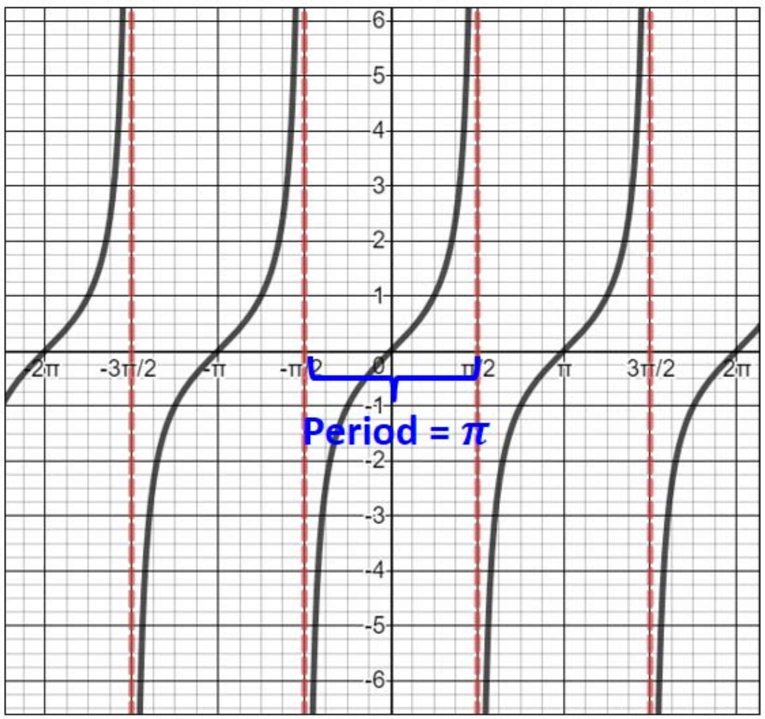
Objective: Graph tangent and cotangent.

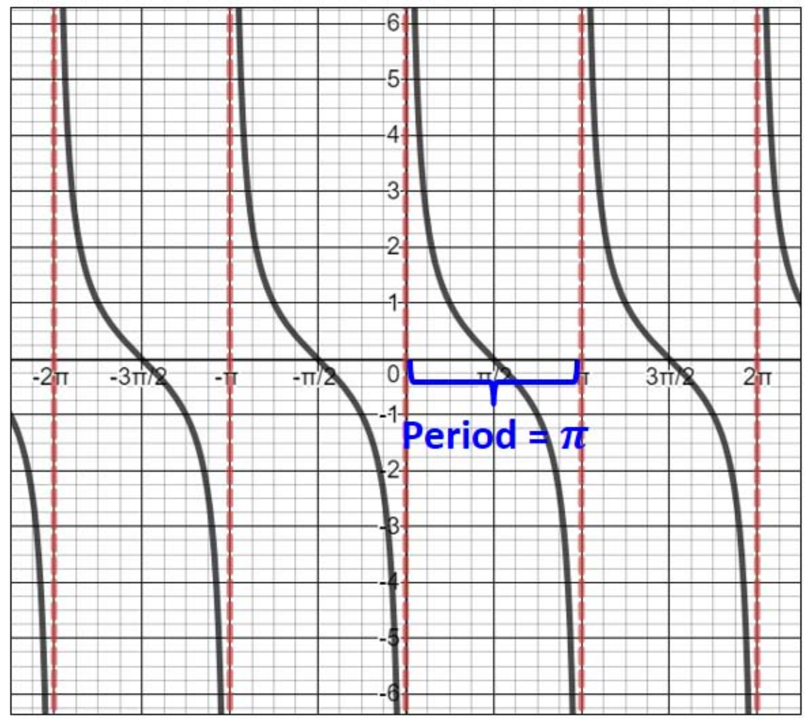
Concept

The functions $\boldsymbol{f(x) = \tan x}$ **and** $\boldsymbol{f(x) = \cot x}$ **both have a period of** $\boldsymbol{\pi}$ **radians,** which is the length of the interval between vertical asymptotes where the functions are undefined. **There is no amplitude for either function** since they do not have a maximum or minimum.

$$f(x) = \tan x$$



$$f(x) = \cot x$$



Objective: Graph tangent and cotangent.

