

4.7 – Inverse Trig Functions (Day 2)

Compositions of Functions

Recall: If $f(x)$ and $f^{-1}(x)$ are truly inverse functions, then for all x values in the domains of $f(x)$ and $f^{-1}(x)$, the following is true:

_____ and _____

Inverse Properties of Trigonometric Functions:

Always true

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

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

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

Only true for x -values in the “restricted” domains

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

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

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

Example 1: Find the exact value of the following:

a) $\sin(\sin^{-1}(1))$

b) $\cos^{-1}\left(\cos\left(\frac{3\pi}{4}\right)\right)$

c) $\sin^{-1}\left(\sin\left(\frac{5\pi}{3}\right)\right)$

d) $\tan\left(\tan^{-1}\left(\frac{\sqrt{3}}{2}\right)\right)$

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Example 2: Find the exact value of the following (hint: draw a triangle!):

a) $\sec\left(\arcsin\left(\frac{4}{5}\right)\right)$

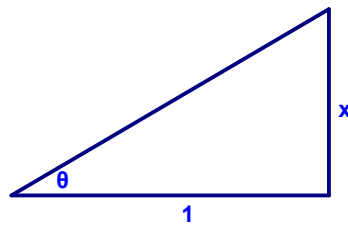
b) $\cot\left(\arctan\left(\frac{5}{8}\right)\right)$

Exploration

Use the triangle at the right to answer the following:

1) Find $\tan\theta$

2) Find $\tan^{-1}(x)$



3) Find the hypotenuse of the triangle as a function of x

4) Find $\sin\left(\tan^{-1}(x)\right)$ as a ratio involving no trig functions

5) Find $\sec\left(\tan^{-1}(x)\right)$ as a ratio involving no trig functions

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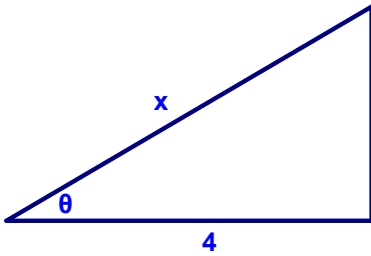
Example 3: Write an algebraic expression that is equivalent to the given expression (hint: draw a triangle!)

a) $\sec(\arctan(3x))$

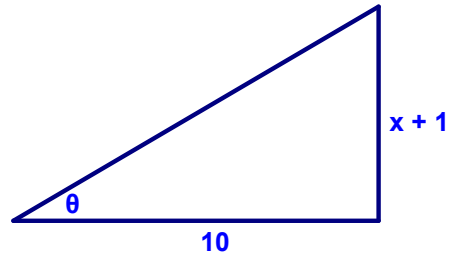
b) $\cot\left(\arcsin\left(\frac{2}{x}\right)\right)$

Example 4: Use an inverse trigonometric function to write θ as a function of x .

a)



b)



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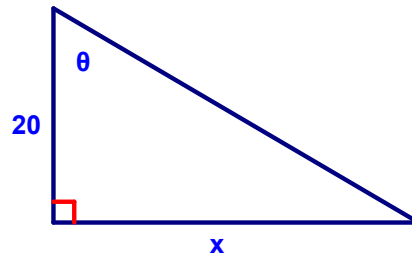
Example 5: Application

A security car with its spotlight on is parked 20 meters from a warehouse. Consider θ and x as shown in the figure.



a. Write θ as a function of x

b. Find θ when $x = 5$ meters.



c. Find θ when $x = 12$ meters.

Example 5: More Practice!

a) $\cos\left(\sin^{-1}\left(\frac{1}{2}\right)\right)$

b) $\sin^{-1}\left(\cos\left(\frac{\pi}{4}\right)\right)$

c) $\sin(\tan^{-1}(-1))$

d) $\cos^{-1}\left(\cos\left(\frac{7\pi}{4}\right)\right)$

Homework: 4.7 Exercises Day 2: p. 349# 37, 39, 41, 49 - 67 odd, 91, 92