ENGR 326
ODE Lab Assignment 4

Solve the following ODEs.

1. $(2x^2 + y)\,dx + (x^2y - x)dy = 0$
2. $(2xy)\,dx + (y^2 - 3x^2)\,dy = 0$
3. $(2xy^3 + 1)\,dx + (3x^2y^2 - y^{-1})\,dy = 0$

Write the following as systems of first order differential equations.

4. $y'' - yy' = 0, \quad y(0) = 1, \quad y'(0) = 1$
5. $0.5\frac{d^2Q}{dt^2} + 6\frac{dQ}{dt} + 50Q = 24\sin(10t)$
   with $Q = 0$ and $dQ/dt = 0$ at $t = 0$.

Solve the following ODE using the Euler's and modified Euler's method.

6. $\frac{dc}{dt} = -kc^2$ where $c_0 = 300$ mg/l and $k = 0.001$ (hr-mg/l)$^{-1}$. Plot the results from each numerical method compared to the exact solution. Use 30 time steps, trying a variety of values for Δt. Turn in the solution and plot for the case where $\Delta t = 2$ hours.