Reading Assignment and exercises — hw-5

Please refer to file qm-file-1.pdf that was sent to you earlier by e-mail

1. Review p 6,7 on the two wavefunctions in coordinate space and in momentum space.
2. Need to know how to get the wavefunction $\Psi(x,t)$ if $\Psi(x,0)$ is given for a free particle. See the example on p.9.
3. For an incident particle coming from the left of a potential step, see p.11, set up the steps that would allow you to obtain the transmission and reflection coefficients.
4. Potential steps and potential well problems on pp15-17.
   Follow the detailed derivations on these three pages. Use the equations given there to plot the transmission probability vs $E/|V_0|$ from 0 to 5, for both the potential step and potential well. Use the equations given there.
   (a) Identify the condition for the case where the transmission probability is 1.0.
   (b) Recall the Bohr quantization condition for atomic hydrogen? It says that the allowed orbitals are such that the circumfernce is an integer multiples of the de Broglie wavelength of the particle. Show that the condition in (a) has the same meaning.
   (c) The results on page 17 is quite anti-intuitive. It says that for a potential well, when the incident energy E is close to zero, the transmission probability goes to zero. How you make peace with yourself on this mathematical result.
5. Read section 3.5 so you know how to solve the 1D problem with an attractive delta potential. It has one bound state. Sketch the wavefunction.
   Next check with the problem for the scattering with an attactive delta potential. Then consider the case if the potential has the same form but is a repulsive potential. Are the results identical?