Coming up in Pre-Calculus...

This Week

Today: 4.7a

Next Week

Monday: 4.7b

Tuesday: 4.8

Wednesday: Sinusoidal Motion Word Problems

Thursday: Quiz Review

Friday: 4.7-4.8 Quiz//end of Ch. 4

Sinusoidal Rollercoaster DUE Thursday October 1

Oct 6-10:16 AM

PreCalculus Section 4.7b Trig. Inverses

Warm UP

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

Simplify

$\frac{\sqrt{3}}{2} \div -\frac{1}{2} = \frac{\sqrt{3}}{\cancel{2}} \cdot -\frac{\cancel{2}}{1}$

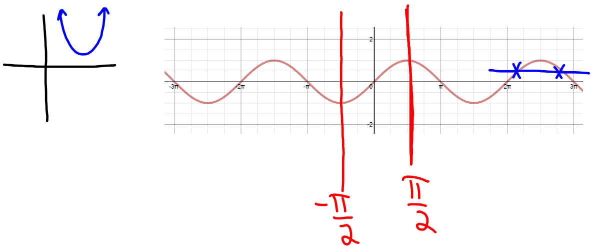
1. Sin(0) **2. Cos($-\frac{\pi}{4}$)** **3. tan(120°)**

0 $\frac{\sqrt{2}}{2}$ $-\sqrt{3}$

Sep 17-4:34 PM

Consider the graph of y=sin(x), shown below. Answer the following questions to prepare for today's lesson:

- Does the graph of y=sin(x) pass the Horizontal Line Test? No
- Based on the previous question, what can you conclude about the inverse of y=sin(x)? Not a function
- Restrict the domain so that the graph DOES pass the HLT.



Oct 3-9:00 AM

Graphing the inverse sine function...

$y = \sin(x)$

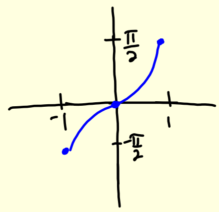
x	y
$-\frac{\pi}{2}$	-1
0	0
$\frac{\pi}{2}$	1

Domain: $[-1, 1]$

Range: $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$

$y = \sin^{-1}(x)$

x	y
-1	$-\frac{\pi}{2}$
0	0
1	$\frac{\pi}{2}$

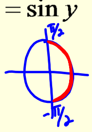


Oct 4-1:59 PM

Inverse Sine

$y = \arcsin(x)$ *or* $y = \sin^{-1}(x)$ *iff* $x = \sin y$

Inverse function is only defined where



Domain: $[-1, 1]$ (where x is a ratio of sides)

Range: $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$ (where y is an angle in Quads I or IV)

WARNING: $y = \sin^{-1}(x) \neq \frac{1}{\sin(x)}$

Oct 4-2:06 PM

EX1: Evaluate $\theta = \arcsin\frac{1}{2}$

Ex $\sin\theta = \frac{\sqrt{3}}{2}$

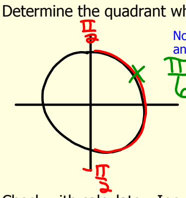
$\theta = \sin^{-1}\left(\frac{\sqrt{3}}{2}\right)$

1) Rewrite: $\sin\theta = \frac{1}{2}$

In other words, find the angle θ where the ratio of sides for sine is $\frac{1}{2}$.

2) Determine the quadrant where this angle could exist:

Normally, sin(θ) is positive in Quad I & II, but we can only look at angles in Quad I because that is where inverse sine is defined.



$\frac{\pi}{6}$ or $30°$

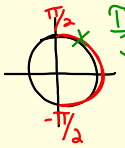
3) Check with calculator: Input $\sin^{-1}\left(\frac{1}{2}\right) \approx .5236$

Calculator will NOT give exact values in terms of π!

