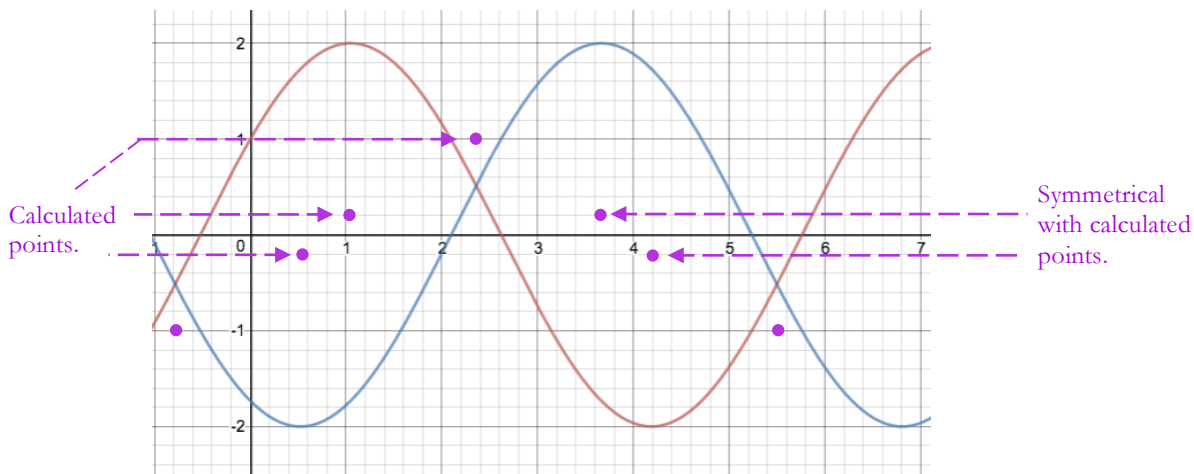
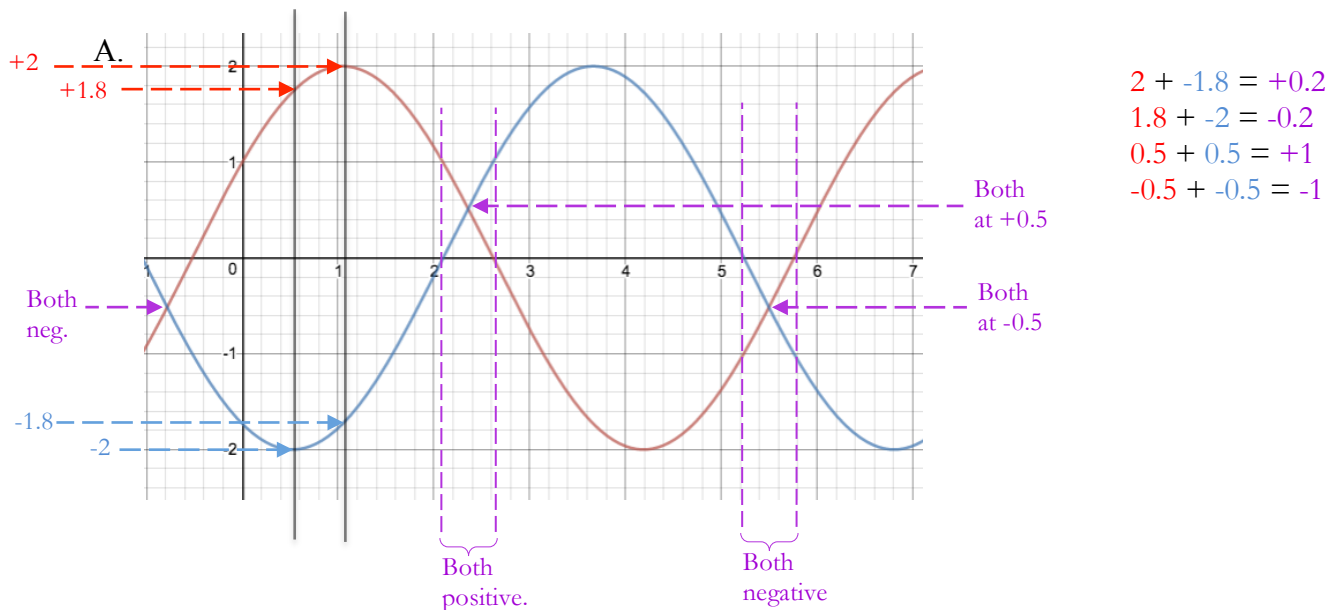


Resonance & Volume II - Solutions

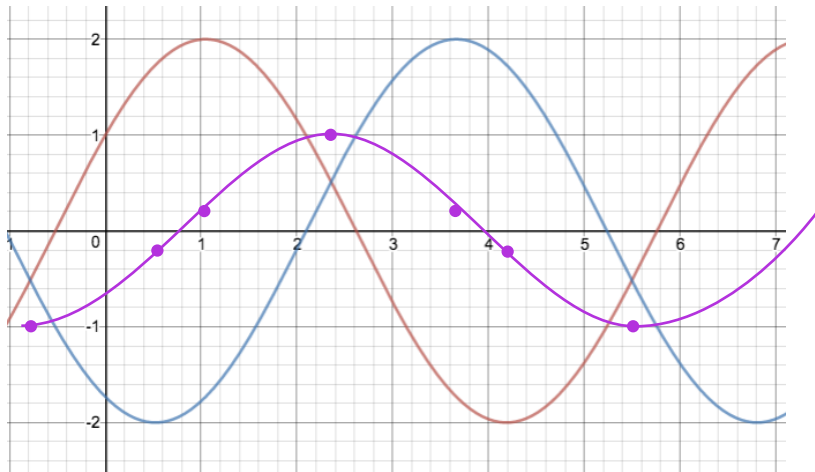
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I. Wave-Interference in 1D

Each of the graphs below shows two waves that are traveling on the SAME piece of string (or, maybe, column of air). The x-axis is horizontal position. The y-axis is vertical position (or maybe pressure). For each pair (A and B), draw the (approximate) waveform resulting from their interference.



Connect the purple dots (and make it *wavy*)!



I. Wave-Interference in 2D

This problem is addressed on the Resonance & Volume 1 solutions.

II. Energy, Power, Intensity, & Volume.

- A. The master volume knob at a P-Funk concert is turned up: as a result, the intensity of sound waves, measured in Watts/m², increases by a factor of 10,000.

By how many decibels does the sound increase?

Recall that $dB = 10 \log(I/I_0)$

$$I_{\text{final}} = I_{\text{initial}} * 10^4 \text{ (given)}$$

(Note: I'm using I_{initial} instead of I_0 , bec I_0 is already in use.)

$$dB_{\text{initial}} = 10 \log\left(\frac{I_i}{I_0}\right)$$

$$dB_{\text{final}} = 10 \log\left(\frac{I_f}{I_0}\right) = 10 \log\left(\frac{(10^4)I_i}{I_0}\right)$$

From basic rules of logarithms, we know that $\log(ab) = \log a + \log b$, so:

$$dB_{\text{final}} = 10 \log\left(\frac{I_i}{I_0}\right) + 10 \log(10^4)$$

But $10 \log(I_i/I_0)$ is just dB_{initial} .

And from the definition of log, we know that $\log(10^4) = 4$, so:

$$dB_{\text{final}} = dB_{\text{initial}} + 40$$

The sound increases by 40 decibels. In general, when sound intensity goes up by a **factor** of 10, dB increases by 10 points.