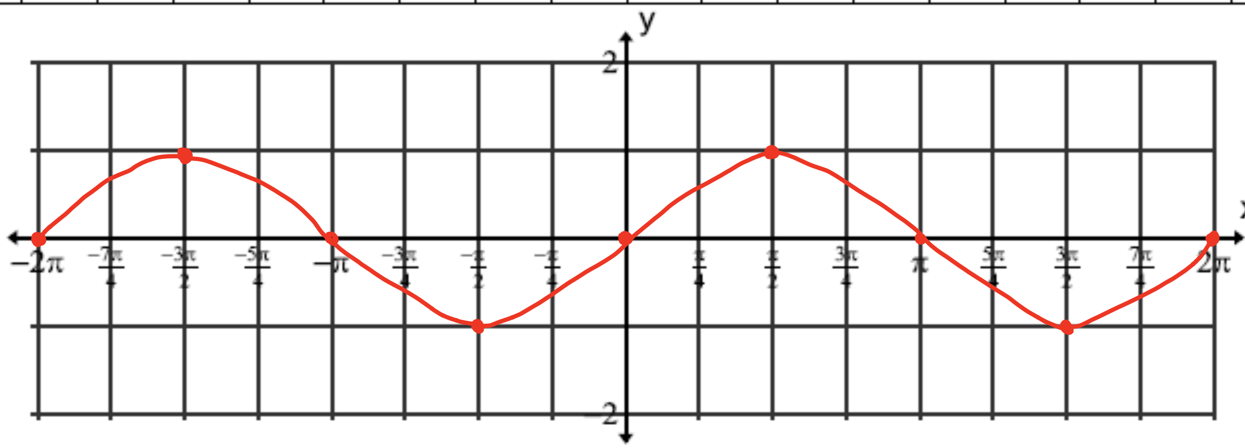
Name Key

Date ____________________

Graphing Sine & Cosine

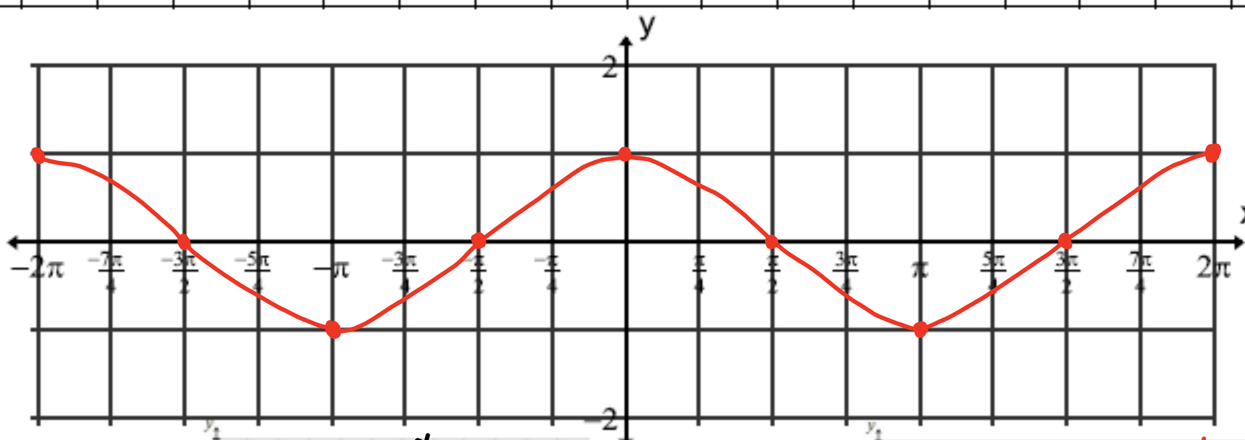
Fill in the table for $f(x)=\sin(x)$ ***(round to the nearest thousandths).***

x	-2π	$-\frac{7\pi}{4}$	$-\frac{3\pi}{2}$	$-\frac{5\pi}{4}$	$-\pi$	$-\frac{3\pi}{4}$	$-\frac{\pi}{2}$	$-\frac{\pi}{4}$	0	$\frac{\pi}{4}$	$\frac{\pi}{2}$	$\frac{3\pi}{4}$	π	$\frac{5\pi}{4}$	$\frac{3\pi}{2}$	$\frac{7\pi}{4}$	2π
y	0		1		0		-1		0		1		0		-1		0



