1. A wave travels along an infinite rope under constant tension. The rope is marked off in meter intervals. At the 0 meter mark, the rope is observed to reach its maximum transverse displacement of $D$ m every $\Delta t$ seconds. The distance between the maxima at any instant in time is $L$ meters. Assume the wave is harmonic.

a. Write a function (of $x$ and $t$ only) that describes this wave in general using variables only. Define any values that are not variables.

b. Write a function (of $x$ and $t$ only) that describes this wave in particular. Assume the wave has a maximum displacement at $x = 0$ when $t = 0$, and is moving along the rope from left to right.

c. Write expressions for the wavelength and the frequency of the wave described above.

d. If $D=1.1$ m, $\Delta t= 8$ sec and $L=25$ m, determine the values for the wavelength and the frequency of the wave described above.
2. You are given two representations that describe a wave disturbance that is traveling with speed $v$ along the $x$ axis. The first of the graphs below shows the displacement $y$ versus the distance $x$ for a given instant of time $t_1=0$. The second graph shows the displacement $y$ versus the time $t$ for a given point $x_1=0$, which undergoes SHM in the $y$ direction.

(a) Which representation is most like a picture you would have taken with a camera? **Explain in words.**

(b) Write a function that describes this traveling wave.

(c) Determine the wave speed.
3. Turn on the Wave on a String interactive applet on your browser
   https://phet.colorado.edu/sims/html/wave-on-a-string/latest/wave-on-a-string_en.html. Set it to “Oscillate” and “No End”. Set the Amplitude to 0.65 cm, the Frequency to 1.00 Hz. Set Damping to “None”. The Tension slider should be somewhere around the middle and make sure it is running in “Normal”, not “Slow Motion”.
   (a) Observe the general motion of the wave. In which direction does the wave move?

   (b) Focus on only one of the green dots somewhere in the middle of the wave. In which directions does it move? Is this the same as the direction the wave moves?

   (c) Each green dot exhibits a motion that you have studied before. What is this motion called?

   (d) Compare two adjacent green dots with each other. Do they oscillate at the same frequency? What is different about them? Explain in words.

   (e) Turn on the Rulers. Pause the animation and measure and record the wavelength \( \lambda_1 \).

   \[
   \lambda_1 =
   \]

   (f) Significantly increase the frequency. Pause the animation, measure and record the wavelength \( \lambda_2 \), hit play.

   \[
   \lambda_2 =
   \]

   Is the wave speed higher or lower than that in (e)? Explain in words.

   (g) Significantly increase the amplitude. Pause the animation and measure and record the wavelength \( \lambda_3 \).

   \[
   \lambda_3 =
   \]

   Is the wave speed higher or lower than that in (f)? Explain in words.

   (h) Are the results of parts (e) through (f) consistent with the relationship between frequency, velocity and wavelength you wrote down in part 4 of your prelab? Explain in words.