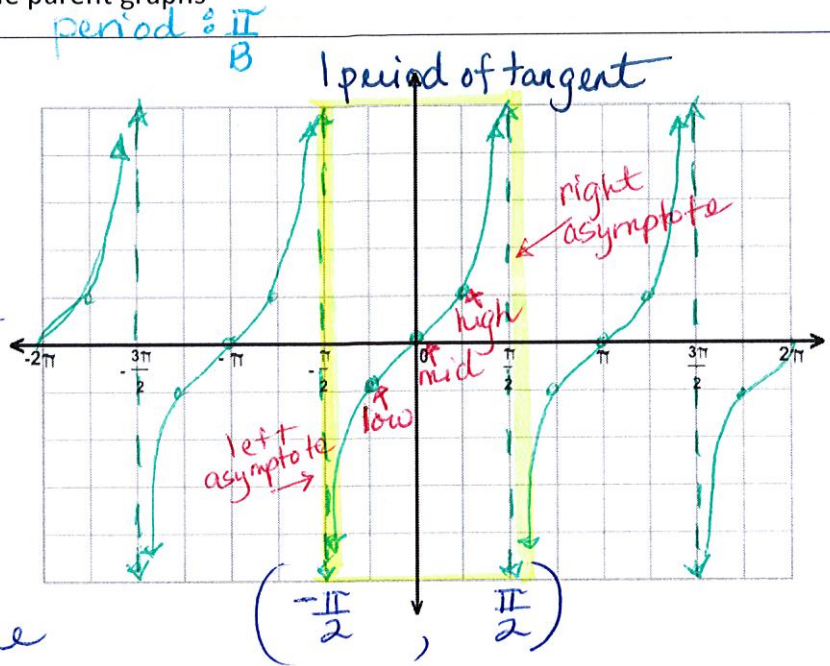


How Can I Sketch Transformations on the Tangent and Cotangent Functions?

First, let's find the basic characteristics of the parent graphs

θ	$y = \tan \theta$
0	0
$\frac{\pi}{4}$	1
$\frac{\pi}{2}$	UND
$\frac{3\pi}{4}$	-1
π	0
$\frac{5\pi}{4}$	1
$\frac{3\pi}{2}$	UND
$\frac{7\pi}{4}$	-1
2π	0

The graph of tangent is discontinuous. There is one s-shaped curve per period. The graph increases to the right.



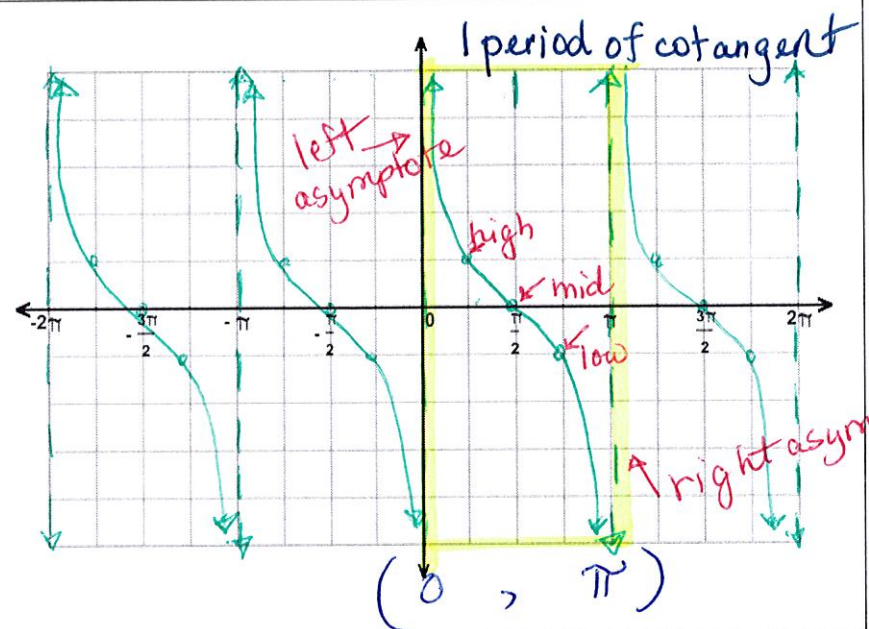
the period is less than sine/cosine

Period $\frac{\pi}{B}$ Intervals $\frac{\pi}{4}$ Asymptotes $-\frac{\pi}{2}, \frac{\pi}{2}$

5 critical values ASYMPTOTE, LOW, MIDPOINT, HIGH, ASYMPTOTE

θ	$y = \cot \theta$
0	UND
$\frac{\pi}{4}$	1
$\frac{\pi}{2}$	0
$\frac{3\pi}{4}$	-1
π	UND
$\frac{5\pi}{4}$	1
$\frac{3\pi}{2}$	0
$\frac{7\pi}{4}$	-1
2π	UND

The graph of cotangent is decreasing left to right. On the parent graph, the 1st period lies between 0 and π .



