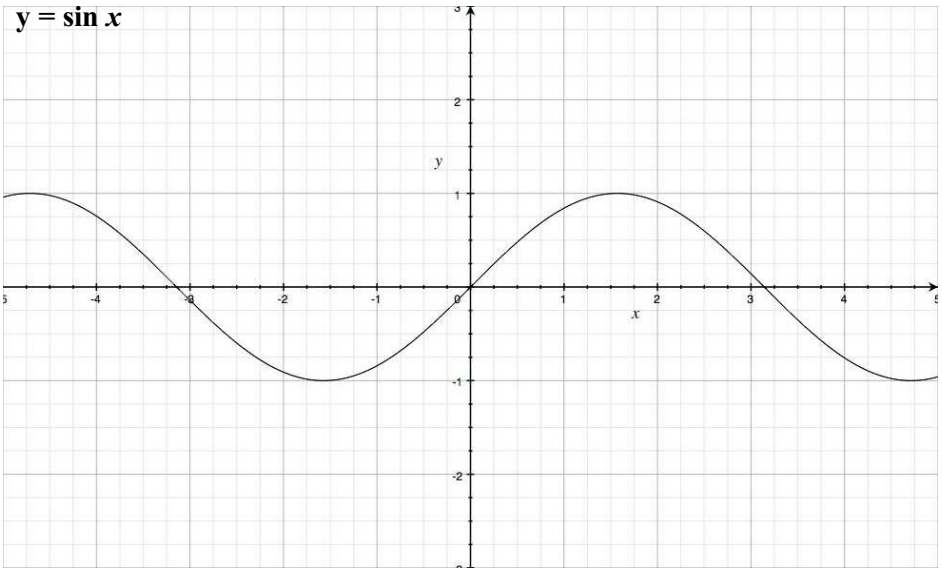
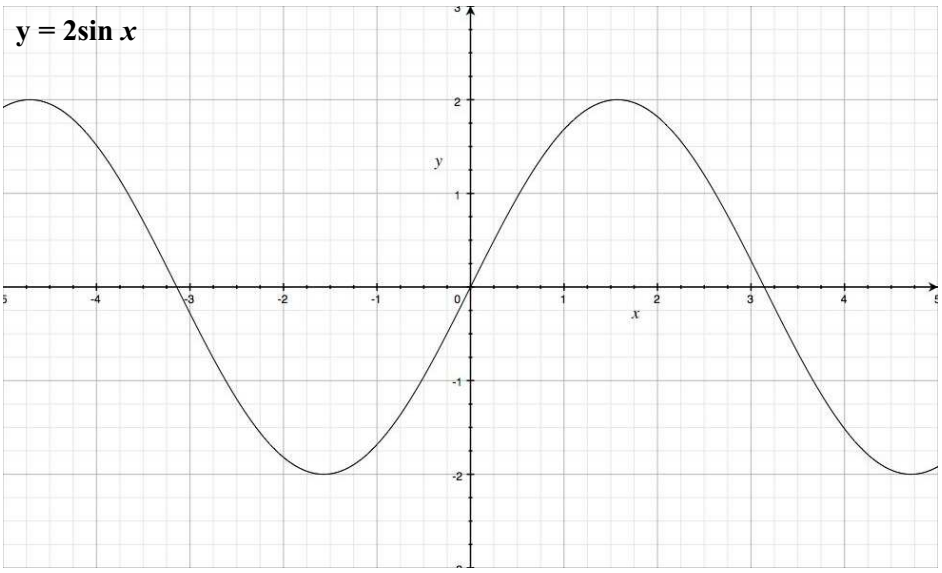
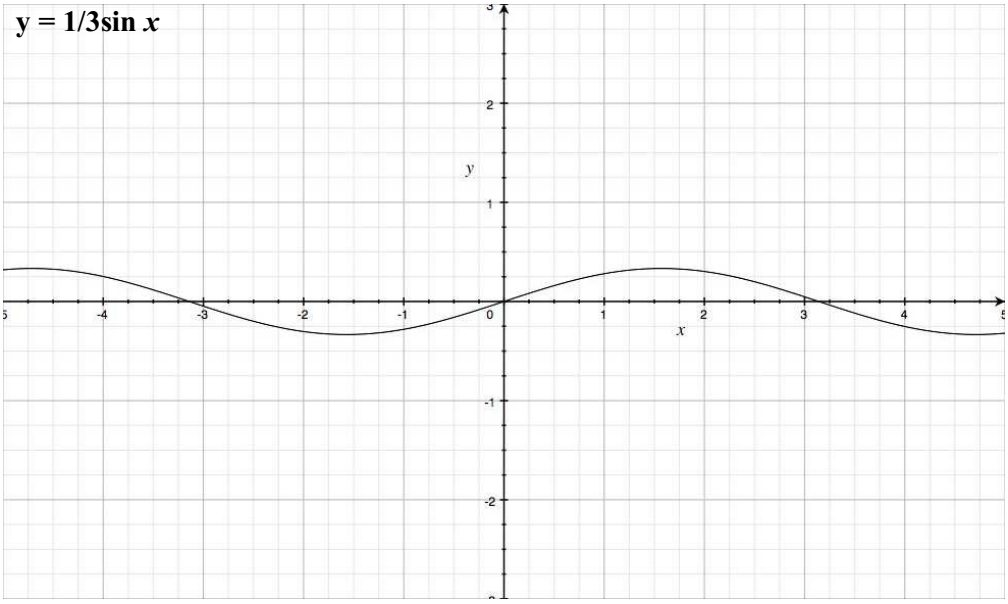
Part 1

