

Date of Exam: 3 October 2005

MATH 4560 Study Guide for Exam I
Professor Chicone Fall 2005

- Ch. 2** Know how to draw the phase-line portrait of every one-dimensional autonomous system known to man. Know how to determine the stability type of a rest point by linearization. Know how to consider a one-dimensional system as a gradient flow. Understand the derivation and implementation of Euler's method and the improved Euler method.
- Ch. 3** Know how to draw the bifurcation diagram of every one-parameter family of one-dimensional autonomous systems known to man. Be able to identify saddle-node, transcritical, and pitchfork bifurcations. Review the existence of pitchfork bifurcations in the model for the bead on a rotating hoop. Also, review our analysis of over-damped limits including how to make a physical model dimensionless by a change of variables.
- Ch. 4** Know how to draw the phase-circle portrait of every one-dimensional 2π -periodic autonomous system known to man. Pay attention to the saddle-node bifurcation leading to periodic orbits. Know how to find the period of a periodic orbit. Know the "square root scaling law" for the period near a saddle node bifurcation.
- Ch. 5** Know how to explicitly solve every 2×2 linear autonomous differential equation known to man. Know how to draw the phase portraits and how to describe the stability types of the rest points. Know the definitions of Lyapunov and asymptotic stability. Know how to change a system to polar coordinates.