Math 221

A checklist of topics covered

First order equations

differential equations terminology, initial value problems (IVPs)
existence/uniqueness theorem
direction fields
separable equations
linear first order equations, integrating factors
applications
    mixing problems
    Newton's law of cooling
    population models
    acceleration/velocity models
autonomous equations
phase diagrams
Euler's method

Second order equations

differential operators
existence/uniqueness theorem
homogeneous solutions, fundamental solutions, particular solutions
Wronskian, linear independence
linear equations with constant coefficients; auxiliary equation
reduction of order
method of undetermined coefficients
variation of parameters
higher-order equations
applications: spring-mass problems
    undamped; underdamped, critically damped, overdamped
    forced vibrations

Systems of equations

elimination method
autonomous systems, direction fields
nullclines, equilibrium solutions
phase portraits
node/spiral ; sink/source/saddle ; stable/unstable
applications: multiple tank systems

Laplace transforms

Laplace transform, linear operator
inverse Laplace transform
solving IVPs: partial fractions
discontinuous external forces, piecewise-defined functions
convolution integral, Duhamel's principle