Accelerated Precalculus Name _____

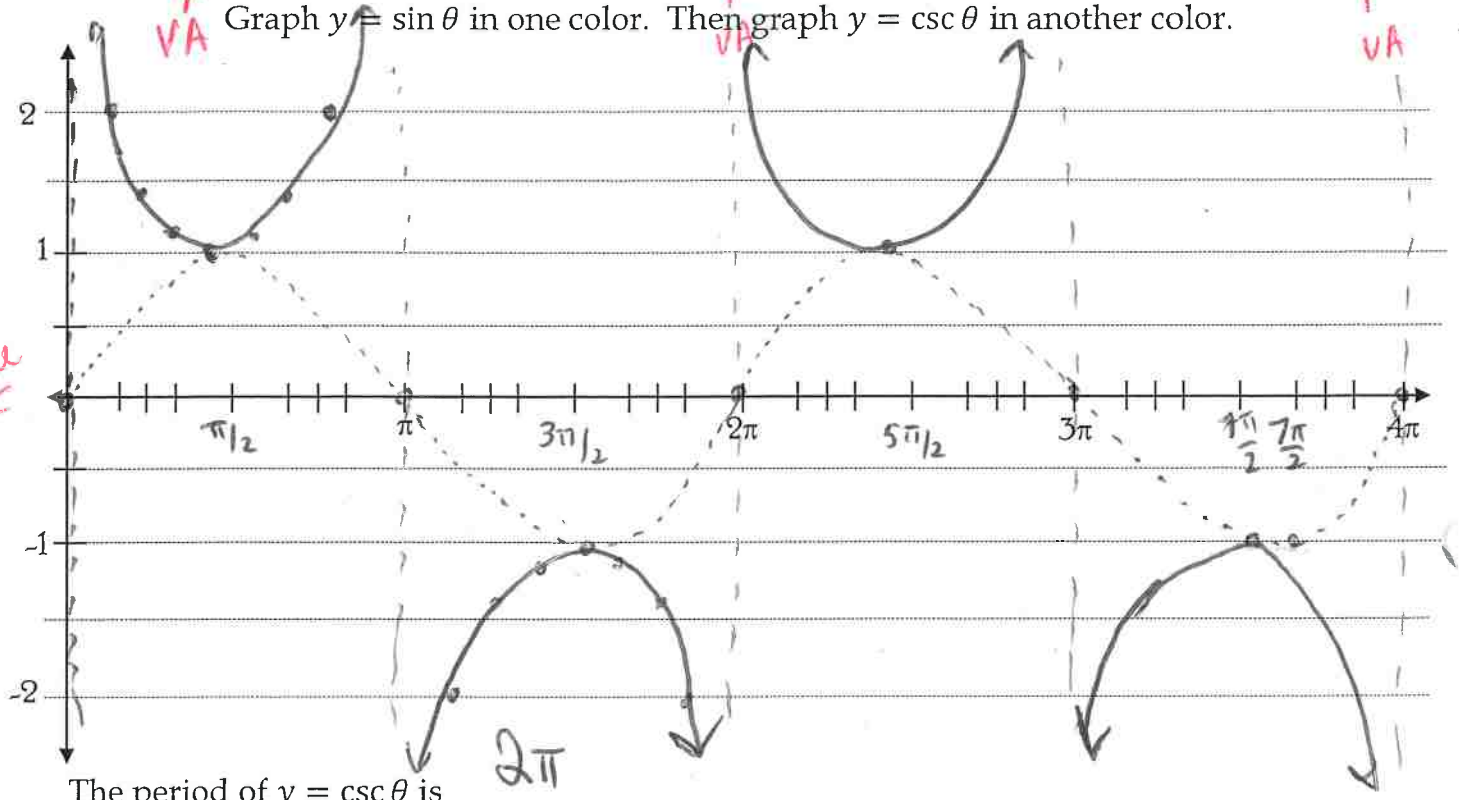
2.09: Exploring the Cosecant & Secant Graphs Date _____ Period _____