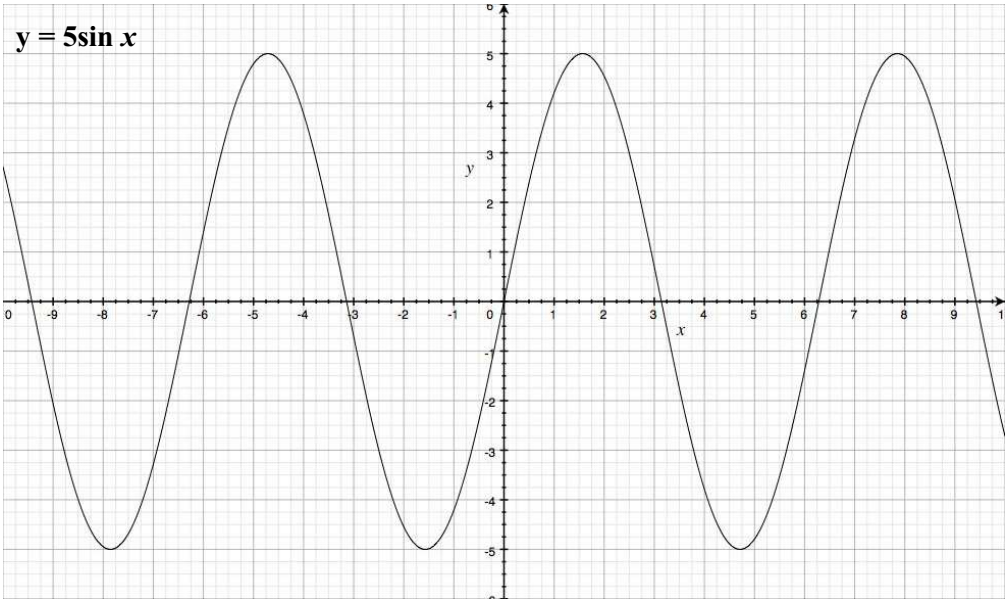
Look at the graphs of **y = sin x**

Compare the graphs of:









The difference between all these graphs is a variable known as A, or amplitude of wave.

When A > 1, the graph stretches vertically.
When 0 < A < 1, the graph compresses vertically.

