Warm Up 1/24

$\frac{4}{3} = 1\frac{1}{3} < \frac{1}{2}$

X2 2X

Evaluate the following.

$\left(-\frac{1}{2}, -\frac{\sqrt{3}}{2}\right)$

1. $\tan\frac{4\pi}{3}$

$\tan = \frac{\sin}{\cos} = \frac{y}{x} = \frac{-\frac{\sqrt{3}}{2}}{-\frac{1}{2}}$

$= +\frac{\sqrt{3}}{2} \cdot +\frac{2}{1} = \boxed{\sqrt{3}}$

$(-1,0)$

2. $\cot\pi$

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

$\frac{-1}{0} = \text{und}$

IV

3. $\sec\frac{11\pi}{6}$

$\frac{11}{6} = 1\frac{5}{6} > \frac{1}{2}$

$\left(\frac{\sqrt{3}}{2}, -\frac{1}{2}\right)$

$\frac{1}{\cos} = \frac{1}{x} = \frac{1}{\frac{\sqrt{3}}{2}}$

$= \frac{2}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \boxed{\frac{2\sqrt{3}}{3}}$

II

$\frac{2}{3} < 1$

4. $\csc\frac{2\pi}{3}$

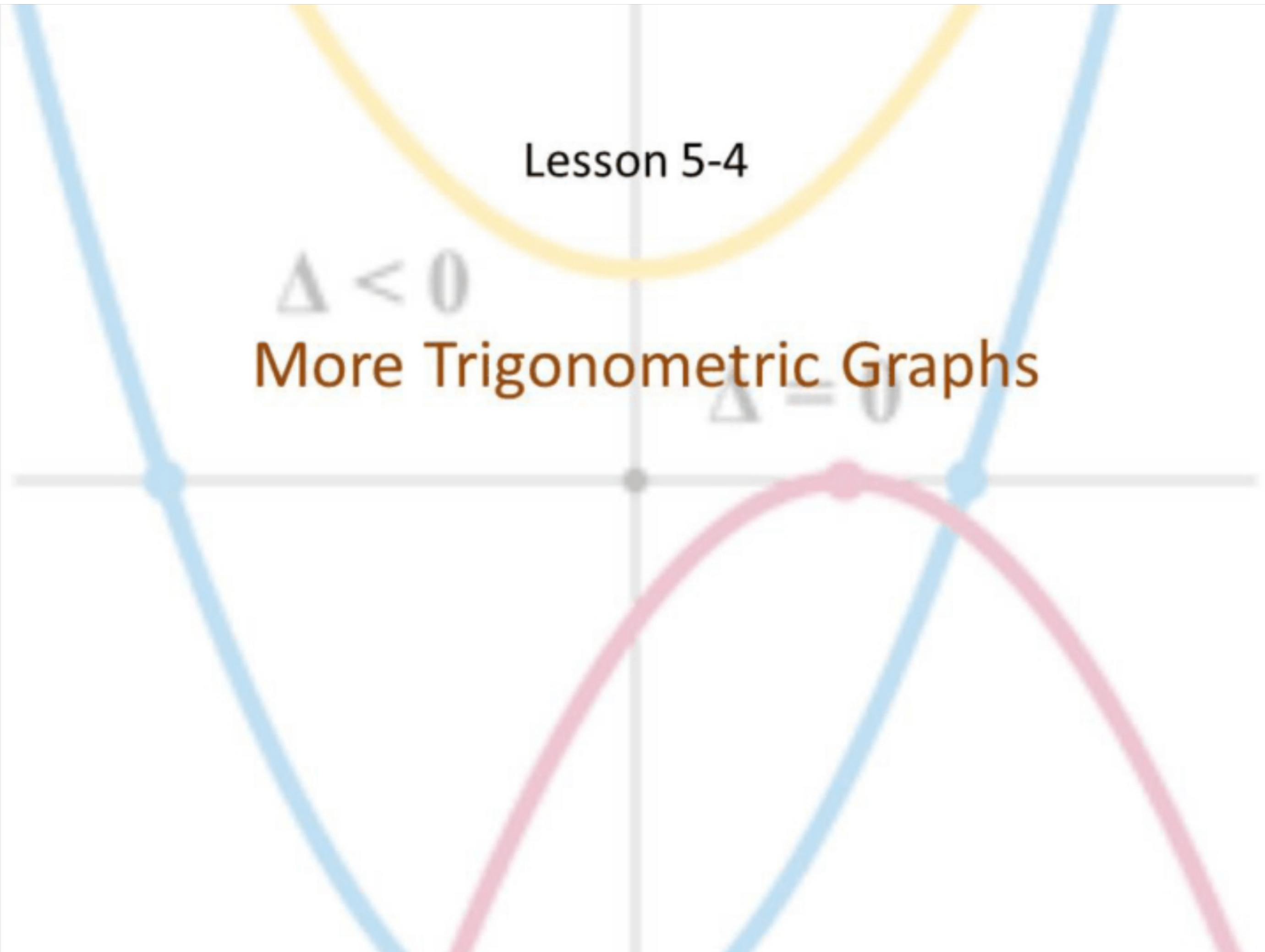
$\left(-\frac{1}{2}, \frac{\sqrt{3}}{2}\right)$

