SYLLABUS

Class- B.com I Year

Subject– Business Mathematics

UNIT–I	Brief history of Vedic mathematics in Indian knowledge tradition, methods and practice of quick calculation of addition,multiplication,division,square and square root of numbers through Vedic mathematics, method of quick Verification of answers from Digital Sum.
UNIT–II	Rules for sign in Algebra and practice, Rules for calculation (BODMAS) and practice, Simultaneous Equations–Meaning, Characteristic, types, Calculation (with word problems)
UNIT–III	Theory of Indices (preliminary knowledge only formulae), Logarithms and Antilogarithms – principles and calculation, Percentage
UNIT–IV	Ratio, Proportion, Discount and Brokerage
UNIT–V	Commission, Average, profit and loss
Unit-VI	Simple Interest, Compound Interest

UNIT I

Brief history of Vedic mathematics in Indian knowledge tradition

- Bharati Krishna Tirtha was born in March 1884 in Puri Village, Orissa, a state in India. Apart from mathematics, he also excelled in Science, Humanities, and Sanskrit as a student. He was passionate about meditation and spiritualism. He claims to have gained knowledge of the Vedic Sutras while meditating in a forest near Singeri for eight years. According to Krishna Tirtha, he learned the sutras from the Vedas, like the Atharva Veda and the Rig Veda. Hence the term 'Vedic Mathematics'.
- He wrote the initial16 sutras in1957.He planned topen moredown,butcataractdevelopedinbotheyes,andhepassedawayin1960.

MeaningofVedicMathematics

The word Vedic Mathematics means Vedic+ Mathematics. 'Vedic' means knowledge and wisdom , and 'Mathematics' is the Abstract science of numbers. Thus vedic mathematics represent knowledge of mathematics. It is used by Indian sages (Rishis).

It is an ancient technique, which simplifies multiplication, divisibility, complex number, squaring, cubic, square roots and cube roots. Even recurring decimals and partial fractions can be handled by Vedic Mathematics. Vedic Mathematics forms part of Jyotish Shastra which is one of the six parts of Vedangas.

Terms and Operations

1. **Ek adhika** means 'One more'
   Ex. Ek adhika of 0 is 0+1=1
   Ek adhika of 5 is 5 +1 =6
2. **Ek anyuna** means 'One Less'
   Ex. Ekanyunaof1is 1 –1=0
   Ekanyunaof5is5 – 1 =4
3. **Purak** means ' Complement' (from 10)Ex. Purakof1is10–1=9
   Purakof2is10–2=8
4. **Rekhank** means 'a digit with a baron its top'
   Ex.A bar on 7is written as $\overline{7}$
5. **Beejank** means sum of digit of an umberadded upto get a single digit.
   Ex. Beejank of 27=2+7 =9
   Beejankof348=3+4 +8 =15=1+5=6
6. **Vinculum** means when we use positive and negative digit together, this is

called vinculum.

Ex.1 $\overline{7}$ here 1 is positive number and7 is a negative number.

- **Methods of quick calculation**
  - **Addition**

1. SUTRA"ENDINGWITHZERO"

This method is called making a number ending with zero and then add theremaining.Thenumberattheend of which there is a zero as 10 , 100 , 1000, 2000,3000…The additioncanbemade easyandinterestingusinghissutra.

Working:

Step 1 : First add the digits of left most column. Then put zero at the end of sumObtained.

Step 2: Addthedigitsofsecondcolumnfromleftto thesumwith zeroattheendin step(1)

Step 3: Again put zero at the end of sum obtained in step (2) . Then add the digitsofthirdcolumnfrom left.

Ex. 86+79usingSutra'endingwithzero'

Sol.

8 6
+7 9

Step 1 :8+7= 15

Put 0 at the end of this sum and we get 150Step2 :150+6+9= 165

2. SUTRA'NIKHLAM'

The addition of numbers around base or sub-basecan be done quickly. Bases are10 ,100 ,1000,……andsub – bases are20,30,40,200 ,300…..20000,3000 etc.Sobyusing'NIKHLAM'sutraadditionisveryeasy.

Working : In this method we write numbers with help of bases or sub-basesEx.102=100+2 99=100– 1

67=70–3 42=40+2

Additionof10,100 ,1000……20,30 ,40 ,70……numbersis veryeasy.Sowecan addeasily.

Ex. Add73 + 96 by using the sutra 'Niklam'.Sol. 73+96

= 73+(100–4)

= (73+100) –4

= 173–4 =169

3. SHUDH METHOD FOR ALISTOFNUMBERS

Shudh means pure. The pure numbers are the single digit numbers i.e. 0,1,2,3…..9 .In Shudh method of addition we drop the 1 at the tens place and carry only the single digit forward.

Ex. Find2+7+8+9+ 6+4

Sol.

```
    2
  • 7
  • 8
    9
  • 6
    4
 ------
  3  6
```

We start adding from bottom to top. As soon as we come across a two – digitnumber, we put a dot (•) and carry only the single digit forward for furtheraddition.Weputdownthesingledigit(6inthis case)thatwegetin theend.Forthefirstdigit,we add allthedots(3inthiscase)andwriteit.

Ex. 234+658 +818 +46

```
      2    3    4
         • 6  •5
          •88  1
               •8
      ------------
         4    6
      ------------
   17    5    6
```

- **SUBSTRACTION**

For subtraction we use sutra " **ending with zero**" as done in addition from left toright .

Ex. Subtract 38 from87

Sol.

```
   87
 - 38
 ------
   4  9
 ------
```

Step1 :8–3= 5

Writeitas50

Step2:50+ 7 – 8=49

- EasywayforMultiplication

1.**SUTRA: VERTICALLY ANDCROSS–WISE**

<u>Same base Method</u>: When both the numbers are less than the samebase .

<u>Working:</u>

Step1: Firstwefindthedeficienciesofthenumberstobemultiplied.

Step2: Cross subtract to get firstpartofanswer.

Step 3 : Multiply deficiencies (vertically) to get second part ofanswer.

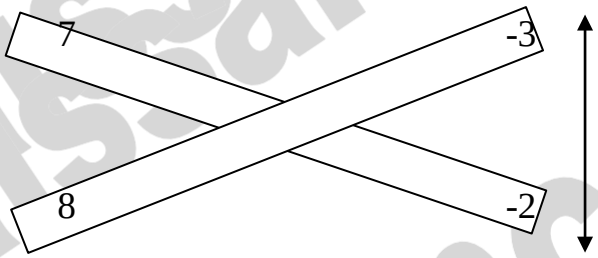
Ex. Multiply 7 × 8

Sol.Herebaseis10

So7is3below10

And8is 2below 10

Step1: Number Deficiency



Step 2 : Cross subtract i.e. 7 – 2 = 5 or 8 – 3 = 5 . The two difference are alwayssame.So 5is the firstpartof answer.

