MATH 41: Trigonometry and Analytic Geometry
Section 7, 105 Wartik Lab
MTWF 4:40 - 5:30 PM

Logarithms—Rules and Concepts

Logarithms can be confusing the first time you see them. The *best* way to approach these problems is to do many examples while *only* using the rules and properties listed in the table below. If it is not listed there, you probably cannot do it.

Algebraic Rule	Corresponding Concept(s)
The Definition of Log $b^m = M \iff \log_b(M) = m$	Logs are defined as the inverses of exponential functions. Logs **are** exponents.
Log Equality Property $\log_b(M) = \log_b(N) \iff M = N$	Equal exponentials w/ same base have equal exponents: $b^m = b^n \iff m = n$
Domain of Logarithms Domain of $\log_b(x)$ is $(0, \infty)$	Logs are inverses of exponential equations The range of an exponential equation is $(0, \infty)$
Product Rule $\log_b(M) + \log_b(N) = \log_b(MN)$	Multiplying exponentials is the same as adding exponents: $b^{m+n} = (b^m)(b^n)$
Power Rule $\log_b(M^k) = k\log_b(M)$	Powers of exponentials will multiply: $(b^m)^k = b^{mk}$
Quotient Rule $\log_b(M) - \log_b(N) = \log_b(\frac{M}{N})$	Elements in the denominator have a negative exponent: $b^{m-n} = \frac{b^m}{b^n}$
Change of Base Formula $\log_b(M) = \frac{\log_a(M)}{\log_a(b)}$	If $b^m = M$ and $a^k = b$, then $a^{km} = M$. (*Substitute*) So, if $a^\ell = M$, then $km = \ell$. Therefore $m = \ell/k$.

Remember, if the formula is not on here, then you probably can't do it! For example,

$$\log_b(x^2 - 1) \neq \log_b(x^2) - \log_b(1)!!$$

and

$$\frac{\log_b(7x)}{\log_b(12)} \neq \log_b(7x - 12)!!$$