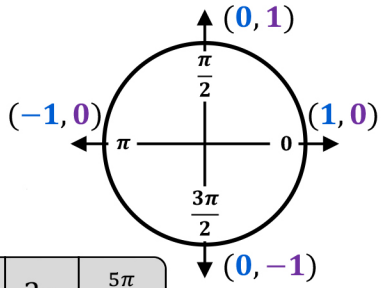
TOPIC: GRAPHS OF SINE & COSINE

Graphing Sine & Cosine (with Vertical Shifts)

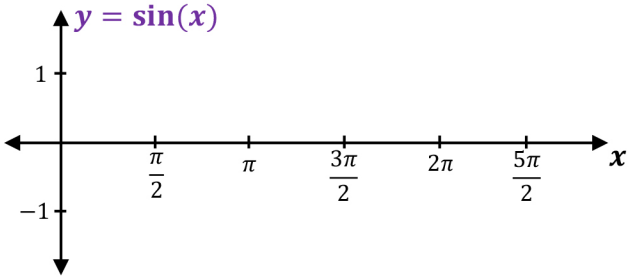


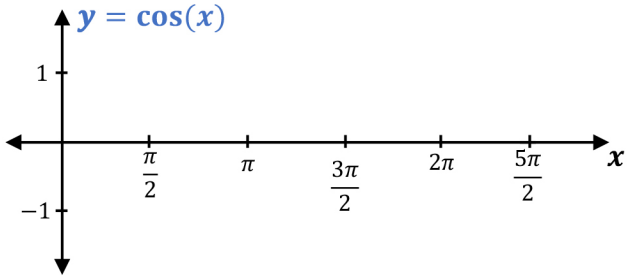
◆ Sine & Cosine values _____ around the unit circle, so their graphs are _____.

- The high points are "crests" or _____; the low points are "troughs" or _____.

x	0	$\frac{\pi}{2}$	π	$\frac{3\pi}{2}$	2π	$\frac{5\pi}{2}$
$\sin x$						

x	0	$\frac{\pi}{2}$	π	$\frac{3\pi}{2}$	2π	$\frac{5\pi}{2}$
$\cos x$						





◆ Just as we've vertically shifted functions, we can also vertically shift $\sin$ & $\cos$ by adding a constant ___.

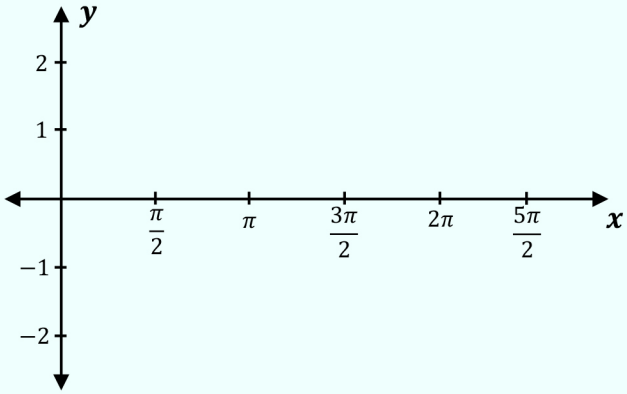
- For positive k, graph shifts **[UP | DOWN]**; for negative k, graph shifts **[UP | DOWN]**.

$y = \sin(x) + \_\_$ $y = \cos(x) + \_\_$

Recall **Transformations**

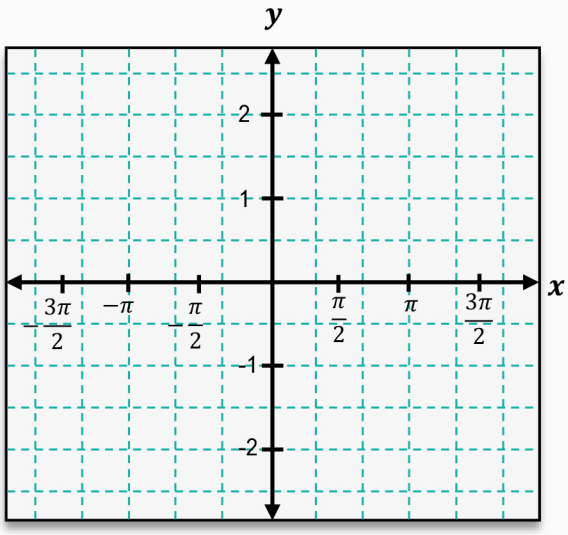
$g(x) = f(x) + k$

EXAMPLE Graph the function $y = \sin(x) + 1$.