$\frac{1}{\sin} = \frac{1}{y} = \frac{1}{\frac{\sqrt{3}}{2}} = \frac{2}{\sqrt{3}}$

$= \boxed{\frac{2\sqrt{3}}{3}}$

Lesson 5-4

More Trigonometric Graphs



Objective

Students will…

- Be able to identify Tangent, Cotangent, Secant, and Cosecant graphs.
- Be able to find the period of Tangent, Cotangent, Secant, and Cosecant functions.

Standard Equation of tan and cot Curves

Just like sine and cosine functions, there exists a standard equation of tangent and cotangent functions.

<u>Tangent Curves</u>: Any equation of a tangent curve is written in the form:

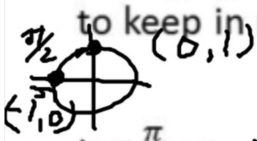
$y = a \tan kx$, where a and k are real numbers with $k > 0$

<u>Cotangent Curves</u>: Any equation of a cotangent curve is written in the form:

$y = a \cot kx$, where a and k are real numbers with $k > 0$

Asymptotes of Tangent and Cotangent Functions

Graphing tangent and cotangent functions by hand is even less efficient than graphing sine or cosine functions. However, there are some things to keep in mind when dealing with them. Consider the following…



$\tan\frac{\pi}{2} = \frac{1}{0} =$ und. $\qquad \frac{\sin}{\cos} = \frac{y}{x}$

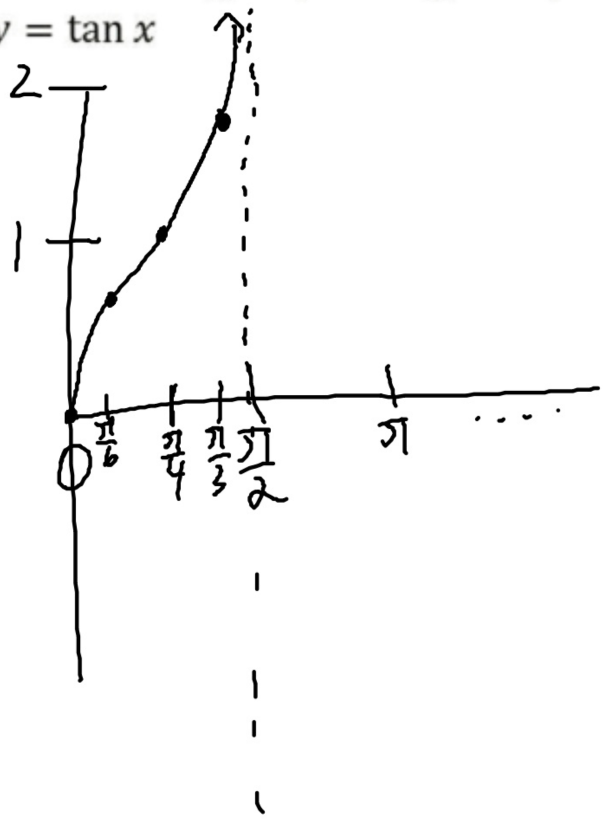
$\cot\pi = \frac{\cos}{\sin} = \frac{x}{y} = \frac{-1}{0} =$ und.

This happens throughout the unit circle, which tells us that the standard tangent and cotangent functions are undefined at various points. This calls for drawing **vertical asymptotes** at these undefined points.

