## Section 4.6 Graphs of Other Trigonometric Functions

Objective: In this lesson you learned how to sketch the graphs of other trigonometric functions.

### I. Graph of the Tangent Function

What you should learn:

How to sketch the graphs of tangent functions

Because the tangent function is odd, the graph of $y = \tan x$ is symmetric with respect to the origin.

The period of the tangent function is $\pi$. The tangent function has vertical asymptotes at $x =$ $\frac{\pi}{2} + n\pi$, where $n$ is an integer. The domain of the tangent function is ALL $x$, $x \neq \frac{\pi}{2} + n\pi$, and the range of the function is ($-\infty$, $+\infty$).

Describe how to sketch the graph of a function of the form $y = a\tan(bx - c)$.

1) Identify Asymptotes
2) Identify Key points $(x = -\pi/4, 0, \pi/4)$
3) Identify the period
4)

### II. Graph of the Cotangent Function

What you should learn:

How to sketch the graphs of cotangent functions

The period of the cotangent function is $\pi$. The domain of the cotangent function is ALL $x$, $x \neq n\pi$, and the range of the cotangent function is ($-\infty$, $+\infty$).

The vertical asymptotes of the cotangent function occur at $x =$ $n\pi$, where $n$ is an integer.

### III. Graphs of the Reciprocal Functions

What you should learn:

How to sketch the graphs of secant and cosecant functions

At a given value of $x$, the $y$-coordinate of $\csc x$ is the reciprocal of the $y$-cooridnate of $\sin x$.

The graph of $y = \csc x$ is symmetric with respect to the origin. The period of the cosecant function is $2\pi$. The cosecant function has vertical asymptotes at $x = n\pi$, where $n$ is an integer. The domain of the cosecant function is ALL $x$; $x \neq n\pi$, and the range of the cosecant functions is $(-\infty, -1]$ AND $[1, +\infty)$.

At a given value of $x$, the $y$-coordinate of $\sec x$ is the reciprocal of the $y$-coordinate of

cos x. The graph of $y = \sec x$ is symmetric with respect to the y-axis. The period of the secant function is $2\pi$. The secant function has vertical asymptotes at $x =$ $\frac{\pi}{2} + n\pi$. The domain of the secant function is All x, $x = \frac{\pi}{2} + n\pi$, and the range of the secant function is $(-\infty, -1]$ and $[1, \infty)$.

To sketch a graph of a secant or cosecant function, you:

→ sin x, cos x, tan x

1) Make a quick sketch of its reciprocal function
2) locate all max & min values for your domain
3) Graph vertical asymptotes at zeros of the reciprocal function
4) Sketch the graph.

In comparing the graphs of cosecant and secant functions with those of the sine and cosine functions, note that the "hills" and "valleys" are interchanged.

## Section 4.6 Examples – Graphs of Other Trigonometric Functions

( 1 ) Describe the translations occurring from the graph of $f$ to the graph of $g$.

$f(x) = \tan x$

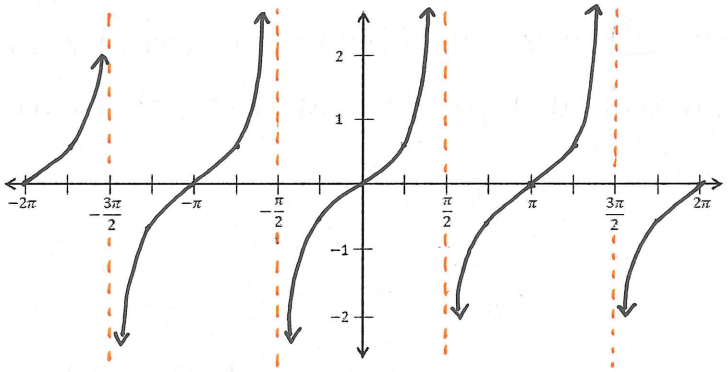
$g(x) = \tan\left(x + \frac{\pi}{4}\right)$

horizontal shift $\leftarrow \pi/4$

( 2 ) Sketch 2 full periods of the graphs of $f$

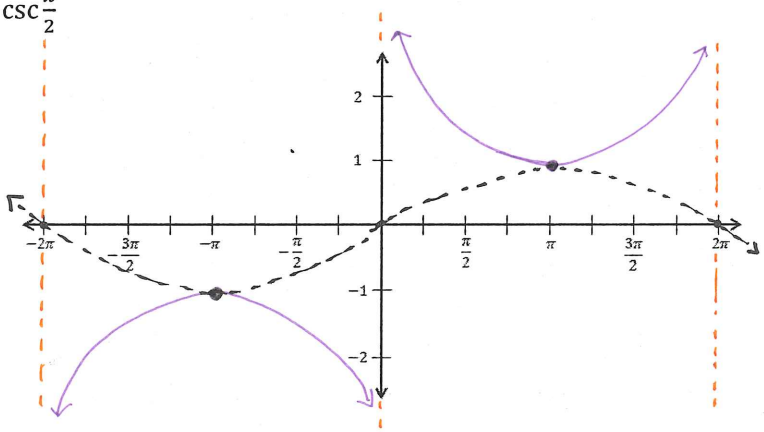
a. $f(x) = \frac{1}{2}\tan x$

vertical shrink by $\frac{1}{2}$




b. $f(x) = \csc\frac{x}{2}$

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



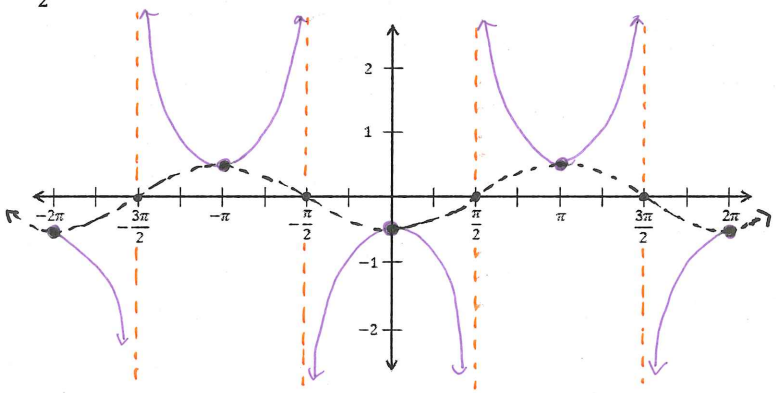

Reciprocal function

$y = \sin\left(\frac{x}{2}\right)$

c. $f(x) = -\frac{1}{2}\sec x$

Vertical Shrink by $\frac{1}{2}$

reflect over x-axis




Reciprocal function

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