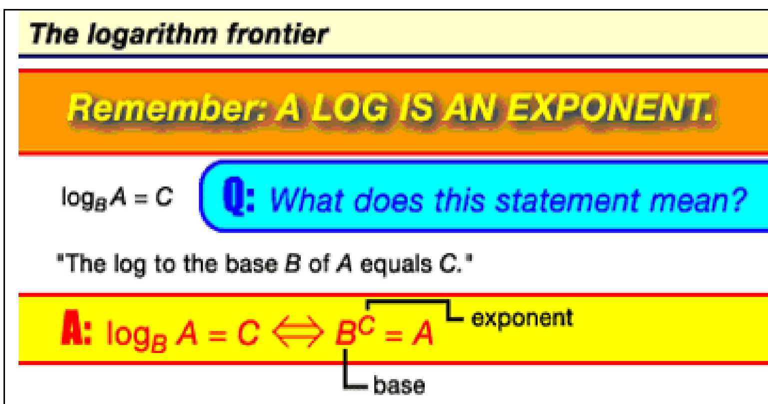
Evaluating Logarithmic Functions

key concepts:

- **Remember: Change of base theorem**:
  $$\log_b x = \frac{\log_a x}{\log_a b}$$
  allows revising a logarithm problem to be in a base that is easier to use in solving the problem.
- A **logarithm** indicates the exponent to which you raise a certain base to produce a given value. The inverse of a **logarithmic function** is an **exponential function**.
- Logs to the base 10 are written without a base. Logs to the base *e* are indicated by the symbol "ln."
- $\log_B(AC) = \log_B A + \log_B C$
- $\log_B\left(\frac{A}{C}\right) = \log_B A - \log_B C$
- $\log_B\left(A^C\right) = C \cdot \log_B A$



A **logarithm** is another way of writing an equation that involves an exponential term.

Always remember that a logarithm is an exponent. Whatever the log equals is actually the exponent of the equivalent equation.

C is the exponent to which you must raise *B* in order to get *A*.

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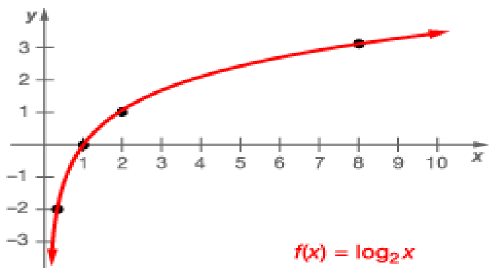
Graphing a logarithmic function

$\log_2 8 = 3$

$\log_2 \frac{1}{4} = -2$

$\log_2 2 = 1$

$\log_2 1 = 0$



The base of a **logarithmic function** remains constant.

Graph a logarithmic function by plotting some points. Notice that for domain values between 0 and 1, this logarithmic curve produces negative range values.

Logarithmic functions are only defined for positive domain values. The logarithmic function is strictly increasing.

Linking logarithms and exponents

$\log_B B^A = A$	$B^{\log_B A} = A$
the exponent to which you raise B to get B^A	B raised to the exponent to which you raise B to get A

Remember

A log is an exponent.

$\log_B B^A = A$ $B^{\log_B A} = A$

Remember, a log is an exponent.

$\log_B B^A = A$ is a fancy way of saying "the exponent to which you must raise B to get B is A."

$B^{\log_B A} = A$ is a fancy way of saying "B raised to the exponent to which you must raise B to get A is A."

A log written without a base is assumed to have base 10, which is also called the **common log**.

A log with base e is called the **natural log** and is abbreviated "ln."

It is a good idea to commit these identities to memory. You can derive them from the definition of a logarithm if you forget them.

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Properties of logarithms	Here are some additional important logarithmic identities.
$\log_B(AC) = \log_B A + \log_B C$ The log of a product is the sum of the logs. Remember: $N^A N^B = N^{A+B}$	The log of a product of two numbers is equal to the sum of the log of the two numbers.
$\log_B\left(\frac{A}{C}\right) = \log_B A - \log_B C$ The log of the quotient is the difference of the logs. Remember: $\frac{N^A}{N^B} = N^{A-B}$	The log of a quotient of two numbers is equal to the log of the numerator minus the log of the denominator.
$\log_B(A^c) = c\log_B A$ Remember: $(N^A)^B = N^{AB}$	The log of a variable raised to a power is equal to the product of the power and the log of the variable.
	Notice that there are no identities for the log of a sum or for the product of two logs.