Math 20750
Spring, 2016

Assignment 7, due February 26

Reread §6.1 and read §§6.2–6.4 in Polking, Boggess and Arnold.

Do: §6.1 #3 (by hand), 4 (by hand), 7,8,13,14 Here "by hand" means don't use a program to solve the problem. It is OK to use a calculator or MATLAB or a spreadsheet to do the arithmetic.

Reread chapters 8 and 9 in *Differential Equations with MATLAB®*.

Do as a MATLAB group:
Problem Set C #1,8,10,16 Also, add the following part to #16:

#16 (e) Modify the program to implement the Runge-Kutta method and repeat parts (a) and (b) using the Runge-Kutta Method. Also use the Runge-Kutta Method with the same step sizes as in (a) and (b) on the interval $0 \leq x \leq 10$. Compare the plots for the two methods.

Note: The Runge-Kutta method means the fourth order Runge-Kutta method.

In #16(a) and (b) you do not need to show the commands for the Euler Method since that is given in the book. You do not need to display the values the method computes. In #16(e) you *must* show your commands for the Runge-Kutta method. You can do this, for example, by creating a function Mfile myrungekutta.m for the method and then giving the command **type myrungekutta**.

Use a separate m-file for each problem. Staple the published solutions together in order. Make sure the names of all members of your MATLAB group are on the MATLAB assignment before turning it in.

Bonus Problem, due Wednesday, March 2

On each part of #10, prove mathematically that your prediction of the behavior of the solution at t is correct. Your solution to a bonus problem **must** include a copy of your Matlab solution to the original problem. You may turn in any number of parts. You may do this individually or with some members of your MATLAB group.

Hints for Problem Set C #1

- Be sure to get explicit formulas for ϕ_0 and ϕ_1 to find out where they "blow up."
- Get as accurate an estimate as you can for t_* by adjusting the interval on which you plot the solution or zooming in.

Hints for Problem Set C #10

- On each part, make sure you plot on an appropriate interval to get a good idea of the behavior of the solution as t increases.
- Find the limiting behavior of y if there is one.
- Estimate the blow-up time if it is finite.
- You might need several plots.

Hints for Problem Set C #16

- (a) Be sure to answer all the questions. This includes:
  - What appears to be happening as t increases?
- (b) A good way to compare the solutions for different step sizes is to plot them together.
- (d) Be sure to discuss (with illustration) the dependence of the solution on the initial value.
- (e) To implement the Runge-Kutta method make appropriate modifications to the M-file myeuler.m for Euler's method given in *Differential Equations with MATLAB®*.
- (e) Again, be sure to answer all the questions.