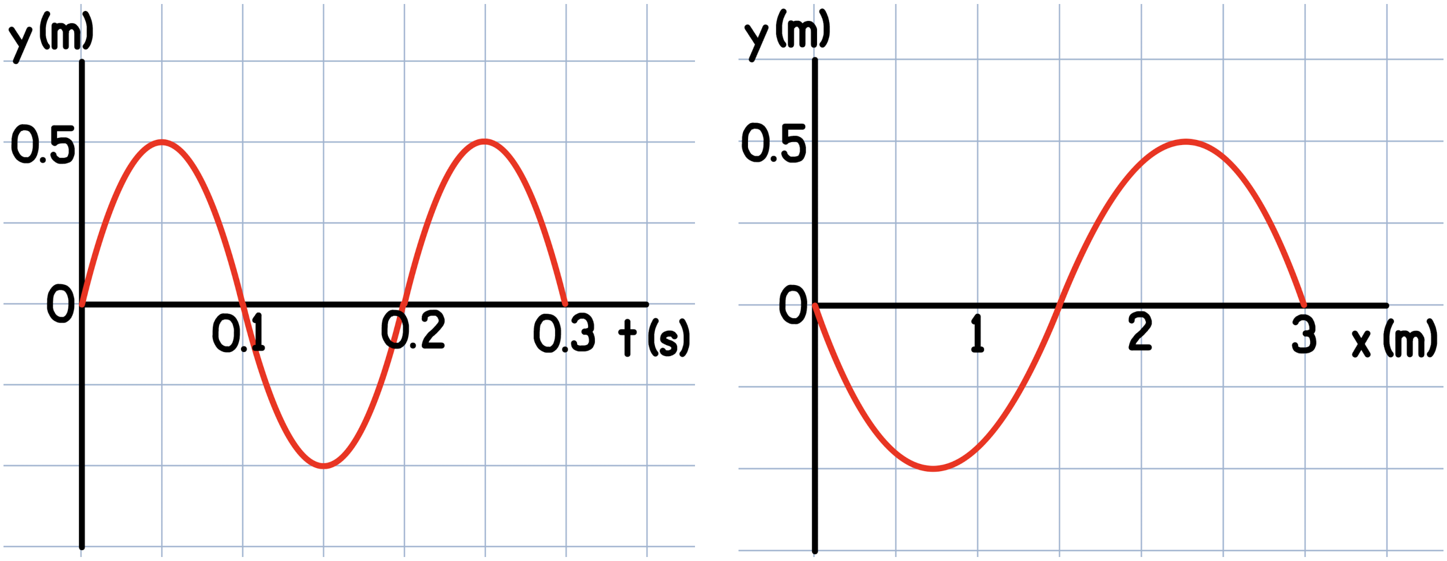
The graph on the left shows the vertical position of a particle in the medium with respect to time. The graph on the right shows the *y*-position vs. *x*-position for the same wave.



Use the graphs to determine the following:

a) amplitude

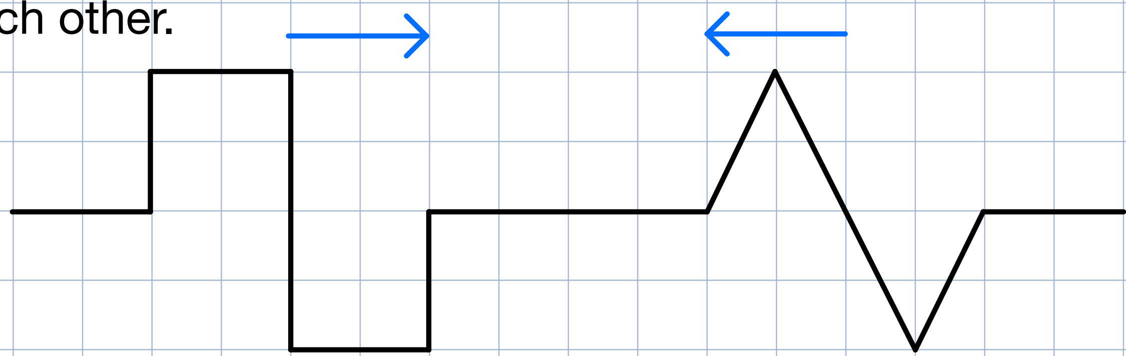
b) wavelength

c) period

d) frequency

e) wave speed

Two wave pulses are propagating along a string toward each other.