Step3:Multiplyvertically(deficiencies)

i.e. , -3 × -2 = 6 which is the second part of answer.Hence 7 -3

8 -2

5 / 6

i.e. 7 ×8=56

Different Base Method

When both numbers are less than baseWorking

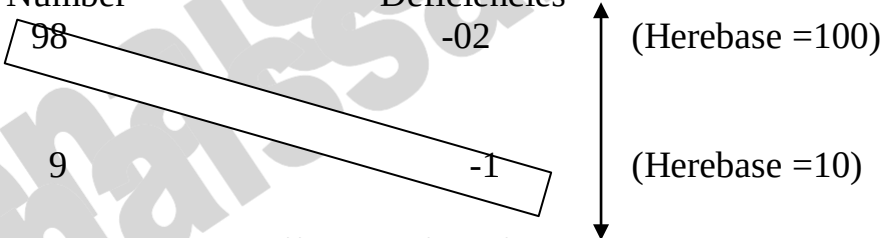
Step 1 : First write the deficiencies of the no.

Step2:Crosssubtractto get first part of answer.

Step 3 : Multiply deficiencies (Vertically) to get the second part of the answerBy combiningthesetwoparts,we gettherequiredanswer.

Ex.Multiply98×9

Sol. Number Deficiencies



CrossSubtract

9 8 (Differenceofno.of digitsinbases=1so

-1 × leaveonespacefrom right.)

8 8

Whichis thepart oftheanswer.

Verticallymultiply

-02×-1 = 2 (one digit allowed as lower base 10 has one zero)Which isthesecondpartofanswer

Hence, 98×9=882

- **Squaring**

  Squaringnumbersnearbase

  Step1:Forfirstpartaddthenumbertoitssurplusorsubtractdeficiencyfromthenumber

  Step 2 : For second part square surplus / deficiency . Number of digit insecondpartshouldbeequaltonumber of zerointhebase.

  Ex.$(107)^2$

  Sol. Base =100Surplus=+07

  Forthefirstpart = 107 + 7 = 114For thesecondpart= $(07)^2$=49

  $(107)^2$= 114/49=11449

  Ex.$(93)^2$

  Sol.Base =100

  Deficiency =-07

  Forthefirstpart = 93- 07 = 86For thesecondpart= $(07)^2$=49

  $(93)^2$= 86/ 49=8649

- **Squareroots**

  Step 1 : From pairs from right to left. Number of pairs decide the number ofdigits inthe square roots.

  Step 2 : For the square root of 4 digit number, take first pair from left, Checkthe square number less than this pair Corresponding digit of this squarenumbergivesthetensdigitof requiredsquare root.

  Step 3 : See the last digit of the number and guess the corresponding digitsStep 4 :To choose thecorrectlastdigitinstep3.

  Find$(Tensdigit)^2$+Tensdigit

  If first pair is less than this number, then choose smaller digit in step 3.Iffirstpairismorethanthisnumberthenchoosebiggerdigitinstep3.

- **Methodofquick verificationofanswersfromdigitsum**

  9'CHECKMETHOD

  In this method digit sum is the sum of digits of a number added upto asingledigit.Digit sum alsoknown as"Beejank"

  VerificationSteps:

  Step1:Writedownthedigitsumsofthenumbersbeing added/subtractedormultiplied.

  Step2:Add/Subtractormultiplythesedigitsumsupto asingledigit.

Step3: Findthedigitsumoftheresult.
Step 4 : Check whether the two digit sums in Step (2) , Step (3) are Same.Ifbotharesame ,thenthe answeriscorrect.

Ex.Add 278 and 119 . Check the answerSol. 278
+119
3 97

Verification:

Step1:Digitsum of2 7 8 = 8
DigitSum of1 1 9 =1+ 1 =2
Step2: L.H.S. = 8+ 2 = 10
1+0=1

Step 3 :Digitsum ofR.H.S.
i.e.Digitsum of result3 9 7
=3+7=10
=1+0= 1

Step 4 : Digitsumof LHS= Digit sum of RHS=
1Hence,answer maybe correct.

UNIT-II

Rules for sign in Algebra and practice, Rules for calculating (BODMAS) and Practice

- **Rules forsigninAlgebraandpractice**

The basic mathematical operators are addition, subtraction , multiplication division, order or exponentsandbrackets.Theyarecalledoperatorsbecausethey 'operatoron' thequantitiesor thenumbers.

1. Addition
   It is the process of combining two or more quantities. The sign of theaddition operator is'+'
   Ex.:2+3=5
2. Subtraction
   It is the process of removing one quantity from another. The sign ofthesubtractionoperationis '-'.
   Ex.:5 – 3=2
3. Multiplication
   It is repeated addition. The sign of the multiplication operator is 'x'.Ex.:5 +5+5+5+5+ 5+5+5means
   8times5
   Soitis5*8=40
4. Division
   Itisseparatingsomethingintoequalparts.Thesignofdivision

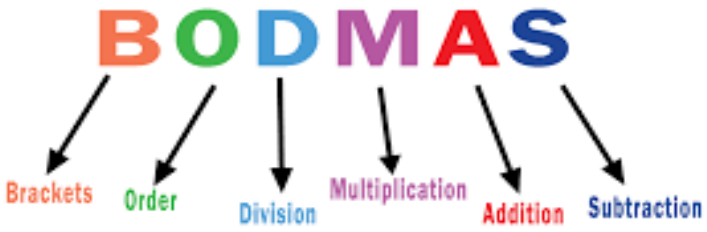
operatoris'÷'Ex.4
0 ÷5=8Orders
/Exponents
They are the number of times the entity must be multiplied with itselfEx.:a^3meansa×a×aetc.

5. Brackets
They are used to break the general order of operations.
Thecommonly usedbracketsare:
(i) ‾ BarBracketorVinculum
(ii) ( ) Parentheses,Small brackets
(iii) {} CurlyBrackets,middle bracket,Braces
(iv) [ ] Square Bracket

Operands
An entity or a quantity, upon which a mathematical operator isperformediscalledasanoperand.
Forex.:Intheexpression
7 + 4 the numbers 7 , and 4 are operands while (+) sign is theoperator.

