QUIZ 10 AND 11 FOR CALC 4 (TAKE HOME)

COMPUTATION PROBLEMS

(1) (2 pt) Solve the differential equation
$$x'(t) = \begin{bmatrix} 3 & 0 \\ 8 & -1 \end{bmatrix} x(t).$$

(2) (2 pt) Solve the differential equation
$$x'(t) = \begin{bmatrix} -4 & 5 \\ -3 & 0 \end{bmatrix} x(t).$$

(3) (2 pt) Solve the differential equation
$$x'(t) = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix} x(t).$$

(4) (3 pt) For the systems defined by equations above, classify the critical point (0,0) as to type, and determine whether it is is stable, asymptotically stable, or unstable.

REVIEW PROBLEMS FOR FIRST ORDER EQUATIONS

(1) (2 pt) For the equation
$$y' = f(y)$$
when do we say $y = y_0$ is an equilibrium? And when do we say $y = y_0$ is stable from above and stable from below?

(2) (2 pt) What is a separable differential equation? How do you solve it?

(3) (2 pt) When is the first order equation
$$M(x,y) + N(x,y)y' = 0$$
exact? And if it is not exact, what can we do to make it exact?

(4) (1 pt for free) Review Lecture 8 - 16. Think about the questions in the next page

REVIEW PROBLEMS FOR HIGHER ORDER EQUATIONS

(1) How to solve homogeneous linear 2nd order differential equation with constant coefficients. (Lecture 8, 10, 11)

(2) When are two functions linear independent? If the coefficients your homogeneous linear 2nd order differential equation are not constants, but you happened to know one independent particular solutions, what can you conclude from the Wronskian theorem? (Lecture 14)

(3) If the coefficients of your homogeneous linear 2nd order differential equation are not constants, but you happened to know one particular solution, what can you do? (Lecture 11)

(4) What did the existence and uniqueness theorem said? (Lecture 4, 10)

(5) What is the structure of general solution of an inhomogeneous 2nd order differential equation? (Lecture 12)

(6) What are the templates for guessing a particular solution for inhomogeneous 2nd order differential equation? If your first try fails, should you give up? (Lecture 12)

(7) How to find a particular solution by the technique variation of parameters? (Lecture 13)

(8) Think about Problem (1) to (6) for general nth order linear differential equation (homogenous and inhomogeneous). (Lecture 14, 15, 16).