Name: ___________________________________ Date: _________________

VERTICAL SHIFTING OF SINUSOIDAL GRAPHS
COMMON CORE ALGEBRA II

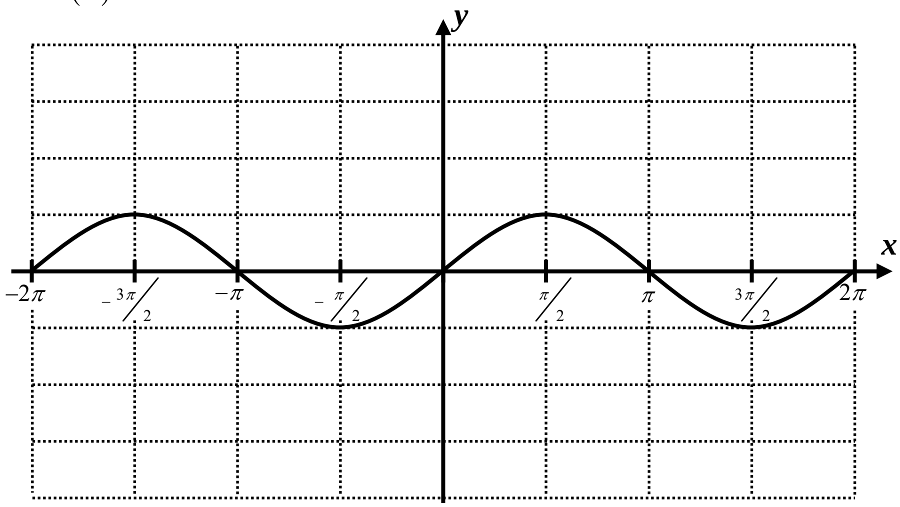
Any graph primarily comprised of either the sine or cosine function is known as **sinusoidal**. These graphs can be stretched vertically, as we saw in the last lesson. Other transformations can occur as well. Today we will explore graphs of equations of the form:

$$y = A\sin(x) + C \text{ and } y = A\cos(x) + C$$

Since we already understand the effect of *A* on the graph, it is now time to review the effect of adding a constant to an equation.

***Exercise* #1:** Consider the function $f(x) = \sin(x) + 3$.

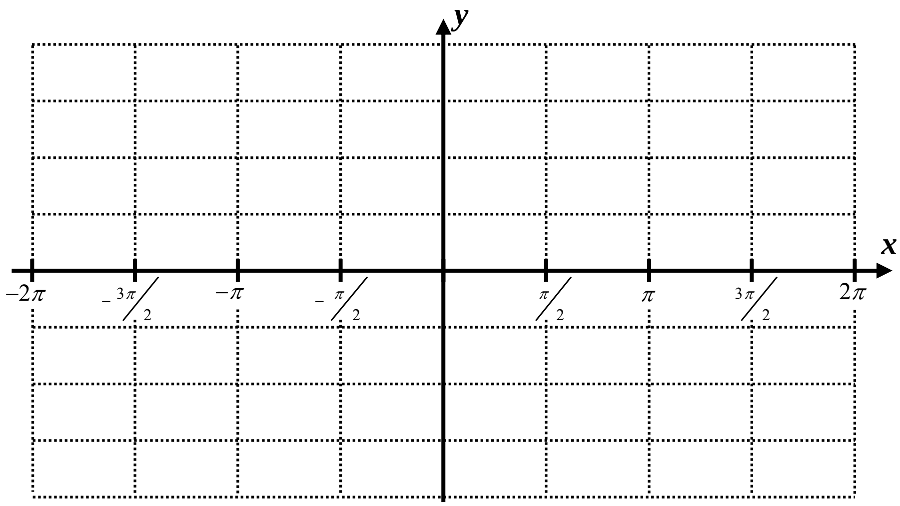
(a) How would the graph of $y = \sin(x)$ be shifted to produce the graph of $f(x)$?



(b) On the grid to the right is the basic sine curve, $y = \sin(x)$. On the same grid, sketch the graph of $f(x)$.

***Exercise* #2:** Consider the function $y = 2\cos(x) + 1$.

(a) Using your calculator, sketch the graph on the grid to the right.



(b) Give the equation of a horizontal line that this curve rises and falls two units above. Sketch this line on the graph.