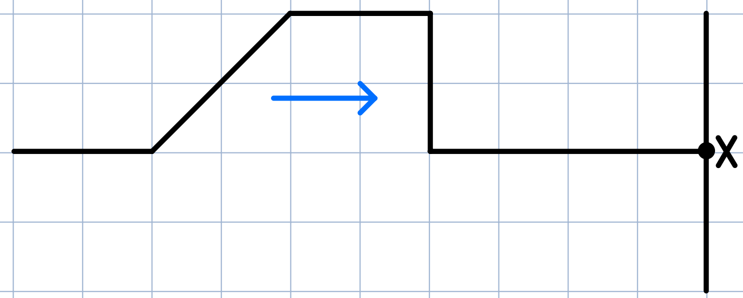
Draw the shape of the string when...

a) the pulses overlap by half of the length of each pulse

b) the pulses completely overlap

c) the pulses have passed each other

A pulse travels along a string at a speed of 1 unit per second and reflects upon reaching *X*.

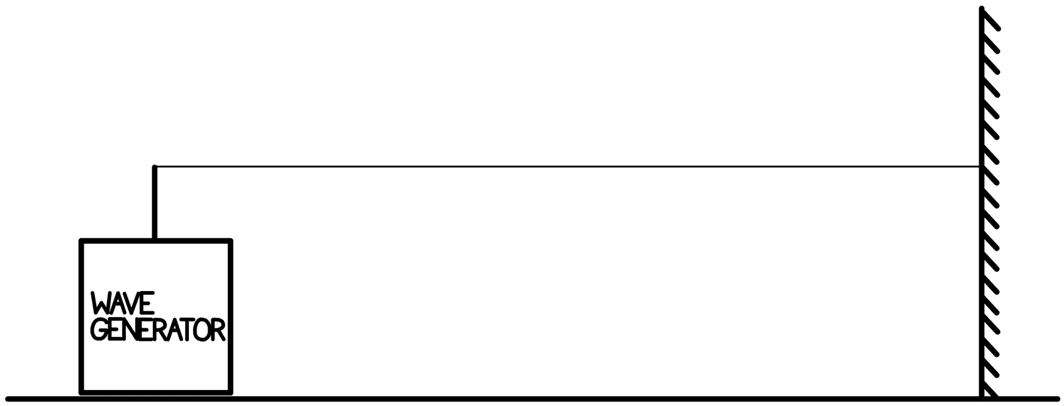


Draw the pulse after six seconds if *X* is a...

a) fixed end

b) free end

A standing wave is created by a wave generator in a string of length 2.0 m.



The frequency of the third harmonic is found to be 360 Hz.

a) What is the wave speed?

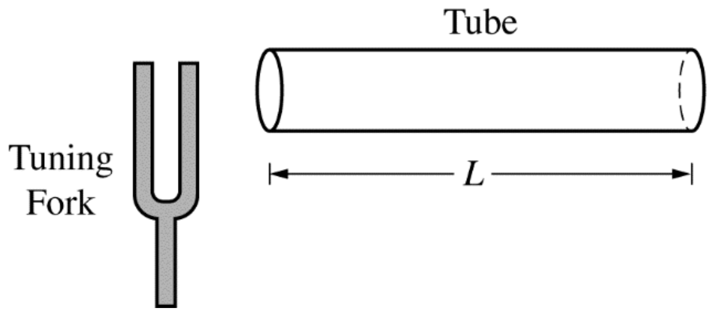
b) What are the frequencies of the second and fourth harmonics?

c) If the string is tightened, the wave speed increases.

   i. Does the wavelength of the third harmonic increase, decrease or stay the same?

