1. Section 4.10 13

2. Consider the differential equation

$$y' = ay - y^3.$$

A bifurcation for this equation happens for $a = a_0$ for some a_0.

a) Determine the value of a_0.

b) For $a > 0$, determine the number of equilibria and their stability. Sketch a phase line and some representative solutions.

c) Repeat part b) for $a = 0$

d) Repeat part b) for $a < 0$.

e) Sketch a bifurcation diagram for this equation. Be sure to indicate which equilibria are stable and which are unstable in your diagram.

3. Repeat the previous problem for

$$y' = y + ay^3.$$

4. Sketch the bifurcation diagram for the equation you studied in Lab 1 problem h). Use Octave to generate the plot. Stable equilibria should be plotted in blue, unstable in red dashes.