Concept

One way to graph tangent and cotangent is to use the key points of the parent function which are shown in the tables and transform these points according to the parameters in the function.

x	$f(x) = \tan x$
$-\frac{\pi}{2}$	undefined
$-\frac{\pi}{4}$	-1
0	0
$\frac{\pi}{4}$	1
$\frac{\pi}{2}$	undefined

x	$f(x) = \cot x$
0	undefined
$\frac{\pi}{4}$	1
$\frac{\pi}{2}$	0
$\frac{3\pi}{4}$	-1
π	undefined

Objective: Graph tangent and cotangent.

Concept

To graph $g(x) = a \cdot \tan\left(\frac{1}{b}x - c\right) + k$ or $g(x) = a \cdot cot\ \left(\frac{1}{b}x - c\right) + k$

Period = $\frac{\pi}{\left|\frac{1}{b}\right|} = \pi \cdot |b|$

Phase Shift = $\frac{c}{\frac{1}{b}} = c \cdot b$

Note: Although there is no amplitude or midline for tangent and cotangent, the parameter of a creates a vertical stretch/compression and/or a reflection over the x-axis, and the parameter of k creates a vertical translation.

1. Determine the period and phase shift. **The scale of $\frac{\pi}{4}$ radians is recommended for the x-axis. If this scale won't work, use the strategy of dividing the period by 4.**
2. Locate the vertical asymptote on the left side of the first cycle and then locate the vertical asymptote at the end of the first cycle. Graph the point of inflection halfway between the asymptotes. Graph the other two key points halfway between the point of inflection and each asymptote. Make sure to apply any stretch, compression, reflection and/or vertical translation to these points.
3. Draw a smooth curve that approaches the asymptotes.
4. Extend the cycles as necessary.

Objective: Graph tangent and cotangent.

Ex) Determine the period and phase shift. Then graph two cycles of the function.