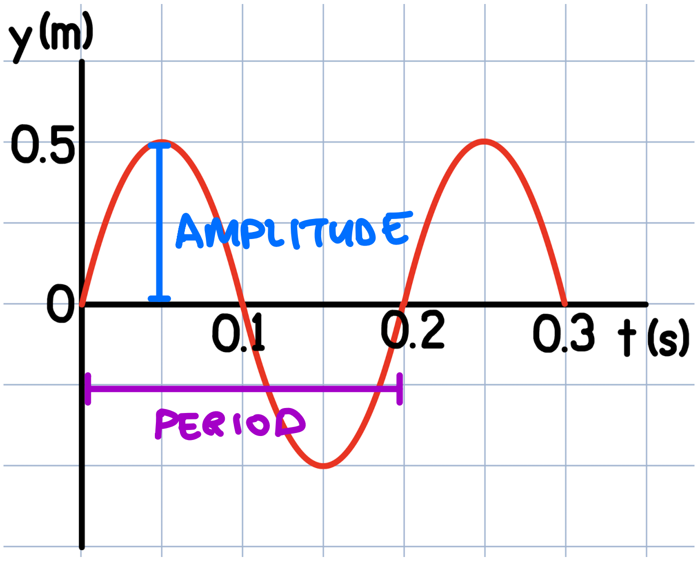
   ii. Does the frequency of the third harmonic increase, decrease or stay the same?

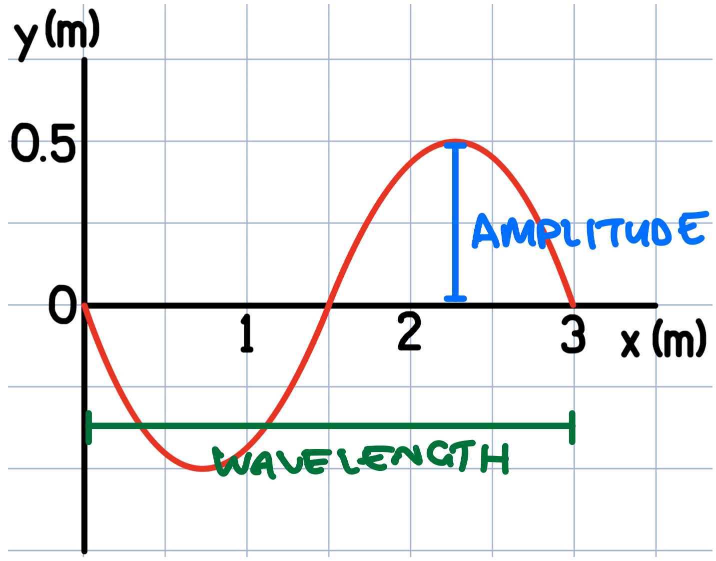
A tuning fork vibrating at 512 Hz is held near one end of a tube of length *L* that is open at both ends. The column of air in the tube resonates at its fundamental frequency. The speed of sound in air is 340 m/s.



a) Calculate the length *L* of the tube.
b) The right end of the tube is now capped shut, and the tube is placed in a chamber that is filled with another gas in which the speed of sound is 1005 m/s. Calculate the new fundamental frequency of the tube.

The graph on the left shows the vertical position of a particle in the medium with respect to time. The graph on the right shows the *y*-position vs. *x*-position for the same wave.





Use the graphs to determine the following:

