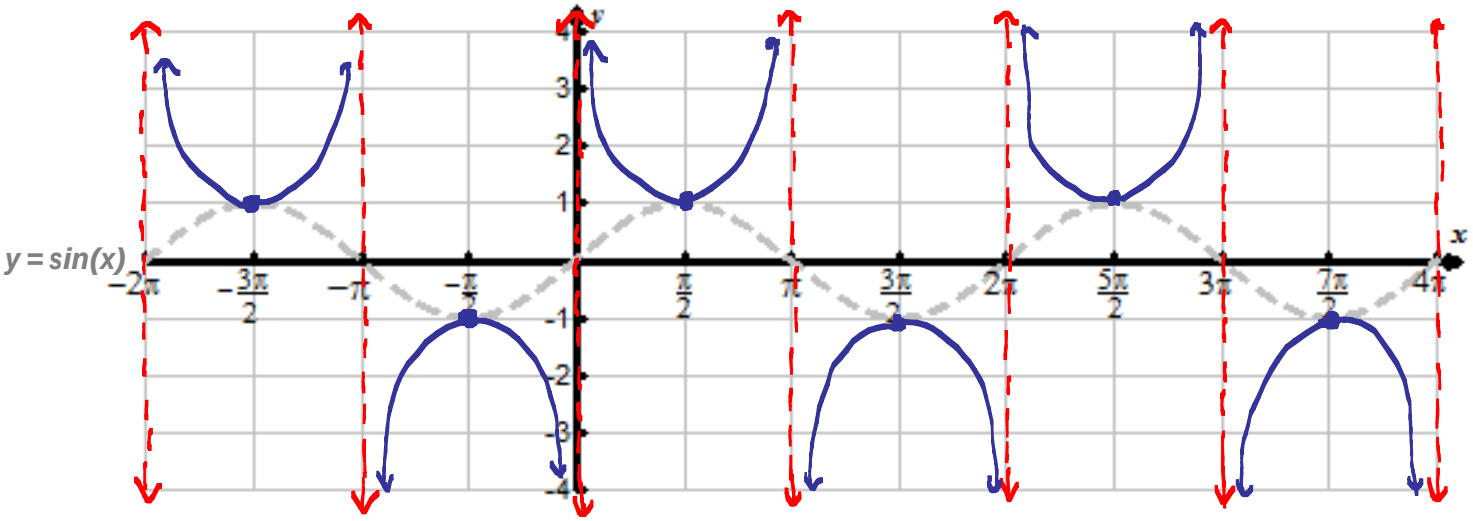
Recall, $sin(\theta) = \frac{opp}{hyp}$, $csc(\theta) = \frac{hyp}{opp}$, $cos(\theta) = \frac{adj}{hyp}$, and $sec(\theta) = \frac{hyp}{adj}$. Use this to show:

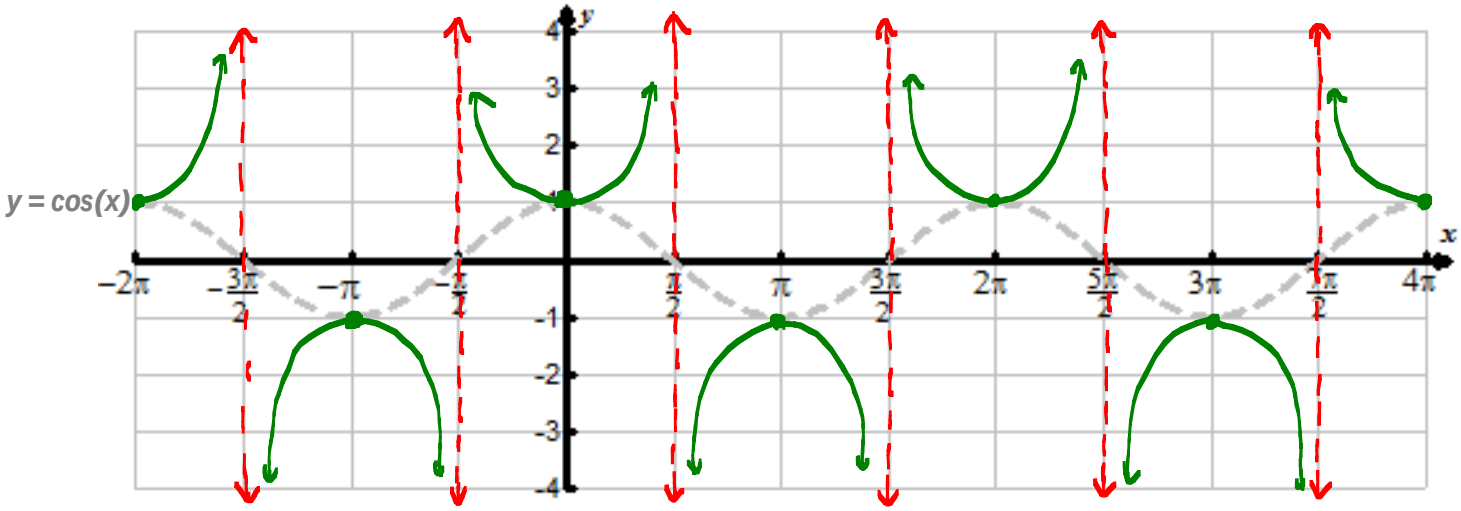
$\frac{1}{sin(\theta)} = \frac{1}{\frac{OPP}{HYP}} = 1 \div \frac{OPP}{HYP} = 1 \cdot \frac{HYP}{OPP} = Csc(\theta)$