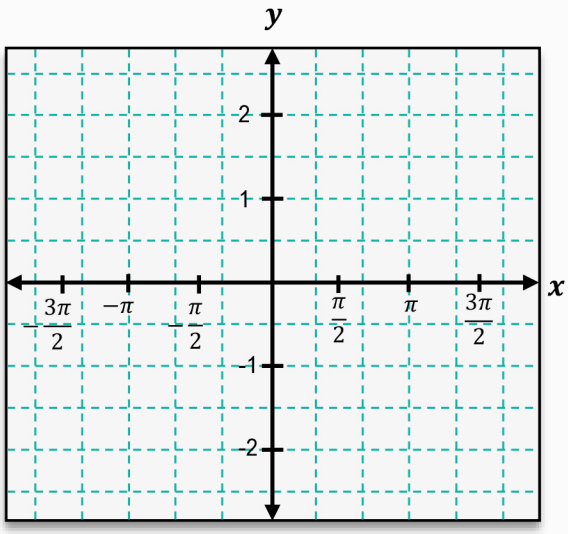


TOPIC: GRAPHS OF SINE & COSINE

PRACTICE Sketch the function $y = \cos(x) - 1$ on the graph below.

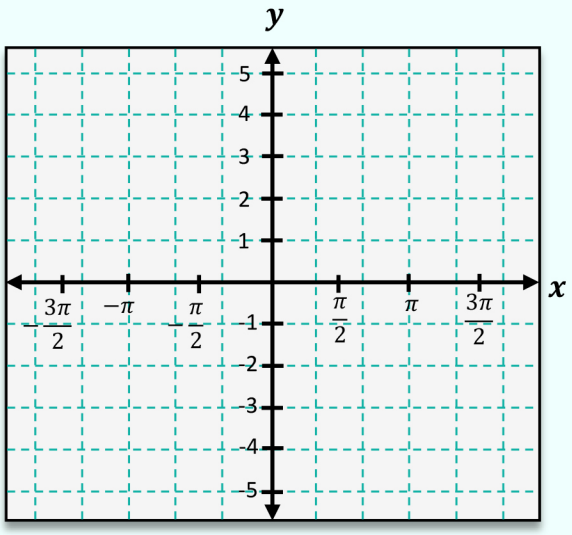


PRACTICE Determine the value of $y = \sin\left(-\frac{\pi}{2}\right) + 50$ without using a calculator or the unit circle.



TOPIC: GRAPHS OF SINE & COSINE

EXAMPLE Graph the function $y = \sin(x) + 3$.



TOPIC: GRAPHS OF SECANT & COSECANT

Graphing the Secant & Cosecant Functions

Recall **Reciprocal Identities**

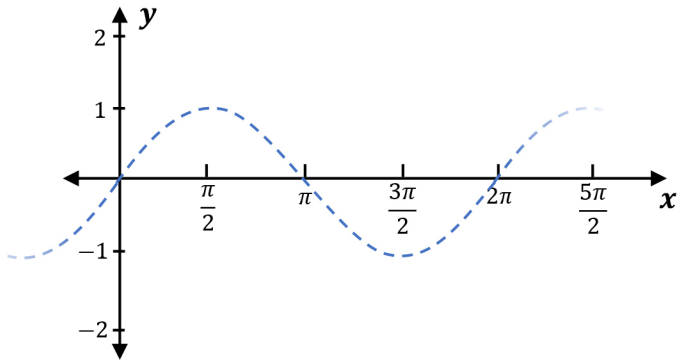
$$\csc x = \frac{1}{\sin x} \qquad \sec x = \frac{1}{\cos x}$$

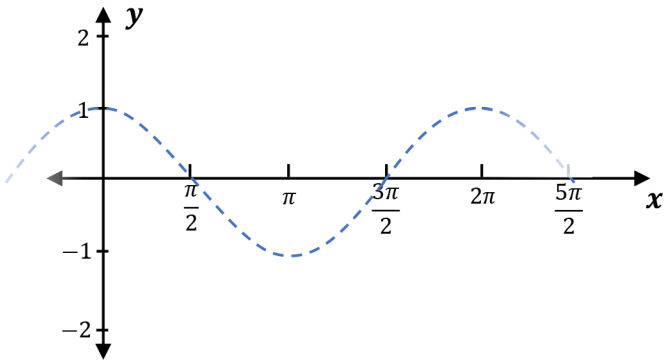
◆ Because they are reciprocals, we can use $\sin$ & $\cos$ to graph $\csc$ & $\sec$.

- When $\sin$ & $\cos = 0$, $\csc$ & $\sec$ are undefined, so they have _____ and approach ∞.

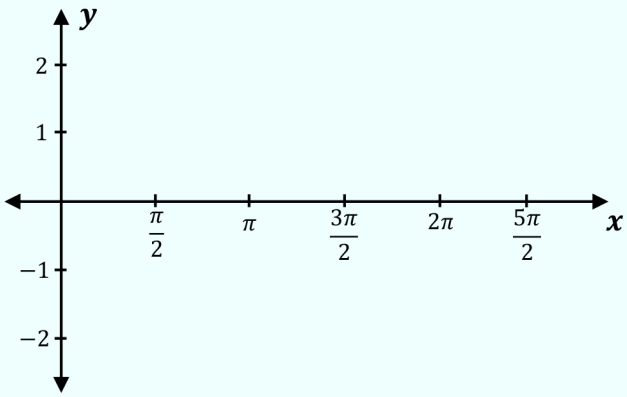
x	0	$\frac{\pi}{2}$	π	$\frac{3\pi}{2}$	2π	$\frac{5\pi}{2}$
$\sin x$	0	1	0	-1	0	1
$\csc x$						

x	0	$\frac{\pi}{2}$	π	$\frac{3\pi}{2}$	2π	$\frac{5\pi}{2}$
$\cos x$	1	0	-1	0	1	0
$\sec x$						



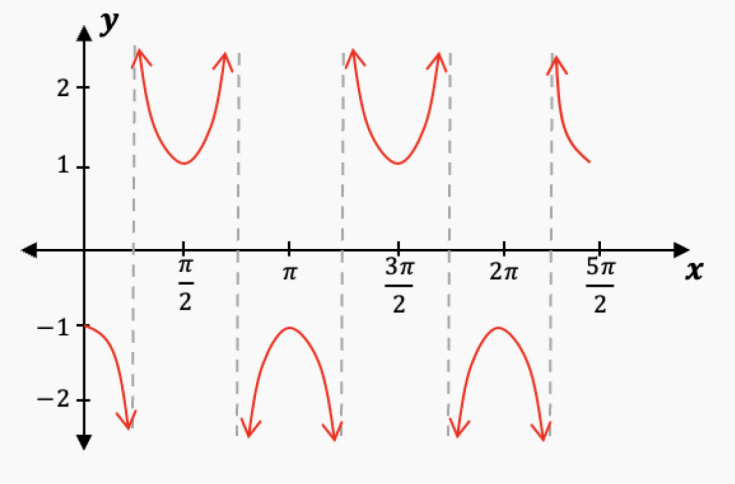


EXAMPLE Graph the function $y = \csc(2x)$.

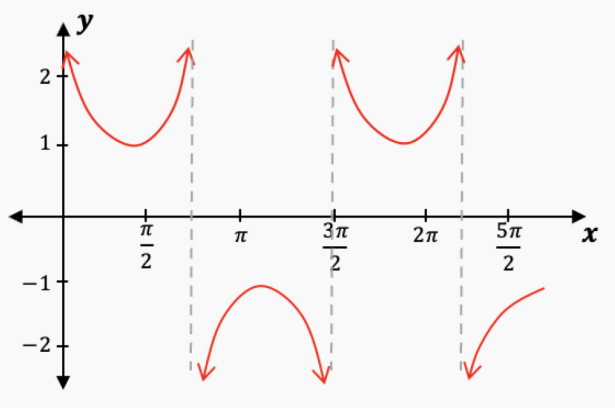


TOPIC: GRAPHS OF SECANT & COSECANT

PRACTICE Below is a graph of the function $y = \sec(bx - \pi)$. Determine the value of b.



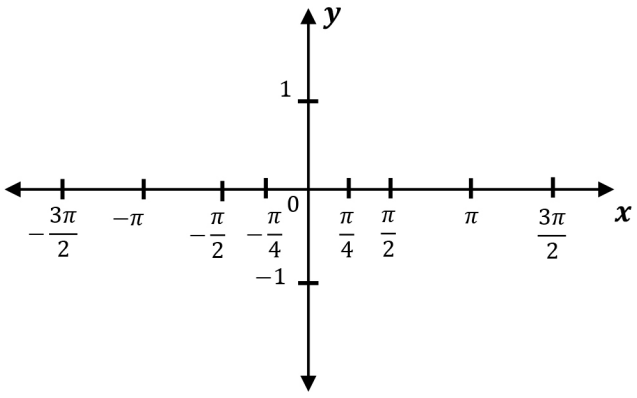
PRACTICE Below is a graph of the function $y = \csc(bx)$. Determine the value of b.



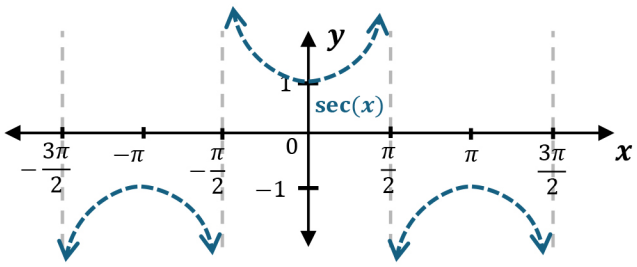
TOPIC: GRAPHS OF TANGENT & COTANGENT

Graphing the Tangent Function

◆ Recall: $\tan(x) = \frac{\sin(x)}{\cos(x)}$, so we can use the values of $\sin$ & $\cos$ to graph $\tan$.



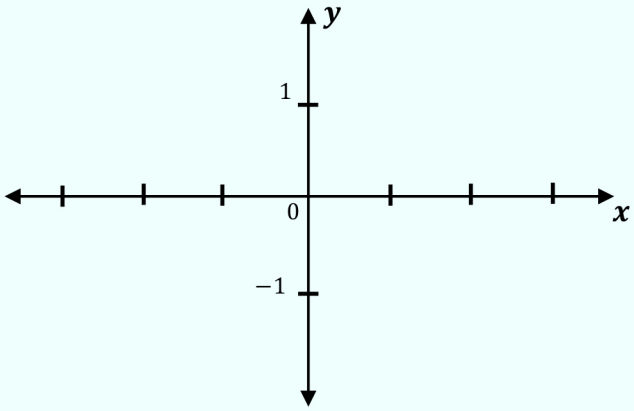
x	$-\frac{\pi}{2}$	$-\frac{\pi}{4}$	0	$\frac{\pi}{4}$	$\frac{\pi}{2}$
$\sin x$	-1	$-\frac{\sqrt{2}}{2}$	0	$\frac{\sqrt{2}}{2}$	1
$\cos x$	0	$\frac{\sqrt{2}}{2}$	1	$\frac{\sqrt{2}}{2}$	0
$\tan x$					



- ***Like*** $\sec(x)$, $\tan(x)$ *repeats* and has *asymptotes* where $\cos(x) = 0$, at _____ multiples of ____.
- ***Unlike*** *other* trig functions, $\tan(x)$ has a period of ____. In general, New $y = \tan(bx) \rightarrow \text{Period } (T) =$ ——— *(Period of Tangent)*

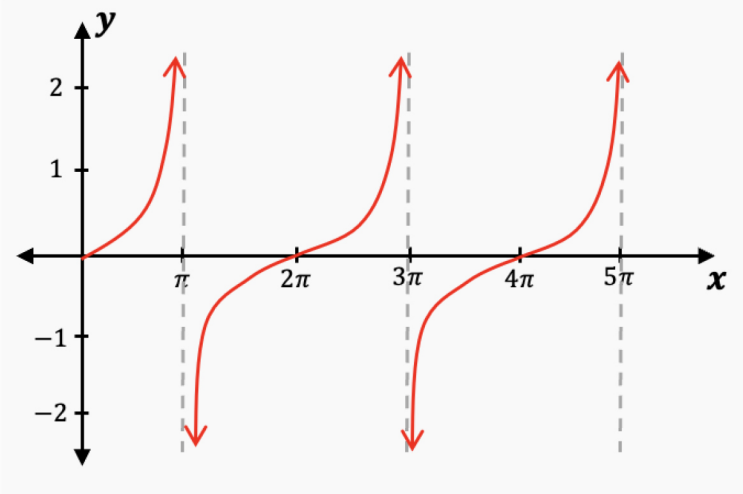
◆ You can use all of the same transformation rules you used for $\sin$ & $\cos$ to stretch and shift graphs of $\tan$!

EXAMPLE Graph the function $y = \tan\left(\frac{\pi}{2}x\right)$.



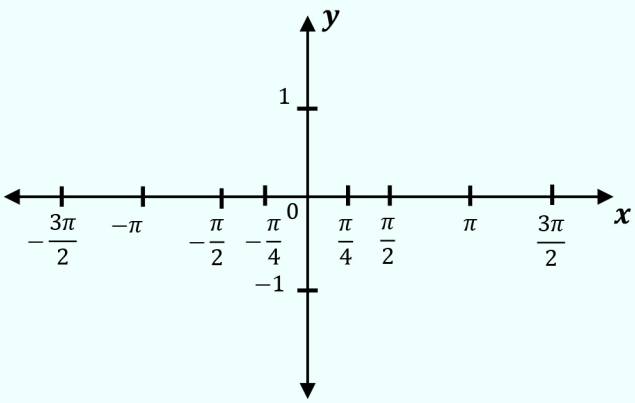
TOPIC: GRAPHS OF TANGENT & COTANGENT

PRACTICE Below is a graph of the function $y = \tan(bx)$. Determine the value of b.



TOPIC: GRAPHS OF TANGENT & COTANGENT

EXAMPLE Graph the function $y = \frac{1}{2} \cdot \tan\left(x - \frac{\pi}{2}\right)$.



TOPIC: GRAPHS OF TANGENT & COTANGENT

Graphing the Cotangent Function

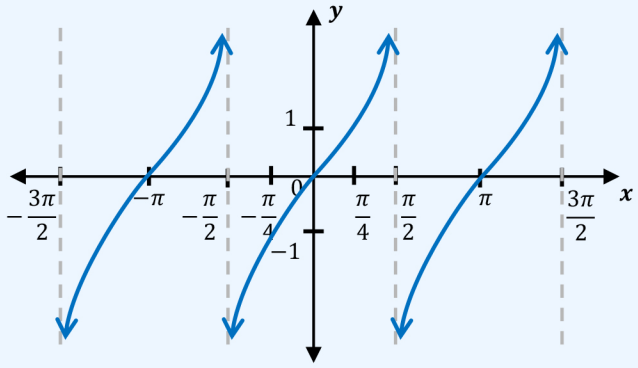
Recall **Reciprocal Identities**

$$\cot(x) = \frac{\cos(x)}{\sin(x)} = \frac{1}{\tan(x)}$$

◆ We can use the graph of tan to graph cot.

- $\cot(x)$ is similar to $\tan(x)$ but _____ upside-down, and has asymptotes at different values.

Recall **Tangent**

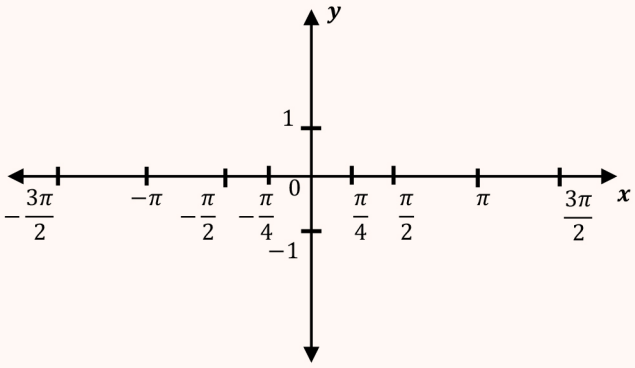


- Repeats every $[\pi \mid 2\pi]$

$$y = \tan(bx) \rightarrow \text{Period } (T) = \frac{\pi}{b}$$

- Asymptotes: **[odd | integer]** multiple of $\left[\frac{\pi}{2} \mid \pi\right]$

New **Cotangent**

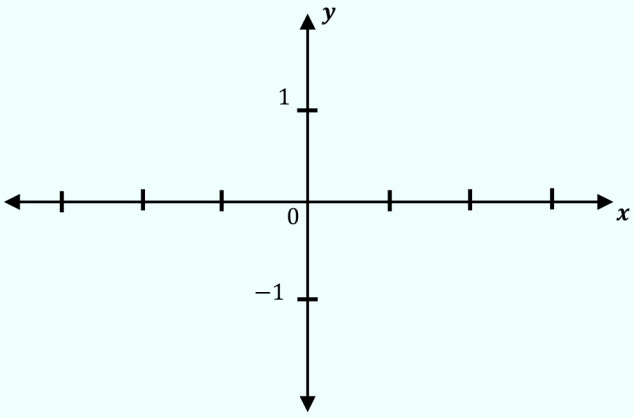


- Repeats every $[\pi \mid 2\pi]$

$$y = \cot(bx) \rightarrow \text{Period } (T) =$$

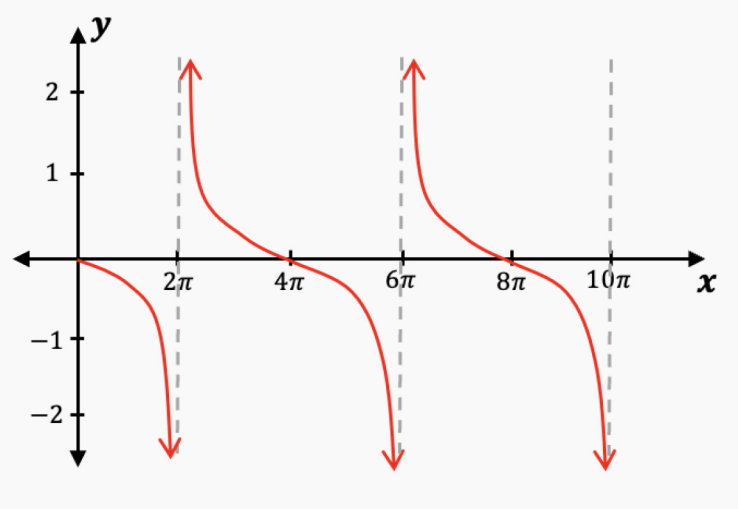
- Asymptotes: **[odd | integer]** multiple of $\left[\frac{\pi}{2} \mid \pi\right]$

EXAMPLE Graph the function $y = \cot(\pi x)$.



TOPIC: GRAPHS OF TANGENT & COTANGENT

PRACTICE Below is a graph of the function $y = \cot\left(bx + \frac{\pi}{2}\right)$. Determine the value of b.



TOPIC: GRAPHS OF TANGENT & COTANGENT

EXAMPLE Graph the function $y = -2 \cdot \cot\left(\frac{1}{4}x\right)$.