"BODMASRULE"

'BODMAS' is the order of operations to simplify expressions is mathematics."BODMAS"rule is:



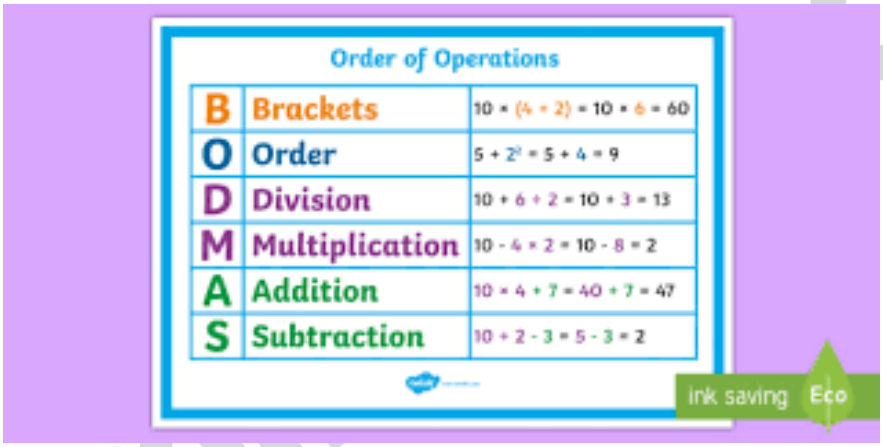
Accordingsothisrule,Inanexpressionthathasallthe operators,wewould first solve operations with in the ' Brackets'. This is called'openingthebracket',
Next we solve exponents (order) or 'of ' , then 'Division' and'Multiplication'operatorswouldbesolved.Afterwhichwewillsolvefor'Addition'and 'Subtraction'.
Ex. 7×3+8÷2−12=?
ThisequationwouldbesolvedusingtheBODMASruleas

$=7\times3+8\div2-12$

$=21+4-12$

$=25-12$

$=1$



-Simultaneous Equations

Equation – Equations signify relation of equality between two algebraic expressions symbolized bythe sign of equality '='. In other words, an equation is statement which says that the two algebraicexpressions areequalandis satisfied onlyforcertainvaluesofthe variables.

Identify – When equality of two algebraic expressions hold true for all values of variables then it iscalledanidentity.

Root of an Equation – The value of unknown or variable for which the equation is true is known astheroot oftheequation.To findtheroots of anequationmeanstosolvethe equations.

DegreeofanEquation–Thedegreeofanequationisthehighestexponentofthevariablexor variables(x,y,...)presentintheequationiscalledthedegreeofanequation.

Linear Equation – An equation which involves power of an unknown quantity not higher than unity(one)iscalled alinear equation.

One variable Linear Equation – A linear equation in one variable (x, say) in which the highestdegreeofthevariablexis1.A linear equation in one variableis, ingeneral, written asax+by=corax =c.Thisequationisalsocalled, "Firstdegree equationinx"orsimple equation.

Twovariableequation–
Alinearequationintwovariables(x,y,say)inwhichthehighestdegreeofthevariablesx andyeachis1.Alinearequationintwovariables,isgeneral,iswritten asax+by+c =0or ax+by=d.

Three variable equation – A linear equation in three variables (x, y, z, say) in which the highestdegree of the variables x, y and z each is 1. A linear equation in three variables, in general, is writtenas $a_1x+b_1y+c_1z=d$.

Types of Simultaneous Equations–

i) LinearSimultaneousEquationsintwoVariables– Twolinearequationsintwovariablestogetherare linearsimultaneousequations intwovariables, e.g.:

$$4x+y = 2$$
$$3x-5y= 18$$

ii) Linear Simultaneous Equations in three Variables–Three linear equations in three variables together are linear simultaneous equations in three variables, e.g.:

$$3x+5y-7z =13$$
$$4x+y-12z =6$$
$$2x+9y-3z =20$$

iii) Specific type of Simultaneous Equations– The equations in other than linear form are called specific type equations, e.g.:

i) quadratic equation:$ax^2+bx+c=0$

ii) Reciprocal equation:$\frac{a}{x}+\frac{b}{y}=c$

iii) a $(\frac{y}{x})+c=by,etc.$

CharacteristicsofSimultaneousEquations–

1) Asystemoflinearequationsinonevariableisnottakenundersimultaneousequations.
2) The set of values of two variables x and y which satisfy each equation in the system ofequationsiscalledthe solutionofsimultaneousequations. Thesolutionsoftwovariablelinearsimultaneousequationsmaybe–
   i) Infinitelymany,
   ii) Anuniquesolution,or
   iii) Nosolution.
3) Forsimultaneousequations– $a_1x+b_1y=c_1$ and $a_2x+b_2y=c_2$
   a. If $\frac{a1}{a2}=\frac{b1}{b2}=k$ and $c1=kC_2$ then thereareinfinitely manysolutions.
   b. If $\frac{a1}{a2}=\frac{b1}{b2}=c1\neq kc_2$, thenthereisnosolution.
   c. If $c_2\neq 0$, then $c_1=kc2\rightarrow \frac{c1}{c2}=k$, hence

$$\frac{a1}{a2}=\frac{b1}{b2}=\frac{c1}{c2}\rightarrow infinitelymanysolutions$$

$$and\ \frac{a1}{a2}=\frac{b1}{b2}\neq\frac{c1}{c2}\rightarrow nosolution$$

   d. If c_1 and c_2 both are zero (i.e., $c_1=0=c_2$)

MethodsofTypesofSolvingSimultaneousEquation

1. MethodofSubstitution
2. MethodofElimination
3. MethodofComparison
4. MethodofCross–Multiplication

1. **MethodofSubstitution:** Thesubstitutionmethodisoneofthealgebraicmethodstosolvesimultaneous linear equations. It involves substituting the value of any one of the variablesfromoneequationtothe other equation.
2. Letusassumetwo linearequations:2x+3(y+5)=0andx+4y+2=0.
3. **Step 1:** Simplify the given equation by expanding the parenthesis if needed. So, here we cansimplifythe firstequationtoget2x +3y +15=0.Nowwe havetwoequations as,

4. 2x +3y+15 =0_____(1)

5. x+4y+2 =0_____(2)
6. **Step 2:** Solve any one of the equations for any one of the variables. You can use any variablebased on the ease of calculation. Suppose we are solving 2nd equation for x. So, we get x = -4y -2.
7. **Step 3:** Substitute the obtained value of x in the other equation. So we are substituting x = -4y-2intheequation2x +3y +15 =0,we get,2(-4y-2) +3y+ 15 =0.
8. **Step 4:** Now, simplify the new equation obtained using arithmetic operations.. We get, -8y-4+3y+15=0

9.-5y+ 11= 0
10.-5y= -11
11.y =11/5
12. **Step 5:** Now, substitute the value of y in any of the given equations. Let us substitute the value ofyin equation(2).
13.x +4y+2 =0
14.x +4 ×(11/5)+2 =0
15.x +44/5+2 =0
16.x +54/5=0
17.x = -54/5
18.Therefore,aftersolvingthegiven linearequationsbysubstitutionmethod,wegetx=-54/5andy=11/5.

