SYLLABUS

Class – B.B.A. I Year

Subject : Business Mathematics

UNIT – I	Average, Ratio and Proportion, Percentage
UNIT – II	Simultaneous Equations: Meaning, Characteristics, Types and Calculations, Preparation of Invoice
UNIT – III	Determinants and Matrices, Matrix – Definition, Types, Basic Operations on Matrices, Determinants- Cofactor and Minor, Adjoint and Inverse
UNIT – IV	Vedic Math, Logarithms and Antilogarithms, Simple Interest, Compound Interest
UNIT – V	Profit and Loss, Commission, Discount, Broke of Matrixrage

UNIT-I
AVERAGE

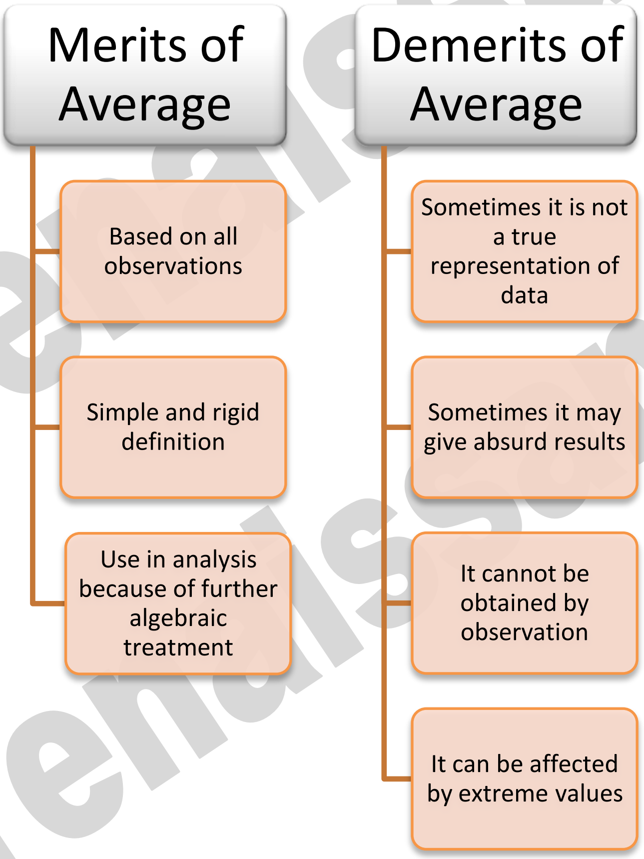
The average of the number of quantities of observations of the same kind is their sum divided by their number. The average is also called average value or mean value or arithmetic mean.

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

Average = $\frac{x_1 + x_2 + x_3 + \ldots\ldots\ldots\ldots + x_n}{n}$, for observations x1 ,x2, x3, ...xn

Functions of Average

a) To present the salient features of data in simple and summarized form
b) To compare and draw conclusion
c) To get a simple value that describes the characteristics of the entire group
d) To help in statistical analysis



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 a cross relation found between two or more quantities of same type.

ii) It must be expressed in the same units.

