PHY 250: Homework 5

Fall 2020

Death-line: November 24th

Exercise 1

A guitar string is supposed to vibrate at $247Hz$, but is measured to actually vibrate at $255Hz$. By what percentage should the tension in the string be changed to get the frequency to the correct value?

Exercise 2

Two strings on a musical instrument are tuned to play at 392 Hz (G) and 494 Hz (B). (a) What are the frequencies of the first two overtones for each string? (b) If the two strings have the same length and are under the same tension, what must be the ratio of their massesm_G/m_Al (c) If the strings, instead, have the same mass per unit length and are under the same tension, what is the ratio of their lengths ℓ_G/ℓ_A (d) If their masses and lengths are the same, what must be the ratio of the tensions in the two strings?

Exercise 3

Estimate the average power of a water wave when it hits the chest of an adult standing in the water at the seashore. Assume that the amplitude of the wave is $0.50m$, the wavelength is $2.5m$, and the period is $4.0s$.

Exercise 4

The displacement of a bell-shaped wave pulse is described by a relation that involves the exponential function:

$$D(x,t) = Ae^{-\alpha(x-vt)^2} \tag{1}$$

where the constants $A = 10.0$ m, $\alpha = 2.0$ m^{-2}, and $v = 3.0$ m/s. (a) Over the rage $-10.0m \leq x \leq 10.0m$, plot Dx, t) in Octave at each of the three times t = 0, t = 1.0, and t = 2.0 s. Do these three plots demonstrate the wave-pulse shape shifting along the x axis by

the expected amount over the span of each 1.0 s interval? (b) Repeat part (a) but assume $D(x,t) = Ae^{-\alpha(x+vt)^2}$.