Radians	0	$\frac{\pi}{6}$	$\frac{\pi}{4}$	$\frac{\pi}{3}$	$\frac{\pi}{2}$	$\frac{2\pi}{3}$	$\frac{3\pi}{4}$	$\frac{5\pi}{6}$	π	$\frac{7\pi}{6}$	$\frac{5\pi}{4}$	$\frac{4\pi}{3}$	$\frac{3\pi}{2}$	$\frac{5\pi}{3}$	$\frac{7\pi}{4}$	$\frac{11\pi}{6}$	2π
Sine (decimal)	0	.5	.707	.866	1	.866	.707	.5	0	-.5	-.707	-.866	-1	-.866	-.707	-.5	0
Cosecant (decimal)	und	2	1.41	1.15	1	1.15	1.41	2	und.	-2	-1.41	-1.15	-1	-1.15	-1.41	-2	und.

1/sinθ

VA VA VA

Graph $y = \sin\theta$ in one color. Then graph $y = \csc\theta$ in another color.



d-value

The period of $y = \csc\theta$ is 2π

The domain of $y = \csc\theta$ is $\mathbb{R}$ except πn where $n \in \mathbb{Z}$

The range of $y = \csc\theta$ is $(-\infty, -1] \cup [1, \infty)$

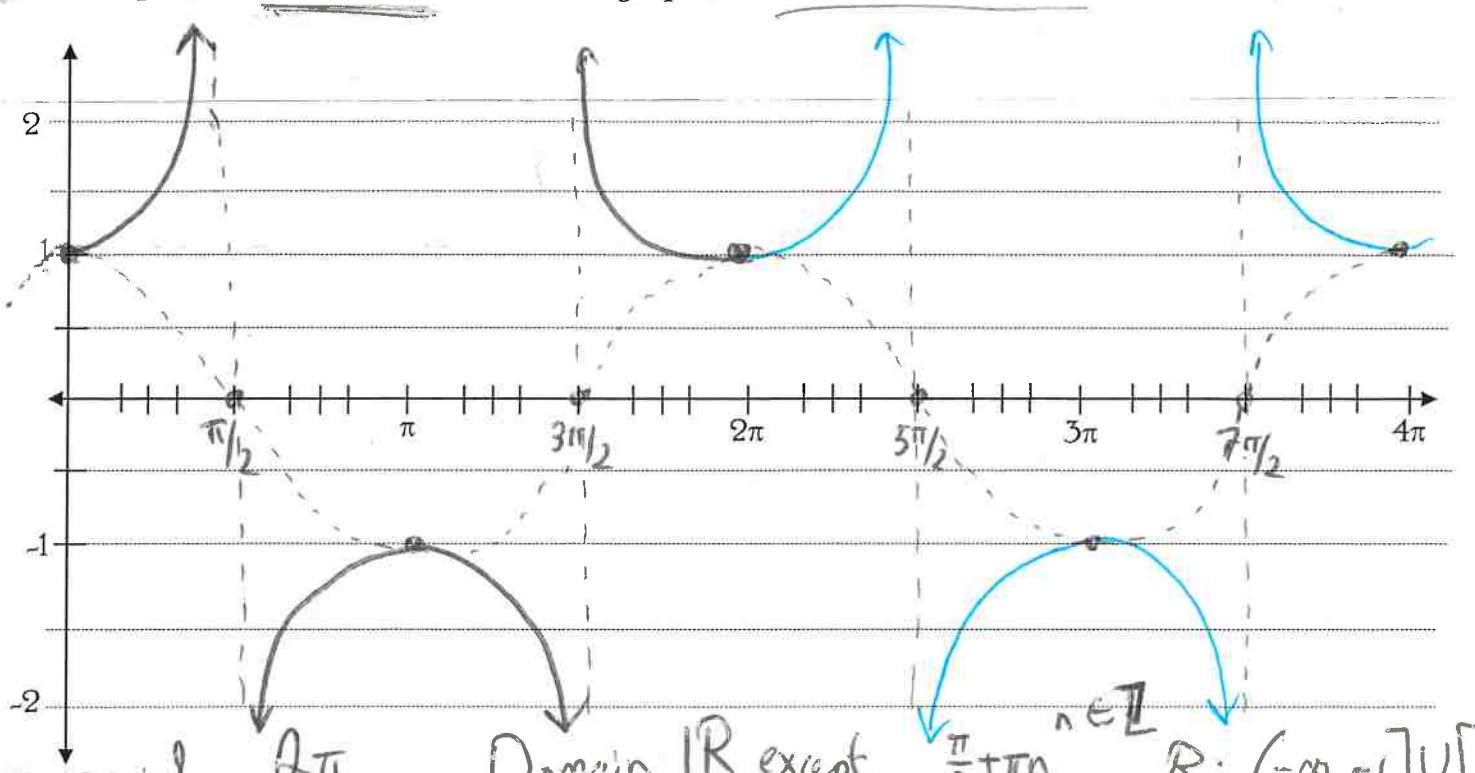
To graph cosecant functions:

