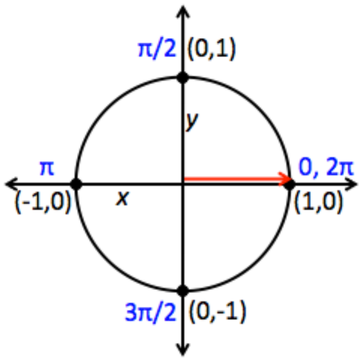
Graphing Trigonometric Functions

***Before reviewing this cheat sheet, take a look at the **Basic Trig Functions and the Unit Circle** cheat sheet.

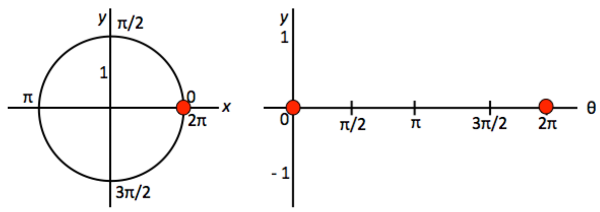
The sine function

In order to understand why the sine graph looks the way it does, it is helpful to compare the graph to the unit circle. We can trace the graph as we move around the unit circle.

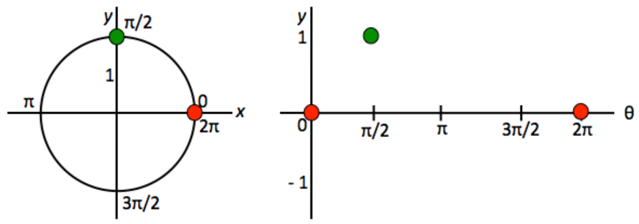


θ = 0 represents our starting point on the unit circle. A line drawn from the center of the circle with θ = 0 intersects the circle at the point (1,0). Remember, sin(θ) = *y* and cos(θ) = *x*
→ sin(0) = 0 and cos(0) = 1

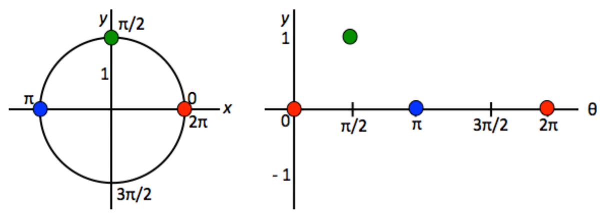
Start at sin(0). Sin(0) = 0, as we just determined, so our first points are at the origin (0,0) and (2π, 0).



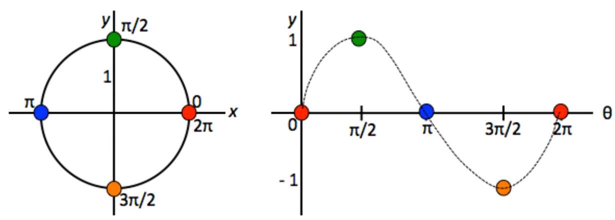
Next, we move counter-clockwise around the circle to sin(π/2). Sin(π/2) = 1, so the next point on our graph will be (π/2, 1).



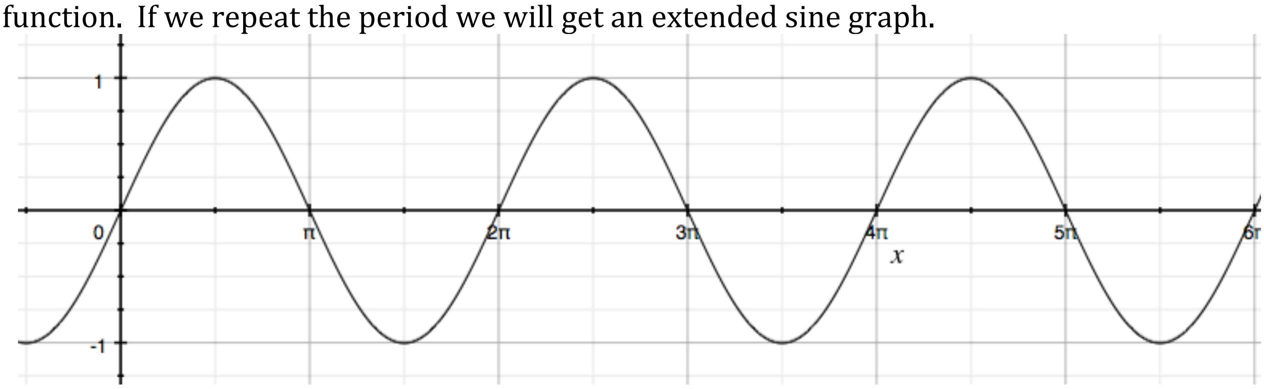
Now we go to sin(π). Sin(π) = 0, so our next point is (π, 0).