Graph of Tangent Function

Let's start with the tangent function. I would begin by making a simple X-Y table. Following is such table for $y = \tan x$

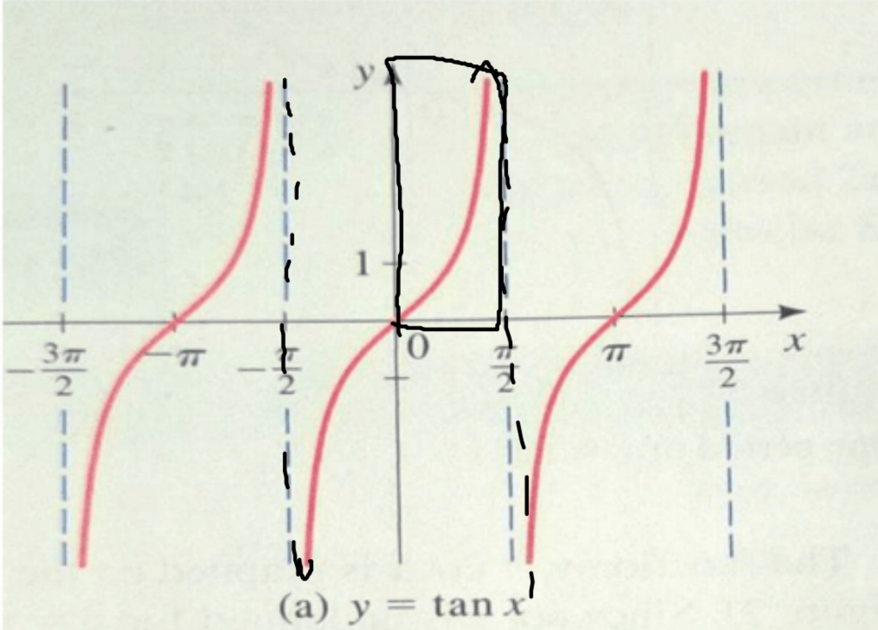
x	$\tan x$
0	0
$\frac{\pi}{6}$	0.58
$\frac{\pi}{4}$	1.00
$\frac{\pi}{3}$	1.73
1.4	5.80
1.5	14.10
1.55	48.08
1.57	1,255.77
1.5707	10,381.33



Graph of Tangent Function

As observed, setting our x-axis window from 0 to 2π, appears to give us an incomplete cycle of the tangent function. Turns out, if we change our window to go from $-\frac{\pi}{2}$ to $\frac{\pi}{2}$ (or we could go from $\frac{\pi}{2}$ to $\frac{3\pi}{2}$), we then get a complete view of the function's cycle. Notice that our period is still $\boldsymbol{\pi}$.

Ex.

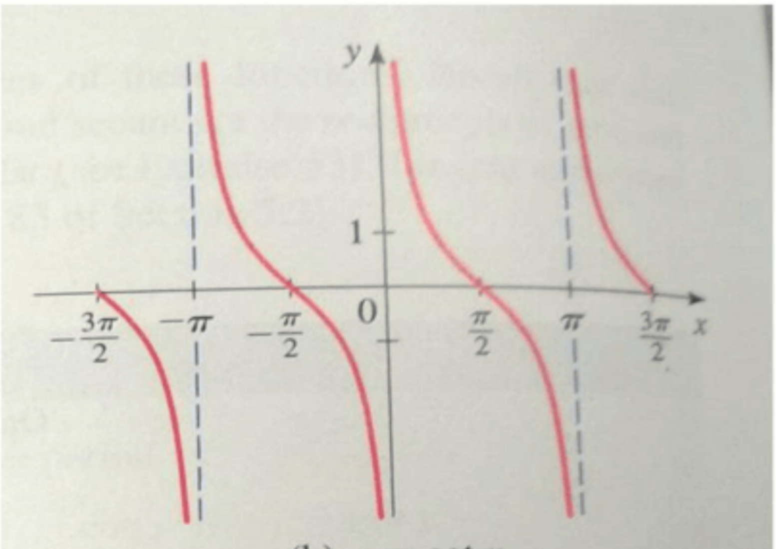


(a) $y = \tan x$

Graph of Cotangent Function

Now, the graph of $\cot x$ is quite similar to the graph of **tan x**. In fact, it's simply a **vertical reflection** of the tangent. Also, we can leave our viewing window the same as sine and cosine functions (0 to 2π), since our **vertical asymptotes** are at different places.

Ex.



