

Logarithm functions:-

* Definition:-

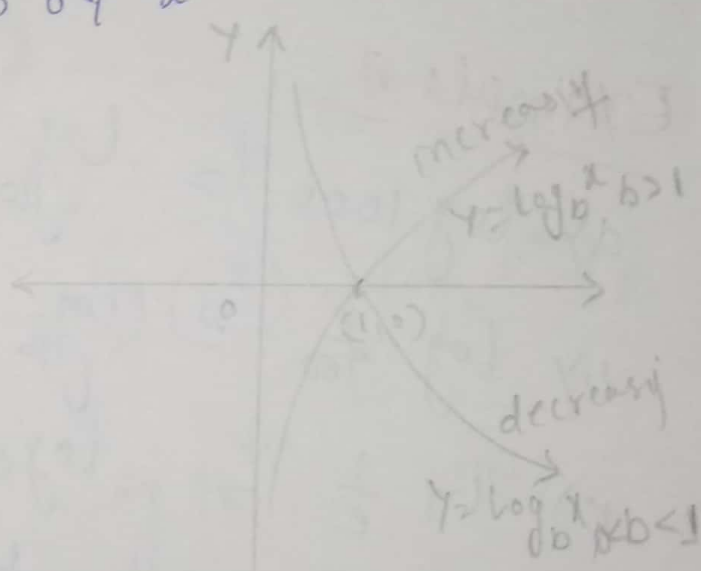
if b is any number such that $b > 0$ and $b \neq 1$, and $x > 0$ Then

$\Rightarrow y = \log_b x \rightarrow$ called logarithm form

$\Rightarrow x = b^y \rightarrow$ exponential form.

Read as "log base b of x "

* $\log_b x$
↑ ↑
Function Base



Example 1:-

9) $\log_4 16$

Let $y = \log_4 16$

$y \Rightarrow \log_4 4^2 = 2$

or $4^y = 4^2 \quad \boxed{y = 2}$

$$b) \log_2 16 \quad \langle c \rangle \log_6 \frac{216}{6} \quad \textcircled{d} \log_5 \frac{1}{125} \quad \langle e \rangle \dots$$

$$\langle f \rangle \log_{\frac{3}{2}} \frac{27}{8}$$

Common logarithm:-

$$\log x = \log_{10} x$$

Natural logarithm:-

$$\ln x = \log_e x$$

irration Number

$$e = 2.718281828 \dots$$

Example 4

$$a) \log 1000 = \log_{10} 10^3 = 3$$

$$b) \log \frac{1}{100} = \log_{10} 10^{-2} = -2$$

$$c) \ln \frac{1}{e} = \log_e e^{-1} = -1$$

$$d) \ln \sqrt{e} = \frac{1}{2}$$

$$e) \log_{34} 34 = 1$$

$$f) \log_2 1 = \log_2 2^0 = \underline{\underline{0}}$$

Properties of log :-

1. $\log_b 1 = \log_b b^0 = 0$

2. $\log_b b = 1$

3. $\log_b b^x = x$

$\log_b b^{f(x)} = f(x)$

4) $b^{\log_b x} = x$

$y = b^{\log_b x}$
 $\log_b y = \log_b b^{\log_b x}$
 $\log_b y = \log_b x \Rightarrow \log_b \left(\frac{y}{x}\right) = 0 \Rightarrow \frac{y}{x} = b^0$
 $y = x$

$\therefore (f \circ g)(x) = f(g(x))$

$= f(\log_b x) = b^{\log_b x} = x$

$\therefore (g \circ f)(x) = g(f(x)) = g(b^x) = \log_b b^x = x$

5) $\ln e^{f(x)} = f(x)$

$e^{\ln f(x)} = f(x)$

$\log_{10} 10^{f(x)} = f(x)$

$10^{\log f(x)} = f(x)$

6) $\log_b (AB) = \log_b A + \log_b B$

7) $\log_b \left(\frac{A}{B}\right) = \log_b A - \log_b B$

$$\Rightarrow \log_b(x^y) = y \log_b x$$

$$\text{If } \log_b x = \log_b y \text{ then } x = y$$

Change Base :-

$$\log_a x = \frac{\log_b x}{\log_b a}$$

Base
change
formula
Common

$$\log_a x = \frac{\log x}{\log a}$$

Natural

$$\log_a x = \frac{\ln x}{\ln a}$$

EX $\log_5 7$

Common

$$\log_5 7 = \frac{\log 7}{\log 5}$$

$$= \frac{0.845098040014}{0.698970004336} = 1.2096$$

Natural

$$\log_5 7 = \frac{\ln 7}{\ln 5} = \frac{1.94591}{1.60943} = 1.2096$$

class - IX
Number System

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☆ Why Number System :-

- To learn way of expression of Numbers
- To learn operations on Real Numbers
- To learn kind of Real Numbers and their operations.
- Representation of Real Numbers.
- To learn exponents of Real Numbers.

