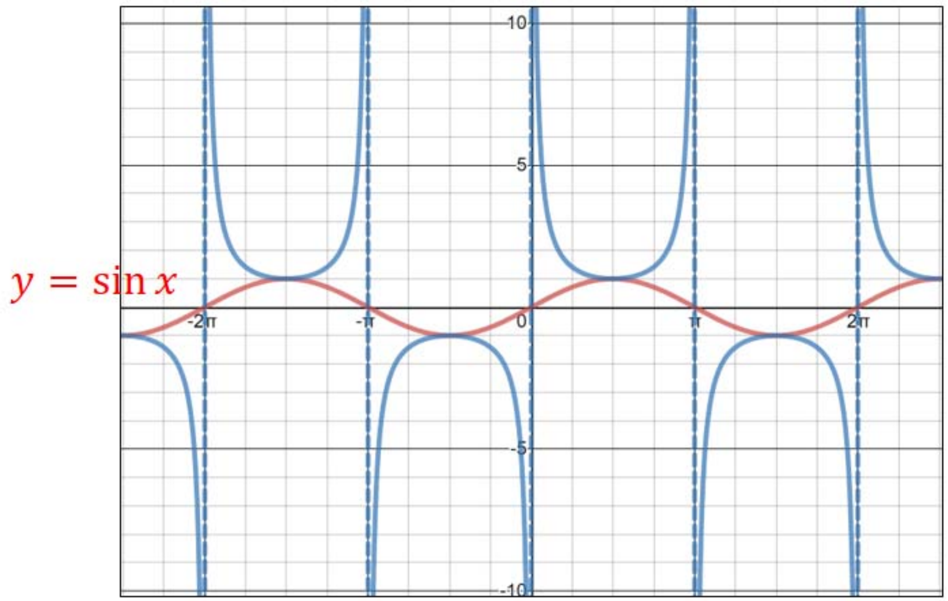
Objective: Graph cosecant and secant with period changes and phase shifts.

Concept

Shown below are the graphs of $y = \sin x$ and $y = \csc x$. Here we can see that the zeros of $y = \sin x$ correspond to vertical asymptotes for $y = \csc x$. We can also see that the maximums of sine are minimums for parts of cosecant and the minimums of sine are maximums for parts of cosecant.

$$y = \csc x = \frac{1}{\sin x}$$



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Objective: Graph cosecant and secant with period changes and phase shifts.

Concept

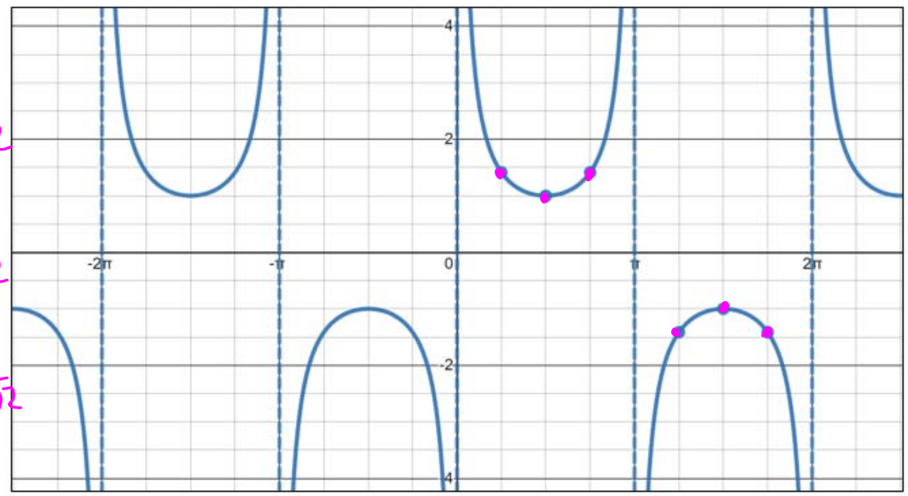
The Graph of $y = \csc x$.

Period = 2π radians

Domain: $\{x | x \neq \pi k \text{ where } k \text{ is any integer}\}$

Range: $(-\infty, -1] \cup [1, \infty)$

x	$\csc x$
0	undefined
$\frac{\pi}{4}$	1.4142136 $\approx \sqrt{2}$
$\frac{\pi}{2}$	1
$\frac{3\pi}{4}$	1.4142136 $\approx \sqrt{2}$
π	undefined
$\frac{5\pi}{4}$	$-1.4142136 \approx -\sqrt{2}$
$\frac{3\pi}{2}$	-1
$\frac{7\pi}{4}$	$-1.4142136 \approx -\sqrt{2}$
2π	undefined



Objective: Graph cosecant and secant with period changes and phase shifts.