(b) $y = \cot x$

Standard Equation of csc and sec Curves

The standard equations of cosecant and secant functions are as follows:

Cosecant Curves: Any equation of a cosecant curve is written in the form:

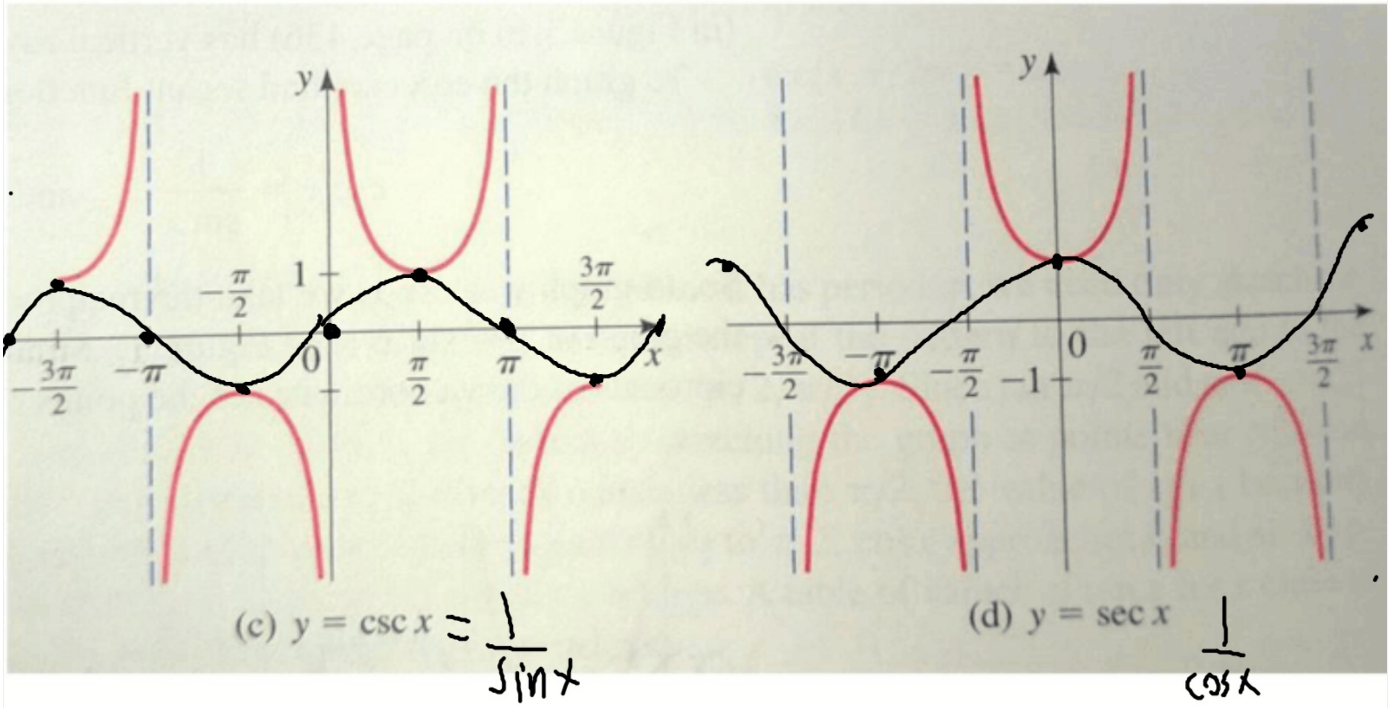
$y = a \csc kx$, where a and k are real numbers with $k > 0$

Secant Curves: Any equation of a secant curve is written in the form:

$y = a \sec kx$, where a and k are real numbers with $k > 0$

Graphs of Cosecant and Secant

Graphs of cosecant and secant can be understood as "branching out" from sine and cosine functions, respectively. We will simply observe these graphs, visually. (Well, lucky you!). They both have a period of 2π.



Finding the Period of tan, cot, csc, and sec

Finding the period of tangent, cotangent, cosecant, and secant functions is as easy as it was for sine and cosine functions.

Recall that standard tangent and cotangent functions have period of π.

So, the period of any tangent or cotangent function is of the form $\frac{\pi}{k}$

Recall that standard cosecant and secant functions have period of 2π.

So, the period of any cosecant or secant function is of the form $\frac{2\pi}{k}$

Examples

Find the period of the following.

a) $3 \tan 5x$

Per: $\frac{\pi}{k} = \frac{\pi}{5}$

b) $\csc 2x$

Per: $\frac{2\pi}{k} = \frac{2\pi}{2} = \pi$

c) $\cot \frac{1}{2}x$

Per: $\frac{\pi}{k} = \frac{\pi}{1/2} = \pi \cdot 2 = 2\pi$

d) $9 \sec 0.25x$

$= \frac{2\pi}{k} = \frac{2\pi}{1/4} = 8\pi$

e) $\frac{1}{2} \tan \pi(2x - \frac{3}{2})$

$k = 2\pi$

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

Homework 1/24

TB pg. 441 #1-6 (use the process of elmination!), 21-41 (e.o.o) (**Find the period only!**)