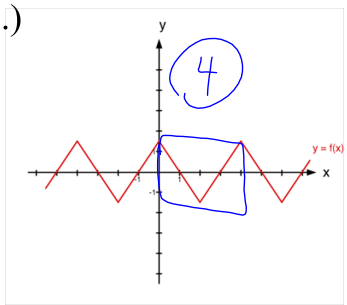
4.5 Graphs of Sine and Cosine: Sinusoids

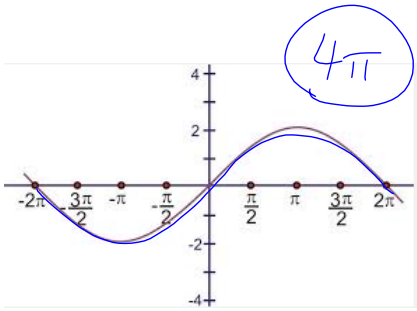
Period: length of one full cycle of the wave

Find the period.

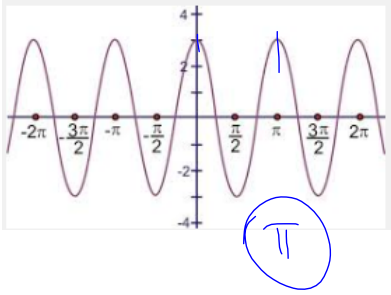
1.)



2.)



3.)



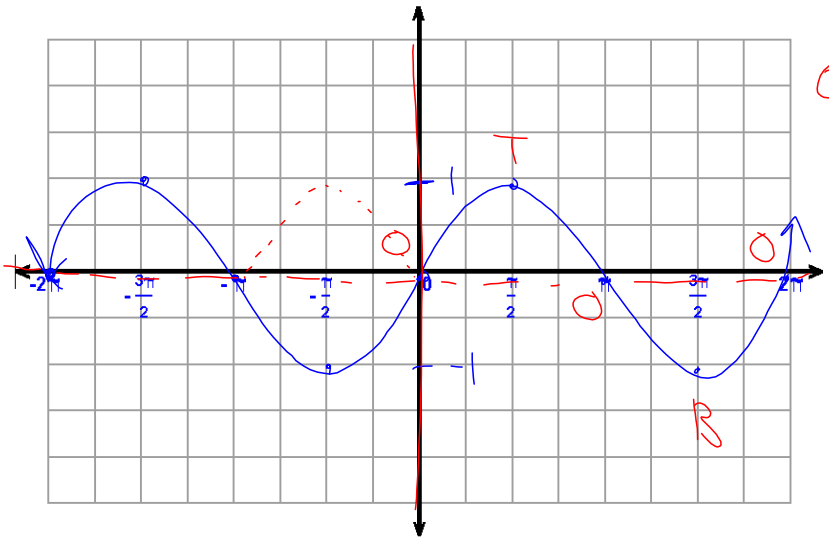
Mar 10-4:09 PM

4.5 Graphs of Sine and Cosine Functions

Graphing the function y = sin x

Complete the chart below. All values must be rationalized and simplified. Use the approximations on the board when generating the graph.

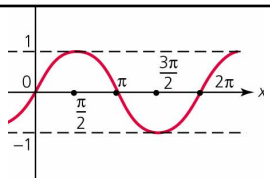
x	-2π	$-\frac{3\pi}{2}$	$-\pi$	$-\frac{\pi}{2}$	0	$\frac{\pi}{2}$	π	$\frac{3\pi}{2}$	2π
Sin x	0	1	0	-1	0	1	0	-1	0



OTOBO

Mar 10-3:46 PM

Properties of the Graph of Sine:

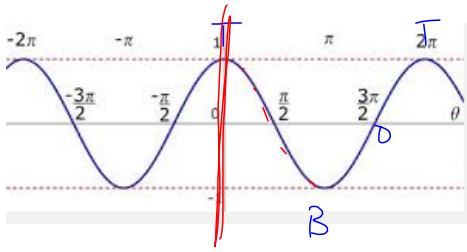


Domain	$(-\infty,\infty)$
Range	$[-1,1]$
Local Max	$1 @ \frac{\pi}{2}+2\pi n$
Local Min	$-1 @ \frac{3\pi}{2}+2\pi n$
x-intercepts	$(\pi n, 0)$
y-intercepts	$(0,0)$
Asymptotes	NONE
Symmetry	ODD
Period	2π

Symmetry: Period:

Mar 10-4:05 PM

Properties of the Graph of Cosine:



