Review Topics for Final Exam

1. Linear algebra
   (a) Least squares solutions
   (b) Vector and matrix norms, e.g. $L^2$ and $L^\infty$ norms
   (c) The singular value decomposition, relative $L^2$ condition number
   (d) Eigenvalues and eigenvectors
      i. Eigenvalues/vectors for real symmetric matrices
      ii. Power method, inverse power method (with shifts)
      iii. Jacobi’s method

2. Function approximation
   (a) Lagrange interpolation
   (b) Approximation in the $\infty$-norm vs. 2-norm
   (c) Norms of functions and inner products
   (d) Orthogonal polynomials, Gram-Schmidt

3. Numerical integration
   (a) Newton-Cotes formulas
   (b) Trapezoidal rule, Simpson’s rule (local error, global error for composite rules)
   (c) Euler-Maclaurin formula
   (d) Gaussian quadrature for polynomials

4. Initial value problems and finite differences
   (a) Truncation (approximation) error vs. round-off error for finite differences
   (b) Richardson extrapolation
   (c) Local error vs. global error
   (d) Systems of initial value problems
   (e) Implicit vs. explicit schemes
   (f) Absolute stability
   (g) Stiff systems