1. Derive

$$\frac{d\rho}{dt} = \frac{\partial \rho}{\partial t} + \vec{u} \cdot \nabla \rho$$

and

$$\frac{df}{dt} = \frac{\partial f}{\partial t} + \vec{u} \cdot \nabla f + \vec{a} \cdot \nabla_u f$$

where ρ and f are the mass density and distribution function, respectively.