Homework 2: Math 22B - Tavernetti, Fall 2016
Due Wednesday, Oct 5 in class
(20 points)

Instructions : Solve all problems. Print out your solutions when computer results are asked for (do not include the dfield8.m code), work neatly, label your plots, show your work. Staple your homework together with your name on it. A random subset of the problems will be graded. You are encouraged to work in groups, but everyone must do their own write up.

Warning : Unstapled homework with multiple pages is minimum -5 out of 20 points and if a page is lost from an unstapled homework the default assumption will be it was not turned in.

Reading Assignment : Read Boyce and DiPrima chapters 2.1-2.7

Problem 1 : Find the general solution and determine (if possible) how solutions behave as $t \to \infty$

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

Problem 2 : Find the general solution and determine (if possible) for $t > 0$ how solutions behave as $t \to \infty$

$$ty' = -y + 3t\cos(2t)$$

Problem 3 : Solve the initial value problem

$$ty' + 2y = \frac{\cos(t)}{t} \text{ subject to } y(\pi) = 0$$

Problem 4 : Find the value of y_0 for which the solution for $t > 0$ of the initial value problem touches but does not cross the t-axis,

$$y' + \frac{2}{3}y = 1 - \frac{1}{t} \text{ subject to } y(0) = y_0.$$

Also use dfield8.m (or it's equivalent) to plot the direction field and highlight or otherwise identify the specific integral curve satisfying this condition. Be sure to label the initial condition on the graph.

Problem 5 : For which value of y_0 does the solution of the initial value problem remain finite as $t \to \infty$,

$$y' - y = 1 + 3\sin(t) \text{ subject to } y(0) = y_0?$$

Problem 6 : Solve the differential equation $y' + y^2\sin(t) = 0$

Problem 7 : Solve the differential equation $xy' = \sqrt{1 - y^2}$

Problem 8 : Solve the initial value problem and determine where the solution attains its maximum value

$$y' = \frac{2\cos(2x)}{3 + 2y} \text{ subject to } y(0) = -1.$$

Solve the problem numerically using dfield8.m or its equivalent, and plot the integral curve corresponding with the given initial condition. Which method, the numerical or analytical method, do you feel is better and why?

Problem 9 : For the following initial value problem

$$y' = \frac{2x}{y + x^2 y} \text{ subject to } y(0) = -2.$$

(a) Find the solution of the IVP in explicit form.

(b) Plot the graph of the solution either by hand, or by computer.

(c) Determine (approximately if necessary) the interval in which the solution is defined.

Problem 10 : For the following initial value problem

$$y' = \frac{3x^2 - e^x}{2y - 5} \text{ subject to } y(0) = 1$$

(a) Find the solution of the IVP in explicit form.

(b) Plot the graph of the solution either by hand, or by computer.

(c) Determine (approximately if necessary) the interval in which the solution is defined.