$$g(x) = \tan\frac{x}{3}$$

$g(x) = 1 \cdot \tan\left(\frac{1}{3}x - 0\right) + 0$

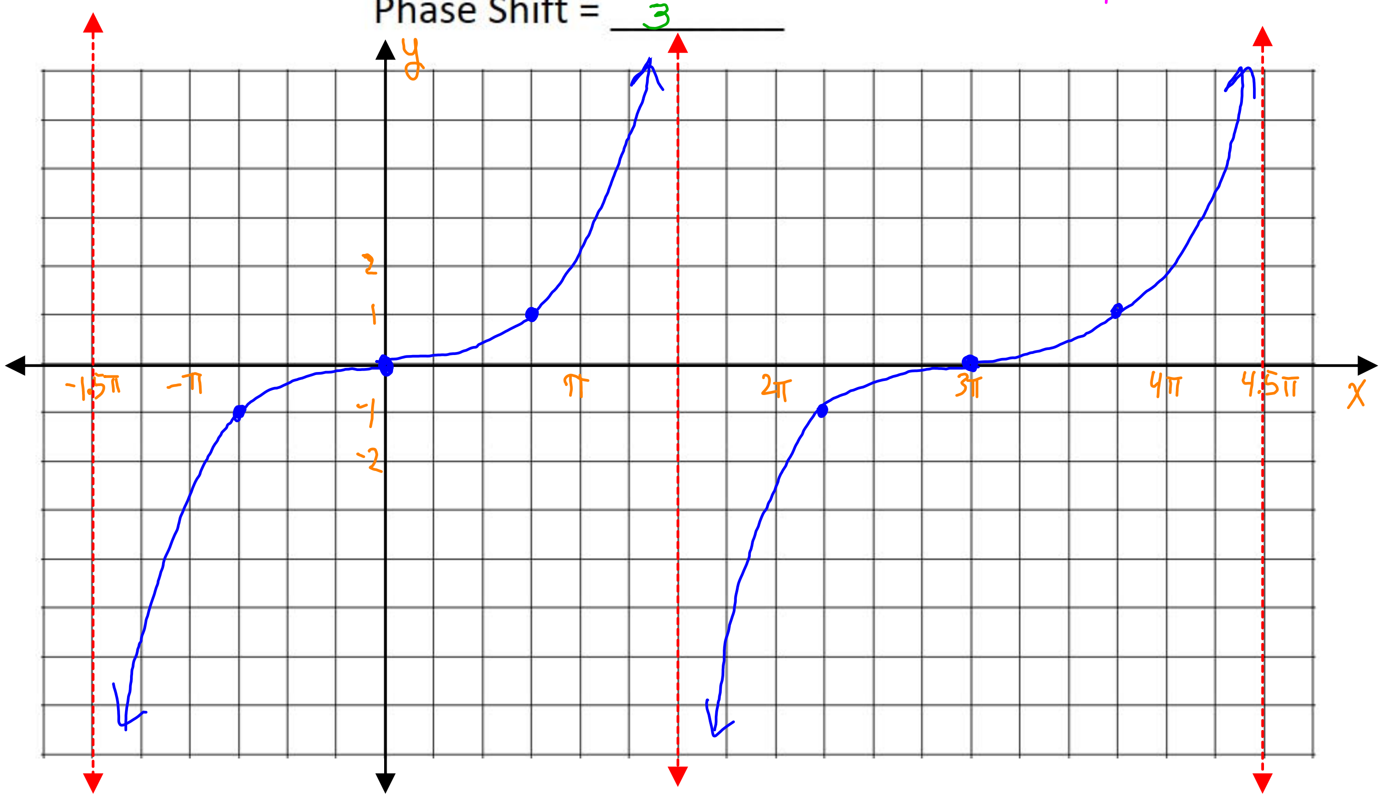
a, $\frac{1}{b}$, opp $= c$, k

$b = 3 \rightarrow$ horiz. stretch

Period = $\frac{\pi}{\frac{1}{3}} = \pi \cdot 3 = 3\pi$

possible scale: $\frac{3\pi}{4}$ or $\frac{\pi}{4}$ ☆

Phase Shift = $\frac{0}{\frac{1}{3}} = 0$ radians



00:04:30 / 00:15:00

Objective: Graph tangent and cotangent.

Ex) Determine the period and phase shift. Then graph two cycles of the function.

