SM 3H

Date: 3/7/24 **Section:** 7.5

Objective: I can graph secant and cosecants.
I can use trig graphs in stories.

Remember, $\sec x =$ and $\csc x =$.

- We aren't allowed to divide by 0. This means:
  - Whenever $\cos x = 0$, $\sec x$ is undefined, and whenever $\sin x = 0$, $\csc x$ is undefined.
    - Places where $\cos x = 0$ and $\sec x$ is undefined: ____________________
    - Places where $\sin x = 0$ and $\csc x$ is undefined: ____________________
  - The graphs of $y = \sec x$ and $y = \csc x$ have vertical asymptotes at these locations.
  - **To Find the Equations of the Asymptotes:**
    - Find the smallest non-negative x where the function is undefined. Add this value to k times the distance between the asymptotes.
      $x = \text{first non-negative asymptote} + (\text{distance between asymptotes}) \cdot k$

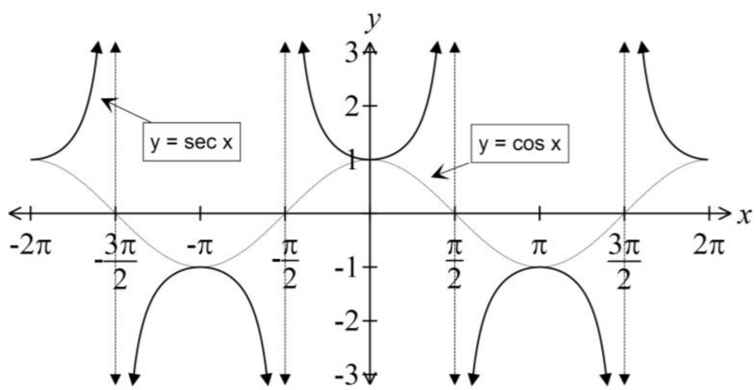
See notecard

Graphing Secant Functions

- To graph $y = a\sec\left[b\left(x - c\right)\right] + d$:
  - Sketch the graph of $y = a\cos\left[b\left(x - c\right)\right] + d$.
  - Wherever the graph of the cosine function crosses its center point, draw a vertical asymptote.
  - The local maxima of the graph of the cosine function become local minima on the graph of the secant function with $y \to \infty$ as x approaches the asymptotes on either side. The local minima of the graph of the cosine function become local maxima on the graph of the secant function with $y \to -\infty$ as x approaches the asymptotes on either side.

Key points on the graph of $y = \sec x$:

x					
$y = \sec x$					



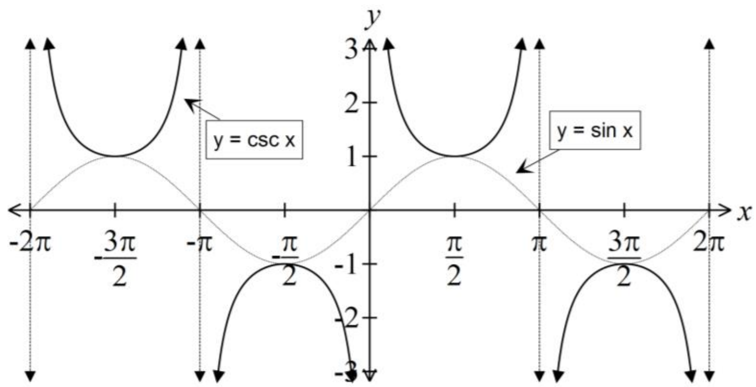
Graphing Cosecant Functions

see notecard

- To graph $y = a\csc\left[b(x-c)\right]+d$:
  - Sketch the graph of $y = a\sin\left[b(x-c)\right]+d$.
  - Wherever the graph of the sine function crosses its center point, draw a vertical asymptote.
  - The local maxima of the graph of the sine function become local minima on the graph of the cosecant function with $y \to \infty$ as x approaches the asymptotes on either side. The local minima of the graph of the sine function become local maxima on the graph of the cosecant function with $y \to -\infty$ as x approaches the asymptotes on either side.

Key points on the graph of $y = \csc x$:

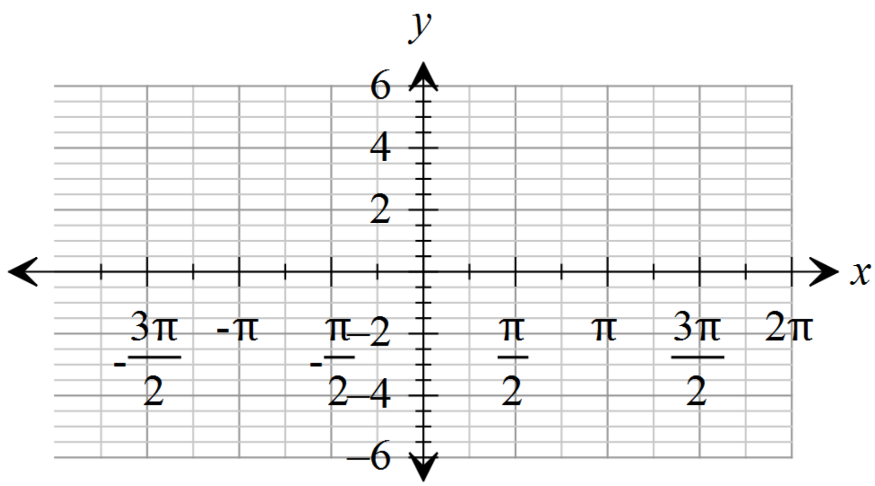
x					
$y = \csc x$					



Examples: Graph the following functions. Find the period, asymptotes, and range of each.

