Section 7.4

2.

$$\frac{dP}{dt} = kP, \ \ so \ \ P = P_0 e^{kt}$$

a) $P_0 = 60, \ \ P\left(\frac{1}{3}\right) = P_0 e^{\frac{k}{3}} = 2P_0$

$Thus \ \ e^{\frac{k}{3}} = 2, \ then \ k = 3\ln 2$

b) $P(t) = 60e^{3\ln 2 \cdot t} \ \ or \ \ P(t) = 60 \cdot 2^{3t}$

c) $P(8) = 60e^{3\ln 2 \cdot 8} = 60e^{24\ln 2}$

$or \ \ 60 \cdot 2^{24} = 10006632960 \approx 10^9$

d) $\left.\frac{dP}{dt}\right|_{t=8} = \left.\frac{d}{dt}\left(60 \cdot 2^{3t}\right)\right|_{t=8}$

$= \left.60 \cdot 3\ln 2 \cdot 2^{3t}\right|_{t=8}$

$= 180 \cdot 2^{24} \ln 2 \approx 2093234394 \ or \ 2.09 \times 10^9$

e) $60 \cdot 2^{3t} = 20000 \ thus$

$t = \frac{\ln(20000/60)}{3\ln 2} \approx 2.793607$

6.

a)

$P(0) = 76, \ \ so \ \ P(t) = 76e^{kt}$

$P(10) = 76e^{10k} = 92, \ so$

$k = \frac{1}{10}\ln\frac{92}{76} \quad (\approx 0.019106)$

$Hence, \ P(t) = 76e^{\left(\frac{1}{10}\ln\frac{92}{76}\right)t} \quad or \quad P(t) = 76 \cdot \left(\frac{92}{76}\right)^{\frac{t}{10}}$

$$P(100) = 76 \cdot \left(\frac{92}{76}\right)^{10} \approx 513.5183$$

b)

$$P(0) = 227, \ \ so \ \ P(t) = 227e^{kt}$$

$$P(10) = 227e^{10k} = 250, \quad so$$

$$k = \frac{1}{10}\ln\frac{250}{227} \quad (\approx 0.009651)$$

$$Hence, \ P(t) = 227e^{\left(\frac{1}{10}\ln\frac{250}{227}\right)t} \quad or \quad P(t) = 227 \cdot \left(\frac{250}{227}\right)^{\frac{t}{10}}$$

$$P(30) = 227\left(\frac{250}{227}\right)^{3} \approx 303.2273, \quad and$$

$$P(40) = 227\left(\frac{250}{227}\right)^{4} \approx 333.9508$$

c) I skip the graph. Compare to the graph of the modeling and real data.

18.

a)

$$A(t) = A_0 e^{0.06t}, \ \ and$$

$$if \quad 2A_0 = A_0 e^{0.06t}, \ then \ \ t = \frac{\ln 2}{0.06} \approx 11.55245$$

b)

$$A(t) = A_0(1+r)^t, \ \ and$$

$$2A_0 = A_0(1+r)^{\frac{\ln 2}{0.06}}, \ \ then$$

$$r = e^{006} - 1 \approx 0.061837, \ thus \ 6.18\%$$