

## Homework # 3

Physics 461 – Quantum Mechanics I  
Fall 2009

Due: Friday, October 2

Reading:

Week of 9/21: Chapter 2, section 2.3.1 – Harmonic Oscillator (analytic method)

Week of 9/28: Chapter 2, section 2.4 – The Free Particle

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1. #2.10 *Hint:* In part (c) you are asked to determine orthogonality by explicit integration. That means you want to show that  $\int \psi_m^* \psi_n = 0$  for the particular wave functions considered here. Note that in part (b) you sketched the relevant wave functions. You can use these sketches to determine for part (c) which ones are even and odd.
2. #2.12 The problem says to use the method of Example 2.5. That means you never have to use the explicit form of  $\psi$ , but rather just the properties of the raising and lowering operators ( $a_+$  and  $a_-$ ) on  $\psi$ . Also, don't forget how the expectation value is defined!
3. #2.15 Although this problem appears at the end of 2.3.2, you don't really need to know anything from that section. One helpful suggestion is to make the substitution:

$$\xi = \sqrt{\frac{m\omega}{\hbar}} x$$

so that the limits of integration become numerals (needed to employ the Error Function hint).