These two examples lead to the following set of rules for differentiating inverse trigonometric functions:

$$\frac{d\left(\sin^{-1}u\right)}{du}=\frac{1}{\sqrt{1-u^2}}du \qquad \frac{d\left(\csc^{-1}u\right)}{du}=\frac{-1}{u\sqrt{u^2-1}}du$$

$$\frac{d\left(\cos^{-1}u\right)}{du}=\frac{-1}{\sqrt{1-u^2}}du \qquad \frac{d\left(\sec^{-1}u\right)}{du}=\frac{1}{u\sqrt{u^2-1}}du$$

$$\frac{d\left(\tan^{-1}u\right)}{du}=\frac{1}{1+u^2}du \qquad \frac{d\left(\cot^{-1}u\right)}{du}=\frac{-1}{u^2+1}du$$

Examples:

Differentiate each of the following...

$$f(x)=x^3\sin^{-1}\left(3x^2\right)$$

$$f'(x)=3x^2\sin^{-1}(3x^2)+x^3\left(\frac{6x}{\sqrt{1-9x^4}}\right)$$

$$f(x)=\sqrt{3x-\tan^{-1}\sqrt{x}}$$

$$f'(x)=\frac{1}{2}\left[3x-\tan^{-1}\sqrt{x}\right]^{-1/2}\left(3-\frac{1}{1+x}\left(\frac{1}{2}x^{-1/2}\right)\right)$$

$$f(x)=\frac{\cot^3 5x}{\cot^{-1}(5x)}$$

$$f'(x)=\frac{3(\cot 5x)^2(-\csc^2 5x(5))\cot^{-1}5x-\cot^3 5x\left(\frac{-5}{1+25x^2}\right)}{(\cot^{-1}5x)^2}$$

$$f(x)=\tan\Big[\underbrace{arc\csc\left(x^5\right)}_{\text{"}u\text{"}}\Big]$$

$$f'(x)=\sec^2(\csc^{-1}x^5)\left(\frac{-5x^4}{x^5\sqrt{x^{10}-1}}\right)$$

Homework:

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Attachments

Worksheet - Trig Identities #2.doc