Week3 Homework

[week1 hw1]

• Problem 1 - Griffiths 2.1

Prove the following three theorems:
(a) For normalizable solutions, the separation constant E muust be $real$.

Proof:

(b) The time-independent wave function $\psi(x)$ can always be taken to be $real$ (unlike $\Psi(x,t)$, which is necessarily complex). This doesm't mean that every solution to the time-independent Schrödinger equation is real; what it says is that if you've got one that is not, it can always be expressed as a linear combination of solutions (with the same energy) that are. So you $might\ as\ well$ stick to ψ's that are real.

Proof:

(c) If $V(x)$ is an **even function** (that is, $V(-x) = V(x)$) then $\psi(x)$ can always be taken to be either even or odd.

Proof:

• Problem 2 - Griffiths 2.2

Show that E must exceed the minimum value of $V(x)$, fot every normalizable solution to the time-independent Schrödinger equation. What is the classical analog to this statement? *Hint:* Rewrite Equation 2.5 in the form

$$\frac{d^2\psi}{dx^2} = \frac{2m}{\hbar}\left[V(x) - E\right]\psi$$

if $E \leq V_min$, then ψ and its second derivative always have the *same sign* – argue that such a function cannot be normalized.

• Problem 3 - Rewrite the entanglement of XXX when c_n and ψ_n are not necessarily $real$.