Exponents and Logarithms Calc II Review; Summer 2010

Rules for Exponents

Description	Rule	Example
Exponent of zero	$x^0 = 1; x \neq 0$	$6^0 = 1$
Exponent of 1	$x^1 = x$	$7^1 = 7$
Product rule	$x^a \cdot x^b = x^{a+b}$	$3^2 \cdot 3^3 = 3^5$
Quotient rule	$\frac{x^a}{x^b} = x^{a-b}$	$\frac{5^7}{5^3} = 5^4$
Reciprocals	$x^{-a} = \frac{1}{x^a}$	$2^{-4} = \frac{1}{2^4}$
Powers	$\left(x^n\right)^m = x^{n \cdot m}$	$\left(10^3\right)^4 = 10^{12}$
Roots	$\sqrt[n]{x} = x^{\frac{1}{n}}$	$\sqrt[4]{16} = 16^{\frac{1}{4}}$

Rules for Logarithms

Description	Rule	Example
Log of 1	$\log_b(1) = 0$	$\log_9(1) = 0$
Log of *b*	$\log_b(b) = 1$	$\log_4 4 = 1$
Product rule	$\log_b(xy) = \log_b x + \log_b y$	$\log_2(4 \cdot 8) = \log_2 4 + \log_2 8$
Quotient rule	$\log_b\left(\frac{x}{y}\right) = \log_b x - \log_b y$	$\log_2\left(\frac{32}{4}\right) = \log_2 32 - \log_2 4$
Reciprocals	$\log_b\left(\frac{1}{x}\right) = -\log_b x$	$\log_2 \frac{1}{4} = -\log_2 4$
Powers	$\log_b\left(x^n\right) = n \log_b x$	$\log_2\left(4^3\right) = 3\log_2 4$
Change of base	$\log_b x = \frac{\log_a x}{\log_a b}$ $\log_b x = \frac{\ln x}{\ln b}$	$\log_2 16 = \frac{\log_4 16}{\log_4 2}$ $\log_{10} 1000 = \frac{\ln 1000}{\ln 10}$

The relationship between logarithms and exponents: $b^{\log_b x} = x;\ \log_b(b^x) = x$
Example: $2^{\log_2 16} = 16;\quad \log_2(2^4) = 4$