Also, A is the number that manipulates how far the graph compresses or stretches to. For example, in the graph of **y = 2sin *x***, the graph stretches out to +2 and down to -2. The characteristics of the waveform are altered because of this. The range of the graph is increased or decreased in conclusion.

The domain and range of the graphs are:

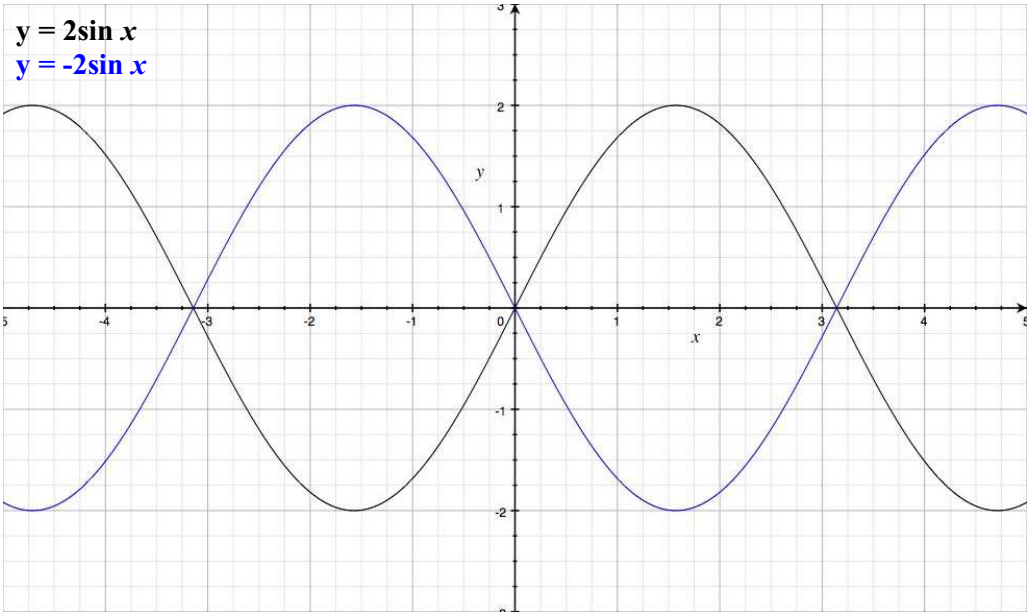
y = sin *x*
D: {x| $x \varepsilon R$}
R: {y| $-1 < y < 1$, $y \varepsilon R$}

y = 2sin *x*
D: {x| $x \varepsilon R$}
R: {y| $-2 < y < 2$, $y \varepsilon R$}

y = 1/3sin *x*
D: {x| $x \varepsilon R$}
R: {y| $-1/3 < y < 1/3$, $y \varepsilon R$}

y = 5sin *x*
D: {x| $x \varepsilon R$}
R: {y| $-5 < y < 5$, $y \varepsilon R$}

Also, if A was negative in the initial equation, it would flip the graph around like a mirror as so:

