Group #: _____   Name: _____

1. (4 points each) Use the Laws of Logarithms to expand the expression.

   (a) $\log_2(x(x-1))$

   (b) $\log_4 \dfrac{y}{y+3}$

   (c) $\log_5 \sqrt[3]{x^2+1}$

   (d) $\log_5 \sqrt{2a^4+1}$

   (e) $\log\left(\dfrac{x^3y^4}{z^6}\right)$

   (f) $\log_2\left(\dfrac{x(x^2+1)}{\sqrt{x^2-1}}\right)$

   (g) $\ln\left(x\sqrt{\dfrac{y}{z}}\right)$

2. (4 points each) Use the Laws of Logarithms to combine the expression.

   (a) $3\log_2 A + 5\log_2 B - 2\log_2 C$

   (b) $4\log x - \dfrac{1}{3}\log(x^2+1) + 2\log(x-1)$

   (c) $2(\log_5 x + 2\log_5 y - 3\log_5 z)$

3. (3 points each) **True or False?** Discuss each equation and determine whether it is true for all possible values of the variables. Ignore values of the variables for which any term is undefined. **If the statement is not true, find a counterexample to show that the statement does not work.** For example, the statement $\log xy = (\log x)(\log y)$ is false since if $x = y = 10$ with base 10, then

$$\text{(left hand side)} \quad \log xy = \log(10\cdot 10) = \log 10^2 = 2$$

   while

$$\text{(right hand side)} \quad (\log x)(\log y) = (\log 10)(\log 10) = 1\cdot 1 = 1.$$

   Clearly $2 \neq 1$, hence the statement can not be true all the time. As long as a statement does not work in **one** case, it's a false statement!

   (a) $\log\left(\dfrac{x}{y}\right) = \dfrac{\log x}{\log y}$

   (b) $\log_2(x-y) = \log_2 x - \log_2 y$

   (c) $\log_5\left(\dfrac{a}{b^2}\right) = \log_5 a - 2\log_5 b$

   (d) $\log 2^z = z\log 2$

   (e) $(\log P)(\log Q) = log P + \log Q$

   (f) $\dfrac{\log a}{\log b} = \log a - \log b$

(g) $(\log_2 7)^x = x \log_2 7$

(h) $\log_a a^a = a^a$

(i) $\log(x - y) = \dfrac{\log x}{\log y}$

(j) $-\ln\left(\dfrac{1}{A}\right) = \ln A$

4. (10 points) The hydrongen ion concentrations in cheeses range from 4.0×10^{-7} M to 1.6×10^{-5} M. Find the corresponding range of pH readings. Round to 2 decimal places if necessary.

5. (10 points) The pH readings for wines vary from 2.8 to 3.8. Find the corresponding range of hydrogen ion concentrations.

6. (10 points) The Northridge, California, earthquake of 1994 had a magnitude of 6.8 on the Richter scale. A year later, a 7.2-magnitude earthquake struck Kobe, Japan. How many times more intense was the Kobe earthquake than the Northridge earthquake?