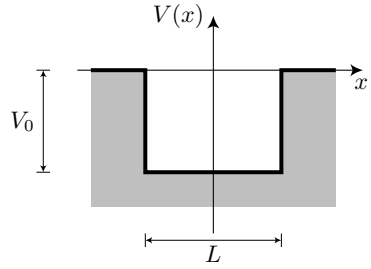
PHYS 631: Quantum Mechanics I (Fall 2020)
Exercises 26 October 2020 (Monday, Week 5)
Due Monday, 2 November 2020

Exercise 1. Consider the square-well potential shown below.



The general form of the solution of this potential is

$$\psi_E(x) = \begin{cases} a_{\rm I} e^{k_{\rm I} x} & \text{(region I)} \\ a_{\rm II} \cos k_{\rm II} x + b_{\rm II} \sin k_{\rm II} x & \text{(region II)} \\ a_{\rm III} e^{-k_{\rm I} x} & \text{(region III)}, \end{cases} \tag{1}$$

after boundary conditions at infinity have been applied. In class, we showed by matching the solutions at the boundaries that the condition for even-parity solutions is

$$\cot(k_{\rm II} L/2) = \frac{k_{\rm II}}{k_{\rm I}}. \tag{2}$$

Now show that the condition for odd-parity solutions is

$$\tan(k_{\rm II} L/2) = -\frac{k_{\rm II}}{k_{\rm I}}. \tag{3}$$