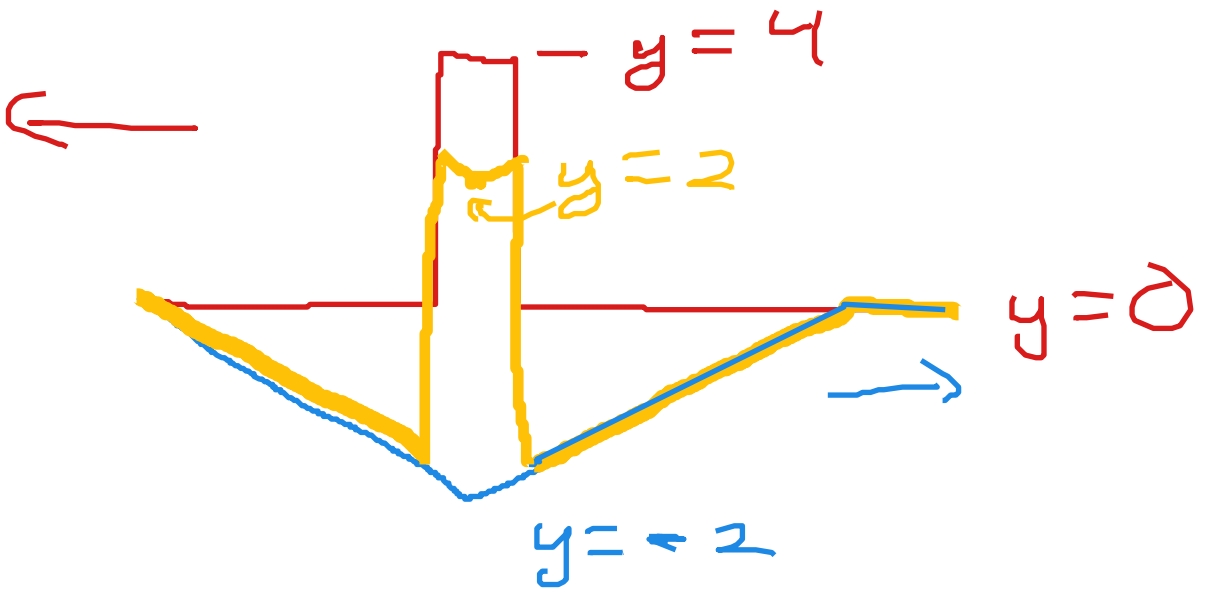
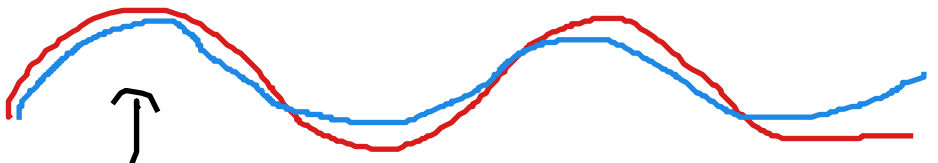


$$y_{total} = y_1 + y_2 + \cdots$$

Wave Superposition

(two waves, same wavelength)

