Chem 2430 HW #3

1. Consider the particle in the box problem, with $V = 0$ between 0 and L, and infinite outside the box.

   Consider the wave function

   $$\psi = Ax(L - x)$$

   a) Is this an eigenfunction of H?

   b) What is the energy associated with the above ψ? How much does it differ from the exact ground state energy?

   c) The ψ given above can be expressed as a linear combination of the eigenfunctions of $\hat{H}$ for this problem. i.e.,

   $$\psi = \sum_{i=1}^{\infty} c_i \phi_i$$ where the ϕ_i are the eigenfunctions

   What are the values of c_1, c_2, and c_3 if we keep only the first 3 terms in the sum?

2. Consider $\left(\hat{A} + \hat{B}\right)^2$ Is this necessarily $= \hat{A}^2 + \hat{B}^2 + 2\hat{A}\hat{B}$?
   Why or why not?

3. Problem 3.22 from Text