Next is sin (3π/2). Sin (3π/2) = -1, which gives the point (3π/2, -1).

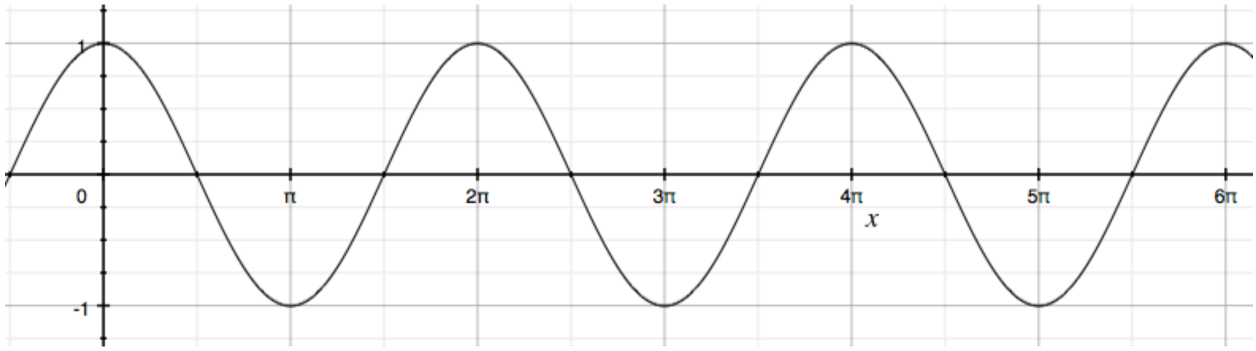


Notice how the **points on the graph** above have the **same height** as their corresponding **points on the unit circle**. When we complete **one full rotation** around the circle, we graph **one period** of the sine function. If we repeat the period we will get an extended sine graph.



The Cosine function

The cosine function looks just like the sine function, but there's one important difference. Here's a graph of the cosine function. How do the two functions differ?



The cosine function starts at (0,1) because cos(0) = 1. But the sine starts at the point (0,0) because sin(0) = 0. Be careful not to mistake one function for the other.

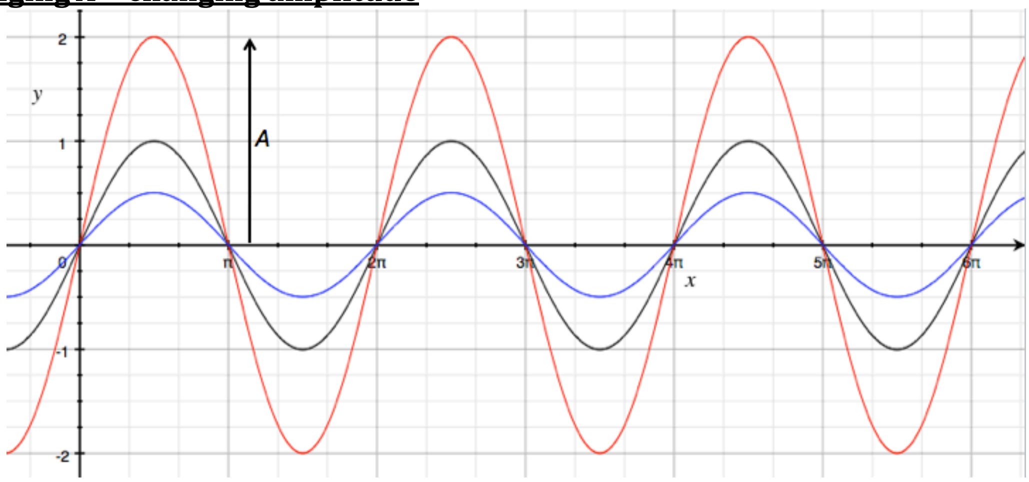
Changes to the sine and cosine functions

You might see the sine and cosine functions written in the general form shown below.

$$y = A\sin(Bx) \text{ or } y = A\cos(Bx)$$

So what happens if you change the values of *A and B*?