$g(x) = \cot 2x$

$a = 1$ $\quad \frac{1}{b}$

$c = 0$

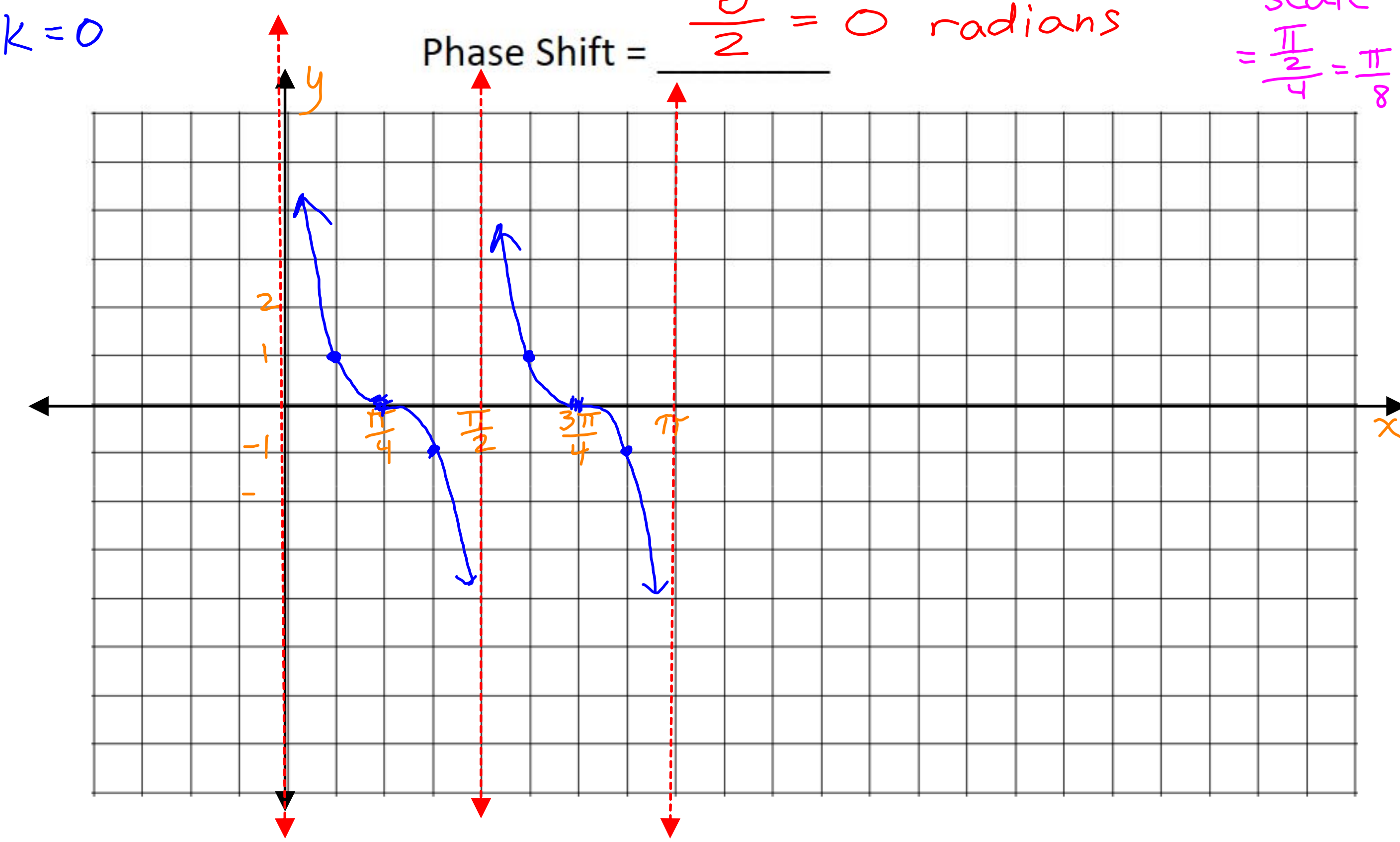
$k = 0$

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

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

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

possible scale $= \frac{\frac{\pi}{2}}{4} = \frac{\pi}{8}$ *



Objective: Graph tangent and cotangent.

