MA 331 **Name (Print):** _____
Fall 2017
Homework 2: Separable Diff Eq & Integrating Factors
Due: 09/07/17

1.) Download MATLAB and bring your laptop to classes for Thursday, September 7, 2017 and Tuesday, September 12, 2017. If you do not have a laptop available, you can check out a laptop from the library.

2.) Are the following differential equations linear/nonlinear, separable/non-separable?

a.) $\sin(x)y' = y^2$

b.) $e^x y' = x^4 + y$

c.) $yy' = 2y - x^3 y$

3.) A small pond initially contains 10,000 gallons of pure water. An evil corporation begins dumping dissolved toxic waste into the lake at a concentration of $\frac{1}{4}$ lb of waste/gallon of water at a rate of 4 gallons/day. Assume the pond is well-mixed and that the pond evaporates at a rate of 4 gallons/day. Define $W(t)$ to be the amount of waste present in the pond at time t, measured in lbs.

a.) Find the rate at which waste is put into the pond (hint: think about your units!)

b.) Find the rate at which waste is eliminated from the pond

c.) Write an initial value problem that describes the rate of change of the waste present in the pond at time t.

d.) Solve the differential equation

e.) At what time will the pollutant become detectable at a concentration of $\frac{1}{100}$ lb/gal? Hint: consider your units!

4.) Find the integrating factor for the following problems (No need to solve! Just find $\mu(t)$)

a.) $y' = -3y + t + e^{-2t}$

b.) $y' + 2ty = 2te^{-t^2}$

c.) $\sin(x)y' + \cos(x)y = 2x$

5.) Solve the following initial value problems

a.) $ty' = -2y + \frac{\cos(t)}{t}, \quad y(\pi) = 0, \quad , y > 0$

b.) $y' = 3y^2(x + \cos(x)), \quad y(0) = -2$

c.) $\sqrt{(}x)y' = y + 2, \quad y(0) = 1$