Interference between two sources, 2 meters apart each with f = 700 Hz. Velocity of sound = 350 m/s
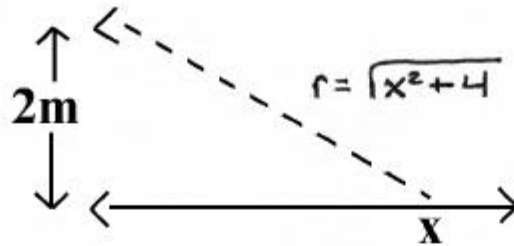

A) Determine positions of x for destructive interference

$$\Delta \text{Length} = \frac{\lambda}{2}, \frac{3\lambda}{2}, \frac{5\lambda}{2}, \cdots \frac{n\lambda}{2} \text{ odd}$$

$$= r - x = \sqrt{x^2+4} - x = \frac{n\lambda}{2}$$

wavelength $\lambda = \frac{v}{f} = \frac{350}{700} = .5\,m = \frac{1}{2}\,m$

$$\Delta L = \sqrt{x^2+4} - x = \frac{n\lambda}{2} = \frac{n}{4}$$

$$\sqrt{x^2+4} = x + \frac{n}{4}$$

$$x^2+4 = x^2 + \frac{nx}{2} + \frac{n^2}{16}$$

$$\frac{nx}{2} = 4 - \frac{n^2}{16}$$

$$x = \frac{8}{n} - \frac{n}{8}$$

$\underline{n=1}$ $x = 8 - \frac{1}{8} = 7.825\,m$

$\underline{n=3}$ $x = \frac{8}{3} - \frac{3}{8} = \frac{64-9}{24} = \frac{55}{24} = 2.7\,m$

$\underline{n=5}$ $\frac{8}{5} - \frac{5}{8} = \frac{64-25}{40} = \frac{39}{40} \approx 1.025\,m$

$\underline{n=7}$ $\frac{8}{7} - \frac{7}{8} = \frac{64-49}{56} = \frac{5}{56}$ **There are no other positions**

What frequency so there is no destructive interference?

$r = \frac{1}{2} = 2 = \frac{\lambda}{2} \Rightarrow \lambda = 4$ $f = \frac{v}{\lambda} = \frac{350}{4} = 87.7\,Hz$