LOGARITHM

WHAT IS LOGARITHM?????

- A logarithm is the power to which a number must be raised in order to get some other number.
- For example, the base ten logarithm of 100 is 2, because ten raised to the power of two is 100:

  log 100 = 2

  because

  $10^2 = 100$

- The base unit is the number being raised to a power.
- There are logarithms using different base units.

- We can also take 2 as the base unit.
- For instance, the base two logarithm of eight is three, because two raised to the power of three equals eight:

$$\mathbf{\log_2 8 = 3}$$

because

$$\mathbf{2^3 = 8}$$

Base Ten Logarithms

- Base ten logarithms are expressions in which the number being raised to a power is ten. The base ten log of 1000 is three:

  log 1000 = 3

  10^3 = 1000

- A base ten log is written as

  log

  and in equation form as

  log a = r

Natural Logarithms

- Logarithms with a base of 'e' are called natural logarithms.
- What is 'e'?
- 'e' is a very special number approximately equal to 2.718. 'e' is a little bit like pi in that it is the result of an equation and it's a big long number that never ends.
- A natural logarithm is written

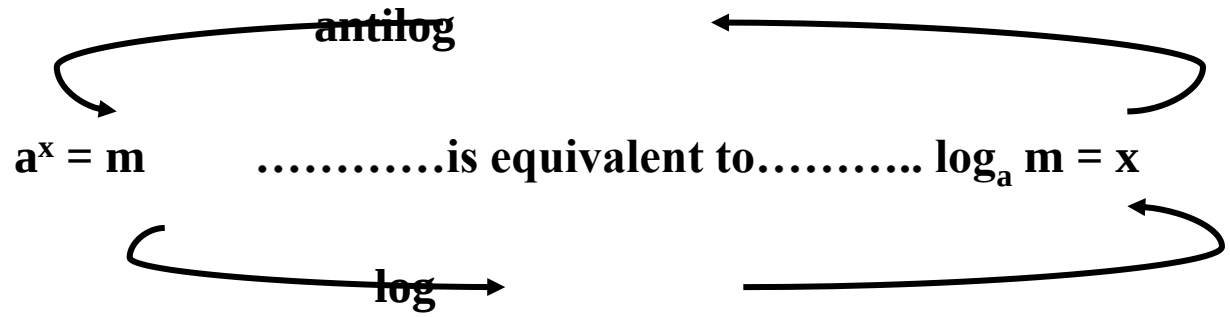
  ln

and in equation form as

  ln a = r

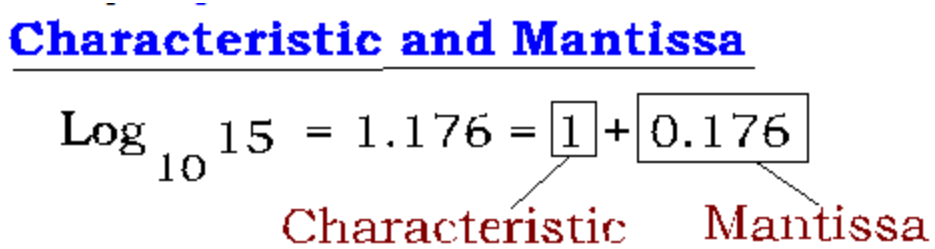
Relationship between Logarithm and Exponential

- Logarithms are the "opposite" of exponentials, just as subtraction is the opposite of addition and division is the opposite of multiplication.
- Logs "undo" exponentials or we can say logs are the inverses of exponentials.



Characteristic and Mantissa

- CHARACTERISTIC
  - It is the integral part of the value
- MANTISSA
  - It is the decimal part of the value



Laws of Logarithms

- **Product rule -** multiplication becomes addition

$$\log_a(xy) = \log_a x + \log_a y$$

- **Quotient rule -** division becomes subtraction

$$\log_a\left(\frac{x}{y}\right) = \log_a x - \log_a y$$

- **Power rule -** exponent becomes multiplier

$$\log_a(x)^y = y\log_a x$$

Laws of Logarithms

- $\log_x(x) = 1$
- $\log_a 1 = 0$
- $\log_a x = \dfrac{1}{\log_x a}$

- Change of Base Formula

$$\log_a b = \frac{\log_c b}{\log_c a}$$

- If base is not mentioned, then base will be 10.

In mathematics logarithms were developed for making complicated calculations simple.

$$x = 365.49 * 1474.3$$

$$\log_{10}(x) = \log_{10}(365.49 * 1474.3)$$

$$\log_{10}(x) = \log_{10}(365.49) + \log_{10}(1474.3)$$

$$\log_{10}(x) = \log_{10}(10^2 * 3.6549) + \log_{10}(10^3 * 1.4743)$$

$$\log_{10}(x) = 2 + \log_{10}(3.6549) + 3 + \log_{10}(1.4743)$$

$$\log_{10}(x) = \log_{10}(10^5) + \log_{10}(3.6549) + \log_{10}(1.4743)$$

Q: The value of $\log_{(.01)}(1000)$ is:

Q: The logarithm of 0.0625 to the base 2 is:

Q: If $\log_8 X = 2/3$, then the value of x is :

Q: If $\log_x y = 100$ and $\log_2 x = 10$, then the value of y is :

Q: The value of $\log_2(\log_5 625)$ is:

Q: If $\log_2 [\log_3 (\log_2 X)] = 1$, then x is equal to:

Q: If $\log_{10} 125 + \log_{10} 8 = x$, then x is equal to :

Q: $(\log_5 3) \times (\log_3 625)$ equals :

Q: If $\log_{12} 27 = a$, then $\log_6 16$ is :

Q: The value of $(\log_3 4)\,(\log_4 5)\,(\log_5 6)\,(\log_6 7)\,(\log_7 8)\,(\log_8 9)$ is:

Q: If $\log_{10} 2=0.3010$, what is the number of digits in 2^{64}