Due: Friday, 9/19, 2:10pm, PHYS360 Assignment 3
Reading:

1. Griffiths, Ch.2, pg. 40-66.
2. Prepare for Reading Quiz: Friday, 9/19, questions on anything in Griffiths, pages 40-66, but especially:

   a) be able to show $\sum_{n=1}^{\infty}|c_n|^2 = 1$, pg. 37

   b) be able to show $\langle H \rangle = \sum_{n=1}^{\infty}|c_n|^2 E_n$, pg. 37

   c) given $\hat{a}_{\pm} \equiv \frac{1}{\sqrt{2\hbar m\omega}}(\pm i\hat{p} + m\omega\hat{x})$, be able to show

   $\hat{x} = \sqrt{\frac{\hbar}{2m\omega}}(\hat{a}_+ + \hat{a}_-)$; $\hat{p} = i\sqrt{\frac{\hbar m\omega}{2}}(\hat{a}_+ - \hat{a}_-)$, as on pg. 49 in Ex 2.5

3. Optional: Applet Simulations (Physlet on CD), Problem 12.1, 12.2, 12.3 (if you do these problems, write the answers on a separate sheet)

Problems:

1. Problem 2.38, pg. 85
2. Problem 2.42, pg. 86

3. A particle in the harmonic oscillator potential is in the state:

$$\Psi(x,0) = \frac{1}{\sqrt{2}}\psi_0(x) + \frac{1}{\sqrt{2}}\psi_1(x)$$

   a) Check whether $\Psi(x,0)$ is normalized
   b) Find the state at time *t*, $\Psi(x,t)$
   c) Show that $\langle x \rangle$ and $\langle p \rangle$ oscillate in time. The answers should not contain any integrals (that is, work all integrals out).
   d) If you measured the energy of this particle, what value might you get and with what probabilities?

4. Show that

$$[\hat{N}, \hat{a}_-] = -\hat{a}_-, \qquad [\hat{N}, \hat{a}_+] = \hat{a}_+$$

5. Problem 2.10, pg. 50
6. Problem 2.11, pg. 50
7. Problem 2.12, pg. 50 (Follow instructions; i.e., use raising and lowering operators.)