

Fall 2012 - Math 462
Partial Differential Equations for Scientists and Engineers
Homework #1 - Due Monday Sept 10th

1. (20 pts) Verify the linearity and nonlinearity of the following equations:

(a) $u_{xx} + u^2 u_y = 0$

(b) $u_{tt} - u_{xx} + u^3 = 0$

(c) $u_{xx} + y u_{yy} = 0$

(d) $u_t + u_{xxx} + (u_x)^2 = 0$

2. (20 pts) Compute the derivatives of the following functions:

(a) $f(t) = \sin \frac{x(t)^2 + \tan(t)}{y(t)}$

(b) $g(t) = \int_{-2t}^{t^3} f(t, xt) dx$

Indicate clearly how you apply the chain rule.

3. (20 pts) Find **all** solutions of the following ODE:

$$xy^2 + y'x^2 = 0.$$

4. (20pts) Solve the equation $(1 + x^2)u_x + u_y = 0$.

Sketch some of the characteristic curves.

5. (20pts) Solve the equation $\sqrt{1 - x^2} u_x + u_y = 0$ with the condition $u(0, y) = y^2$.