in-phase

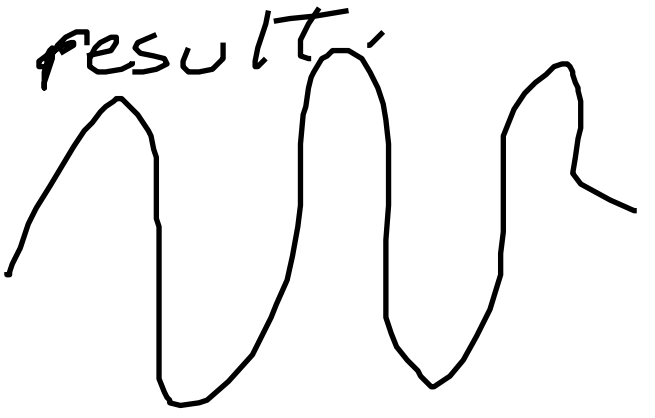


crest & crest

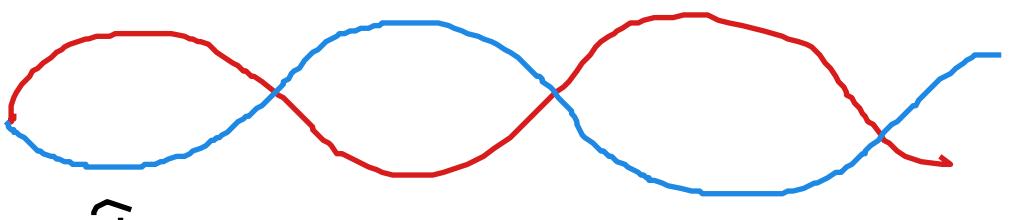
trough & trough

constructive interference

result



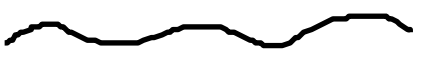
out of phase

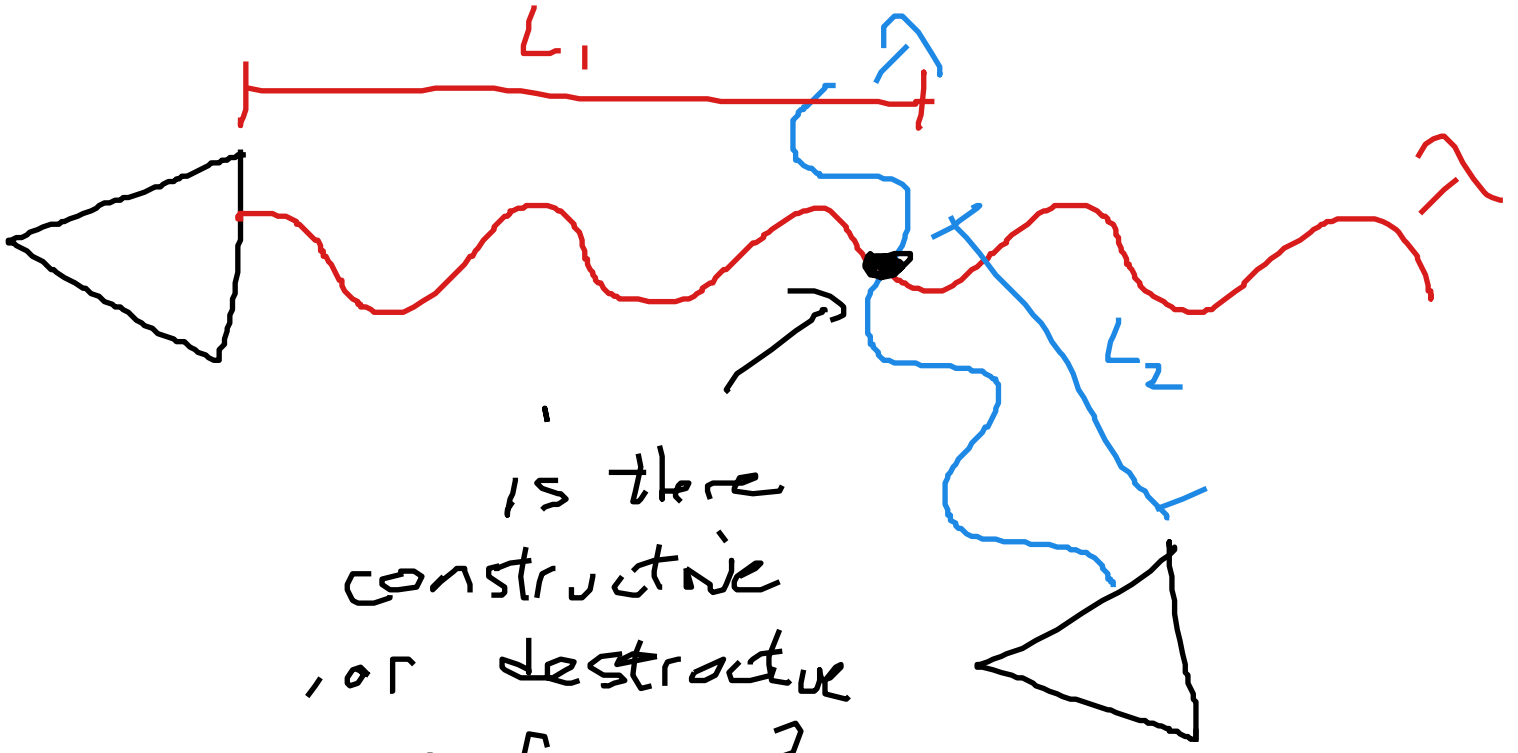


crest & trough overlap

destructive interference

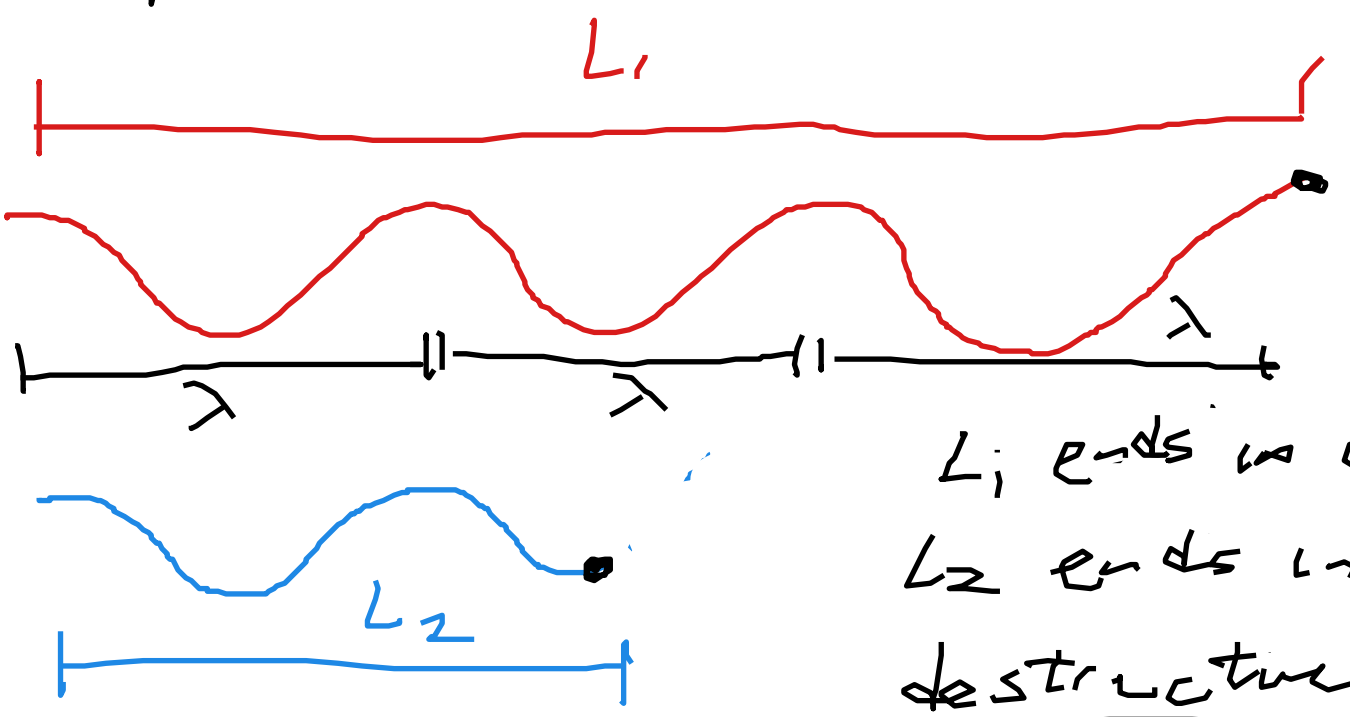
result





is there constructive, or destructive interference?

two speakers produce single wavelength of sound in phase with each other



L_1 ends in crest

L_2 ends in trough

destructive

# of cycles in L_1 : 3

$$L_1 = 3\lambda$$

$$L_2 = 1.5\lambda$$

3λ 5λ

If L_1 & L_2 are $n\lambda$, $n = 0, 1, 2, \ldots$

Constructive (2 crests)

3.5λ 2.5λ

If L_1 & L_2 are $\left(n + \frac{1}{2}\right)\lambda$

Constructive (2 troughs)

