Test 1 Topics

APM 522 Numerical Methods for Partial Differential Equations

• PS 1–3 + Lectures

• Omit floating point, Fourier series solution, [Topics in brackets], & programs

• Discretizations of $df/dx$, $d^2f/dx^2$ (second-order central differences & first-order one-sided differences for $df/dx$)

• Diffusion/Heat Equation: forward Euler, backward Euler, & TR methods for $u_t = u_{xx}$ (memorize these methods)
  1. Order of accuracy (LTE = $\Delta t \tau$)
  2. Stability (Fourier analysis for $G(k)$)

• 3. TRBDF2 & Nonlinear Diffusion
  TRBDF2 method (I will give you the formulas)
  TR/TR method

• 4. Conservative Methods
  A numerical method for the 1D conservation law
  
  \[ w_t + f(w)_x = 0 \]

  is conservative if it can be written in the form
  
  \[ \frac{dw_i(t)}{dt} + \frac{1}{\Delta x} \left( F_{i+\frac{1}{2}} - F_{i-\frac{1}{2}} \right) = 0 \]