

Investigation #1
The Sine Function: Amplitude

Name _____
Period _____

In this lesson you will learn how A affects the graph of $y = A \sin(x)$

1. Use a graphing calculator to graph each of the following functions. All work will be done in degrees, so you must set the mode setting on your calculator to degrees. The suggested window settings are $X_{min} = -360$, $X_{max} = 360$, $X_{scl} = 90$, $Y_{min} = -4$, $Y_{max} = 4$, $Y_{scl} = 1$.

Equation	A	Sketch	Max	Min	Amp.	Is the graph inc. or dec. from 0° to 90° ?
$y = 1 \sin(x)$						
$y = 2 \sin(x)$						
$y = 0.5 \sin(x)$						
$y = -2 \sin(x)$						
$y = -3.5 \sin(x)$						

2. Use your graphs to answer the following questions about $y = A \sin(x)$.

- As $|A|$ increases, does the graph become steeper or flatter? _____
- Does the sign of A affect the value of the maximum, minimum, or amplitude? If so, how? _____
- How do the graphs of $y = A \sin(x)$ and $y = -A \sin(x)$ differ? _____
- Are the graphs of $y = A \sin(x)$ and $y = -A \sin(x)$ symmetric? If so, are they symmetric about the x-axis or the y-axis? _____
- If $A = 2.5$, will the maximum be greater or less than the graph with $A = 1$? _____
- Suppose you want the maximum value of $y = A \sin(x)$ to be 1.5 and the graph to be increasing from 0° to 90° . What value of A would you choose? Check your answer on the calculator. _____
- Suppose you want the minimum value of $y = A \sin(x)$ to be between -1.25 and -1.50 and the graph to be decreasing from 0° to 90° . What value of A would you choose? Check your answer on the calculator. _____

3. Write formulas for the maximum value, minimum value, and amplitude in terms of the constant A in the equation $y = A \sin(x)$. Remember that A can be either positive or negative.

Maximum: _____

Minimum: _____

Amplitude: _____

Explain how the constant A affects the graph of $y = A \sin(x)$. _____

Investigation #2
The Sine Function: Vertical Shift

In this lesson you will learn how A and D affect the graph of $y = A\sin(x) + D$.

- Use a graphing calculator to graph each of the following functions. All work will be done in degrees, so you must set the mode setting on your calculator to degrees. The suggested window settings are $X_{\min} = -360$, $X_{\max} = 360$, $X_{\text{scl}} = 90$, $Y_{\min} = -4$, $Y_{\max} = 4$, $Y_{\text{scl}} = 1$.

Equation	A	D	Sketch	Max	Min	$\frac{\text{Max} + \text{Min}}{2}$
$y = 1\sin(x) + 0$						
$y = 1\sin(x) + 2$						
$y = \sin(x) - 3$						
$y = 2\sin(x) + 2$						
$y = -1\sin(x) + 1$						

- Use your graphs to answer the following questions about $y = A\sin(x) + D$

- If the constant D is positive, does the graph shift up or down? _____
 - If the constant D is negative, does the graph shift up or down? _____
 - Write a sentence describing what happens to the graph if we add a non-zero constant D to the equation $y = A\sin(x)$. _____
- If you want the graph of $y = A\sin(x)$ to shift 1.5 units above the x-axis, what value of D should you choose? _____
 - If a function is periodic, like the sine function, then one-half the sum of the maximum value plus the minimum value is the center line of the function. What does the center line of $y = A\sin(x) + D$ tell you about the graph? _____
 - The graph of $y = 1\sin(x) + 2$ has a new center line because it has been shifted up from the x-axis. What is the equation of the new center line? _____
 - Explain how the constants A and D affect the shape and location of the graph of $y = A\sin(x) + D$. _____

- State formulas for the vertical shift, center line, maximum value and minimum value in terms of the constants A and D in the equation $y = A\sin(x) + D$.

Vertical Shift: _____ Center Line: _____
 Maximum: _____ Minimum: _____

- Write equations of the form $y = A\sin(x) + D$ for the maximum, minimum, and vertical shift values given below. The first entry has been completed for you.

Maximum	Minimum	Amplitude	Vertical Shift	Equation
3	1	1	2	$y = 1\sin(x) + 2$
1	-3	2	-1	
2	-1			
3				

- Write an equation whose graph is a sine curve between the graphs of the equations $y = -1\sin(x) + 2$ and $y = -1\sin(x) + 0.5$. Verify your answer using the calculator. _____

- Explain how the constant D affects the graph of $y = A\sin(x) + D$. _____