Period $\frac{\pi}{B}$ Intervals $\frac{\pi}{4}$ Asymptotes $0, \pi$

5 critical values ASYMPTOTE, HIGH, MIDPOINT, LOW, ASYMPTOTE

Graphing Tan and Cot

Graph each function.

$$1. y = 2 \cot\left(\frac{1}{2}\theta - \frac{7\pi}{4}\right) + 1$$

$$2. y = 4 \tan\left(\frac{1}{3}\theta - \frac{5\pi}{6}\right) + 3$$

$$3. y = 2 + \tan\left(2\theta - \frac{\pi}{6}\right)$$

$$4. y = -2 + 2 \cot 5\theta$$

$$5. y = 3 \cot\left(2\theta + \frac{3\pi}{2}\right)$$

$$6. y = 2 \tan\left(3\theta + \frac{\pi}{6}\right) + 2$$

$$1. y = 2 \cot\left(\frac{1}{2}\theta - \frac{7\pi}{4}\right) + 1$$

$$\text{period: } \frac{\pi}{\frac{1}{2}} \rightarrow 2\pi$$

$$\text{intervals: } \frac{2\pi}{4} = \frac{\pi}{2}$$

DECREASING

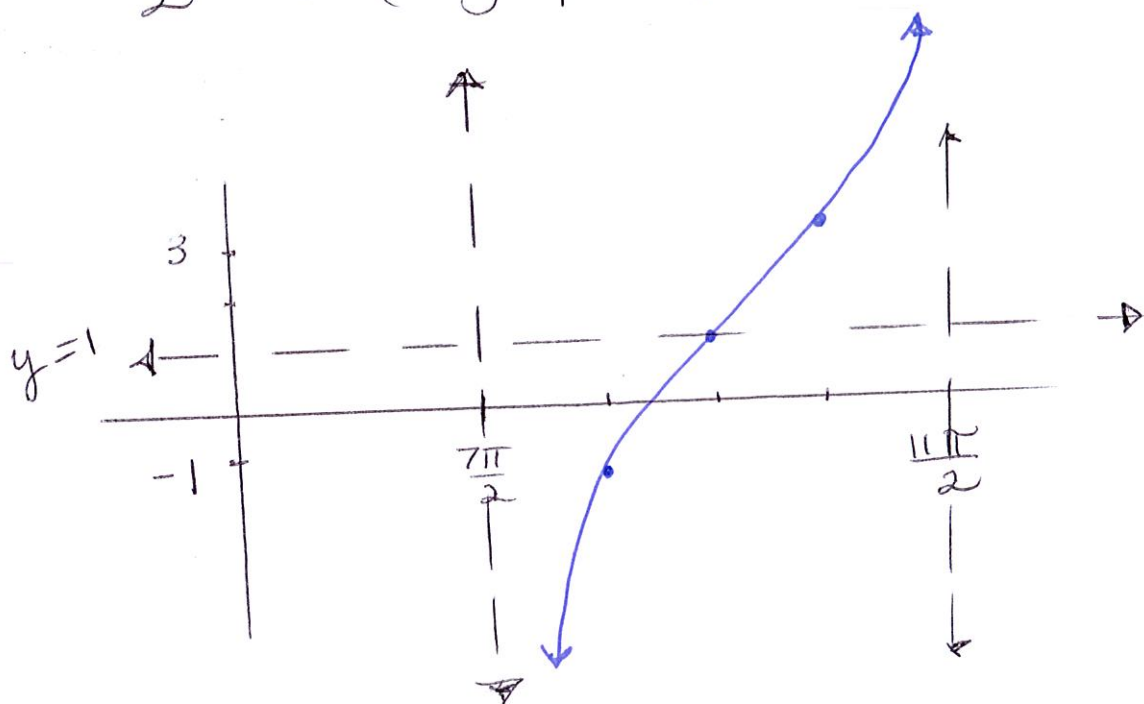
For cotangent, set argument = 0 to find starting θ value

