Name ________________________ Score __________________

MATH 581 - Fall 2004 - Homework 6

Carefully Read and Follow Directions Clearly label your work and attach it to this sheet. No credit will be given for unsubstantiated answers.

Each of the following problems deals with the pde

$$u_t + au_x = 0$$

1. Problem 4.2 on page 126 for the Lax-Wendroff scheme only.
2. Use Discrete Fourier Transforms to show that the implicit version of the Lax-Wendroff scheme given below is unconditionally stable.
$$-\frac{\nu}{2}(\nu+1)U_{j-1}^{n+1} + (1+\nu^2)U_j^{n+1} + \frac{\nu}{2}(1-\nu)U_{j+1}^{n+1} = U_j^n$$
Here $\nu = \frac{a\Delta t}{\Delta x}$.
3. Find the CFL condition for the Lax-Friedrichs scheme given by
$$U_j^{n+1} = \frac{1}{2}(1+\nu)U_{j-1}^n + \frac{1}{2}(1-\nu)U_{j+1}^n, \quad n \geq 0.$$
Here $\nu = \frac{a\Delta t}{\Delta x}$.
4. Reproduce the results in Figures 4.6 and 4.8 of your text. These figures discuss the results of applying both the upwind and Lax-Wendroff scheme to the problem in equations (4.33a)-(4.34b) on page 97.