Name: _____ Date: _____

7.3 Product and Quotient Laws of Logarithms

BLM 7–5

1. Simplify, using the laws of logarithms. Then evaluate, correct to three decimal places.

a) $\log 99 - \log 9$

b) $\log_5 20 + \log_5 3$

2. Simplify each algebraic expression. State any restrictions on the variables.

a) $\log_4 x + \log_4 (2y) - \log_4 (z-3)$

b) $\log a - 2\log b + 3\log c$

3. Evaluate, using the laws of logarithms.

a) $\log_3 54 - \log_3 6$

b) $\log_6 4 + \log_6 6 + \log_6 \frac{3}{2}$

c) $\log 5 + 2\log 4 - \log 8$

4. Write as a sum or difference of logarithms. Simplify, if possible.

a) $\log\left(\frac{x^2 y}{z^3}\right)$

b) $\log_3\left(\frac{5\sqrt[3]{m}}{n^4}\right)$

5. Simplify. State any restrictions on the variables.

a) $\log(m^5) - \log(m^2) + \log m$

b) $\log\left(\sqrt[3]{p}\right) + \log\left(\sqrt{p}\right) + \log\left(\sqrt[6]{p}\right)$

c) $\log(x^2 - 5x - 6) - \log(x-3)$

d) $\log(6x^2 + 5x - 6) + \log(2x-3) - \log(4x^2 - 9)$

6. Use Technology

a) Graph the function $f(x) = \log x$.

b) Graph the function $g(x) = 2f(x)$.

c) Graph the function $h(x) = f(x^2)$.

d) How are the functions $g(x)$ and $h(x)$ related? What law of logarithms does this illustrate?

7. Jorge is offered two different jobs. One pays a starting salary of $50 000 per year, with a guaranteed raise of $1000 every year. The other pays a starting salary of $25 000 with a guaranteed raise of 5% per year.

a) How long would Jorge have to work before the two jobs paid the same salary?

b) If salary is the only factor in Jorge's decision, which job offer would be better? Explain.

c) Would your answer to part b) change if each company had a pension plan that paid the average of the best five years of income as a pension, provided the worker spent 30 years with the company? Explain.

8. Use the laws of logarithms to write y as a function of x for each of the following. Then, state the domain of the function.

a) $\log(xy) = 2\log(x-3)$

b) $\log(y) + 3 = \log(y+1) + \log(x)$

c) $\log\left(\frac{x^2}{y}\right) = 2\log(x+5)$

9. Prove that $\frac{1}{\log_x 10} + \frac{1}{\log_y 10} = \frac{1}{\log_{xy} 10}$.

(Hint: recall that $\log_n m = \frac{\log m}{\log n}$)