C-21-2 Models in Applied Mathematics
Winter 1997
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Problem Set 2 January 23, 1997

Due February 4, 1997

1. in Lee&Segel problem 14.1.12.
   Instead of following the instructions in Lee&Segel you can derive the evolution equation for the distribution function $\psi(x,u,t)$ also by considering the flow in the phase space of a galaxy and making use of the conservation of galaxies.

2. in Lee&Segel problem 14.2.1.

3. in Lee&Segel problem 14.2.3.

4. Consider a fluid under the influence of a conservative force $\mathbf{f} = -\nabla\Phi$.
   a) Show that for the fluid to be at rest the surfaces of constant density have to be parallel to the equipotential surfaces.
   b) Consider the density stratification in the atmosphere. Assuming that the air is at rest, calculate the height dependence of the pressure for the following two equations of states,

$$i) \qquad p = \rho R T, \qquad T = const., \qquad \text{(ideal gas)},$$

$$ii) \qquad p = c\rho^{\gamma}, \qquad \gamma = \frac{c_p}{c_v}, \qquad \text{(isentropic)}.$$