

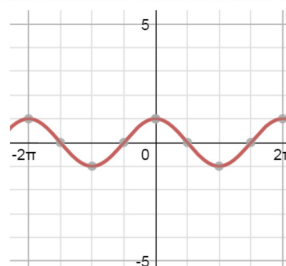
## 4.5 Graphs of Tangent, Cotangent, Secant, and Cosecant

### ESSENTIAL QUESTION:

How are the graphs of the tangent, cotangent, secant, and cosecant functions related to the graphs of sine and/or cosine?

### Graphing $y = \tan x$

The graph of  $y = \cos x$  is below. Label the axes with an appropriate scale.

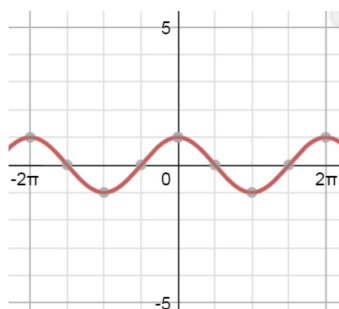


Remember that  $\tan x = \frac{\sin x}{\cos x}$

For what values of  $x$  would  $\tan x$  be undefined?

$\tan x$  will have asymptotes wherever  $\cos x = 0$ . Sketch in the asymptotes. Then fill in the table (unit circle will help) and plot the points.

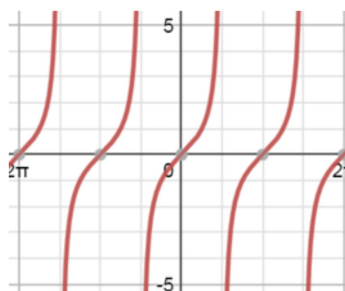
$x$	$y = \tan x$
$-\frac{\pi}{2}$	
$-\frac{\pi}{3}$	
$-\frac{\pi}{4}$	
$-\frac{\pi}{6}$	
0	
$\frac{\pi}{6}$	
$\frac{\pi}{4}$	
$\frac{\pi}{3}$	
$\frac{\pi}{2}$	



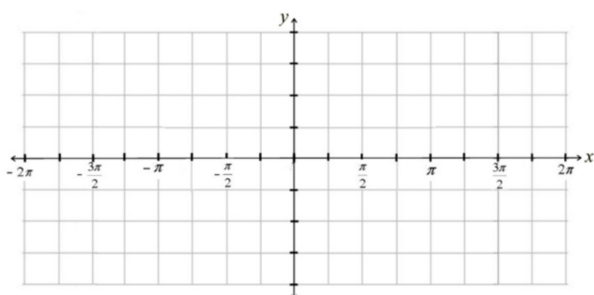
It appears that the period of  $y = \tan x$  is \_\_\_\_\_. Repeat the cycle to sketch in several more periods.

Look at your handout with the 6 basic trig functions. Sketch in the asymptotes and label the  $x$ -values where they occur.

$y = \tan x$

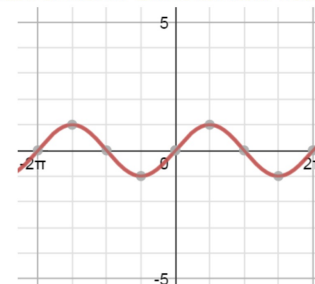


What would the graph of  $y = \tan(2x)$  look like?



### Graphing $y = \cot x$

The graph of  $y = \sin x$  is below. Label the axes with an appropriate scale.

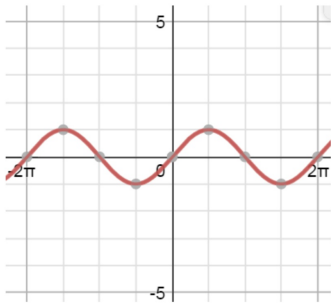


Remember that  $\cot x = \frac{\cos x}{\sin x}$

For what values of  $x$  would  $\cot x$  be undefined?

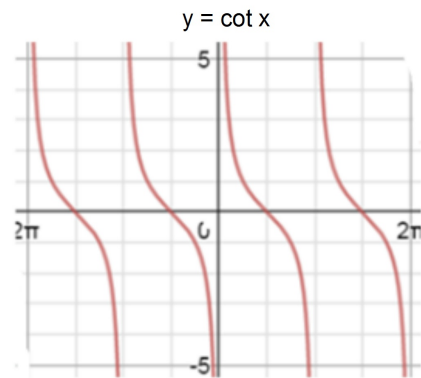
Cot  $x$  will have asymptotes wherever  $\sin x = 0$ . Sketch in the asymptotes. Then fill in the table (unit circle will help) and plot the points.

