PHYS 100C, Homework #1, due Monday, April 12 before class.

Problem 9.2 Show that the **standing wave** $f(z,t) = A\sin(kz)\cos(kvt)$ satisfies the wave equation, and express it as the sum of a wave traveling to the left and a wave traveling to the right (Eq. 9.6).

Problem 9.3 Use Eq. 9.19 to determine A_3 and δ_3 in terms of A_1, A_2, δ_1, and δ_2.

Problem 9.5 Suppose you send an incident wave of specified shape, $g_I(z - v_1 t)$, down string number 1. It gives rise to a reflected wave, $h_R(z + v_1 t)$, and a transmitted wave, $g_T(z - v_2 t)$. By imposing the boundary conditions 9.26 and 9.27, find h_R and g_T.

Problem 9.10 The intensity of sunlight hitting the earth is about 1300 $\mathrm{W/m^2}$. If sunlight strikes a perfect absorber, what pressure does it exert? How about a perfect reflector? What fraction of atmospheric pressure does this amount to?

Problem 9.11 In the complex notation there is a clever device for finding the time average of a product. Suppose $f(\mathbf{r},t) = A\cos(\mathbf{k}\cdot\mathbf{r} - \omega t + \delta_a)$ and $g(\mathbf{r},t) = B\cos(\mathbf{k}\cdot\mathbf{r} - \omega t + \delta_b)$. Show that $\langle fg\rangle = (1/2)\mathrm{Re}(\tilde{f}\tilde{g}^*)$, where the star denotes complex conjugation. [Note that this only works if the two waves have the same $\mathbf{k}$ and ω, but they need not have the same amplitude or phase.] For example

$$\langle u\rangle = \frac{1}{4}\mathrm{Re}\left(\epsilon_0\tilde{\mathbf{E}}\cdot\tilde{\mathbf{E}}^* + \frac{1}{\mu_0}\tilde{\mathbf{B}}\cdot\tilde{\mathbf{B}}^*\right) \quad \text{and} \quad \langle \mathbf{S}\rangle = \frac{1}{2\mu_0}\mathrm{Re}(\tilde{\mathbf{E}}\times\tilde{\mathbf{B}}^*).$$