MATH 2920: Fall 2010

Midterm Exam Review Topics

Chapters: 1.1-1.4, 2.1-2.6, 3.1-3.2, 3.4-3.5, 6.1-6.6

Theory:
- Banach contraction principle (Theorem 2.1)
- Picard-Lindelöf theorem (Theorem 2.2)
- Gronwall’s inequality
- Theorem 2.8 (dependence of the solution on initial condition and RHS)
- Theorem 2.16 (global existence and uniqueness)
- Principal matrix solution of a linear system and its properties
- Fundamental matrix solution
- Wronskian
- Liouville’s theorem (Lemma 3.9)
- Liapunov and asymptotic stability
- Floquet theorem (Theorem 3.12)
- Dynamical system, transformation, orbit
- Liapunov theorem (Theorem 6.11)
- Krasovskii-LaSalle principle (Theorem 6.12)

Methods:
- Solving 1-st order ODE’s by separation of variables
- Solving 1-st order linear ODE’s using integrating factor
- Proving local existence of solutions
- Proving local uniqueness of solutions
- Finding maximal interval of existence
- Proving extensibility of solutions to all of R
- Computing matrix exponential for a general matrix using real Jordan canonical form
- Solving homogeneous linear systems with constant coefficients
- Determination of the stability of a 2x2 linear system.
- Classification of fixed points of 2x2 linear systems.
- Solving in-homogeneous linear systems (Theorem 3.10)
- Proving that a linear system is Liapunov or asymptotically stable.
- Computing the monodromy matrix for a periodic linear system.
- Computing Floquet exponents and multipliers
- Determination of the stability of a solution of a periodic linear system (Corollary 3.14)
- Proving a set is σ-invariant
- Finding minimal σ-invariant sets
- Finding an ω-limit set.
- Proving stability of a fixed point using Liapunov or Krasovskii-LaSalle principle