2. Method of Elimination : The elimination method is useful to solve linear equations containingtwo or three variables. We can solve three equations as well using this method. But it can only beapplied to two equations at a time. Let us look at the steps to solve a system of equations usingtheeliminationmethod

Ex.:Let, x+y=8____(1)and2x-3y=4____(2)

Step1:Tomake the coefficientsofxequal,multiplyequation(1)by2andequation(2)by1.Weget,

(x+y=8)×2____(1)

(2x-3y=4)×1____(2)

So,thetwoequations wehavenoware2x+2y=16 (1) and 2x-3y=4 (2).

Step2:Subtractequation2from1,we get,y=12/5.

$$2x + 2y = 16$$
$$2x - 3y = 4$$
$$\ominus \quad \oplus \quad \ominus$$
$$5y = 12$$

$$y = \frac{12}{5}$$

Step3:Substitute thevalue ofyinequation1,weget,x +12/5 =8

x =8-12/5

x= 28/5

Therefore,x =28/5andy=12/5.

3. Method of Comparison : Steps to solve the system of linear equations by using thecomparison method **to find the value of x and y**. Therefore, we have comparedthe values of x obtained from equation (i) and (ii) and formed an equation in y, sothis method of solving simultaneous equations is known as the comparisonmethod

Ex.:3x– 2y= 2 ---------- (i)

7x+ 3y= 43 ----------(ii)

Now for solving the above simultaneous linear equations by using the method ofcomparisonfollowtheinstructionsandthe methodofsolution.

StepI: Fromequation3x– 2y=2 ---------- (i),express**x** intermsof**y**.

Likewise,from equation7x+ 3y= 43 ----------(ii),express **x**intermsof **y**.

Fromequation(i) 3x–2y=2 weget;

3x – 2y + 2y = 2 + 2y (adding both sides by

2y)or,3x= 2 + 2y

or, 3x/3 = (2 + 2y)/3 (dividing both sides by

3)or,x= (2 + 2y)/3

Therefore,x=(2y+2)/3---------- (iii)

Fromequation(ii) 7x+3y=43we get;

7x + 3y – 3y = 43 – 3y (subtracting both sides by

3y)or,7x= 43– 3y

or, 7x/7 = (43 – 3y)/7 (dividing both sides by

7)or,x= (43– 3y)/7

Therefore,x=(–3y+43)/7---------- (iv)

StepII: Equatethevaluesof**x**inequation(iii)andequation(iv)formingtheequationin**y**
From equation (iii) and (iv), we

get;(2y+2)/3=(–3y+43)/7 --------- (v)

StepIII: Solvethelinearequation(v)in**y**
(2y+2)/3=(–3y+43)/7 ---------- (v)Simplifyingweget;

or, 7(2y + 2) = 3(–3y +

43)or,14y+14=–9y+129

or, 14y + 14 – 14 = –9y + 129 –

14or,14y=-9y+115

or, 14y + 9y = –9y + 9y +

115or,23y=115

or, 23y/23 =

115/23Therefore,y=

5

StepIV: Putting the value of **y** inequation(iii)orequation(iv),findthevalueof**x**
Putting the value of **y** = 5 in equation (iii) we

get;x=(2 ×5+2)/3

or, x = (10 +

2)/3or, x =

12/3Therefore,x

=4

Step V: Required solution of the two

equationsTherefore, x=4andy=5

Method of Cross Multiplication : Cross-multiplication is a technique to determine thesolution of linear equationsin two variables. It proves to be the fastest method to solve apairoflinearequations. Foragivenpairoflinearequationsin twovariables:

$a_1x+b_1y+c_1=0$

$a_2x+b_2y+c_2=0$

By usingcross multiplication,thevaluesx and ywillbe:

$$\frac{X}{B_1C_2-B_2C_1} = \frac{Y}{A_2C_1-A_1C_2} = \frac{1}{A_1B_2-A_2B_1}$$

Unit 3

Indices, Logarithms, Antilogarithms

The Theory of Indices (also known as Exponents) is a fundamental pillar of Business Mathematics. It deals with the shorthand way of expressing repeated multiplication of the same number.

In business, indices are used heavily in calculating compound interest, depreciation, and growth models.

1. Definition and Notation

If a number a is multiplied by itself n times, it is written as:

$$a^n$$

• a (The Base): The number being multiplied.

• n (The Index/Exponent/Power): The number of times the base is multiplied.

Example: 2^3 = 2 \times 2 \times 2 = 8.

2. Fundamental Laws of Indices

To solve business math problems efficiently, you must master these seven laws:

I. Multiplication Law

When multiplying two terms with the same base, you add the powers.

$$a^m \times a^n = a^{m+n}$$

Example: 5^2 \times 5^3 = 5^{(2+3)} = 5^5.

II. Division Law

When dividing two terms with the same base, you subtract the powers.

$$\frac{a^m}{a^n} = a^{m-n}$$

Example: x^{10} \div x^{4} = x^6.

III. Power of a Power Law

If an exponential term is raised to another power, you multiply the powers.

$$(a^m)^n = a^{m \times n}$$

Example: (2^3)^2 = 2^6 = 64.

IV. Product Power Law

The power applies to every factor inside the bracket.

$$(ab)^n = a^n \times b^n$$

V. Zero Index Law

Any non-zero number raised to the power of zero is always 1.

$$a^0 = 1 \quad (\text{where } a \neq 0)$$

Business Note: This is crucial in finance formulas where a growth rate might be zero over a specific period.

VI. Negative Index Law

A negative power indicates the reciprocal of the base with a positive power.

$$a^{-n} = \frac{1}{a^n}$$

VII. Fractional Index Law (Roots)

Fractional powers represent roots (Square roots, Cube roots, etc.).

$$a^{1/n} = \sqrt[n]{a}$$

$$a^{m/n} = \sqrt[n]{a^m}$$

3. Key Concepts to Remember

1. Base Equality: If a^x = a^y, then x = y (provided a \neq 1, 0, -1). This is used to solve equations.

2. Parentheses Matter: Note that -3^2 is -(3 \times 3) = -9, whereas (-3)^2 is (-3) \times (-3) = 9.

3. Numerical Conversion: In many B.Com exams, you will need to convert large numbers into prime bases (e.g., converting 81 to 3^4) to simplify equations.

LOGARITHMS

While indices focus on the result of a calculation (e.g., 2^3 = ?), logarithms focus on the power needed to get a result (e.g., 2^? = 8).

