Birzeit University
Department of Physics
Physics of vibrations and waves, Phys236
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Extra Problems

1. A particle of mass m is suspended from the end of a vertical spring whose stiffness is s. A constat downward force F_0 is applied continuously to the particle for a certain time interval. At time t_0 the force is removed. Find the displacement of the particle from its equilibrium position.

2. An object of mass m motion is described as damped simple harmonic motion. The object is now under the influence of two driving forces, simultaneously. The forces are given by:

$$F_1 = A_1 cos(\omega t)$$
$$F_2 = A_2 cos(\omega t + \phi)$$

   Show that the steady state solution is simply a linear combination of the solution of each of the forces when acting by itself.

3. A particle of mass m is attached to the lower end, B, of a vertical elastic spring AB whose modulus is and natural length is b. The upper end, A, is forced to undergo a vertical oscillation, $asin\omega t$. The mass m is subject to a resistance equal in magnitude to ms times its speed. If the springs length at time t is $b + mgb/\lambda + x$, show that x satisfies

$$\ddot{x} + s\dot{x} + (\lambda/mb)x = a\omega[\omega sin\omega t - kcos\omega t]$$

   Find the amplitude of the forced oscillation of the mass when $k = \omega$ and $\lambda/mb = \omega^2$, and find the phase angle of this oscillation relative to As position