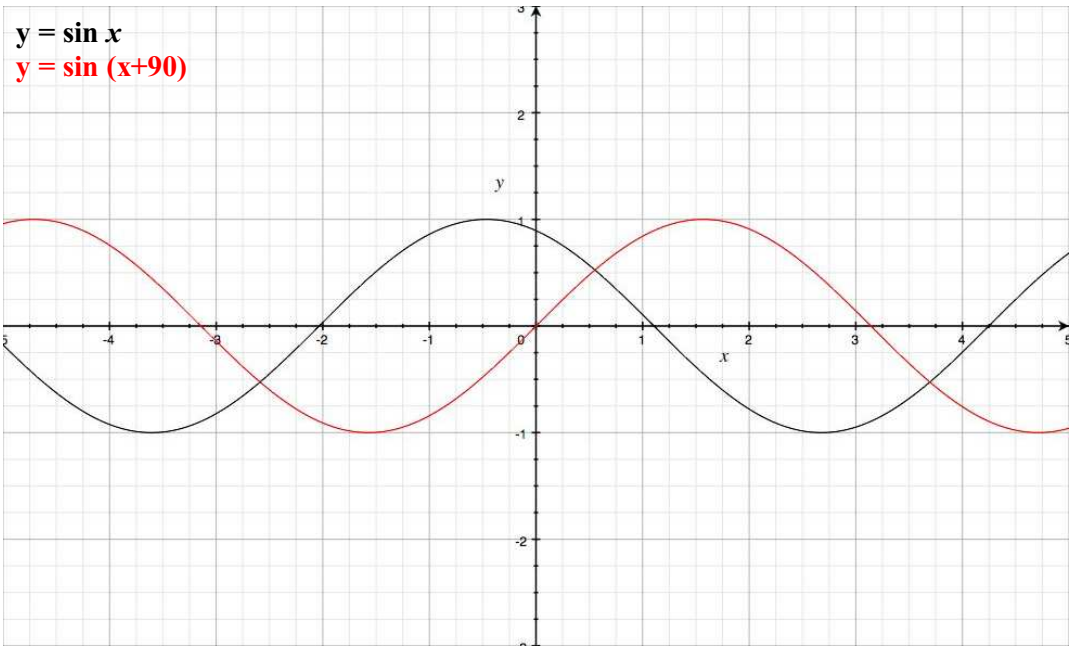


Part 2

Investigate the family of curves **y = sin (x + C)**, where $0^o \leq C \leq 360^o$. How does the value of C transform the standard curve **y = sin *x***?

The C variable in **y = sin (x + C)** is a variable that creates a horizontal translation.

In example, if C is substituted with 90, the equation becomes **y = sin (*x* + 90)**:



It is evident that the entire graph shifted to the left by 90 unit. This can conclude that the amount that the graph moves by is by C, except it moves the direction opposite to the symbol in front of it. In this case, C, 90, caused the graph to move to the left by 90. This said, if C was -90, the graph would move to the right by 90 units. The range for **y = sin (*x* + C)** is not affected by the translation.

The domain and range of the graphs are:

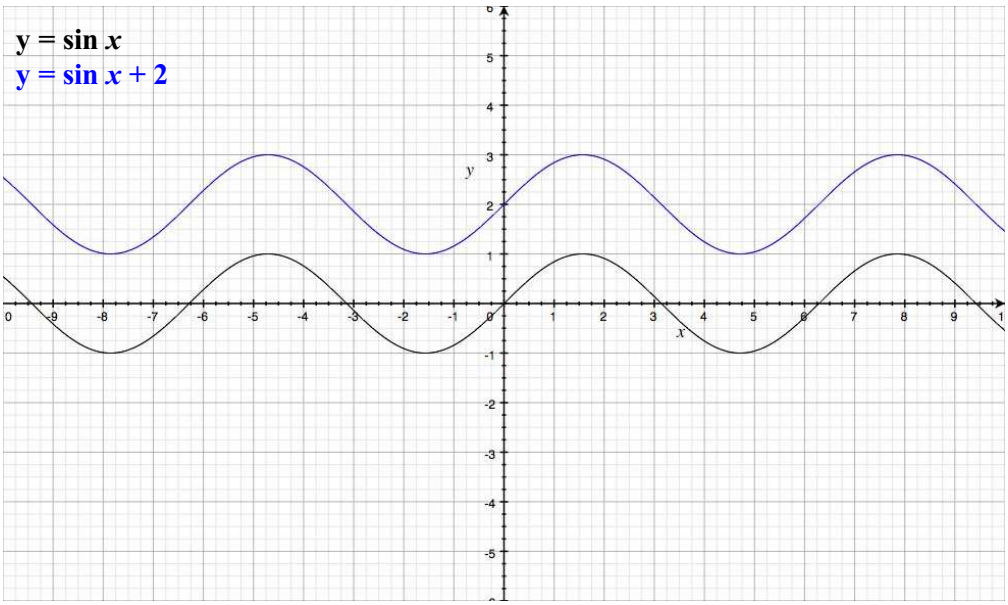
y = sin *x*
D: {x| $x \varepsilon R$}
R: {y| $-1 < y < 1, y \varepsilon R$}

