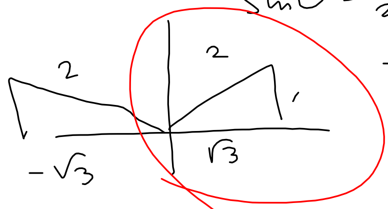
What's causing heartburn on the homework?

$\arcsin\left(\cos\frac{\pi}{3}\right) = \arcsin\left(\frac{1}{2}\right)$

$\sin\theta = \frac{1}{2}$ picture for $\arcsin\left(\frac{1}{2}\right)$

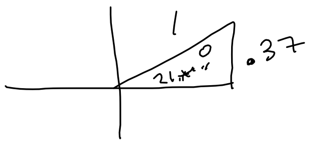


arcsine ($\sin^{-1}$) only sees this one, due to the conventional restriction on the domain of sin for the purposes of inverse functions.

(Need to make sine 1-to-1 to invert it.)

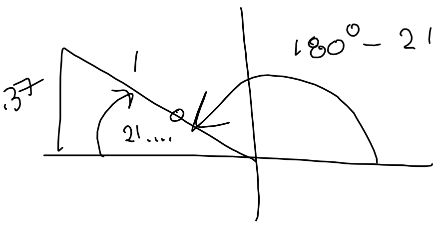
Suppose asked to solve $\sin(x) = .37$

$\sin^{-1}(.37) \approx 21.71561728°$

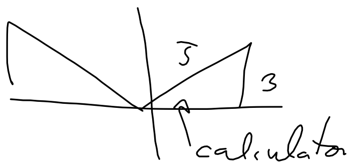


Then we know the other one is

$180° - 21.71561728°$



$\sin x = \frac{3}{5}$



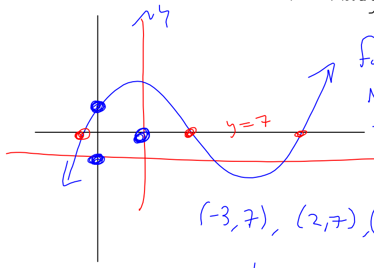
158.2843827

$\sin(x) = .37 \Rightarrow x \approx 21.7156°$ or $180 - 21.7156°$

$= 158.2844°$

Recall: 1-to-1 function is a function that assigns exactly one x-value in the domain to each y-value in the range. Horizontal line test

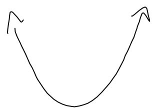
Recall: A function is a rule that assigns exactly one y-value in the range to each x-value in the domain. Vertical line test for $y = f(x)$.



function.
Not 1-to-1.
The horizontal line hits it more than once

$(-3,7)$, $(2,7)$, $(6,7)$ all points on graph

To make inverse relation
$(7,-3)$, $(7,2)$, $(7,6)$ Not function.



$y = x^2$ is classic "not 1-to-1" func.

$y = x^2$ Solve for x:

$$\sqrt{y} = \sqrt{x^2} = |x|$$

$$|x| = \sqrt{y}$$

$$x = \pm\sqrt{y}$$

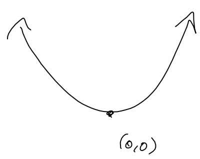
$\sqrt{3^2} = 3$

$\sqrt{(-3)^2} = 3$

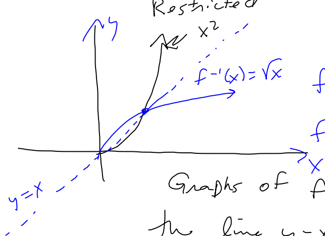
Look! 2 x-values for each (nonzero) value of y.

$\sqrt{x^2}$ Acts just like $|x|$.

Patch: we can say $y = \sqrt{x}$ is the inverse function for $y = x^2$ if we restrict $y = x^2$ to a ~~rag~~ domain where $y = x^2$ is 1-to-1.



If we restrict x to $\{x \mid x \geq 0\} = [0, \infty)$ then $f(x) = x^2$ is 1-to-1 and it makes sense to talk about f-inverse of x = $f^{-1}(x)$



$f(x) = x^2 \quad (x \geq 0)$

$f^{-1}(x) = \sqrt{x}$ makes sense.

