Phase Zero

This lab is designed to be used with your TI-83$^+$ calculator. You will be exploring the relationship between trigonometric functions and their equations. You will also be predicting results and answering questions about these relationships. You can work by yourself or as a member of a group no larger than three students.

You will need:

graph paper
straight edge
TI-83$^+$ calculator

Calculator Setup:

1. Make sure that your calculator is set to radian mode. (Check that **Radian** is highlighted in the **MODE** menu)
2. You are graphing trigonometric functions, so you should set the screen accordingly - use **ZTrig** in the **ZOOM** menu.
   * You may need to modify the **WINDOW** setting slightly during the lab.

Phase One

For each equation:

a) Sketch a prediction of what the graph will look like. Be sure to label the zeroes, maximum and minimum values.

b) Once you have completed your sketch, use your calculator to graph the equation.

c) For each graph, use the **TRACE** feature or the **CALC** menu to check for zeroes, maximum and minimum values. If the graph produced by your calculator is the same as your prediction, write *SAME* beside your graph. If your graph is different from your prediction, draw the correct graph, using a different colour, on the same set of axes and write a sentence describing what incorrect assumption you made.

Hint: Remember y = mx + b and how m and b affect the graph of the line

A. Equations of the form:
y = a sin x or y = a cos x

1.

2.

3.

4.

5.

a) Explain in your own words how the graph is affected by the coefficient a. Be sure to include what happens when a is negative.

b) Why do you think the hint was given to think about the equation y = mx + b?

B. Equations of the form: y = c + a sin x or y = c + a cos x

1.

2.

3.

4.

5.

a) Explain in your own words how the graph is affected by the constant c.

b) Why do you think the hint was given to think about the equation y = mx + b?

Phase Two

For each equation:

a) Sketch a prediction of what the graph will look like. Be sure to label the zeroes, maximum and minimum values.

b) Use your calculator to graph the equation.

c) For each graph, use the **TRACE** feature or the **CALC** menu to check for zeroes, maximum and minimum values. If the graph produced by your calculator is the same as your prediction, write *SAME* beside your graph. If your graph is different from your prediction, draw the correct graph, using a different colour, on the same set of axes and write a sentence describing what incorrect assumption you made.

C. Equations of the form:
$y = c + a \sin (x - p)$ or $y = c + a \cos (x - p)$

1.

2.

3.

4.

5.

6.

7.

a) Compare the equation and graph from part B number 5 with the equation and graph from part C number 5. How are they the same and/or different? Why do you think this is so?

b) Explain what the constant p does to the graph.

c) Is there another way to write the equation for part C number 7? If so, write the equation.

D. Equations of the form: $y = c + a \sin b(x - p)$ or $y = c + a \cos b(x - p)$

1.

2.

3.

4.

5.

6.

7.

8.

9.

10.

a) Explain what the constant b does to the equation.

b) Compare and contrast the equations and the graphs of part D number 7, 9, and 10.

c) Are all of the sets of brackets necessary for each of the above equations in part D? Which brackets, if any, could be removed without changing the graph of the equation? Which sets could be extended to include the constant b without changing the graph?

The Final Phase

You have been looking at equations of the form:
y = c + a sin b (x - p) and y = c + a cos b (x - p)

c: the vertical shift
a: the change in amplitude
b: the change in frequency
p: the phase shift

a) All of the work you have done has concentrated on sine and cosine. Using what you have learned in this lab, explain what effect you think the constants a, b, c, and p would have on the tangent function. (Or other trigonometric functions)

b) AM and FM waves are sinusoidal waves. Using what you've learned, make a prediction as to what the letters in AM and FM stand for.

c) Did you find this activity helpful in learning about the equations and graphs of sine and cosine? Explain.

d) Make at least one suggestion to improve this activity.

Assessment Piece

In small groups, design a project which uses technology to model an application of trigonometry. The goals of the project include demonstrating understanding of trigonometry and the application you choose to study, using technology to present your findings, and learning about an application that interests you.

Some ideas for projects:
- pendulum motion
- circular motion

- waves
  - sound waves
  - radio waves
  - ocean waves
  - light waves