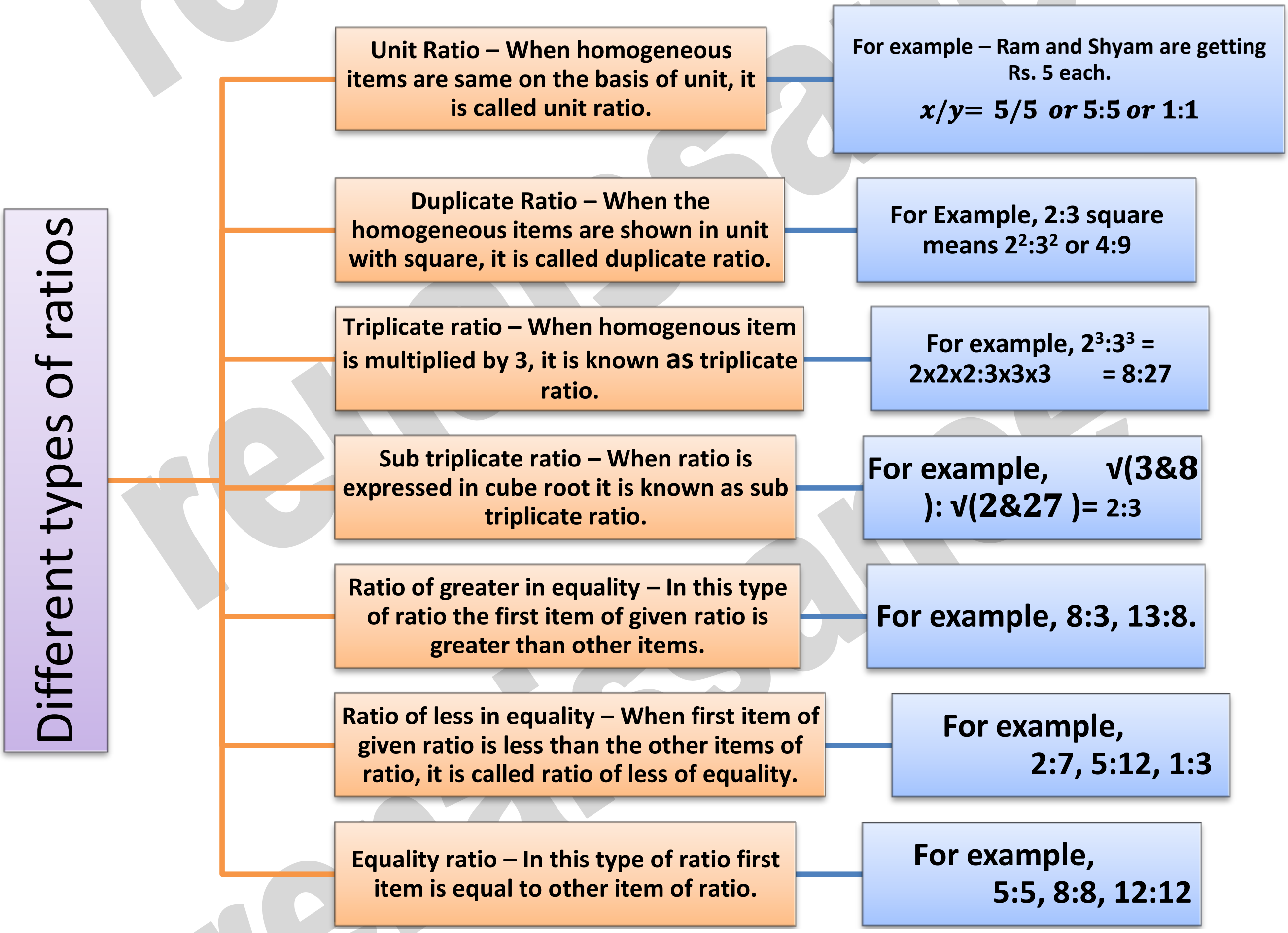
iii) By the fraction laws a ratio can be expressed as below:

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

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

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 common denominator.



PROPORTION

Relationship between the two ratio's is called proportion. Here, quantity ratio of first two items 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 have the same relationship which is found between the items of first ratio. For example 2:5::6:15. Here 5 is 2.5 times of 2 in case of first ratio. In the same 15 is 2.5 times of 6 in the second set of ratio.

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) First and fourth items are known as extremes items and second and third items are known as mean items.

iii) It is not necessary in proportion that all four items should be homogenous. But the ratios of first and second and third and fourth should be the same.

Types of Proportion

Direct Proportion – In this type of ratio, two different items has the such relation that if the one is increased or decreased, another will change accordingly in the same ratio.

Inverse Proportion – In this type of ratio, two different items has such a relation that if the one is increased or decreased, another will change inthe opposite direction in the same ratio.

Continued proportion – If ratio of items is going on continuously, e.g., ratio of first and two is equal to two and three and ratio of two and three is equal to three and fourth item and so on, thus, ratio is known as continued ratio.

For example, A/B= B/C= C/D= D/E= E/F....