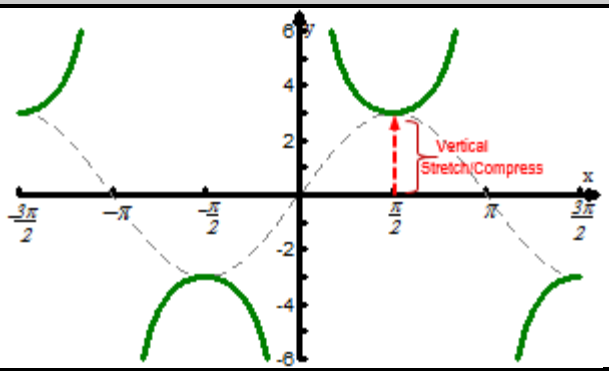
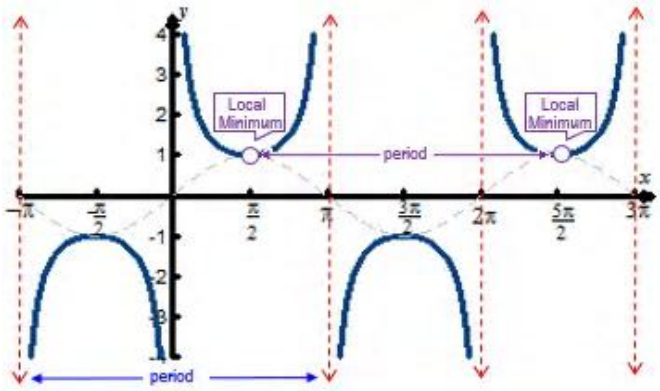
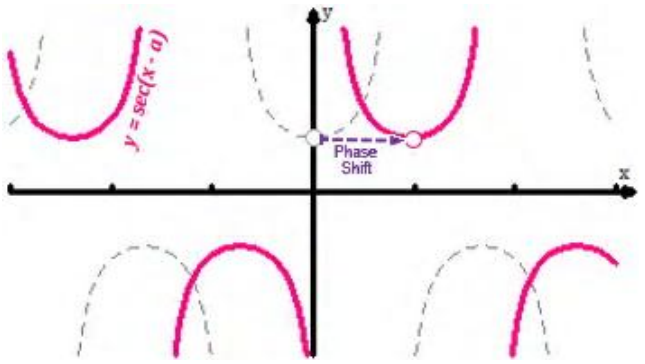
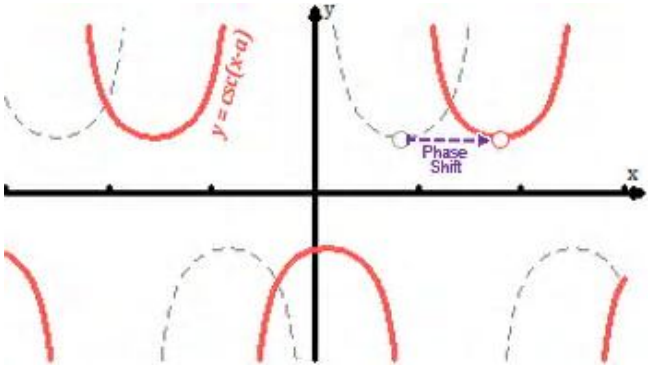
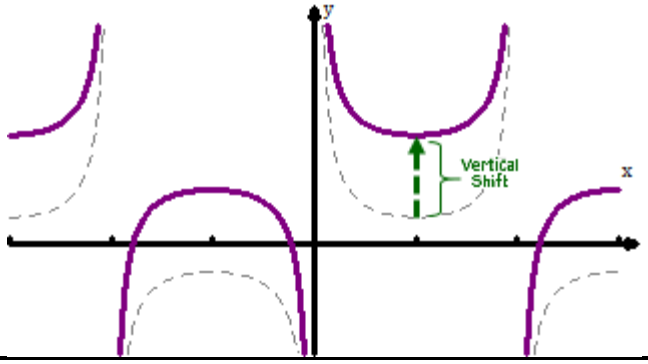
$\frac{1}{cos(\theta)} = \frac{1}{\frac{ADJ}{HYP}} = 1 \div \frac{ADJ}{HYP} = 1 \cdot \frac{HYP}{ADJ} = Sec(\theta)$

