Q- Two loudspeakers emit sound waves along the x-axis. The sound has maximum intensity when the speakers are 22 cm apart. The sound intensity decreases as the distance between the speakers is increased, reaching zero at a separation of 66 cm.
(a) What is the wavelength of the sound?

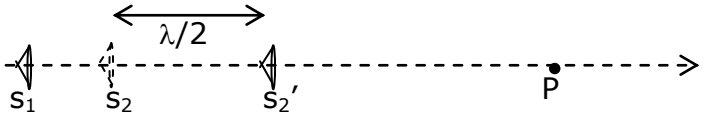
The distance between two speakers is 22 cm and the intensity of the sound at any point P is maximum means there is constructive interference and the phase difference between the two waves at a point P on x axis must be an even multiple of π, and the equivalent path difference is $n\lambda$. Due to increase in the distance between the speakers the equivalent path difference increases and when the distance becomes 66 cm the intensity becomes zero means destructive interference and the equivalent path difference must be increase from $n\lambda$ to $n\lambda + (\lambda/2)$

Hence we get

$[n\lambda + (\lambda/2)] - n\lambda = 66 - 22$

Gives $\lambda/2 = 44$ cm

Or λ **= 88 cm.**



(b) If the distance between the speakers continues to increase, at what separation will the sound intensity again be a maximum?

For the next maximum of intensity the path difference must be increased to $(n+1)\lambda$ or the distance must be further increased by $\lambda/2 = 44$ cm. hence the intensity will be maximum again when the separation will be

$66 + 44 =$ **110 cm**

(Note: Initially the distance between the speakers is 22 cm which is $\lambda/2$ and the waves are in phase, this means that the two speakers are oscillate at a phase difference of p or they are in opposite phase.)