1. Definition of Logarithms

If a^x = n, then x is called the logarithm of n to the base a.

It is written as:

$$\log_a n = x$$

Condition: a > 0, a \neq 1, and n > 0.

• Relationship: * Exponential Form: 5^2 = 25

• Logarithmic Form: \log_5 25 = 2

2. Fundamental Laws of Logarithms

These laws are essential for simplifying complex business calculations involving multiplication and division.

I. Product Law (Log of a Product)

The log of a product is the sum of the logs.

$$\log_a(mn) = \log_a m + \log_a n$$

II. Quotient Law (Log of a Fraction)

The log of a quotient is the difference of the logs.

$$\log_a\left(\frac{m}{n}\right) = \log_a m - \log_a n$$

III. Power Law

The power of the number shifts to the front of the log.

$$\log_a(m^n) = n\log_a m$$

IV. Base Change Formula

Useful when you need to switch to a common base (usually base 10 or e).

$$\log_b m = \frac{\log_a m}{\log_a b}$$

V. Important Standard Values

• \log_a a = 1 (The log of a number to its own base is 1)

• \log_a 1 = 0 (The log of 1 to any base is 0)

3. Common Logarithms (Base 10)

In B.Com, we mostly use Common Logarithms where the base is 10. A logarithm has two parts:

1. Characteristic: The integral part (can be positive, negative, or zero).

• Determined by the position of the decimal point.

• Rule: (n-1) where n is the number of digits before the decimal.

2. Mantissa: The fractional part (always positive).

• Determined using a Log Table.

4. Anti-Logarithms

The Anti-logarithm is the inverse process of finding a logarithm. If \log x = y, then x = \text{antilog } y.

How to find Anti-log:

1. Ignore the Characteristic: Use only the decimal part (Mantissa) to look up the value in an Anti-log Table.

2. Locate the value: Find the first two digits of the mantissa in the left column, then look under the third digit's column.

3. Place the Decimal: * If the characteristic is n, place the decimal after (n+1) digits.

• If the characteristic is negative (denoted as \bar{n}), place (n-1) zeros after the decimal point before the first significant figure.

5. Practical Application in Business

Logarithms are used to solve for "time" or "interest rates" in finance when the variable is in the exponent:

Calculating "n" in Compound Interest: If A = P(1+r)^n, we take logs on both sides to solve for n:

$$\log A = \log P + n \log(1 + r)$$

Depreciation: Finding the life of a machine when its value reduces by a fixed percentage.

Data Scaling: Turning exponential growth charts into linear lines for easier analysis.

Principes

1. Core Principles of Logarithms

Think of these principles as the "operating rules." They allow you to turn difficult multiplication and division into simple addition and subtraction.

• Principle of Inverse Relationship: Logarithms and Exponents are opposites. If 10^3 = 1000, then \log_{10} 1000 = 3.

• Principle of Monotonicity: As the number increases, its logarithm also increases. This allows us to compare large financial figures easily.

• Principle of Base Standard: In Business Math, if no base is written (e.g., \log 50), it is assumed to be Base 10 (Common Logarithm).

2. Calculation Components

Every logarithm of a number consists of two distinct parts that you must calculate separately.

A. The Characteristic (Determined by Inspection)

This is the whole number part. You don't need a table for this; you just look at the number.

• For numbers > 1: Count the digits before the decimal point and subtract 1.

• Example: For 432.5, there are 3 digits. Characteristic = 3 - 1 = \mathbf{2}.

• Example: For 5, there is 1 digit. Characteristic = 1 - 1 = \mathbf{0}.

• For numbers < 1: Count the number of zeros immediately after the decimal point, add 1, and put a bar over it.

• Example: 0.0052 has two zeros. Characteristic = 2 + 1 = 3, written as \mathbf{\bar{3}}.

B. The Mantissa (Determined by Log Tables)

This is the decimal part. It is always positive and is found using the log table.

How to find it:

1. Take the first four significant digits of your number (ignore the decimal point).

2. Look for the first two digits in the leftmost column of the log table.

3. Move horizontally to the column headed by the third digit.

4. Find the value in the "Mean Difference" column for the fourth digit and add it to your previous number.

3. Step-by-Step Calculation Example

Question: Find \log 25.43

1. Find Characteristic: There are 2 digits (25) before the decimal. 2 - 1 = \mathbf{1}.

2. Find Mantissa: Look at the number as 2543.

• In the Log Table, find row 25.

• Look under column 4. You will find the value .4048.

• Look under Mean Difference column 3 for row 25. You find 5.

• Add them: 4048 + 5 = \mathbf{4053}.

3. Combine: \log 25.43 = \mathbf{1.4053}.

4. Anti-Logarithm Calculations

To find the number back from a log value (e.g., finding x when \log x = 1.4053):

1. Identify the Mantissa: Look only at the decimal part .4053.

2. Use Anti-Log Table: * Look for row .40.

• Look under column 5. Value = 2541.

• Look under Mean Difference 3. Value = 2.

• Total = 2543.

3. Place the Decimal: Look at the characteristic (1).

• Rule: Place decimal after (n + 1) digits.

• 1 + 1 = 2.

• Result: 25.43.

Percentage

1. Fundamental Principles

A percentage is a ratio where the denominator is always fixed at 100.

• Conversion of Fraction to Percentage: Multiply the fraction by 100.

• Example: 3/4 \times 100 = 75\%

• Conversion of Percentage to Fraction/Decimal: Divide the percentage by 100.

• Example: 20\% = 20/100 = 0.2

• The "Base" Principle: A percentage means nothing without its base. 10\% of 1,000 (100) is very different from 10\% of 10,000 (1,000).

2. Key Business Calculations

I. Percentage Change (Increase/Decrease)

This is used to find the growth in sales or the reduction in expenses over two periods.

$$\text{Percentage Change} = \frac{\text{New Value} - \text{Old Value}}{\text{Old Value}} \times 100$$

Positive Result: Percentage Increase.

• Negative Result: Percentage Decrease.

II. Percentage of a Quantity

To find a specific amount (like Tax or Commission):

$$\text{Amount} = \frac{\text{Percentage Rate}}{100} \times \text{Total Value}$$

III. Finding the Original Value

If you know the value after a percentage change and the rate, you can find the original amount.

$$\text{Original Value} = \frac{\text{New Value}}{100 \pm \text{Percentage Change}} \times 100$$

(Use + for increase, - for decrease)

3. Advanced Applications in B.Com

A. Successive Percentage Changes

In business, values often change multiple times (e.g., a 10\% increase followed by a 10\% discount).

Crucial Note: A 10\% increase followed by a 10\% decrease does not bring you back to the original value.