1. Plot your points like you're graphing $\sin\theta$ ("d-value")

2. You'll have vertical asymptotes where you see points on the x-axis

3. Plot parabolas at max and min points. max points open up and min points open down

Now let's do the same for cosine and secant.
Graph $y = \cos\theta$ in one color. Then graph $y = \sec\theta$ in another color.



period 2π Domain $\mathbb{R}$ except $\frac{\pi}{2}+\pi n$, $n \in \mathbb{Z}$ R: $(-\infty, -1] \cup [1, \infty)$

Graph each function by first graphing their reciprocal trigonometric function.

1. $y = -3\csc\left(\frac{\theta}{4}+\frac{\pi}{8}\right)-2$

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

$a = -3$
$b = 1/4$
period $= \frac{2\pi}{1/4} = 8\pi$
$I = \frac{1}{4}\cdot 8\pi = 2\pi$

Vertical Stretch: 3

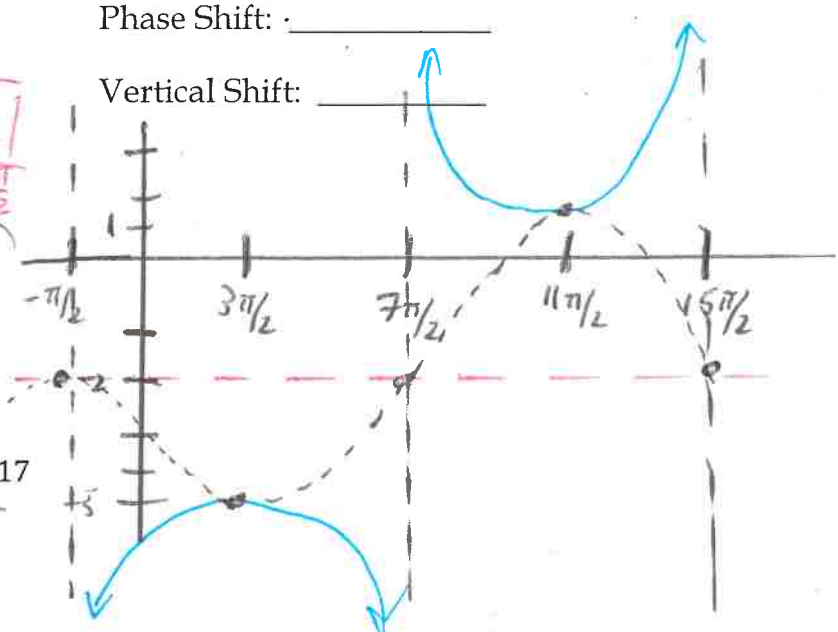
Period: 8π

Phase Shift: left $\pi/2$

Vertical Shift: down 2

θ	0 $-\frac{\pi}{2}$	2π $-\frac{\pi}{2}$	4π $-\frac{\pi}{2}$	6π $-\frac{\pi}{2}$	8π $-\frac{\pi}{2}$
$\csc\left(\frac{\theta}{4}\right)$	0	1	0	-1	0
$-3\csc\left(\frac{\theta}{4}\right)$	0	-3	0	3	0

$-\pi/2$ $3\pi/2$ $7\pi/2$ $11\pi/2$ $15\pi/2$



2. $y = -0.5\sec(2\theta - \pi)+3$

Vertical Stretch: _____

Period: _____

Phase Shift: _____

Vertical Shift: _____

2.09 Practice: Graphing Secant and Cosecant Functions Date _____

Graph each.

