

MATH 271 – Homework #8

due 19 March 2009

All calculations must be done in Matlab!

1) In class, we used Euler's method to obtain a numerical solution of the differential equation

$$y' = y + 2t$$

for $0 \leq t \leq 2$ with initial condition $y(0) = 1$. Use and/or modify this code to run this problem where the number of time steps is 10, 20, 30, ..., 90, 100. For each of these runs, determine the error at $t = 2$, where error is the true solution minus the numerical approximation. Finally, make a plot where the horizontal axis is $\log h$ and the vertical axis is $\log |\text{error}|$, where "log" is the common (base 10) logarithm. If you have done this correctly, the 10 points you plotted should fall on (approximately) a straight line. What is the slope of this line?

2) Repeat this exercise for the Runge-Kutta Fourth Order (RK4) method for solving first order initial value problems. You may need to look in a numerical analysis text or on Wikipedia to find a description of RK4.