Problem Set #2

1. $y = y_0 e^{kt}$

$y_0 = 1700$

$k = 190\% = 1.9$

$t = 1993 - 1983 = 10$

$y = 1700 e^{1.9 \times 10}$

$y = 1700 e^{19}$

$y = 303419911637.418$

≈ 303419911638 people

or

3.034×10^{11} people

---

2. a) $P = mw + c$

$P(w) = mw + c$

$w = 0$

$P(0) = m(0) + c$

$P(0) = c \Rightarrow c = 6$

$P(w) = mw + 6$

$w = 4$

$P(4) = m(4) + 6$

$22 = 4m + 6$

$4m = 16$

$m = 4$

$P(w) = 4w + 6$

$P(10) = 4(10) + 6$

$P(10) = 40 + 6$

$P(10) = 46$

b) $82 = 4w + 6$

$4w = 82 - 6$

$4w = 76$

$w = 19$ weeks

---

3 a) $y = y_0 e^{kt}$

$y(t) = 200 e^{kt}$ $\qquad 450 = 200 e^{6r}$

$y(t) = 200 e^{\left(\frac{\ln 2.25}{6}\right)t}$ $\qquad e^{6r} = 2.25$

$\ln e^{6r} = \ln 2.25$

$y(t) = 200 e^{0.13515t}$ $\qquad 6r = \ln 2.25$

$y(1) = 200 e^{0.13515}$ $\qquad r = \frac{\ln 2.25}{6}$

$y(1) = 228.94169$

≈ 229 bacteria

b) $200 \times 3 = 200 e^{0.13515t}$

$3 = e^{0.13515t}$

$\ln 3 = \ln e^{0.13515t}$

$0.13515t = \ln 3$

$t = \frac{\ln 3}{0.13515}$

$t = 8.12883$

≈ 9 hours

---

4 a) $y = y_0 e^{kt}$

$130 = 5 e^{6k}$

$65 = e^{6k}$

$\ln 65 = \ln e^{6k}$

$6k = \ln 65$

$k = \frac{\ln 65}{6} = 0.69573$

$y = 5 e^{0.69573 \times 5}$

$y = 5 e^{3.47865}$

$y = 162$

$\therefore 162$ Cadbury mini eggs

b) $y = 5 e^{0.69573 \times 27}$

$y = 5 e^{18.78471}$

$y = 5.13$

≈ 5 Cadbury mini eggs.

5. (8, 1.60) (16, 2.30)

a) $\frac{b^{16}}{b^{8}} = \frac{2.30}{1.60}$

$b^8 = 1.4375$

$b = 1.0464078$

$A(t) = A_0(1.0464078)^t$.

b) $1.60 = A_0(1.0464078)^8$

$1.60 = A_0(1.4375)$

$A_0 = \frac{1.60}{1.4375}$

$A_0 = 1.113043$

c) 1996 - 1960 = 36.

$A(36) = 1.113043(1.0464078)^{36}$

$A(36) = 5.69831$

$A(36) \approx \$5.70$.

∴ \$5.15 is below the minimum wage predicted by the model.

---

6. Let the value of the money be V.

$V = 1000(1-0.05)^{20}$.

$V = 1000(0.95)^{20}$.

$V = \$358.49$

---

7. a) exponentially.

0 → 500

b) 1 → 375 = 500 × 0.75

2 → $281.25 = 500(0.75)^2$

3 → $210.94 = 500(0.75)^3$

4 → $158.20 = 500(0.75)^4$.

n^{th} → n^{th} value $= 500(0.75)^n$.

c) 8 → $500(0.75)^8 = 50.0565$

≈ 50 M&M's

---

8. a) $a_{n+1} = 1.1a_n - 100$.

$a_0 = 2000$

b) $a_1 = (1.1 \times 2000) - 100 = 2100$

$a_2 = (1.1 \times 2100) - 100 = 2210$

$a_3 = (1.1 \times 2210) - 100 = 2331$

c) Max. Value $= \frac{10}{100}$ of 2000

$= \frac{10}{100} \times 2000$

= 200 fish.