TOBOT

Domain	$(-\infty,\infty)$
Range	$[-1,1]$
Local Max	$1 @ 2\pi n$
Local Min	$-1 @ \pi+2\pi n$
x-intercepts	$\left(\frac{\pi}{2}+\pi n, 0\right)$
y-intercepts	$(0,1)$
Asymptotes	None
Symmetry	Even
Period	2π

Mar 10-4:09 PM

Graphing Sine and Cosine with Transformations

Standard Form: $y = a\sin(bx + c) + d$

$y = a\cos(bx + c) + d$

Amplitude: represents half the distance between the maximum and minimum values of the function and is given by

Amplitude = $|a|$

Period: cycle length of the curve; horizontal shrink/stretch

$Period = \frac{2\pi}{|b|}$

*To get the x-intervals on your graph, divide the period by 4.

$x^2 - 4x + 4$

$(x-2)(x-2)$

Frequency: the number of complete cycles the wave completes in a unit interval

$frequency = \frac{|b|}{2\pi}$

Phase Shift: Horizonal shift; left or right; where to start the graph

OTOBO (sine) and TOBOT (cosine)

O - midline T - top B - bottom

$Phase\ shift - Solve\ for\ x: bx + c = 0$

Vertical Translation: Vertical shift; up or down

$Vertical\ Translation = d$

Midline: New "x-axis"; "midpoint" of max/min of range

= d

Range: Midline +/- amplitude

Reflection: If the value of a is negative, reflect the graph across the midline.

cos: TOBOT sin: OTOBO

-cos: BOTOB -sin: OBOTO

Mar 10-4:21 PM

Identify the amplitude and period.

1.) $y = \frac{1}{4}\sin 2\pi x$

$a = \frac{1}{4}$

$P = \frac{2\pi}{b} = \frac{2\pi}{2\pi}$

$P = 1$

2.) $y = 2\cos 3x$

$a = 2$

$P = \frac{2\pi}{3}$

3.) $y = \frac{1}{2}\sin\frac{\pi x}{3}$

$a = \frac{1}{2}$

$P = \frac{2\pi}{\frac{\pi}{3}}$

$2\cancel{\pi} \cdot \frac{3}{\cancel{\pi}} = 6$

Mar 11-12:05 PM

Describe the relationship between the graphs of *f* and *g*.

4.) $f(x) = \sin x$
$g(x) = \sin(x - \pi)$

$\rightarrow \pi$

5.) $f(x) = \cos 2x$
$g(x) = -\cos 2x$ R_x

TOBOT $\rightarrow$ BOTOB

6.) $f(x) = \cos x$ $\frac{2\pi}{1} = 2\pi$
$g(x) = \cos 2x$ $\frac{2\pi}{2} = \pi$

Horizontal shrink by $1/2$

7.) $f(x) = \sin x$
$g(x) = \sin x + 3$

$\uparrow 3$

Mar 11-12:10 PM

Graphing Sine and Cosine Functions

1. Identify amplitude, period, phase shift and vertical shift.

2. Label y-axis
- Make a dashed line to indicate the midline (d).
- Make a dashed line to indicate the max y value and the min y value (d + amp, d – amp).

3. Label x-axis
- Take period and divide it by 4: this is the increment that you want to go up by. As long as it's not unreasonable, complete the x-axis from -2 π to 2π.

4. Start at the phase shift
-Phase shift is where to start OTOBO (sin) or TOBOT (cos). O stands for plotting a point on the midline, the "new" zero, T stands for top and B stands for bottom.

