Reservoir Simulation
Homework #1
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1. Prove that:

$$\frac{df}{dx} = \frac{-f_{i+2} + 4f_{i+1} - 3f_i}{2h} + O\left(h^2\right)$$

$$\frac{df}{dx} = \frac{8(f_{i+1} - f_{i-1}) - \left(f_{i+2} - f_{i-2}\right)}{12h} + O\left(h^4\right)$$

2. Obtain the flow equation of compressible fluids using P^2-method and Pseudo-Pressure approach:

$$\frac{\varphi \mu_g c_g}{k}\frac{\partial p^2}{\partial t} = \nabla^2 p^2 + \frac{2zRT\,\mu_g}{Wk} q$$

$$\frac{\varphi \mu_g c_g}{k}\frac{\partial \psi}{\partial t} = \nabla^2 \psi + \frac{2RT}{Wk} q$$

Where the W is the molecular weight of gas, z is compressibility factor, R is the universal gas constant and k is the permeability of porous media.

3. Drive the single phase flow equation for slightly compressible fluid in cylindrical geometry.