Difference Between Ratio and Proportion –

S.No.	Ratio	Proportion
1	There are two terms in a ratio.	There are four terms in a proportion.
2	Comparison of two quantities of same type.	Comparison of two ratios.
3	Two quantities must be of same type.	All four quantities are not of same type but the first two are of one type and the last two may be of another type.
4	There is not a product rule	The product of extremes is equal to product of the means.

PERCENTAGE

Percent and Percentage

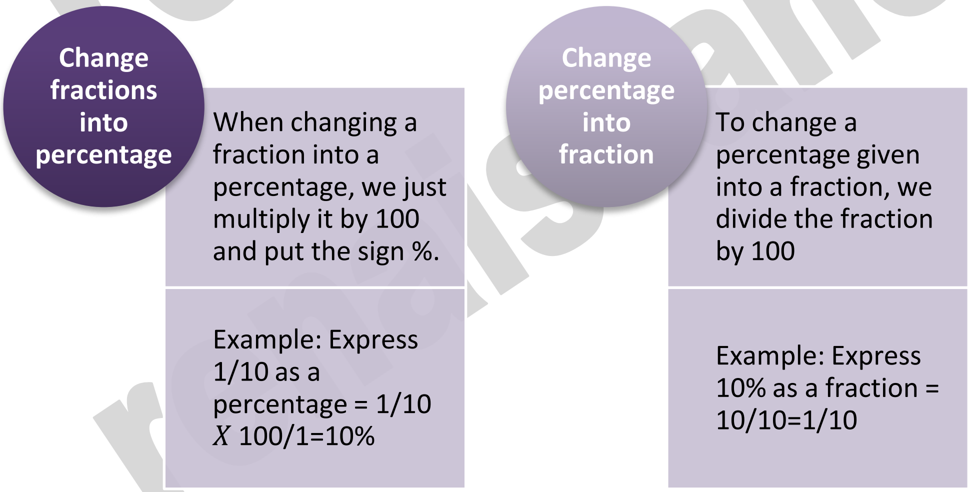
When we talk of percentage, we usually refer to "for every one hundred."
Actually percentage can be defined as a fractional expression with 100 as its denominator.

When we talk of 10 percentage of a number, we mean 10 parts put of one hundred parts of the number in consider action the word "percentage" can be denoted by the sign (%).

In the above example 10 percentages can be written as 10% or even $\frac{10}{100}$. When written in the form $\frac{10}{100}$, it is in a fraction form whereby the upper number is the numerator and the bottom the denominator. It can further be simplified as –

$$\frac{10}{100} = \frac{1}{10}$$

From the above discussion we can conclude that when dealing with percentage, a number can be expressed as a fraction of percentage, i.e.,
$\frac{10}{100} = \frac{1}{10}$; or it can be written just in percentage form, i.e., 10 percent = 10%.



To find percentage of quantity with another quantity –

Let x and y be two quantities of same type and rate percentage r, such that

$r\ \%\ of\ x = y$

or

$x.\frac{r}{100} = y$

$r = \frac{yX\ 100}{x}$

i.e., Rate percent = $\frac{Thequantityw\quad hichrepresentinpercent}{Secondquantity} X\ 100$

Example: What percent Rs. 20 of Rs. 350?

Solution: $r = \frac{20X100}{350} = 5\frac{5}{7}$

To find the quantity when rate percent and percentage value are known –

If rate percent value are given then

Quantity = $\frac{PercentvalueX\quad 100}{Ratepercent}$

UNIT-II

Simultaneous Equations

Equation – Equations signify relation of equality between two algebraic expressions symbolized by the sign of equality '='. In other words, an equation is statement which says that the two algebraic expressions are equal and is satisfied only for certain values of the variables.

Identify – When equality of two algebraic expressions hold true for all values of variables then it is called an identity.

Root of an Equation – The value of unknown or variable for which the equation is true is known as the root of the equation. To find the roots of an equation means to solve the equations.

Degree of an Equation – The degree of an equation is the highest exponent of the variable x or variables (x, y, ...) present in the equation is called the degree of an equation.

Linear Equation – An equation which involves power of an unknown quantity not higher than unity (one) is called a linear equation.

One variable Linear Equation – A linear equation in one variable (x, say) in which the highest degree of the variable x is 1. A linear equation in one variable is, in general, written as ax+by = c or ax = c. This equation is also called, "First degree equation in x" or simple equation.

