Review Sheet for Math 20580, Fall '10, Exam 3

Disclaimer. The following review sheet represents a sincere attempt to help you prepare for the exam. It is not in any sense a practice exam. Nor is it necessarily complete. There might be things on the exam that are not mentioned directly here, problems that look different than the review problems suggested here, etc. Nonetheless, we think it's better than nothing...

Practical details. The exam runs from 8-9:15 AM Tuesday, 11/16 in Jordan 101. There will be a review session Monday 4/15 from 7-8 PM in Hayes-Healy 129.

The exam will cover 5.5 and chapter 6.1-6.6 from Lay's book and sections 1.1-1.3, 2.1-2.3 and 2.5 in Boyce and DiPrima. The format of the exam will be similar to that of the first two. *No calculators, books, or notes will be allowed.*

Things to know

Terminology and concepts. Following are some words you should understand thoroughly for the exam.

- **Inner Products:** Length (or norm) of a vector, orthogonal vectors, orthogonal complement of a subspace, orthogonal/orthonormal set of vectors, orthogonal projection onto a vector/subspace, least squares solution and normal equations associated to a linear system.
- **ODEs:** ordinary differential equation, initial value problem, partial differential equation, order of a DE, linear ODE, separable ODE, autonomous ODE; stable/unstable critical (i.e. equilibrium) point of a first order autonomous ODE.

Computational skills.

- **Eigenstuff:** Dealing with complex eigenvalues and eigenvectors. Interpreting a 2×2 matrix with complex eigenvalues in terms of rotation and scaling.
- **Inner products:** Finding length and inner products of vectors in $\mathbf{R}^n$, determining whether a given set of vectors is orthogonal/orthonormal, computing orthogonal projections onto vectors/subspaces, finding the distance between a vector and a subspace, finding an orthogonal basis for a subspace, finding the least squares solution of a linear system, finding the line that best fits a set of points in the plane.
- **ODEs:** Relationship between a 1st order ODE and its direction field. Solving separable and linear first order ODEs and initial value problems, determining whether a function satisfies a given DE, determining the direction field for a given ODE. Solving word problems involving first order ODEs. Understanding the asymptotic behavior of solutions to an autonomous first order ODE.