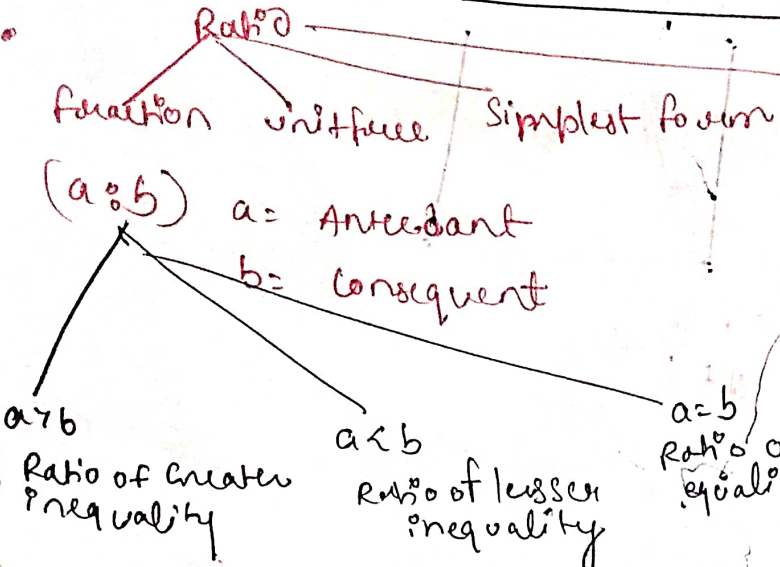
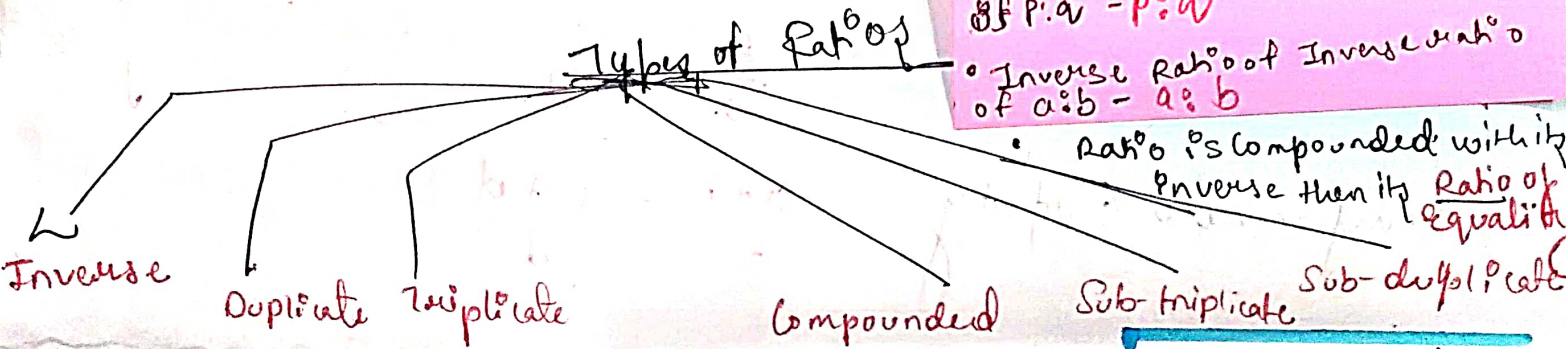


# Ratio/Proportion (Indices)



**NOTE**

- Duplicate Ratio of sub-duplicate ratio of  $m:n = m:n$
- Sub-duplicate ratio of duplicate ratio of  $m:n$  is  $m:n$
- Triplicate ratio of sub-triplicate ratio of  $a:b$  is  $a:b$
- Sub triplicate ratio of triplicate of  $P:Q = P:Q$
- Inverse Ratio of Inverse ratio of  $a:b = a:b$



- ①  $a^b$  over  $b\sqrt{a} = a^b$  on calculator.
- Take  $a$  on calsi
  - press  $\sqrt{\quad}$  (12 times)
  - deduct 1
  - multiply the  $b$
  - Add 1
  - press  $(\frac{\square}{\square} \div)$  12 times

press  $(\sqrt{\quad})$  one on calsi its = Root 2  
 Twice = Root 4  
 Thrice = Root 8  
 likewise, it will give.....

**How to get  $(a)^{99}$  on calsi.**

- press  $a$  on calsi
- press  $(=)$  <sup>next</sup> till step Count comes of  $(b)$  are 99.

