General Relativity Ph236b
Problem Set 5
Due: In class, February 7, 2005

Suggested Reading: "Theory of CMB Polarization," P. Cabella and M. Kamionkowski, http://arxiv.org/abs/astro-ph/0403392.

1. Use linear theory to show that if (i) the transverse-vector perturbation is at some initial time nonzero, (ii) if its source vanishes (i.e., $\Sigma_{\perp,ij} = 0$), and (iii), the Universe consists only of pressureless matter, then transverse-vector-perturbation amplitude ($w_{\perp,i}$ in Poisson gauge and h_i in synchronous gauge) decays with the expansion. Derive this result in both synchronous and in Poisson gauge. To do so, you will need the continuity and Euler equations, as well as the relevant Einstein equation.

2-8. Do Exercises 1 through 7 in the suggested reading (astro-ph/0403392).