

**Learning Goal:** I will be able to sketch the reciprocal trigonometric functions.

**Minds On:** Sketching Reciprocals

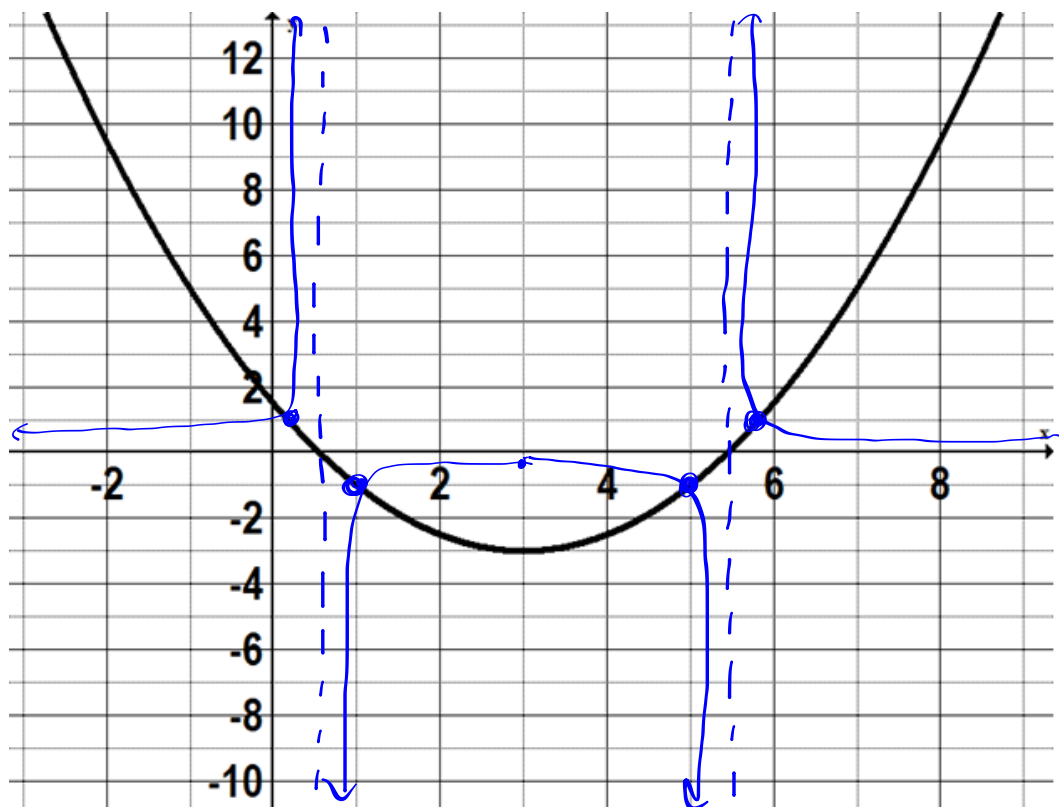
**Action:** Sketching the Reciprocal Trigonometric Functions

**Consolidation:** Domain and Range

## Minds On

### Sketching the Reciprocal

Given the graph of  $f(x)$  as seen below, sketch the graph of the reciprocal function  $1/f(x)$ .



#### Properties of Reciprocal Functions

$f(x)$	Positive	Negative	Increasing	Decreasing	Approaches 0	Approaches $\infty$
$\frac{1}{f(x)}$	Positive	Negative	Decreasing	Increasing	Approach $\infty$	Approach 0

