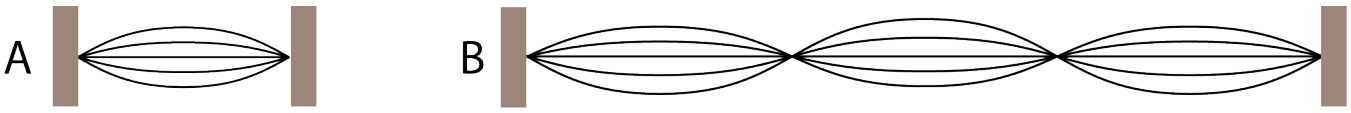
NAME:

Frequencies for standing waves on a string: $f_n = \dfrac{nv}{2L} \quad n = 1, 2, 3 \ldots$

Speed of a wave on a string: $v = \sqrt{\dfrac{F}{m/L}}$ Linear density: $\dfrac{m}{L}$

PROBLEM

The diagram below illustrates two strings, A and B, that are stretched between fixed supports and vibrating in standing wave motion. The strings have the same tension and linear density, but string B is 4.25 times longer than string A. (a) Which wave string is vibrating in its fundamental frequency? (A, B, or both) (b) If the frequency of the standing wave on string B is 412 Hz, then what is the frequency of the standing wave on string A?



NAME:

$$\text{Intensity:} \quad I = \frac{P_{\text{avg}}}{A} \qquad \text{Intensity, isotropic} \quad I = \frac{P_{\text{avg}}}{4\pi r^2}$$

$$\text{Intensity level:} \beta = (10\,\text{dB}) \log \frac{I}{I_0} \qquad \text{Threshold of hearing:} \quad I_0 = 10^{-12}\,\text{W/m}^2$$

PROBLEM

Parrots are loud animals. Suppose that 100 identical parrots sit in a tree and they are all squawking at the same time (each creating the same sound intensity at point far from the tree). Tina, who is far from the tree detects an intensity level of 30.0 dB. (a) What is the intensity of the sound at Tina's location? (b) What is the sound intensity level detected by Tina if 94 parrots flew away, leaving just 6 squawking in the tree?

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$$\text{Beat frequency:} \quad f_\text{b} = |f_1 - f_2|$$

PROBLEM

Two variable-frequency sound sources, A and B, are played simultaneously and a beat frequency of 9 Hz is detected.

(a) If source A has a frequency of 500 Hz then what are the two possible frequencies of source B?

(b) The frequency of source B is increased by 3 Hz and the beat frequency *decreases*. Which of the two frequencies from part (a) was the original frequency of source B?

(c) What is the new frequency of source B?

(d) What is the new beat frequency?

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$$\text{Doppler effect:} \quad f_\text{o} = \frac{f_\text{s}}{1 \pm v_\text{s}/v} \qquad f_\text{o} = f_\text{s}(1 \pm v_\text{o}/v) \qquad f_\text{o} = f_\text{s}\left(\frac{1 \pm v_\text{o}/v}{1 \pm v_\text{s}/v}\right)$$

$$\text{Speed of sound in air:} \quad 343\,\text{m/s}$$

PROBLEM

In a game of ice hockey, a referee and a player are skating directly toward each other. The referee blows a whistle whose frequency is 8101 Hz, but the player detects a frequency of 8283 Hz. The speed of the player is 2.60 m/s. (a) Choose an equation from above and write it as it appears after you choose the plus or minus sign(s). (b) What is the speed of the referee?