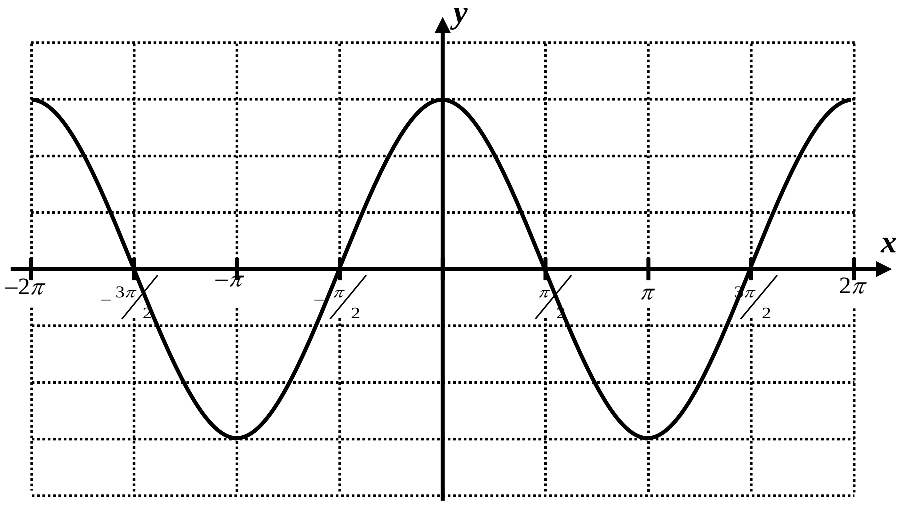
Name: ____________________________________ Date: _________________

THE FREQUENCY AND PERIOD OF A SINUSOIDAL GRAPH
ALGEBRA 2 WITH TRIGONOMETRY

A final transformation will allow us to horizontally stretch and compress sinusoidal graphs. It is important to be able to do this, especially when modeling real-world phenomena, because most **periodic functions** do not have a period of 2π. The first exercise will illustrate the pattern.

***Exercise* #1:** On the grid below is a graph of the function $y = 3\cos(x)$.



(a) Using your calculator, sketch the graph of $y = 3\cos(2x)$ on the same axes.

(b) How many full cycles or periods of this function now fit within 2π radians?

(c) Using your calculator, sketch the graph of $y = 3\cos\left(\frac{1}{2}x\right)$ on the same axes.

(d) How many full cycles or periods of this function now fit within 2π radians?

The **period**, P, of a sinusoidal function is an extremely important concept. It is defined as the minimum horizontal shift needed for the function to repeat its fundamental pattern. The period for the basic sinusoidal graphs is 2π. Clearly, from our first exercise, the period of the function depends on the coefficient B in the general equations $y = A\sin(Bx)$ and $y = A\cos(Bx)$. This coefficient, B, is known as the **frequency**.

***Exercise* #2:** Consider the graphs from *Exercise* #1. For each below, state the frequency and period.

(a) $y = 3\cos(x)$

Frequency, $B =$

Period, $P =$

(b) $y = 3\cos(2x)$

Frequency, $B =$

Period, $P =$

(c) $y = 3\cos\left(\frac{1}{2}x\right)$

Frequency, $B =$

Period, $P =$

Clearly we can see from *Exercise* #2 that the frequency and period are **inversely related**, that is as one increases the other decreases and vice versa.

***Exercise* #4:** If we know that the frequency and period of a sinusoidal graph are inversely related, determine a general formula that relates the frequency, B, and period, P, of a sinusoidal graph. Recall that if two variables are inversely related their product will be a constant.

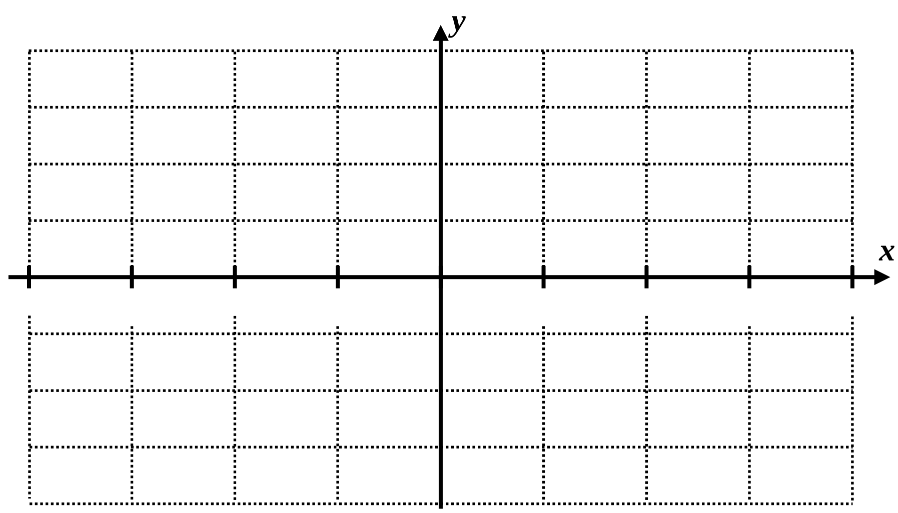
***Exercise* #5:** Determine the period of each of the following sinusoidal functions. Express your answers in exact form.