In a series -  $P, Q, R, S$

IF  $P:Q = R:S$   
 OR  
 $PS = QR$   
 then they are said to be in **proportion**.

## proportion (P)

## Continued Proportion

In,  $P, Q, R, S$   
 IF  $P:Q = Q:R = R:S$   
 then they are said to be in **Continued proportion (CP)**

\* when  $(P)$  is in  $(P)$  then it is not necessary they must be in  $(CP)$

\* when it is in  $CP$  then it is also in  $P$

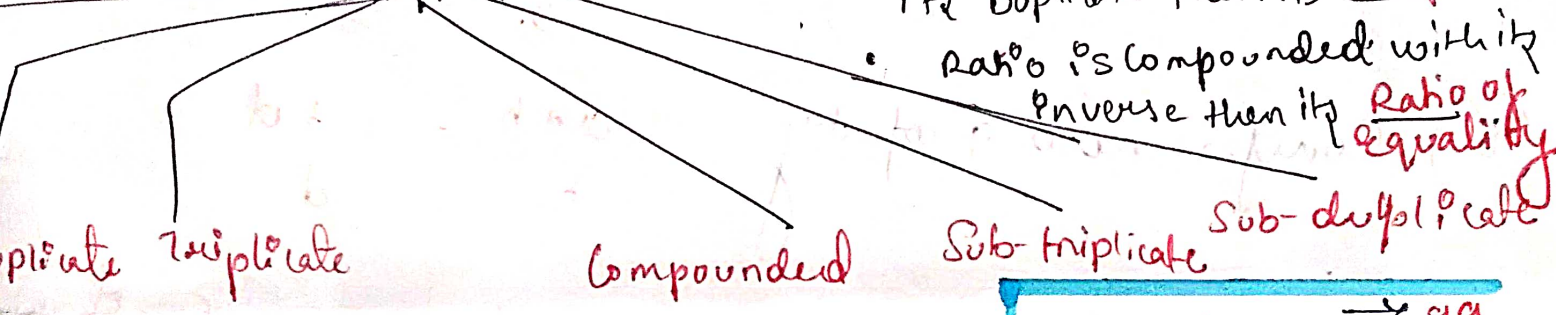
= Antecedent  
= Consequent

$a < b$   
Ratio of lesser inequality

$a = b$   
Ratio of equality

• If Ratio is compounded with itself then result is Duplicate Ratio.

Types of Ratios



• Ratio is compounded with its Duplicate then its Triplicate

• Ratio is compounded with its Inverse then its Ratio of equality

over  $b\sqrt{a} = a^b$  on calculator.

a on calsi  
 $\sqrt{\quad}$  (12 times)  
multiply the b  
press  $(\frac{1}{x})$  12 times

press  $(\sqrt{\quad})$  one on calsi its = Root 2  
Twice = Root 4  
Thrice = Root 8  
likewise, it will give ....

How to get  $\sqrt[n]{a}$  on calsi.  
① press a on calsi  
② press  $(\frac{1}{x})$  till step count comes of (b) on calsi.

P, q, r, s  
= ratios  
= a, b, c, d  
are said to be in proportion.

proportions (P)

Continued proportion

In, P, q, r, s  
IF  $P:q = q:r = r:s$   
then they are said to be in Continued proportion. (CP)

if a is in (P) then

• Some imp properties on proportion.

