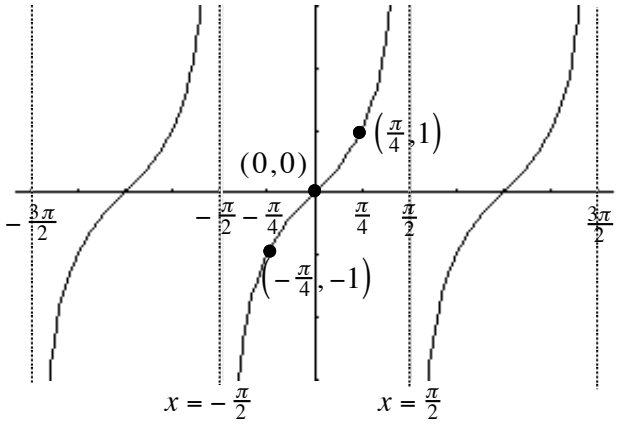
§4.6 Graphs of the Other Trigonometric Functions

Graph of y = tan x

x	$\frac{-\pi}{2}$	$\frac{-\pi}{4}$	0	$\frac{\pi}{4}$	$\frac{\pi}{2}$
tan x	undefined	–1	0	1	undefined



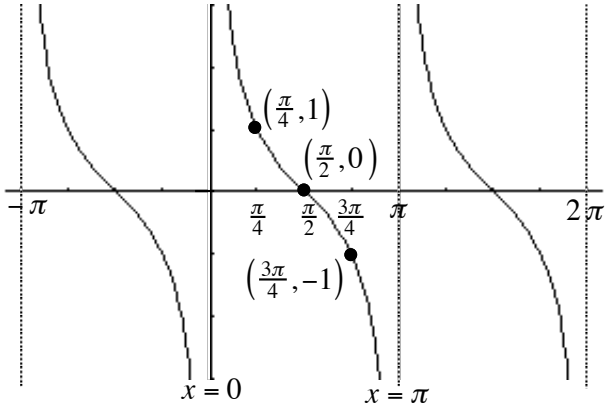
since the domain of $y = \tan x$ is all real numbers except $\frac{(2n+1)\pi}{2}$, the graph repeats infinitely to
the left and the right

one <u>period</u> (or <u>cycle</u>) of the graph is on $\left[-\frac{\pi}{2},\frac{\pi}{2}\right]$

Example 1: a) Graph $y = \tan\frac{x}{2}$ b) Graph $y = -3\tan 2x$

Graph of y = cot x

x	0	$\frac{\pi}{4}$	$\frac{\pi}{2}$	$\frac{3\pi}{4}$	π
cot x	undefined	1	0	–1	undefined



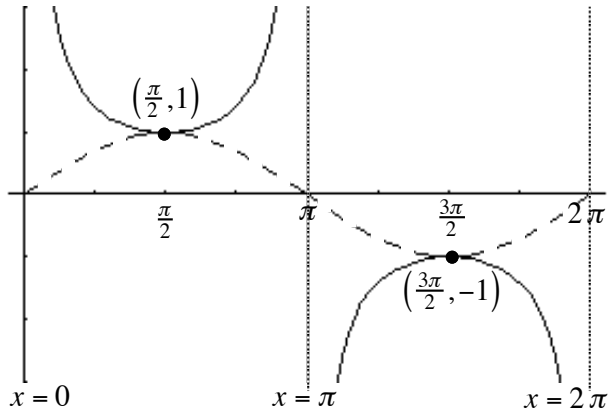
since the domain of $y = \cot x$ is all real numbers
except $n\pi$, the graph repeats infinitely to the left
and the right

one <u>period</u> (or <u>cycle</u>) of the graph is on $[0,\pi]$

Example 2: Graph $y = 2\cot\frac{x}{3}$

Graph of y = csc (x)

x	0	$\frac{\pi}{2}$	π	$\frac{3\pi}{2}$	2π
y = csc x	undefined	1	undefined	-1	undefined

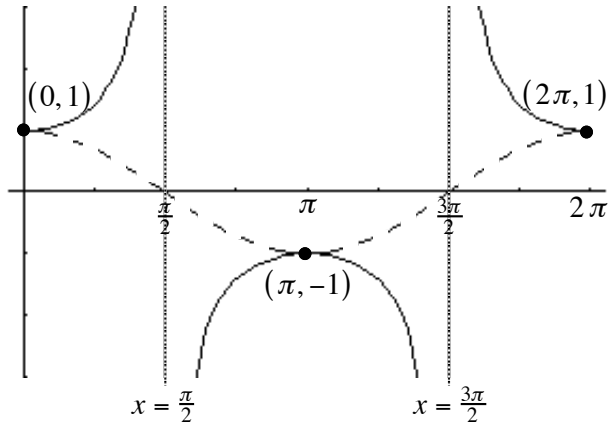


since the domain of $y = \csc x$ is all real numbers except $n\pi$, the graph repeats infinitely to the left and the right

one period (or cycle) of the graph is on $[0,2\pi]$

Graph of y = sec (x)

x	0	$\frac{\pi}{2}$	π	$\frac{3\pi}{2}$	2π
y = sec x	1	undefined	-1	undefined	1



since the domain of $y = \sec x$ is all real numbers except $\frac{(2n+1)\pi}{2}$, the graph repeats infinitely to the left and the right

one period (or cycle) of the graph is on $[0,2\pi]$

Example 3: Graph $y = 2\csc\left(x + \frac{\pi}{4}\right)$ Example 4: Graph $y = \sec(2x)$

