AE/ME 330 Spring 2013, Homework VIII, Due Friday May 10th.

1.
$$\frac{dy}{dt} = te^{3t} - 2y, \qquad 0 \le t \le 1, \qquad y(0) = 0$$

Approximate the solution to the above initial value problem using

(a) Modified-Euler Method

(b) Midpoint Method

(c) Heun's Method

(d) 4-stage Runge-Kutta Method

with a time step of $h = 0.1$. For each method, tabulate the approximate solution and the error at each time step using the exact solution to this problem
$$y(t) = \frac{1}{5}te^{3t} - \frac{1}{25}e^{3t} + \frac{1}{25}e^{-2t}$$

Plot the approximate solutions and the exact function for comparison. In another graph, plot the error distributions. Note that you may need to give a separate plot for the error of 4-stage Runge-Kutta scheme to see the trend in a larger scale.

2.
$$\frac{dy}{dt} = \frac{y}{t} - \left(\frac{y}{t}\right)^2, \qquad 1 \le t \le 2, \qquad y(1) = 1$$

Approximate the solution to the above initial value problem using

(a) 2-step Adams-Bashfort Method

(b) 3-step Adams-Bashfort Method

with a time step of $h = 0.1$. In each case use starting values obtained from 4-stage Runge-Kutta method. For each method, tabulate the approximate solution and the error at each time step using the exact solution to this problem
$$y(t) = \frac{t}{1 + ln(t)}$$

Plot the approximate solutions and the exact function for comparison. In another graph, plot the error distributions.