① A Bando property

$$\frac{a}{c} = \frac{b}{d}$$

② Addendo property

$$\frac{a+c}{b+d} = \frac{c+a}{d+b}$$

③ Subtrahendo property

$$\frac{a-c}{b-d} = \frac{c-a}{d-b}$$

④ Invertendo property

$$\frac{a}{b} = \frac{c}{d} = \left\{ \frac{b}{a} = \frac{d}{c} \right\}$$

⑤ Componendo property

$$\frac{a+b}{b} = \frac{c+d}{d}$$

⑥ Dividendo property

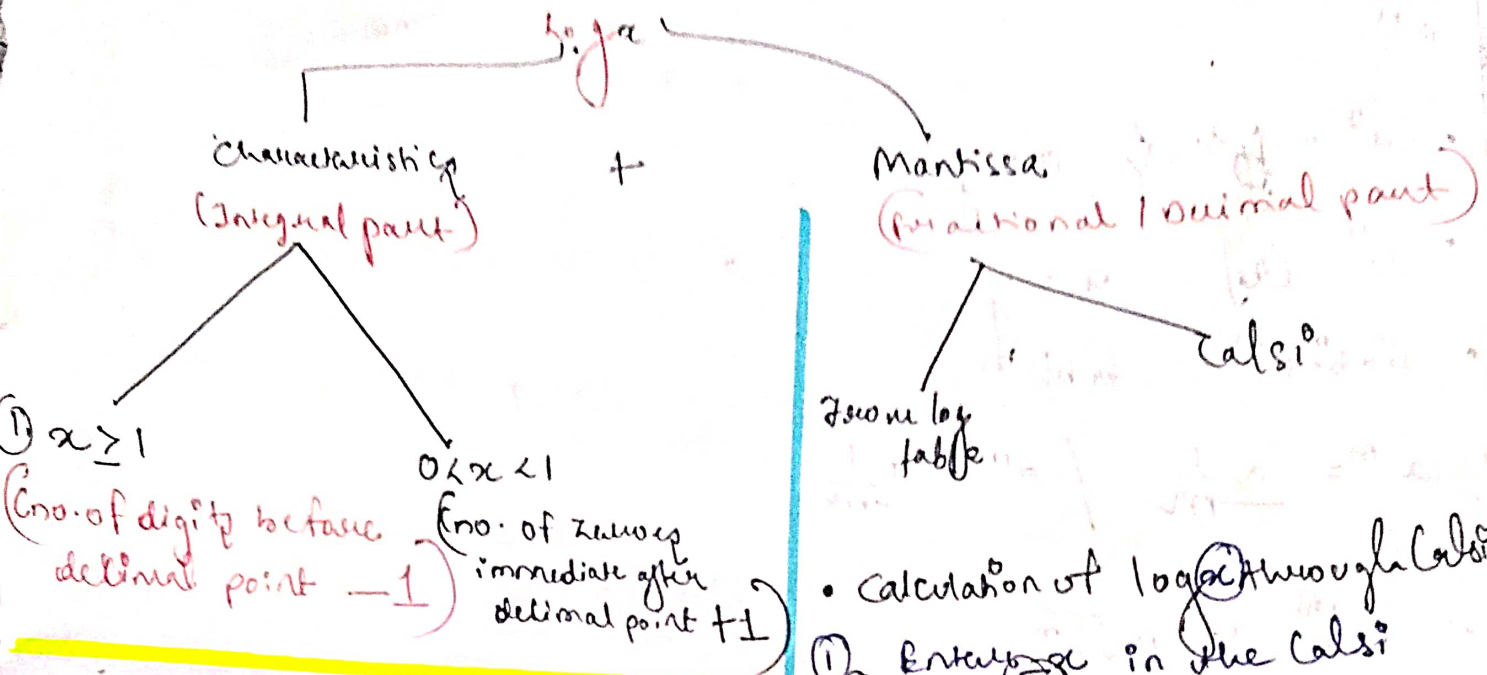
$$\frac{a-b}{b} = \frac{c-d}{d}$$

⑦ Componendo property  
Dividendo

$$\frac{a+b}{a-b} = \frac{c+d}{c-d}$$

# Logarithms (log) 2-6 hour

•  $\log x = \text{characteristic } x + \text{mantissa of } x$ .



## properties of logs

- ①  $A \cdot \log (\log k) = k \cdot a = \log (A \cdot \log k)$
- ② Common base 10  
then  $\log_{10} 10 = 1$   $\log_{10} 100 = 2$   $\log_{10} 1000 = 3$   
 $\log_{10} 1 = 0$   $\log_{10} 10^0 = 1$
- ③ If  $\log_b a = k$  then  $b^k = a$
- ④  $\log_b a = \frac{\log a}{\log b}$
- ⑤  $\log (a \times b) = \log a + \log b$
- ⑥  $\log_m (x \times y \times z) = \log_m x + \log_m y + \log_m z$
- ⑦  $\log \frac{a}{b} = \log a - \log b$
- ⑧  $\log a^b = b \cdot \log a$
- ⑨  $\log_b b^a \times \log a^b = 1$
- ⑩  $\log_b a \times \log_c b = \log_c a$
- ⑪  $\log \frac{ab}{c} = \log a + \log b - \log c$

## Calculation of Anti-log of $x$

- ① Enter  $x$  on calc
- ② Divide by 14230.9635
- ③ Add 1
- ④ press "x=" 15 times.

