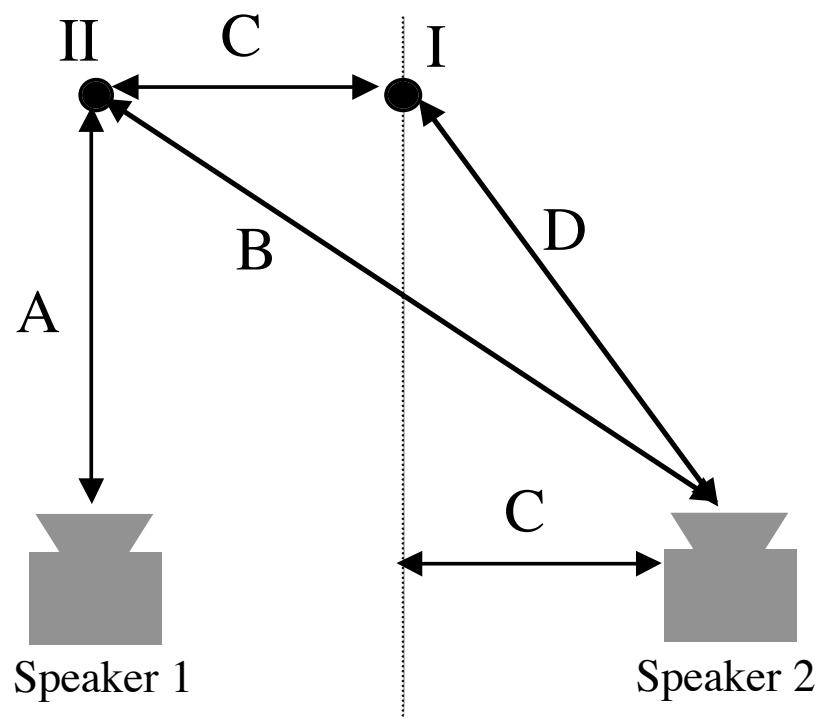


1. Two speakers are playing the *same frequency, f* , in air. When you stand at *position I*, as shown in the diagram, the sound you hear is *continuously very quiet*. When you stand at *position II* the sound you hear is *continuously very loud*. What is a *possible wavelength (λ)* of the sound you are hearing?

Please *solve for λ symbolically* and rearrange your equations to show a final equation for f . Distances are designated by *A, B, C, & D*. Solve in *terms of the distances* and *explain* your work.



$$y(x,t) - y_0 = A \sin \Phi, \quad \Phi = \frac{2\pi t}{T} \pm \frac{2\pi x}{\lambda} + \phi, \quad \lambda = \frac{v_{\text{wave}}}{f}, \quad T = \frac{1}{f},$$

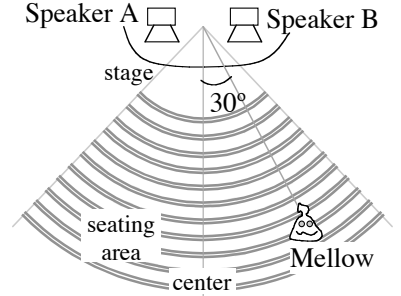
$$\Delta\Phi = \begin{cases} \text{Even} \cdot \pi \cdots \text{Constructive} \\ \text{Odd} \cdot \pi \cdots \text{Destructive} \end{cases}, \quad f_{\text{beats}} = |f_1 - f_2|, \quad f_{\text{carrier}} = \frac{1}{2}(f_1 + f_2),$$

Quiz 3B TA _____ Name (last) _____ (first) _____ | | | |

Rubric Codes: _____ Student ID: _____ first 3 letters last name

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Mellow attended a “concert.” There were *two loudspeakers* on the stage, each blaring the *same frequency* (500 Hz). Mellow was at a constructive interference point and had a “wonderful concert experience” during the first “song” of the show because she could clearly hear 500 Hz (which is her favorite note). During the second song of the concert, the speakers broadcast 1000 Hz. Was Mellow still at a *constructive interference point, a destructive point, or somewhere in between* for the 1000Hz “song”. *Explain.*