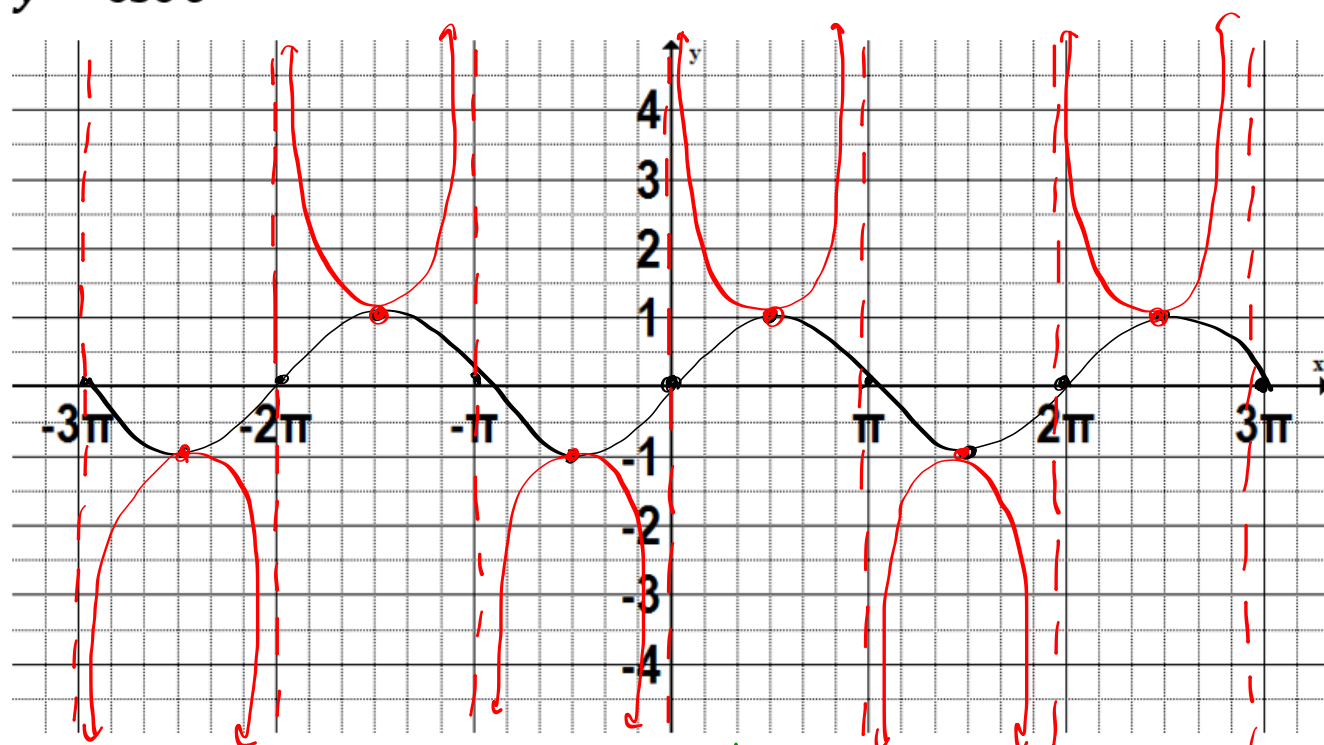
$f(x)$	Equals Zero	Vertical Asymptote	Equals 1	Equals -1
$\frac{1}{f(x)}$	undefined	zero	1	-1

**Action**

## Graphing the Reciprocal Trigonometric Functions

For each reciprocal function, first graph its primary function, then use the properties of reciprocal functions to graph the reciprocal.

