Phys 2110, Spring 2013
Hint-o-licious Hints, Problem Set #14

14.31 Average power transmitted by a harmonic wave in a string is

$$\bar{P} = \tfrac{1}{2}\mu\omega^2 A^2 v$$

where μ is a linear mass density of the string. Get the speed of the wave from the formula $v = \sqrt{F/\mu}$ then plug in stuff.

14.52 For an isotropic source of waves (which this is) the intensity of waves at distance r is $I = \frac{\bar{P}}{4\pi r^2}$.

14.40 Recall that for the fundamental mode on a string the length of the string is a half–wavelength. Use $\lambda f = v$.

14.43 The lowest–frequency mode in a pipe closed at one end is a quater-wavelength long. And use $\lambda f = v$ with v here being the given speed of sound.

14.68 You are given the fundamental frequency; find the wavelength of the fundamental and from that get the speed of the waves. From that and the string tension find the mass density. From that and the lenth, get the mass of the string.

14.46 New frequency heard for an object approaching with speed u is

$$f' = f\left(\frac{1}{1 - u/v}\right)$$

where v is the speed of sound.

14.73 New frequency heard for an object *moving away* with speed u is

$$f' = f\left(\frac{1}{1 + u/v}\right)$$

Take the difference of the heard frequencies when the truck is approaching and moving away; it depends only on the speed of the truck u. It may help with the algebra to let $\frac{u}{v}$ equal x, then solve for x.

$$\lambda f = v \qquad T = \frac{1}{f} \qquad y(x,t) = A\cos(kx \mp \omega t) \qquad k = \frac{2\pi}{\lambda} \qquad \omega = \frac{2\pi}{T} \qquad v = \frac{\omega}{k}$$

$$v = \sqrt{\frac{F}{\mu}} \qquad \bar{P} = \tfrac{1}{2}\mu\omega^2 A^2 v \qquad I = \frac{P}{A} = \frac{P}{4\pi r^2} \qquad \beta = 10\log_{10}\left(\frac{I}{I_0}\right) \qquad I_0 = 1\times 10^{-12}\,\frac{\mathrm{W}}{\mathrm{m}^2}$$

$$f_{\text{beta}} = |f_1 - f_2| \qquad f = \frac{nv}{2L} \qquad L = \frac{m\lambda}{2} \quad \text{or} \quad L = \frac{n\lambda}{4} \quad n = 1, 3, 5, \ldots$$

$$f' = f\left(\frac{1 \pm u_o/v}{1 \mp u_s/v}\right) \quad \text{for motion} \ \begin{smallmatrix}\text{toward}\\ \text{away}\end{smallmatrix}$$