Other Trig Functions

10/30

ES: what about other trig functions and their derivatives?

we already Know

① $\frac{d}{dx}[\sin x] = \cos x$

② $\frac{d}{dx}[\cos x] = -\sin x$

③ $\tan x = \frac{\sin x}{\cos x}$ $\frac{u}{v}$ $y' = \frac{u' \cdot v - u \cdot v'}{v^2}$

$$\frac{d}{dx}[\tan x] = \frac{(\cos x)(\cos x) - (\sin x)(-\sin x)}{(\cos x)^2}$$

$(\cos x)^2$

$$= \frac{\cos^2 x + \sin^2 x}{\cos^2 x}$$

$$= \frac{1}{\cos^2 x}$$

$\sec x = \frac{1}{\cos x}$

$$\frac{d}{dx}[\tan x] = \sec^2(x)$$

④ $\cot x = \frac{\cos x}{\sin x}$ $\quad \frac{d}{dx}[\cot x] = -\csc^2 x$

⑤ $\sec x = \frac{1}{\cos x}$ $\quad \frac{d}{dx}[\sec x] = \tan x \cdot \sec x$

⑥ $\csc x = \frac{1}{\sin x}$ $\quad \frac{d}{dx}[\csc x] = -\cot x \cdot \csc x$

Chain Rule How do we find the derivative of a composition function $y=(3x+1)^2$?

What is a Composite F(x)?

A function composed of two or more functions.

$$y=(3x+1)^2$$

Outside function

$f(x)=x^2$

Inside function

$g(x)=3x+1$

So $y=f(g(x))$

Chain Rule

$$\frac{d}{dx}\left[f(g(x))\right]=f'(g(x))\cdot g'(x)$$

derivative of outside — derivative of inside

(ex) $y=(3x+1)^2$

$y'=2(3x+1)^1\cdot(3)$

$y'=18x+6$

OR Chain Rule

$$\frac{dy}{dx}=\frac{dy}{du}\cdot\frac{du}{dx}$$

(ex) $y=(3x+1)^2$

1st Define u and rewrite y

let $u=3x+1$ $\quad y=u^2$

2nd Find $\frac{dy}{du}$ or y'

$y = u^2$

$\frac{dy}{du} = 2u$

3rd Find $\frac{du}{dx}$ or u'

$u = 3x + 1$

$\frac{du}{dx} = 3$

4th Multiply $\frac{dy}{du} \cdot \frac{du}{dx}$

$\frac{dy}{dx} = 2u \cdot 3$

$= 6u$

5th Plug $3x+1$ for u

$\frac{dy}{dx} = 6(3x+1)$

$= 18x + 6$

Summary