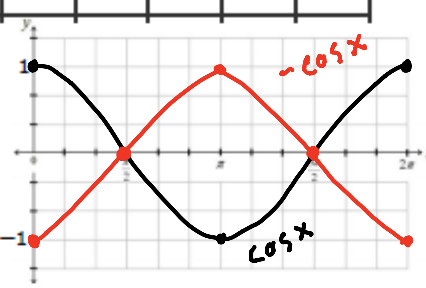
Fill in the table for $f(x)=\cos(x)$ ***(round to the nearest thousandths).***

x	-2π	$-\frac{7\pi}{4}$	$-\frac{3\pi}{2}$	$-\frac{5\pi}{4}$	$-\pi$	$-\frac{3\pi}{4}$	$-\frac{\pi}{2}$	$-\frac{\pi}{4}$	0	$\frac{\pi}{4}$	$\frac{\pi}{2}$	$\frac{3\pi}{4}$	π	$\frac{5\pi}{4}$	$\frac{3\pi}{2}$	$\frac{7\pi}{4}$	2π
y	1		0		-1		0		1		0		-1		0		1



Sketch one cycle of $y=-\sin x$

Sketch one cycle of $y=-\cos x$



AFM Name Key

Unit 3 Day 5 Notes Cont. – Graphs of Sine and Cosine Date ______________

From the graphing activity, you should have discovered that sine and cosine values repeat themselves. Thus, the sine and cosine functions are periodic.

A function is **periodic** if there is a positive number p such that $f(t + p) = f(t)$ for every t. The least such positive number is called the **period**.

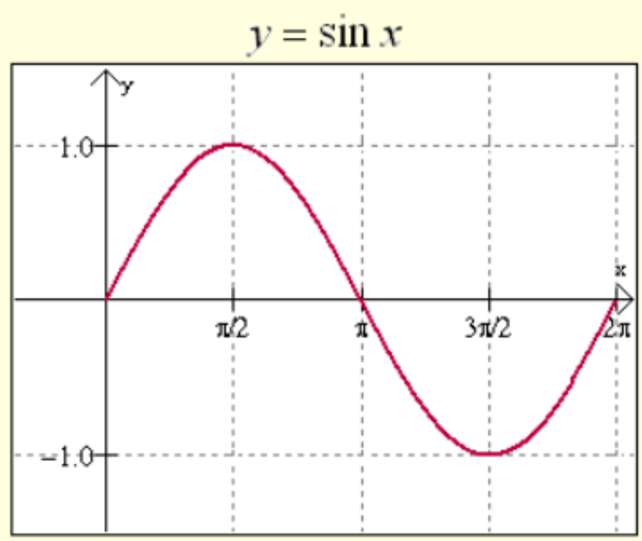
Points you should know from the unit circle

x	Angle in Radians	0	π/2	π	3π/2	2π
y	sin x	0	1	0	-1	0

Sine Function: $y = \sin x$

- called a "wave" because of its rolling wave-like appearance (also referred to as oscillating)
- amplitude: 1 (height)
- period: 2π (length of one cycle)
- frequency: 1 cycle in 2π radians [or $1/(2\pi)$]
- domain: $\{x \mid x \in \mathbb{R}\}$
- range: $\{y \mid -1 \le y \le 1\}$

At $x = 0$, the sine wave is on the shoreline!
(meaning the y-value is equal to zero)

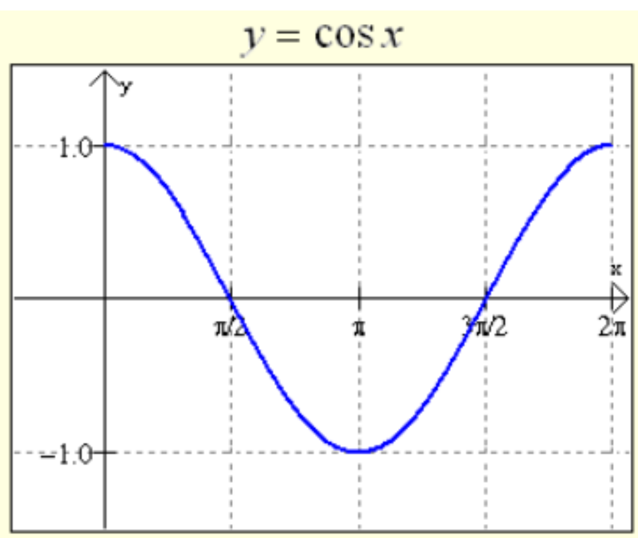


x	Angle in Radians	0	π/2	π	3π/2	2π
y	cos x	1	0	-1	0	1

Cosine Function: $y = \cos x$

- called a "wave" because of its rolling wave-like appearance
- amplitude: 1
- period: 2π
- frequency: 1 cycle in 2π radians [or $1/(2\pi)$]
- domain: $\{x \mid x \in \mathbb{R}\}$
- range: $\{y \mid -1 \le y \le 1\}$