Concept

For $g(x) = a \cdot csc\left(\frac{1}{b}x - c\right) + k$ or $g(x) = a \cdot sec\left(\frac{1}{b}x - c\right) + k$

Period of a cosecant or secant function: $P = \frac{2\pi}{\left|\frac{1}{b}\right|} = 2\pi \cdot |b|$

Phase Shift of a cosecant or secant function: $\frac{c}{\frac{1}{b}} = c \cdot b$

To graph a cosecant or secant function with the above form:

1. Determine the period and phase shift. Note any parameter of a, as this may create a vertical stretch, compression, or reflection across the x-axis. Note an parameter of k, as this will create a vertical translation.
2. Determine the locations of the vertical asymptotes using the period and phase shift. Identify the maximums and minimums. Draw a smooth curve approaching the asymptotes. **The scale of $\frac{\pi}{4}$ radians is suggested for the x-axis. If this scale won't work, use the strategy of dividing the period by 4 to determine another possible scale for the x-axis.**

Note. Another strategy is to lightly graph the related sine or cosine curve first and then determine the asymptotes, maximums, and minimums of the related cosecant or secant function.

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Objective: Graph cosecant and secant with period changes and phase shifts.

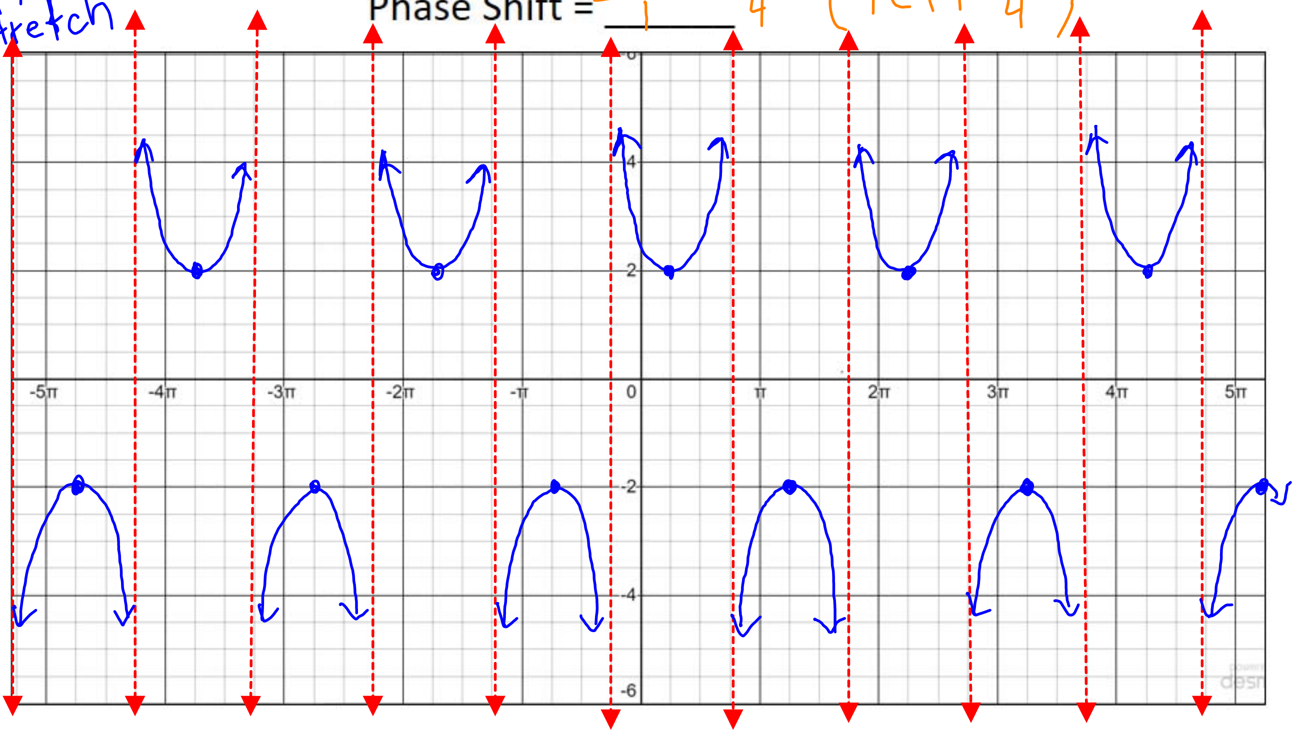
Ex) Identify the period and phase shift. Sketch as much of the function as possible on the given graph.