a) amplitude b) wavelength c) period

d) frequency e) wave speed

a) USE EITHER GRAPH

0.5 m

b) USE y VS. x GRAPH

$\lambda = 3\text{ m}$

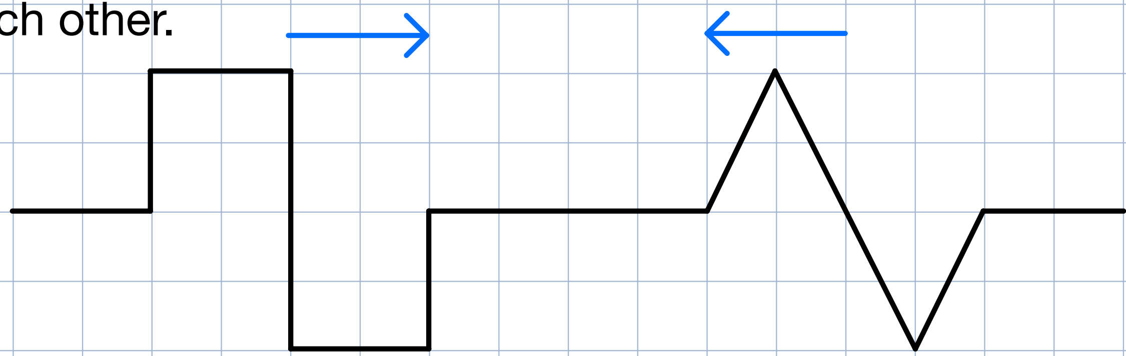
c) USE y VS. t GRAPH

$T = 0.2\text{ s}$

d) $f = \frac{1}{T} = \frac{1}{0.2} = 5\text{ Hz}$

e) $v = \lambda f = (3)(5) = 15\ \frac{m}{s}$

Two wave pulses are propagating along a string toward each other.



Draw the shape of the string when...

