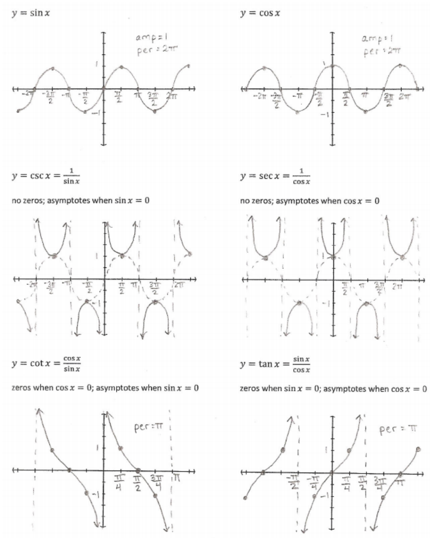
Read 5.5-5.7 and "Trig Guide to Graphing" on brewermath.com

Due Wed. 12/7:

- 5.5: #55-60 all; 77-84 all
- 5.6 #1-47 odd; 49-54 all; 63-70 all
- 5.7 #1-50 all; #53-64 all; 87-92 all




Review:
An industrial pulley has a 60 inch diameter, and moves a belt at a rate of 60 miles per hour.
What is the angular speed of a point on the edge of the pulley?

**Goal**: Transform a trigonometric function of the form $y = f(x)$ to one of the form $y = af(bx + c) + d$ by observing changes in amplitude and period, as well as horizontal and vertical shifts.

**Recall**:

- Constants that are multiplied (divided) result in a stretching/scaling of the graph (amplitude/period changes), that we show by changing the scale on our axes
- Constants that are added (subtracted) result in shifting of the graph
- Constants outside the function ($a$ & $d$) affect it vertically, as we would expect
- Constants inside the function ($b$ & $c$) affect it horizontally, opposite of what we would expect

$y = af(bx)$ ✓ scaling

$y = f(x+c)+d$ shifting

$y = f(x+c)+d$ shifting

outside - vertically as we would expect

inside - horizontally, opposite

$d$ = vertical shift ↕

- $d>0$ up
- $d<0$ down

$c$ = horizontal shift ↔

- $c>0$ left
- $c<0$ right

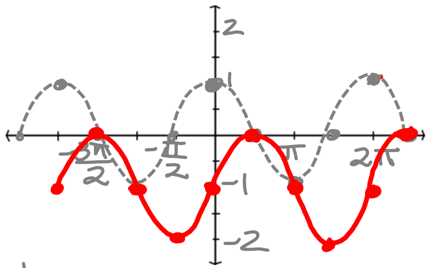
$y = \cos(x-\frac{\pi}{2})-1$

amplitude: 1

period: $2\pi$

horiz. shift: right $\frac{\pi}{2}$ (1 tick)

vert. shift: down 1 (2 ticks)




$y = \sin x - 1$

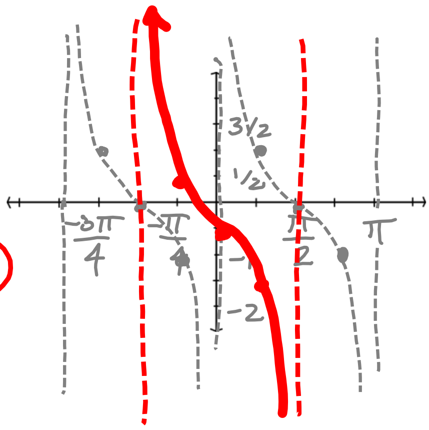
$y = \cot(x+\frac{\pi}{2})-\frac{1}{2}$

amplitude: —

period: $\pi$

horiz. shift: left $\frac{\pi}{2}$ (2 ticks)

vert. shift: down $\frac{1}{2}$ (1 tick)



## Graphing Trigonometric Functions continued...

**Goal**: Transform a trigonometric function of the form $y = f(x)$ to one of the form $\boxed{y = af(bx + c) + d}$ by observing changes in amplitude and period, as well as horizontal and vertical shifts.