Use the above relationship to help you graph $y = csc(x)$.



Use the above relationship to help you graph $y = sec(x)$.



Parts of a Tangent and Cotangent Graph	Visual
Vertical Stretch/Compress: **Secant and Cosecant graphs have a vertical stretch that would be equivalent to the amplitude of their reciprocal trig function.** $\textbf{Vertical Factor} = \frac{(Local\ Max\ Y) - (Local\ Min\ Y)}{2}$	
Period: **The period of the graph is the horizontal distance of one complete cycle.** $\textbf{Period} = (Local\ Min\ X) - (Previous\ Local\ Min\ X)$ $\textbf{Period} = (Local\ Max\ X) - (Previous\ Local\ Max\ X)$ $\textbf{Period} = (Asymptote\ X) - (2nd\ Previous\ Asymptote\ X)$	
Phase Shift (Secant): **The amount the graph is shifted right/ left** $\textbf{Secant Phase Shift} = Local\ Min\ X$	
Phase Shift (Cosecant): **The amount the graph is shifted right/ left** $\textbf{Cosecant Phase Shift} = \frac{Local\ Max\ X + Next\ Local\ Min\ X}{2}$	
Vertical Shift: **The amount the graph is shifted up/down** $\textbf{Vertical Shift} = \frac{Local\ Max\ Y + Local\ Min\ Y}{2}$	

$$y = a \cdot sec\big(b(x - c)\big) + d$$

$$y = a \cdot csc\big(b(x - c)\big) + d$$

a = Vertical Stretch/Compress

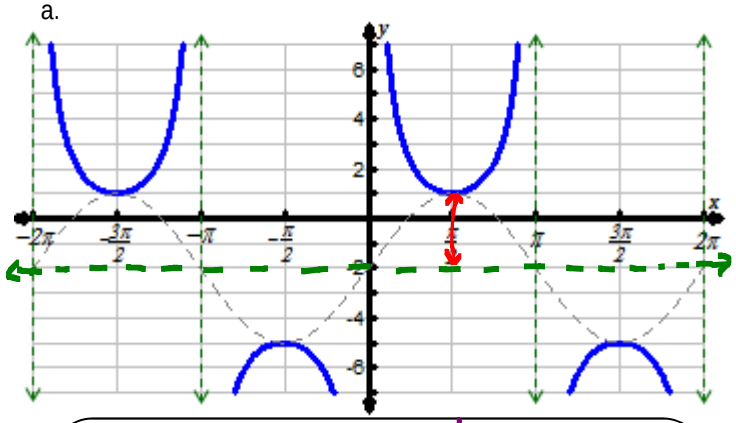
$\frac{2\pi}{b}$ = Period

c = Phase Shift

d = Vertical Shift

1. Find the parameters of each **SECANT/COSECANT** graph and determine a possible equation.

a.

