Final Review
CAS708, April 2014

1. Numerical integration

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

2. 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.
   - Hybrid methods (PECE methods)

3. Solving nonlinear equations

   - Issues in an iterative method:
     Initialization
     convergence and rate of convergence (proving convergence)
     termination
     The example of computing square root
   - Bisection method
   - Newton's method
   - System of nonlinear equations, Newton's method, Jacobian matrix
   - The Newton's method for continuous optimization, gradient and Hessian matrix.