WEEK 5 SECTION PROBLEMS

Solve the following problems. If initial conditions are given, solve for all constants of integration. It is okay to leave answers in implicit form or with unsolved integrals.

1. $xy'' + 2y' + x = 1$, $y(1) = 2$, $y'(1) = 1$
2. $y'' - y'y = 0$
3. $\frac{1}{3}x^2y'' + xy' + \frac{1}{3}y = 0$, $y(1) = 1$, $y'(1) = 1$
4. **ode45:** For the following system, write a function to evaluate the derivatives, and then write the function call to ode45 to store the numerical solution over the range $0 \le t \le 10$. Be sure to pass α as a parameter into the derivative function.

$$\dot{x} = 2x + 3y$$

$$\dot{y} = x - \alpha y$$

$$x(0) = y(0) = 1$$

5. The red and green lines in the plot below are the numerical solution to a coupled system of ODEs, and the blue line is a plot of step size taken by ode45 over the domain. What is the relationship between the step size and numerical solution? *Hint:* Think about the derivative of the functions.