# Indices

•  $a^m \cdot a^n = a^{m+n}$

•  $\frac{a^m}{a^n} = a^{m-n}$

•  $a^x = y^x \iff a=y$

•  $a^x = a^y \iff x=y$

•  $a^m \cdot b^m \cdot c^m = (abc)^m$

•  $a^{-m} = \frac{a^1}{a^m} \iff a^m = \frac{1}{a^{-m}}$

•  $a^{\frac{1}{n}} = \sqrt[n]{a}$

•  $a^0 = 1$

$\left(\frac{xy}{z}\right)^m = \frac{(x^m \cdot y^m)}{(z^m)} = x^m \cdot \frac{y^m}{z^m}$

$\sqrt[m]{a} = a^{\frac{1}{m}}$

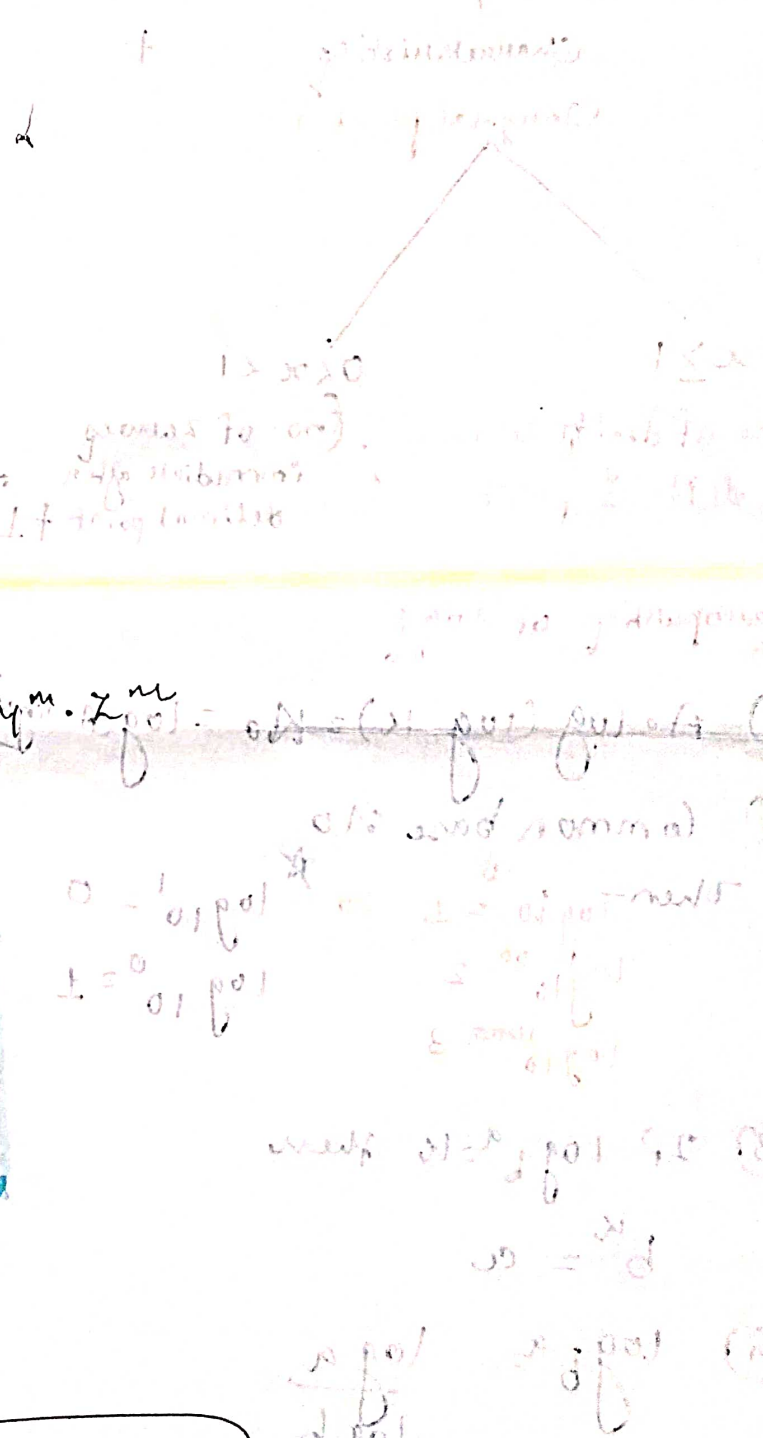
$\frac{ab \times a^c}{a^d} = a^{b+c-d}$

•  $(m^p)^q = m^{p \times q}$

•  $(a \times b)^x = a^x \times b^x$

•  $\frac{a^x}{a^y} = a^{x-y}$

Commensurable  
(which can be written in the form of integers)



Incommensurable Ratio  
(which cannot be written in the form of integers)