PHYS 360: Quantum Mechanics NAME:_____

Reading Quiz

Date 9/19/8

Reading: Griffiths, pages 40-66

1) Griffiths explains that there are two ways of solving the Schr. Eq. with the harmonic oscillator: one method is with the so called ladder operator and the other is:

Circle One:

a) The algebraic method
b) The power series method
c) The method of raising and lowering operators
d) The method of creation and destruction operators.

2) Given: $\hat{a}_{\pm} \equiv \frac{1}{\sqrt{2\hbar m\omega}}\left(\pm i\hat{p} + m\omega\hat{x}\right)$

Work out $\hat{x}$ and $\hat{p}$ in terms of $\hat{a}_+$ and $\hat{a}_-$ and circle the correct answer

a) $\hat{x} = \sqrt{\frac{\hbar}{2m\omega}}\left(\hat{a}_+ - \hat{a}_-\right);\ \hat{p} = i\sqrt{\frac{\hbar m\omega}{2}}\left(\hat{a}_+ + \hat{a}_-\right)$

b) $\hat{x} = \sqrt{\frac{\hbar}{2m\omega}}\left(\hat{a}_+ + \hat{a}_-\right);\ \hat{p} = i\sqrt{\frac{\hbar m\omega}{2}}\left(\hat{a}_+ - \hat{a}_-\right)$

c) $\hat{x} = \sqrt{\frac{\hbar}{2m\omega}}\left(\hat{a}_+ + \hat{a}_-\right);\ \hat{p} = i\sqrt{\frac{\hbar m\omega}{2}}\left(\hat{a}_+ + \hat{a}_-\right)$

d) $\hat{x} = \sqrt{\frac{\hbar}{2m\omega}}\left(\hat{a}_+ + \hat{a}_-\right);\ \hat{p} = -i\sqrt{\frac{\hbar m\omega}{2}}\left(\hat{a}_+ + \hat{a}_-\right)$

e) $\hat{x} = -\sqrt{\frac{\hbar}{2m\omega}}\left(\hat{a}_+ - \hat{a}_-\right);\ \hat{p} = i\sqrt{\frac{\hbar m\omega}{2}}\left(\hat{a}_+ - \hat{a}_-\right)$