Trig Derivatives Day 2

I. Trig Derivatives

A. $\frac{d}{dx}[\sin x] = \cos x \cdot x'$

B. $\frac{d}{dx}[\cos x] = -\sin x \cdot x'$

C. $\frac{d}{dx}[\tan x] = sec^2 x \cdot x'$

D. $\frac{d}{dx}[\cot x] = -csc^2 x \cdot x'$

E. $\frac{d}{dx}[\sec x] = \sec x \tan x \cdot x'$

F. $\frac{d}{dx}[\csc x] = -\csc x \cot x \cdot x'$

II. Natural Log Derivatives

A. $\frac{d}{dx}[\ln x] = \frac{x'}{x}$

B. $\frac{d}{dx}[e^x] = e^x \cdot x'$

III. Day 2 Examples:

**With trig functions A – C, the Chain Rule means that your derivative will be found by:
(Derivative of trig function)(Derivative of Angle)

A. $f(x) = x + \sec\left(x^2 + \sqrt{2}\right)$

$f'(x) = 1 + \sec\left(x^2 + \sqrt{2}\right)\tan\left(x^2 + \sqrt{2}\right) \cdot (2x)$

$f'(x) = 1 + 2x\sec\left(x^2 + \sqrt{2}\right)\tan\left(x^2 + \sqrt{2}\right)$

B. $y = -\csc\left(x^2 + 7x\right)$

$f'(x) = -[-csc(x^2 + 7x)cot(x^2 + 7x) * (2x + 7)]$

$f'(x) = (2x + 7)\csc(x^2 + 7x)\cot(x^2 + 7x)$

C. $f(x) = 5\cot\left(\frac{2}{x}\right)$ rewrite as $f(x) = 5\cot(2x^{-1})$

$f'(x) = -5\csc^2(2x^{-1}) \cdot (-2x^{-2})$ Apply derivative for cot *x*

$f'(x) = 10x^{-2}\csc^2(2x^{-1})$ Multiply coefficients

$f'(x) = \frac{10}{x^2}\csc^2\left(\frac{2}{x}\right)$ Write with no negative exponents

D. $y = (\csc x + \cot x)^{-1}$ recognize as Chain Rule

$y' = -1(\csc x + \cot x)^{-2} \cdot [-\csc x \cot x - \csc^2 x]$

$y' = (\csc x + \cot x)^{-2} \cdot [\csc x \cot x + \csc^2 x]$ Distribute – 1

$y' = \frac{\csc x \cot x + \csc^2 x}{(\csc x + \cot x)^2}$ Write with no negative exponents

$y' = \frac{\csc x (\cot x + \csc x)}{(\csc x + \cot x)^2}$ Factor the numerator

$y' = \frac{\csc x}{(\csc x + \cot x)}$ Reduce like factors

E. $y = \sec^3(3x)$ recognize as Chain Rule (Power Rule)(Derivative of trig function)(Derivative of angle)

$y' = 3\sec^2(3x)\ [\sec(3x)\tan(3x)] \cdot (3)$ Apply Chain Rule

$y' = 9\sec^3(3x)\ \tan(3x)$ Clean up by multiplying coefficients &like trig functions

F. $y = \cos^4(5x)$ recognize as Chain Rule (Power Rule)(Derivative of trig function)(Derivative of angle)

$y' = 4\cos^3(5x)\ [-\sin(5x)] \cdot (5)$ Apply Chain Rule

$y' = -20\cos^3(5x)\ \sin(5x)$ Multiply coefficients

G. $f(x) = \ln(3x)$

$f'(x) = \frac{3}{3x}$ Apply natural log rule

$f'(x) = \frac{1}{x}$ Reduce

H. $f(x) = \ln(5x^2)$

$f'(x) = \frac{10x}{5x^2}$ Apply natural log rule

$f'(x) = \frac{2}{x}$ Reduce

I. $y = \ln^3(4x)$ recognize as Chain Rule

$y' = 3\ln^2(x) \cdot \left[\frac{4}{4x}\right]$ Apply natural log rule

$y' = \frac{12\ln^2(x)}{4x}$ Multiply

$y' = \frac{3\ln^2(x)}{x}$ Reduce

J. $f(x) = e^{8x^2+4x}$

$f'(x) = e^{8x^2+4x} \cdot (16x + 4)$ Apply natural log rule

$f'(x) = (16x + 4)e^{8x^2+4x}$ Clean up