

Inverse Trig

Used to “free” a variable from inside of a trig function.

Example: $\cos(x) = \frac{1}{2}$

Function	Inverse Relation
$\sin \theta = a$	$\sin^{-1} a = \theta$
$\cos \theta = a$	$\cos^{-1} a = \theta$
$\tan \theta = a$	$\tan^{-1} a = \theta$

Example #1: Find all possible values of $\sin^{-1} \left(\frac{1}{2} \right)$

Example #2: Find all possible values of $\tan^{-1} 1$.

Sign characteristics of the unit circle:

- A. In which quadrant are all the ratios positive?
- B. Which quadrant has only sine positive?
- C. Which quadrant has only cosine positive?
- D. What quadrant has only tangent positive?

Remember: “All Students Take Calculus”

You try: Find $\sin^{-1} \left(\frac{-\sqrt{3}}{2} \right)$

Example #3: Solve for θ given that $\sin \theta = 0.4$, for $-90^\circ \leq \theta \leq 90^\circ$.

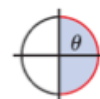
Example #4: Solve for θ given that $\tan \theta = -2$, for $-90^\circ < \theta < 90^\circ$.

Because more than one value of θ produces the same output value for a given trigonometric function, it is necessary to restrict the domain of each trigonometric function in order to define the inverse trigonometric functions.

- Trigonometric functions with restricted domains are indicated with a capital letter.
- The domains of the Sine, Cosine, and Tangent functions are restricted as follows:

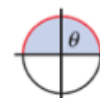
$$\text{Sin}\theta = \sin\theta \text{ for } \left\{ \theta \mid -\frac{\pi}{2} \leq \theta \leq \frac{\pi}{2} \right\}$$

θ is restricted to Quadrants I and IV.



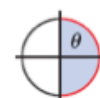
$$\text{Cos}\theta = \cos\theta \text{ for } \left\{ \theta \mid 0 \leq \theta \leq \pi \right\}$$

θ is restricted to Quadrants I and II.



$$\text{Tan}\theta = \tan\theta \text{ for } \left\{ \theta \mid -\frac{\pi}{2} < \theta < \frac{\pi}{2} \right\}$$

θ is restricted to Quadrants I and IV.



Example #5: Evaluate each inverse trigonometric function. Give your answer in radians.

$$\text{Cos}^{-1}\left(-\frac{\sqrt{3}}{2}\right)$$

$$\text{Sin}^{-1}\left(-\frac{\sqrt{2}}{2}\right)$$

$$\mathbf{\textit{Tan}^{-1}(-\sqrt{3})}$$

$$\mathbf{\text{Sin}^{-1} \frac{3}{2}}$$

Write about it:

Explain the difference between $\tan^{-1}a$ and $\text{Tan}^{-1}a$.