your name(s)_____

Physics 321 Exercise 3 - Monday, Sep. 25

A particle of mass m is in a damped harmonic oscillator. The spring constant is $m\omega_0^2$, and the damping force is $-bv$ with $\beta = b/2m$. The equations of motion are,

$$\ddot{x} = -\omega_0^2 x - 2\beta\dot{x}.$$

Now, add an additional transient driving force, $F(t) = F_0\Theta(t)\Theta(\tau - t)$. I.e.,

$$F(t) = \begin{cases} 0, & t < 0 \\ F_0, & 0 < t < \tau \\ 0, & t > \tau \end{cases}$$

1. (5 pts) Write the new equations of motion.

2. (5 pts) Edit your program from last week to solve for $x(t)$. Let the initial conditions be $x(t = 0) = 0$ and $v(t = 0) = 0$. Set $\beta = 0.75$ Hz, m=100 g, $f_0 = 0.5$ Hz, $\tau = 3$ seconds, and $F_0 = 50N$. Plot $x(t)$ for $0 < t < 10$ seconds.

3. (5 pta) Repeat the same calculation, but with two different forms for $F(t)$,

$$F_a(t) = F_0\Theta(t)\Theta(\tau - t)\frac{t}{\tau},$$
$$F_b(t) = F_0\Theta(t)\Theta(\tau - t)\left(1 - \frac{t}{\tau}\right).$$

   On the same plot as before, plot $x_a(t)$, $x_b(t)$ and $x_a(t) + x_b(t)$. (Four plots on same graph)