If L_1 is $n\lambda$ & L_2 is $\left(n + \frac{1}{2}\right)\lambda$

destructive

Path Length Difference

$$\Delta L = |L_1 - L_2|$$

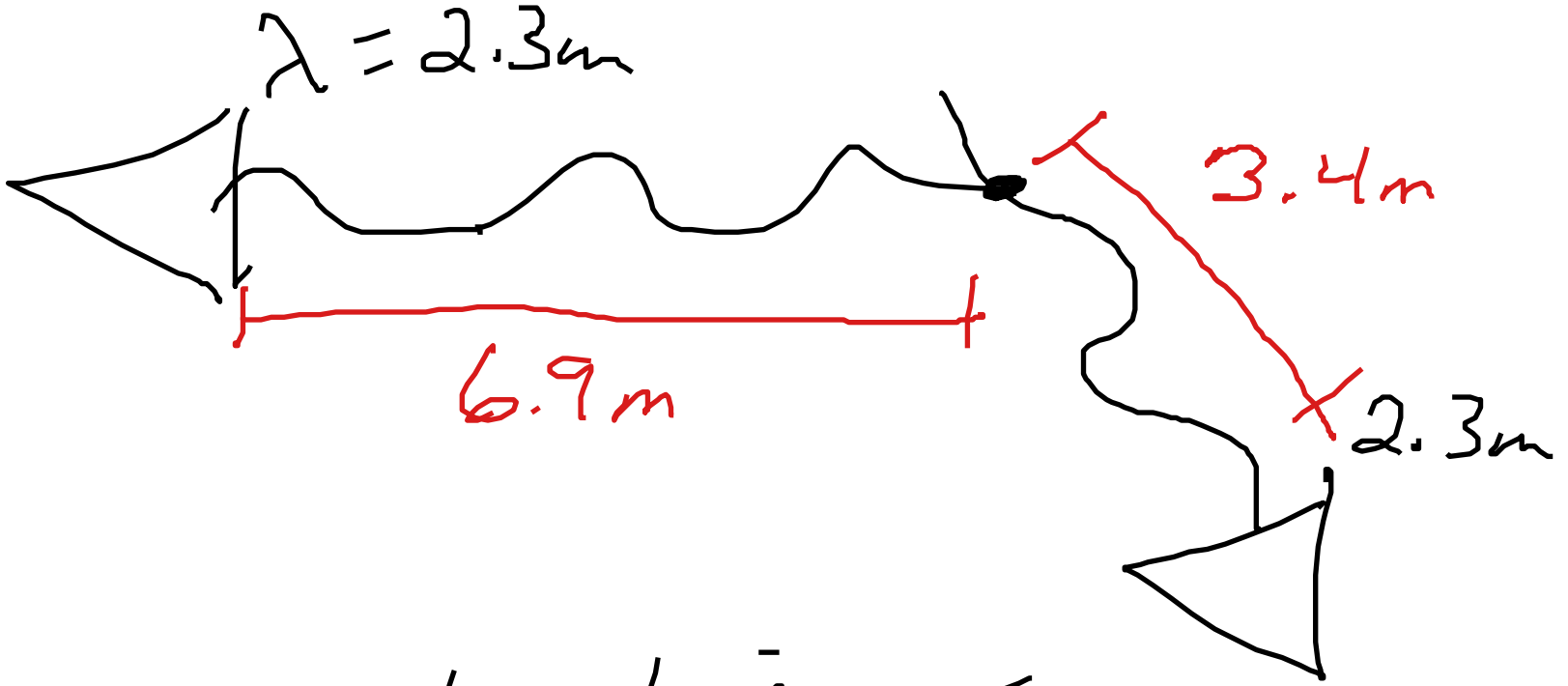
if $\Delta L = n\lambda$, $n = 0, 1, 2, \ldots$

constructive

if $\Delta L = (n + \frac{1}{2})\lambda$

destructive

$$\frac{\Delta L}{\lambda} = \begin{cases} \text{integer}, & \text{constructive} \\ \text{integer} + \frac{1}{2}, & \text{destructive} \end{cases}$$



constructive or destructive?

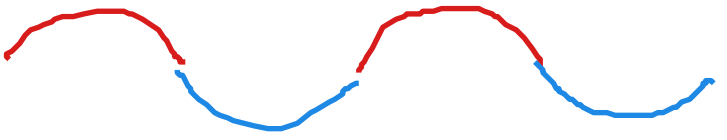
1) $\Delta L = |6.9m - 3.4m|$

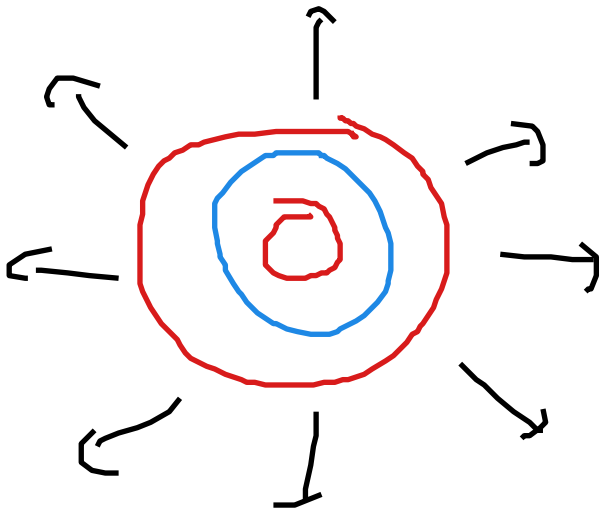
$= 3.5m$

2) $\frac{\Delta L}{\lambda} = \frac{3.5m}{2.3m} = 1.4$

3) Closest to 1.5 → destructive

See Demo





wavefronts

(eg ripples on a pond)