1. Let us consider the wave function given by the lecture notes Eq. (67). Determine such values for the coefficients that the wave function and its derivative become continuous.
   The continuity requirements lead to a system of equations. In the model solution F has been chosen as the free variable.

2. On the lecture notes page 50, the squared norms of the coefficients A, B, C, D and F are given. On page 51, the reflection and transmission coefficients are given in given in terms of these squared norms. Starting from these two results, derive lecture notes Eq. (68). Furthermore, can the incoming particle have such energy that it surely passes the potential well? If that is possible, is it also possible to form an explicit expression for these energies?

3. A particle scatters from a symmetric one-dimensional potential well of height $V_0 < E$.
   a) Show that the probability density oscillates in regions I and II but is a constant in region III (use the same region numbering as in the lectures).
   b) Show that the wavelength of the oscillations in region I is longer that in region II.

4. A particle scatters from a finite potential well. Calculate the wave function for the *first resonance state*. Show that at the boundary $x = \pm a$, the wave function satisfies

$$|u(\pm a)| = 1 \text{ and } \frac{d|u_{II}(x)|}{dx}|_{x=\pm a} = 0.$$

5. Show that the continuum states of a symmetric potential well cannot be presented as a linear combination of the symmetric (or antisymmetric) wave functions of the bound states. Why are the parity properties for the continuum states different from those of the bound states?