

# CA FOUNDATION

The Institute of Chartered Accountants of India

**BUSINESS MATHEMATICS & LOGICAL REASONING** 



#### **CONTENTS**

#### **BUSINESS MATHEMATICS**

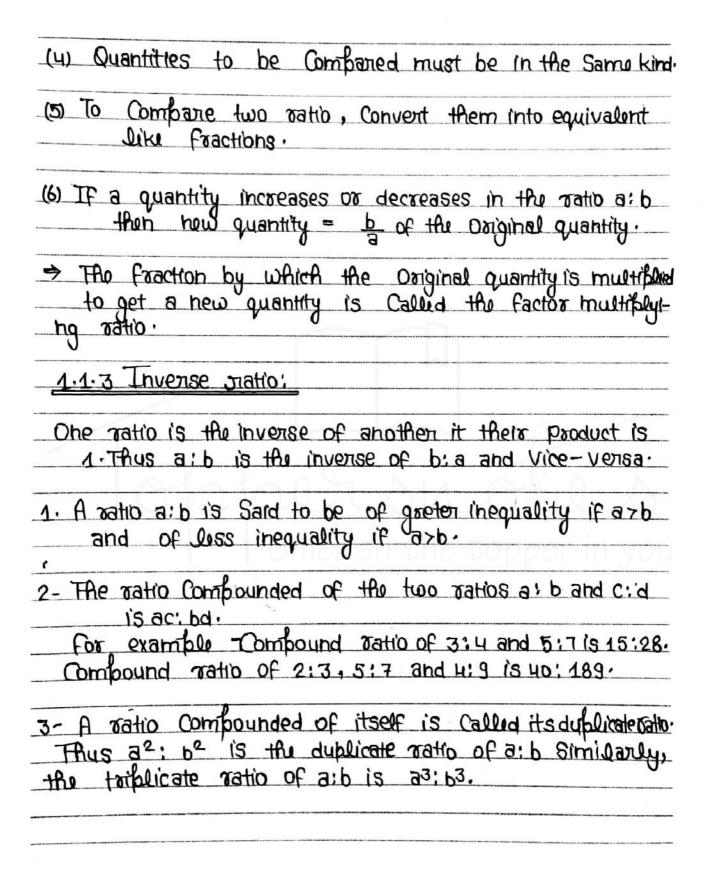
1. Ratio and Proportion, Indices, Logarithms	1
2. Equation and Matrices	36
3. Linear Inequalities	62
4. Time Value of Money	105
5. Permutation and Combination	142
6. Sequence and Series	152
7. Set, Relation and Function	183
8. Differential Calculus	212
9. Integral Calculus	238
LOGICAL REASONING	
1. Number Series	257
2. Coding and Decoding	266
3. Odd One Out	276
4. Distance and Direction Test	278
5. Sitting Arrangement	297
6. Blood Relation	319
7. Syllogism	325



## RATIO & PROPORTION

A viatio is a Companison of the Size of two or more
quantities of the Same kind by division.
division,
If a and b are two quantities of the same kind in Same
unit), then the fraction alb is Called the ratio of a tob.
* It is worthen as a:b
* Thus the ratio of a to b = alb or a:b
* The quantities a and b are Called the terms of the
Tatio.
* a is Called the first term or anteredent and b is
Called the Second term or Consequent:
Important hotes:
(4) Both terms of a ratio Can be multiplied or divided
by the Same (non-zero) humber.
(2) The Order of the terms in ratio is important.
3;4 ≠ 4:3
Pa Palia avida Onto La a a lilia an o o
(3) Ratio exists Only blu quantities of the Same Kind.

