

MA 5629 – Numerical PDEs
Michigan Technological University
Fall 2016
Homework #2, Due 9/29

1. Using the method of characteristic tracing (and interpolation), derive the Lax–Wendroff finite difference formula for the linear advection equation. You will want to construct the interpolating polynomial using the cells u_{i-1}, u_i, u_{i+1} .
2. The Lax–Wendroff finite difference formula applied to the linear advection equation, $u_t + au_x = 0$, solves the modified equation,

$$u_t + au_x = \frac{1}{6}a\Delta x^2 \left(\left(\frac{a\Delta t}{\Delta x} \right)^2 - 1 \right) u_{xxx}$$

to higher-order. Please derive this modified equation, and make some observations about the behavior of the Lax-Wendroff scheme applied to the linear advection equation. Implement the Lax–Wendroff FD scheme, and see if the numerical behavior correlates to your intuition based on the modified equation.