

## Problem set 2, due in on Monday 30.

1. Consider homogeneous inviscid gas at rest, with pressure  $P$ , density  $\rho$ , and homogeneous magnetic field  $\vec{B}$ . Consider a plane wave with a wave-vector  $\vec{k}$ .
  - a. **Alfven waves.** Consider the case where fluid displacements are perpendicular to both  $\vec{B}$  and  $\vec{k}$ . Show that the fluid motion is incompressible, and that the pressure perturbation is zero. Find the dispersion relation for the wave and hence the phase and group velocities.
  - b. **Fast magnetosonic wave.** Consider the case where  $\vec{k}$  is perpendicular to  $\vec{B}$ , and fluid displacement is parallel to  $\vec{k}$ . Find the phase speed of the wave.
2. Consider magnetic field in vacuum, generated by a magnetic dipole. Show explicitly that magnetic pressure-gradient force and tension force exactly balance each other.