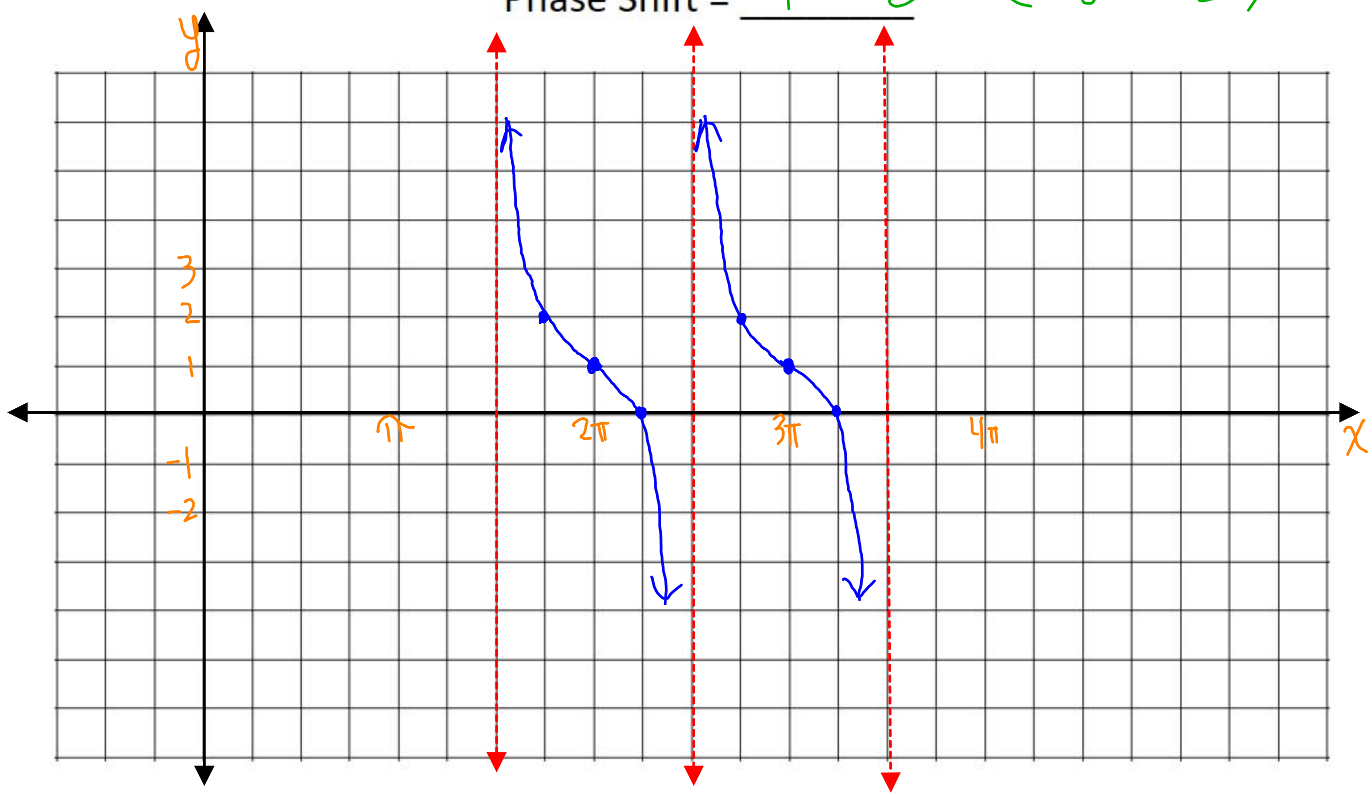
Ex) Determine the period and phase shift. Then graph two cycles of the function.

$$g(x) = \cot\left(1x - \frac{3\pi}{2}\right) + 1$$

$\frac{1}{b}$ opp $= c$ up 1 k

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

Phase Shift = $\frac{\frac{3\pi}{2}}{1} = \frac{3\pi}{2} \rightarrow$ (right $\frac{3\pi}{2}$)



00:00:21 / 00:15:00

Objective: Graph tangent and cotangent.

Ex) Determine the period and phase shift. Then graph two cycles of the function.

