Graphing Sine and Cosine

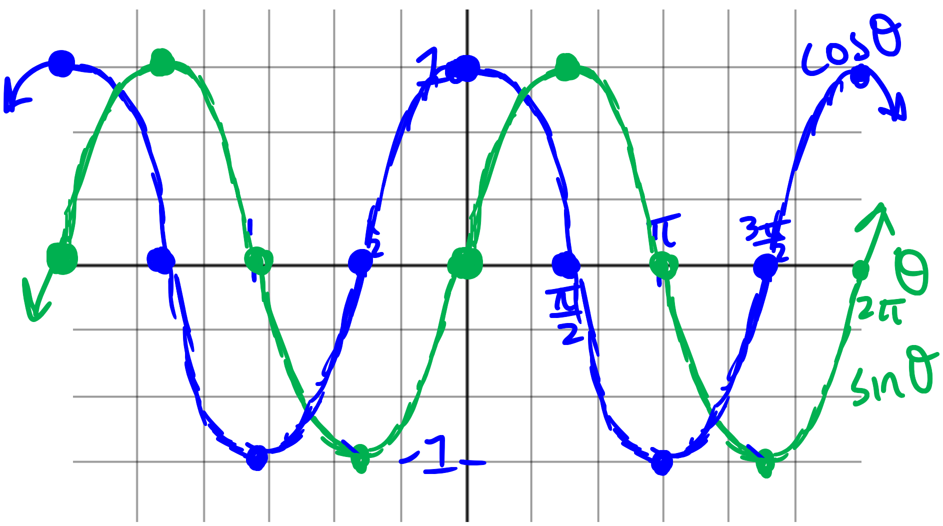
KNOW	DO	UNDERSTAND
How to identify the amplitude and period of a trig function. What a sinusoidal function looks like.	Can graph a trig function from the equation or characteristics accurately. Can build the equation of a trig function from the graph or characteristics accurately.	*Transformation:* Can explain how certain characteristics are or are not affected by a transformation. *Function Characteristics:* How the amplitude relates to the max/min values, midline as the average, period as the frequency, and shift as the start.

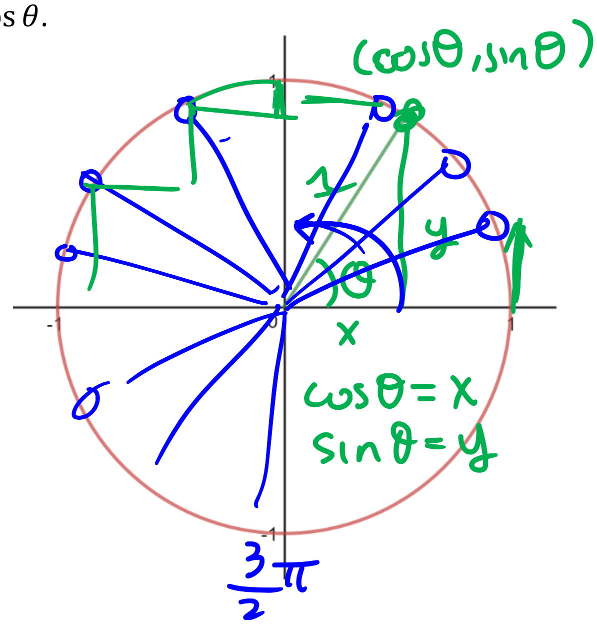
Vocab & Notation

- Amplitude
- Period
- Midline
- Phase Shift
- Sinusoidal function

Cah

Using a unit circle, graph the angle θ and the values of $\sin\theta$ and $\cos\theta$.





θ	0	$\frac{\pi}{2}$	π	$\frac{3\pi}{2}$	2π
$\cos\theta$	1	0	-1	0	1
$\sin\theta$	0	1	0	-1	0

Definition: Functions that repeat after a certain amount of time are called **periodic functions** (periodic meaning occurring at regular intervals). Periodic functions that have this regular "wave" shape are called **sinusoidal functions**.

