§6.4 Logarithmic Functions

Logarithm :

For all real numbers y, and all positive numbers a and x, where $a \neq 1$: $y = \log_a x$ if and only if $x = a^y$.

Examples textbook.

Note that your calculator has the ability to evaluate two types of logs.

Common Logs	**log (base 10)**	**-> log x**
Natural Logs	**log (base e)**	**-> ln x**

Example 1: Evaluating Logarithms on a Calculator

a) $\log_{10} 2.5$ b) $\log_{10}\left(\frac{1}{3}\right)$ c) $\ln 0.3$ d) $\ln(-1)$

Properties of Logarithms: (also true for natural logarithms)

1) $\log_a 1 = 0$ because $a^0 = 1$
2) $\log_a a = 1$ because $a^1 = a$
3) $\log_a a^x = x$ because $a^x = a^x$
4) $\log_a x = \log_a y$, then $x = y$

Graphs of the Form: $f(x) = \log_a x$

1) The points (1, 0), (a, 1), $\left(\frac{1}{a}, -1\right)$ is on the graph.
2) If a > 1, f is an increasing function; If 0 < a < 1, f is a decreasing function**.**
3) The y-axis is a vertical asymptote.
4) The domain is $(0, \infty)$and the range is $(-\infty, \infty)$.

Examples: a) $y = \log\ \ x$ b) $y = \log_2(x-1) + 3$

(Graph)

Solving Logarithmic Equations

Solve: a) $\log_3(4x - 7) = 2$

Solve: b) $\log_x 64 = 2$

Solve: c) $e^{2x} = 5$