Assignments for the week of Sept. 6:

- 45 minutes of Khan Academy
- Read 5.5-5.7 and "Trig Guide to Graphing" on brewermath.com
- Due Fri. 9 Sept:
  5.5: #55-60 all; 77-84 all
  5.6 #1-47 odd; 49-54 all; 63-70 all

- Not due until next week:
  5.7 #1-50 all; #53-64 all; 87-92 all

- Test #2 - Next Friday, 9/16?

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?

$v = 60\frac{mi}{h}$; $r = 30\,in$; $\omega = ?$ $\quad \frac{v}{r} = \frac{r\omega}{r}$ $\quad \omega = \frac{v}{1}\cdot\frac{1}{r}$

$$\omega = \frac{60\,mi}{h}\cdot\frac{1}{30\,in}\cdot\frac{12\,in}{1\,ft}\cdot\frac{5280\,ft}{mi} = 126{,}720\,\frac{rad}{h}$$

Graphing Trigonometric Functions continued...

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

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: $y = af\left[b\left(x + \frac{c}{b}\right)\right] + d$

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 $= \frac{c}{b}$, $\begin{cases} left\ if\ \frac{c}{b} > 0 \\ right\ if\ \frac{c}{b} < 0 \end{cases}$

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

Vertical shift $= d$, $\begin{cases} up\ if\ d > 0 \\ down\ if\ d < 0 \end{cases}$

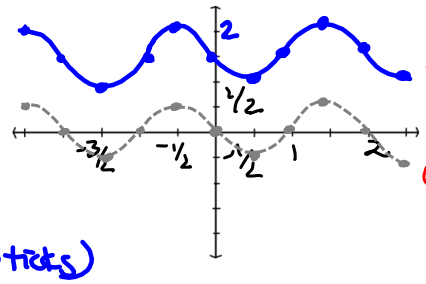
$y = -\frac{1}{2}\sin \pi x + \frac{3}{2}$ $\frac{\pi}{\pi/2} = \frac{\pi}{1} \cdot \frac{2}{\pi}$

amplitude: $\frac{1}{2}$

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

horiz. shift: none

vert. shift: up $\frac{3}{2}$ (3 ticks)



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

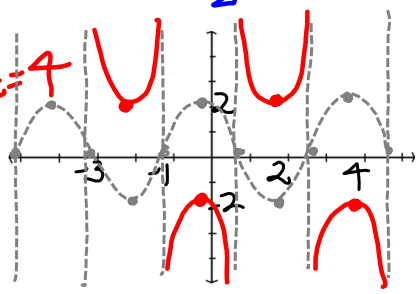
$= -2\sec\frac{\pi}{2}x$

amplitude: 2

period: $\frac{2\pi}{\pi/2} = \frac{2\pi}{1} \cdot \frac{2}{\pi} = 4$

horiz. shift: right 2 (2 ticks)

vert. shift: none



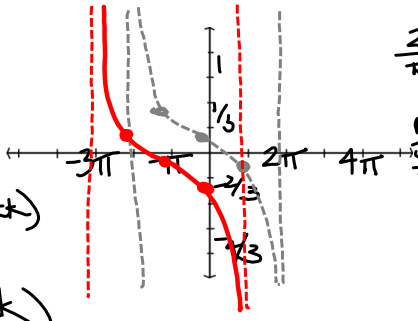
$y = -\frac{1}{3}\tan\left(\frac{1}{4}x + \frac{\pi}{4}\right) - \frac{1}{3}$ $\frac{1}{4}(x+\pi)$

amplitude: $\frac{1}{3}$

period: $\frac{\pi}{1/4} = 4\pi$

horiz. shift: left $\frac{\pi}{1/4} = \pi$ (1 tick)

vert. shift: down $\frac{1}{3}$ (1 tick)



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

amplitude: 2

period: $\frac{2\pi}{\pi/3} = 6$

horiz. shift: right $\frac{3\pi/2}{\pi/3} = \frac{3\pi}{2} \cdot \frac{3}{\pi} = \frac{9}{2}$ (3 ticks)

vert. shift: up 1 (1 tick)