$$y = 2\csc\left(1x + \frac{\pi}{4}\right) + 0$$

a ↓ vert. stretch; $\frac{1}{b}$; opp = c; k

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

Phase Shift = $\frac{-\frac{\pi}{4}}{1} = -\frac{\pi}{4}$ (left $\frac{\pi}{4}$)



00:04:53 / 00:15:00

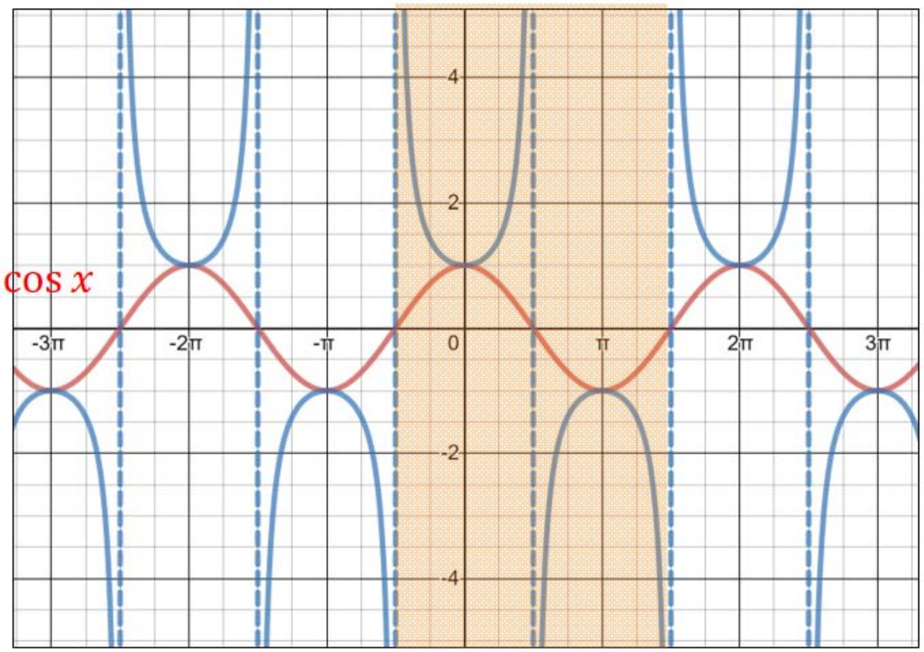
Objective: Graph cosecant and secant with period changes and phase shifts.

Concept

Shown below are the graphs of $y = \cos x$ and $y = \sec x$. Here we can see that the zeros of $y = \cos x$ correspond to vertical asymptotes for $y = \sec x$. We can also see that the maximums of cosine are minimums for parts of secant and the minimums of cosine are maximums for parts of secant.

$$y = \sec x = \frac{1}{\cos x}$$

$y = \cos x$



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Objective: Graph cosecant and secant with period changes and phase shifts.

Concept

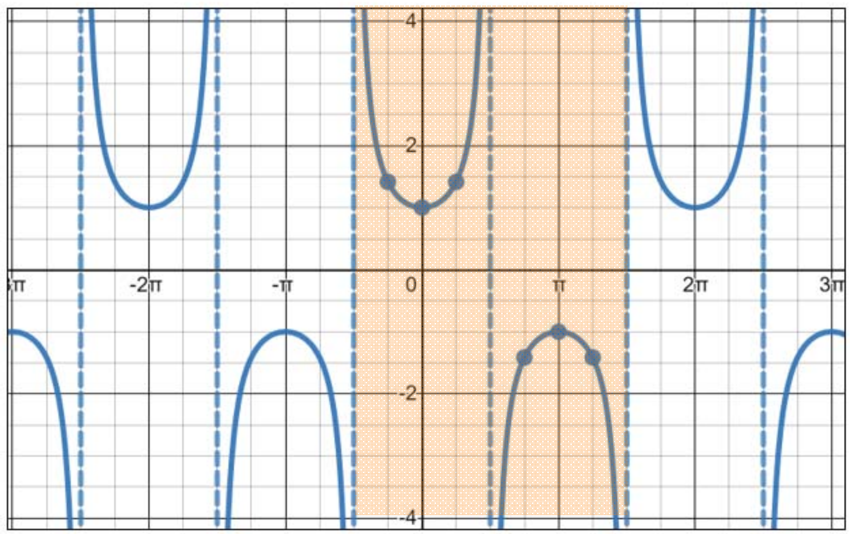
The Graph of $y = sec\, x$.

