

22M:096:001
Traffic Flow Module–Homework 1

1. Suppose that $f : \mathbb{R} \rightarrow \mathbb{R}$ is continuous, and that for every $a \leq b$

$$\int_a^b f(x)dx = 0$$

Prove that $f(x) = 0$.

2. Solve each of the following PDEs for the given initial conditions and sketch the characteristics in each case.

- (a) Consider the partial differential equation for traffic flow

$$\rho_t + 7\rho_x = 0$$

with initial conditions

$$\rho(x, 0) = 1.$$

- (b) Consider the PDE

$$\rho_t + \rho_x = 0$$

with initial conditions

$$\rho(x, 0) = x.$$

- (c) Consider the PDE

$$\rho_t + x\rho_x = 0$$

with initial conditions

$$\rho(x, 0) = 1.$$