Math 3H 7-6a Inverse Trig Name:_________

$Sin^{-1}x =$ arcsinx="The <u>angle</u> between -90° and 90° whose sine is x." This means you put **IN** a sine value, x, and you get **OUT** an angle in the designated range. For example, $Sin^{-1}\frac{-\sqrt{3}}{2} = -60^{\circ}$.
$Cos^{-1}x =$ arccosx="The <u>angle</u> between 0° and 180° whose cosine is x." ." This means you put **IN** a cosine value, x, and you get **OUT** an angle in the designated range. For example, $Cos^{-1} -\frac{1}{2} = 120^{\circ}$.
$Tan^{-1}x =$ arctanx="the <u>angle</u> between -90° and 90° whose tangent is x." This means you put **IN** a tangent value, x, and you get **OUT** an angle in the designated range. For example, $Tan^{-1}1 = 45^{\circ}$.

A couple of important points when solving equations:

- If the question you're trying to answer asks for angle measures between 0° and 360°, you may have to add the period of the function to get the answer in the correct range.
- Also, the inverse trig functions will give you ONE answer for each input, as functions do. You must use your BRAIN to find any other answers that are appropriate for the question. Reference angles will help you here.

For example: Solve for all angles such that $0^{\circ} \le \theta \le 360^{\circ}$: $Sinx = -\frac{\sqrt{2}}{2}$.

If you do $Sin^{-1} -\frac{\sqrt{2}}{2}$ on your calculator, what answer do you get?__________

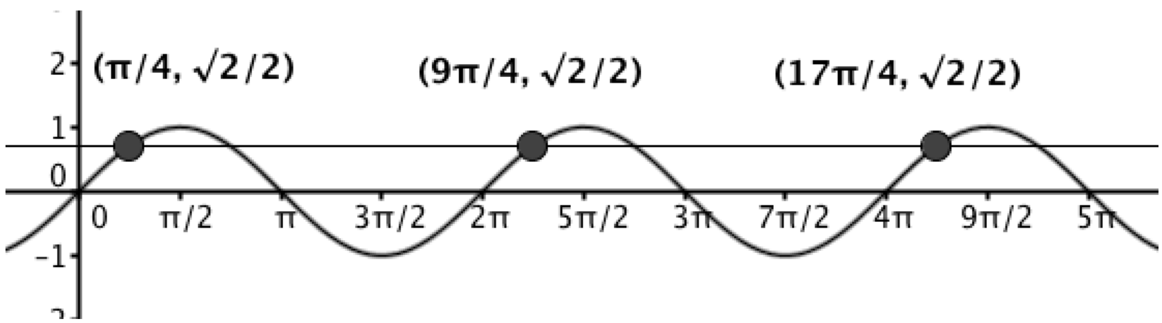
But the problem calls for angles between 0° and 360°. What do you get when you add 360° to the answer the calculator gave you?______________

But you know from the unit circle that there is ANOTHER angle between 0° and 360° that has a sine value of $-\frac{\sqrt{2}}{2}$. What is it? __________________

You found that one using your BRAIN.

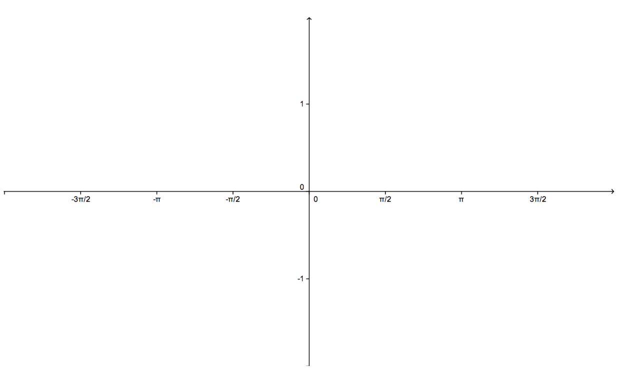
So why all of the complicated angle restrictions for inverse trig functions? Isn't life hard enough?