$$g(x) = 0.5\tan\left(1x + \frac{\pi}{2}\right)$$

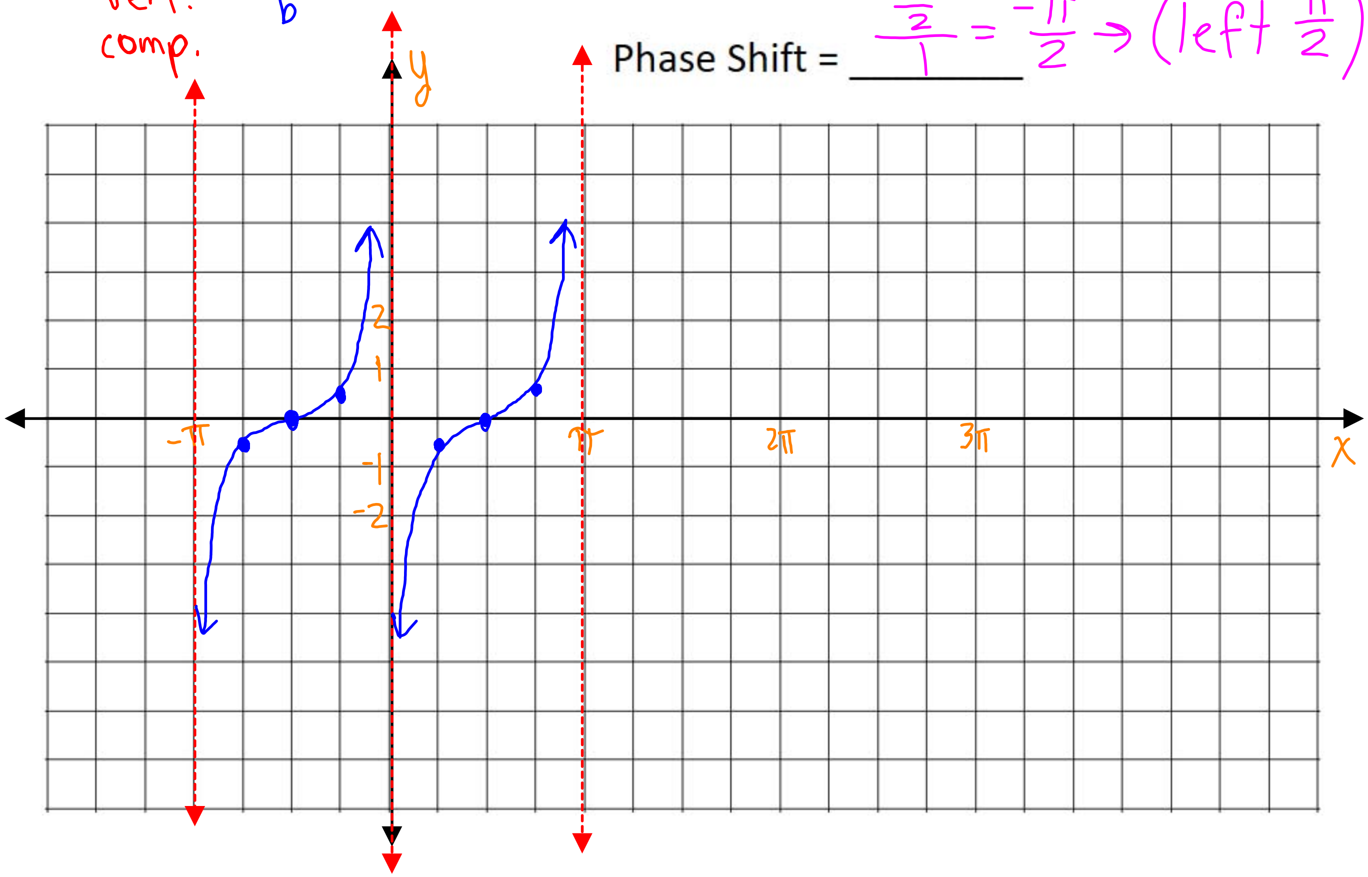
a → vert. comp.

$\frac{1}{b}$

opp = C

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

Phase Shift = $\frac{-\frac{\pi}{2}}{1} = -\frac{\pi}{2} \rightarrow$ (left $\frac{\pi}{2}$)



00:05:21 / 00:15:00

Objective: Graph tangent and cotangent.

