

2.11 Additional Practice: Graphing Sec, Csc, Tan, Cot

Date _____

Find the Vertical Stretch, Period, Phase Shift, and Vertical Shift. Then graph the function.

1. $y = \csc\left(4\theta + \frac{\pi}{2}\right)$
 Vertical Stretch: none
 Period: $\frac{\pi}{2}$
 Phase Shift: left $\frac{\pi}{8}$
 Vertical Shift: none

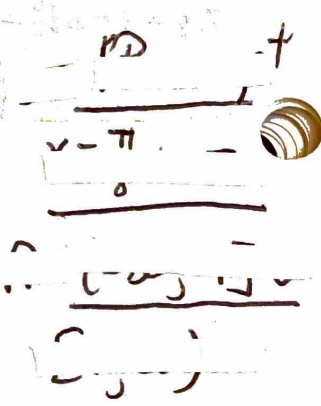
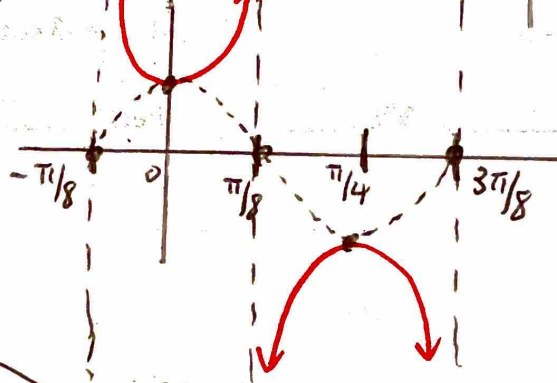
$$y = \csc\left[4\left(\theta + \frac{\pi}{8}\right)\right]$$

$$a=1 \quad b=4 \\ c=\frac{\pi}{8} \quad d=0$$

$$\text{period} = \frac{2\pi}{b} \rightarrow \frac{2\pi}{4} = \frac{\pi}{2} \quad I = \frac{1}{4} \cdot P \rightarrow \frac{1}{4} \cdot \frac{\pi}{2} = \frac{\pi}{8}$$

θ	$0 - \frac{\pi}{8}$	$\frac{\pi}{8} - \frac{\pi}{8}$	$\frac{2\pi}{8} - \frac{\pi}{8}$	$\frac{3\pi}{8} - \frac{\pi}{8}$	$\frac{4\pi}{8} - \frac{\pi}{8}$
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$\csc(4\theta)$	0	1	0	-1	0
$\csc(4\theta)$	0	1	0	-1	0



3. $y = -3 \sec(2\theta) + 1$
 Vertical Stretch: 3
 Period: π
 Phase Shift: none
 Vertical Shift: up 1

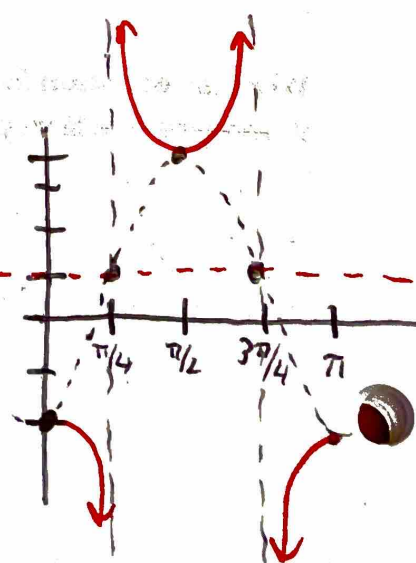
$$y = -3 \sec[2(\theta)] + 1$$

$$\text{period} = \frac{2\pi}{b} \rightarrow \frac{2\pi}{2} = \pi$$

$$a=-3 \quad c=0 \\ b=2 \quad d=1$$

$$I = \frac{1}{4} \cdot \pi = \frac{\pi}{4}$$

θ	0	$\frac{\pi}{4}$	$\frac{\pi}{2}$	$\frac{3\pi}{4}$	π
$\sec \theta$	1	0	-1	0	1
$-3 \sec \theta$	-3	0	3	0	-3



