Physics 3344
Homework 8 18 Mar 2008
Due Tues, Mar 25

1. Read Marion 6.4-6.7

   True/False: I read this material.

2. Marion Ch 3, Problem 42

3. (a) You live on a planet where engineers have figured out a way to drive an harmonic oscillator with a complex force. Find a particular solution to the damped harmonic oscillator when the driving force is $F_0 \exp(in\omega t)$, where n is an integer and F_0 is a real constant. (The solution will in general be complex.)

   (b) Only kidding. You live on earth, and complex driving forces are absurd. However, because the equation is linear, the real part of the solution in part (a) corresponds to the case where you have a driving force which is the real part of $F_0 \exp(in\omega t)$. Use this to derive the particular solution for a driving force $F_0 \cos(n\omega t)$, and show that for $n = 1$ it is equivalent to the solution for the case discussed in lecture. (Hint: First rationalize the complex denominator by multiplying it (and the numerator) by its conjugate.) Note that if you use the format $x + iy$ for the complex amplitude you'll get the first form of our solution; if you use the polar representation $r \exp(i\theta)$, you'll get the second form (with the phase shift). Either is fine. (Show both for extra credit and valuable prizes.)

   (c) Use the result from (a) again to give the solution for the driving force $F_0 \sin(n\omega t)$. (This should involve little additional work.)

   Note that this is a standard method for analyzing AC circuits.

4. Use the results from the previous problem and from problem 3.32 to give an approximate (particular) solution for the case of the square wave driving function defined in 3.32. (You only need to include contributions resulting from the four terms you kept in 3.32.)