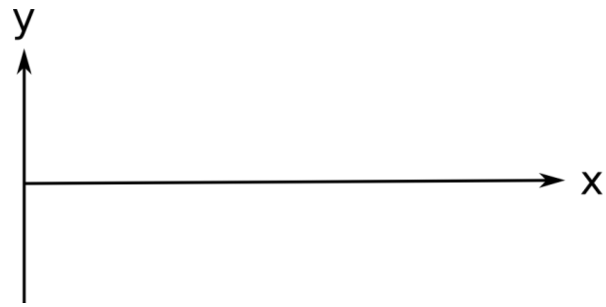
Waves – Set 3

Name: ______________________ **Problems Solved __/ 6**

a) Sketch a sine curve on the coordinate axis below using a solid line
b) Sketch a second sine curve at a slightly different phase (let $\varphi<\pi$) using a dashed line.
c) Label the phase shift between the two waves.

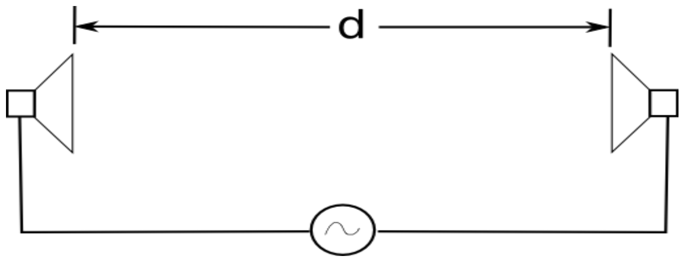


Using the picture and what you know about *super position*, fill in the table below with the relationships for constructive and destructive interference.

Relationship	Destructive	Constructive
$\varphi(n)$		
$\Delta L(\varphi,k)$		
$\Delta L(n,k)$		
$\Delta L(n,\lambda)$		
$\Delta t(\varphi,w)$		
$\Delta t(n,\omega)$		
$\Delta t(n,T)$		

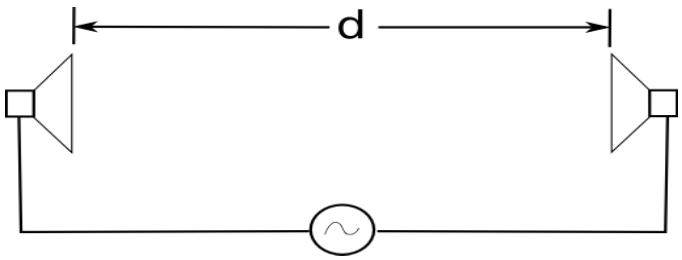
Two identical speakers are separated by a distance *d* are driven by the same oscillator with a frequency *f*.

a) Use the *path length difference* to find an expression for the locations of the nodes between the speakers.
b) Use the *path length difference* to find an expression for the locations of the antinodes between the speakers.
b) Let $\lambda = d$ and mark the locations of nodes with a - (minus) and the locations of antinodes with a +.



Two identical speakers are separated by a distance *d* are driven by the same oscillator with a frequency *f*.

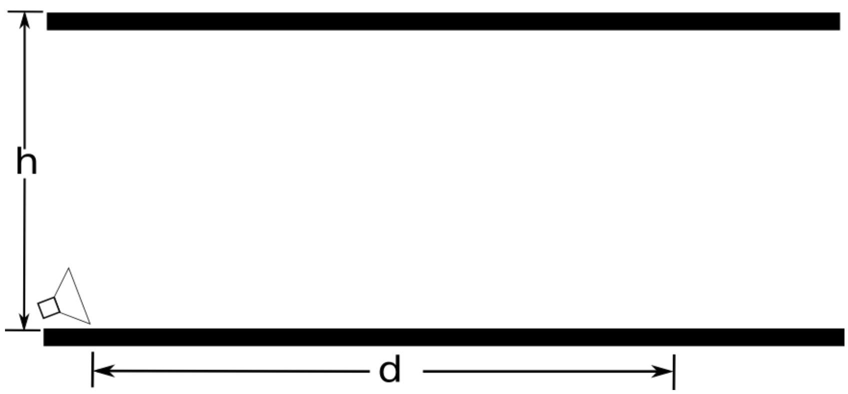
a) Use *superposition* to show that there is an antinode directly between the two speakers.
b) Use superposition to find the amplitude of the wave to the right of the two speakers.



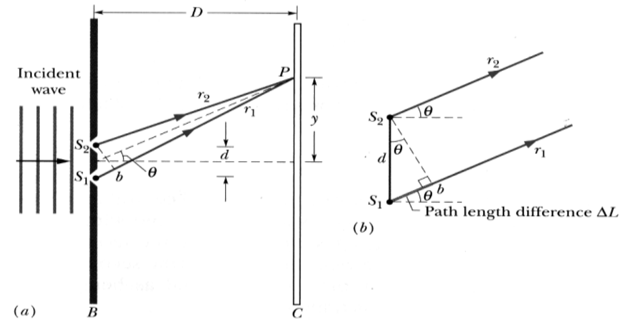
In the image below, the speaker is emitting waves with a wavelength λ. Due to reflected waves from the ceiling, you find a quiet spot (node) at a distance d from the speaker.

a) Show that, due to the reflection, nodes appear when $\Delta L = n\lambda$.
b) Use the path length difference between the direct and reflected waves to find the height of the ceiling.

NOTE: When a wave reflects off of a surface, the reflected wave is 180 degrees out of phase with the incident wave and the angle of incidence is equal to the angle of reflection (that is the distance from the speaker to the ceiling is equal to the distance from the ceiling to the receiver).



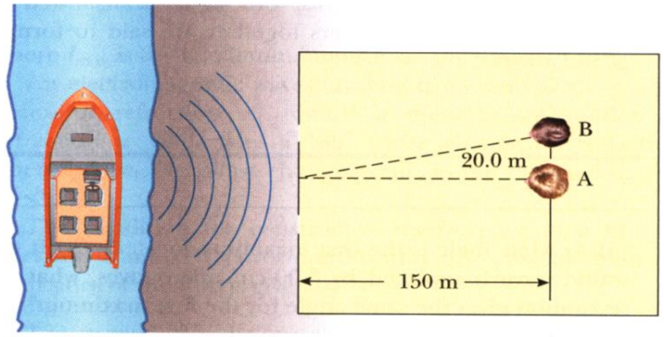
The figure shows light shining on a barrier that has two slits cut into it separated by a distance d. A screen is set up a distance D away. Consider the light hitting a point P located a distance y above a horizontal line positioned midway between the two slits. Light through the bottom slit takes the path r_1 to get to the point P while light through the top slit takes the path r_2. Because $r_1 \neq r_2$, an interference pattern will appear on the screen. When $y=0$, the light intensity will be maximum.



Assume that $D >> d$ so that r_1 is parallel to r_2.
Assume that $d >> \lambda$, and $D >> y$ so that $\sin\theta \approx \theta$ and $\tan\theta \approx \theta$

a) Find an expression for the distance y_{min} to the first minimum in terms of d, D, and λ.
b) Find an expression for the distance y_{max} to the second maximum (the first being at $y=0$).

A riverside warehouse has two open doors as shown in the figure. A boat on the river sounds its horn. To person A, the sound is loud and clear. To person B, the sound is barely audible. The sound has a wavelength of 3.00m. Assuming person B is at the position of the first minima, determine the distance between the doors, center to center.



a) Find an exact solution by (shudder) getting intermediate numerical values.
b) Use the double slit approximations