**Physics 451** **Winter 2026**

# Homework #1

(due Wednesday, January 14, 2026)

1. (10 pts) McIntyre 2.17
2. (10 pts) McIntyre 5.11
3. (10 pts) The particle is moving in a potential described by $U(x) = -\lambda\delta(0)$ where λ is a positive constant.

   (a) What is the dimensionality of λ ?
   (b) Sketch the potential energy U(x)
   (c) Solve the energy eigenvalue equation analytically to find the bound state energy eigenvalue and corresponding eigenfunction.
   (d) Sketch the wavefunction and discuss its features.

4. (10 pts) Fill in the table that describes the different representations of the operators, eigenvalues, eigenstates *etc*. for a quantum particle subject to a 1-dimensional infinite square well potential energy (p. 2).
5. Review Ch. 1-5 of McIntyre.

| 1-d infinite well potential energy | Ket Representation | Matrix Representation | Wave Function Representation | Graph Representation (if any) |
|---|---|---|---|---|
| Hamiltonian | | | | |
| Eigenvalues of Hamiltonian | | | | |
| Normalized eigenstates of Hamiltonian | | | | |
| Coefficient of $n^{th}$ energy eigenstate | | | | |
| Probability of measuring $E_n$ | | | | |
| Expectation value of Hamiltonian | | | | |