$e^{-.002x} = \frac{6}{11}$$

$$-.002x = \ln \frac{6}{11}$$

$$x = \left(\ln \frac{6}{11} \right) / -.002 \approx \boxed{303}$$

$$(110) \quad b) \quad 400 = 5000 \left(1 - \frac{4}{4 + e^{-0.002x}} \right)$$

$$\frac{2}{25} = 1 - \frac{4}{4 + e^{-0.002x}}$$

$$\frac{4}{4 + e^{-0.002x}} = \frac{23}{25}$$

$$4 + e^{-0.002x} = \frac{100}{23}$$

$$e^{-0.002x} = \frac{8}{23}$$

$$-0.002x = \ln \frac{8}{23}$$

$$x = \frac{\ln \left(\frac{8}{23} \right)}{-0.002}$$

≈ 528 units