

- 4.4 - Graphing Reciprocal Trig. Functions and Tan **Day 1**

Essential Understanding Cosine, sine, and tangent have reciprocals. Cosine and *secant* are reciprocals, as are sine and *cosecant*. Tangent and *cotangent* are also reciprocals.

Today we will focus on csc and sec...

Take note

Key Concept Cosecant, Secant, and Cotangent Functions

The **cosecant** (csc), **secant** (sec), and **cotangent** (cot) functions are defined using reciprocals. Their domains do not include the real numbers θ that make the denominator zero.

$$\text{csc } \theta = \frac{1}{\sin \theta}$$

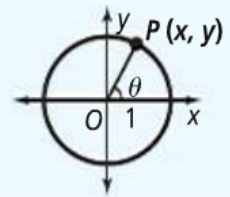
$$\text{sec } \theta = \frac{1}{\cos \theta}$$

$$\text{cot } \theta = \frac{1}{\tan \theta}$$

(cot $\theta = 0$ at odd multiples of $\frac{\pi}{2}$, where tan θ is undefined.)

You can use the unit circle to evaluate the reciprocal trigonometric functions directly. Suppose the terminal side of an angle θ in standard position intersects the unit circle at the point (x, y) .

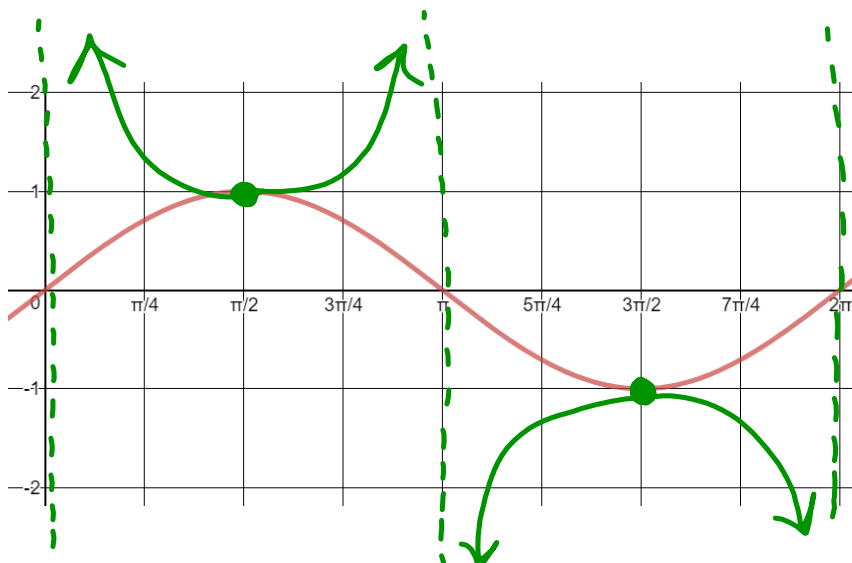
Then $\text{csc } \theta = \frac{1}{y}$, $\text{sec } \theta = \frac{1}{x}$, $\text{cot } \theta = \frac{x}{y}$.



$$y = \text{csc } x$$

Let's start with the parent function, $y = \sin x$...

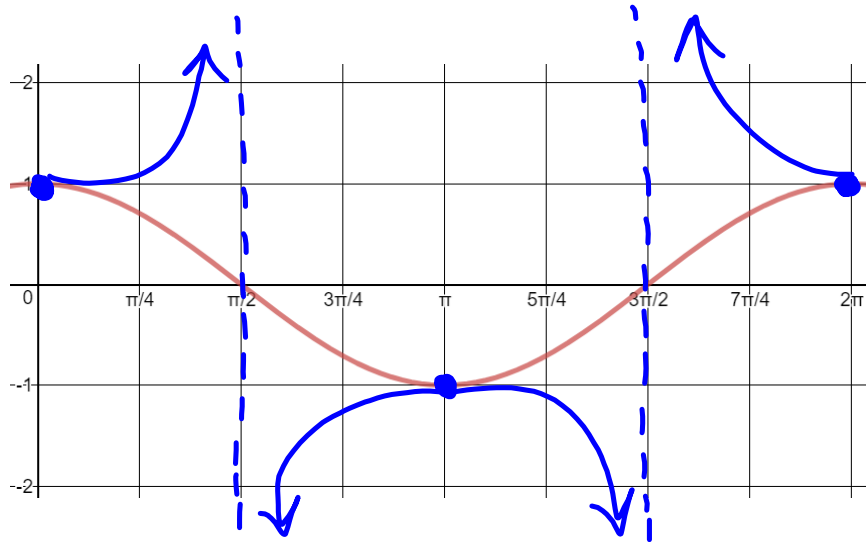
To create the graph of $y = \text{csc } x$, you must take the y -value of each point of $y = \sin x$ and take the reciprocal ($1/y$).



$$y = \sec x$$

Let's start with the parent function, $y = \cos x$...

