1. Show that the wave functions for the one-dimensional motion of a free particle (use periodic boundary conditions) form a set of orthonormal functions (proof).

2. Can you show that equation for calculating energy of particle inside of **finite potential well** $\tan\left(\frac{a\sqrt{2mE}}{\hbar}\right) = \frac{2\sqrt{E(U_0 - E)}}{2E - U_0}$ give the correct values for energy for **infinite potential well** $E_n = \frac{(\pi \hbar)^2}{2Ma^2} \cdot n^2$, n = 1, 2, ... in limit $U_0 \rightarrow \infty$? (proof)

Why the wavefunction value inside of walls of infinitely deep potential well should be equal to 0 ? (proof)

3. Write the Schrödinger equation to determine the third-order corrections for energy and wave functions in terms of perturbation theory (time-independent case).

PS! http://parsek.yf.ttu.ee/~physics/QM.html