FUN	AP CALCULUS	
1	Topic: 3.4	Differentiating Inverse Trigonometric Functions
Learning Objective FUN-3.E: Calculate derivatives of inverse and inverse trigonometric functions.		

To complete our study of differentiation and inverse functions, we will now focus on taking the derivatives of the six inverse trigonometric functions.

Derivatives of Basic Inverse Trigonometric Functions

$$\frac{d}{dx}[\arcsin x] = \frac{1}{\sqrt{1-x^2}} \qquad \frac{d}{dx}[\arccos x] = -\frac{1}{\sqrt{1-x^2}}$$

$$\frac{d}{dx}[\arctan x] = \frac{1}{1+x^2} \qquad \frac{d}{dx}[\operatorname{arccot} x] = \frac{1}{1+x^2}$$

$$\frac{d}{dx}[\operatorname{arcsec} x] = \frac{1}{|x|\sqrt{x^2-1}} \qquad \frac{d}{dx}[\operatorname{arccsc} x] = -\frac{1}{|x|\sqrt{x^2-1}}$$

THEOREM: Derivatives of the Six Inverse Trigonometric Functions (Chain Rule)

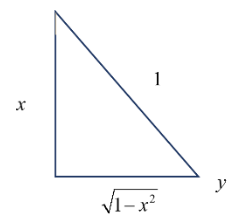
Let u be a function of x.

$$\frac{d}{dx}[\arcsin u] = \frac{u'}{\sqrt{1-u^2}} \qquad \frac{d}{dx}[\arccos u] = \frac{-u'}{\sqrt{1-u^2}}$$

$$\frac{d}{dx}[\arctan u] = \frac{u'}{1+u^2} \qquad \frac{d}{dx}[\operatorname{arccot} u] = \frac{-u'}{1+u^2}$$

$$\frac{d}{dx}[\operatorname{arcsec} u] = \frac{u'}{|u|\sqrt{u^2-1}} \qquad \frac{d}{dx}[\operatorname{arccsc} u] = \frac{-u'}{|u|\sqrt{u^2-1}}$$

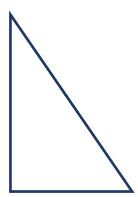
Let $y = \arcsin x$. How could we find $\frac{dy}{dx}$ without using an inverse trigonometric function?



Example 1: Find each of the following derivatives.

a. $\frac{d}{dx}[\arcsin(2x)]$

Long Method



Derivative Rule

b. $\frac{d}{dx}[\arctan(3x)]$

c. $\frac{d}{dx}\left[tan^{-1}\sqrt{x}\right]$

d. $\frac{d}{dx}[sec^{-1}(e^{2x})]^2$