

Derivatives of Inverse Trig Functions.

$\sin^{-1} x$ or $\arcsin x$
 $\cos^{-1} x$ or $\arccos x$
 $\tan^{-1} x$ or $\arctan x$
 $\cot^{-1} x$ or $\operatorname{arccot} x$
 $\sec^{-1} x$ or $\operatorname{arcsec} x$
 $\csc^{-1} x$ or $\operatorname{arccsc} x$

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$$\begin{aligned}
 \frac{d}{dx}(\sin^{-1} x) &= \frac{d}{dx}(\arcsin x) = \frac{1}{\sqrt{1-x^2}} \\
 \frac{d}{dx}(\cos^{-1} x) &= \frac{d}{dx}(\arccos x) = \frac{-1}{\sqrt{1-x^2}} \\
 \frac{d}{dx}(\tan^{-1} x) &= \frac{d}{dx}(\arctan x) = \frac{1}{1+x^2} \\
 \frac{d}{dx}(\cot^{-1} x) &= \frac{d}{dx}(\operatorname{arccot} x) = \frac{-1}{1+x^2} \\
 \frac{d}{dx}(\sec^{-1} x) &= \frac{d}{dx}(\operatorname{arcsec} x) = \frac{1}{|x|\sqrt{x^2-1}} \\
 \frac{d}{dx}(\csc^{-1} x) &= \frac{d}{dx}(\operatorname{arccsc} x) = \frac{-1}{|x|\sqrt{x^2-1}}
 \end{aligned}$$

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Establish the formula for the derivative of $g(x) = \sin^{-1} x$.

$$f(x) = \sin x; \quad g(x) = \sin^{-1} x.$$

Want: find a formula for $g'(x)$

$$\text{By IFT; } g'(x) = \frac{1}{f'(g(x))}$$

$$f(x) = \sin x; \quad f'(x) = \cos x; \quad f'(g(x))$$

$$\Rightarrow f'(\sin^{-1} x) = \cos(\sin^{-1} x)$$

$$g'(x) = \frac{1}{\cos(\sin^{-1} x)} = \frac{1}{\cos(\alpha)} = \frac{1}{\sqrt{1-x^2}}$$

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$$\sin^{-1} x = \alpha$$

$$\sin \alpha = x$$

$(adj)^2 + x^2 = 1$
 $(adj)^2 = 1 - x^2$
 $adj = \sqrt{1-x^2}$
 $\cos \alpha = \frac{adj}{hyp} = \frac{\sqrt{1-x^2}}{1}$
 $\cos \alpha = \sqrt{1-x^2}$

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