

ECE 656: Fall 2009
Lecture 2 Homework

- 1) Assume $T = 0\text{K}$ and work out the electron density per unit area for two cases:
 - i) A semiconductor with parabolic energy bands and an effective mass of m^* and
 - ii) Graphene, where we consider $E > 0$ to be the conduction band. ($E = 0$ is where the bands cross, the so-called Dirac point.)
 - 1a) Express your two answers in terms of the Fermi energy, and show that they are different.
 - 1b) Express your two answers in terms of the Fermi wavevector and show that they are the same.
- 2) Assume a finite temperature and work out the sheet carrier densities for a parabolic band semiconductor and for electrons in the conduction band ($E > 0$) of graphene.
- 3) Assume $T = 0\text{K}$ and work out the average +x-directed velocity for electrons in:
 - i) A semiconductor with parabolic energy bands and
 - ii) In the conduction ($E > 0$) of graphene.

Your answer should be in terms of the Fermi energy, E_F .