1. $y = \csc 3\theta$

Per: _____ PS: _____ VS: _____

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

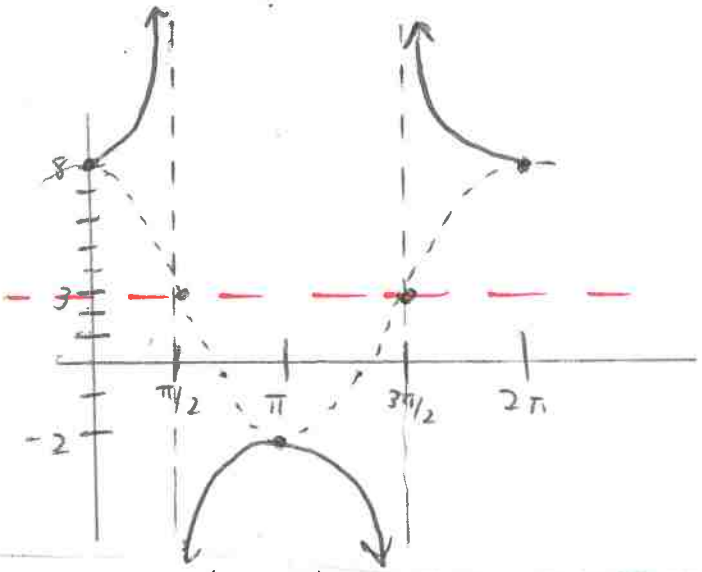
Per: _____ PS: _____ VS: _____

3. $y = 5\sec\theta + 3$ (*Graph cos θ first)

Per: 2π PS: none VS: up 3

$a = 5$
$b = 1$
$c = 0$
$d = 3$

θ	0	$\pi/2$	π	$3\pi/2$	2π
$\cos\theta$ / $\sec\theta$	1	0	-1	0	1
$5\sec\theta$	5	0	-5	0	5



6. $y = -3\csc\left(6\theta + \frac{3\pi}{2}\right) + 1$ (*Graph sin θ first)

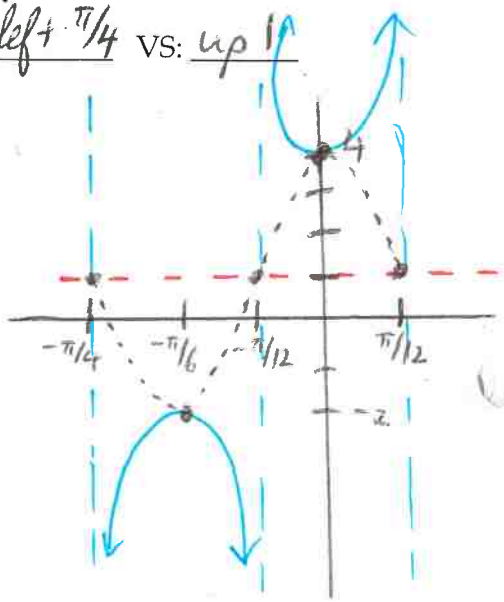
Per: $\pi/3$ PS: left $\pi/4$ VS: up 1

$6)\ y = -3\csc\left[6\left(\theta + \frac{\pi}{4}\right)\right] + 1$

$a = -3$
$b = 6$
period $= \frac{2\pi}{6} = \frac{\pi}{3}$
$c = \pi/4$
$d = 1$

$I = \frac{1}{4} \cdot \frac{\pi}{3} = \frac{\pi}{12}$

θ	0 $-\pi/4$	$\frac{\pi}{12} - \pi/4$	$\frac{2\pi}{12} - \pi/4$	$\frac{3\pi}{12} - \pi/4$	$\frac{4\pi}{12} - \pi/4$
	$-\pi/4$	$-\pi/6$	$-\frac{\pi}{12}$	0	$\pi/12$
*sin csc(6θ)	0	1	0	-1	0
$-3\csc\theta$	0	-3	0	3	0