Net Change Formula: If a value changes by x\% and then by y\%, the net change is:

$$\left(x + y + \frac{xy}{100}\right)\%$$

B. Mark-up vs. Margin

• Mark-up: Percentage added to the Cost Price to arrive at the Selling Price.

• Margin: Percentage of the Selling Price that is profit.

• Calculation Tip: A 25\% mark-up on cost is equal to a 20\% profit margin on sales.

4. Practical Example

Question: A shopkeeper marks his goods 20\% above the cost price but allows a 10\% discount for cash payment. Find his net profit percentage.

1. Assume Cost Price (CP): 100

2. Marked Price (MP): 100 + 20\% \text{ of } 100 = 120

3. Discount: 10\% \text{ of } 120 = 12

4. Selling Price (SP): 120 - 12 = 108

5. Net Profit: 108 - 100 = 8

6. Profit Percentage: (8/100) \times 100 = \mathbf{8\%}

UNIT-4

RATIO

A ratio can exist only between two quantities of the same type. If x and y are any two numbers and y ≠0 then the fraction $\frac{x}{y}$ is called the ratio of x and y is written as x:y.

Characteristics of Ratio–

The following characteristics are attributed to ratio relationship:

i) Ratio is across relation found between two or more equantities of same type.

ii) It must be expressed in the same units.

iii) By the fraction laws a ratio can be expressed as below:

$\frac{y}{x}$ =x:y

$\frac{10}{5}$ =10:5 or 2:1

iv) A ratio expresses the number of times that one quantity contains another.

v) Two or more ratios may be compared by reducing their equivalent fractions to a commonden nominator.

Different types of Ratio–

Ratio can be divided into following ways–

1) Unit Ratio – When homogeneous items are same on the basis of unit, it is called unit ratio. For example– Ram and Shyam are getting Rs. 5 each.

$\frac{x}{y} = \frac{5}{5}$ $or 5:5$ $or 1:1$

2) Duplicate Ratio– When the homogeneous items are shown in unit with square, it is called duplicate ratio. For Example, 2:3 square means $2^2:3^2$ or 4:9

3) Triplicate ratio – When homogenous item is multiplied by 3, it is known as triplicate ratio. For example, $2^3:3^3$ = x2x2x2:3x3x3 8:27

4) Subtriplicate ratio– When ratio is expressed in cube root it is known as subtriplicate ratio. For example, $\sqrt[3]{8}:\sqrt[3]{27}$ = 2:3

5) Ratio of greater inequality– In this type of ratio the first item of given ratio is greater than other items. For example, 8:3, 13:8.

6) Ratio of less in equality– When first item of given ratio is less than the other items of ratio, it is called ratio of less of equality. For example, 2:7, 5:12, 1:3

7) Equality ratio – In this type of ratio first item is equal to other item of ratio. For example, 5:5, 8:8, 12:12

Proportion

Relationship between the two ratio's is called proportion. Here, quantity ratio of first two it ems is Equality to rest two terms.

For example, 2:5::6:15

Proportion is expressed by four parallel points (::).

In the simple proportion here its not necessary that two items of first ratio and the items of second ratio should be homogeneous. But the items of second set of ratio has the samerelationshipwhichisfoundbetweentheitemsoffirstratio.Forexample2:5::6:15.Here5is 2.5times of2incaseof first ratio.Inthesame15is2.5times of 6inthe secondsetofratio.

Characteristics of Proportion–

i) Proportion is given in four parts. So first number is known as first item, second number is second item, third number is third item and fourth number is known as fourth item.

ii) Firstandfourthitemsareknownasextremesitemsandsecondandthirditemsareknownas meanitems.

iii) It is not necessary in proportion thatallfouritems shouldbe homogenous.But the ratios of first and second and third and fourth shouldbe the same.

TypesofProportion –

1) **Continuedproportion**–
If ratio of items is going on continuously, e.g., ratio of first and two is equal to two and threeand ratio of two and three is equal to three and fourth item and so on, thus, ratio is known ascontinuedratio.
Forexample, $\frac{A}{B}=\frac{B}{C}=\frac{C}{D}=\frac{D}{E}=\frac{E}{F}\ldots$
HereA, B, C, D, EandFareincontinuedratio.

2) **DirectProportion**–
Inthistypeofratio,twodifferentitemshasthesuchrelationthatiftheoneisincreasedordecreased,another willchangeaccordinglyinthesame ratio.

DifferenceBetween RatioandProportion –

S.No.	Ratio	Proportion
1	Therearetwotermsinaratio.	Therearefourtermsinaproportion.
2	Comparisonoftwoquantitiesofsametype.	Comparisonoftworatios.
3	Twoquantitiesmustbeofsametype.	Allfourquantitiesarenotofsametypebutthefirsttwoareofonetypeandthelasttwomaybeofanothertype.
4	Thereis notaproductrule	Theproductofextremesisequaltoproductofthemeans.

DISCOUNT

The allowance or deduction from the market price of goods sold given by the vendor (Seller)to the purchaser (Buyer) is called discount. Discount is also known as allowance. The objective ofallowing discountare–

- Toincreasethesales
- Toretainthecustomership
- Toencouragethecustomers tomakethepaymentearly

KindsofDiscount –

Generaltherearetwotypesofdiscountsareallowedtothecustomers–
TradeDiscountandCashDiscount

1) **Trade Discount –** The Discount which is allowed by the seller according to the customs and traditions of the Business and which isallowed to allthecustomers irrespectiveofthepayments conditions is called Trade Discount. The objective allowing Trade Discount is toincreasethe sales.

2) **Cash Discount –** The deduction on the marked price or invoice price or the selling price tothe customer to encourage them to pay in cash or to make earlier cash payments is calledcashdiscount.

   IngeneralTradediscountisgivenonmarkedpriceandcashdiscountisgivenontheremainingamou ntafterdeductingtradediscount.Inthiswaythepurchaserincashisentitledtoget both typeof discount.

   Apartfromthesetwodiscounts,therearesomemoretypesofdiscount.
   Bulk discount or Quantity discount – It is allowed to the customers on purchasing on good inbig quantityorbulkquantity.

   Successivediscount–Whenanotherdiscountisgivenafteradiscount,thenthecombinationof thesetwo discountsare knownassuccessivediscounts.

   Equivalent Rate of Discount– The discount for which the amount due is equal to the amount due for successive discount is called their equivalent discount. Equivalent discount rateisalso calledsinglerate of equivalent discount.

Itistobenotedthatthetotalamountofsuccessivediscountisequaltotheamongofequivalentdiscount.