a) the pulses overlap by half of the length of each pulse

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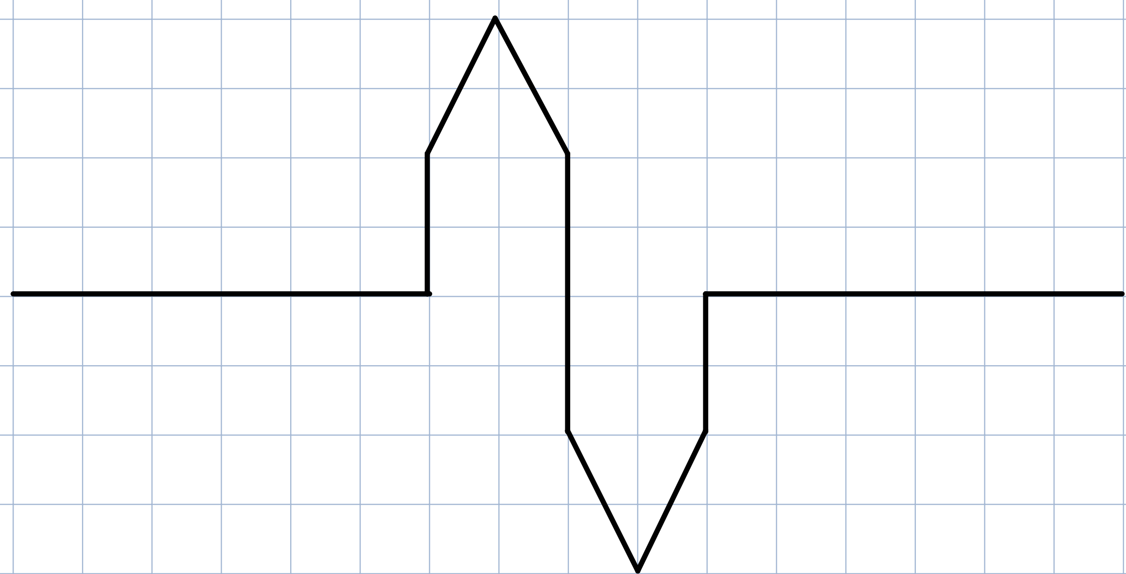
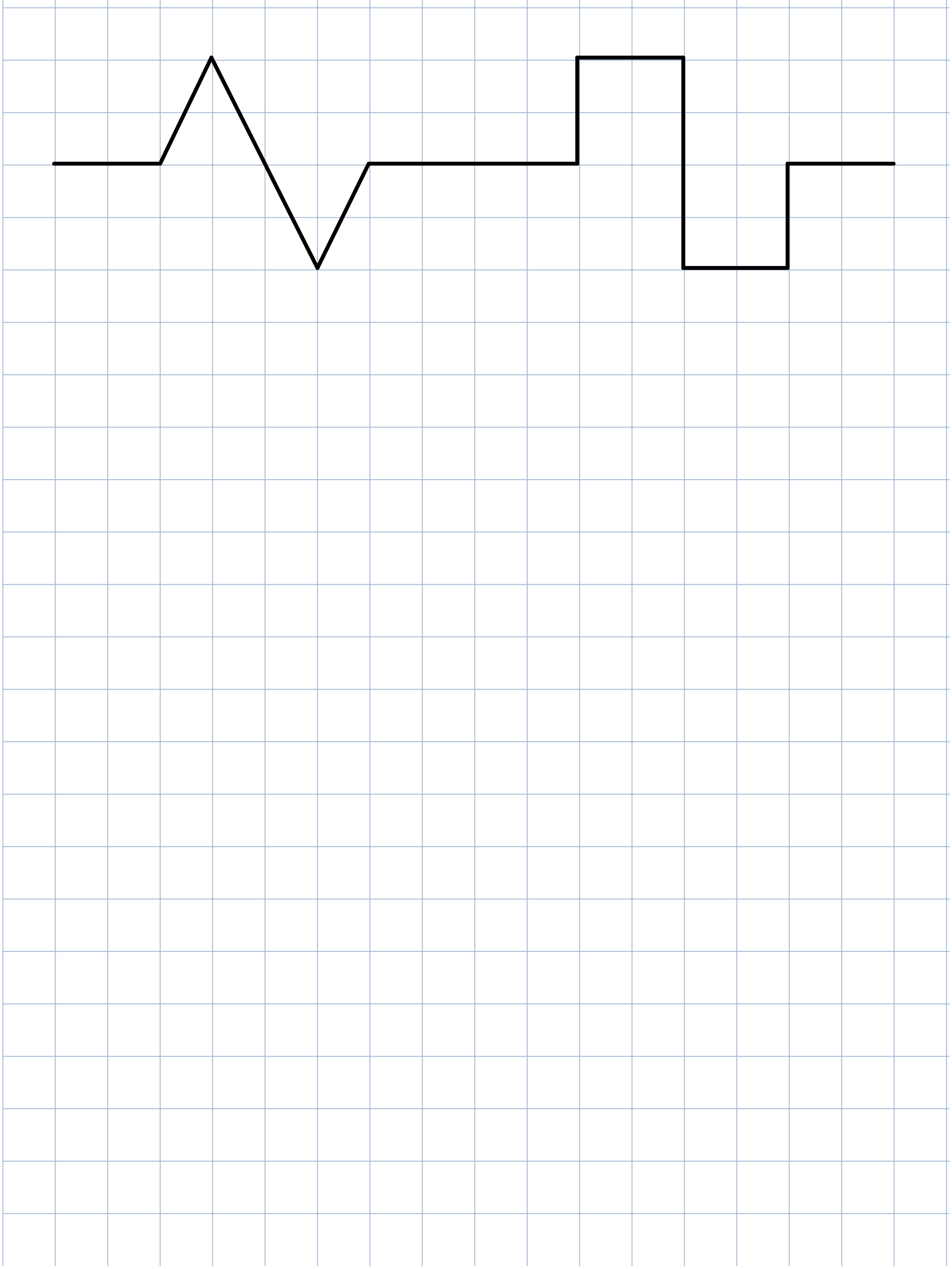
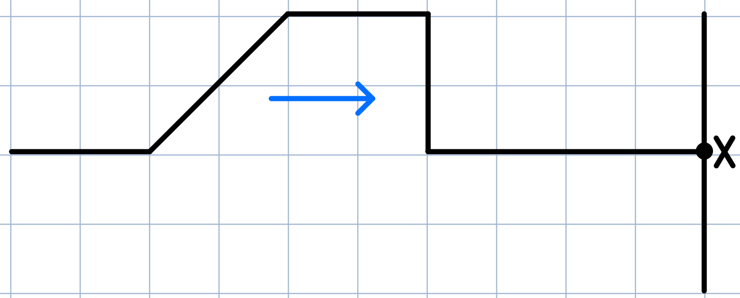


