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

POSITIVE

NEGATIVE

## Section 3.10 — Derivatives of Inverse Trigonometric Functions

Important Ideas:

$\frac{d}{dx}\sin^{-1}u = \frac{du/dx}{\sqrt{1-x^2}}$

$\frac{d}{dx}\sin^{-1}x = \frac{1}{\sqrt{1-x^2}}$ $\qquad$ $\frac{d}{dx}\cos^{-1}x = \frac{-1}{\sqrt{1-x^2}}$

$\frac{d\cos^{-1}u}{dx} = -\frac{1}{\sqrt{1-u^2}}\cdot\frac{du}{dx}$

$\frac{d}{dx}\tan^{-1}u = \frac{1}{1+u^2}\cdot\frac{du}{dx}$

$\frac{d}{dx}\tan^{-1}x = \frac{1}{1+x^2}$ $\qquad$ $\frac{d}{dx}\cot^{-1}x = \frac{-1}{1+x^2}$

$\frac{d}{dx}\sec^{-1}x = $ ☹ $\qquad$ $\frac{d}{dx}\csc^{-1}x = \frac{-1}{|x|\sqrt{x^2-1}}$

see other resources

oops

$\frac{1}{|x|\sqrt{x^2-1}}$

$(3x)^2 = 9x^2$

Check Your Understanding!

1. Let $y = \sin^{-1}(3x)$. Find $y'$.

$u = 3x$

$\frac{d}{dx}\sin^{-1}u = \frac{1}{\sqrt{1-u^2}}\cdot\frac{du}{dx} = \frac{1}{\sqrt{1-9x^2}}\cdot\frac{d}{dx}(3x) = \frac{1}{\sqrt{1-9x^2}}\cdot\frac{3}{1}$

$= \boxed{\frac{3}{\sqrt{1-9x^2}}}$

2. For $y = \tan^{-1}(4x^2)$, find $\frac{dy}{dx}$.

$u = 4x^2$

$\frac{du}{dx} = 8x$

$\frac{d}{dx}\tan^{-1}(4x^2) = \frac{1}{1+u^2}\cdot\frac{du}{dx}$

$= \frac{1}{1+(4x^2)^2}\cdot 8x = \boxed{\frac{8x}{1+16x^4}}$

3. If $\arcsin x = \ln y$, find $\frac{dy}{dx}$.

$\frac{d}{dx}\arcsin x = \frac{d}{dx}\ln y$

$\frac{1}{\sqrt{1-x^2}} = \frac{1}{y}\cdot y'$

$y' = \boxed{\frac{y}{\sqrt{1-x^2}}} = \boxed{\frac{e^{\arcsin x}}{\sqrt{1-x^2}}}$ meh.

$\frac{d}{dx}\arccos u = \frac{-1}{\sqrt{1-u^2}}\cdot\frac{du}{dx}$

4. For $y = \arccos(e^{7x})$, find $y'$.

$u = e^{7x}$

$\frac{du}{dx} = 7e^{7x}$

$u^2 = (e^{7x})^2 = e^{14x}$

$\frac{d}{dx}\arccos e^{7x} = \frac{-1}{\sqrt{1-e^{14x}}}\cdot 7e^{7x}$

$= \boxed{\frac{-7e^{7x}}{\sqrt{1-e^{14x}}}}$

5. Let $g(x) = \operatorname{arccot} x$. Find $g'(2)$.

$g'(x) = \frac{d}{dx}\operatorname{arccot} x = \frac{-1}{1+x^2} = \frac{-1}{1+(2)^2} = \boxed{\frac{-1}{5}}$