Name________________________________ **Date**______________

Calc I H – Chapter 5 Derivatives Review **Period** ____________

Do you remember the rules for finding the derivative of exponential and natural log functions?

$\frac{d}{dx}\left[e^x\right] = e^x$ $\frac{d}{dx}\left[e^u\right] = e^u u'$ $\frac{d}{dx}\left[\ln(x)\right] = \frac{1}{x}$ $\frac{d}{dx}\left[\ln(u)\right] = \frac{1}{u} \cdot u' = \frac{u'}{u}$

Find the derivative of each function.

1) $f(x) = e^{5x^2+1}$

$f'(x) = e^{5x^2+1} \cdot 10x$

$f'(x) = 10xe^{5x^2+1}$

2) $y = \ln(3x^3 + 4x)$

$y = \frac{1}{3x^3+4x}(9x^2+4) = \frac{9x^2+4}{3x^3+4x}$

3) $g(x) = e^{(3x^2+1)^2}$

$g'(x) = 2(3x^2+1)(6x)e^{(3x^2+1)^2}$

$g'(x) = 12x(3x^2+1)e^{(3x^2+1)^2}$

4) $p(x) = \ln\left(\frac{5x^2}{3x+1}\right)$

$p(x) = \ln 5x^2 - \ln(3x+1)$

$p'(x) = \frac{1}{5x^2}(10x) - \frac{1}{3x+1}(3)$

$p'(x) = \frac{2}{x} - \frac{3}{3x+1}$

5) What is the equation of the tangent line to $y = \ln e^{5x^2}$ at the point where $x = 3$?

Slope

$y' = \frac{1}{e^{5x^2}}(10x)e^{5x^2}$

$y' = 10x$

$y'(3) = 10(3)$

$y'(3) = 30$

Point

$y(3) = \ln e^{5(3)^2}$

$= \ln e^{45}$

$y(3) = 45$

$(3, 45)$

Tangent Line

$y - 45 = 30(x - 3)$

Practice in your groups:

6) $\frac{d}{dx}\left[e^{\frac{x^5}{2}}\right] = \frac{5}{2}x^4 e^{\frac{x^5}{2}}$

$= \frac{5x^4 e^{\frac{x^5}{2}}}{2}$

7) $\frac{d}{dx}\left[\ln(4x^2(3x+2)^2\right] =$

$\frac{d}{dx}\left[\ln 4x^2 + \ln(3x+2)^2\right]$

$\frac{d}{dx}\left[\ln 4 + 2\ln x + 2\ln(3x+2)\right] = 0 + 2\left(\frac{1}{x}\right) + 2\left(\frac{3}{3x+2}\right)$

$= \frac{2}{x} + \frac{6}{3x+2}$

8) $\frac{d}{dx}\left[5xe^{3x^5}\right] = 5e^{3x^5} + 5x(15x^4)e^{3x^5}$

$= 5e^{3x^5} + 75x^5 e^{3x^5}$

or

$5e^{3x^5}(1+15x^5)$

9) $\frac{d}{dx}\left[\ln(e^{x^4})\right] = \frac{1}{e^{x^4}}(4x^3 e^{x^4})$

$= 4x^3$

or

$\frac{d}{dx}(x^4) = 4x^3$

10) Find the slope of the tangent line to the function at the given point:

a. $f(x) = e^{3x^2}$ at $(2, e^{12})$

$f'(x) = 6xe^{3x^2}$

Slope

$f'(2) = 6(2)e^{3(2)^2}$

$= 12e^{12}$

$y - e^{12} = 12e^{12}(x-2)$

b. $g(x) = \ln\left(\frac{3x}{2}\right)$ at $(4, \ln(6))$

$g'(x) = \frac{1}{\frac{3x}{2}} \cdot \frac{3}{2} = \frac{1}{x}$

Slope

$g'(4) = \frac{1}{4}$

$y - \ln(6) = \frac{1}{4}(x-4)$

11) Write down the equation of the tangent line to the given function at the given *x*-coordinate.

a. $h(x) = 4xe^{x^3}$ at $x = -2$

$h'(x) = 4e^{x^3} + 4x(3x^2)e^{x^3}$

$= 4e^{x^3} + 12x^3 e^{x^3}$

Slope

$h'(-2) = 4e^{(-2)^3} + 12(-2)^3 e^{(-2)^3}$

$= 4e^{-8} - 96e^{-8}$

$= -92e^{-8}$

Point

$h(-2) = 4(-2)e^{(-2)^3}$

$= -8e^{-8}$

$(-2, -8e^{-8})$

$y + 8e^{-8} = -92e^{-8}(x+2)$

b. $p(x) = \ln(5x^2 + 1)$ at $x = 2$

$p'(x) = \frac{1}{5x^2+1}(10x) = \frac{10x}{5x^2+1}$

Slope

$p'(2) = \frac{10(2)}{5(2)^2+1}$

$= \frac{20}{21}$

Point

$p(2) = \ln(5(2)^2+1)$

$= \ln(21)$

$(2, 21)$

$y - 21 = \frac{20}{21}(x-2)$