c) the pulses have passed each other

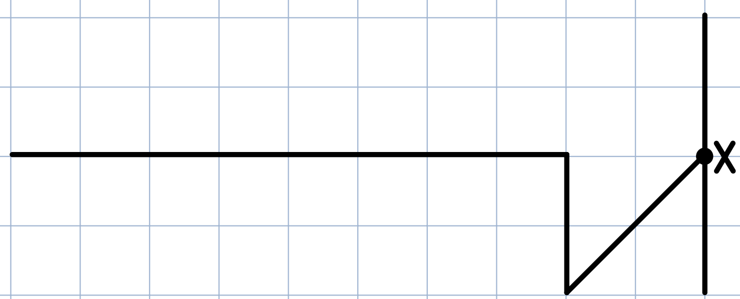


A pulse travels along a string at a speed of 1 unit per second and reflects upon reaching *X*.

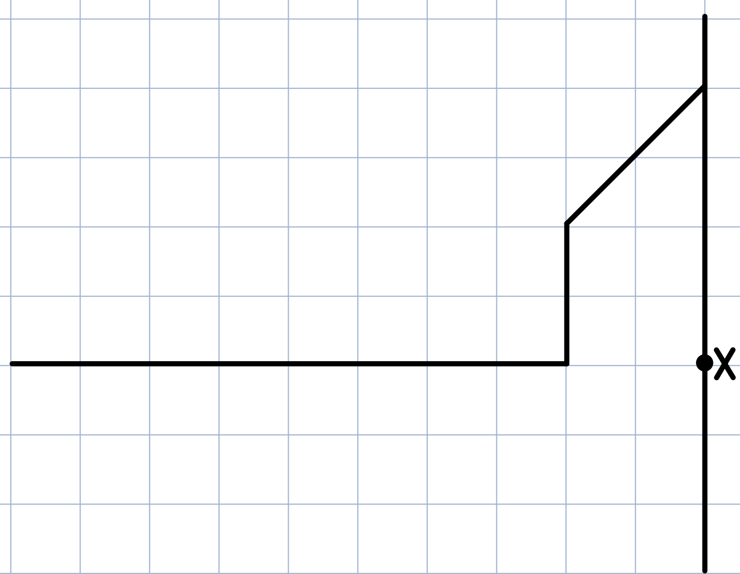


Draw the pulse after six seconds if *X* is a...

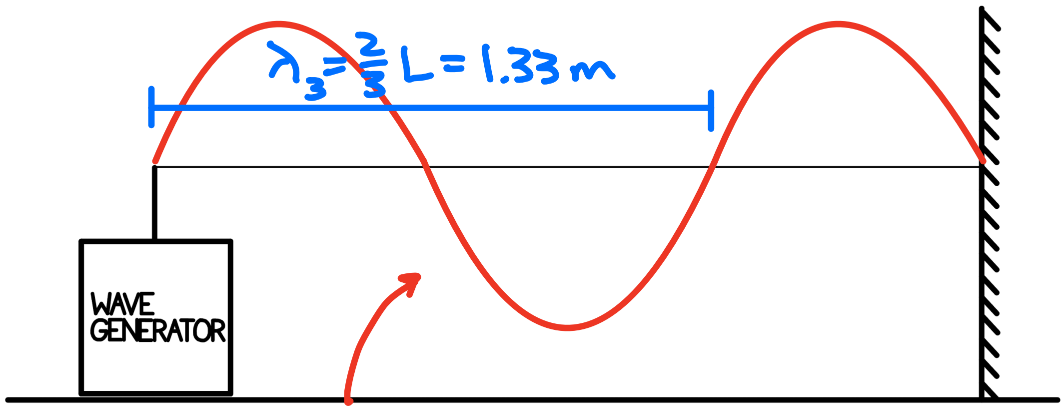
a) fixed end



b) free end



A standing wave is created by a wave generator in a string of length 2.0 m.



The frequency of the third harmonic is found to be 360 Hz.

a) What is the wave speed?