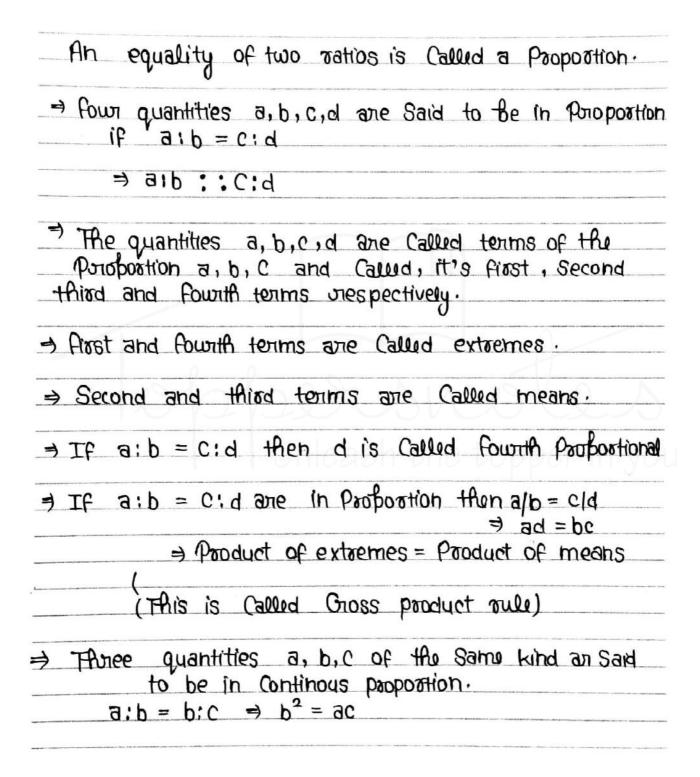




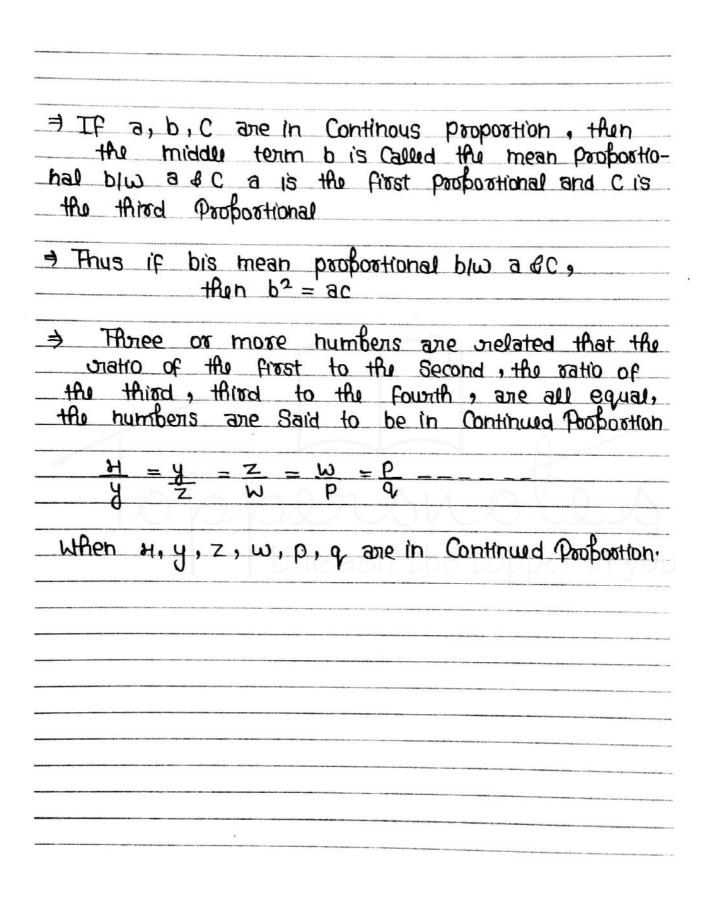


For example, duplicate ratio of 2:3 is 4:9 Triplicate ratio of a:b is a 2:3 is 8:27.
44 The Sub-duplicate ratio of a: b is $\sqrt{a}$ : $\sqrt{b}$ and the Sub toiblicate ratio of a: b is $\sqrt{a}$ : $\sqrt{b}$ .  For example Sub-duplicate ratio of 4:9 is $\sqrt{4}$ : $\sqrt{9}$ = 2:3  And Sub-triplicate ratio of 8:27 is $\sqrt{38}$ : $\sqrt{327}$ = 2:3
5 The vatio of two Similar quantities Can be expressed as a vatio of two integers, the quantities are Said to be Commensurable, otherwise, they are Said to be incommensurable. 3: 12 Cannot be expressed as the vatio of two integers and therefore, 13 and 12 are incommensurable quantities.  6 Continued Ratio is the relation (or Combassion) between the magnitudes of three or more quantities of the Same kind, The Continued vatio of three quantities a, b, c is written as a: b:c.