5. Reflect
-If the value of *a* is negative, reflect the graph across the midline.

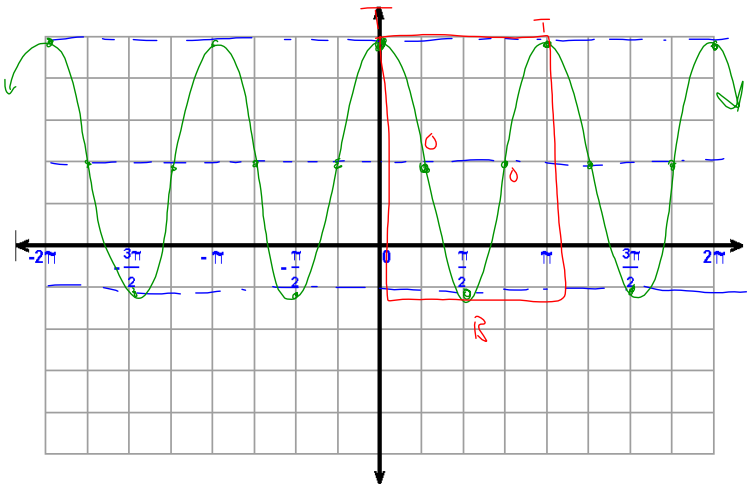
Dec 1-3:07 PM

Graphing Sine and Cosine with Transformations

Graph: $y = 3\cos(2x) + 2$

Intervals	$\frac{\text{Period}}{4}$	$\pi/4$	

Amplitude	3	Range	[-1, 5]
Period $\frac{2\pi}{b}$	$\frac{2\pi}{2} = \pi$	Phase Shift Start!	$2x = 0$, $x = 0$ N/A
Vertical Shift	↑ 2	Reflection No.	TOBOT

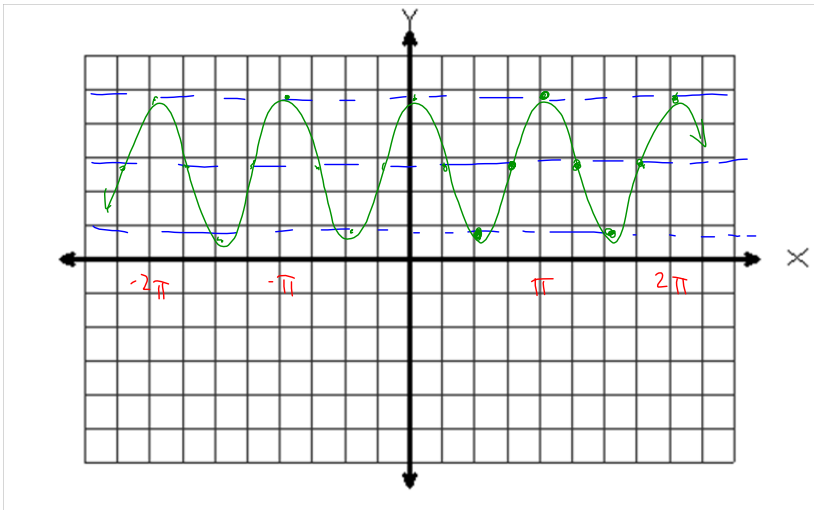


Mar 10-4:43 PM

Graph: $y = -2\cos(2\theta - \pi) + 3$

Intervals	$\pi/4$		

Amplitude	2	Range	[1, 5]
Period $\frac{2\pi}{2}$	π	Phase Shift Start	$2\theta - \pi = 0$, $2\theta = \pi$, $\theta = \frac{\pi}{2}$
Vertical Shift	↑ 3	Reflection YES.	BOTOB



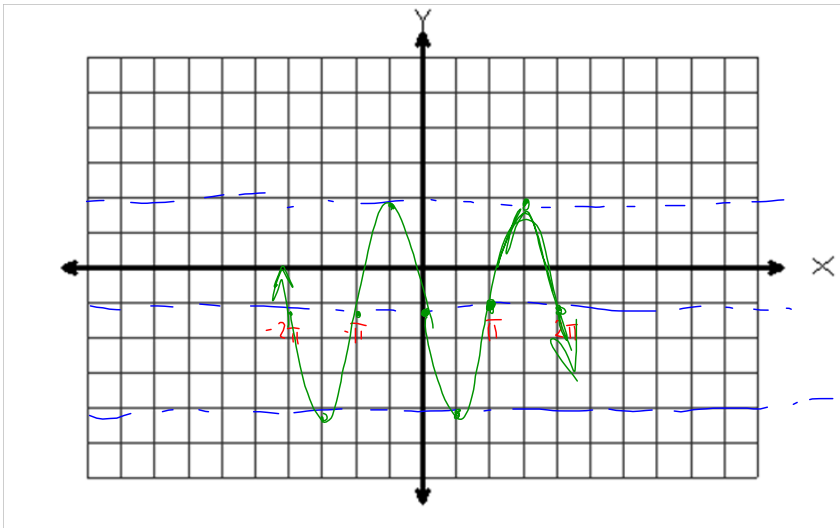
Dec 1-3:20 PM

Graph: $y = 3\sin(x - \pi) - 1$

$y = a\sin(bx + c) + d$

Intervals	$\frac{2\pi}{4} =$	$\pi/2$

Amplitude	3	Range	
Period	2π	Phase Shift	$x = \pi$
Vertical Shift	$\downarrow 1$	Reflection No.	OTOBO



Mar 10-4:47 PM

Nov 30-6:41 PM