Calc AB

$\boxed{\text{Lesson 84}}$

1/6/16

Agenda: 1/6/16

Lesson 84

Logarithmic Differentiation

★ logarithms can simplify the process of find derivatives of Complicated Expressions

Ex. 84.1 If $y = \dfrac{x^2}{(3x+2)^4}$ What is $\dfrac{dy}{dx}$?

$$\ln y = \ln\left(\frac{x^2}{(3x+2)^4}\right) = 2\ln x - 4\ln(3x+2)$$

$$\frac{1}{y}dy = \frac{2}{x}dx - \frac{4}{3x+2}\cdot 3dx$$

$$\frac{dy}{dx} = \left(\frac{2}{x} - \frac{12}{3x+2}\right)\cdot y$$

$$\frac{dy}{dx} = \frac{6x+4-12x}{x(3x+2)}\cdot\frac{x^2}{(3x+2)^4} = \boxed{\frac{(4-6x)x}{(3x+2)^5}}$$

Ex. 84.4 Let $y = x^x$ find $\dfrac{dy}{dx}$ given the domain is all positive reals.

$$\ln y = \ln(x^x) = x\cdot\ln(x)$$

$$\frac{1}{y}\frac{dy}{dx} = \ln(x)+1$$

$$\frac{dy}{dx} = y(1+\ln(x)) = \boxed{x^x(1+\ln(x))}$$

Ex. Let $y = x^{x^5-2}$ find $\dfrac{dy}{dx}$ given the domain is all positive reals.

$$\ln y = (x^5-2)\ln(x)$$

$$\boxed{\frac{dy}{dx} = x^{(x^5-2)}\left(5x^4\cdot\ln(x) + \frac{(x^5-2)}{x}\right)}$$