4. $y = 2.5 \csc\left(\theta - \frac{\pi}{4}\right) - 5$
 Vertical Stretch: _____
 Period: _____
 Phase Shift: _____
 Vertical Shift: _____

$$a=2 \quad c=0$$

$$b=1 \quad d=4$$

$$\text{period} = \frac{\pi}{b} \rightarrow \frac{\pi}{1} = \pi$$

$$I = \frac{1}{4} \cdot P \rightarrow \frac{1}{4} \cdot \pi = \frac{\pi}{4}$$

5. $y = 2 \tan \theta + 4$

Vertical Stretch: 2

Period: π

Phase Shift: none

Vertical Shift: up 4

θ	$-\frac{\pi}{2}$	$-\frac{\pi}{4}$	0	$\frac{\pi}{4}$	$\frac{\pi}{2}$
$\tan \theta$	und	-1	0	1	und
$2 \tan \theta$	und	-2	0	2	und

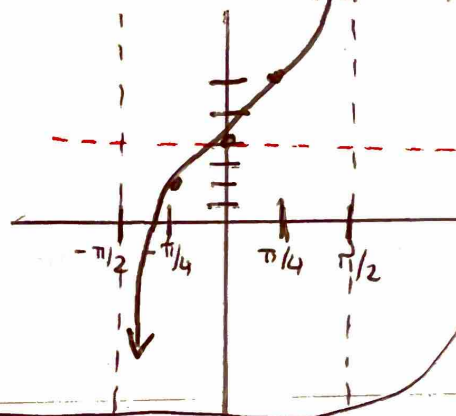
6. $y = \cot(2\theta - \frac{\pi}{2})$

Vertical Stretch: _____

Period: _____

Phase Shift: _____

Vertical Shift: _____



$$a=-3 \quad b=\frac{1}{3}$$

$$c=\frac{\pi}{2} \quad d=1$$

$$\text{period} = \frac{\pi}{b} \rightarrow \frac{\pi}{\frac{1}{3}} \rightarrow \pi \cdot \frac{3}{1} = 3\pi$$

$$I = \frac{1}{4} \cdot P \rightarrow \frac{1}{4} \cdot 3\pi = \frac{3\pi}{4}$$

7. $y = -3 \cot(\frac{\theta}{3} + \frac{\pi}{6}) + 1$

Vertical Stretch: 3

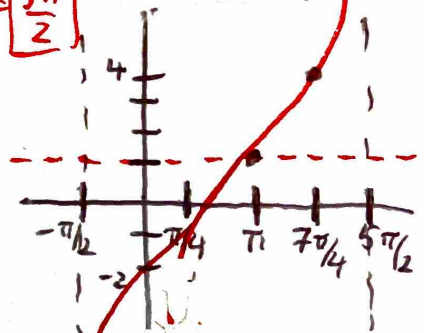
Period: 3π

Phase Shift: left $\frac{\pi}{2}$

Vertical Shift: up 1

$$y = -3 \left[\frac{1}{3} \left(\theta + \frac{\pi}{2} \right) \right] + 1$$

θ	0	$\frac{3\pi}{4}$	$\frac{6\pi}{4}$	$\frac{9\pi}{4}$	3π
$\cot \theta$	und	1	0	-1	und
$-3 \cot \theta$	und	-3	0	3	und



Write the equation described.

8. A secant function that has been shifted to the left $\frac{\pi}{3}$ units and down 4 units, and that has a wavelength of π units.

$$\text{period} = \pi \quad \frac{\pi}{1} = \frac{2\pi}{b} \quad b=2$$

$$\text{period} = \frac{2\pi}{b} \quad b\pi = 2\pi \quad c = \frac{\pi}{3}$$

$$d = -4$$

$$y = \sec\left[2\left(\theta + \frac{\pi}{3}\right)\right] - 4$$

9. A cotangent function that has a period of 3π , has been shifted to $\frac{\pi}{2}$ units to the right, and has been shifted 4 units up.