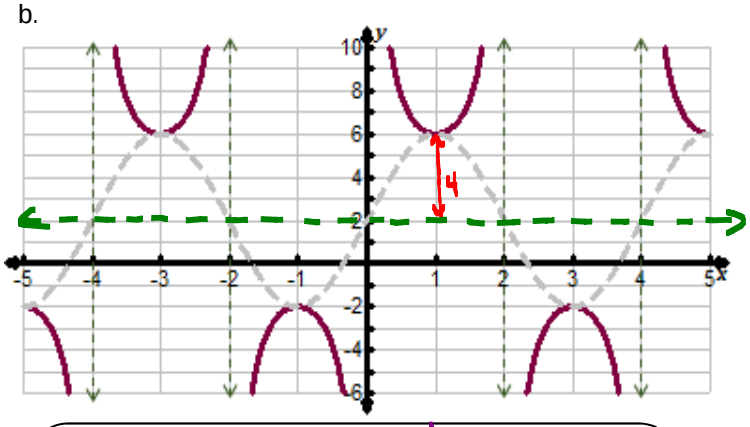


Vertical Stretch/Compress : 3 Period: 2π Phase Shift: 0 Vertical Shift: -2

$y = 3\csc\left(\frac{2\pi}{2\pi}(x - 0)\right) - 2$

Possible Equation: $y = 3\csc(x) - 2$ *(Using Cosecant)*

b.

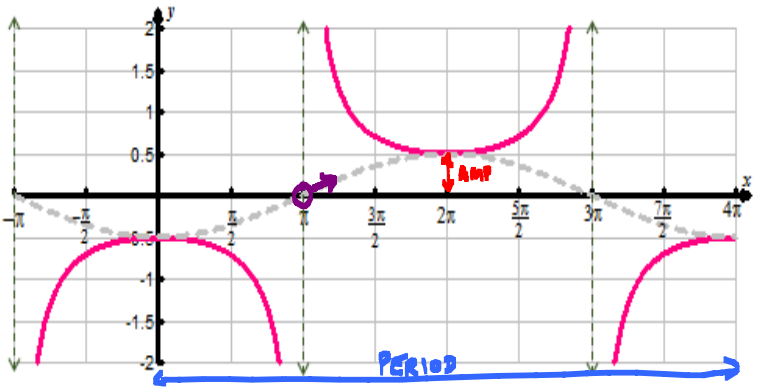


Vertical Stretch/Compress : 4 Period: 4 Phase Shift: 0 Vertical Shift: 2

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

Possible Equation: $y = 4\csc\left(\frac{\pi}{2}(x)\right) + 2$ *(Using Cosecant)*

c.

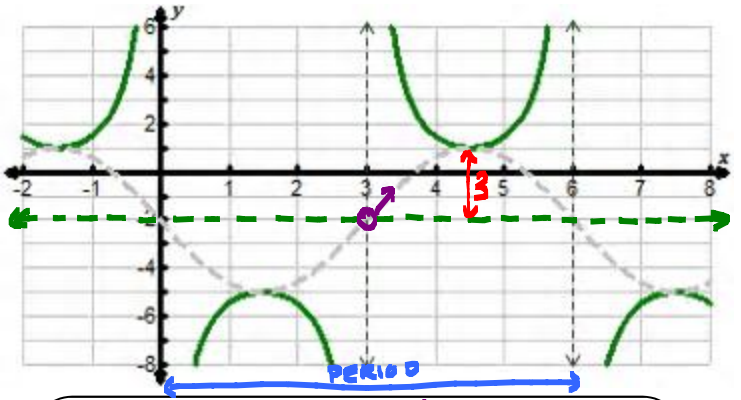


Vertical Stretch/Compress : 0.5 Period: 4π Phase Shift: π Vertical Shift: 0

$y = 0.5\csc\left(\frac{2\pi}{4\pi}(x - \pi)\right) + 0$

Possible Equation: $y = 0.5\csc\left(\frac{1}{2}(x - \pi)\right)$ *(Using Cosecant)*

d.