At $x = 0$, the cosine wave breaks off the cliff!
(meaning the y-value is equal to one)

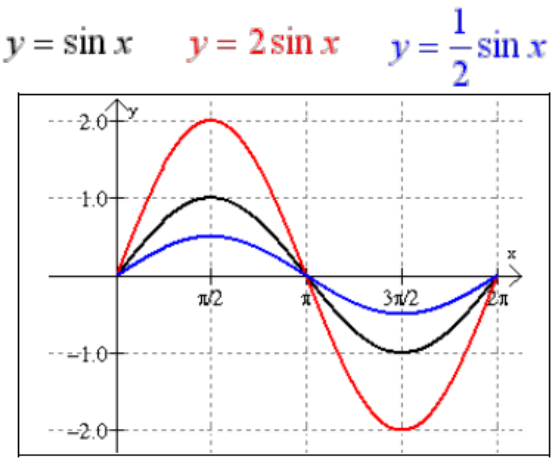


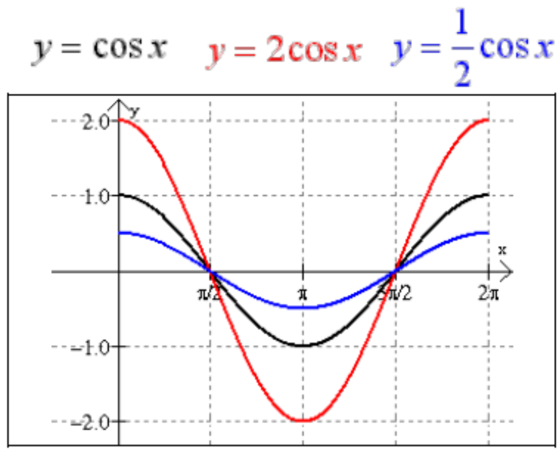
__Transformations of the sine and cosine graphs__

$$y = a\sin(b(x-h)) + k \text{ and } y = a\cos(b(x-h)) + k$$

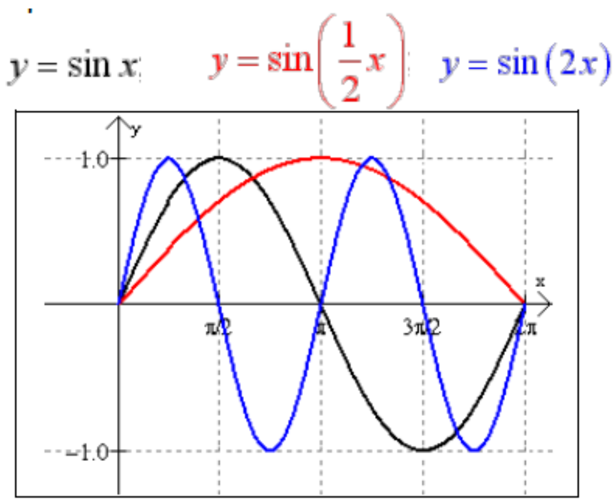
- The value ***a*** affects the amplitude. The **amplitude** (half the distance from the max to the min) will be |***a***| because distance is always positive. Increasing or decreasing an ***a*** value will *vertically stretch or shrink* a graph.

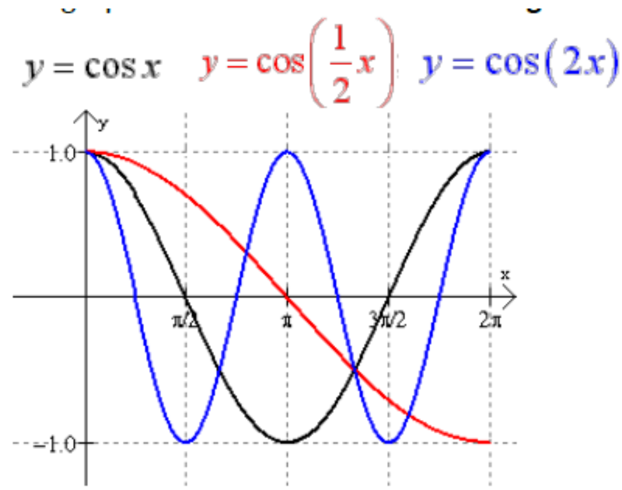
to 2π.