We want to analyze this curve so that we can graph functions of the form:

vert. stretch by a ← $a \cdot \sin(b(x-c)) + d$ → shift up/down

horiz. stretch by $\frac{1}{b}$

shift left/right

Definition: The **midline** is the average value of the function.

for $\sin\theta$ midline is 0

☆ only changed by vert. shift

Definition: The **amplitude** is the distance from the midline to the maximum or minimum, or equivalently, half the distance between the max and min.

for $\sin\theta$ amplitude is 1

☆ vertical stretch $|a|$

☆ amplitude is > 0

Definition: The **period** is the length of one complete cycle of a periodic function. Not necessarily how long it takes to repeat itself, but how long it takes to repeat the pattern.

for $\sin\theta$ period $= T = 2\pi$ (1 rotation)

☆ change with horiz. stretch

$T > 0$

$g(\theta) = \sin b\theta$, $T = \frac{2\pi}{b}$

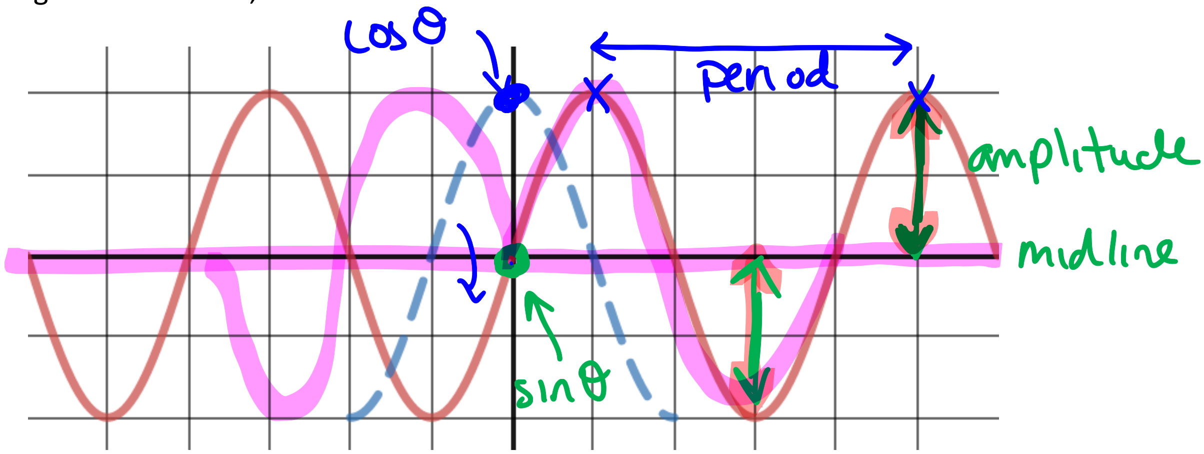
Definition: The **phase shift** is where the starting point of $\theta = 0$ got moved to.

$\sin\theta$ starts on midline @ $(0,0)$

☆ shift / left right changes start point.

$\cos\theta$ starts @ max $(0,1)$

When transforming a new function, we need to understand the basic function well to start.



$\cos(-\theta) = \cos\theta$

$\sin(-\theta) = -\sin\theta$

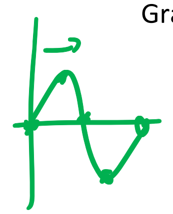
☆ cosine is even

☆ sine is odd

$(-x)^2 = x^2$

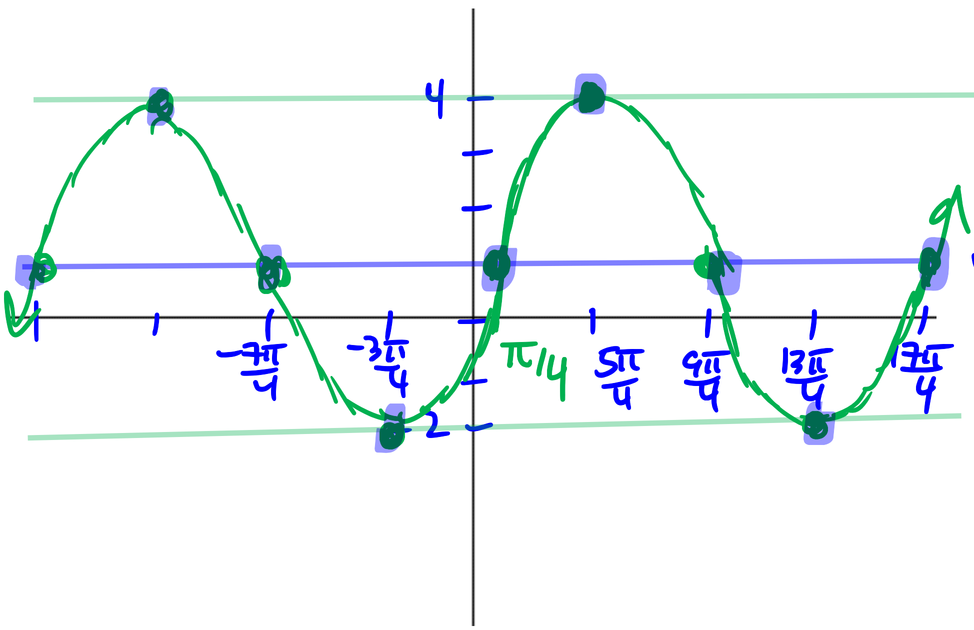
$(-x)^3 = -x^3$

Example: Graph $f(\theta) = 3\sin\left(\frac{1}{2}\left(\theta - \frac{\pi}{4}\right)\right) + 1$



