

MATH 0290: Topics for exam 1

Spring 2014

January 30, 2014

This is a short summary of the topics that you are required to know for exam 1. The material goes from the first lecture through the beginning of the lecture on Monday, February 3. That means you need to know about linear, homogeneous equations with constant coefficients, but you don't need to know about the method of undetermined coefficients.

1 General ODE concepts

1. Definition of an ODE
2. The order of an ODE
3. What it means for a function to be a solution to an ODE
4. Initial value problems
5. General vs. particular solutions
6. Explicit vs. implicit solutions
7. Intervals of existence

2 First order ODEs

1. Separable ODEs
2. Linear ODEs
3. Exact ODEs
4. Direction fields
5. Uniqueness of solutions and what it means for solutions
6. Numerical solutions: Euler integration

3 Modeling

1. The Malthusian model of population growth
2. The logistic model of population growth
3. Personal finance: accounts with compounded interest, withdrawals, deposits

4 Second order ODEs

1. The form of initial value problems for second order ODEs
2. Linear combinations: $C_1y_1 + C_2y_2$
3. Linear dependence vs. linear independence
4. General form of solutions (in terms of linear combinations of the fundamental set of solutions)
5. How to solve second order equations with constant coefficients
6. Intuition for the three cases: real distinct roots, complex roots, and repeated roots
7. Intuition for the behavior of linear, homogeneous spring-mass systems: natural frequency, damping coefficient, spring constant, overdamped vs. underdamped vs. critically damped