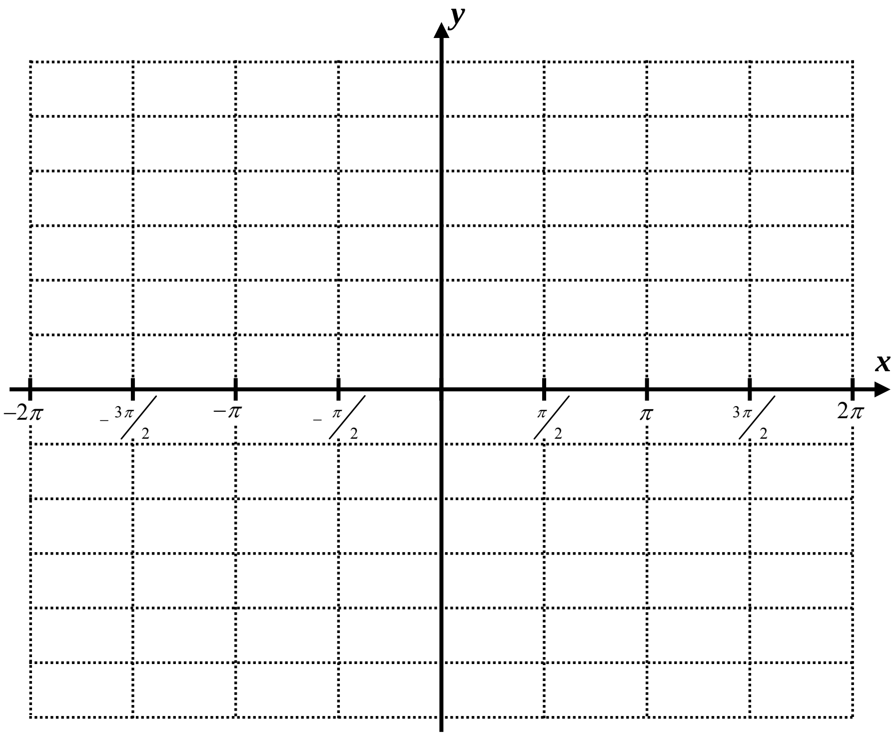
(c) State the range of this trigonometric function in interval notation.

For curves that have the general form $y = A\sin(x) + C$ and $y = A\cos(x) + C$ the value C is called the **midline** or **average value** of the trigonometric function. It is the height or horizontal line that the sinusoidal curve rises and falls above and below by a distance of $|A|$ (the amplitude).

***Exercise* #3:** Sketch and label the functions $y = 4\sin(x) - 2$ and $y = -2\cos(x) + 3$ on the grid below. Try them first without your calculator and then use it to help or verify your graphs. Then, state the ranges of each of the equations in interval notation.

Range of $y = 4\sin(x) - 2$:

Range of $y = -2\cos(x) + 3$:



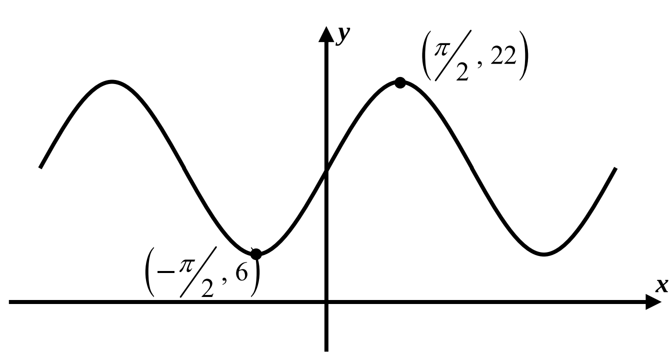
***Exercise* #4:** Determine the range of each of the following trigonometric functions. Express your answer in interval notation.

(a) $y = 7\sin(x) + 4$

(b) $y = -5\cos(x) + 2$

(c) $y = 25\sin(x) + 35$

***Exercise* #5:** The graph below shows a sinusoidal curve of the form $y = A\sin(x) + C$. Determine the values of A and C. Show how you arrived at your results.