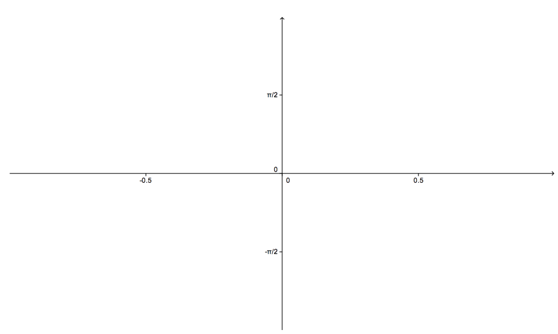
It's because we are dealing with FUNCTIONS, equations that give only ONE OUTPUT for each INPUT. If we didn't restrict the inverse trig functions in some way, we would get many answers. There are an infinite number of angles whose sine is $\frac{\sqrt{2}}{2}$. If you whip out your calculator, you could give me ten answers on the spot. Just keep adding 360° right?



This is easy to see visually if you look at the graphs of the sine, cosine and tangent functions.

1. Graph $y = \sin\theta$ on the axes below.
2. Does it pass the horizontal line test?
3. What does this mean?
4. Where should we restrict the function so that we get all values of the function but only once?
5. Graph $y = Sin^{-1}x$ on the other axes by switching the domain and range of the $\sin\theta$ function.





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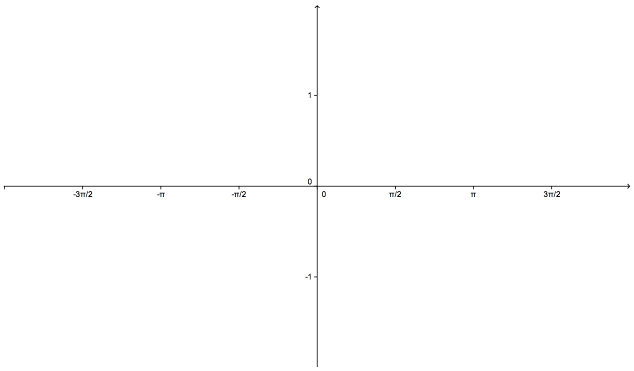
6. Repeat for $Cos^{-1}x$ and $Tan^{-1}x$.



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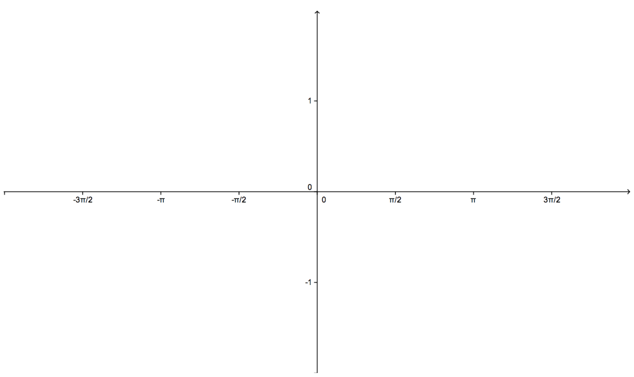

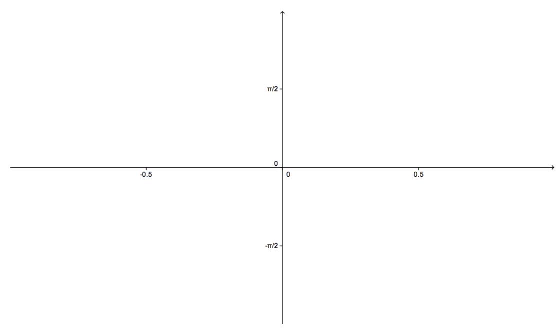

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Evaluate the following—NO CALCS:

1a. $\arcsin\left(\frac{\sqrt{3}}{2}\right) =$

b. $\sin^{-1}\left(\frac{1}{2}\right) =$

c. $\arcsin(1) =$

d. (tricky) $\sin^{-1}\left(\frac{5}{4}\right) =$

2a. $\arccos\left(\frac{\sqrt{2}}{2}\right) =$

b. $\cos^{-1}\left(-\frac{1}{2}\right) =$

c. $\arccos(0) =$

3a. $\arctan\sqrt{3} =$

b. $\tan^{-1}(-1) =$

c. $\arctan(0) =$