

# AMS527: Numerical Analysis II

## Review for Test 2

Xiangmin Jiao

SUNY Stony Brook

March 25, 2009

# Materials Covered Since Test 1 (1)

- Numerical Integration
  - Concepts: quadrature rules; degree of quadrature rules; stability of quadrature rules; connections with polynomial interpolation; Newton-Cotes rules; Gaussian quadrature rules; change of interval; composite quadrature rule; multiple integrals
  - Basic algorithms/schemes: method of undetermined coefficients; midpoint rule, trapezoid rule; Simpson's rule; Gaussian quadrature rules
  - Application to integral equations
- Numerical Differentiation
  - Concepts: Finite difference approximation; connections with polynomial interpolation
  - Basic algorithms/schemes: forward difference, backward difference, centered difference
- Other key concepts: Integral equations and Richardson extrapolation

- Numerical Methods for Initial Value Problems
  - Concepts: existence, uniqueness, and stability of solutions of ODEs; order of ODEs; global error vs. local error; growth factor for analysis of stability; stiffness; unconditionally stable; predictor-corrector methods
  - Basic algorithms/schemes: Euler's method; backward Euler; trapezoid method; Heun's method; fourth-order Runge-Kutta method
  - Understand how first- and second-order methods are derived
  - Other methods: Taylor series methods; multistep methods; multivalued methods

# How to Prepare for Test

- Go through lecture notes and refer back to textbook for details
- Go through review questions in Chapters 8 and 9
- Review homework problems
- Go through selected exercises in Chapters 8 and 9 (e.g., 8.7, 8.14, 9.2a, 9.5, 9.7, 9.9)