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Vertical Shifting of Sinusoidal Graphs
Common Core Algebra II Homework

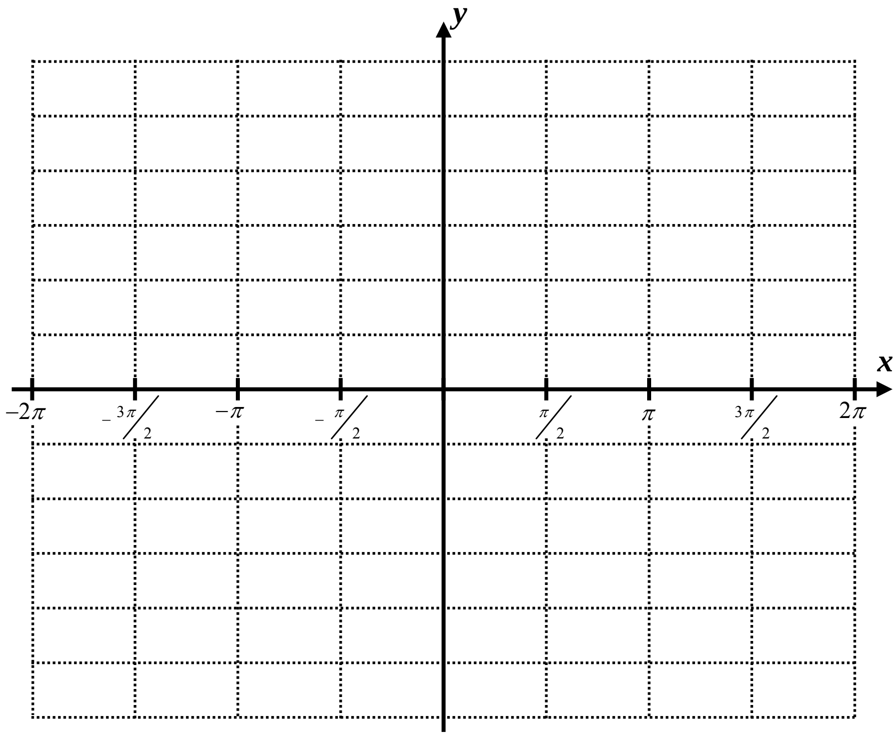
Fluency

1. Sketch each of the following equations on the graph grid below. Label each with its equation.

$y = 4\sin(x) + 2$

$y = 2\cos(x) - 4$

$y = -\sin(x) + 4$

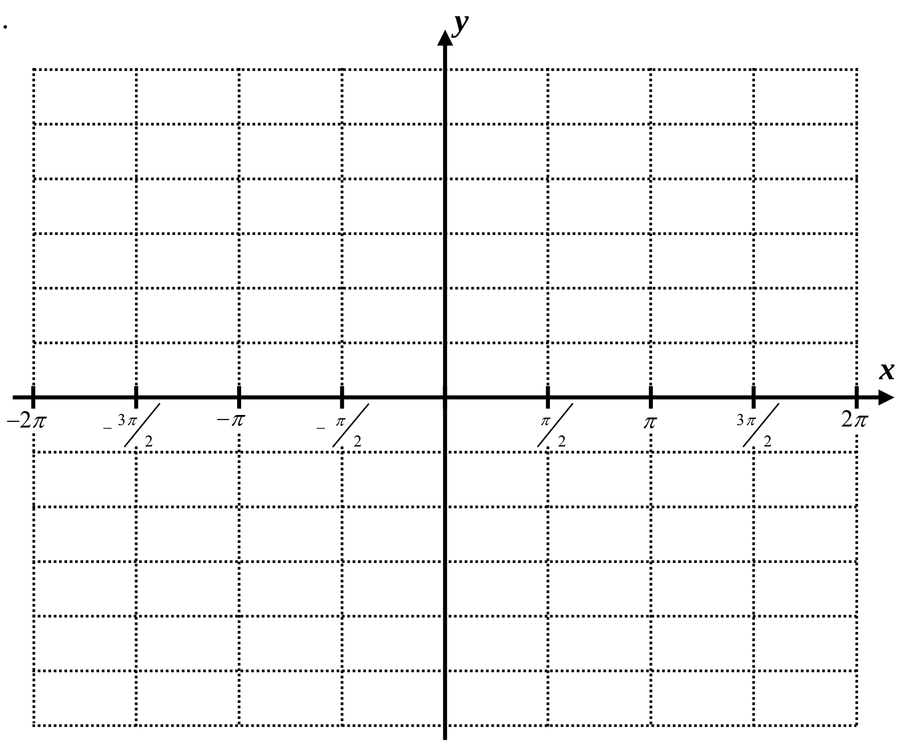


2. Graph and label both of the curves below. Then, state their intersection points (in other words, solve the system of equations shown below).

