Math 3280 Worksheet 10: bifurcations of autonomous ODEs

Group members (2 to 4): _____

(1) Suppose that before fishing is allowed, a population of fish in a lake satisfies the differential equation $\dfrac{dP}{dt} = P(1000 - P)$ where t is measured in years. Then fishing is allowed at a rate proportional to the population, so that $\dfrac{dP}{dt}$ is decreased by hP where h is a parameter.

   (a) Sketch a bifurcation diagram in the (h, P) plane that shows the equilibria of the system as h is varied.

   (b) If $h = 500$, and the lake begins in an overstocked state with $P = 2000$, what value will the population approach over time?

   (c) If $h = 1000$, and the lake begins in an overstocked state with $P = 2000$, what value will the population approach over time?