Computer Assignment 1: MATH 341, Spring 2014

Due Friday, February 21

You may work alone or in teams of two people. Each team must submit a single printed solution. Solutions must contain your *relevant* MATLAB input and output (do not include commands that didn't work), and text that indicates what your commands are doing and interprets your results. (You may find one of the following commands useful in preparing your solutions: `publish`, `notebook`, or `diary`; see MATLAB's online help for details.) Organization and clarity count.

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Consider the initial value problem

$$\frac{dy}{dt} = 2y - 2 + 3e^{-t}, y(0) = 0.$$

(a) Use the program `myeuler.m` to approximate the exact solution $y(t)$ using Euler's Method with step size $h = 0.2$ and $N = 10$ steps. Use `plot` to graph the piecewise linear function connecting the computed points (t_j, y_j). What happens to the approximate solution as t increases?

(b) Repeat part (a) with $h = 0.1$ and $N = 20$, then with $h = 0.05$ and $N = 40$. How do the approximate solutions change as the step size decreases? Can you predict from these approximate solutions how the exact solution will behave for large t?

(c) Use `ode45` (see the online help, and remarks at the end of Section I.7 of the MATH 246 Class Notes) to find an approximate solution and plot it on the interval $[0, 2]$. Now what does it look like $y(t)$ will to as $t \to \infty$? Next, plot the approximate solution from `ode45` on the interval $[0, 10]$. What happens as t increases?

(d) Solve the initial value problem symbolically (using `dsolve` or by hand), and draw the direction field (see Section I.5 of the MATH 246 Class Notes) for the differential equation. Compare the exact solution and the direction field to the approximations you found above. Discuss your results in relation to what you've learned in class about the errors in numerical solution methods.