BAHRIA COLLEGE ZAFAR CAMPUS
E-8 ISLAMABAD

CLASS: 9TH

UNIT# 3

LOGARITHM

If $log_a b = c$, then what is the relationship between the variables?

$$\log_a b = c \Rightarrow a^c = b$$

base exponent

The log is the exponent

$$a^x = y \Leftrightarrow \log_a y = x$$

base

$$a > 0, a \neq 1, y \neq 0$$

Example:

$2^5 = 32$ means $\log_2 32 = 5$

Logarithm

Exponential form	Logarithmic form
$b^{x} = y$	$\log_b y = x$
$2^{4} = 16$	$\log_2 16 = 4$
$5^{-2} = 0.04$	$\log_5 0.04 = -2$

Exercise 3.2:

Q1. Find the common logarithm of the following numbers:

i. 232.92

$$\text{Characteristics} = 2$$

$$\text{Mantissa} = 0.3672$$

$$\log 232.92 = 2.3672$$

ii. 29.326

$$\text{Characteristics} = 1$$

$$\text{Mantissa} = 0.4672$$

$$\log 29.326 = 1.4672$$

iii. 0.00032

$$\text{Characteristics} = -4$$

$$\text{Mantissa} = 0.5051$$

$$\log 0.00032 = \bar{4}.5051$$

iv. 0.3206

$$\text{Characteristics} = -1$$

$$\text{Mantissa} = 0.5059$$

$$\log 0.3206 = \bar{1}.5059$$

Q2. If $\log 31.09 = 1.4926$, find the values of following:

i. log 3.109

Characteristics $= 0$

Mantissa $= 0.4926$

$\log 3.109 = 0.4926$

ii. log 310.9

Characteristics $= 2$

Mantissa $= 0.4926$

$\log 310.9 = 2.4926$

iii. log 0.003109

Characteristics $= -3$

Mantissa $= 0.4926$

$\log 0.003109 = \bar{3}.4926$

iv. log 0.3109

Characteristics $= -1$

Mantissa $= 0.4926$

$\log 0.3109 = \bar{1}.4926$

Q3. Find the numbers whose common logarithms are:

i. 3.5621

Since it is log of any number. So,

$$\text{Characteristics} = 3$$

$$\text{Mantissa} = 0.5621$$

by looking mantissa in antilog table we get 3.6484

$\Rightarrow$ *Characteristics change the place of decimal.*

So, Antilog $3.5621 = 3648.4$

ii. $\bar{1}.7427$

Since it is log of any number. So,

Characteristics $= -1$

Mantissa $= 0.7427$

by looking mantissa in antilog table we get 5.5297

$\Rightarrow$ *Characteristics change the place of decimal.*

So, Antilog $5.5297 = 0.55297 \cong 0.5530$

Q4. What replacement for the unknown in each of following will make the statement true?

i. $\log_3 81 = L$

Writing in exponential form:

$3^L = 81$

$3^L = 3^4$

$\Rightarrow L = 4$

ii. $\log_a 6 = 0.5$

Writing in exponential form:

$a^{0.5} = 6$

$a^{1/2} = 6$

Squaring on both sides:

$\Rightarrow a = 36$

iii. $\log_5 n = 2$

Writing in exponential form:

$5^2 = n$

$\Rightarrow n = 25$

iv. $10^p = 40$

Writing in logarithmic form:

$\log_{10} 40 = p$

$\Rightarrow p = 1.6021$

Q5. Evaluate

i. $\log_2 \frac{1}{128}$

$$let\ x = \log_2 \frac{1}{128}$$

Writing in exponential form:

$$2^x = \frac{1}{128}$$

$$2^x = \frac{1}{2^7}$$

$$2^x = 2^{-7}$$

$$\Rightarrow \log_2 \frac{1}{128} = x = -7$$

ii. ***log* 512 *to the base* $2\sqrt{2}$**

$let\ x = \log_{2\sqrt{2}} 512$

Writing in exponential form:

$$(2\sqrt{2})^x = 512$$

$$(2^{1+1/2})^x = 2^9$$

$$2^{\frac{3}{2}x} = 2^9$$

$$\frac{3}{2}x = 9$$

$$3x = 2 \times 9$$

$$x = \frac{2\times 9}{3}$$

$$\Rightarrow \log_{2\sqrt{2}} 512 = x = 6$$

Q6. Evaluate the value of 'x' from the following statements.

i. $\log_2 x = 5$

Writing in exponential form:

$$2^5 = x$$

$$\Rightarrow x = 32$$

ii. $\log_{81} 9 = x$

Writing in exponential form:

$$81^x = 9$$

$$(9^2)^x = 9$$

$$9^{2x} = 9$$

$$2x = 1$$

$$\Rightarrow x = {}^1/_2$$

iii. $\log_{64} 8 = \frac{x}{2}$

Writing in exponential form:

$$64^{x/2} = 8$$
$$(2^6)^x = 2^3$$
$$2^{6x} = 2^3$$
$$6x = 3$$
$$x = \frac{3}{6}$$
$$\Rightarrow x = {}^1/_2$$

iv. $\log_x 64 = 2$

Writing in exponential form:

$$x^2 = 64$$

Taking square root on both sides:

$$\Rightarrow x = 8$$

v. $\log_3 x = 4$

Writing in exponential form:

$$3^4 = x$$
$$\Rightarrow x = 81$$