Homework #3: Phys 3344: Prof. Olness Fall 2018

Due 11 September2018

Consider the equation:

$$x'' + 2\,\beta\,x' + \omega_0^2\,x = Q_0\,\mathrm{Cos}(\omega_D\,t) \equiv Q_0\,\mathrm{Exp}(i\,\omega_D\,t)$$

The term $2\,\beta\,x'$ is the friction (dissipative) term.
The term $Q_0\,\mathrm{Cos}(\omega_D\,t) \equiv Q_0\,\mathrm{Exp}(i\,\omega_D\,t)$ is the driving term.

1) Case: $x'' + 0 + \omega_0^2\,x = 0.$
2) Case: $x'' + 2\,\beta\,x' + \omega_0^2\,x = 0$
3) Case: $x'' + 0 + \omega_0^2\,x = Q_0\,\mathrm{Cos}(\omega_D\,t)$
4) Case: $x'' + 2\,\beta\,x' + \omega_0^2\,x = Q_0\,\mathrm{Cos}(\omega_D\,t)$

Note, if you prefer (personally, I do) you may also replace
$Q_0\,\mathrm{Cos}(\omega_D\,t)$ by $Q_0\,\mathrm{Exp}(i\,\omega_D\,t)$; your choice
Note also: the factor of 2 I've inserted in front of β above is not a universal standard, but it should be as it make the math much easier.

Goals: We are trying to obtain the general solution for each case, and characterize the solution in terms of the physical expectations. Later we'll verify these numerically.

Note, you may find it convenient to define: $\omega_1^2 = \omega_0^2 - \beta^2$.

Your mission: Solve each of the 4 above equations BY HAND. You can refer to your old texts and other reference material from previous courses, and other students. The important point is that you UNDERSTAND the physical properties of the solutions.