

Syllabus for the midterm test

The test will consist of four or five problems, proofs, or explanations, concerning the topics below which were covered in class or on homework. The test is take-home, to be worked individually without help except the text(s) and your notes. It will be given at the end of class Wednesday, April 2, to be handed in at the beginning of class Friday, April 4.

The initial value problem for systems of ODE: Existence for continuous systems. The Lipschitz condition. Gronwall's inequality and uniqueness. Maximal interval of existence; continuation. Differentiability with respect to initial conditions.

Linear systems with constant coefficients: Exponential of a matrix. Jordan normal form; generalized eigenvectors. Log of a matrix. Criteria for stability, asymptotic stability.

General theory of linear systems of ODE: Linear independence, fundamental matrices. Abel's formula. Transport; evolution of phase space volume. Variation of constants formula. Nonlinear asymptotic stability of equilibria. Floquet theory: Floquet exponents, Floquet's theorem.

Omega-limit sets. Poincaré sections. Poincaré-Bendixson theory for 2D flows.