SYLLABUS

Class- I Year

Subject–Business Mathematics

UNIT–I	Brief history of Vedic mathematics in Indian knowledgetradition, methods and practice of quick calculation ofaddition,multiplication,division,squareandsquarerootof numbersthroughVedicmathematics,methodofquick verificationofanswersfromDigitalSum.
UNIT–II	RulesforsigninAlgebraandpractice,Rulesforcalculation (BODMAS)andpractice, SimultaneousEquations–Meaning,Characteristic,types, calculation(withwordproblems)
UNIT–III	TheoryofIndices (preliminaryknowledgeonly formulae), Logarithms and Antilogarithms – principlesandcalculation, Percentage
UNIT–IV	Ratio,Proportion,DiscountandBrokerage
UNIT–V	Commission,Average,profitandloss
Unit-VI	SimpleInterest,CompoundInterest

UNIT I,II,&III

BriefhistoryofVedicmathematicsinIndianknowledgetradition

- 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 thesutras from the Vedas, like the Atharva Veda and the Rig Veda. Hence the term 'Vedic Mathematics'.
- Hewrotetheinitial16sutrasin1957.Heplanned 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 $1\bar{7}$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. SHUDHMETHODFOR 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 thesingledigitforward.

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 the second part of theanswer.

Ex. Multiply 7 × 8Sol.Herebaseis10

So7is3below10

And8is 2below 10

Step1: Number Deficiency

Number	Deficiency
7	-3
8	-2

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

DifferentBaseMethod

When both numbers are less than baseWorking

Step 1 : First write the deficiencies of the numbers.Step2:Crosssubtractto get firstpartofanswer.

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

Ex.Multiply98×9

Sol.	Number	Deficiencies	
	98	-02	(Herebase =100)
	9	-1	(Herebase =10)

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$(\text{Tensdigit})^2$+Tensdigit

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

- **<u>Methodofquick verificationofanswersfromdigitsum</u>**

  <u>9'CHECKMETHOD</u>

  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 / $\cancel{7}$ 8 = 8
DigitSum of1 1 $\cancel{9}$ =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
Rulesfor signinAlgebraandpractice,Rules forcalculating(BODMAS)andPractice

- **Rules forsigninAlgebraandpractice**
  The basic mathematical operators are addition, subtraction , multiplicationdivision,orderorexponentsandbrackets.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

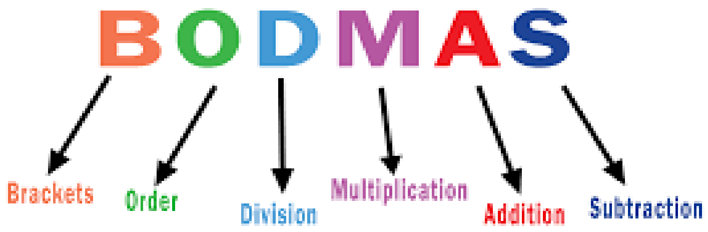
An entity or a quantity, upon which a mathematical operator isperformediscalledasanoperand.

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:



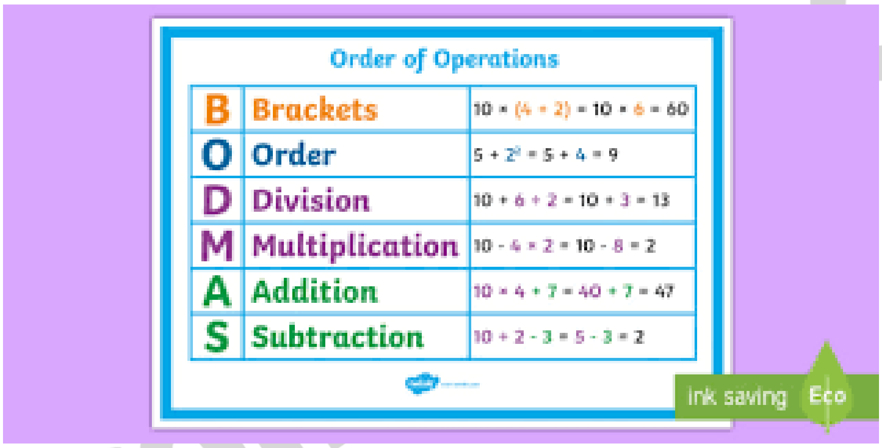
Accordingsothisrule,Inanexpressionthathasallthe operators,wewould first solve operations with in the ' Brackets'. This is called'openingthebracket',

Next we solve exponents (order) or 'of ' , then 'Division' and'Multiplication'operatorswouldbesolved.Afterwhichwewillsolvefor'Addition'and 'Subtraction'.

Ex. $7\times3+8\div2-12=?$

Thisequationwouldbesolvedusingthe BODMASruleas

$=7\times3+8\div2-12$
$=21+4-12$
$=25-12$
$=1$



-SimultaneousEquations

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.Alinearequationinonevariableis,ingeneral,writtenasax+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 $a_1x+b_1y+c_1z=d$.

TypesofSimultaneousEquations–

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

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

ii) LinearSimultaneousEquationsinthreeVariables–Threelinearequationsinthreevariables togetherarelinearsimultaneousequationsinthreevariables,e.g.:

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

iii) Specifictype of SimultaneousEquations– The equationsin other thanlinearformarecalledspecifictypeequations, e.g.:

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

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

iii) $a\left(\frac{y}{x}\right)+c=by$, 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 $c_2\neq0$,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 bothare 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.

$$\begin{aligned} \cancel{2x} + 2y &= 16 \\ \cancel{2x} - 3y &= 4 \\ - \quad + \quad & \quad - \\ \hline 5y &= 12 \end{aligned}$$

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

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: Puttingthevalueof**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:

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