$f_3 = 360\,Hz$

$\lambda_3 = \frac{2}{3}L = 1.33\,m$

$v = ?$

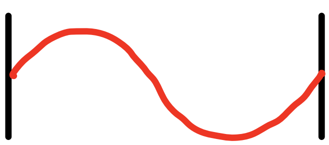
$v = \lambda_3 f_3$

$= (1.33)(360)$

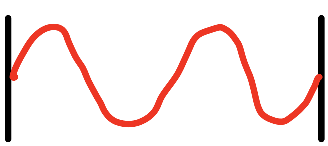
$= \boxed{480\,\frac{m}{s}}$

b) What are the frequencies of the second and fourth harmonics?

METHOD 1:



$f_2 = \frac{v}{\lambda_2} = \frac{480}{2.0} = \boxed{240\,Hz}$



$f_4 = \frac{v}{\lambda_4} = \frac{480}{1.0} = \boxed{480\,Hz}$

METHOD 2:

$f_1 = \frac{1}{3} f_3 = 120\,Hz$

$f_2 = 2 \cdot f_1 = 2 \cdot 120$

$= \boxed{240\,Hz}$

$f_4 = 4 \cdot f_4 = 4 \cdot 120$

$= \boxed{480\,Hz}$

c) If the string is tightened, the wave speed increases.

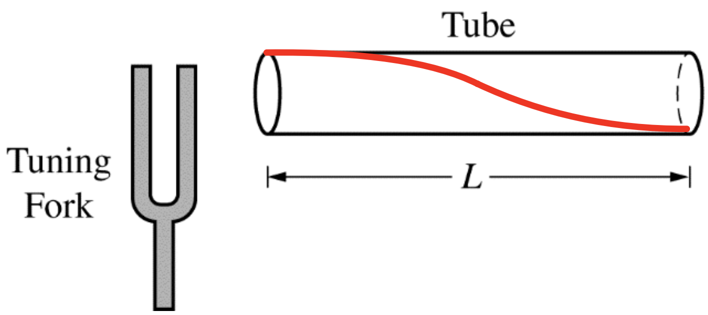
i. Does the wavelength of the third harmonic increase, decrease or stay the same?

LENGTH REMAINS THE SAME SO WAVELENGTH IS UNCHANGED

ii. Does the frequency of the third harmonic increase, decrease or stay the same? $f = \frac{v}{\lambda} \rightarrow f \propto v$

FREQUENCY IS DIRECTLY PROPORTIONAL TO SPEED. SPEED INCREASES (AND WAVELENGTH STAYS THE SAME) SO FREQUENCY INCREASES.

A tuning fork vibrating at 512 Hz is held near one end of a tube of length *L* that is open at both ends. The column of air in the tube resonates at its fundamental frequency. The speed of sound in air is 340 m/s.



a) Calculate the length *L* of the tube.

$\lambda_1 = 2L$

$v = 340 \ m/s$

$f_1 = 512 \ m/s$

$v = \lambda_1 f_1$

$v = (2L) f$

$L = \frac{v}{2f} = \frac{340}{2(512)} = \boxed{0.332 m}$

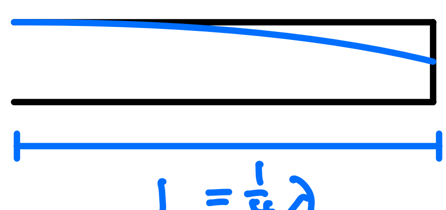
b) The right end of the tube is now capped shut, and the tube is placed in a chamber that is filled with another gas in which the speed of sound is 1005 m/s. Calculate the new fundamental frequency of the tube.

$\lambda_1 = 4L$

$v = 1005 \frac{m}{s}$

$f_1 = ?$

ONE END FIXED (NODE)
ONE END FREE (ANTINODE)



$v = \lambda_1 f_1$

$v = (4L) f_1$

$f_1 = \frac{v}{4L} = \frac{1005}{4(0.332)} = \boxed{757 \ Hz}$