$y = 3\sec(2x)$

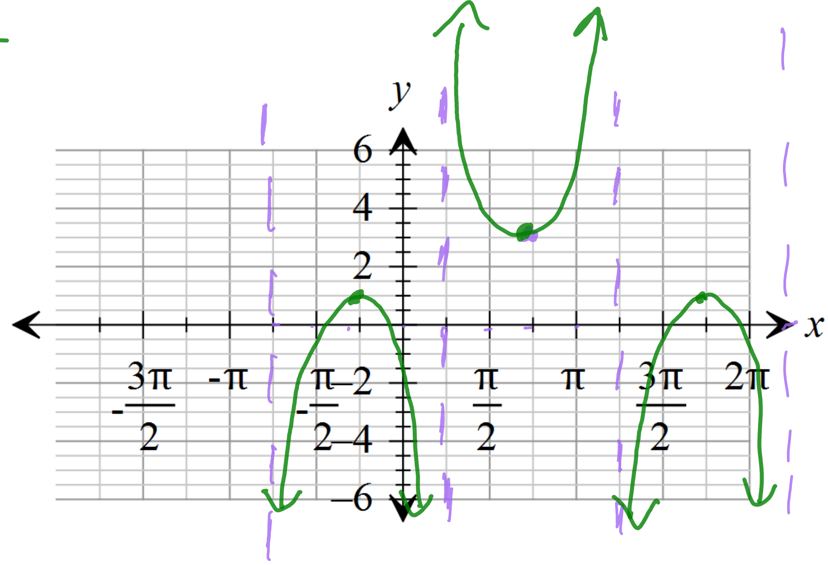
x	$f(x)$



$y = \csc\left(x - \frac{\pi}{4}\right) + 2$

$a = 1$
$b = 1$ per. 2π
$c = \frac{\pi}{4}$
$d = 2$

	$x + \frac{\pi}{4}$	y +2	
0	$\frac{\pi}{4}$	undef	0
$\frac{\pi}{2}$	$\frac{3\pi}{4}$	3	1
π	$\frac{5\pi}{4}$	undef	0
$\frac{3\pi}{2}$	$\frac{7\pi}{4}$	1	−1
2π	$\frac{9\pi}{4}$	undef	0

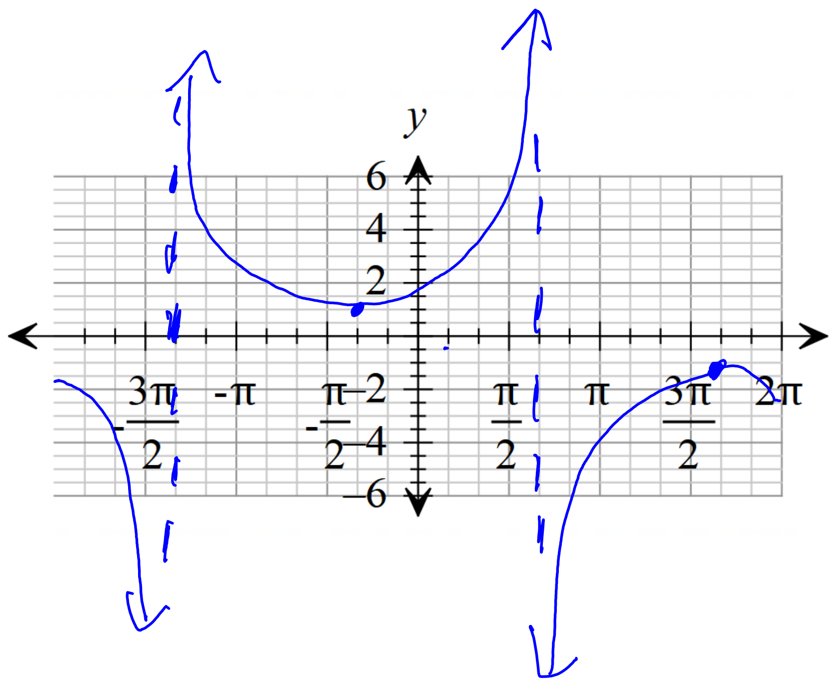


asy
$x = \frac{\pi}{4} + \pi k$

$y = \sec\left(\frac{1}{2}x + \frac{\pi}{6}\right) = \sec\left(\frac{1}{2}\left(x + \frac{\pi}{3}\right)\right)$

