Exercise #1

Background: The data shown at left were measured on a flat grassy area of a college campus in the photos on the right. Each of the three shown seismic waves - known as '***traces***' - were created by striking a steel plate on the ground with a hammer, and measuring the trace at three distances from the hammer: x=0.75 m, x=1.5 m, and x=2.5 m. The traces were measured using a ***geophone***, similar to a microphone that is attached to the ground.

Assignment:

Using the equation in the red box below, calculate the frequency (*f*) of each wave based on the provided velocity (v) and wavelength (λ), then make an X/X scatterplot of the frequency on the y-axis against the distance from the hammer location on the x-xis. Describe the relationship you observe: is the line curved or straight? which way is it sloping?

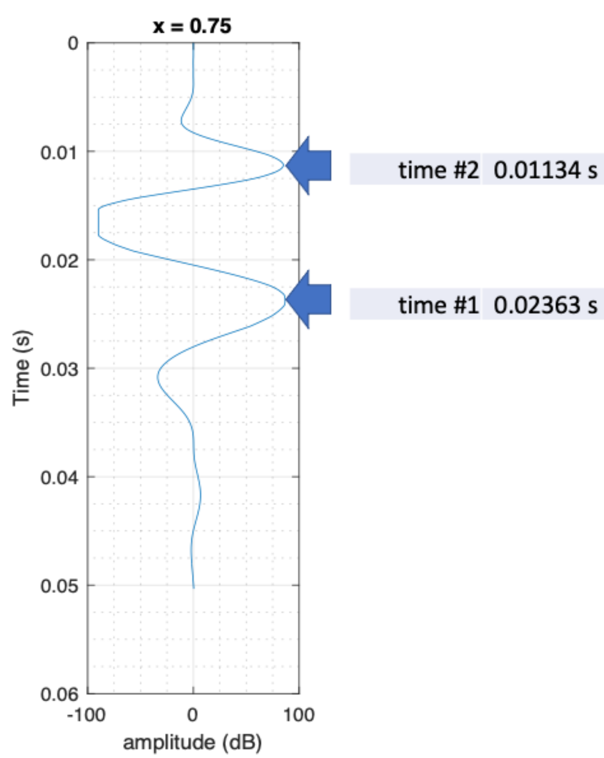
Recall:

--> The wavelength may be measured between any two equivalent points on the wave, e.g., peak-to-peak, trough-to-trough, zero-crossing to zero-crossing.

--> The traces are recorded in units of *time*, however you need the *distance in meters* of the wavelength. Use the given velocity to convert.

Procedure:

1) First, you will look at each trace and identify any two equivalent points on the wave, e.g., peak-to-peak, trough-to-trough, zero-crossing to zero-crossing. Example values are shown for Trace 1.



2) Next, you need to calculate the difference between time 1 and 2: do this by filling out subtraction formulae on row 26 for each trace.

time difference = time #1 – time#2

time difference = 0.2363 s – 0.01134 s

0.01229 s = 0.2363 s – 0.01134 s

3) Now, you can calculate the wavelength, which is the time difference multiplied by the velocity. In this case, the velocity is provided to you, so just add a formula on row 30 to multiply the velocity by the time difference.

wavelength = time difference X velocity

wavelength = 0.01229 s X 400 m/s

4.916 m = 0.01229 s X 400 m/s

4) Then, you can calculate the frequency - also known as 'cycles per second' - by dividing the velocity by the wavelength. Add a formula on row 32 to do this.

frequency = velocity/wavelength

frequency = 400 m/s / 4.916 m

81.37 Hz = 400 m/s / 4.916 m

5) Finally, copy the frequency results and geophone offsets (x=#.# at the top) into two new columns, and insert a new scatterplot into the workbook.

meters	Hertz
0.75	81.37
1.5	-
2.5	-