Two variable equation – A linear equation in two variables (x, y, say) in which the highest degree of the variables x and y each is 1. A linear equation in two variables, is general, is written as ax+by+c = 0 or ax+by=d.

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

Types of Simultaneous Equations –

i) Linear Simultaneous Equations in two Variables – Two linear equations in two variables together are linear simultaneous equations in two variables, 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 $\left(\frac{y}{x}\right) + c = by, etc.$

Characteristics of Simultaneous Equations –

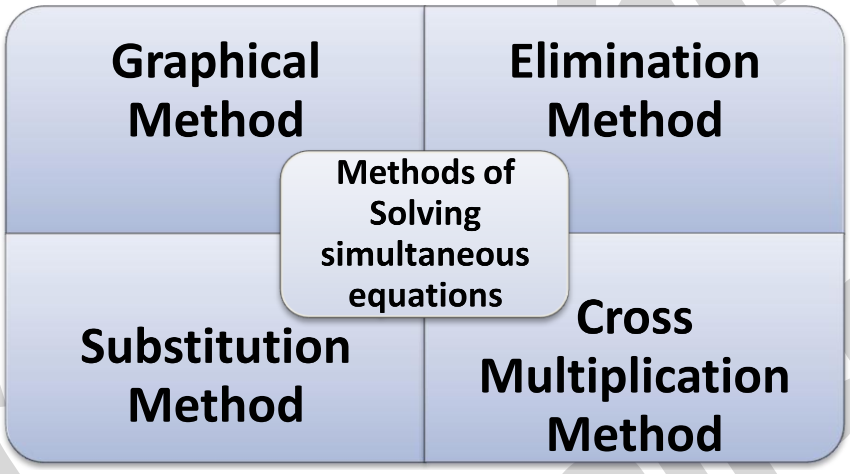
1) A system of linear equations in one variable is not taken under simultaneous equations.
2) The set of values of two variables x and y which satisfy each equation in the system of equations is called the solution of simultaneous equations.
The solutions of two variable linear simultaneous equations may be –
   i) Infinitely many,
   ii) An unique solution, or
   iii) No solution.

3) For simultaneous equations –
$a_1x + b_1y = c_1$ and $a_2x + b_2y = c_2$
   a. If $\frac{a1}{a2} = \frac{b1}{b2} = k and c1 = k$ C_2 then there are infinitely many solutions.
   b. If $\frac{a1}{a2} = \frac{b1}{b2} = c1 \neq$ kc_2, then there is no solution.
   c. If $c_2 \neq 0$, then $c_1 = kc2 \rightarrow \frac{c1}{c2} = k, hence$

$$\frac{a1}{a2} = \frac{b1}{b2} = \frac{c1}{c2} \rightarrow infinitely many solutions$$

$$and \frac{a1}{a2} = \frac{b1}{b2} \neq \frac{c1}{c2} \rightarrow no solution$$

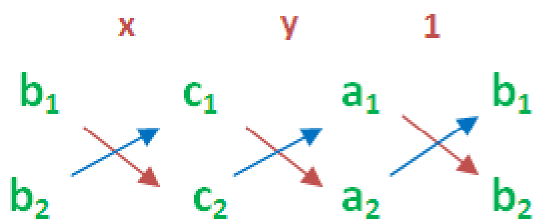
   d. If $\frac{a1}{a2} \neq \frac{b1}{b2}$, then there is an unique solution of the given system of equations.



Solving by Elimination:
1) Write the equations in the same order. (line up the x's and y's)
2) Make the numbers in front of the $x's$ OR the $y's$ the same. (whichever seems easier)
3) Same signs: subtract one equation from the other. Different signs: add the equations together.
4) Solve the new equation to find x or y.
5) Substitute back into one of the original equations to find the other letter.

Solving by Substitution:
1) Rearrange one of the equations (if necessary) to make either $\boldsymbol{x}$ or $\boldsymbol{y}$ the subject.
2) Substitute either x or y into the other equation.
3) Solve the new equation to find x or y.
4) Substitute back into your rearranged equation to find the value of the other letter.