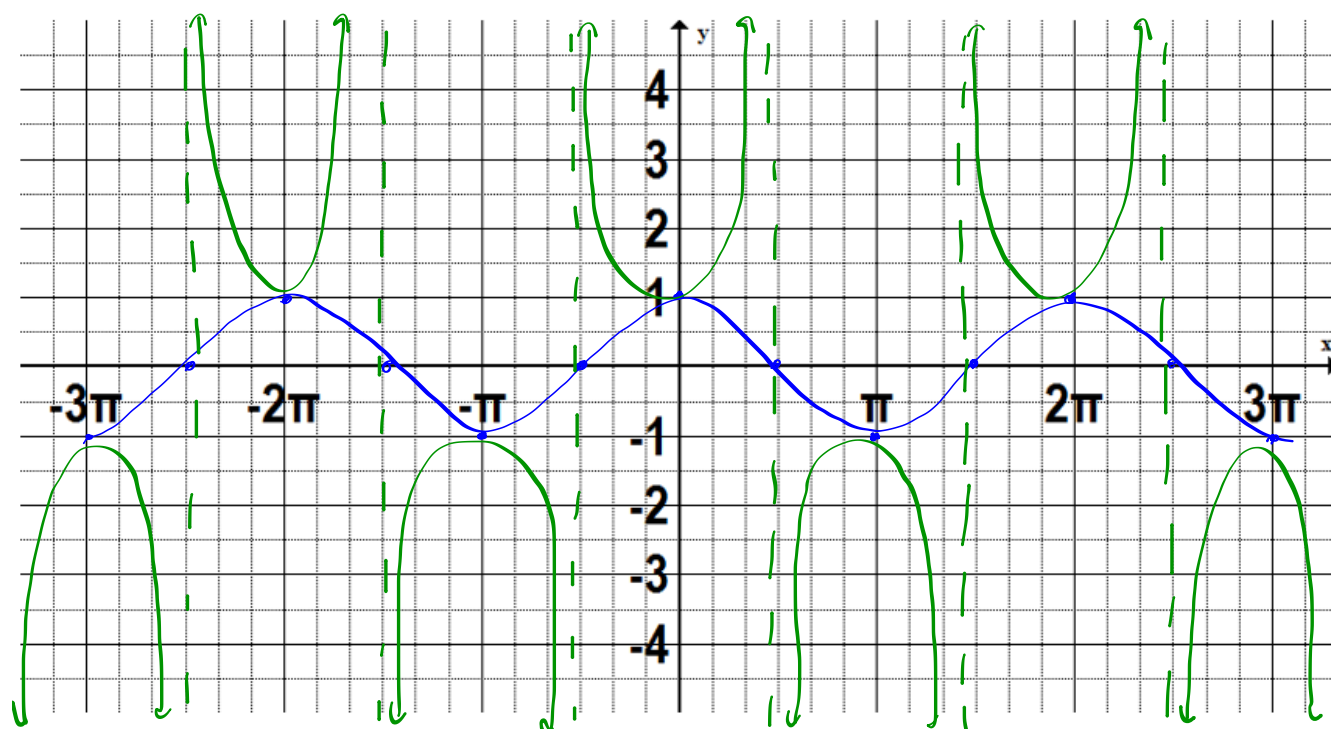
$$y = \csc \theta$$



$$\text{Domain} = \{ \theta \in \mathbb{R} \mid \theta \neq \pi n, n \in \mathbb{I} \}$$

$$\text{Range} = \{ \csc \theta \in \mathbb{R} \mid \csc \theta \geq 1, \csc \theta \leq -1 \}$$

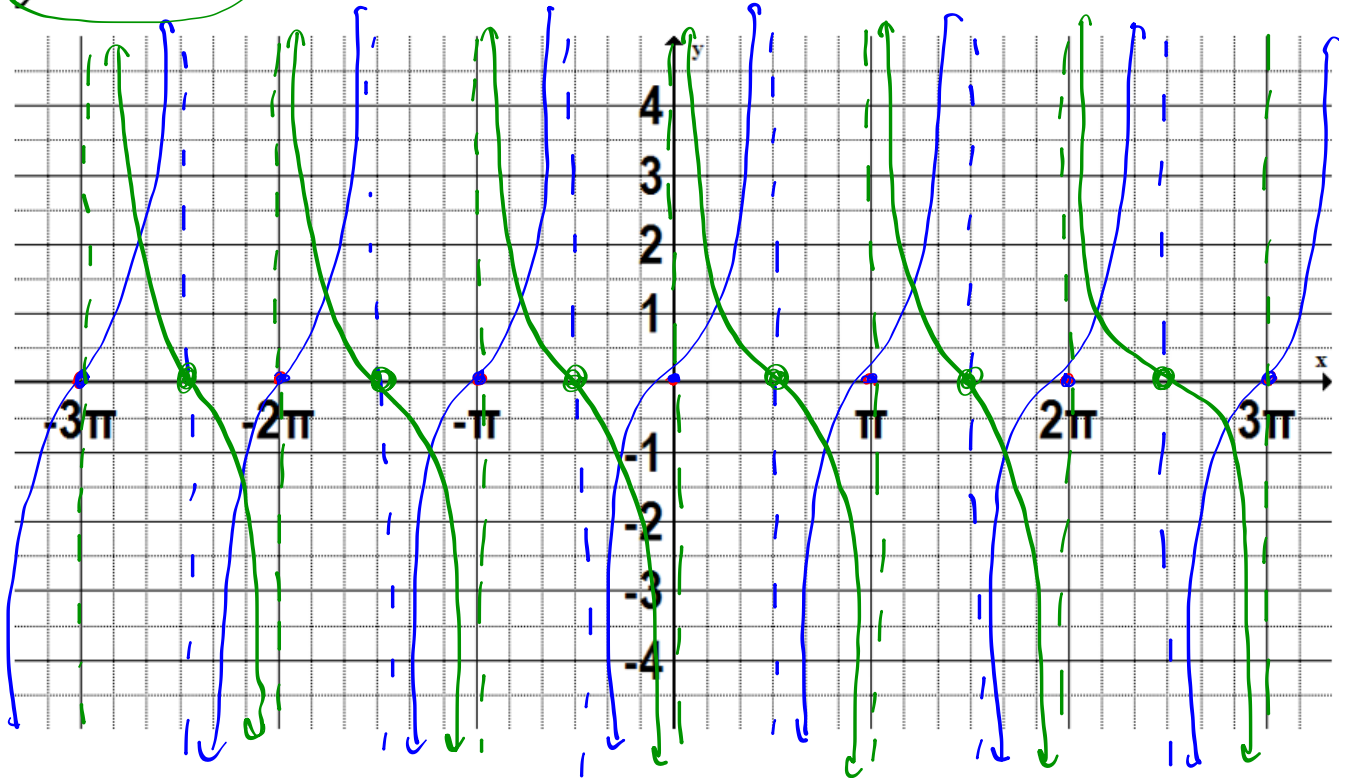
$$y = \sec \theta$$



$$\text{Domain} = \left\{ \theta \in \mathbb{R} \mid \theta \neq \frac{\pi}{2}n, n = \pm 1, 3, 5, \dots \right\}$$