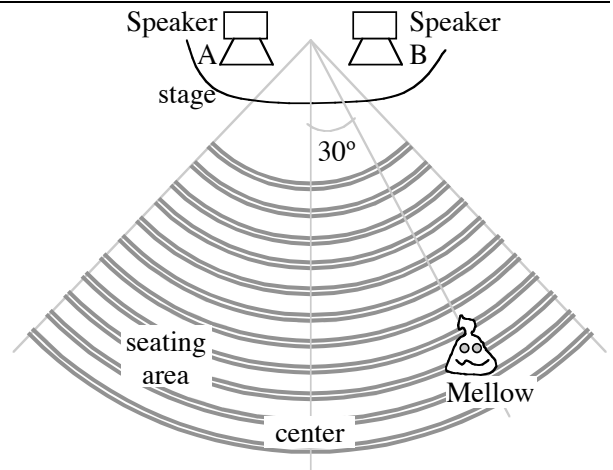
$$y(x,t) = A \sin\left(\frac{2\pi t}{T} \pm \frac{2\pi x}{\lambda} + \varphi\right) + y_o; \quad \lambda = \frac{v_{\text{wave}}}{f}; \quad T = \frac{1}{f}; \quad \lambda = d \sin \theta; \quad n_1 \sin \theta_1 = n_2 \sin \theta_2; \quad n = c/v; \quad \theta_i = \theta_r$$

Rubric Codes: **6**

Student ID: _____

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1. A single-eared alien (named Mellow) is seated in an amphitheatre (see drawing to the right). There are *two loudspeakers* on the stage, each blaring the *same frequency*. Mellow was furious because, at her seat, she could hear *no sound*. After several minutes, she moved to the *center* of the auditorium and still heard *absolutely nothing*. However, while she walked from her original position to the center position, she heard a “beautiful note at exactly 500 Hz.” During her review of the concert, she stated that *one of the speakers was wired opposite* from the other speaker. How did she know that the speakers were wired oppositely? **Explain.**



2. During intermission, the audio technicians fixed the wiring so that the speakers were *wired identically*. The speakers were not moved and, thus, remained at their *same locations*. The second act featured a “concert” that was a *sustained note at 250 Hz*. Mellow expectantly returned to her original seat for this was her favorite note. Which of the following occurred (You must **explain** your answer *clearly, completely, and concisely*):
- Mellow was seated at a *destructive interference* point and *heard little or no sound*
 - Mellow was seated at a *partially destructive/constructive* point and *clearly heard sound*
 - Mellow was seated at a *constructive interference* point and *heard loud sound*.

$$y(x,t) = A \sin \Phi + y_0; \quad \Phi = \frac{2\pi t}{T} \pm \frac{2\pi x}{\lambda} + \varphi; \quad \lambda = \frac{v_{wave}}{f}; \quad T = \frac{1}{f}; \quad \Delta x = d \sin \theta$$

Rubric Codes: 7

Student ID: _____

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Signature _____

The following is a re-enactment of an event that never actually occurred:

The FCC recently told KDVS, the campus radio station, that they needed to change their broadcast pattern. As you may remember from the FNT's, the station currently broadcasts to the East but not to the West. The FCC wanted the station to **broadcast a signal to the East AND the West** but to eliminate the signal (**destructive interference**) **directly to the North AND the South**.

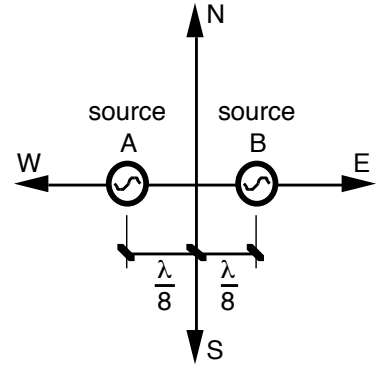
The station is not allowed to change their frequency of broadcast, so they will have the **same wavelength** as before.

They have enough money to re-position one of their antennae.

The also have the ability to readjust the relative phases of the antennae.

How can the radio station **move one antenna and change the relative phases** so that they can meet the FCC's new requirements? Specifically, to **where** should they **move the antenna** and **what** should the **relative phases** be?

Note: There are multiple ways to accomplish this task, so **explain** how and why your solution will meet the four requirements (N, E, S, & W) as set by the FCC.



$$y(x,t) = A \sin \Phi + y_0; \quad \Phi = \frac{2\pi t}{T} \pm \frac{2\pi x}{\lambda} + \varphi; \quad \lambda = \frac{v_{wave}}{f}; \quad T = \frac{1}{f}; \quad \Delta x = d \sin \theta$$

