

# Homework 6 Solution Addendum, ECE 535, Fall 2009

15 October 2009

(Stolen from a student — I didn't think of this)

$$\frac{\hbar k^2}{2m} = E \left( 1 + \frac{E^2}{E_g^2} \right)^{\frac{1}{2}}$$

Note:

$$\frac{dE}{dk} = \frac{1}{\frac{dk}{dE}}$$

Differentiate **with respect to k** using the chain rule:

$$\frac{d^2 E}{dk^2} = -\frac{1}{\left(\frac{dk}{dE}\right)^2} \frac{d}{dk} \left( \frac{dk}{dE} \right) = -\frac{1}{\left(\frac{dk}{dE}\right)^2} \frac{d^2 k}{dE^2} \frac{1}{\frac{dk}{dE}} = -\frac{d^2 k}{dE^2} \left( \frac{dk}{dE} \right)^{-3}$$

Now the RHS is *easy* to calculate for the given problem (after you express the original equation in terms of k by taking the square root). And all the derivatives on the RHS are with respect to E. Then just invert the final answer.

The overall solution is much shorter if you do it this way.