$$\text{LEFT ASYMPTOTE: } \frac{1}{2}\theta - \frac{7\pi}{4} = 0$$

$$\frac{1}{2}\theta = \frac{7\pi}{4}$$

$$\theta = \frac{14\pi}{4} = \frac{7\pi}{2}$$

θ	cot θ
$\frac{7\pi}{2}$	UND (asymptote)
4π	HIGH 3
$\frac{9\pi}{2}$	MID 1
5π	LOW -1
$\frac{11\pi}{2}$	UND (asymptote)



$$2. \quad y = 4 \tan\left(\frac{1}{3}\theta - \frac{5\pi}{6}\right) + 3$$

INCREASING

$$\text{period} : \frac{\pi}{4}$$

$$\text{intervals} : \frac{\pi}{4 \cdot 4} = \frac{\pi}{16}$$

$$\text{Start} : \frac{1}{3}\theta - \frac{5\pi}{6} = -\frac{\pi}{2}$$

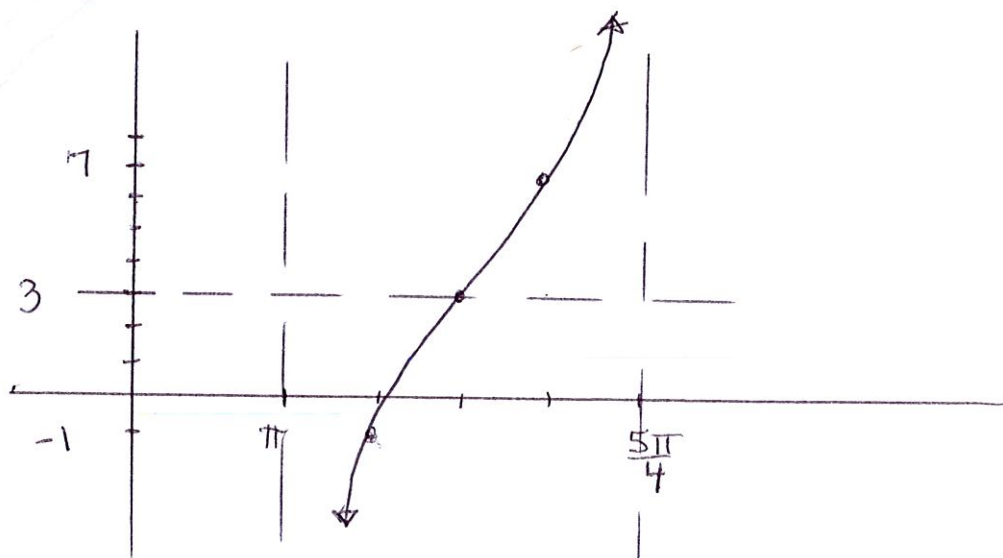
$$\frac{1}{3}\theta = \frac{2\pi}{6}$$

$$\theta = \frac{6\pi}{6} = \pi$$

For tangent graphs
set argument = $-\frac{\pi}{2}$
to find starting
or value.

θ	$\tan \theta$
π	UND
$\frac{17\pi}{16}$	-1 (LOW)
$\frac{18\pi}{16}$	3 (MID)
$\frac{19\pi}{16}$	7 (HIGH)
$\frac{20\pi}{16}$	UND