$x$	$y = \cot x$
0	
$\frac{\pi}{6}$	
$\frac{\pi}{4}$	
$\frac{\pi}{3}$	
$\frac{\pi}{2}$	
$\frac{2\pi}{3}$	
$\frac{3\pi}{4}$	
$\frac{5\pi}{6}$	
$\pi$	

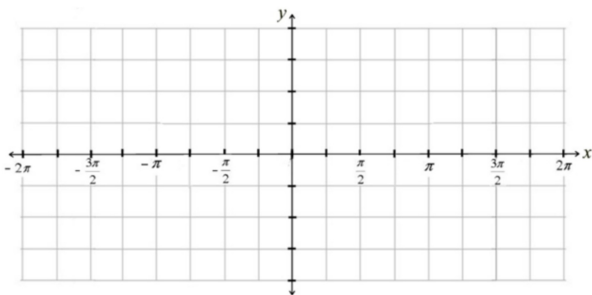


It appears that the period of  $y = \cot x$  is  $\pi$ . Repeat the cycle to sketch in several more periods.

Sketch in the asymptotes & label the  $x$ -values where the asymptotes occur.



Sketch the graph of  $y = \cot\left(\frac{x}{4}\right)$ . What is the transformation?

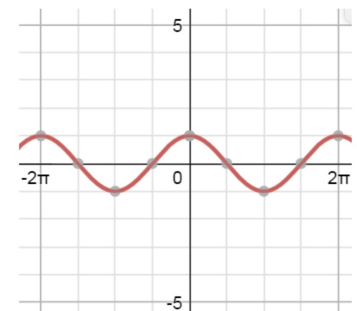


Graphing  $y = \sec x$

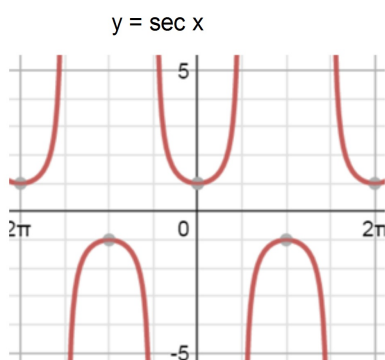
Remember that  $\sec x = \frac{1}{\cos x}$

For what values of  $x$  would  $\sec x$  be undefined?

Sketch in the asymptotes.



Sketch in the asymptotes & label the  $x$ -values where the asymptotes occur.

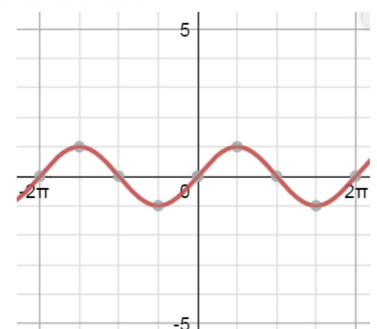


Graphing  $y = \csc x$

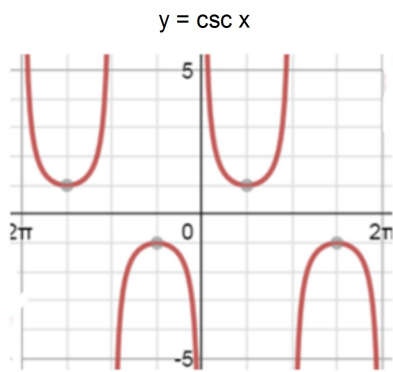
Remember that  $\csc x = \frac{1}{\sin x}$

For what values of  $x$  would  $\csc x$  be undefined?

Sketch in the asymptotes.



Sketch in the asymptotes & label the x-values where the asymptotes occur.

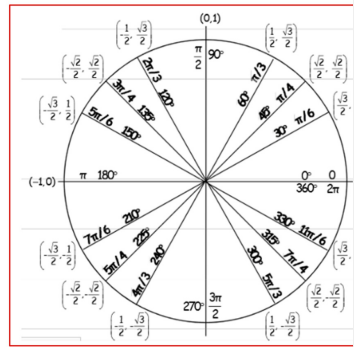


Now let's practice solving some simple trig equations.  
No calculators, but your unit circle will be helpful.

1.  $\csc x = 2, \quad \pi/2 \leq x \leq \pi$

2.  $\sec x = -\sqrt{2}, \quad \pi \leq x \leq 3\pi/2$

3.  $\cot x = 1, \quad -\pi \leq x \leq -\pi/2$



Use your calculator to solve for x.

4.  $\sec x = 2.4, \quad 0 \leq x \leq \frac{\pi}{2}$

5.  $\csc x = -1.5, \quad \pi \leq x \leq \frac{3\pi}{2}$

