18.306 Advanced Partial Differential Equations with Applications
Fall 2009

Lecture 03 2009 09 16 WED

TOPICS: Classification of pde.
        Examples.
        Kinematic waves and characteristics.

Definition of PDE. Rank PDE from general to simplest.
   Quasi-linear, semi-linear, linear, high order, first order, systems,
   scalar ...

Simplest pde: scalar, first order in 2-D, and linear
   a*u_x + b*u_y = c*u + d, with a and b functions of (x, y).

Show it can be reduced to ode's along characteristics (this property
defines it as a hyperbolic equation).
Characteristic form of the equations.
Allowed type of data: solution given along a curve that intersects
   (transversally) every characteristic in the region of interests
   once and only once.
Examples: a) linearized traffic flow and b) linearized river waves.
--- General solution of the initial value problem.
--- in (a) density waves move backwards through traffic.
--- in (b) flood waves move forward of particles.