Graphs of f & f^{-1} are symmetric about the line $y = x$

x	f: x^2	f^{-1}: $\sqrt{x}$
0	0	0
1	1	1
2	4	2
3	9	3

$\sin^{-1}(x)$ doesn't mean $\dfrac{1}{\sin(x)} = \csc(x)$

-1 powers suck, because they mean $\dfrac{1}{\text{stuff}}$ sometimes but also mean inverse functions. Only way to know is by context. I always use $\underline{\arcsin(x)}$ rather than $\sin^{-1}(x)$.

angle whose sine is x.

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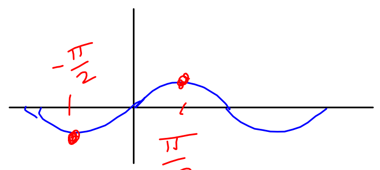
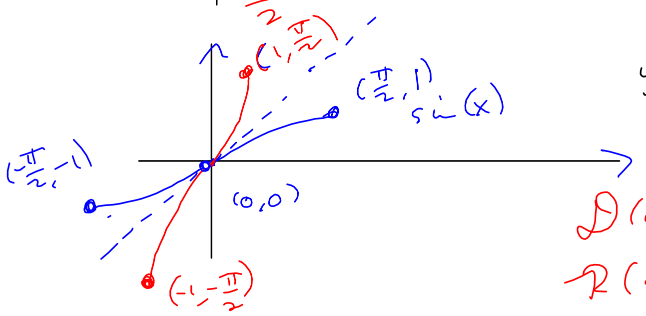
sin(x) is not 1-to-1!





Restrict the domain to keep it 1-to-1:

$x \in [-\frac{\pi}{2}, \frac{\pi}{2}] = \mathcal{D} = \mathcal{R}(\text{arcsine})$

$y \in [-1, 1] = \mathcal{R} = \mathcal{D}(\text{arcsine})$

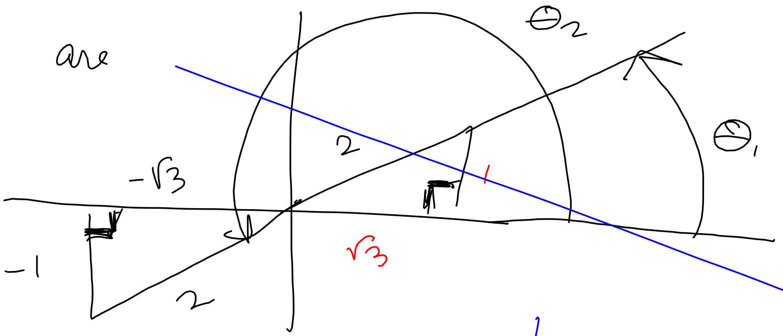
$\mathcal{D}(\text{arcsine}) = [-1, 1]$

$\mathcal{R}(\text{arcsine}) = [-\frac{\pi}{2}, \frac{\pi}{2}]$

Your calculator only sees angles between -90 degrees and + 90 degrees for arcsine.

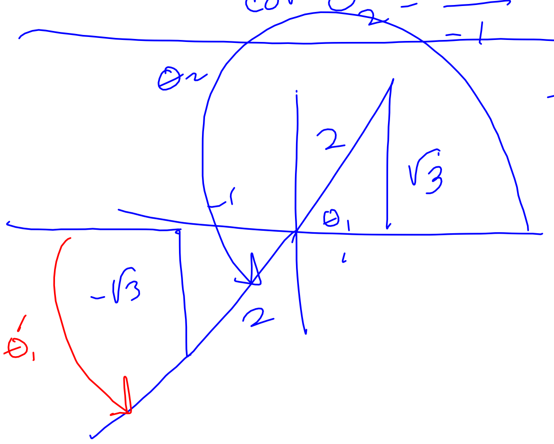
Cleaning up last week's boo-boo: 2 pictures for $\cot x = \frac{1}{\sqrt{3}}$

are



No, idiot!
You got x's & y's backwards

$\cot \theta_2 = \frac{-\sqrt{3}}{-1}$ oops! wrong pic!