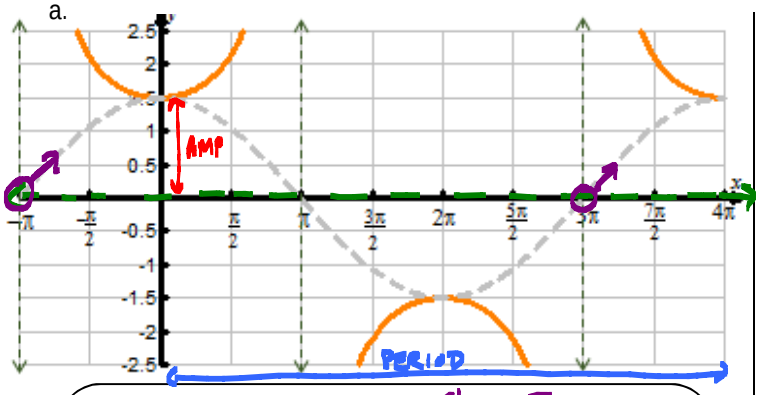
Vertical Stretch/Compress : 3 Period: 6 Phase Shift: 3 Vertical Shift: -2

$y = 3\csc\left(\frac{2\pi}{6}(x - 3)\right) - 2$

Possible Equation: $y = 3\csc\left(\frac{\pi}{3}(x - 3)\right) - 2$ *(Using Cosecant)*

2. Find the parameters of each **SECANT / COSECANT** graph and determine a possible equation.

a.

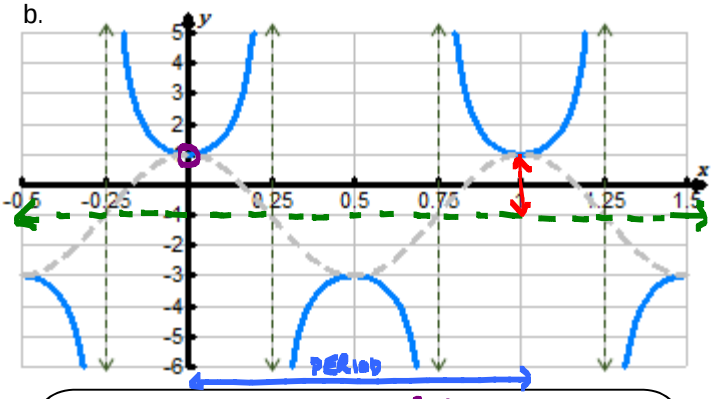


Vertical Stretch/Compress: 1.5 Period: 4π Phase Shift: Sin $-\pi$ or 3π Vertical Shift: 0

$y = 1.5 \csc\left(\frac{2\pi}{4\pi}(x - -\pi)\right) + 0$

Possible Equation: *(Using Cosecant)* $y = 1.5 \csc\left(\frac{\pi}{2}(x+\pi)\right)$

b.

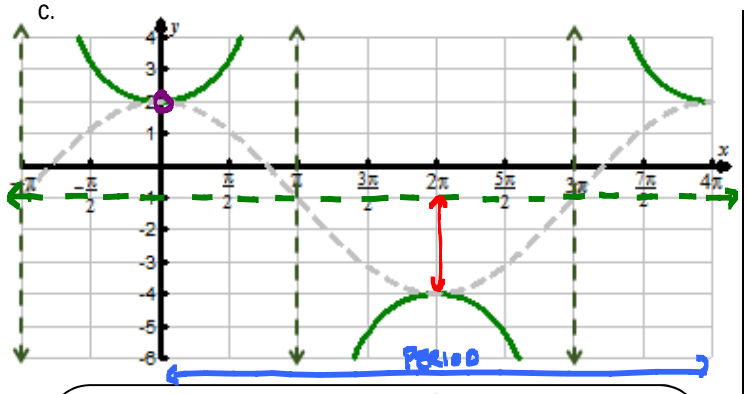


Vertical Stretch/Compress: 2 Period: 1 Phase Shift: Cos 0 Vertical Shift: -1

$y = 2 \sec\left(\frac{2\pi}{1}(x-0)\right) - 1$

Possible Equation: *(Using Secant)* $y = 2\sec(2\pi(x)) - 1$

c.

