Homework 10

Due Friday, October 28th at 5pm

Reading: Read Boas Ch. 8, sections 1-6. Focus particularly on section 5.

1. Boas Ch 3, 12.16
2. Boas Ch 3, 12.18. Here you will need to use the unequal mass example discussed in Ch 3. section 12, example 4.
3. Boas Ch 8, 5.8 and 5.11
4. Boas Ch 8, 5.14
5. Solve $y'' + (1-i)y' - iy = 0$. [Hint: See Chapter 2, Section 10, for a method of finding the square root of a complex number.]
6. Boas Ch 8, 5.31
7. In class we derived three forms for the equation of damped oscillations. The first was

   $$x(t) = C_1 e^{-bt+i\omega_1 t} + C_2 e^{-bt-i\omega_1 t},$$

   where $b = \beta/2m$, β is the damping coefficient, $\omega_1 = \sqrt{\omega_0^2 - b^2}$, and ω_0 is the natural frequency of the system $\omega_0 = \sqrt{k/m}$. The second was

   $$x(t) = e^{-bt}[D_1 \cos(\omega_1 t) + D_2 \sin(\omega_1 t)],$$

   and the third was

   $$x(t) = Ae^{-bt}\cos(\omega_1 t + \phi).$$

   Find expressions for D_1 and D_2 in terms of C_1 and C_2, and for A and ϕ in terms of D_1 and D_2. Finally if you are given that $x(0) = x_o$ and $\dot{x}(0) = v$ find A and ϕ in terms of these initial conditions.
8. Boas Ch 8, 5.38. [The setup of this problem requires knowledge of basic circuits. All of the relevant material is covered in the first section of Ch 8, but you will likely want to review your introductory physics textbook. Of course, and as always, feel free to discuss this foundational material with me.]