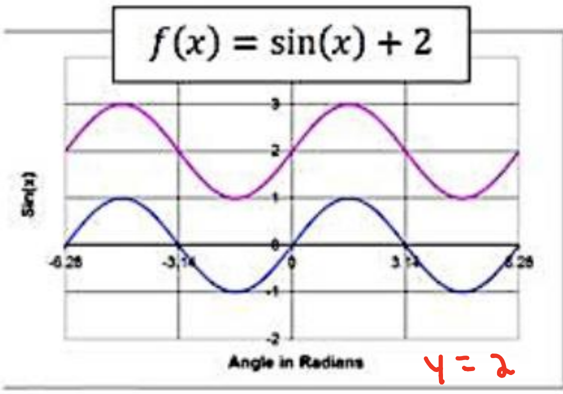
- The ***b*** value is the number of cycles it completes in an interval of $(0, 2\pi)$ or $(0°, 360°)$. The ***b*** value affects the **period**. The period of sine and cosine is $\boxed{\left|\frac{2\pi}{b}\right|}$ When $0<b<1$ the period of the function is greater than 2π and the graph will have a *horizontal stretch*. When $b>1$, the period is less than 2π and the graph will have a *horizontal shrink.*

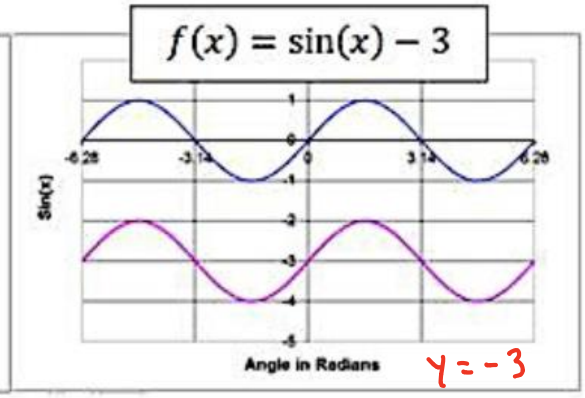




These graphs change horizontal "width" but do not change height. The two red graphs only show us half of the original graphs in their 0 to 2π windows. We would need to "stretch" the domain window to 4π to see entire cycles of those two graphs. The two blue graphs show us two complete cycles of the graphs in their 0 to 2π windows, which would allow us to "shrink" the domain window and still see complete cycles of the graphs.

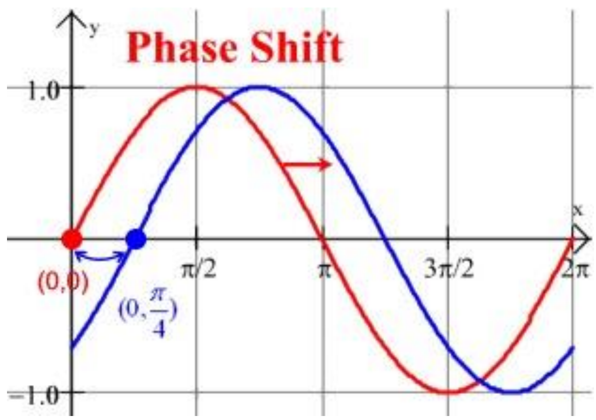
➢ Just like any other function, adding a constant **on the end of the function** will shift the trig graph vertically (up if the constant is *positive*, down if the constant is *negative*).





The vertical change is called the <u>midline</u>. It is always $y = k$

➢ Also just like any other function, adding a constant on **into the function** will shift the trig graph *horizontally* (left if the constant is positive, right if the constant is negative). This is called a **<u>phase shift</u>**.



Note: You may have to factor out b in order to determine the phase shift or set what is inside main parentheses = 0 and solve for x.

Example: Determine midline, vertical shift, amplitude, period, and phase shift.

a) $y = 2\sin\left(\frac{2}{3}x + \frac{\pi}{3}\right) - 1$

$y = 2\sin\left(\frac{2}{3}(x + \pi)\right) - 1$

Midline: $y = -1$

Vertical shift: down 1

Amplitude: 2

Period: $\frac{2\pi}{b} = \frac{2\pi}{2/3} = 3\pi$

Phase shift: left π

b) $y = 3\cos\left(\frac{1}{2}(x - 2)\right) + 4$

Midline: $y = 4$

Vertical shift: up 4

Amplitude: 3

Period: $\frac{2\pi}{b} = \frac{2\pi}{\frac{1}{2}} = 4\pi$

Phase shift: None