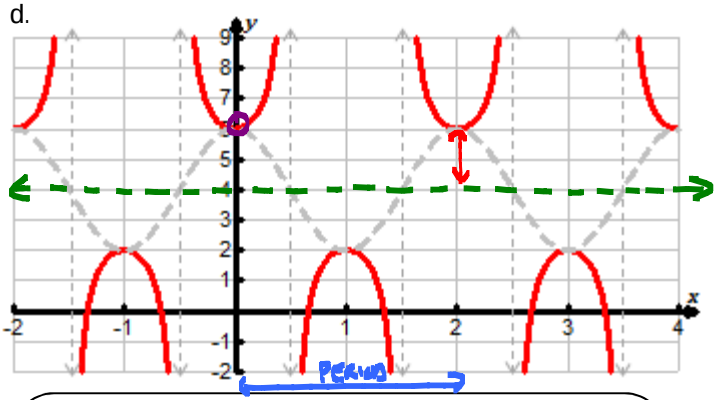


Vertical Stretch/Compress: 3 Period: 4π Phase Shift: Cos 0 Vertical Shift: -1

$y = 3 \sec\left(\frac{2\pi}{4\pi}(x-0)\right) - 1$

Possible Equation: *(Using Secant)* $y = 3\sec\left(\frac{1}{2}(x)\right) - 1$

d.

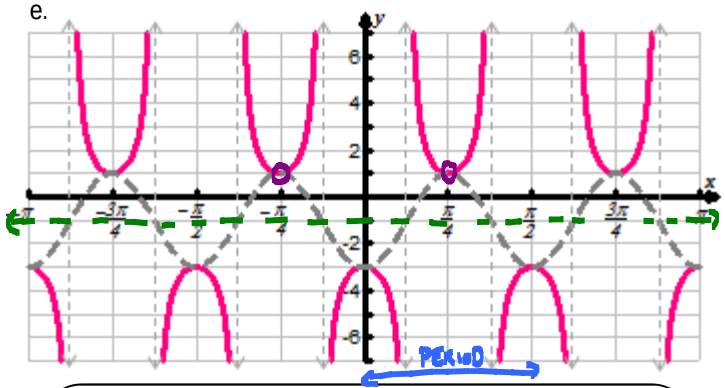


Vertical Stretch/Compress: 2 Period: 2 Phase Shift: Cos 0 Vertical Shift: 4

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

Possible Equation: *(Using Secant)* $y = 2\sec(\pi(x)) + 4$

e.

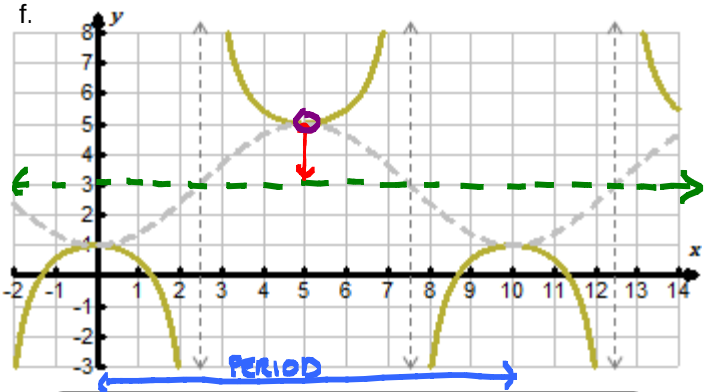


Vertical Stretch/Compress: 2 Period: $\frac{\pi}{2}$ Phase Shift: Cos $\frac{\pi}{2}$ Vertical Shift: -1

$y = 2 \sec\left(\frac{2\pi}{\pi/2}(x - \frac{\pi}{2})\right) - 1$

Possible Equation: *(Using Secant)* $y = 2\sec(4(x - \pi/2)) - 1$

f.



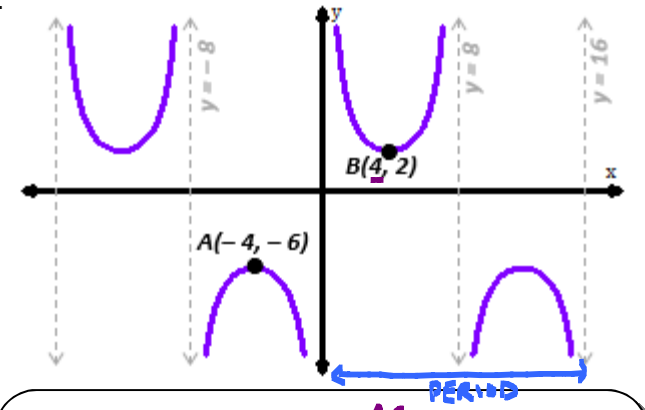
Vertical Stretch/Compress: 2 Period: 10 Phase Shift: Cos 5 Vertical Shift: 3

$y = 2 \sec\left(\frac{2\pi}{10}(x-5)\right) + 3$

Possible Equation: *(Using Secant)* $y = 2\sec\left(\frac{\pi}{5}(x-5)\right) + 3$

3. Find the parameters of each **SECANT/COSECANT** graph and determine a possible equation.

a.

