Name: _____ Date: _____

Learning Goal 3.3	Using more derivative rules.

$\ln x = \log_e x$

$$\frac{d}{dx}(\ln(x)) = \frac{1}{x}$$

$$\frac{d}{dx}(\log_b(x)) = \frac{1}{\ln b \cdot x}$$

$$\frac{d}{dx}(\ln(g(x))) = \frac{1}{g(x)} \times g'(x)$$

↑ CHAIN RULE

$$\frac{d}{dx}(\log_b(g(x))) = \frac{1}{\ln b \times g(x)} \times g'(x)$$

**** Recall the domain for logarithms **** $x > 0$ (UNTRANSFORMED)

Example Differentiate.

a. $y = \cos(\ln x)$

$$\frac{dy}{dx} = -\sin(\ln x) \times \frac{1}{x}$$

$$= -\frac{\sin(\ln x)}{x}$$

$x > 0$

b. $y = (\ln(1 + e^x))^2$

$$\frac{dy}{dx} = 2(\ln(1+e^x))' \times \frac{d}{dx}(\ln(1+e^x))$$

$$= 2(\ln(1+e^x)) \times \frac{1}{1+e^x} \times \frac{d}{dx}(1+e^x)$$

$$= 2(\ln(1+e^x)) \times \frac{1}{1+e^x} \times e^x$$

Change of Base for Logarithms

$$\log_b x = \frac{\log_a x}{\log_a b}$$

* a is ARBITRARY
* MOSTLY USED FOR EVALUATING

c. $y = \ln\sqrt{\dfrac{3x+2}{3x-2}}$

$f(x) = \dfrac{3x+2}{3x-2}$

$f'(x) = \dfrac{(3x-2)(3x+2)' - (3x+2)(3x-2)'}{(3x-2)^2}$

$= \dfrac{3(3x-2) - 3(3x+2)}{(3x-2)^2}$

$= \dfrac{-12}{(3x-2)^2}$

$\dfrac{dy}{dx} = \dfrac{1}{\sqrt{\frac{3x+2}{3x-2}}} \times \dfrac{1}{2\sqrt{\frac{3x+2}{3x-2}}} \times \dfrac{-12}{(3x-2)^2}$

$= \dfrac{-12}{2\left(\frac{3x+2}{3x-2}\right)\times(3x-2)^2}$

$= \dfrac{-6}{(3x+2)(3x-2)}$

d. $y = \log_2(1-3x)$

$\dfrac{dy}{dx} = \dfrac{1}{\ln 2\,(1-3x)} \times -3$