Section 3.8, problem 6.

$$x_{t+1} = x_t - \frac{x_t^3 - 20}{3x_t^2}$$

Start with initial guess $x_0 = 3$.
$x_1 = 3 - \frac{3^3-20}{3 \cdot 3^2} = 2.7407$
$x_2 = x_1 - \frac{x_1^3-20}{3 \cdot x_1^2} = 2.7147$
$x_3 = x_1 - \frac{x_2^3-20}{3 \cdot x_2^2} = 2.7144$

Section 3.8, problem 28.

$$M_t = p(M_t)M_t + 1$$

1. To find an equilibrium we need to solve:

$$M^* = p(M^*)M^* + 1,$$

which is equivalent to finding a zero of

$$f(x) = x - p(x)x - 1.$$

$f(0) = -1 < 0$, and $f(10) = 5.69 > 0$, so by the intermediate value theorem there is an equilibrium of the above system between $M = 0$ and $M = 10$.

2. Start with $M_0 = 10$. Then $M_1 = 4.3109$, $M_2 = 3.5211$, $M_3 = 3.2284$, $M_4 = 3.1039$, $M_5 = 3.0481$, $M_6 = 3.0225$, $M_7 = 3.0107$, $M_8 = 3.0052$, $M_7 = 3.0026$, $M_9 = 3.0014$. According to this M^* is close to 3.

3. NOw do the same thing with the Newton's method.

$$x_{t+1} = x_t - \frac{x_t - p(x_a)x_t - 1}{1 - p'(x_t)x_t - p(x_t)} = x_t - \frac{x_t - 0.9e^{-0.1x_t}x_t - 1}{1 + 0.09e^{-0.1x_t}x_t - 0.9e^{-0.1x_t}}.$$

Start with $x_0 = 10$.
Then $x_1 = 4.3109$, $x_2 = 3.1273$, $x_3 = 3.0020$, $x_4 = 3.0020$, $x_5 = 3.0004$. This sytem coverges to $M^* = 3$ much faster.

p.128, 2

a. $y = (3/16)t + 2$, where t is time in hours from 5PM on Tuesday and y is the number of bacteria in hundreds of millions.

b. $11 = (3/16)t + 2$. Solving for t: $t = 48$, i.e at 5pm on Thursday.

c. Their culrure is described with $y_2 = (1.4/16)t + 2$. Need to solve:

$$(3/16)t + 2 = 2((1.4/16)t + 2).$$

$t = 32/.2 = 160$ hours, i.e. at 9am on tuesday a week later.

p.128, 4
a. $3x_t$, where time step is 2 hours
b. 162×10^7
c. $x_0 3^t$
d. $2 \times 10^7 \times 3^t = 10^9$, i.e $3^t = 50$, $t = 3.57$ time units or $t = 3.57 \times 2 = 7.14$ hours

p.233, 28
b. $V(2) = 2$, $V(2.5) = 3.25$. Secant line $y = 2 + 2.5(t - 2)$.
c. $V'(t) = -2 + 2t$. $V'(2) = 2$ thousands of cubic microns per minute.
d. It is growing ($V'(2) > 0$)

p. 234,34
a. $P(1) = 1/3; P(2) = .4$**. Average rate of change (.4-1/3)/1=1/15**
b. $y = .4 + 0.07(t - 2)$