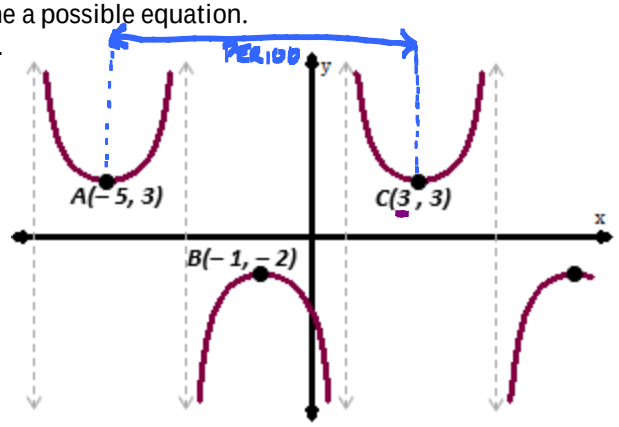


Vertical Stretch/Compress: 4 Period: 16 Phase Shift (Cos): 4 Vertical Shift: −2

$y = 4\sec\left(\frac{2\pi}{16}(x-4)\right)-2$

Possible Equation: *(Using Secant)* $y = 4\sec\left(\frac{\pi}{8}(x-4)\right)-2$

b.

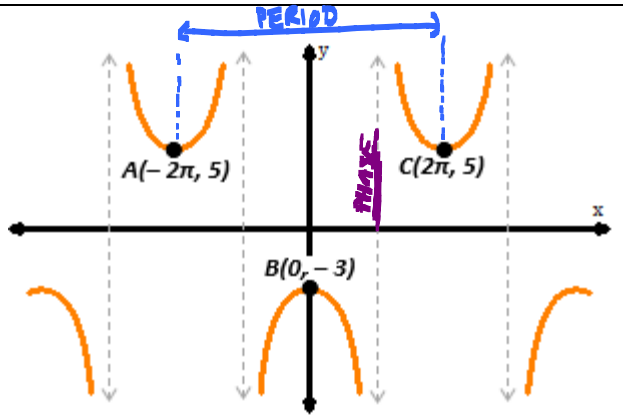


Vertical Stretch/Compress: 2.5 Period: 8 Phase Shift (Cos): 3 Vertical Shift: 0.5

$y = 2.5\sec\left(\frac{2\pi}{8}(x-3)\right)+0.5$

Possible Equation: *(Using Secant)* $y = 2.5\sec\left(\frac{\pi}{4}(x-3)\right)+0.5$

c.

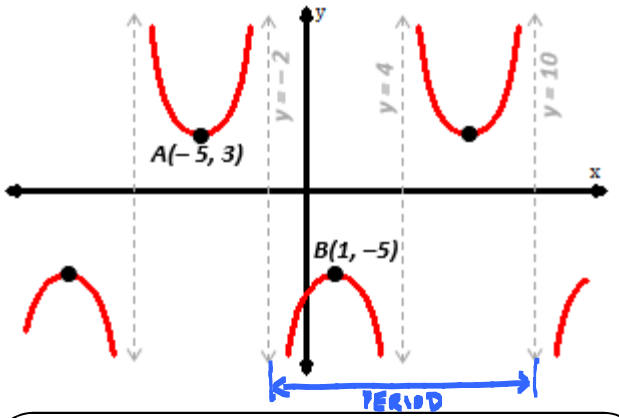


Vertical Stretch/Compress: 4 Period: 4π Phase Shift: π Vertical Shift: 1

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

Possible Equation: *(Using Cosecant)* $y = 4\csc\left(\frac{1}{2}(x-\pi)\right)+1$

d.



