PHYS 3310
Spring 2010
TE Coan
Due: 24 Mar '24, 6:00 pm

Homework 4

1. Suppose a harmonic oscillator has its displacement x from equilibrium described by the differential equation:

$$\ddot{x} - \alpha\dot{x} + \omega_0^2 x = 0$$

where $\alpha = 0.05$/sec and $\omega_0 = 2.0$/sec. What is $\lim_{t\to\infty} |x(t)|$?

2. Suppose now the relevant differential equation is

$$\ddot{s} + 2\eta\dot{s} + \omega_0^2 s = 0$$

with s the displacement from equilibrium , $\eta = 0.05$/sec and, again, $\omega_0 = 2.0$/sec. Same question. What is $\lim_{t\to\infty} |s(t)|$?

3. Graph the solution to

$$\ddot{s} + 2\beta\dot{s} + \omega_0^2 s = 0$$

assuming $\beta = 0.3$/sec, $\omega = 1.0$/sec, and that at $t = 0$, $x = 2.0$ cm and $\dot{x} = 3.0\,\text{cm/sec}$. Label axes, with units, an use any graphing routine you find convenient.

4. French, 3-4 (pt. a only), p. 70. (Be careful of the word frequency. Are you talking about angular frequency, or something else?) This "buoy" problem is a review from PHYS 1303 and the principle of why things float. You can also read the very first sentence on p49 of French in the section labeled "Floating Objects." Show all work or zero credit awarded.

5. Bekefi and Barrett 1.4, pp. 624-625.

6. Bekefi and Barrett 1.7, pp. 625-626.