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Domain Issues of Inverse Composite Trig Functions

Case 1: Inner Function is the Restricted Function

- If argument (θ) is not within the domain, use its reference angle instead. For cos, it is easier to apply odd/even property.

Restricted Function Domain and Range:

$y = \sin(\theta)$ $D: \left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$

$R: [-1, 1]$

$y = \cos(\theta)$ $D: [0, \pi]$

$R: [-1, 1]$

$y = \tan(\theta)$ $D: \left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$ Note use of ( )

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

- Then,

$$\sin^{-1}(\sin(\theta)) = \theta$$

$$\cos^{-1}(\cos(\theta)) = \theta$$

$$\tan^{-1}(\tan(\theta)) = \theta$$

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Case 2: Inner Function is the Inverse Function

- If argument (trig. value) is not within the domain, then the outer (restricted) function is also not defined.

Inverse Function Domain and Range:

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

$D: [-1, 1]$

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

$y = \cos^{-1}(x) \rightarrow \theta = \cos^{-1}(x)$

$D: [-1, 1]$

$R: [0, \pi]$

$y = \tan^{-1}(x) \rightarrow \theta = \tan^{-1}(x)$

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

$R: \left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$ ← Note use of ( )

- Then, the composite function is not defined.
- No real solution.
- If defined, then

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

$\cos(\cos^{-1}(x)) = x$

$\tan(\tan^{-1}(x)) = x$

} x means trig value