P7.1 energy surface meets Bragg plane *cf.* Eq. 9.28. The nearly free electron picture shows that energy bands are distorted near the Bragg planes where $|\mathbf{k}| = |\mathbf{k} - \mathbf{K}|$.

a) Find the gradient of $\mathcal{E}_{n,k}$ near such a plane using the formula 9.26, given that the potential energy with wavevector $\mathbf{K}$ is $U_{\mathbf{K}}$.
b) Find the direction of the gradient vector when $\mathbf{k}$ lies *in* the Bragg plane.
c) At what angle does a surface of constant energy intersect the Bragg plane?

P7.2 triangular lattice bands *cf.* Prob. 3, p. 171. A triangular lattice of atoms interacts weakly with electrons.

a) If there are two electrons per atom, and the interaction strength is very small compared to the Fermi energy, what fraction of the occupied states lie in the second-lowest band?
b) Suppose the smallest reciprocal lattice vector has magnitude K_1, and denote the lattice potential at these wavevectors by U_1. Suppose the unperturbed energy for $\mathbf{k}$ at a corner of the Brillouin Zone is $\mathcal{E}_0$. Find the three energy lowest energy states for this $\mathbf{k}$ in terms of U_1 and $\mathcal{E}_0$.

P7.3 Density of levels for a two-band model Problem 2, p. 170.

do Parts a), b) and c)
d) From the figure it looks like $g(\mathcal{E})$ has its unperturbed value when $\mathcal{E} = \mathcal{E}_0(K/2)$. Is this true?
e) It looks like $g(\mathcal{E})$ is linear for energies $\mathcal{E}$ that straddle the lower and upper bands. Is this true?