

LOGARITHMS:

Definition: Logarithm of a number to a given base is the power to which the base must be raised to equal that number.

For example: $100=10^2$

Therefore, $\log_{10} 100 = \log (10)^2 = 2$

FORMULAE OF LOGARITHM:

$$(1) \log_a a = 1$$

$$(2) \log_a (a^m) = m$$

$$(3) \log(1) = 0$$

$$(4) \log(m \times n) = \log(m) + \log(n)$$

$$(5) \log(m/n) = \log(m) - \log(n)$$

$$(6) \log(m^n) = n \log(m)$$

$$(7) \log_n(m) = \log_a(m) / \log_a(n) = \log_a(m) \times \log_n(a)$$

TWO SYSTEM OF LOGARITHM:

(1) Natural log or Neperian log: of the base of the log is e, then the log is called natural log. Here $e=2.718$.

(2) if the base of the log is 10 then log is called common log.

CONVERSION OF NATURAL LOG INTO COMMON LOG.

$$\log_e(x) = 2.3026 \log_{10}(x).$$

METHOD FOR FINDING LOG OF A NUMBER FROM LOG TABLE:

The logarithm of a given number consists of two parts. One is an integral part, called **characteristic or index** and the other is the decimal part called **mantissa**. Mantissa is always positive.

Example: The logarithm of a number is (1) 3.2357 (2) -2.4283. Find the characteristic and mantissa?

Sol. (1) Characteristic=3, Mantissa=0.2357

Sol. (2) -2.4283 = -2 + (-.4283) = (-2-1) + (1-0.4283) = -3 + 0.5717 = 3-.5717

ch=-3 and mantissa=0.5717

RULES TO FIND CHARACTERISTIC:

(1) The characteristic of any quantity greater than one is positive and is less by one than the number of figures to the left of the decimal part.

Example: The characteristic of a quantity 7.8678 is 0

78.678 is 1, 786.78 is 2, 78678.6 is 4.

(2) The characteristic of any quantity less than unity is negative and is greater by one than the number of zeros which follow the decimal point.

Example: 0.7867 is -1

0.07867 is -2

0.007867 is -3

HOW TO FIND MANTISSA:

The mantissa of the LOGARITHMS of all numbers consisting of the same digit in the same order but differing only in the position of decimal point are the same.

Example: The mantissa of $\log 7867$, $\log 7.867$, $\log 78.67$, $\log 0.7867$, and $\log 78670$ are the same.

HOW TO USE THE LOGARITHMS TABLE:

Let us find the value of $\log 78.67$

The characteristic is $(2-1)=1$

(1) Removing the decimal point from the given number we get 7867. Now keep in mind that the first figures from the left form 78, the third figure is 6 and the fourth is 7.

(2) In the table of logarithms, run the eyes down the extreme left hand column headed by a blank space until the eye arrives at 78.

(3) In the horizontal row beginning with 78, and under the column headed by 6, we find that the number is 8954 at the intersection. It is noted down.

(4) In continuation of this horizontal row and the mean difference. Column headed by 7, we find the number at the intersection. Adding 4 to 8954, we get 8958.

Thus $\log 78.67 = 1.8958$

HOW TO USE ANTILOGARITHM TABLE:

Let us find the antilogarithm of 2.7852 with help of following steps.

(1) First find the two digits right to the decimal i.e. 78 at the extreme left row of the antilogarithm

table.

(2) Now passing along the horizontal line to the number in the vertical column headed by the third digit (after decimal) i.e., 5

(3) Note the figure i.e. 6095

(4) In the continuation of this horizontal row and under the mean difference column headed by 5, we find number 3 at the intersection.

(5) Adding 3 to 6095, we get 6098

(6) As the characteristic is 2, the number of digits to the left of the decimal point will be 3.

(7) Add one to the characteristic to get this value, hence

Antilog 2.7852 = 609.8

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