#### 1.2.1 Properties of Propostion-

1 - if a: b = c:d, then ad = bc

Proof.  $\frac{a}{b} = \frac{c}{d}$ ; ... ad = bc (By Oross-multiplication

2- if a: b = c:d, then b: a = d:c (Inventendo)

Proof.  $\frac{a}{b} = \frac{c}{d}$  or  $1/\frac{a}{b} = 1/\frac{c}{d}$ , or,  $\frac{b}{a} = \frac{d}{c}$ 

3- if a:b = C:d, then a:c = b:d (Alternendo)

Proof.  $\frac{a}{b} = \frac{c}{c}$  or, ad = bc

Dividing both Sides by Cd, We get.

 $\frac{ad}{cd} = \frac{bc}{cd}$ , or  $\frac{a}{c} = \frac{b}{d}$ , i.e a:c = b:d

u-if a:b=c:d, then a+b;b=c+d:d (Combonendo)

 $\frac{0}{b} = \frac{0}{c}, \quad 00, \quad \frac{0}{b} + 1 = \frac{0}{c} + 1$ 

 $\frac{a+b}{or}$  =  $\frac{c+d}{d}$ , i-e a+b; b = c+d; d.

5- if a: b = c:d, then a-b=c-d:d (Dividendo)

Proof 3 = C , or 3 +1 = C +1, or

3+b = c-b, 1.e. a-b;b = c-d;d.



$P_{000}f, \frac{a}{b} = \frac{c}{d}, o_{0} \frac{a}{b} + 1 =$	and Dividendo) $\frac{C}{1} + 1 + 0$
$\frac{a+b}{b} = \frac{c+d}{c+d}$	1
Again, $\frac{a}{b} - 1$ , $= \frac{c}{d} - 1$ , or $\frac{a}{b}$	and the contract of the contra
Dividing (1) by (2)	
hie get,	
$\frac{a+b}{a-b} = \frac{C+d}{c-d}  i \cdot e  a+b :$	a-b = C+d : C-d
(7) if a:b=c:d=e:f=	then
each of thuse vations is e	Anal
(a+c+e+): (b+d+	f+)
	The second secon



#### SURDS & INDICES

The index of a number Says flow many times to use the number in a multiplication

⇒ It is Written as a Small number to the right and above the base number.

Exit 2 sexponent

(or)

Base Index
(or)

Power

means,
A factor which multiples is Called the "base" and the number of times it is multiplied is Called the "Power" or the "index".

 $\frac{\text{Law I}}{\text{am } \times \text{ah} = \text{am+h}}$ 

When mand n are Positive integers.

Ex; 34x35 ⇒ 34+5 = 34,

 $\frac{aw II}{ah} = a^{m-h}$   $Ext = 2^{7}$   $2^{4} = 2^{7-4} = 2^{3} = 8$ 



#### Law-3

$$(a^m)^h = a^{mh}$$

Where mand n are positive integers.

Example:

$$(2^{4})^{3} = 2^{4 \times 3} = 2^{4} = 4096$$

Law-4

$$(ab)^h = a^h b^h$$

When n Can take all of the Values.