$a=1 \quad b=\pi/5 \quad \text{period} = \frac{2\pi}{b} \rightarrow \frac{2\pi}{\pi/5} = 2\pi \cdot \frac{5}{\pi} = 10$

$I = \frac{1}{4} \cdot 10 = \frac{5}{2} = 2.5$

$y = \sec\left[\frac{\pi}{5}\left(\theta - \frac{5}{2}\right)\right] - 1.5$

7. $y = \sec\left(\frac{\pi\theta}{5} - \frac{\pi}{2}\right) - 1.5$

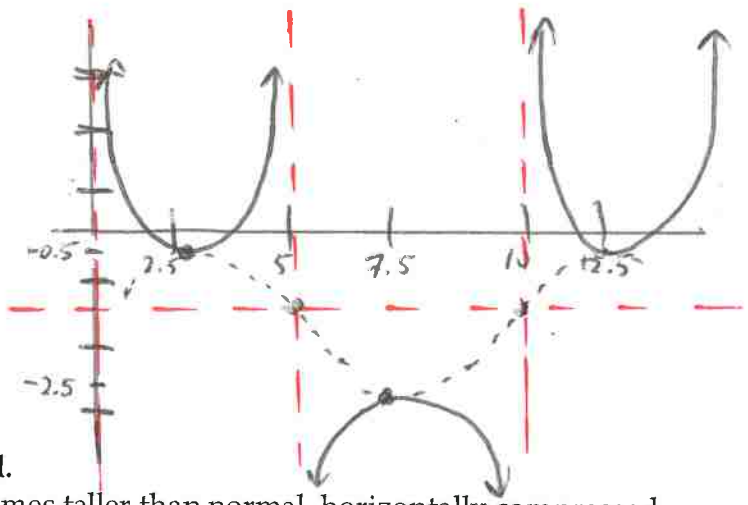
Per: 10 PS: 2.5 right VS: down 1.5

θ	0 +2.5	2.5 +2.5	5 +2.5	7.5 +2.5	10 +2.5
	2.5	5	7.5	10	12.5
cosθ	1	0	-1	0	1
secθ	1	0	-1	0	1

8. $y = \csc(2\pi\theta + \pi)$

$a=1$
$b=\pi/5$
$c=5/2$
$d=-1.5$

Per: _____ PS: Y VS: _____



Write an equation for each function described.

9. Secant function, vertically stretched to be 5 times taller than normal, horizontally compressed to have a period one-half the length as normal, shifted $\frac{\pi}{4}$ units to the right and 10 units down.

$a=5$
$\text{period} = \pi$
$\text{period} = \frac{2\pi}{b}$
$\pi = \frac{2\pi}{b}$
$b\pi = 2\pi \rightarrow b = 2$

$c = -\pi/4$
$d = -10$

$y = 5\sec\left[2\left(\theta - \frac{\pi}{4}\right)\right] - 10$

10. Cosecant function, reflected upside down, period = $\frac{\pi}{3}$, phase shift right $\frac{\pi}{2}$, and vertical shift up 4

$a=-1$
$\frac{\pi}{3} = \frac{2\pi}{b}$
$b\pi = 6\pi$
$b = 6$

$c = -\frac{\pi}{2}$
$d = 4$

$y = -\csc\left[6\left(\theta - \frac{\pi}{2}\right)\right] + 4$

11. Secant function, period = 8, phase shift right 5, and vertical shift up 7.5

$\text{period} = \frac{2\pi}{b}$
$8 = \frac{2\pi}{b}$
$8b = 2\pi$
$b = \frac{2\pi}{8} = \frac{\pi}{4}$

$c = -5$
$d = 7.5$

$y = \sec\left[\frac{\pi}{4}(\theta - 5)\right] + 7.5$