1. We have $\Delta P = -0.2P_n$.
   a. Write the updating equation.
      \[
P_{n+1} - P_n = -0.2P_n
      \]
      \[
P_{n+1} = P_n - 0.2P_n = 0.8P_n
      \]
   b. If $P_0 = 50$, write the explicit solution for $P_n$.
      \[
P_n = 50 \left(0.8\right)^n
      \]
   c. Describe the long term behavior of $P_n$ as $n \to \infty$.
      \[
P_n \to 0 \text{ because } \left(0.8\right)^n \to 0
      \]

2. Suppose $Q_{n+1} = -0.7Q_n + 153$.
   a. Compute the equilibrium value $Q^*$.
      \[
      Q^* = -0.7Q^* + 153
      \]
      \[
      1.7Q^* = 153 \quad Q^* = 90
      \]
   b. If $Q_0 = 100$ determine the solution equation for $Q_n$. Recall that an affine discrete model $P_{n+1} = aP_n + b$ has an explicit solution $P_n = Ca^n + P^*$, where $P^*$ is the equilibrium value, and $C$ can be determined from the initial condition.
      \[
a = -0.7
      \]
      \[
      Q_n = C \left(-0.7\right)^n + 90 = 10 \left(-0.7\right)^n + 90
      \]
      \[
      100 = Q_0 = C \left(-0.7\right)^0 + 90 = C + 90, \quad C = 10
      \]
   c. Determine the long term behavior of $Q_n$ as $n \to \infty$.
      \[
      Q_n \to 90 \text{ oscillating above and below with smaller and smaller oscillations since } \left(0.7\right)^n \to 0 \text{ and } (-1)^n \text{ flip flops sign.}
      \]