PHYS 100C Midterm, Thursday May 14, 8AM-9AM (1 hour).

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 9.25 Assuming negligible damping ($\gamma_j = 0$), calculate the group velocity ($v_g = d\omega/dk$) of the waves described by Eqs. 9.166 and 9.169. Show that $v_g < c$, even when $v > c$.

Problem 10.4 Suppose $V = 0$ and $\mathbf{A} = A_0 \sin(kx - \omega t)\,\hat{\mathbf{y}}$, where A_0, ω, and k are constants. Find $\mathbf{E}$ and $\mathbf{B}$, and check that they satisfy Maxwell's equations in vacuum. What condition must you impose on ω and k?

Problem 10.19

(a) Use Eq. 10.68 to calculate the electric field a distance d from an infinite straight wire carrying a uniform line charge λ, moving at a constant speed v down the wire.

(b) Use Eq. 10.69 to find the *magnetic* field of this wire.

Hint: $\displaystyle\int_{x_1}^{x_2} \frac{dx}{(1+ax^2)^{3/2}} = \left.\frac{x}{\sqrt{1+ax^2}}\right|_{x_1}^{x_2}$