LIST OF TOPICS: MATH 215/255 SEPTEMBER-DECEMBER 2017 MIDTERM ONE

First Order Differential Equations

- Identify linear, nonlinear and separable equations, and understand order of an ODE (Lebl 0.2, 0.3, 1.3).
- Understand solutions in algebraic, integral and graphical forms (Lebl 1.1).
- Know and apply conditions that guarantee the existence and uniqueness of solutions for first order equations (Lebl 1.2).
- Understand slope fields for first order equations and be able to plot and interpret simple examples (Lebl 1.2).
- Understand and interpret plots of dy/dx vs y for autonomous equations (Lebl 1.6).
- Solve 1st order linear differential equations using an integrating factor. (Lebl 1.4)
- Solve separable 1st order equations via separation of variables (Lebl 1.3).
- Interpret solutions and link to properties of the original ODE (Examples in class and assignments).
- Applications, including: Newton's law of cooling, dilutions, evaporation problems, population growth, logistic equation, radioactivity, etc (Examples in class, assignments).
- Identify and solve exact equations (Lebl 1.8).

Numerical Methods

- Know Euler's method and apply to find numerical approximations to solutions of differential equations. (Lebl 1.7)
- Understand the estimated convergence of Euler's method (global (accumulated) error proportional to the time step h, for small h). (Lebl 1.7)
- Understand Matlab/Octave syntax as used on the homework problems (plotting direction fields for 1-D problems, and using ode45 to generate numerical solutions) (assignments)

Systems of Linear First Order Differential Equations

- Solve simple systems using eigenvalue-eigenvector method including complex eigenvalue and repeated eigenvector (defective matrix) cases (Lebl 3.4, 3.7).
- Understand vector fields for first order equations and be able to plot and interpret for all 2x2 cases (Lebl 3.5).