$\frac{+\pi}{16}$
x4
↓



3. $y = 2 + \tan(2\theta - \frac{\pi}{6})$

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

intervals: $\frac{\pi}{8}$

Start: $2\theta - \frac{\pi}{6} = -\frac{\pi}{2}$

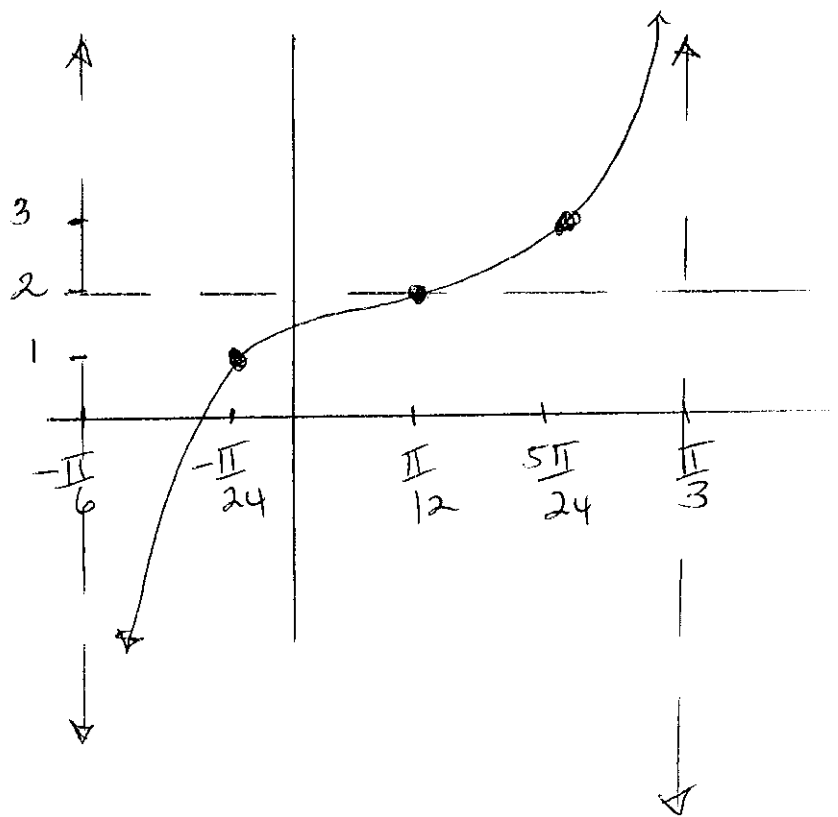
$2\theta = -\frac{2\pi}{6}$

$\theta = -\frac{2\pi}{12}$

$\theta = -\frac{\pi}{6}$

θ	$\tan \theta$
$-\frac{\pi}{6}$	UNDEF
$-\frac{\pi}{24}$	1
$\frac{\pi}{12}$	2
$\frac{5\pi}{24}$	3
$\frac{\pi}{3}$	UNDEF

$+\frac{\pi}{8}$
 $+\frac{\pi}{8}$
 $+\frac{\pi}{8}$
 $+\frac{\pi}{8}$



4. $y = -2 + 2 \cot 5\theta$

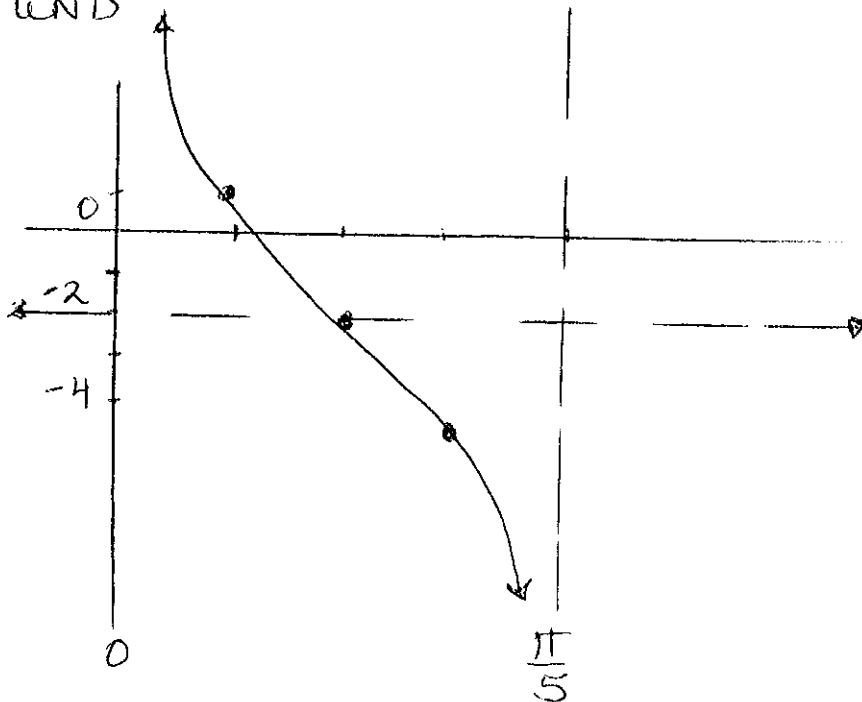
period : $\frac{\pi}{5}$

intervals : $\frac{\pi}{20}$

Start : $5\theta = 0$

$\theta = 0$

θ	$\cot \theta$
0	UND
$\frac{\pi}{20}$	HIGH 0
$\frac{2\pi}{20}$	MID -2
$\frac{3\pi}{20}$	LOW -4
$\frac{4\pi}{20}$	UND