y = sin (*x*+90)
D: {x| $x \varepsilon R$}
R: {y| $-2 < y < 2, y \varepsilon R$}

Part 3

Investigate the family of curves **y = sin *x* + D**.

An example of **y = sin *x* + D** is **y = sin *x* + 2**. Here is the graph for it:



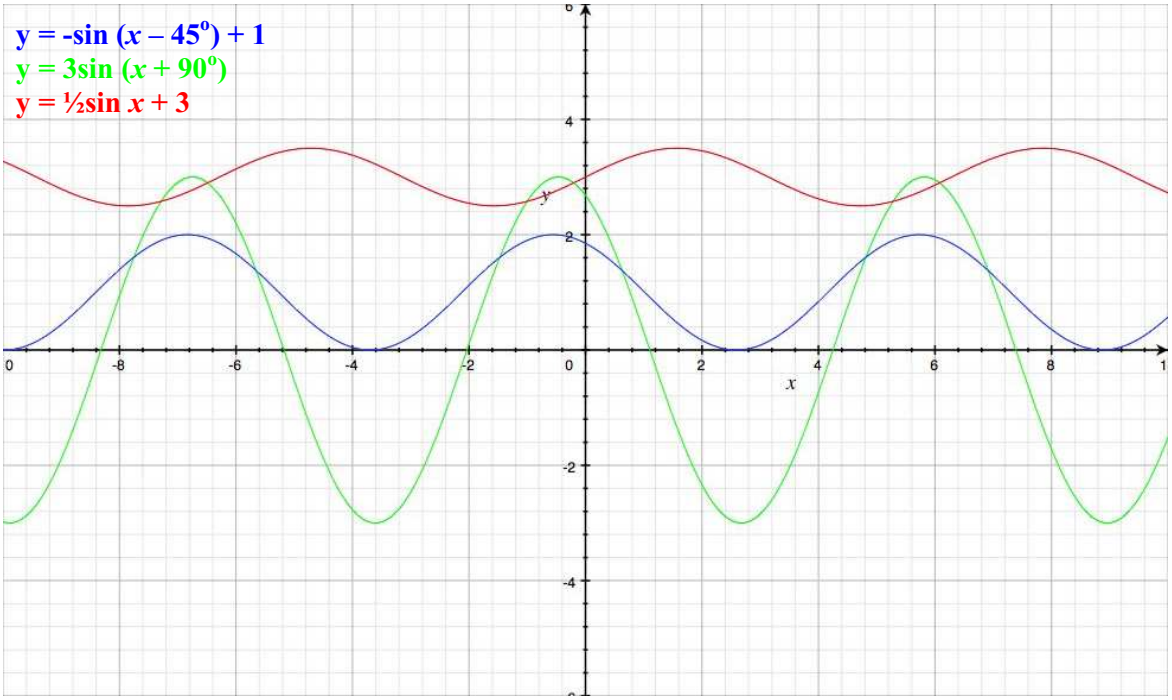
As you can see, removing the brackets from **y = sin (*x* + C)** caused the translation to switch from a horizontal translation to a vertical translation. D, in this case, 2 units, raises the entire graph up or down the y-axis. The range for **y = sin *x* + D** is not affected by the translation. Because there is no A in the equation, the range was not affected, therefore the graph still spans for only 2 units. The only difference is it was moved up the y-axis.

The domain and range of the graphs are:

y = sin *x*
D: {x| $x \varepsilon R$}
R: {y| $-1 < y < 1$, $y \varepsilon R$}

y = sin *x* + 2
D: {x| $x \varepsilon R$}
R: {y| $1 < y < 3$, $y \varepsilon R$}

Part 4



Check your predictions.