$$\text{period} = \frac{\pi}{b} \quad 3\pi b = \pi \quad b = \frac{\pi}{3\pi} = \frac{1}{3}$$

$$\frac{3\pi}{1} = \frac{\pi}{b} \quad c = -\frac{\pi}{2}$$

$$d = 4$$

$$y = \cot\left[\frac{1}{3}\left(\theta - \frac{\pi}{2}\right)\right] + 4$$

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2) $y = \sec\left(\frac{\theta}{2} - \pi\right)$

Vert. Sticht none

Period 4π

PS right 2π

VS none

$y = \sec\left[\frac{1}{2}(\theta - 2\pi)\right]$

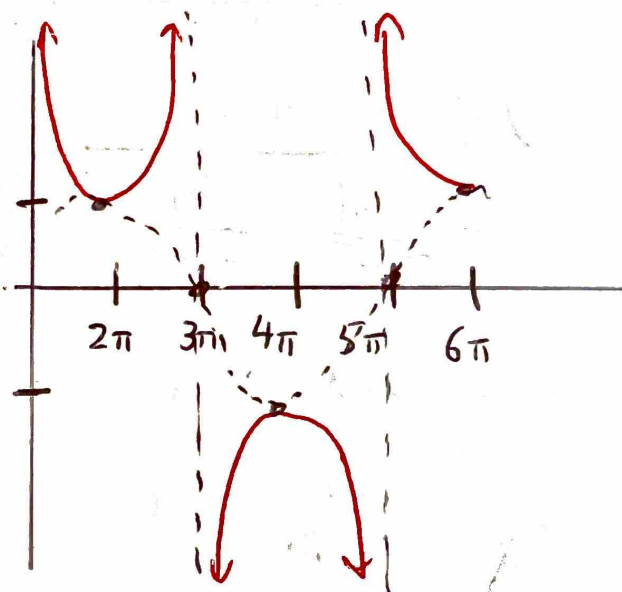
$a = 1$ $c = 2\pi$

$b = \frac{1}{2}$ $d = 0$

period = $\frac{2\pi}{b} \rightarrow \frac{2\pi}{\frac{1}{2}} \rightarrow 2\pi \cdot \frac{2}{1} = 4\pi$

$I = \frac{1}{4} \cdot P \rightarrow \frac{1}{4} \cdot 4\pi = \pi$

θ	$0 + 2\pi$	$\pi + 2\pi$	$2\pi + 2\pi$	$3\pi + 2\pi$	$4\pi + 2\pi$
$\sec \theta$	1	0	-1	0	1
$\sec \theta$	1	0	-1	0	1



