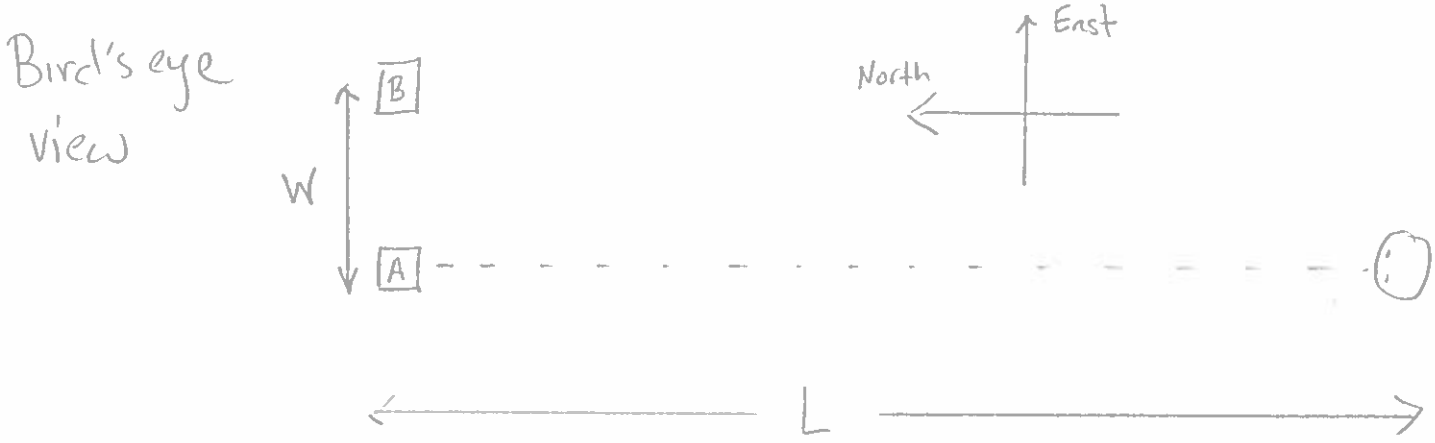

Joe Acoustic sets up two speakers in his sound lab. Speaker A is located a distance L due North of Joe, at the same height H as his ears. Speaker B is located exactly W to the East of speaker A, and at a vertical height J above speaker A.

Joe connects speaker A to a wave generator, which produces sound waves such that

$$y_A = \frac{A}{r_A} \sin\left(kr_A - \omega t\right)$$

where

$$A = 0.0076\ \sqrt{\text{Watts}}$$

$$\omega = 2\pi f = 2\pi\,(600\ \text{Hz}) = 3770\ \text{rad/s}$$

$$k = \frac{\omega}{v_s} = \frac{3770\ \text{rad/s}}{343\ \text{m/s}} = 10.99\ \text{rad/m}$$

What is the intensity of the wave at Joe's position at $t = 2.59\ s$?

$$\text{intensity} = (y_A)^2 = \frac{A^2}{L^2}\sin^2(kL - \omega t)$$

Plug in numbers; in my case $L = 8.57\ m$

$$\text{intensity} = (y_A)^2 = 2.37 \times 10^{-9}\ \frac{W}{m^2}$$

Joe unplugs speaker A, and plugs in speaker B. He plays the same sound. At $t = 2.59\ s$ after re-starting, what is intensity?

Now dist $r_B = \sqrt{L^2 + W^2 + J^2}$ where $W = 0.56\ m$, $J = 0.35\ m$

$$r_B = 8.60\ m$$

Plug in, $\text{intensity} = (y_B)^2 = 3.87 \times 10^{-8}\ \frac{W}{m^2}$

Finally, Joe plugs in <u>both</u> speakers and re-starts the sound generator. The intensity now is

$$\text{intensity} = (y_A + y_B)^2$$ not $y_A^2 + y_B^2$

Plugging in numbers,

$$y_A = -4.87 \times 10^{-5}\ \frac{\sqrt{W}}{m}$$

$$y_B = 1.97 \times 10^{-4}\ \frac{\sqrt{W}}{m}$$

$$(y_A + y_B) = 1.47 \times 10^{-4}\ \frac{\sqrt{W}}{m}$$

$$\rightarrow \text{intensity} = (y_A + y_B)^2 = 2.19 \times 10^{-8}\ \frac{W}{m^2}$$