Solving by Cross Multiplication :



Preparation of Invoice

After the dispatch of goods, the seller prepares an invoice of the goods sold in which the quantity and quality of goods and their price is mentioned. Discount, if any, is deducted from the total amount, to this are added the seller's other expenses. Railway receipt number is also mentioned in the invoice if the goods have been sent by train.

Types of Invoice –

1) ***Local invoices*** – In these invoices only the cost of the goods less any trade discount is borne by the seller. All expenses of packing, cartage, loading and freight for carrying goods to the place of buyer are shown extra and charged to the buyer. It means that the cost includes cost of the goods only and all other expenses are extra and are recovered from the buyer.

2) ***At station invoice*** – This implies that all costs upto the stage of putting the goods at railway station will be borne by the seller and are included in the cost of goods but expenses beyond that, i.e., the railway fare, insurance, etc., will be borne by the buyer.

3) ***Free on Rails (FOR) invoices*** – Under this all the costs, i.e., cost of goods, cost of packing, carrying the goods to railway station, loading them in wagons, are borne by the seller and further expenses are borne by the buyer, i.e., they are charged over and above the cost of goods.

4) ***Cost and Freight (C and F) invoice*** – In such type of invoices it is presumed that cost which the seller is charging includes cost of goods, cost of packing, freight for carrying goods to the buyer and all other incidental expenses. All expenses other than above, i.e., insurance will be charged extra.

5) ***Cost, Insurance and freight, (CI & F) invoice*** – In such invoices cost charged by the seller includes cost of goods, cost of packing, freight and insurance. Other expenses are charged extra.

6) ***Franco invoice*** – In such invoices all costs upto putting the goods at the door of the buyer are borne by the seller, i.e., the price which he has quoted includes all expenses incurred in carrying the goods to the buyer's place. For example, Franco cost invoice will mean that cost charged by the seller includes cost of the goods, cost of packing, freight, insurance and local transportation charges.

Preparation of Invoice –
Invoice is prepared in duplicate. The original copy is sent to the buyer and the duplicate is kept for future reference. The usual contents of the invoice are –

i. Name and address of the seller
ii. No. and date of the invoice
iii. No. of the purchase order

iv. Name and address of the buyer
v. Place where it has been made
vi. Terms of trade
vii. Details about quantity of goods like weight or length etc.
viii. Date
ix. Separate price of each item and total price.
x. Trade discount, if any.
xi. Expenses incurred on sending the goods.
xii. Advance payment received (if paid by the buyer)
xiii. Net amount payable.
xiv. Details about mode of sending the goods
xv. Errors and omissions excepted
xvi. Special information, if any
xvii. Signature of the seller.

Uses of Invoice –
Following are the uses of invoice –
a. It informs the buyer about the price of the goods and other expenses he has to pay.
b. If the invoice reaches buyer before the goods, he can make arrangement for their resale.
c. The buyer can compare the invoice with his order.
d. After taking delivery of the goods he can compare the contents of the packages with the invoice and point discrepancy, if any to the seller.
e. Pay Octroi etc. on the basis of the invoice.

Necessary entries can be made in the books of accounts on the basis of invoice.

UNIT - III

Definition of Matrix –
A matrix (plural of matrices) is an array of real numbers (or other suitable elements) arranged in row and columns is called as a matrix. Consider a set of real numbers *m* and *n* when multiplied together we get *mxn* or *mn*. These can be used to define a matrix.

1. **Row Matrix or Row Vector –**
A matrix having only one row is known as a row matrix or a row vector. It is in the form (1x*n*).
Example –

$$[\,1 \quad 2 \quad 3\,]$$

2. **Column Matrix or Column Vector –**
This is a type of Matrix which has only one column. It is in the form (*m* x 1).
Example –

$$\begin{matrix} 1 \\ 2 \\ 3 \end{matrix}$$

3. Zero or Null Matrix –

This is a type of Matrix whose every element is zero. It is usually denoted by bold face zero **(0)**.

