Final Review
SE3X03/CS4X03, 2012

1. Floating-point arithmetic

   - IEEE floating-point standards, single precision, double precision, binary representation, special quantities (denormals, $\pm\infty$, ± 0, NaN)
   - Error measurements: unit of roundoff, unit of last place (ulp)
   - Overflow, underflow, (scaling technique), cancellations (benign and catastrophic)

2. Solving linear systems: Gaussian elimination with partial pivoting, `decomp` and `solve`

3. Interpolation

   - Polynomial interpolation (Lagrange polynomials)
   - Piecewise polynomial interpolation, `ncspline`, `seval`

4. Numerical integration

   - Rectangle, trapezoidal, and Simpson's rules
   - Richardson's extrapolation, error estimation using one-panel and two-panel
   - Adaptive quadratures, `QUADR`, `QUADS`

5. Solving ordinary differential equations

   - Accuracy, order of a method
   - Forward Euler's method (explicit, single step, first order), backward Euler's method (implicit, single step, first order)
   - Transforming a higher (second) order ODE into a system of first order ODEs, solving a system of first order ODEs using the forward (explicit) Euler's method or the backward (implicit) Euler's method.

6. Solving nonlinear equations

   - Issues in an iterative method: Initialization, convergence and rate of convergence, termination. The example of computing square root
   - Bisection method
   - Newton's method for finding a zero of a nonlinear function.