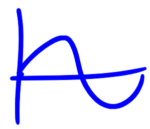
- Identify the midline from the vertical displacement
- Use the amplitude to find the max and min lines
- Use the phase shift to identify the starting point
- Split the period into quarters.

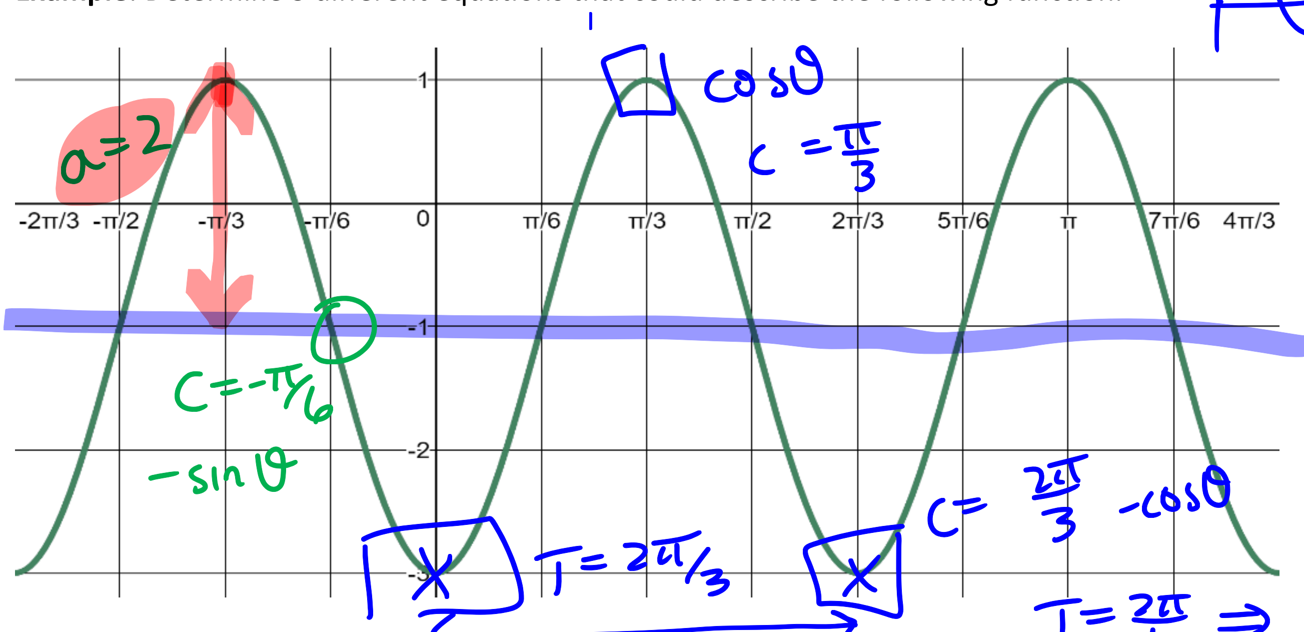
$T = 4\pi = \frac{2\pi}{1/2}$



$y=1$ midline

Example: Determine 3 different equations that could describe the following function.