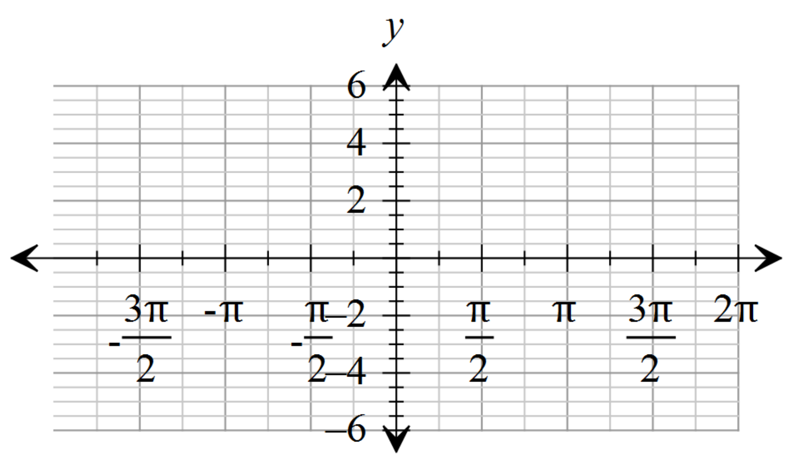
$a = 1$
$b = \frac{1}{2}$
$c = -\frac{\pi}{3}$
$d = 0$

	$2x - \frac{\pi}{3}$	y	
0	$-\frac{\pi}{3}$	1	1
$\frac{\pi}{2}$	$\frac{2\pi}{3}$	undef	0
π	$\frac{5\pi}{3}$	−1	−1
$\frac{3\pi}{2}$	$\frac{8\pi}{3}$	undef	0
2π	$\frac{11\pi}{3}$	1	1



$y = 2\csc\left(\frac{\pi}{4}x + \frac{3\pi}{4}\right)$

x	y



Read each story and write the appropriate trigonometric function to model each periodic situation below.

1. At the Bay of Fundy, low tide is at 11:30 am and high tide is at 5:30 pm. The water level varies 50 feet between low and high tide. Write a cosine equation that represents this function.

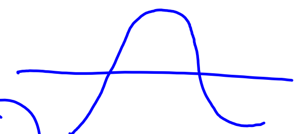
$a = 25$ $\quad b = \frac{\pi}{6}$ $\quad c = 0$ $\quad d = 0$

per $= 12$

$\frac{12}{1} = \frac{2\pi}{b}$

$\frac{12b}{12} = \frac{2\pi}{12}$

$y = -25\cos\left(\frac{\pi}{6}x\right)$



2. On Mars at the equator, the temperature varies from 70° F to -100° F in a single day. Write a sine equation that represents this function.

$a = 85$ $\quad c = 0$

$d = -15$ $\quad b = \frac{\pi}{12}$

Per $= 24 = \frac{2\pi}{b}$

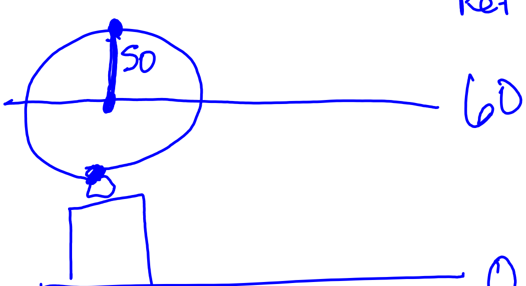
$y = 85\sin\left(\frac{\pi}{12}x\right) - 15$

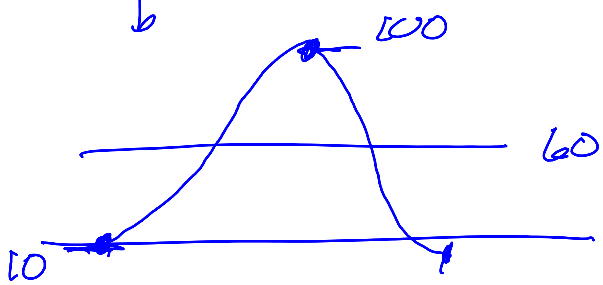
3. A Ferris wheel 100 feet in diameter makes one revolution every 60 seconds. The center of the wheel is 60 above the ground. People load at the bottom of the Ferris wheel. Write a cosine function to model the height of a car on the Ferris wheel at any time *t*.

$a = 50$ $\quad b = \frac{\pi}{30}$ $\quad c = 0$ $\quad d = 60$

Per: $60 = \frac{2\pi}{b}$

$y = -50\cos\left(\frac{\pi}{30}x\right) + 60$





4. A greater wax moth has hearing capable of sensing high-frequency sounds up to 300,000 cycles per second. Write a sine function representing the sound wave of the pitch. (Amplitude is 1.)

$a = 1$ $\quad c = 0$ $\quad d = 0$

$f = \frac{300{,}000}{1}$

per $= \frac{1}{300000} = \frac{2\pi}{b}$

$b = 600000\pi$

$y = \sin(600000\pi x)$