Example: $y = \tan\left(\frac{x}{2}\right)$ (Remember APTEV)

Formulas for General Form $y = a\tan(bx - c) + d$

amplitude = none

period (of tan and cot) =

$\frac{\pi}{b} = \frac{\pi}{1/2} = 2\pi$

tick marks = $\frac{\text{period}}{4} = \frac{2\pi}{4} = \frac{\pi}{2}$

tick mark calculations:

(1) $-\pi$ (2) $-\pi + \frac{\pi}{2} = \frac{-\pi}{2}$

(3) $\frac{-\pi}{2} + \frac{\pi}{2} = 0$ (4) $0 + \frac{\pi}{2} = \frac{\pi}{2}$

(5) $\frac{\pi}{2} + \frac{\pi}{2} = \pi$

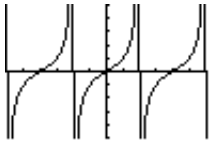
endpoints Solve:

$bx - c = \frac{-\pi}{2}$ $bx - c = \frac{\pi}{2}$

$\frac{x}{2} = \frac{-\pi}{2}$ $\frac{x}{2} = \frac{\pi}{2}$

$x = -\pi$ $x = \pi$

(starts) (ends)



vertical shift = none

Example: $y = 2\cot\left(\frac{x}{3}\right)$ (Remember APTEV)

Formulas for General Form $y = a\ \cot(bx - c) + d$

amplitude = none

period (of tan and cot) =

$\frac{\pi}{b} = \frac{\pi}{1/3} = 3\pi$

tick marks = $\frac{\text{period}}{4} = \frac{3\pi}{4}$

tick mark calculations:

(1) 0

(2) $0 + \frac{3\pi}{4} = \frac{3\pi}{4}$

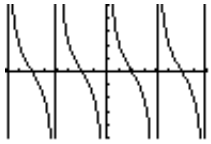
(3) $\frac{3\pi}{4} + \frac{3\pi}{4} = \frac{3\pi}{2}$

(4) $\frac{3\pi}{2} + \frac{3\pi}{4} = \frac{9\pi}{4}$

(5) $\frac{9\pi}{4} + \frac{3\pi}{4} = 3\pi$

endpoints Solve:

$bx - c = 0$	$bx - c = \pi$
$\frac{x}{3} = 0$	$\frac{x}{3} = \pi$
$x = 0$	$x = 3\pi$
(starts)	(ends)



vertical shift = none

Example: $y = 2\csc\left(x + \frac{\pi}{4}\right)$ (Remember APTEV)

Formulas for General Form $y = a\sin(bx - c) + d$ **and** $y = a\cos(bx - c) + d$

amplitude = $|a| = |2| = 2$

period (of sine and cosine) =

$\frac{2\pi}{b} = \frac{2\pi}{1} = 2\pi$

tick marks = $\frac{\text{period}}{4} = \frac{2\pi}{4} = \frac{\pi}{2}$

tick mark calculations:

(1) $\frac{-\pi}{4}$

(2) $\frac{-\pi}{4} + \frac{\pi}{2} = \frac{\pi}{4}$

(3) $\frac{\pi}{4} + \frac{\pi}{2} = \frac{3\pi}{4}$

(4) $\frac{3\pi}{4} + \frac{\pi}{2} = \frac{5\pi}{4}$

(5) $\frac{5\pi}{4} + \frac{\pi}{2} = \frac{7\pi}{4}$

endpoints Solve:

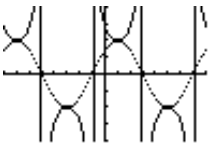
$bx - c = 0$ $bx - c = 2\pi$

$x + \frac{\pi}{4} = 0$ $x + \frac{\pi}{4} = 2\pi$

$x = \frac{-\pi}{4}$ $x = 2\pi - \frac{\pi}{4} = \frac{7\pi}{4}$

(starts) (ends)

Remember to graph: $y = 2\sin\left(x + \frac{\pi}{4}\right)$



vertical shift = d = none

Example: $y = \sec(2x)$ (Remember APTEV)

Formulas for General Form $y = a\sin(bx - c) + d$ **and** $y = a\cos(bx - c) + d$

amplitude = $|a| = |1| = 1$

period (of sine and cosine) =

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

tick marks = $\frac{\text{period}}{4} = \frac{\pi}{4}$

tick mark calculations:

(1) 0

(2) $0 + \frac{\pi}{4} = \frac{\pi}{4}$

(3) $\frac{\pi}{4} + \frac{\pi}{4} = \frac{\pi}{2}$

(4) $\frac{\pi}{2} + \frac{\pi}{4} = \frac{3\pi}{4}$

(5) $\frac{3\pi}{4} + \frac{\pi}{4} = \pi$

endpoints Solve:

$bx - c = 0$ $bx - c = 2\pi$

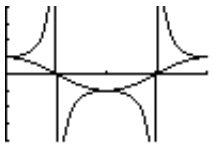
$2x = 0$ $2x = 2\pi$

$x = 0$ $x = \pi$

(starts) (ends)

Remember to first graph:

$y = \cos(2x)$



vertical shift = d = none