(1) (§ 1.1 #7) You currently have $5000 in a savings account that pays 0.5% interest each month. You add another $200 each month. Formulate a dynamical system that models the change exactly.

(2) (§ 1.1 #8) You owe $500 on a credit card that charges 1.5% interest per month. You pay $50 each month and make no new charges. Formulate a dynamical system that models the change in balance exactly.

(3) (§ 1.2 #6) A certain drug is effective in treating a disease if the concentration remains above 100 mg/L. The initial concentration is 640 mg/L. It is known from laboratory experiments that the drug decays at a rate of 20% of the amount each hour.
   (a) Formulate a model representing the concentration at each hour.
   (b) Build a table of values and determine when the concentration reaches 100 mg/L.

(4) (§ 1.3 #2h) For $a_{n+1} = 0.8a_n - 100$, find the equilibrium if it exists, and classify it as stable or unstable.

(5) (§ 1.3 #4d) For $a_{n+1} = -3a_n + 4$, $a_0 = 5$, find the solution and possible equilibrium value, and discuss the long-term behavior of the solution for various initial values.
(6) (§1.4 # 4) Suppose the spotted owls’ primary food source is a single prey: mice. An ecologist wishes to predict the population levels of spotted owls and mice in a wildlife sanctuary. Letting $M_n$ represent the mouse population after $n$ years and $O_n$ the predator owl population, the ecologist has suggested the following model:

$$
M_{n+1} = 1.2M_n - 0.001O_nM_n \\
O_{n+1} = 0.7O_n + 0.002O_nM_n
$$

The ecologist wants to know whether the two species can coexist in the habitat and whether the outcome is sensitive to the starting populations.

(a) Compare the sign of the coefficients of this model with the signs of the hawks-owls model from class. Explain the signs of the coefficients $1.2$, $-0.001$, $0.7$, and $0.002$ in terms of the predator-prey relationship.

(b) Test the initial populations in the following table and predict the long-term outcome:

<table>
<thead>
<tr>
<th>Case</th>
<th>Owls</th>
<th>Mice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case A</td>
<td>150</td>
<td>200</td>
</tr>
<tr>
<td>Case B</td>
<td>150</td>
<td>300</td>
</tr>
<tr>
<td>Case C</td>
<td>100</td>
<td>200</td>
</tr>
<tr>
<td>Case D</td>
<td>10</td>
<td>20</td>
</tr>
</tbody>
</table>