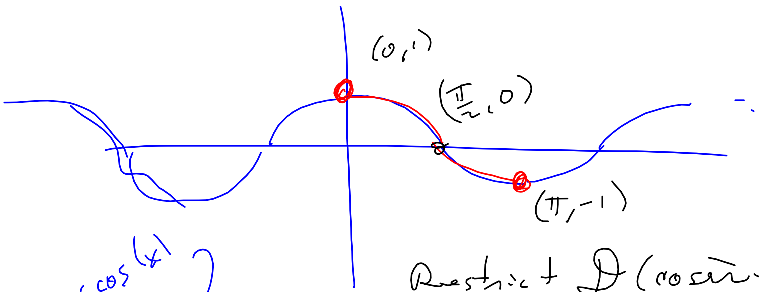


This is $\cot x = \frac{1}{\sqrt{3}}$ pic:

$$\cot \theta_2 = \frac{-1}{-\sqrt{3}} = +\frac{1}{\sqrt{3}}$$

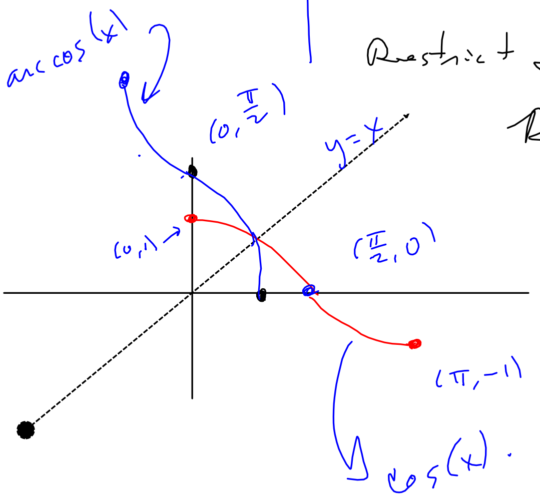
$$\cot \theta_1 = \frac{1}{\sqrt{3}}$$

cosine $\longleftrightarrow$ arc cosine

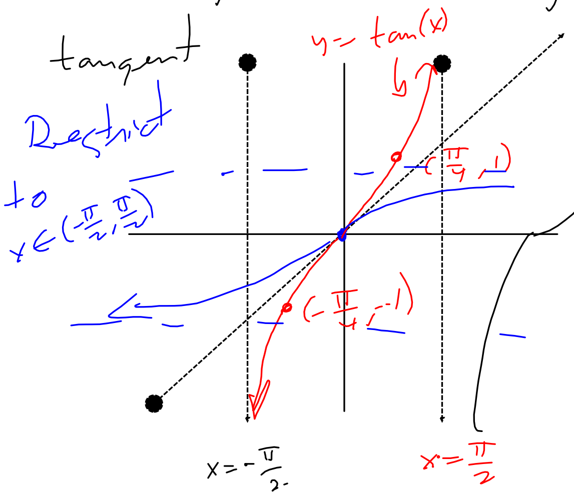


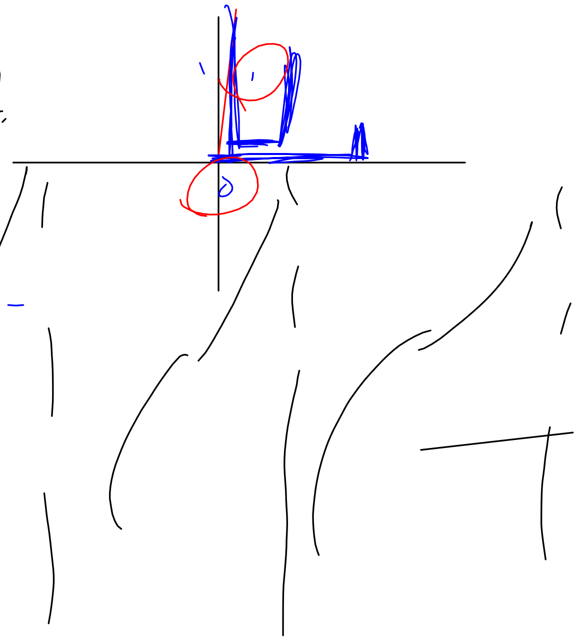
Restrict $\mathcal{D}(\text{cosine})$ to $[0,\pi] = \mathcal{R}(\arccos)$

$\mathcal{R}(\text{cosine}) = [-1,1] = \mathcal{D}(\arccos)$



tangent and arctangent.





$\mathcal{D} = (-\infty,\infty)$, $\mathcal{R} = (-\frac{\pi}{2}, \frac{\pi}{2})$