☆ Introduction :-

- Is any one "seen Numbers" in physical form?
- Numbers are not present in physical form, as we can see 5 apples, 4 dogs, 6 girls etc. But Number are in your mind only.
- Like a game cannot play without rules. In same manner without operation like addition, subtraction, multiplication, division etc. Numbers are of No use.
- These all operation belonging to a system called.---

☆ Number System :-

- A system for expressing Numbers with some set of rules for their expression, like addition, subtraction, multiplication etc.

Numerals :- Numerals are symbols to represent numbers. These are 10, i.e. 0, 1, 2, 3, 4, 5, 6, 7, 8, 9. indecimal called Hindu-Arabic numerals.

- These are infinite numbers.

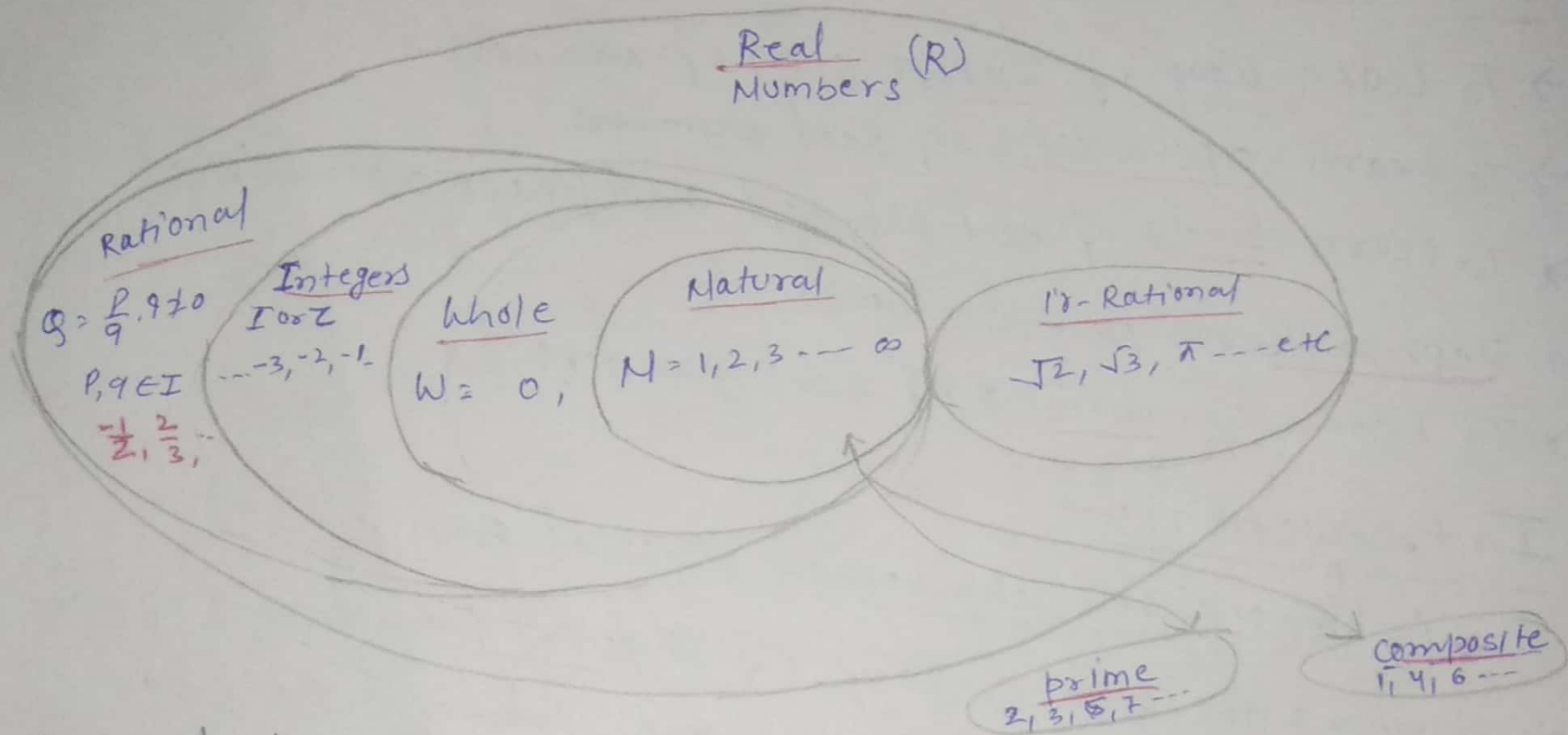
→ Number System also called System of Numeration.

Classification of Numbers:-

→ Two types of Numbers are there:-

1) Real Numbers

2) Imaginary Number (Not in course)



1. Natural Numbers:-