Period = 2π radians

Domain: $\left\{x \middle| x \neq \frac{\pi}{2}k \text{ where } k \text{ is any integer}\right\}$

Range: $(-\infty, -1] \cup [1, \infty)$

x	$\sec x$
$-\frac{\pi}{2}$	undefined
$-\frac{\pi}{4}$	1.4142136 $\approx \sqrt{2}$
0	1
$\frac{\pi}{4}$	1.4142136 $\approx \sqrt{2}$
$\frac{\pi}{2}$	undefined
$\frac{3\pi}{4}$	−1.4142136 $\approx -\sqrt{2}$
π	−1
$\frac{5\pi}{4}$	−1.4142136 $\approx -\sqrt{2}$
$\frac{3\pi}{2}$	undefined



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Objective: Graph cosecant and secant with period changes and phase shifts.

Ex) Identify the period and phase shift. Sketch as much of the function as possible on the given graph.

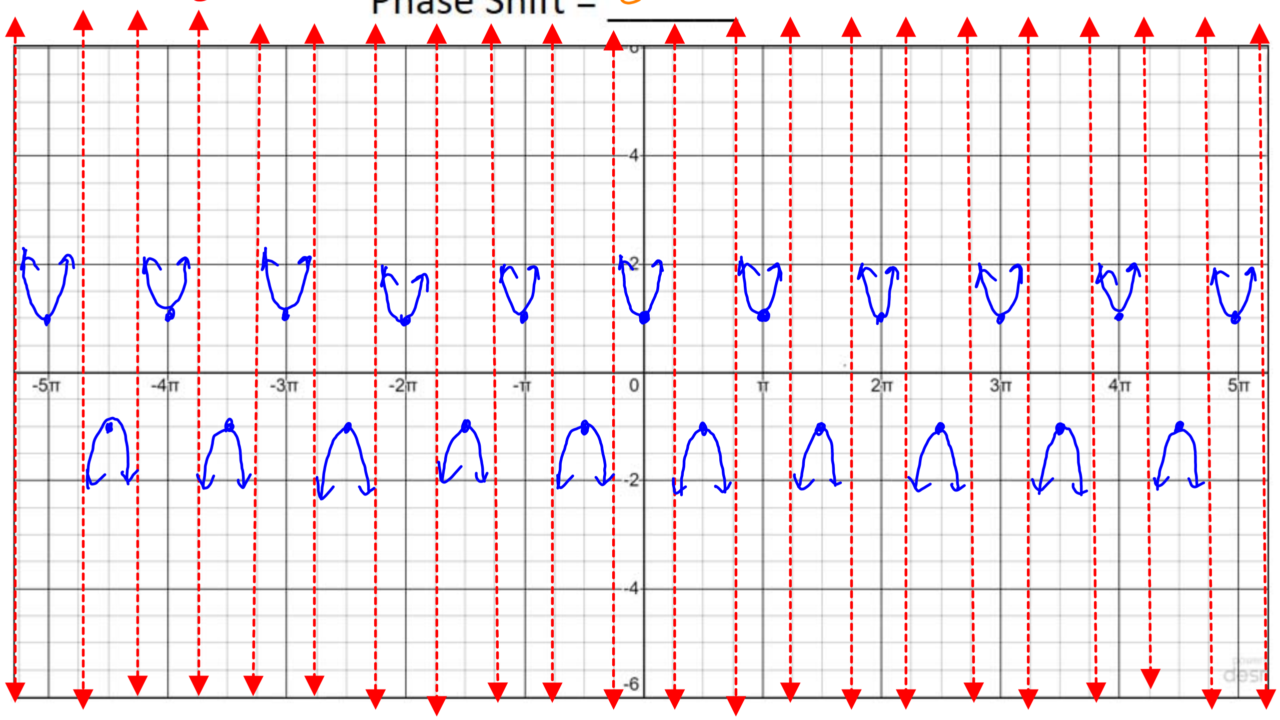
$y = \sec 2x$

$y = \underset{a}{1}\sec(\underset{\frac{1}{b}}{2}x \underset{\text{opp} = c}{- 0}) + \overset{k}{0}$

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

* horiz. comp. $b = \frac{1}{2}$

Phase Shift = $\frac{0}{2} = 0$ radians



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