Ex) Determine the period and phase shift. Then graph two cycles of the function.

$$g(x) = -\tan\left(\frac{x}{2} - \frac{\pi}{4}\right)$$

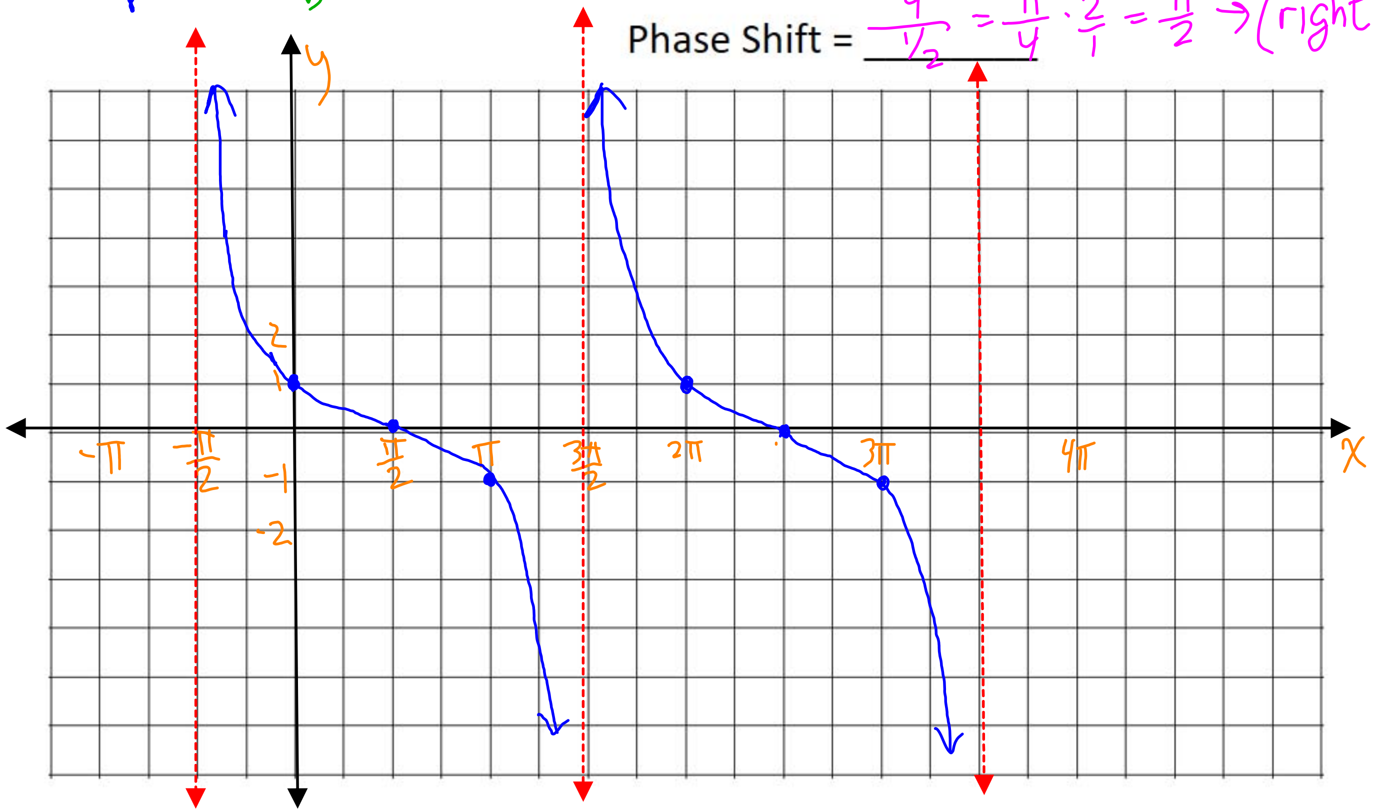
$a = -1$ → x-axis refl.

$\left(\frac{1}{2}x - \frac{\pi}{4}\right)$ $\frac{1}{b}$ opp = c

Period = $\frac{\pi}{\frac{1}{2}} = \pi \cdot 2 = 2\pi$ → $b = 2$ horiz. stretch

scale = $\frac{2\pi}{4} = \frac{\pi}{2}$ or ★ $\frac{\pi}{4}$

Phase Shift = $\frac{\frac{\pi}{4}}{\frac{1}{2}} = \frac{\pi}{4} \cdot \frac{2}{1} = \frac{\pi}{2}$ → (right $\frac{\pi}{2}$)



00:09:36 / 00:15:00