PH351: Week of October 17

Monday Oct. 17: Forced harmonic oscillation (D. Soper, guest lecture)

Wednesday Oct. 19: Review, question & answer session (come prepared with questions!)

Friday, Oct 21: Midterm I, in class, 50 minutes.

- Exam covers Chapter 1 (pages 1-12 and 25-29; Chapter 2, Chapter 3 (pages 53-64, basic concepts only, see problem set below for examples).
- Exam is closed book but you may use one page of notes (both sides!) as an aid.

Problem set 4. Not to turn in. Please note, however, that problems like these may appear on an exam.

1. A damped, spring and mass system described by the differential equation

$$m\ddot{x} + b\dot{x} + sx = 0\,,$$

where m = 0.1 kg, s = 1.6 N/m and b = 0.1 kg/s, is driven by a harmonically varying force with amplitude 2 N. Find the amplitude and phase of the steady state motion when the angular frequency of the driving force is:

(a) $\omega = 0.4\ s^{-1}$
(b) $\omega = 4\ s^{-1}$
(c) $\omega = 40\ s^{-1}$

2. A driven, damped harmonic oscillator has solution

$$\Psi = A\cos(\omega t + \varphi)$$
$$A = \frac{f_0}{\sqrt{(\omega_0^2 - \omega^2)^2 + \gamma^2\omega^2}}$$

If γ is fairly small, the amplitude A is big when the driving frequency $\omega \approx \omega 0$. For which value of ω is A biggest? What is the value of A at this value of ω?