1. For the following equations, compute the bifurcation values, draw the bifurcation diagram, and discuss the stability of equilibriums.

(a) \( \frac{dy}{dt} = y^2 + \alpha \),
(b) \( \frac{dy}{dt} = y^2 - \alpha y + 1 \),
(c) \( \frac{dy}{dt} = y^6 - 2y^3 + \alpha \).

2. Consider the population model

\[ \frac{dP}{dt} = -\frac{P^2}{50} + 2P, \]

for a species of fish in a lake. Suppose it is decided that fishing will be allowed, but it is unclear how many fishing licenses should be issued. Suppose the average catch of a fisherman with a license is 3 fish per year (these fish are hard to catch).

(a) What is the largest number of licenses that can be issued if the fish are to have a chance to survive in the lake?

(b) Suppose the number of fishing licenses in part (a) is issued. What will happen to the fish population—that is, how does the behavior of the population depend on the initial population?
Chapter 4
Section 4.1: 1-4, 7-10, 12, 13, 14, 18, 19, 20, 21, 23.
Section 4.2: 11, 12, 13, 14, 15, 16, 19, 20, 21, 37, 38.
Section 4.3: 1, 2, 3, 4, 6, 7, 13, 15, 16, 17.
Section 4.4: 1, 2, 3, 5, 6, 14.

Chapter 5
Section 5.1: 2, 4, 5, 7, 13, 16, 24, 25, 27.
Section 5.2: 3, 5, 7, 9, 11, 12, 15(a).
Section 5.3: 1, 2, 6, 7, 10, 26, 27, 28, 29.
Section 5.4: 1, 3, 4, 5, 6, 8, 17, 18, 19, 20, 22.
Section 5.5: 1, 3, 4, 5, 7, 8, 11, 12.
Section 5.6: 1, 2, 3, 4, 7, 14, 15.
Section 5.7: 2, 3, 5, 6, 9(a-c), 14.