MATH 112 SOLUTIONS FOR 4.3, P. 340

3. $Q_0 \approx 89$.
5. about 10.58 days.
6. $\dfrac{dV}{dt} = -kV \Rightarrow V = V_0 e^{-kt}, k = \dfrac{\ln 2}{h}$. $V = 0.1V_0 \Rightarrow t \approx 19.93$ weeks.
7. $Q = Q_0 e^{-kt}, k = \dfrac{\ln 2}{h}; Q = 0.52Q_0 \Rightarrow t \approx 4.245 \cdot 10^9$ years.
8. (a) $Q_0 = 0.00362$ moles. (b) about 218.9 million years.
11. $t = \dfrac{9 \ln \frac{17}{28}}{\ln \frac{13}{14}} \approx 61$ minutes.
13. (b) $\frac{1}{2}L$. (c) The graph of Q is increasing where $\frac{dQ}{dt}$ is positive, concave upward where $\frac{dQ}{dt}$ is increasing, and concave downward where $\frac{dQ}{dt}$ is decreasing. Thus the graph of Q is always increasing, concave upward between Q_0 and $\frac{1}{2}L$, and concave downward between $\frac{1}{2}L$ and L.
15. Use $L = 1$, $Q_0 = 0.1$, and the condition $Q = 0.4$ when $t = 20$. When $t = 120$, $Q = 99.98\%$.
16. $t = \dfrac{\ln \frac{1/2}{199}}{-3000k} \approx 3.67$ hours.
17. The rate of increase begins to decrease between 1983 and 1984, so half capacity is about 1900, making the carrying capacity about 3800.
18. (a) $k = \dfrac{\ln 2}{h} \approx 0.0347$. (b) $\dfrac{dQ}{dt} = U - kQ$. (c) $Q = \dfrac{U}{k} + Ae^{-kt}$. (d) $t \to \infty \Rightarrow Q \to \dfrac{U}{k}$. (e) ... an essay summarizing (a) - (d)...
19. (a) $t = \frac{1}{2} \Rightarrow T \approx 131.8°$F. (b) Using the same k, $T \approx 122.33°$F. (c) about 35.12 minutes.
20. (a) Show that $H'(x) = 0$, so that $H(x)$ is constant; find $H(0)$.
    (b) Show that $K'(x) = 0$, so that $K(x)$ is constant; then show that $K(0) = 0$. The sum of squares is zero only if each square is zero.