

## MAT 171 - CLASS NOTES - Section 4.3: Properties of Logarithms

### 1) Properties of Logarithms

a) Product Property:  $\log_b MN = \log_b M + \log_b N$

b) Quotient Property:  $\log_b \frac{M}{N} = \log_b M - \log_b N$

c) Power Property:  $\log_b M^p = p \log_b M$

d)  $\log_b M = \log_b N$ : if and only if  $M = N$

### 2) Use the properties of logarithms to expand the expression as much as possible:

a)  $\log_b(x^3 y^2)$

b)  $\log_b \left( \frac{x^2}{yz^4} \right)$

c)  $\log_2 \left( \frac{\sqrt[2]{xy^4}}{z^5} \right)$

d)  $\log_8(13 * 7)$

e)  $\log(10000x)$

f)  $\ln \frac{e^4}{8}$

g)  $\log_5 \frac{\sqrt[2]{x}}{25}$

3) Use the properties of logarithms to condense each logarithmic expression.

a)  $\ln x + \ln 3$

b)  $\log_3(3x + 7) - \log_3 x$

c)  $5\log_3 x + 4\log_3 y - 2\log_3 z$

d)  $\frac{1}{2}\log_b x - 3\log_b y - 4\log_b z$

4) **Change-of-Base Formula**

5) Find  $\log_4 23$  to three decimal places.