1. a. $y(t) = 6e^{2t}$.

b. $z(t) = 20 - 15e^{0.1t}$.

c. $x(t) = 10e^{-t/3}$.

d. $h(t) = 25 - 15e^{-0.2t}$.

e. $y(t) = 50e^{0.02(t-2)}$.

f. $r(t) = 4 + 2e^{-(t-1)/4}$.

2. a. $Y(t) = 100e^{0.14t}$. Doubling time, $t_d = \frac{100}{14}\ln(2) \simeq 4.95$ hr.

b. $P(t) = 1000e^{-0.07t}$. Time for half the population, $t_h = \frac{100}{7}\ln(2) \simeq 9.9$ hr.

c. Populations are equal at $t = \frac{100}{21}\ln(10) \simeq 10.96$ hr.

3. a. Population of Canada, $C(t) = 24,070,000e^{k_1 t}$, with the rate constant $k_1 = \frac{1}{10}\ln(26620/24070) \simeq 0.01007$ yr^{-1}. Doubling time, $t_d = \frac{1}{k_1}\ln(2) \simeq 68.8$ yr.

b. Population of Kenya, $K(t) = 16,681,000e^{k_2 t}$, with the rate constant $k_2 = \frac{1}{10}\ln(24229/16681) \simeq 0.03733$ yr^{-1}. Doubling time, $t_d = \frac{1}{k_2}\ln(2) \simeq 18.6$ yr.

c. Populations in 2000 are given by $C(20) = 29,440,150$ and $K(20) = 35,192,401$. The populations are equal in 13.5 years (or 1993).

4. $R(t) = 10e^{-kt}$ with $k = \frac{1}{25}\ln(10/8) \simeq 0.008926$ day^{-1}. Half-life is $t_h = \ln(2)/k \simeq 77.7$ days.

5. a. $S(t) = 20e^{-kt}$ with $k = \frac{1}{28}\ln(2) \simeq 0.02476$ yr^{-1}. After 10 years, $S(10) = 15.6$ mg.

b. For 7 mg remaining, $t = \ln(20/7)/k \simeq 42.4$ yr.

6. a. $Q = 7$ liters/min, which is about a 25% increase. The systolic and diastolic pressures are $P_{sys} = 149.9$ mm Hg and $P_{dia} = 99.9$ mm Hg, respectively.

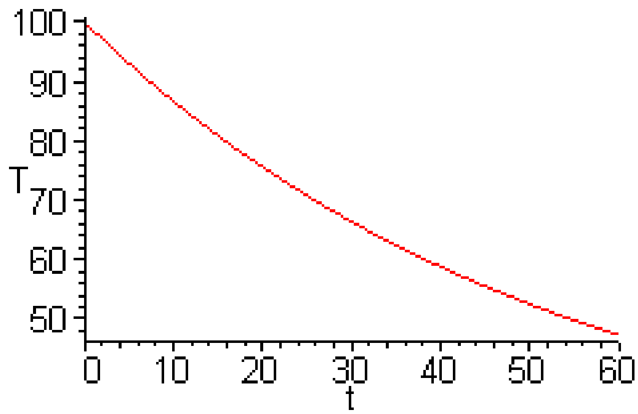
b. The systolic and diastolic pressures are $P_{sys} = 174.1$ mm Hg and $P_{dia} = 124.1$ mm Hg, respectively.

7. a. The systolic and diastolic pressures are $P_{sys} = 125.7.1$ mm Hg and $P_{dia} = 75.6$ mm Hg, respectively. Thus, the 20% decrease in compliance causes minimal changes in the blood pressure.

b. The systolic and diastolic pressures are $P_{sys} = 144.9$ mm Hg and $P_{dia} = 94.9$ mm Hg, respectively, so increasing the resistance causes blood pressure to dramatically increase.

8. a. $T'(t) = -k(T(t) - 22), \quad T(0) = 100$. This has the solution $T(t) = 22 + 78e^{-kt}$.

b. The rate constant $k = \ln(78/71)/5 \simeq 0.0188$. It takes 78.0 min to reach 40°C, while $T(60) = 47.2$°C. A sketch of the graph is below.



9. a. $T'(t) = -k(T(t) - 20), \quad T(0) = 100$. This has the solution $T(t) = 20 + 80e^{-kt}$.

b. The rate constant $k = \ln(4/3)/10 \simeq 0.02877$. It takes 72.3 min to reach 30°C.

10. a. $P(t) = 1500e^{kt}$, where $k = \frac{1}{4}\ln(4/3) \simeq 0.0719$. The doubling time is $t_d = 4\ln(2)/\ln(4/3) \simeq$ 9.64 hr.

b. $P(t) = 1000 + 4000e^{-0.1t}$. The limiting population is $\lim_{t\to\infty} P(t) = 1000$.

11. a. Initial value problem: $c'(t) = \frac{1}{50}(5 - c(t)),\ c(0) = 0$. Solution: $c(t) = 5 - 5e^{-t/50}$.

b. Concentration reaches 4 ppb at $t = 50\ln(5) \simeq 80.5$ days.

c. The limiting concentration is $\lim_{t\to\infty} c(t) = 5$ ppb.

12. a. Solution: $c(t) = 12 - 12e^{-t/400}$.

b. Concentration reaches 10 ppb at $t = 400\ln(6) \simeq 716.7$ days. The limiting concentration is $\lim_{t\to\infty} c(t) = 12$ ppb.

c. Solution: $c(t) = 12e^{-t/400}$. Reaches 4 ppb at $t = 400\ln(3) \simeq 439.4$ days.

13. a. Solution: $L(t) = 34 - 32e^{-kt}$.

b. The rate constant is $k = \ln(4/3)/4 \simeq 0.07192$. The sketch of the graph is below.

c. When $t = 10$, $L(10) = 18.4$. The limiting length is $\lim_{t\to\infty} L(t) = 34$ ppb.