Euler Assignment Fall 2009

1. Apply Euler's method to approximate the solution of the IVP $\begin{array}{l} y'(t) = ty^3 - y \\ y(0) = 1 \end{array}$ using N = 4 time steps over interval [0, 1]. Do by hand (i.e. calculator) and show all calculations to 6 decimal places. After the calculations are shown display a table of t vs. the Euler approximation. The true solution of the IVP is $y(t) = \dfrac{2}{\sqrt{2 + 4t + 2e^{2t}}}$. Add a column of absolute errors to your table. Describe the behavior of the error.

2. (a) Apply Euler's method with MATLAB routine **eulerh** (in MATLAB use **help eulerh** for directions) to approximate the solution of the IVP $\begin{array}{l} y'(t) = \dfrac{-2ty}{1+t^2} \\ y(2) = -5 \end{array}$ using N = 10 time steps over interval [2, 6]. Include a print out of the plots and the table of values displayed. The true solution is $y = \dfrac{-25}{1+t^2}$.
   (b) When the routine is over the table computed will be in variable **ans**. Do the following in MATLAB: data=ans;   v=data(:,4);   🡐 v will contain the absolute errors.
   Briefly discuss the behavior of the numerical values v(2) thru v(11) in regard to the accuracy of the approximation generated by Euler's method.

3. (a) Apply Euler's method with MATLAB routine **eulerh** (in MATLAB use **help eulerh** for directions) to approximate the solution of the IVP $\begin{array}{l} y'(t) = 2 - \dfrac{y}{t} \\ y(1) = 2 \end{array}$ using N = 10 time steps over interval [1, 6]. Include a print out of the plots and the table of values displayed. The true solution is $y = t + \dfrac{1}{t}$.
   (b) When the routine is over the table computed will be in variable **ans**. Do the following in MATLAB: data=ans;   v=data(:,4);   🡐 v will contain the absolute errors.
   Briefly discuss the behavior of the numerical values v(2) thru v(11) in regard to the accuracy of the approximation generated by Euler's method.