

**Fall 2008 - Math 462 Section 0101**  
**Partial Differential Equations for Scientists and Engineers**  
Homework #2 - Due Thursday Sept 18th

1. (25 pts)

- (a) Solve the equation  $y u_x + x u_y = 0$  with  $u(0, y) = e^{-y^2}$ .
- (b) Sketch the characteristic curves.
- (c) In which region of the  $xy$  plane is the solution uniquely determined?

2. (25 pts) Consider the initial value problem

$$(1+t)u_t + x u_x = (1+t)u^2$$
$$u(x, 0) = \sin(x)$$

- (a) Find the equation for the characteristic curves  $x(t)$ .
- (b) Find the solution  $u(x, t)$ .
- (c) Verify that the function you obtained in (b) is a solution of the initial value problem.

3. (25 pts) Solve  $u_x + u_y + u = e^{2+2y}$  with  $u(x, 0) = 0$ .

4. (25 pts) Carefully derive the equation of a string oscillating in a medium in which the resistance is proportional to the velocity (there is an additional force that you must take into account, which is in the direction opposite to the motion of the string, and with modulus  $\gamma|u_t|$  for some constant  $\gamma$ ).