CAS MA539 – Methods of Scientific Computing

Boston University, Fall 2005

Homework 4: Initial Value Problems.

(Due October 26)

Exercise 9.1, page 416 Practice rewriting higher order differential equations as a system of equations.

Exercise 9.4, page 417 A chance to study issues of problem and algorithm stability, in the simple context of an exponential growth equation and Euler algorithms.

Computer 9.2, page 418 Use the computer to study the dynamics of a population of predators and prey. Note that the emphasis here is on *exploring* and *experimenting* how the population dynamics change as you manipulate the system parameters. Be creative and inquisitive!

Computer 9.7, page 419 Here you have a chance to explore Newton's models for the motion of the planets. Note that the author asks you to check in many places whether or not the numerical solutions conform to various theoretical expectations. Be careful to address all of these questions.

Additional Note: In writing up each of the two computer problems, I would like to see (a) a short summary of your results (that is, what routines did you use, what error tolerances and any other such settings did you choose, what was the nature of your solutions to the given problem, what settings yielded the types of variations on these solutions asked for by the author, etc.), and (b) a handful of plots. For the plots, you should be conscious of labeling your axes, using titles, and exploiting various line types when over-plotting more than one function.