(a) $y = 6\sin(4x)$

(b) $y = 8\cos\left(\frac{\pi}{3}x\right)$

(c) $y = -12\sin\left(\frac{2}{3}x\right)$

***Exercise* #6:** Sketch the function $y = 2\sin(4x)$ on the grid below for one full period to the left and right of the y-axis. Label the scale on your axes.



***Exercise* #7:** The heights of the tides can be described using a sinusoidal model of the form $y = A\cos(Bx) + C$. If high tides are separated by 24 hours, which of the following gives the frequency, B, of the curve?

(1) 12

(2) $\frac{\pi}{24}$

(3) $\frac{\pi}{12}$

(4) $\frac{\pi}{6}$

______

Name: ____________________________________ Date: ________________

THE FREQUENCY AND PERIOD OF A SINUSOIDAL GRAPH
ALGEBRA 2 WITH TRIGONOMETRY - HOMEWORK

SKILLS

1. For each of the following sinusoidal functions, determine its period in exact terms of pi.

(a) $y = 6\sin(10x)$ (b) $y = -2\cos(8x)$ (c) $y = 7\sin\left(\frac{1}{3}x\right)$

(d) $y = \frac{2}{3}\cos\left(\frac{4}{3}x\right)$ (e) $y = 8\sin(0.25x)$ (f) $y = 2.5\cos(0.4x)$

2. For each of the following sinusoidal functions, determine its exact period.

(a) $y = 5\sin\left(\frac{2\pi}{7}x\right)$ (b) $y = 5\cos\left(\frac{2\pi}{365}t\right)+12$ (c) $y = -8\sin\left(\frac{\pi}{9}x\right)-1$

3. If the period of a sinusoidal function is equal to 18, which of the following gives its frequency?

(1) $\frac{\pi}{9}$ (3) $\frac{\pi}{18}$

(2) 18π (4) 6π __________

4. It is known for that a particular sine curve repeats its fundamental pattern after every $\frac{2\pi}{7}$ units along the *x*-axis. Which of the following is the frequency of this curve?

(1) $\frac{2}{7}$ (3) $\frac{7}{2}$

(2) 7 (4) 14 __________

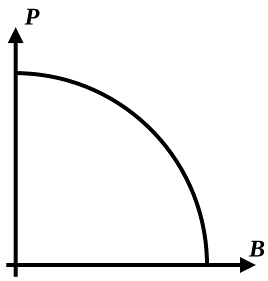
5. When the period of a sine function doubles the frequency

(1) doubles. (3) is halved.

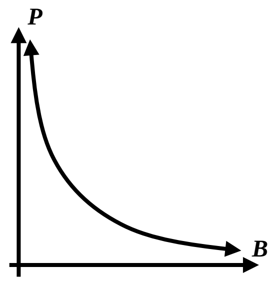
(2) increases by 2. (4) decreases by 2.

6. Which of the following graphs shows the relationship between the frequency, *B*, and the period, *P*, of a sinusoidal graph?

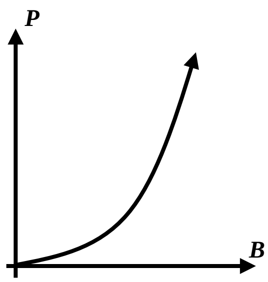
(1)



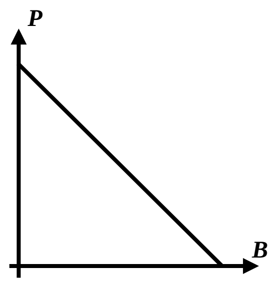
(3)



(2)



(4)



7. Consider the curve whose equation is $y = -2\cos\left(\frac{\pi}{8}x\right) + 3$.

(a) Determine the exact period of this sinusoidal function.

(b) What is the amplitude of this sinusoidal function?

(c) What is the midline value of this sinusoidal function?

(d) Sketch the function on the axes for a full period on both sides of the *y*-axis. Label the scale on your *x*-axis.s