NAME: Answers, Sect. #_____

Physics 109 **Homework # 4** due **Wednesday** October 10, 2001

formulae: open pipe:

$$\lambda = \frac{v}{f} \qquad f_1 = \frac{v}{2L}$$

speed of sound in air: 340 m/s.

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1. A 2 meter long piano string has a fundamental frequency of 50 Hz.

a) find the period of the oscillation: T = 0.02 sec.

$T_1 = 1/f = 1/50$ sec

b) what is the round trip travel time of the wave on this string? (this relates to the slinky experiment in the lab):

round trip time = $T_1 = 0.02$ sec

c) what is the speed of propagation of the wave on the string? (speed = distance / time!)

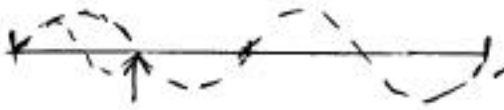
speed = $\frac{4m}{0.02s} = 200$ m / sec.

round trip distance = 2L = 4m ; time 0.02 sec

speed = distance / time

2. The string of a string bass is 1 meter long. When the string is plucked 1/4 meter from the end of the string, what modes will be missing in the resulting oscillation?

missing modes #4, #8, #12,



missing (since it needs NODE at 1/4 pt).

3. A guitar string is plucked at a point one-third of the string length away from one end.

a) what modes will NOT be present in the ensuing oscillation?

NOT present: #3 , 6 , 9

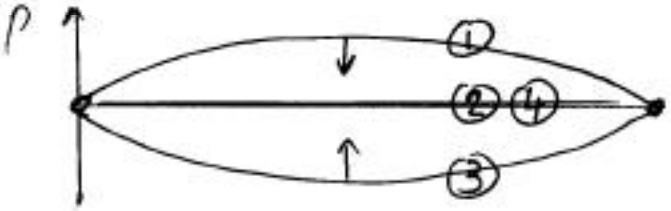
b) The string is now touched lightly at the midpoint. What modes will be present afterwards?

modes still present: 2 , 4 , 6 ,

4. An open pipe oscillates in the fundamental mode. Make a graph of the pressure at the various places inside the pipe. Since the pressure keeps changing, show the pressure distribution at three instances one-quarter cycle apart.

pipe:

pressure graph:



5. how long an organ pipe would you need to play a 40 Hz tone?

for open pipe:

$f_1 = v/2L \rightarrow L = v/2f$

$= 340/80$ m

length = 4.25 m

(about 14 feet long)