$d=-1$

$T = \frac{2\pi}{b} \Rightarrow b = \frac{2\pi}{T}$

$\Rightarrow b = \frac{2\pi}{2\pi/3} = 3$

$y_1 = -2\sin\left(3\left(x + \pi/6\right)\right) - 1$

$y_2 = 2\cos\left(3\left(x - \frac{\pi}{3}\right)\right) - 1$

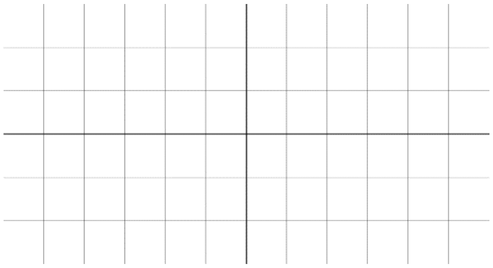
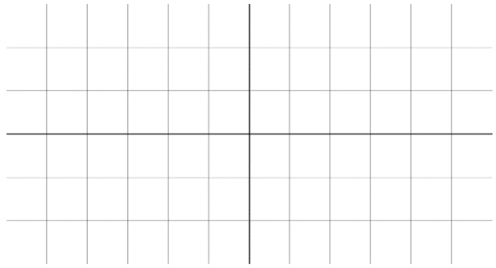
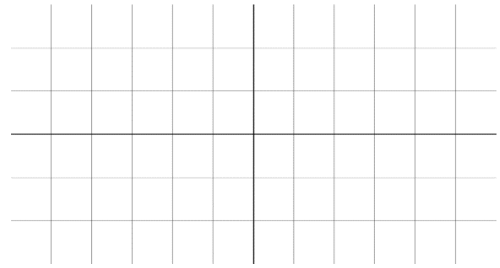
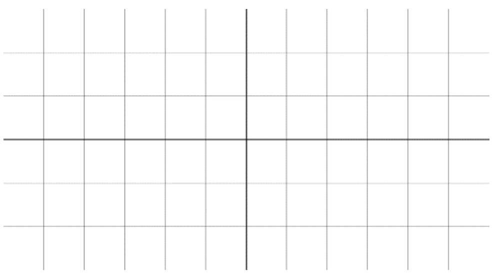
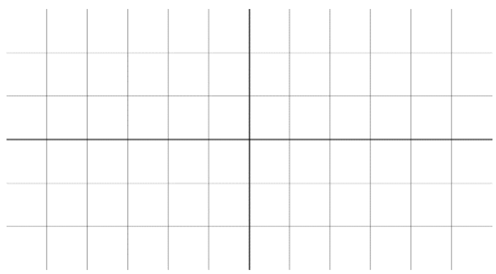
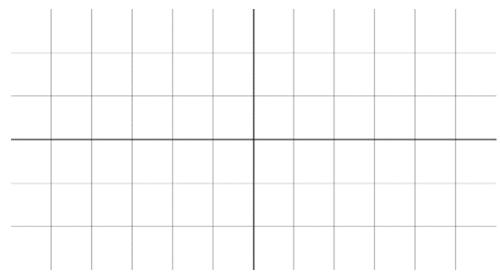
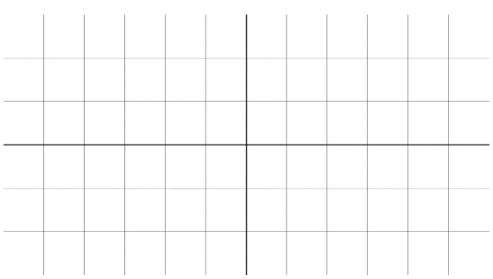
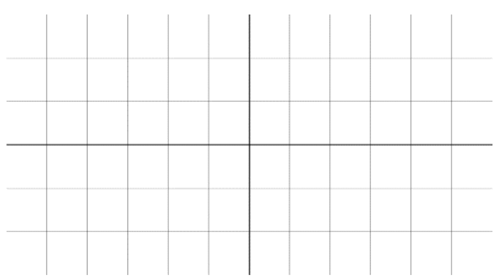
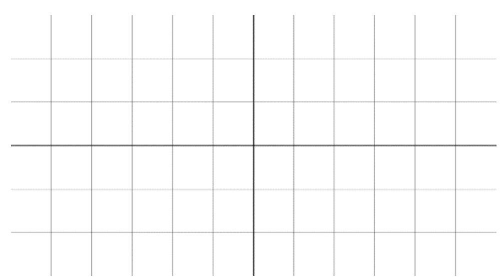
$y_3 = -2\cos(3x) - 1$

Example: Determine two equations (one sine, one cosine) that could describe a sinusoidal function that has two minimums at $(-1,-3)$ and $(3,-3)$ and has an amplitude of 0.5.

see morning notes

Practice Problems: 5.1 page 233 – 236 # 1-12, 20-22 5.2 page 250 – 254 # 1-7, 10-19

Trig Graphs

$\sin x$  Domain: Range:	$\csc x$  Domain: Range:	$\arcsin x = \sin^{-1} x$  Domain: Range:
$\cos x$  Domain: Range:	$\sec x$  Domain: Range:	$\arccos x = \cos^{-1} x$  Domain: Range:
$\tan x$  Domain: Range:	$\cot x$  Domain: Range:	$\arctan x = \tan^{-1} x$  Domain: Range: