6.3 Exploring Graphs of the Primary Trigonometric Functions

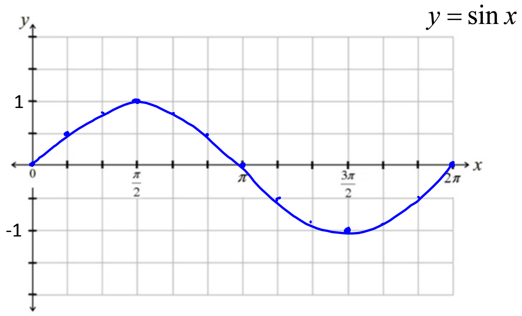
Math Learning Target:
"I can use radians to graph the primary trigonometric functions.
Also, I can create formulas that describe the location of various properties of these functions, such as zeros, minimum values, maximum values, etc."

1. Complete the table, except for the last row.

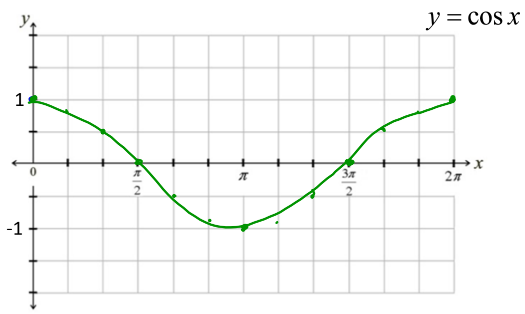
$\frac{S \mid A}{T \mid C}$

x	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
$\sin x$	0	$\frac{1}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{3}}{2}$	1	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{1}{2}$	0	$\frac{-1}{2}$	$-\frac{\sqrt{2}}{2}$	$\frac{-\sqrt{3}}{2}$	-1	$\frac{-\sqrt{3}}{2}$	$\frac{-\sqrt{2}}{2}$	$-\frac{1}{2}$	0
$\cos x$	1	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{1}{2}$	0	$\frac{-1}{2}$	$\frac{-\sqrt{2}}{2}$	$\frac{-\sqrt{3}}{2}$	-1	$\frac{-\sqrt{3}}{2}$	$-\frac{\sqrt{2}}{2}$	$\frac{-1}{2}$	0	$\frac{1}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{3}}{2}$	1
$\frac{\sin x}{\cos x}$	0	$\frac{\sqrt{3}}{3}$	1	$\sqrt{3}$	undefined	$-\sqrt{3}$	-1	$\frac{-\sqrt{3}}{3}$	0	$\frac{\sqrt{3}}{3}$	1	$\sqrt{3}$	undef.	$-\sqrt{3}$	-1	$-\frac{\sqrt{3}}{3}$	
x	0	30°	45°	60°	90°	120°					225°					330°	

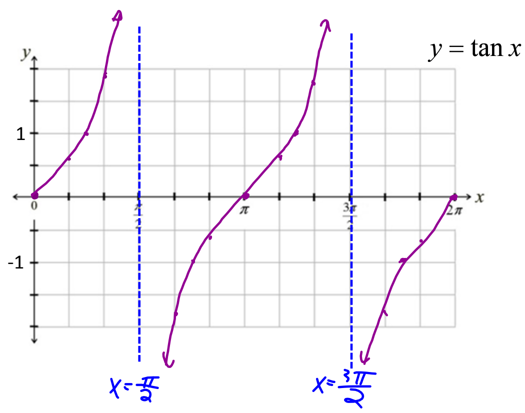
2. ***Recall***: $\tan x = \frac{\sin x}{\cos x}$. Graph all three primary trigonometric functions (increments of $\frac{\pi}{6}$ radians) on separate grids. Complete the properties in the table for each function.



Period: 2π
Equaon of horizontal axis: $y=0$
Amplitude: 1
Minimum Value: -1
Maximum Value: 1
Domain: $(-\infty, \infty)$
Range: $[-1, 1]$
Zeros: $0, \pi, 2\pi$



Period: 2π
Equaon of horizontal axis: $y=0$
Amplitude: 1
Minimum Value: -1
Maximum Value: 1
Domain: $(-\infty, \infty)$
Range: $[-1, 1]$
Zeros: $\frac{\pi}{2}, \frac{3\pi}{2}$



Period: π
Equaon of horizontal axis: None
Amplitude: undefined
Minimum Value: none
Maximum Value: none
Domain: $[0, \frac{\pi}{2}) \cup (\frac{\pi}{2}, \frac{3\pi}{2}) \cup (\frac{3\pi}{2}, 2\pi]$
Range: $(-\infty, \infty)$
Zeros: $0, \pi, 2\pi$
Asymptotes: $x=\frac{\pi}{2}$, $x=\frac{3\pi}{2}$

Recall:

The general term of an arithmetic sequence...

$t_n = a + (n-1)d$ where a is the first term and d is what the sequence terms increase or decrease by.

common difference

3. It is more precise to write a set of values as a formula or expression.
   For example, the set of numbers {2, 4, 6, 8, 10, ...} can be expressed as the expression $2n$, where n is an integer beginning at 1.
   Note: there are many formulas that can be found for this example!
   Let's determine some other ways...

$\{2n, n \in \mathbb{N}\}$

$2n+2, n \in \mathbb{W}$

$2n+4$ $n \in \mathbb{Z}, n \geq -1$

vs $2n-2$ $n \in \mathbb{Z}$ $n \geq 2$

4. Create any formula that determines all values in the Domain for $y = \tan x$.
   Note: there are many formulas that could work!

Asymptotes: $\{\ldots, -\frac{3\pi}{2}, -\frac{\pi}{2}, \frac{\pi}{2}, \frac{3\pi}{2}, \frac{5\pi}{2}, \ldots\}$

Domain: $\{x \in \mathbb{R} \mid x \neq \frac{(2n+1)\pi}{2}, n \in \mathbb{Z}\}$

$x \neq \frac{\pi}{2} + 2k\pi, k \in \mathbb{Z}$

Entertainment: p. 336 #2c, 3, 5