Physics 410 Quantum Mechanics Fall 2010

Homework #4 Sept 24, 2010

due **Friday, Oct 1, 2009**

Griffiths problems 2.11 (a)-(b), 2.12, 2.16

<u>Johnson 4.1</u> In Example 2.4, Griffiths shows how to use the raising operator a_+ to get the first excited harmonic oscillator state, $\psi_1(x)$ from the ground state wfn $\psi_0(x)$. Apply again to get the second excited state, $\psi_2(x)$ (do not worry about overall normalization). Does this agree with what we find in section 2.3.2?

<u>Johnson 4.2</u>: In the following, *do not evaluate any integrals*. Instead, I want you to practice your dimensional thinking.

Consider $\Psi(x) = Ae^{-\lambda x^6}$ from $-\infty$ to ∞.

(a) Up to some dimensionless constant, what do you expect for the normalization A?

(b) Up to some dimensionless constant, what do you expect for $< x >$?

(c) Up to some dimensionless constant, what do you expect for $< x^2 >$?

(d) Up to some dimensionless constant, what do you expect for $< p >$?

(e) Up to some dimensionless constant, what do you expect for $< p^2 >$?

(f) Do you expect this wavefunction to satisfy the Heisenberg uncertainty principle? Why or why not?

(g) Extra credit: Are any of the above integrals "easy" to evaluate, without using a table of integrals or a computer program of any sort? If so, do so.