Oct 4-4:01 PM

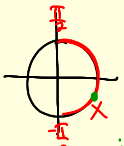
Try #9(a), p. 327 (HW)

a) $\sin^{-1}\frac{\sqrt{3}}{2}$



$\frac{\pi}{3}$

b) $\tan^{-1}\left(-\frac{\sqrt{3}}{3}\right)$



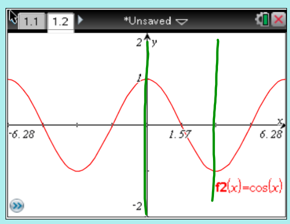
$\frac{11\pi}{6} = -\frac{\pi}{6}$

$\frac{\sqrt{3}}{3} \cdot \frac{\sqrt{3}}{\sqrt{3}}$

$\frac{3}{3\sqrt{3}} = \frac{1 \div 2}{\sqrt{3} \div 2}$ $\frac{\sin\frac{1}{2}}{\cos\frac{\sqrt{3}}{2}}$

Oct 4-4:01 PM

Consider y = cos(x)



Is the function one-to-one? NO

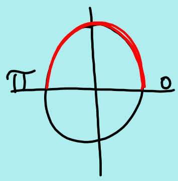
Is the inverse a function? NO

Restrict the domain: $[0, \pi]$

Now is the function one-to-one? yes

f(x)=cos(x)
Domain: $[0, \pi]$
Range: $[-1, 1]$

f(x)=cos^{-1}(x)
Domain: $[-1, 1]$
Range: $[0, \pi]$



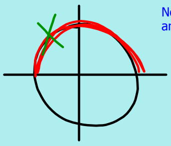
Oct 4-1:59 PM

Example: Evaluate $\cos^{-1}-\frac{\sqrt{2}}{2}$

1) Rewrite: $\cos\theta = -\frac{\sqrt{2}}{2}$

In other words, find the angle y where the ratio of sides for cosine is $\underline{-\frac{\sqrt{2}}{2}}$.

2) Determine the quadrant where this angle could exist:



Normally, cos(θ) is negative in Quad II & III, but we can only look at angles in Quad II because that is where inverse cosine is defined.

$\frac{3\pi}{4}$ $0 \le \theta \le \pi$

3) Check with calculator: Input $\cos^{-1}-\frac{\sqrt{2}}{2}$ ≈ 2.356

Calculator will NOT give exact values in terms of π!

Oct 4-4:01 PM

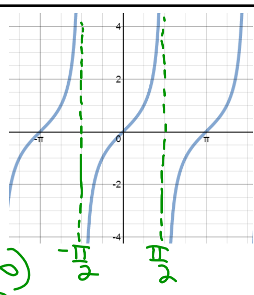
Consider y = tan(x)

Is the function one-to-one? NO

Is the inverse a function? NO

Restrict the domain: $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$

Now is the function one-to-one? yes



f(x)=tan(x)

Domain: $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$

Range: $(-\infty, \infty)$ $\mathbb{R}$

f(x)=tan^{-1}(x)

Domain: $(-\infty, \infty)$

Range: $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$

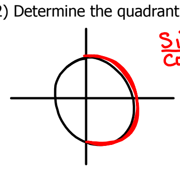
Oct 4-1:59 PM

Example: Evaluate $\arctan(0)$

1) Rewrite: $\tan\theta = 0$

In other words, find the angle y where the ratio of sides for tangent is $\underline{0}$.

2) Determine the quadrant where this angle could exist:



$\frac{\sin}{\cos} = 0$

0

3) Check with calculator: Input $\tan^{-1}(0) = 0$

In this case, calculator did give the exact value.

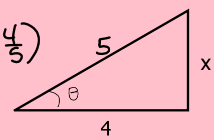
Oct 4-4:01 PM

We can use inverse trig functions to solve for angles in a right triangle.

$\cos\theta = \frac{4}{5}$

$\theta = \arccos\left(\frac{4}{5}\right)$

$\theta = 36.87°$



Find θ in terms of x.

Note: The ratio of sides must always be between -1 and 1 for $\sin^{-1}(x)$ and $\cos^{-1}(x)$. Calculator will produce an error otherwise.

Oct 4-4:34 PM

Summary

Function	Range	Quadrants
$\sin^{-1}(x)$	$\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$	I + IV
$\cos^{-1}(x)$	$[0, \pi]$	I + II
$\tan^{-1}(x)$	$\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$	I + IV

Oct 3-9:00 AM

HOMEWORK

...Not too much work for a Friday :]

4.7a (p. 327): 1-9 (odd), 13, 14, 15-27(odd)

Oct 6-10:14 AM

Inverse trig ratios allow us to solve for ANGLE values that correspond to a given ratio of sides.

EX: Find arcsin(.56) using a calculator.

In radian mode:

In degree mode:

Find approximate angle values rounding to 3 decimal places.

Oct 4-4:31 PM