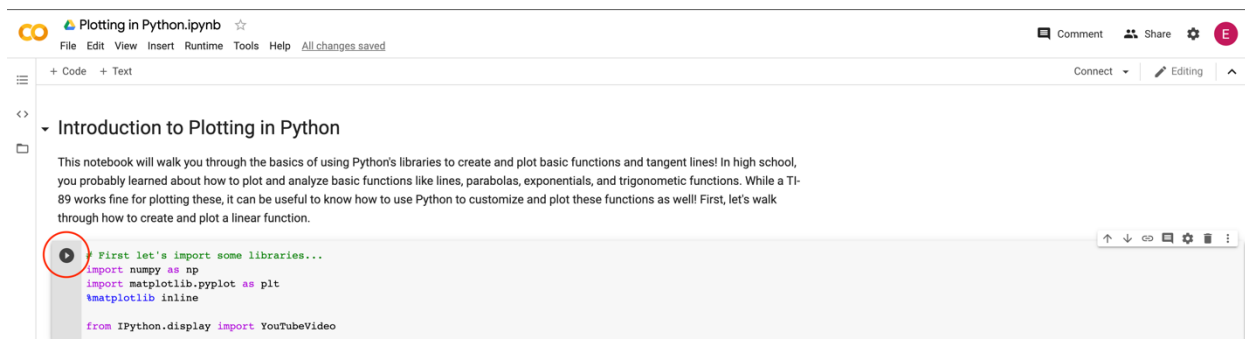


# Jupyter Notebook Activity Sheet **Key**

## Directions

Open the file **WhatisAWave\_NOTEBOOK.ipynb** in [Google Colaboratory](#) by selecting “File->Open Notebook” (NOTE: You will need a Google Account to use Google Colaboratory.) Read each cell (block) of text and run each cell of code by clicking the play button on the left side of the block as indicated by the red circle in the figure below.



As you read and run each cell, answer the following questions. This is a graded assignment.

1. Set the **amplitude** of the wave to 0. Describe the graph.

The graph is a horizontal line

2. Now, set the **amplitude** to a positive value. Then, set the **amplitude** to a negative value of the same magnitude (i.e. if you used a +2 in the previous step, you should use -2 for this step). How does the plot with a positive amplitude differ from the plot with the negative value?

The graph with the negative amplitude should start at zero then move downward first

The graph with the positive amplitude should start at zero then move upward first

OPTIONAL/BONUS: The magnitude of the amplitude is the same for each graph

3. Reset the plot (re-run the code cell). Now, set the **frequency** to 0 and adjust the **phase shift**. Describe the graph and how it changes in response to a change in **phase shift**.

When the frequency is 0, the graph is a horizontal line

Changing the phase shift causes the line to move up (phase shift is positive) or down (phase shift is negative)

Name:

Date:

Class:

4. Reset the plot. Now, set the **amplitude** to 2 and the **frequency** to 0.1. How many **zeroes** are in the plot? How does the number of **zeroes** change when you **double** the frequency?

There are 5 zeroes (x-intercepts) if you count the beginning and end of the wave (3 is also a suitable answer if the beginning and end are not counted)

The number of zeroes increases when the frequency is doubled—there should be 9 (or 7, if the beginning and end aren't counted)

5. Create your own sine wave by adjusting all four properties to values of your choice. Provide the equation below, along with a sketch of the graph.

All answers are suitable here—just make sure students include the values of A, f, p, and v in an equation and include a small sketch of their wave.

OPTIONAL: Have students group together and try to recreate each other's waves based ONLY on their sketches!