Changing *A* – changing amplitude



--- $y = 2\sin x$
--- $y = \sin x$
--- $y = .5\sin x$

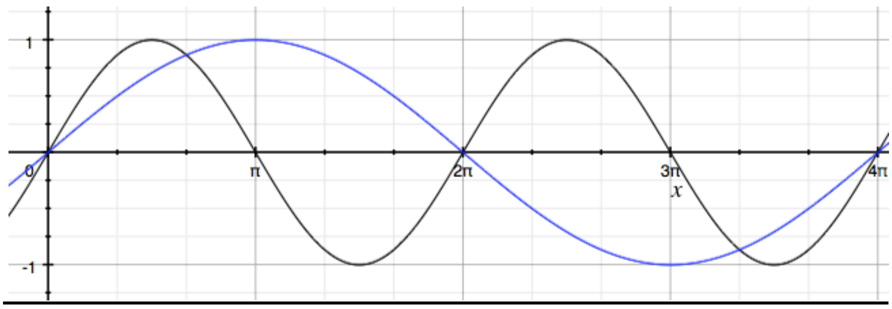
A is the height, or **amplitude**, of the wave.
As you can see, the function ***y* = 2 sin *x*** has an amplitude of **2**.

Changing *B* – changing period

--- $y = \sin(2x)$
--- $y = \sin x$

The **period** of the wave **sin (2*x*)** is **half** the period of **sin *x*.** (We get two units of the red wave for every one unit of the black.)

Below, you can see the **period** of **sin (.5*x*)** is **twice as long** as the period of **sin *x*.**



--- $y = \sin x$
--- $y = \sin(.5x)$

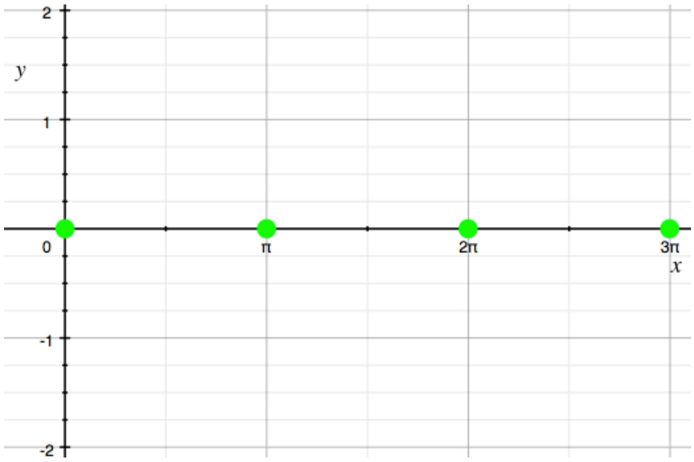
$$period = \frac{2\pi}{B}$$

The tangent function

The tangent graph is a little different from the graphs of sine and cosine. Lets remember:

$$\tan x = \frac{\sin x}{\cos x}$$

With the equation above in mind, we know
tan x = 0 when sin x = 0.
sin x = 0 at 0, π, 2π, etc.

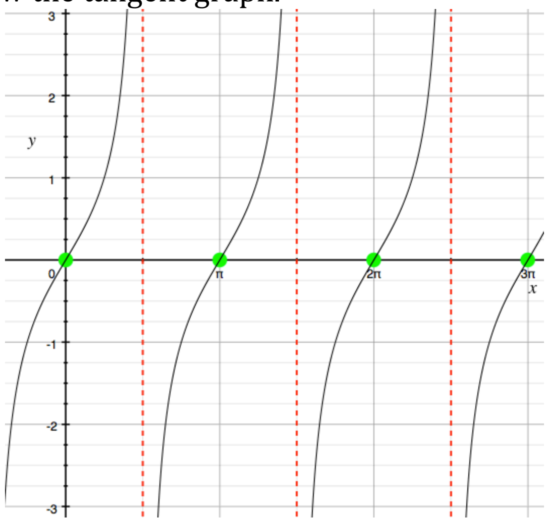


We also know that **tan x is undefined when cos x = 0** (because cos x is the denominator)**.**
cos x = 0 at π/2, 3π/2, etc. The tangent graph will have an **asymptote** at these points.

Next, we can determine where the tangent graph will be positive and negative based on the values of sine and cosine.

	sin x	cos x	**tan x**
$0 < x < \pi/2$	+	+	**+**
$\pi/2 < x < \pi$	+	-	**-**
$\pi < x < 3\pi/2$	-	-	**+**
$3\pi/2 < x < 2\pi$	-	+	**-**

The graph will approach positive or negative infinity at the asymptotes, but the function will never cross these points. The function must also pass through the zero points we determined. With these things in mind, we can now draw the tangent graph.



For more help and practice problems with graphing trig functions check out these sites:

- http://www.mathsisfun.com/algebra/trig-interactive-unit-circle.html
- http://hotmath.com/help/gt/genericalg2/section_11_3.html
- http://www.youtube.com/watch?v=QmxMPPkZpME
- http://math.ucsd.edu/~wgarner/math4c/textbook/chapter5/shift_trig_func.htm

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