

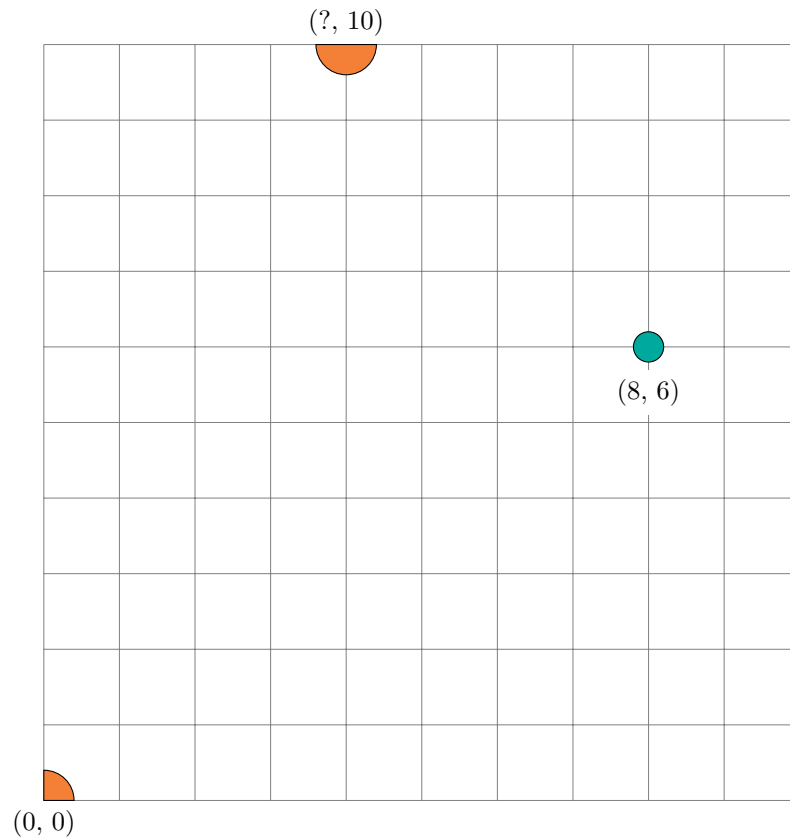
## Book Problems:

**Chapter 23:** 39, 43

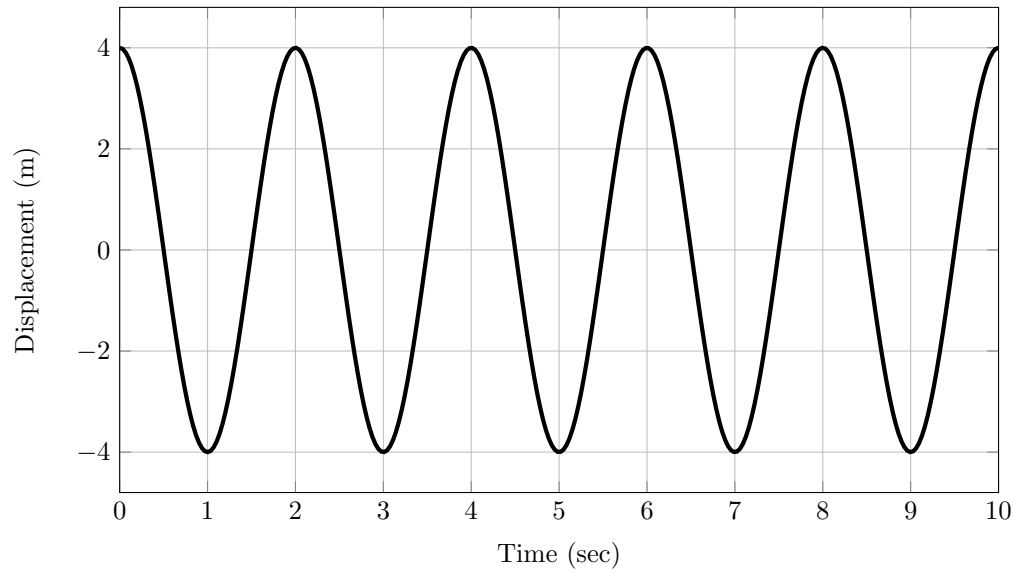
**Supplementary:** 12, 14

## My Problems:

- Two speakers are located at particular positions in a  $10\text{ m} \times 10\text{ m}$  room where the speed of sound is equal to  $343\text{ m/s}$ . One speaker you know is located at the origin, but the other you know only that it has  $y = 10\text{ m}$ . You noticed perfect constructive interference of the pitch A4 ( $440\text{ Hz}$ ) at the point  $(8,6)$ . What are 4 possible  $x$ -locations for the second speaker? You can assume both speakers are synchronized.

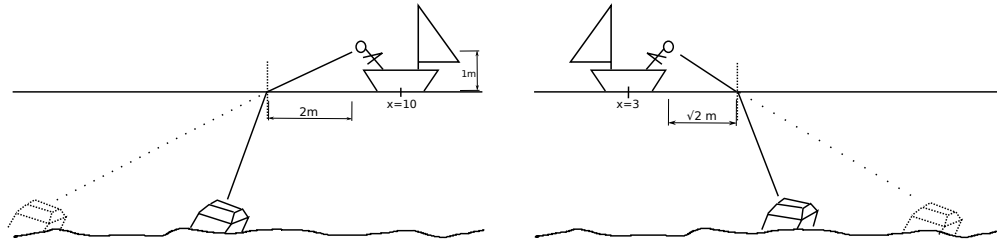


2. A wave is traveling in the negative y direction at 30 m/s and has the below plot. Determine a mathematical expression which describes the wave.



3. Suppose you shine white light onto two narrow slits. Each slit has a width of  $0.1\text{ mm}$  and the slits are separated by a distance of  $2\text{ }\mu\text{m}$ . The light is projected onto a wall which is  $2\text{ m}$  away. When this happens, points of constructive interference make bright spots on the wall which depend on the wavelength. Since white light is made out of all the visible wavelengths, this means different colored bright spots will appear in different locations. What is the distance (on the wall) between the first ( $m = 1$ ) red ( $\lambda = 700\text{ nm}$ ) and the violet ( $\lambda = 400\text{ nm}$ ) bright spots?

4. You are a treasure hunter in the Caribbean. Looking down from your boat, you see some treasure lying at the bottom of the lagoon. Unfortunately, the refraction from the water makes it difficult to ascertain it's exact location. As such, you take measures from two different locations in the lagoon, noting for each the position that the treasure SEEMS to be from the boat. What is the depth of the lagoon and where is the treasure located? The index of refraction of water is 1.33. (*This is a little tricky and definitely harder than a single problem would show up on the final, but is a nice application of Snell's law. It might help to draw the whole situation out to see the needed geometries.*)



**Book Solutions:**

- S3.12: 294 m, 13.3  $\mu\text{s}$
- S3.14:  $\omega = 25.1 \text{ rad/s}$ ,  $f = 3.99 \text{ Hz}$ ,  $T = 0.25 \text{ s}$ ,  $\lambda = 2.5 \text{ m}$ ,  $v = 10 \text{ m/s}$ , Direction =  $+\hat{\mathbf{x}}$ , Amplitude = 1.5 m, 0!

**My Solutions:**

1. Some Possibilities:

- 0.567 m
- 1.466 m
- 2.4 m
- 3.39 m
- 4.49 m
- 5.85 m

2.  $4 \cos\left(\frac{2\pi}{2}t + \frac{2\pi}{60}y\right)$

3. 34 cm

4. Depth: 2.126 m, Treasure at  $x = 6.346 \text{ m}$