Example –

$$\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$$

4. Diagonal Matrix –

Some matrix are such that all their elements are zero apart from the diagonal extending from the upper left hand corner to the lower right hand corner. These are known as diagonal matrix.

$$\begin{bmatrix} 1 & 0 \\ 0 & 3 \end{bmatrix}$$

5. Square Matrix –

In this matrix, the number of rows and columns are the same.

$$\begin{bmatrix} 3 & 5 \\ 1 & 4 \end{bmatrix}$$

6. Unit or Identity Matrix –

This is a type of matrix where diagonal elements have values of 1. A unit matrix is usually denoted by bold face **(I)**. Examples of unit matrix are as follows –

$$\begin{matrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{matrix}$$

7. Scalar Matrix –

This is a diagonal matrix whose diagonal elements are all equal. See examples given below –

$$\begin{bmatrix} 2 & 0 \\ 0 & 2 \end{bmatrix}$$

8. Upper Triangular Matrix –

A square matrix in which every element below the principal diagonal are zero is known as an upper triangular matrix. Examples –

$$\begin{bmatrix} 1 & 0 \\ 3 & 2 \end{bmatrix}$$

9. Lower Triangular Matrix –

A square matrix in which every element above the principal diagonal are zero is known as the lower triangular matrix. Examples –

$$\begin{bmatrix} 2 & 0 \\ 1 & 3 \end{bmatrix}$$

10. Transpose Matrix –

A matrix obtained by interchanging the row and columns of a matrix is called transpose of A and is denoted by A^T or A'. Example given below –

$$A = \begin{bmatrix} 2 & 3 \\ 4 & 5 \end{bmatrix}$$

$$A^T = \begin{bmatrix} 2 & 4 \\ 3 & 5 \end{bmatrix}$$

UNIT - IV

VEDIC MATHEMATICS

MULTIPLICATION RULE

1) Criss – Cross Method –

```
2x2:   3  4
     x 3  7
     12  5  8
     3  2
```

```
2)  3x3:   1  2  3
         x 4  5  7
             5  6  2  1  1
           1  3  3  2
```

```
3)  4x4:   4  5  2  7
         x 3  2  1  5
   14  5  5  4  3  0  5
   2   2  5  4  2  3
```

4) Copy the unalloted cell from initial matrix.

5) Subtract matrix 4 to matrix 3.

6) If all sign are positive than initial solution.

7) If sign is negative, than by making new allocation by making close loop starting from non allotted negative cell.

8) Again prepare u-v matrix.

9) And apply MODI method. until & unless. We find all sign are positive.

SQUARE METHOD

Ekadhikam Purvam:

5 5 x 5 5	3 5 x 3 5	4 5 x 4 5
= 5 (SH) / 5^2	= 3 (3+1) / 5^2	= 4 (4+1) / 5^2
= 3025	= 1225	= 2025
4 3 x 4 7	5 3 x 5 7	9 1 x 9 9
= 4(4+1) / 21	= 5 (5+1) / 21	= 9(9+1) / 9
= 2021	= 3021	= 9009

Duplex Method: (D' Method)

4 – D's – 16	23 – D's – 2 (2x3) = 12
5 – D's – 25	43 – D's – 2 (4x3) = 24
7 – D's – 49	37 – D's – 2 (3x7) = 41

Nikhilam Aadhar Sutra:

13 x 12			14 x 18		
13	+	3	14	+	8
12	+	2	14	+	4
15		6	18	+	8
			25	/	2
			3		

Base 100:

102 x 104			108x 104			98x97		
102	+	2	108	+	8	98	-	2
104	+	4	104	+	4	97	-	3
106	/	08	112	/	32	95	/	06

103	+	3	107	+	7
97	-	3	97	-	3
100	/	09	104	/	21
= (100-1) / 100-9			= 104-1 / 100-21		
= 9991			= 103/79 = 10379		

123 - D's - 2(1x3) + 2^2 = 10
432 - D's - 2(4x2) + 3^2 = 25

Squaring:

23^2

= 2 3

= 3 – D's – 9
= 23 – D's – 2(2x3) = 2
= 2 – D's – 4 (4+1) = 5
= 529

112^2
= 1 1 2

= 2 – D's – 4
= 12 – D's – 2(1x2) = 4
= 112 – D's – 2 (1+2)+1^2 = 5
= 11 – D's – 2 (1+1) = 2
= 1 – D's – 1
= 12544

SIMPLE INTEREST

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

Simple interest is one method of determining the amount due at the end of loan duration.

