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U of I MAC Handouts:

Rules for Logarithms, Exponents, and Radical

Logs to Exponentials

$log_b x = y \iff b^y = x$

$lnx = y \iff e^y = x$

Laws of Logarithms

$log_b(xy) = log_b x + log_b y$

$log_b(\frac{x}{y}) = log_b x - log_b y$

$log_b(x^r) = r log_b x$

Rules of Exponents

$x^a \cdot x^b = x^{a+b}$

$\frac{x^a}{x^b} = x^{a-b}$

$(x^a)^b = x^{ab}$

Rules of Radicals

$\sqrt[n]{a \cdot b} = \sqrt[n]{a} \cdot \sqrt[n]{b}$

$\sqrt[n]{\frac{a}{b}} = \frac{\sqrt[n]{a}}{\sqrt[n]{b}}$

$\sqrt[n]{a^m} = a^{\frac{m}{n}}$

$\sqrt[n]{b} = b^{\frac{1}{n}}$

Change of Bases

$log_b(a) = \frac{log(a)}{log(b)}$

Inverse Operations

$e^{lnx} = x$

$ln(e^x) = x$

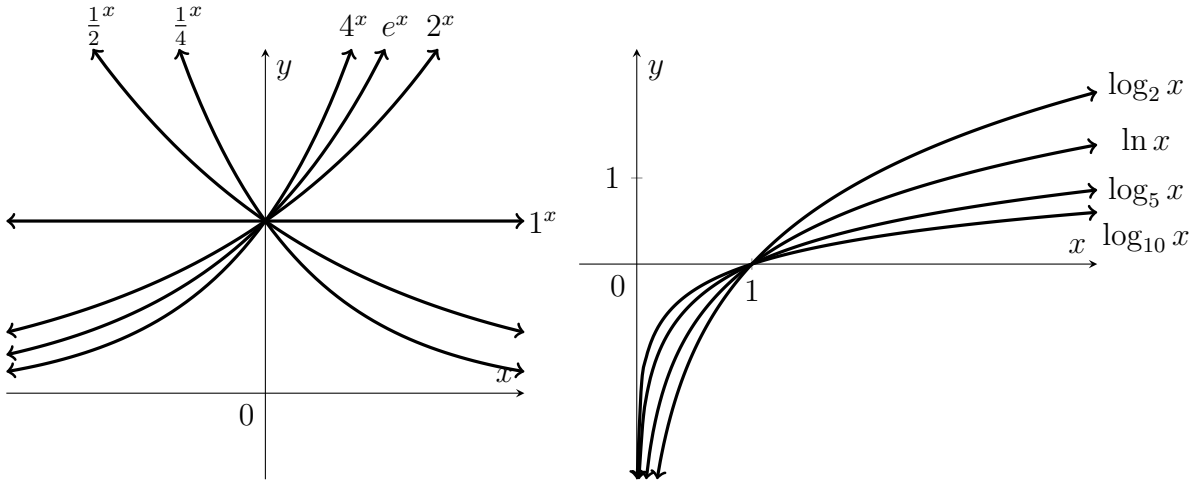
$b^{log_b x} = x$

$log_b(b^x) = x$

Domain and Range

- Logarithmic functions have a domain of $(0, \infty)$ and range of $(-\infty, \infty)$.
- Exponential functions have a domain of $(-\infty, \infty)$ and range of $(0, \infty)$.

Function Graphs



- The function $f(x) = b^x$ is *decreasing* when $b < 0$.
- The function $f(x) = b^x$ is *increasing* when $b > 0$.
- The function $f(x) = 1^x$ is a *horizontal line*.
- The larger the base of a logarithm, the *sharper* the curve.