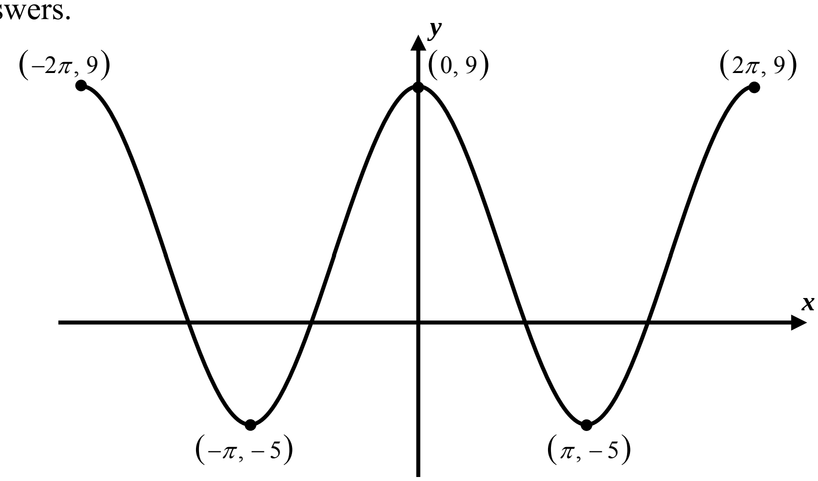
$y = 4\cos(x) + 1$

$y = -\cos(x) - 4$

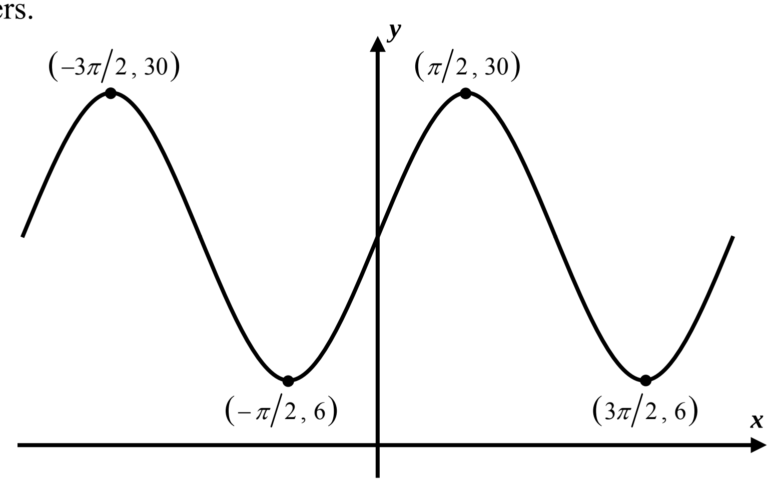
Intersection Points:



4. The following graph can be described using an equation of the form $y = A\cos(x) + C$. Determine the values of *A* and *C*. Show how you arrived at your answers.



5. The following graph can be described using an equation of the form $y = A\sin(x) + C$. Determine the values of *A* and *C*. Show how you arrived at your answers.



6. State the range of each of the following sinusoidal functions in interval form.

(a) $y = 10\sin(x) - 3$ (b) $y = -8\cos(x) + 2$ (c) $y = 22\sin(x) + 30$

7. When graphed, the line $y = 14$ would not intersect the graph of which of the following functions?

(1) $y = 5\cos(x) + 9$ (3) $y = 2\sin(x) + 15$

(2) $y = -6\cos(x) + 10$ (4) $y = 3\sin(x) + 20$

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8. Which of the following functions has a maximum value of 25?

(1) $y = 25\sin(x) + 12$ (3) $y = 8\cos(x) + 17$

(2) $y = -10\cos(x) + 35$ (4) $y = 5\sin(x) + 15$

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