Examble:

$$= (2x3)^3 = 2^3x3^3 = 8x27 = 216.$$

Properties -

$$0 \quad a^{-m} = \frac{1}{a^m}$$

and 
$$\frac{1}{a^{-m}} = a^m$$

$$\Psi$$
  $ma = a^{1}/n$ 



## LOGARITHM

the logarithm is the increase function to exponentiation
That means the logarithm of a given number H is the exponent to which another fixed humber the base by must be raised, to produce that number H.
Ext how many 25 We multiply to get 8?
=> 2x2x2 = 8, So we had to multiply is Called the 'base'
→ " the logarithm of 8 With base 2 is 3.
→ OT " log base 2 of 8 is 3"
OF I UIICASII VIIC VUPPOI III YU
"the base 2 log of 8 is 3.
Example: 24 = 16
log_16 = 4



<u>facts'-</u>
1 → The two equation ax = n and x = log a 11 ane Only transformation of each other and should be remembered to change One form of the relation into the other.
2.3 The logarithm of 1 to any base is zero, This is because any humber raised to the power zero is one.  Since $a^{\circ} = 1$ , $log_{\circ}1 = 0$
3 > The logarithm of any quantity of the Same base is unity. This is because any quantity  Since a¹ = a , log, a = 1
Examples:
1. if logo $\sqrt{2} = \frac{1}{6}$ , Aind the Value of a. 2. We have $3^{1/6} = \sqrt{2} \Rightarrow 3 = (\sqrt{2})^6 = 2^3 = 8$
2- Find the logarithm of 5832 to the base 3/2
Let us take log 3/2 5832 = x
We may Write, $(3\sqrt{2})^{x} = 5832 = 8 \times 729 = 2^{3} \times 3^{6} = (\sqrt{2})^{6} (3)^{6} = (3\sqrt{2})^{6}$
Loganithms of numbers to the base 10 are known as Common Loganithm.



#### Fundamental Laws of Logarithm. 1 + Logarithm of the Product of two numbers is equal to the sum of the Logarithms of the numbers to the Samu base i.e. Loga mn = loga m + loga n 2) the logarithm of the quotient of two numbers is equal to the difference of their logarithm to Same base. logam - logan 3+ logarithm of the number raised to the power equal to the index of the power multiblied Joganithm of the number to the Same base. log mh = h log m Hange of base the logarithm of a number to any base is given loganithm of the Same humber to any Other base Can be determined from the chelation Jogam = Jogam x Jogap logam 10968



- Accounter toleton			
Logarithm tables:			
The logarithm of a number Consists of two parts, the whole part or the integral part is Called the chracteristic and the decimal part is Called the "mantissa".  Lithere the former Can be known by more insepection the letter has to be obtained from the logarithm tables.			
Chanacteristic:  The Chracteristic of the Jogarithm of any number greater than, is positive and is One Jess than the number of digits to the Jest of the decimal point in the given number.			
Zeno on positive chracteristic When the number under Consideration is greater than unity.			
Since - $10^{\circ} = 1$ , $\log 1_{10} = 0$			
$10^{1} = 10$ , $\log 10 = 1$			
$10^2 = 100$ $\log 100 = 2$			
10 <sup>3</sup> = 1000 log 1000 = 3			



### hegative Chracteristics-

$$10^{-1} = \frac{1}{10} = 0 = 1 \rightarrow \log 0.1 = -1$$

## $10^{-2} = \frac{1}{100} = 0.01 \rightarrow \log 0.01 = -2$

#### Mantissa

The mantissa is the fractional part of the logarithm of a given humber-

Number	Mantissa	logazithm
Jog 4594	= ( 6623)	= 3.6623
Jog 459.4	= (6623)	= 2.6623
Jog 45.94	<b>=</b> ( <b>6</b> 623)	= 1.6623
Jog 4.234	= (6623)	= 0.6623
Jog ·4594	= (6623)	= T.6623

Hnti loganithm

If H is the loganithm of a given number h with a given base then n is Called antiloganithm of the hotel base.

Ho that base.

Ex:-logan=x then n= antilog H



Number	Loganithm.			
206	2.3139			
20.6	4.3139			
2.06	0.3139			
•206	-1.3139			
	-2.3139			
Relation blw indics	and logarithm			
1 logam + logam =	loga mn			
@ logamh = h logam				
Important Rints				
• Log, mn = logam + logan				
$= Ex \cdot \log(2x3) = \log^2$	+ log 3			
· loga (m/h) = log, m-	log n			
Ex - log (3/2) = log	$3 - \log^2$			