Homework #5: Solutions to Selected Exercises

Assignment:
Section 3.1, Part 2 (page 131): Exercise 3cdghij.
Section 3.1, Part 3 (page 132): Exercise 4bcef.
Section 3.1, Part 4 (pages 132–133): Exercises 5, 7, 8.
Section 3.2, Part 1 (page 147): Exercises 1abcefgjklo, 2adfghij.
Section 3.2, Part 2 (pages 147–148): Exercises 5, 6, 8, 10, 11.

Section 3.1, Part 2

3. (c) $g'(t) = 1.5e^t$. (d) $dq/dt = 3e^{2t}$. (g) $dy/dx = 4x^4e^{4x} + 4x^3e^{4x}$. (h) $f'(v) = \dfrac{e^v}{(1+e^v)^2}$.

(i) $dy/dx = 5x^5e^{5x} + 5x^4e^{5x}\sec^2(x^5e^{5x})$. (j) $dy/dx = e^{e^x}e^x$.

Section 3.1, Part 3

4. (b) 1. (c) e^{x^2-2x}. (e) 1. (f) e^{-2x}.

Section 3.1, Part 4

7.

(a)
$$\frac{dR}{dt} = -\frac{1}{2337}R, \qquad R(0) = 1.$$

(b) We have $R = e^{-(1/2337)t}$. So 20 years ago, the weight was $R(-20) = 1.00859$ grams; in 200 years, the weight will be $R(200) = 0.91798$ grams.

8.

(a) $\dfrac{dI}{dx} = -kI$.

(b) A better shield means faster absorption, which means a larger k.

(c) $I = I_0e^{-kx}$.

Section 3.2, Part 1

1. (a) 1. (b) 5. (c) 4. (e) 2. (f) 8. (g) 8. (j) 1/8. (k) 6. (l) 6. (o) 2.

2. (a) $dy/dx = 1/x$. (d) $dy/dx = \ln(2)$. (f) $dy/dx = 6x/(4+3x^2)$. (g) $dy/dx = 1 + \ln(x)$. (h) $dy/dx = -\sin(\ln(x\sin(x)))(\sin(x) + x\cos(x))/(x\sin(x))$. (i) $dy/dx = 1/(x\ln^2(1/x))$. (j) $dy/dx = \ln(x)$.

Section 3.2, Part 2

5. It will double to 400 grams after $t = \ln(2)/0.12 = 5.77623$ hours. It will double again after another 5.77623 hours. And so on. The doubling time is 5.77623 hours.
6. The intensity 3 inches inside the wall is $R(1/4) = 0.916219A$ rads. The intensity 18 inches inside the wall is $R(1.5) = 0.591555A$ rads. The intensity reduces to $A/2$ when the rays have penetrated $s = 1.98042$ feet inside the wall. The intensity reduces to $A/4$ when the rays have penetrated $s = 3.96084$ feet inside the wall.
8. According to this model, there would be about 5.79776 billion people in 2010. (The actual number was closer to 6.9 billion!)
11. The barometer will read 20 psi at about 10,902.4 feet above sea level.