MATLAB II

Consider the I.V.P. :

$$\frac{dy}{dt} = 2\left(1 - \frac{y}{3}\right)y, \qquad y(0) = 1.$$

1. Using Matlab, write a script that solves the above I.V.P. with Euler's method at a specified time and for a specified time step.

2. Generate a table containing the solutions at time $t = 0.5, 1.0, 1.5, 2.0$ using the above script with time steps $h = 0.5, 0.1, 0.01$. In the same table add two more columns, one for the exact solution of the problem at the specified times and one for the approximated solution obtained by using the Matlab ode solver ODE45.

3. According to the table which method would you choose? Euler or ODE45? Why?

To use ODE45, you need to generate a separate script containing dy/dt. For example if you want to solve $dy/dt = 3 + e^{-t} - y/2$ with $y(0) = 1$, you could do so by first creating the following script:
function dy/dt=yprime(t,y)
dydt=3+exp(-t)-y/2;
end
After saving this file with the name yprime.m, you can use ODE45 to find the solution within a time interval $[t_0, t_f]$:
$[ty] = ODE45('yprime', [t_0, t_f], y_0)$;
If we want to solve between 0 and 4, with the given initial condition, we would type:
$[ty] = ODE45('yprime', [0, 4], 1)$.
To obtain full credit, the student should submit a typewritten document, containing the table, al the code used to generate it, and all the answers to the above problem including the exact solution of the I.V.P. in explicit form.