

M412 Assignment 3, due Friday September 16

1. [10 pts] Use the method of characteristics to solve the PDE

$$\begin{aligned}u_x - u_y + 2y &= 0 \\ u(x, y) &= xy \text{ on the line } x + 2y = 1.\end{aligned}$$

2. [10 pts] For the PDE

$$\begin{aligned}u_t + f(u)_x &= 0 \\ u(0, x) &= g(x),\end{aligned}$$

use the method of characteristics to show that solutions satisfy the implicit relationship

$$u(t, x) = g(x - f'(u(t, x))t).$$

3. [20 pts] Use the methods of characteristics and diagonalization to solve the PDE system

$$\begin{aligned}u_{1_t} - u_{1_x} - u_{2_x} &= 0; & u_1(0, x) &= f(x) \\ u_{2_t} - u_{1_x} &= 0; & u_2(0, x) &= g(x).\end{aligned}$$

4. [10 pts] Haberman Problem 12.4.4.
5. [10 pts] Haberman Problem 12.4.6. (The solution to this one is in the back.)