

Mathematical Modeling
Review for Midterm 2

1. Most Important!! Know the following for nonlinear differential equations (2 variables).
 - Find steady states and determine when they exist.
 - Determine stability (trace, determinant). Know the conditions for a steady state to be a saddle point, a stable node, a stable spiral, an unstable node, an unstable spiral or neutrally stable.
 - Determine behavior for different parameter regimes.
2. Ways to understand the dynamics.
 - Find nullclines and plot a rough vector field (without pplane).
 - Understand how nullclines shift as parameters change.
 - Know how to construct a bifurcation diagram.
 - Know how to read a bifurcation diagram - and recognize bifurcation points.
 - Prove whether or not there is a periodic solution.
3. Know what the following are and when they are used.
 - Nondimensionalization
 - Quasi-steady state
4. Know the underlying assumptions and main result of the following models.
 - Chemostat Model
 - Perelson's HIV Model
 - Lotka Volterra Model (with different functional responses)
 - Hodgkin-Huxley Model / Fitzhugh Nagumo Model