Review sheet for the midterm

Standard disclaimer: The following represents a sincere attempt to help you prepare for our exam. It is not guaranteed to be perfect. There might well be minor errors or (especially) omissions. These will not, however, absolve you of the responsibility to be fully prepared for the exam. If you suspect a problem with this review sheet, please bring it to my attention.

Format: The exam will take place Thursday, March 9 from 6:15-8:15 PM in Jordan 310. There will be no take home portion.

The basic format of the exam will be similar to that of last semester's exams—a section of statements, a section of true false, and then several partial credit problems. Possibly I'll lean harder on the partial credit this time since we've been doing a lot of things with a strong computational bent lately.

Things to know:

definitions and statements. You should be able to give valid definitions of *unitary operator*, *isometry*, *adjoint operator*, *normal operator*, *self-adjoint operator*, *spectral theorems* for normal and self-adjoint operators, *positive operator*, *singular value*, *polar decomposition* of a linear operator, *singular value decomposition* of a linear transformation, *order of a differential equation*, *linear ode*, *autonomous ode*, *equilibrium point* of an autonomous ode, *existence and uniqueness theorem* for first order ordinary differential equations.

knowledge useful for answering questions. Recognizing isometries, normal and (positive) self-adjoint operators (it might help to know a couple of simple examples of each of these). Understanding what singular values "mean" for a linear transformation. Understanding how a first order ODE can be 'visualized' as a vector field in $\mathbf{R}^2$. Describing asymptotic behavior of solutions to first order autonomous ODEs and classifying equilibrium solutions as stable, unstable, or neither.

computational skills. Finding the adjoint of a given linear operator. Finding 'the' square root of a positive operator, polar decomposition of a linear operator, the singular values, the singular value decomposition of a linear transformation. Solving first order separable and linear ODEs and initial value problems, solving (homogeneous and inhomogeneous) higher order linear ODEs with constant coefficients.