To create the graph of $y = \sec x$, you must take the y -value of each point of $y = \cos x$ and take the reciprocal ($1/y$).



Graphing \csc and \sec with Transformations

- 1.) Start with graphing as though it is a ***sin*** or ***cos*** graph.
(Do everything that you have been taught before).
- 2.) Remember to do the phase shift last if there is one.
- 3.) Once the ***sin*** or ***cos*** graph is done, wherever there are points on the midline those are the vertical asymptotes. The other points are the relative min and max points of the final ***csc*** or ***sec*** graph.

Ex.1 Find all the unknowns. Then graph one cycle.

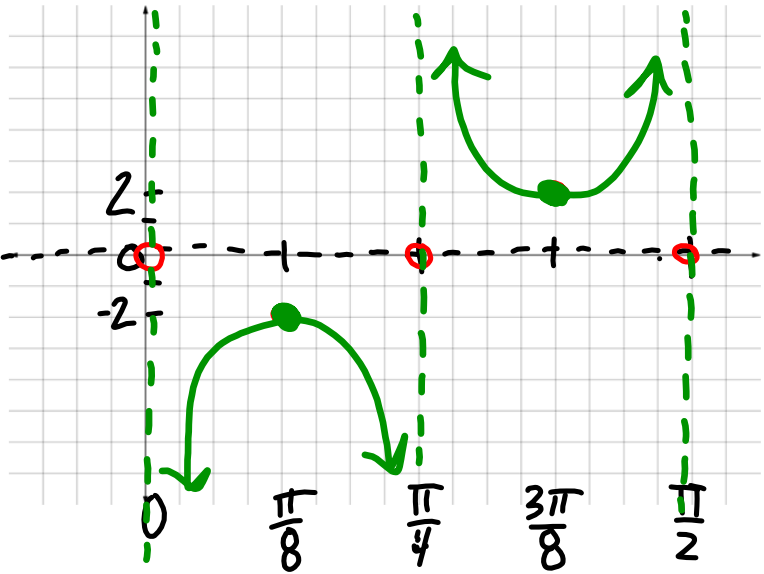
$$y = -2 \text{csc} 4\theta$$

→ sin

Amplitude = 2
 Reflection? Yes / No (circle one)

Period = $\frac{\pi}{2}$ ← $\frac{2\pi}{4}$

Midline: $y=0$



Ex.2 Find all the unknowns. Then graph one cycle.

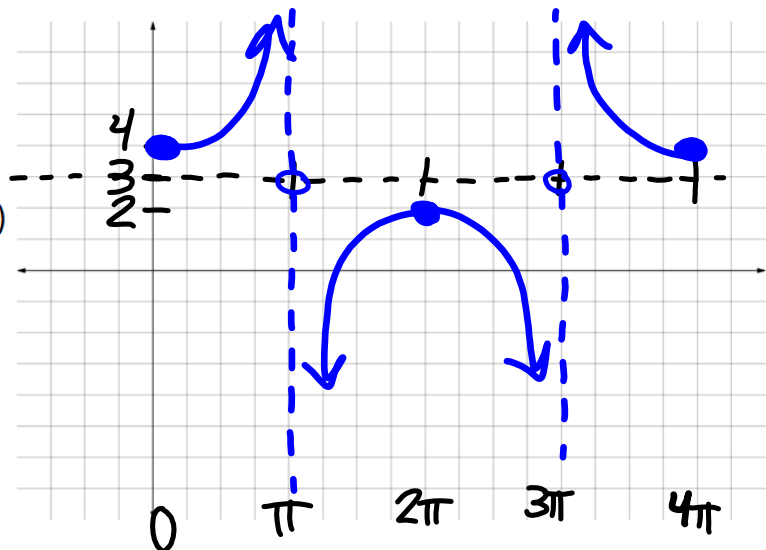
$$y = \text{sec} \frac{\theta}{2} + 3$$

← cos

Amplitude = 1
 Reflection? Yes / No (circle one)

Period = 4π ← $\frac{2\pi}{1/2}$

Midline: $y=3$



Ex.4 Find all the unknowns. Then graph using the entire grid.

Level 4

$$y = -3 \overset{\text{cos}}{\text{sec}} 2\left(\theta + \frac{\pi}{8}\right) - 1$$

Amplitude = 3
 Reflection? Yes No (circle one)

Period = π = $\frac{2\pi}{2}$

Midline: $y = -1$

8
 Left $\frac{\pi}{8}$
 (2 units)