If **y = Asin (*x* + C) + D**, explain how you can predict the shape and position of the graphs for specific values of A, B, and C.

y = -sin (*x* – 45°) + 1

I predicted this function to be a mirror since A is negative. Since A ≤The C (-45°) translates the line to the right by 45. The D in the graph translates the line up on the y-axis by 1 unit.

D: {x| $x \varepsilon R$}

R: {y| $0 < y < 2$, $y \varepsilon R$}

y = 3sin (*x* + 90°)

I predicted this function as a vertical stretch since A > 1. The C in the graph translates the line 90 units to the left. There is no D in this function.

D: {x| $x \varepsilon R$}

R: {y| $-3 < y < 3$, $y \varepsilon R$}

y = ½sin *x* + 3

I predicted this function as a vertical compression because A < 1. There is no C present in this function. The D in the function moves the line up 3 units on the y-axis.

D: {x| $x \varepsilon R$}

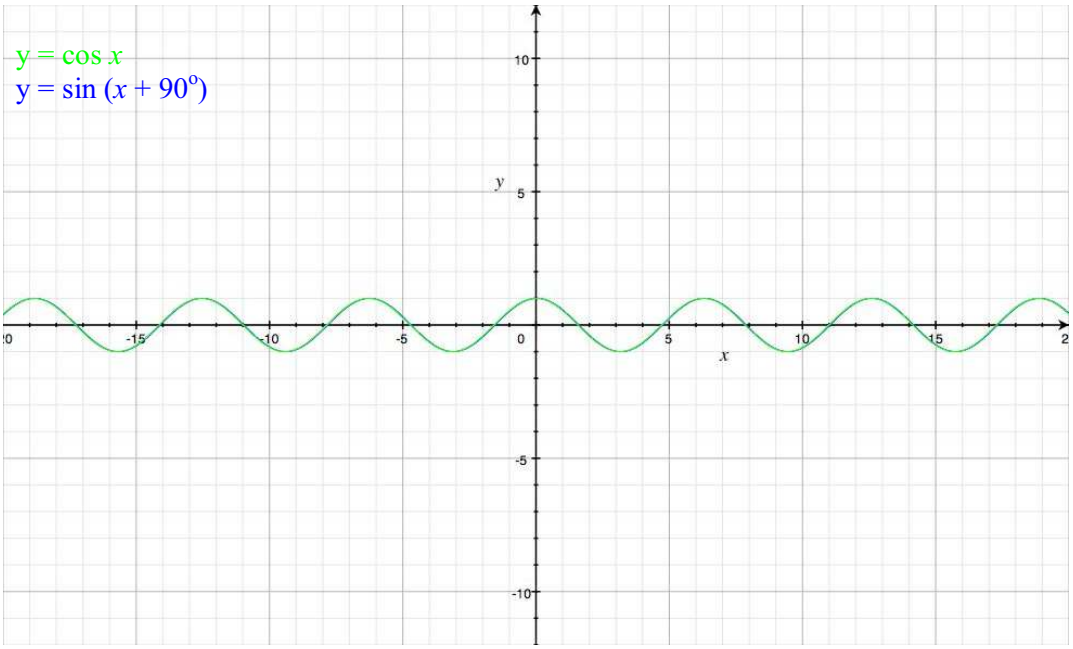
R: {y| $-2½ < y < 3½$, $y \varepsilon R$}

Part 5

The graph of **y = cos *x*** and the graph of **y = sin *x*** is almost the exact same thing. The only difference is that the same graph would be translated 90° to the left if it involved the cos function.

Essentially, **cos (*x*) = sin (*x* +90°)**.

Since this is true, it is conclusive that sine is a very versatile function with many altering variables.



*Although it is not completely evident, the two lines are overlapping, as I had predicted.