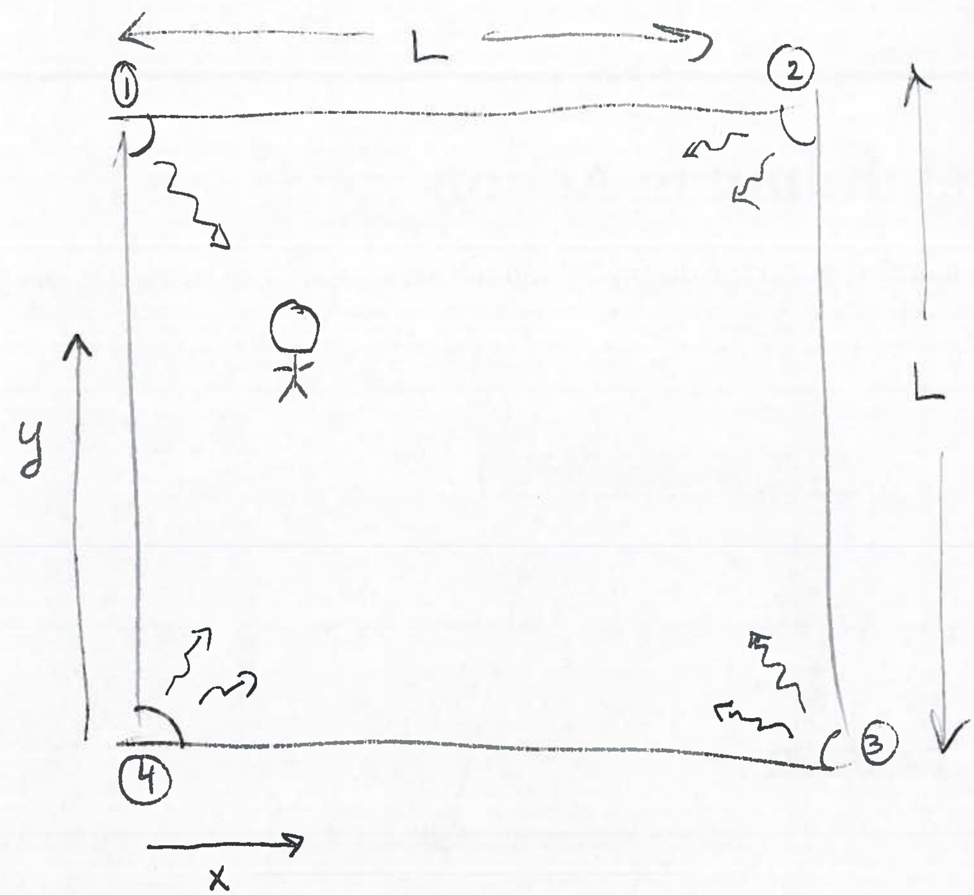


Joe stands in room, square of length $L = 15\,m$. He is at

$$(x, y) = (4\,m, 10\,m)$$

Alarms ring with freq $f = 300\,Hz$ and power $P = 100\,W$ each. Room has air of temp $T = 20°C$, pressure 1 atm. Thus

$$v_{sound} = 343\,m/s$$

$$\rho_{air} = 1.20\,kg/m^3$$

The wavelength of sound waves is

$$\lambda = \frac{v_{sound}}{f} = 1.143\,m$$

alarm in corner	distance (m)	number of wavelengths	phase offset
1	6.403	5.600	216°
2	12.083	10.568	204°
3	14.866	13.002	1°
4	10.770	9.420	151°

To turn the number of wavelengths into a phase offset, use this method:

$$\text{phase} = \left(\text{fractional \# of wavelengths}\right) * 360^\circ$$

We can compute the intensity of waves from each alarm using

$$\text{Intensity} = \frac{\text{Power}}{4\pi r^2} = \frac{(\Delta P_{max})^2}{2\rho v}$$

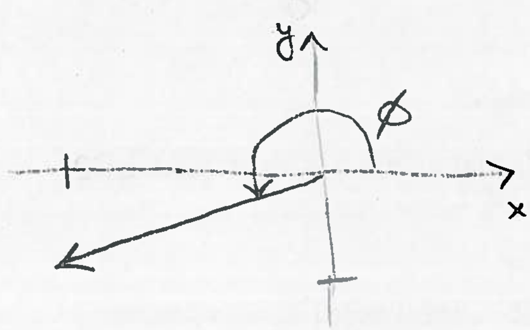
alarm in corner	distance (m)	Intensity $\left(\frac{W}{m^2}\right)$	Pressure Amplitude $\left(\frac{N}{m^2}\right)$
1	6.403	0.194	12.6
2	12.083	0.0545	6.70
3	14.866	0.0360	5.44
4	10.770	0.0686	7.51

Now that we have amplitude and phase of each wave, we can add them with phasors.

WAVE	eqn
1	$\left(12.6\ \frac{N}{m^2}\right)\cos\left(kx - \omega t + 216^\circ\right)$
2	$\left(6.70\ \frac{N}{m^2}\right)\cos\left(kx - \omega t + 204^\circ\right)$
3	$\left(5.44\ \frac{N}{m^2}\right)\cos\left(kx - \omega t + 1^\circ\right)$
4	$\left(7.51\ \frac{N}{m^2}\right)\cos\left(kx - \omega t + 151^\circ\right)$

Break each wave into components:

wave	$x = A\cos(\phi)$	$y = A\sin(\phi)$
1	$-6.57\ \frac{N}{m^2}$	$-4.42\ N/m^2$
2	-6.12	-2.73
3	$+5.44$	$+0.09$
4	-6.57	$+3.64$
total	-13.82	-3.42



combined wave has

$$\text{phase} = \tan^{-1}\left(\frac{-3.42}{-13.82}\right) = 194^\circ$$

$$\text{amp} = \sqrt{\left(13.82\ \frac{N}{m}\right)^2 + \left(3.42\ \frac{N}{m}\right)^2}$$

$$\boxed{\text{amp} = 14.2\ \frac{N}{m^2}}$$