$$\text{Range} = \left\{ \sec \theta \in \mathbb{R} \mid \sec \theta \geq 1, \sec \theta \leq -1 \right\}$$

$$y = \cot \theta$$



$$\tan \theta = \frac{\sin \theta}{\cos \theta}$$

\* intersect  
at  $y = -1$

$$\text{Domain} = \{ \theta \in \mathbb{R} \mid \theta \neq \pi n, n \in \mathbb{I} \}$$

$$\text{Range} = \{ \cot \theta \in \mathbb{R} \}$$

	Period	Amplitude	Asymptotes	y-intercept	$\theta$ -intercepts
$\csc \theta$	$2\pi$	undefined	$0, \pi, 2\pi, \dots$	none	none
$\sec \theta$	$2\pi$	undefined	$\frac{\pi}{2}, \frac{3\pi}{2}, \frac{5\pi}{2}, \dots$	1	none
$\cot \theta$	$\pi$	undefined	$0, \pi, 2\pi, \dots$	none	$\frac{\pi}{2}, \frac{3\pi}{2}, \dots$

## Consolidation

### Representing Patterns in Trigonometric Functions

\*The equation  $t_n = a + (n - 1)d$  can be used to represent the general term of any arithmetic sequence, where  $a$  is the first term and  $d$  is the common difference.

Use this equation to find an expression that describes each of the following values for  $y = \sin x$ , where  $n \in \mathbb{I}$  and  $x$  is in radians.

a) **Maximum Values**

$$t_n = \frac{\pi}{2} + (n-1)2\pi$$

b) **Minimum Values**

c) **x-Intercepts**



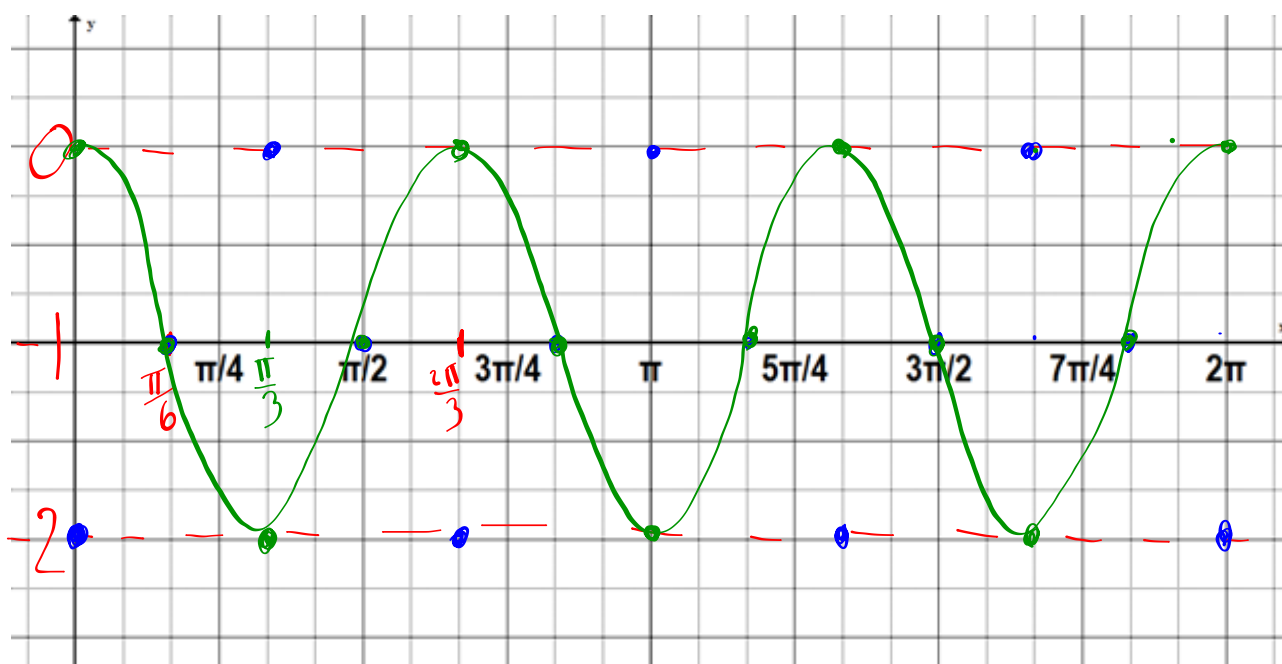
## Minds On

## Warm-Up Question

Sketch a rough graph of the function below on the interval  $0 \leq x \leq 2\pi$ .

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

period =  $\frac{2\pi}{k}$   
period =  $\frac{2\pi}{3}$



**Consolidation**

# Homework

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