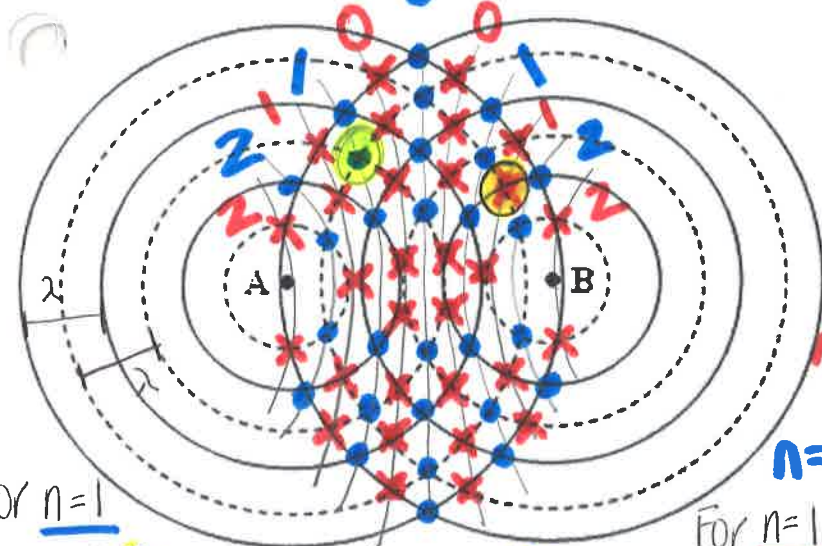
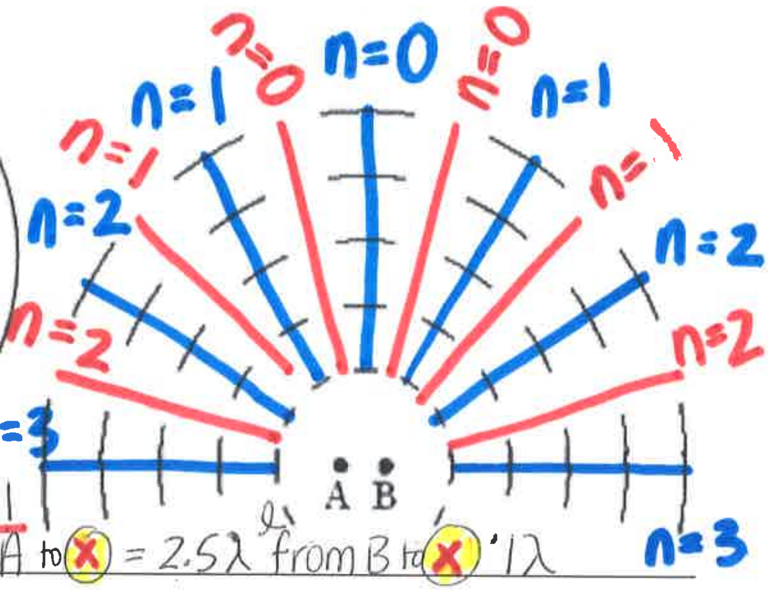
Two-Source Interference of Waves





For n=1 ℓ from A (•) = 1.5λ ℓ from B to (•) = 2.5λ For n=1 ℓ from A to (x) = 2.5λ ℓ from B to (x) 1λ

Path Length (ℓ) – distance traveled by a wave from source to a location

Path Difference (Δℓ) – difference in path lengths between two waves = $|\ell_1 - \ell_2|$

Anti-nodal Line: line of maximum constructive interference

Conditions for Anti-nodal Line

Phase difference: in phase, 0° difference

Path difference: … $\Delta\ell = (2.5\lambda - 1.5\lambda) = 1\lambda$ where n=1 $\Delta\ell = n\lambda$

Nodal Line: line of constant destructive interference

Conditions for Nodal Line

Phase difference: out of phase by 180°

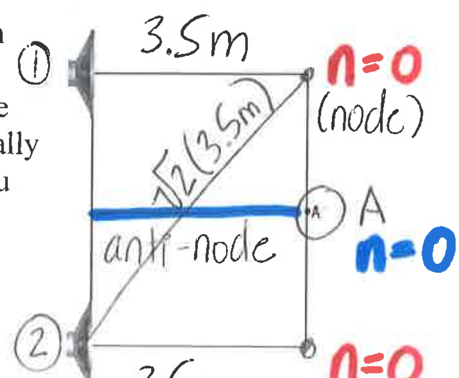
Path difference $\Delta\ell = (2.5\lambda - 1\lambda) = 1.5\lambda$ where n=1 $\Delta\ell = (n + \frac{1}{2})\lambda$

Conditions for a stable interference pattern:

1) waves have approximately same amplitude/intensity and frequency/wavelength

2) sources are coherent

1. A square is 3.5 m on a side, and point A is the midpoint of one of its sides. On the side opposite this spot, two in-phase loudspeakers are located at adjacent corners. Standing at point A, you hear a loud sound and as you walk along the side of the square toward either empty corner, the loudness diminishes gradually but does not entirely disappear until you reach either empty corner, where you hear no sound at all. Find the wavelength of the sound waves.



What is λ?

$\Delta\ell = (n + \frac{1}{2})\lambda$ $\frac{|3.5m - \sqrt{2}(3.5m)|}{0.5}$

$\lambda = \frac{\Delta\ell}{(n + \frac{1}{2})}$ where n=0   = 2.9m = λ

loudspeaker #1 → node = 3.5m

$c^2 = a^2 + b^2$ $c^2 = 2(3.5m)^2$ loudspeaker #2 → node = $\sqrt{2(3.5m)^2}$