1. Consider a model of logistic growth with constant harvesting:

\[ x_{n+1} = ax_n(1 - x_n) - h \]

where \( 1 < a < 3 \) (to guarantee the unharvested fixed point is stable). Find the fixed points (it will involve using the quadratic formula). Which (if any) is stable. What is the maximum value of \( h \) that allows for a fixed point. Is it advisable to harvest at the max? What happens if \( h \) is larger than the maximum?

2. Consider a model where the harvesting is proportional to the total:

\[ x_{n+1} = ax_n(1 - x_n) - kx_n \]

Again, find the fixed points and their stability assuming \( 1 < a < 3 \) and that \( k \geq 0 \). Find the value of \( k \) that maximizes the yield, \( kx \) (That is, if \( x \) is a fixed point, then your yield is \( kx \)).

3. Suppose that the growth of an organism requires two to grow, so that the model is:

\[ x_{n+1} = ax_n^2(1 - x_n) = f(x_n) \]

Show that \( x = 0 \) is always a stable equilibrium no matter what \( a \) is. Find the equilibria (quadratic equation again!). For what values of \( a \) are there nonzero equilibria. Pick \( a = 5 \) and iterate the equation for \( x_0 = 0.2, 0.5 \) what happens in each case? What is the critical value of \( x_0 \) such that you will go to the positive fixed point? Plot \( f(x) \) vs \( x \) along with the line \( y = x \) for \( a = 5 \) and cobweb the result (or use a cobwebbing program) You will see three intersections. Interpret the meaning of the middle one. If you want try computing the stability! You will find that the upper state is stable for \( 4 < a < 16/3 \).

4. Problem 2.4.13 in the book.