Vertical Stretch/Compress: 4 Period: 12 Phase Shift: 4 Vertical Shift: −1

$y = 4\csc\left(\frac{2\pi}{12}(x-4)\right)-1$

Possible Equation: *(Using Cosecant)* $y = 4\csc\left(\frac{\pi}{6}(x-4)\right)-1$

4. Find the requested **SECANT/COSECANT** parameters based on the following equations.

a. $y = 3\sec(2x-6)+1$

$y = 3\sec\left(2(x-3)\right)+1$

Vertical Stretch/Compress = STRETCH FACTOR 3 Period = $\frac{2\pi}{2} = \pi$

Phase Shift = 3 Vertical Shift = 1

b. $y = 0.5\csc\left(\frac{2\pi}{3}(x+1)\right)-3$

Vertical Stretch/Compress = COMPRESS FACTOR 0.5 Period = $\frac{2\pi}{2\pi/3} = 3$

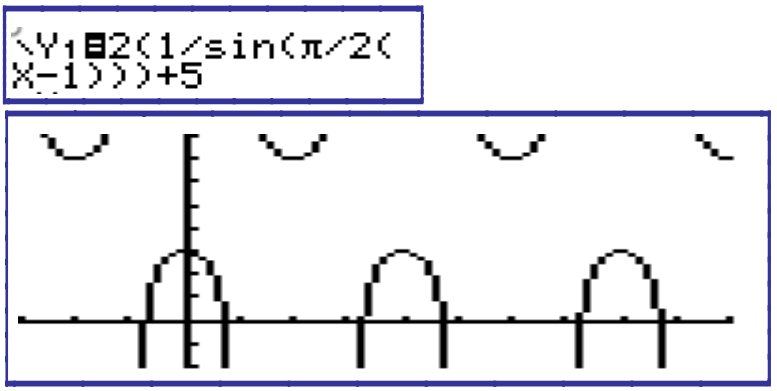
Phase Shift = −1 Vertical Shift = −3

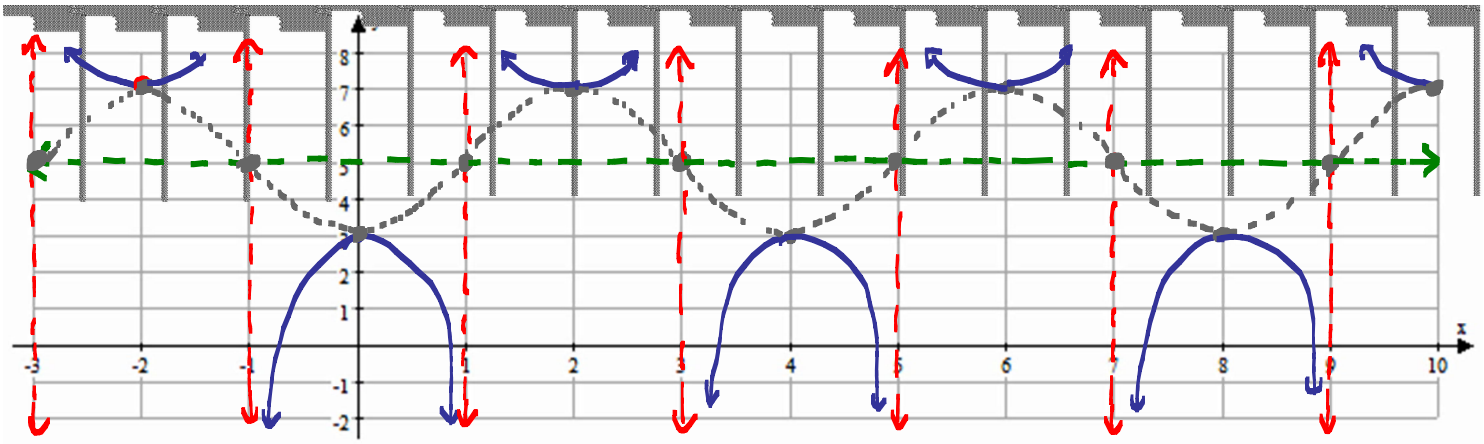
5. Graph the following equation.

a. $y = 2\csc\left(\frac{\pi}{2}(x-1)\right)+5$

GRAPH $y = 2\sin\left(\frac{\pi}{2}(x-1)\right)+5$ FIRST

AMP = 2 | PER = $\frac{2\pi}{\pi/2}$ = 4 | PHASE = 1 | VERT SHIFT = 5





b. $y = 2\sec\left(2\left(x-\frac{\pi}{2}\right)\right)+6$

GRAPH $y = 2\cos\left(2(x-\pi/2)\right)+6$ FIRST

AMP = 2 | PERIOD = $\frac{2\pi}{2}$ = π | PHASE = $\pi/2$ | VERT SHIFT = 6