Forexample:
Ifatraderallowssuccessivediscountof20%and5%thenthesinglerate/equivalentrateofdiscount willbe–
D =20+5–20x5 /100 =24%

NINE-VALUE TABLE

It is a method of calculating discount on a certain sum of list price/marked price. In thismethodonthebasisofrategivenfirstofallwehavetocalculatethediscountforRupee1andaccordinglyforRupees2,3, 4, 5, 6, 7,8 and9.

Withthehelpofthistablewecancalculatethecommissionordiscountonanyquantity.

Questionstobeprepared

1) Givethedefinitionandcharacteristicsof Ratioandalsoexplainitstypes.
2) DescribethevarioustypeofProportion.
3) DistinguishbetweenRatioandProportion.
4) Explaintheimportance/significanceofPercentage.
5) ExplainthetermsCommission,Discount&Brokerage.
6) Whatissuccessivediscount?
7) Explainequivalentrateofdiscountwithexample.

ExplainNine-ValuesTablewithexample.

Brokerage–

This is the remuneration paid to the broker. It is actually a commission paid to the broker. It iscalculatedonthebasisofpercentageofthetotalvalueofthebusiness transactedbythebroker.

DelCredereAgent –
Adel-credereagentisapersonwhoguaranteescollectionofduesfortheprincipalfromthecustomers. They got a special type of commission known as del-credere commission. Usually theydeductthecommissiononthedues collectedandremittheremaining amounttotheprincipal.

TravellingAgent –
Thisisapersonwhomovesroundthetradingzoneoftheprincipaldoingthesellingproceeds.

Importantformulae–

i) Amountofcommission $= \frac{Rate\ of commissionX\ Amount\ of sales}{100}$

ii) Rateofcommission $= \frac{Rate of commissionX100}{Amount of Sales}$

iii) Amountof Sales $= \frac{Rate of commissionX100}{Rate of commission}$

iv) AmountofDel-craderecommission $= \frac{CreditSalesXRate of del-credarecommission}{100}$

UNIT - V

COMMISSION

The terms commission and discount are commonly applicable in the business world. We should clearly understand the terminologies before solving questions related with them.

Who is an Agent?
Usually businessman may not be directly doing the business transactions themselves because of expanded area of business. They may employee persons to be doing the selling or buying on their behalf. Such person are known as agents. Agents get commission against their works performance.

Commission–
Having transacted the business transactions, the agents will require remuneration from their principal such as remuneration is known as commission. Usually the commission is calculated on the basis of the percentage of total sales done by the agent.

WhoisaBroker?
The buyer and seller may not come into contact face to face. Their transaction may be made possibleby a middleman. He negotiates the sales and purchase proceeds between the buyer and seller such anegotiatorisknownasbroker.

Brokerage–
This is the remuneration paid to the broker. It is actually a commission paid to the broker. It iscalculatedonthebasis ofpercentageofthetotalvalueofthebusiness transactedbythebroker.

DelCredereAgent –
Adel-credereagentisapersonwhoguaranteescollectionofduesfortheprincipalfromthecustomers. They got a special type of commission known as del-credere commission. Usually theydeductthecommissiononthedues collectedandremittheremaining amounttotheprincipal.

TravellingAgent –
Thisisapersonwhomovesroundthetradingzoneoftheprincipaldoingthesellingproceeds.

Importantformulae–

i. AmountofcommissionRateofcommissionXAmountofsales100

ii. RateofcommissionRateofcommissionX100AmountofSales

iii. AmountofSalesRateofcommissionX 100Rateofcommission

AmountofDel-craderecommissionCreditSalesXRateof del-credarecommission100

AVERAGE

The average of the number of quantities of observations of the same kind is their sum divided by their number. The average is also called average value or mean value or arithmetic mean.

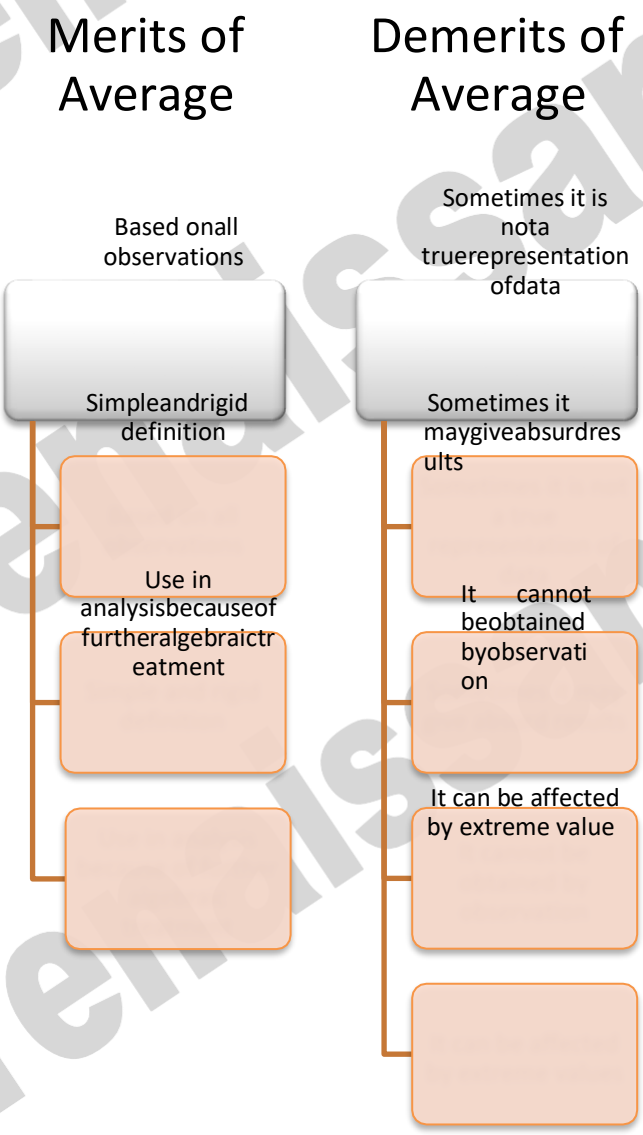
Average = , for observations x1 ,x2,x3, ...xn

$$\text{Average} = \frac{\text{Sum of all Elements}}{\text{Total No. of Elements}}$$

FunctionsofAverage

a) Topresentthesalientfeaturesofdatainsimpleandsummarizedform
b) Tocompareanddrawconclusion
c) Togetasimplevaluethatdescribes thecharacteristics oftheentiregroup
d) Tohelpinstatisticalanalysis

$$\frac{x_1+x_2+x_3+\cdots+x_n}{n}$$



PROFIT AND LOSS

SOMEIMPORTANTDEFINITIONSRELATEDWITHPROFITANDLOSS

CostPrice(CP)

The price, which is paid to acquire a product, is called costprice.Alltheoverheadexpenses(transportation,taxesetc.) arealsoincludedinthe costprice.

SellingPrice (SP)

Thesumofmoney,whichisfinallyreceivedfortheproduct i.e.thepriceatwhichtheproductisfinallydisposedoffiscalledth e Sellingprice.

MarkedPrice(MP)

Theprice,whichis listedormarkedontheproduct,isalsoknown as quotation price/printed price/catalogueprice/invoiceprice.

Profit

IfsellingpriceisgreaterthanCostprice,thenexcessof SPtoCPiscalledGainor Profit.
PROFIT=SELLINGPRICE–COST PRICE

Loss

IfsellingpriceislessthanCostprice,thenexcessofCP toSP iscalledLoss.
LOSS=COST PRICE–SELLINGPRICE

Profitpercentageformula

Profit%= 100×Profit/CostPrice.

PercentageLoss

Loss%= 100×Loss/CostPrice.

UNIT- VI

SIMPLE INTEREST

Interest –Whenever we borrow a certain sum of money (known as the principal), we pay back the originalamount accompanied with a certain amount of interest on that amount. In a way, those are the charges ofborrowingthatsumof money.

Simpleinterestisonemethod ofdeterminingtheamountdueattheendof loan duration.

DefinitionsofUsualWords –

Principal(P): Theoriginalsumofmoneyloaned/deposited.

Interest (I): The amount of money that you pay to borrow money or the amount of money that you earnon a deposit.

Time(T): Theduration forwhichthemoneyisborrowed/deposited.

Rate of Interest (R): The percent of interest that you pay for money borrowed, or earn for moneydeposited

$$Simple\ Interest\ (SI) = \frac{P \times R \times T}{100}$$

Where:
P: Principal (original amount)R: Rateof Interest(in %)
T:Timeperiod(yearly,half-yearlyetc.)

AmountDueat theendofthetimeperiod, **A=P(originalamount)+SI**

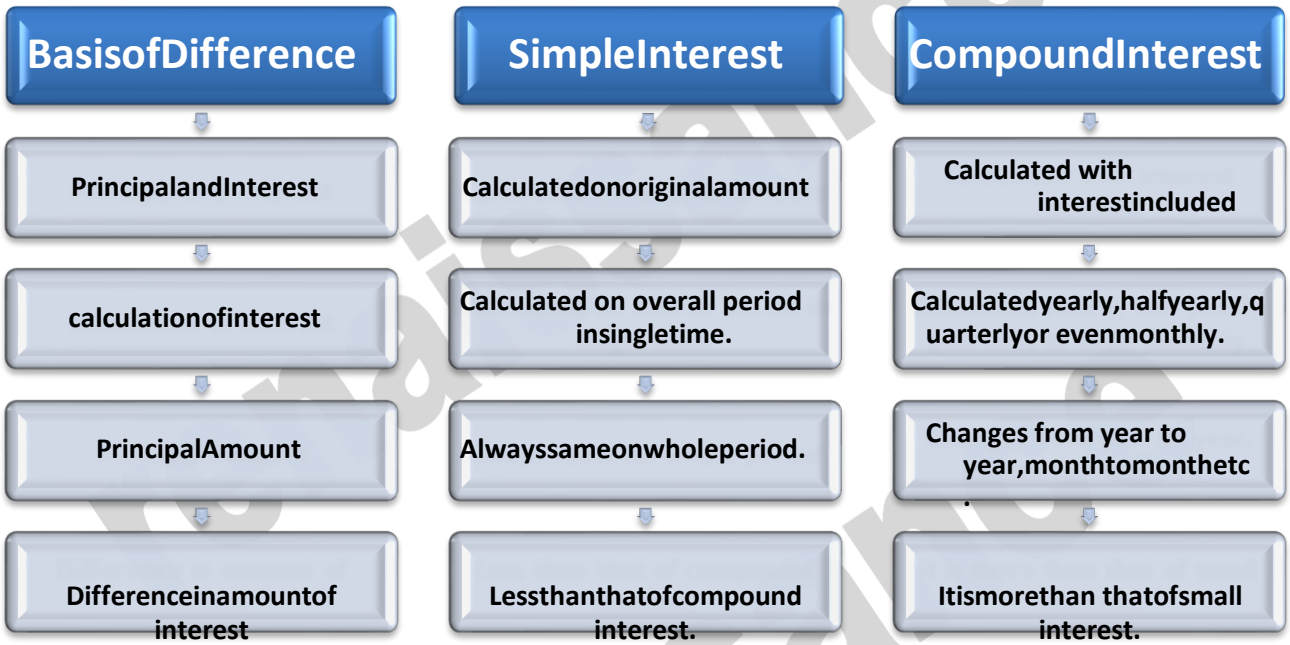
$$A = P + \left\{ \frac{P \times R \times T}{100} \right\}$$

Ifyouhaveacloselook,SimpleInterestisnothingelsebutanapplicationoftheconcept ofpercentages.

Meaningof CompoundInterest–
Bycompoundinterestwemeanwheninterestbecomesdueafteracertainperiod,itisaddedtotheprincipal amount and interest on succeeding years is based on the principal and the interest added. Thedifferencebetweentheamount and theoriginalprincipal iscalledthecompoundinterest.

Itmeansthatincompoundinterest,theprincipaldoesn'tremainfixedattheoriginalsumbutincreaseatthe end of each interest period. Interest period is the period at which the interest becomes due. It may be ayear,half yearor quarteryear.

Methods for Calculation of Compound Interest–



Thefollowing aresomeofthemethodsusedtocalculatecompoundinterest–

1) Simpleinterestmethod.
2) Interesttablemethod.
3) Decimalpointmethod.
4) Compoundinterestformulamethod.
5) ByLogarithmmethod.

1) SimpleInterestMethod–

When the time of the interest is not so long, i.e., when interest is calculated for only a fewyears then we use this method. It is just similar to that used to find out simple interest. Follow thestepsbelow –

i) Calculateinterestonprincipalattheendofeveryyear.
ii) Addtheinterestgotinstep(i)abovetotheoriginalprincipal.Thisamountisprincipalfor thenextyear.
iii) Calculatecompoundinterestbyaddingeachyear'sinterestfortheentireperiod.
iv) Finallysubtractthe originalfromthecompoundedamountandthisgivesthecompoundinteres t.

2) CompoundInterestFormulaMethod–

When thenumberofyearsinvolved tocalculate thecompoundinterest aremany,weuse theabovemethod.The formulausedis–

$$A=P\left(1+\frac{R}{100}\right)^{n}$$

WhereP denotes =Principal(original)
n = number of years (interest period)r=rateofinterest(inpercentage)
A =Amount after*n*years.