$$5. y = 3 \cot\left(2\theta + \frac{3\pi}{2}\right)$$

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

$$\text{intervals: } \frac{\pi}{8}$$

$$\text{Start: } 2\theta + \frac{3\pi}{2} = 0$$

$$2\theta = -\frac{3\pi}{2}$$

$$\theta = -\frac{3\pi}{4}$$

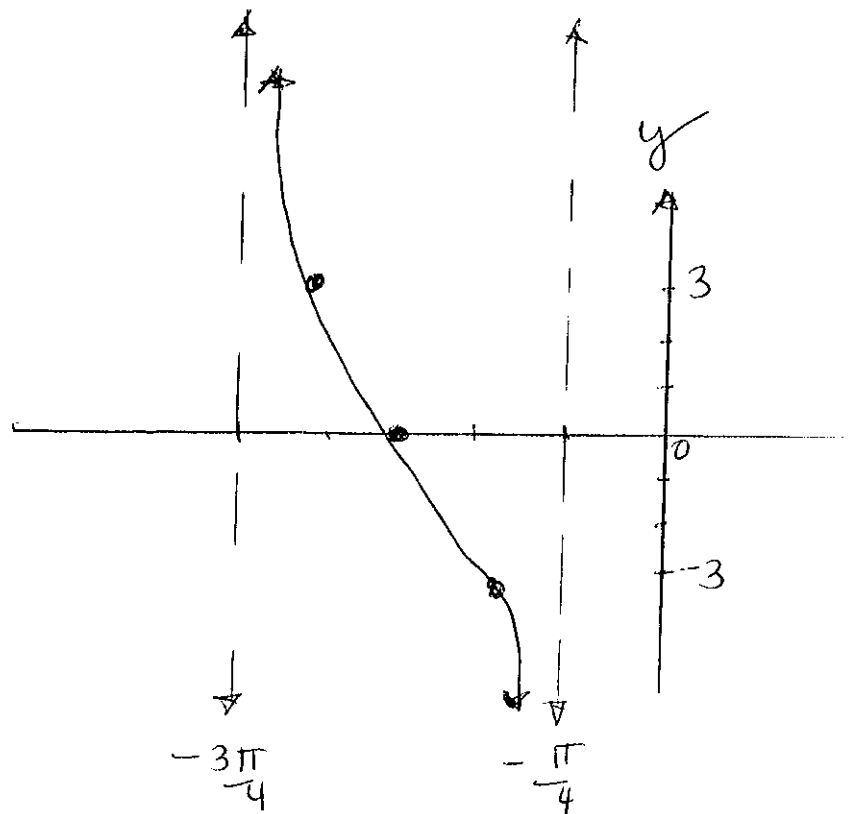
θ	$\cot\theta$
$-\frac{3\pi}{4}$	UND
$-\frac{5\pi}{8}$	3
$-\frac{4\pi}{8}$	0
$-\frac{3\pi}{8}$	-3
$-\frac{2\pi}{8}$	UND

$$+\frac{\pi}{8}$$

$$+\frac{\pi}{8}$$

$$+\frac{\pi}{8}$$

$$+\frac{\pi}{8}$$



$$6. \quad y = 2 \tan \left(3\theta + \frac{\pi}{6} \right) + 2$$

$$\text{period} : \frac{\pi}{3}$$

$$\text{intervals} : \frac{\pi}{12}$$

$$\text{start} : 3\theta + \frac{\pi}{6} = \frac{-\pi}{2}$$

$$3\theta = \frac{-4\pi}{6}$$

$$\theta = \frac{-4\pi}{18}$$

$$\theta = \frac{-2\pi}{9}$$

θ	$\tan \theta$
$\frac{-2\pi}{9}$	UND
$\frac{+\pi}{12}$	$\frac{-5\pi}{36}$
$\frac{+\pi}{12}$	$\frac{-\pi}{18}$
$\frac{+\pi}{12}$	$\frac{\pi}{36}$
$\frac{+\pi}{12}$	$\frac{\pi}{9}$
	UND