**Recall**:

- Constants that are multiplied (divided) result in a stretching/scaling of the graph (amplitude/period changes), that we show by changing the scale on our axes
- Constants that are added (subtracted) result in shifting of the graph
- Constants outside the function ($a$ & $d$) affect it vertically, as we would expect
- Constants inside the function ($b$ & $c$) affect it horizontally, opposite of what we would expect

**Note**:

When both $b$ and $c$ are present (i.e. when $b$ is anything other than 1), the horizontal shift is not just $c = \frac{c}{1}$, as it is affected by the presence of $b$. In this case (and in general), the horizontal shift is $\frac{c}{b}$, which we can more easily see by factoring $b$ out in the general equation: $\boxed{y = af\left[b\left(x + \frac{c}{b}\right)\right] + d}$

**Summary**:

For a Trigonometric function of the form $y = af\left[b\left(x + \frac{c}{b}\right)\right] + d$,

Amplitude $= |a|$ (note that amplitude is always positive)

Period $= \dfrac{original\ period\ of\ the\ function\ (\pi\ or\ 2\pi)}{|b|}$

Horizontal shift $= \dfrac{c}{b}$ , $left\ if\ \frac{c}{b}>0$, $right\ if\ \frac{c}{b}<0$

phase shift $-\frac{c}{b}$

Vertical shift $= d$ , $up\ if\ d>0$, $down\ if\ d<0$

$y = -\frac{1}{2}\sin \pi x + \frac{3}{2}$

amplitude:

$\frac{1}{2}$

period:

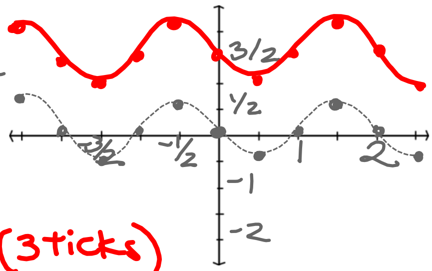
$\frac{2\pi}{\pi} = 2$

horiz. shift:

N/A

vert. shift:

up $\frac{3}{2}$ (3 ticks)




$y = 2\sec\left(\frac{\pi}{2}x - \pi\right) = 2\sec\left[\frac{\pi}{2}(x-2)\right]$

"amplitude"

$2$

period:

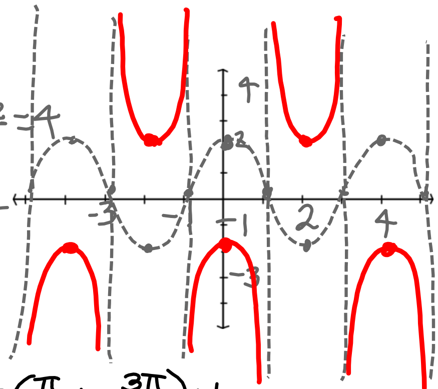
$\frac{2\pi}{\pi/2} = 2\pi \cdot \frac{2}{\pi} = 4$

horiz. shift:

right $\frac{\pi}{\pi/2} = 2$ (2 ticks)

vert. shift:

N/A



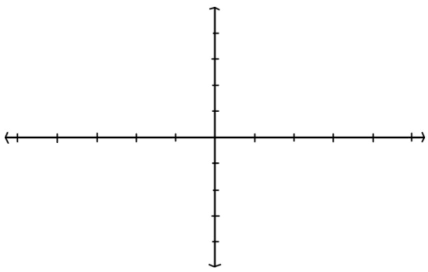

$y = -\frac{1}{3}\tan\left(\frac{1}{4}x + \frac{\pi}{4}\right) - \frac{1}{3}$

amplitude:

period:

horiz. shift:

vert. shift:



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

amplitude:

period:

horiz. shift:

vert. shift: