p186 #31 $Q = 10e^{-0.15t}$

a $Q_0 = 10$

15% continuous decay rate

b Graph A on calc

c $2 = 10e^{-0.15t}$

$\frac{1}{5} = e^{-0.15t}$

$\ln\left(\frac{1}{5}\right) = \ln\left(e^{-0.15t}\right) = -0.15t$

$\frac{-\ln\left(\frac{1}{5}\right)}{0.15} = t$

$10.7296 \approx t$

33 a $\log 3 = \log\left(\frac{15}{5}\right) = \log 15 - \log 5$

b $\log 25 = \log(5^2) = 2\log 5$

c $\log 75 = \log(5 \cdot 15) = \log 5 + \log 15$

35 $91 = 46(1.1)^x$

$\frac{91}{46} = 1.1^x$

$\log\left(\frac{91}{46}\right) = \log 1.1^x$

$\log\left(\frac{91}{46}\right) = x \log 1.1$

$7.16 \approx \frac{\log(91/46)}{\log 1.1} = x$

37 $e^{0.044t} = 6$

$\ln(e^{0.044t}) = \ln 6$

$0.044t = \ln 6$

$t = \frac{\ln 6}{0.044} \approx 40.722$

41 $0.4\left(\frac{1}{3}\right)^{3x} = 7(2)^{-x}$ note: $0.4 = \frac{2}{5}$

$\left(\frac{1}{3}\right)^{3x} = \frac{35}{2}(2)^{-x}$

$\log\left(\frac{1}{3}\right)^{3x} = \log\left(\frac{35}{2}\right) + \log 2^{-x}$

$3x \log\left(\frac{1}{3}\right) = \log\left(\frac{35}{2}\right) - x\log 2$

$3x\log\left(\frac{1}{3}\right) + x\log 2 = \log\left(\frac{35}{2}\right)$

$x\left(3\log\left(\frac{1}{3}\right) + \log 2\right) = \log\left(\frac{35}{2}\right)$

$x = \frac{\log\left(\frac{35}{2}\right)}{3\log\left(\frac{1}{3}\right) + \log 2} \approx -1.0997$

39 $e^{x+4} = 10$

$\ln e^{x+4} = \ln 10$

$x + 4 = \ln 10$

$x = \ln 10 - 4 \approx -1.69741$