Physics 301-001

Homework #11: numerical methods

1) Are we still doing physics [20 pts]? Let's get a solution to a complicated differential equation:

$$\dot{x} = -2x$$

a.) Find an exact solution to this differential equation. Use any method you'd like.
b.) Derive an expression for solving this equation numerically.
c.) Write a Matlab script to solve this over the range from t=0 to t=3.
d.) Devise a way to compare your exact solution with what your script tells you.
e.) Try different step sizes and make a plot of how your error (see step d) relates to the step size.

2) Isn't it summer yet [8 pts]? Write a Matlab script to do the following:

$$\int_{-2}^{-1} x^2 \, dx$$

3) I demand ice cream [4 pts]! Plot the derivative (using numerical methods) of the following function from y=4 to y=10:

$$g(y) = y^3$$

4) Numerical Again! I want to go to the beach! [10 pts]: Use numerical methods to solve the following differential equation for y(0)=-1 and dy/dt (0) = +1:

$$y'' = -10y$$