Due date: ____________ **Name:** ___________________________________

Getting Ready for Derivatives (Part 4)

Notes

Recall the following properties of logarithms:

$\boldsymbol{\log_a(AB) = \log_a A + \log_a B}$

$\boldsymbol{\log_a\left(\frac{A}{B}\right) = \log_a A - \log_a B}$

$\boldsymbol{\log_a A^C = C\log_a A}$

(Note: A and B must be positive)

ex: Expand $\log_5 \frac{\sqrt[3]{x}}{25y^3}$

ex: Expand $\ln\left(\frac{3x^2+15x+18}{e^5\cdot\sqrt[3]{x}\cdot(2x+1)^3}\right)$

1. Expand each of the following expressions using the properties of logarithms.

   a) $\ln\left(\frac{(x+1)\sqrt{2x-3}}{x^2-x-2}\right)$

b) $\ln\left(\sqrt{\frac{x(x-1)}{x^2+2}}\right)$

c) $\ln\left(e^5 \cdot \sqrt[3]{x} \cdot (2x^2 - 9x - 5)\right)$

Exponential Equations

2. Solve the following equation: $3^{4x} = 5^{x+1}$

Logarithmic Equations

3. Solve the following equation: $\log x + \log(x + 15) = 2$

Practice at home

4. Expand each of the following expressions using the properties of logarithms.

   a) $\log\left(\frac{x}{\sqrt[3]{1-x}}\right)$

   b) $\ln x^{\sqrt{x+1}}$

   c) $\log_2 \frac{x^3}{3(y-1)(z+2)^2}$

   d) $\log_3 \frac{x^3+x^2}{x^2-4}$

   e) $\log\sqrt{\frac{10x^2-10x-60}{(x+1)^7}}$

f) $\ln\left(\frac{\sqrt{x}\cos^{-1}x}{2^x(x+1)}\right)$

g) $\ln\left(\frac{\sqrt[4]{x}\cdot(2x^3+1)^2}{e^{\tan^{-1}x}}\right)$

5. Determine whether each statement is true or false.

a) $(\ln x)^3 = 3\ln x$

b) $\log x^2 = 2\log x$

c) $\ln\sqrt{x} = \frac{1}{2}\ln x$

d) $\ln\frac{x}{yz} = \ln x - \ln y + \ln z$

e) $\sqrt[4]{\log x} = \frac{1}{4}\log x$

6. Solve the following equations.

a) $2^{2x-1} = 3^{x+2}$

b) $10^{1-x} = 6^x$

c) $\log_2 x + \log_2(2x + 3) = 1$

d) $\ln x - \ln(x - 2) = \ln 3$

e) $2 - \log_3(x + 2) = \log_3(2x + 1)$

7. Circle the mistake. Then write the correct solution.

a) $\log_2 x + \log_2(x-2) = 3$

$2^{\log_2 x} + 2^{\log_2(x-2)} = 2^3$
$x + (x-2) = 8$
$2x - 2 = 8$
$2x = 10$
$\boxed{x = 5}$

b) $\log(x+1) - \log x = 2$

$\log\left(\frac{x+1}{x}\right) = 2$
$\frac{x+1}{x} = 2$
$x + 1 = 2x$
$1 = x$
$\boxed{x = 1}$