$$4) y = 2.5 \csc\left(\theta - \frac{\pi}{4}\right) - 5$$

$$a = 2.5 \quad c = \frac{\pi}{4}$$

$$b = 1 \quad d = -5$$

vert. stretch 2.5

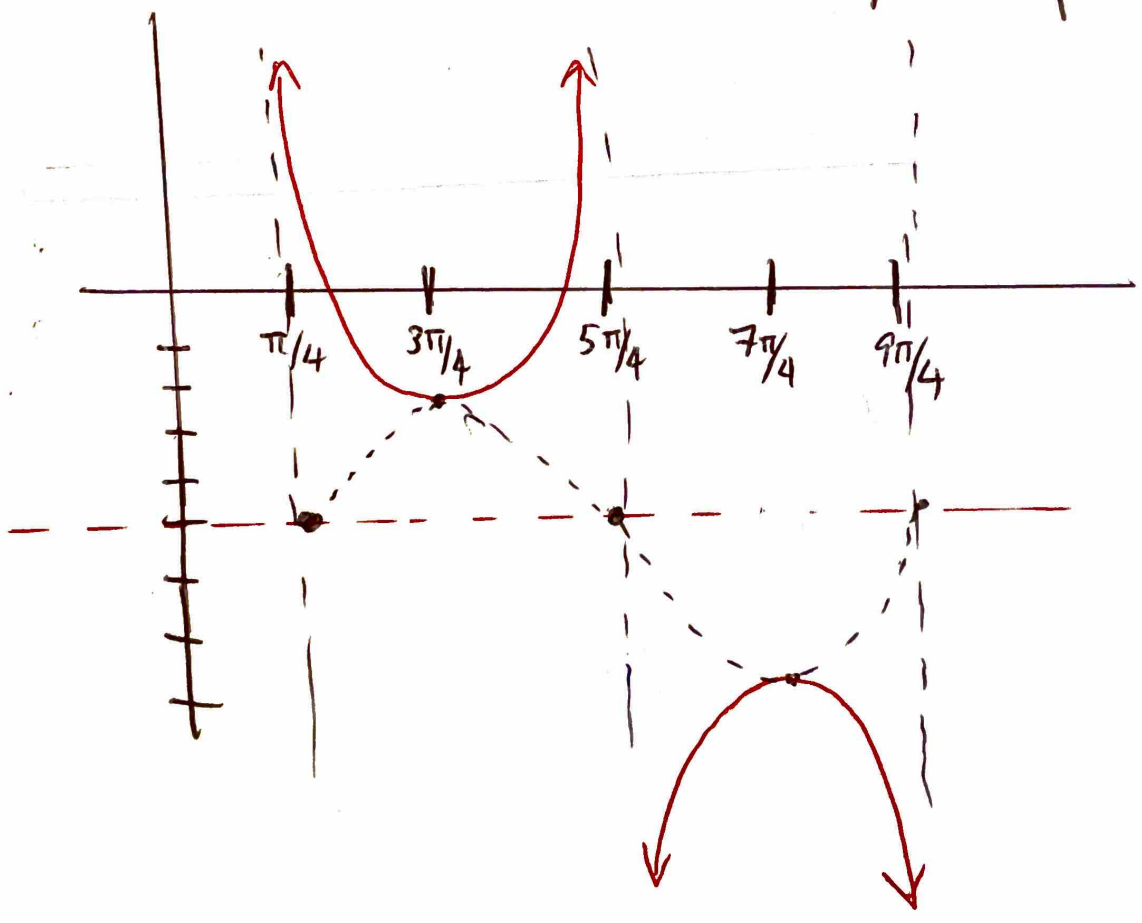
PS right $\frac{\pi}{4}$

VS down 5

Period 2π

$$I = \frac{1}{4} \cdot 2\pi = \frac{\pi}{2}$$

θ	$\frac{\pi}{4}$	$\frac{3\pi}{4}$	$\frac{5\pi}{4}$	$\frac{7\pi}{4}$	$\frac{9\pi}{4}$
$0 + \frac{\pi}{4}$	$\frac{\pi}{2} + \frac{\pi}{4}$	$\pi + \frac{\pi}{4}$	$\frac{3\pi}{2} + \frac{\pi}{4}$	$2\pi + \frac{\pi}{4}$	
$\csc \theta$	0	1	0	-1	0
$2.5 \csc \theta$	0	2.5	0	-2.5	0



6) $y = \cot(2\theta - \frac{\pi}{2})$

$y = \cot[2(\theta - \frac{\pi}{4})]$

Vert stretch: none

period $\frac{\pi}{2}$

PS right $\frac{\pi}{4}$

VS none

$a=1$ $c = -\frac{\pi}{4}$

$b=2$ $d=0$

period = $\frac{\pi}{b} \rightarrow \frac{\pi}{2} = \frac{\pi}{2}$

$I = \frac{1}{4} \cdot P$

$I = \frac{1}{4} \cdot \frac{\pi}{2} = \frac{\pi}{8}$

θ	$\frac{\pi/4}{0 + \frac{\pi}{4}}$	$\frac{3\pi/8}{\frac{\pi}{8} + \frac{2\pi}{8}}$	$\frac{\pi/2}{\frac{2\pi}{8} + \frac{2\pi}{8}}$	$\frac{5\pi/8}{\frac{3\pi}{8} + \frac{2\pi}{8}}$	$\frac{3\pi/4}{\frac{4\pi}{8} + \frac{2\pi}{8}}$
$\cot 2\theta$	und.	1	0	-1	und.
$\cot(2\theta)$	und.	1	0	-1	und.