Definitions of Usual Words –

Principal (P): The original sum of money loaned/deposited.

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

Time (T): The duration for which the money is borrowed/deposited.

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

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

Where:
P: Principal (original amount)
R: Rate of Interest (in %)
T: Time period (yearly, half-yearly etc.)

Amount Due at the end of the time period, **A = P (original amount) + SI**

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

If you have a close look, Simple Interest is nothing else but an application of the concept of percentages.

Meaning of Compound Interest –

By compound interest we mean when interest becomes due after a certain period, it is added to the principal amount and interest on succeeding years is based on the principal and the interest added. The difference between the amount and the original principal is called the compound interest.

It means that in compound interest, the principal doesn't remain fixed at the original sum but increase at the end of each interest period. Interest period is the period at which the interest becomes due. It may be a year, half year or quarter year.

Methods for Calculation of Compound Interest –

Basis of Difference	Simple Interest	Compound Interest
Principal and Interest	Calculated on original amount	Calculated with interest included
calculation of interest	Calculated on overall period in single time.	Calculated yearly, half yearly, quarterly or even monthly.
Principal Amount	Always same on whole period.	Changes from year to year, month to month etc.
Difference in amount of interest	Less than that of compound interest.	It is more than that of small interest.

The following are some of the methods used to calculate compound interest –

1) Simple interest method.
2) Interest table method.
3) Decimal point method.
4) Compound interest formula method.
5) By Logarithm method.

1) Simple Interest Method –

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

i) Calculate interest on principal at the end of every year.
ii) Add the interest got in step (i) above to the original principal. This amount is principal for the next year.
iii) Calculate compound interest by adding each year's interest for the entire period.

iv) Finally subtract the original from the compounded amount and this gives the compound interest.

2) Compound Interest Formula Method –

When the number of years involved to calculate the compound interest are many, we use the above method. The formula used is –

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

Where P denotes = Principal (original)
n = number of years (interest period)
r = rate of interest (in percentage)
A = Amount after n years.

UNIT - V

PROFIT AND LOSS

SOME IMPORTANT DEFINITIONSRELATED WITH PROFIT AND LOSS

Cost Price (CP)

The price, which is paid to acquire a product, is called cost price. All the overhead expenses (transportation, taxes etc.) are also included in the cost price.

Selling Price (SP)

The sum of money, which is finally received for the product i.e. the price at which the product is finally disposed off is called the Selling price.

Marked Price (MP)

The price, which is listed or marked on the product, is also known as quotation price/printed price/catalogue price/invoice price.

Profit

If selling price is greater than Cost price, then excess of SP to CP is called Gain or Profit.
PROFIT = SELLING PRICE – COST PRICE

Loss

If selling price is less than Cost price, then excess of CP to SP is called Loss.
LOSS = COST PRICE – SELLING PRICE

Profit percentage formula

Profit % = 100 × Profit/Cost Price.

Percentage Loss

Loss % = 100 × Loss/Cost Price.

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 employe 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.

Who is a Broker?
The buyer and seller may not come into contact face to face. Their transaction may be made possible by a middleman. He negotiates the sales and purchase proceeds between the buyer and seller such a negotiator is known as broker.

Brokerage –
This is the remuneration paid to the broker. It is actually a commission paid to the broker. It is calculated on the basis of percentage of the total value of the business transacted by the broker.

Del Credere Agent –
A del-credere agent is a person who guarantees collection of dues for the principal from the customers. They got a special type of commission known as del-credere commission. Usually they deduct the commission on the dues collected and remit the remaining amount to the principal.

Travelling Agent –
This is a person who moves round the trading zone of the principal doing the selling proceeds.

Important formulae –

i. Amount of commission = Rate of commission X Amount of sales100

ii. Rate of commission = Rate of commission X 100Amount of Sales

iii. Amount of Sales = Rate of commission X 100Rate of commission

iv. Amount of Del-cradere commission = Credit Sales X Rate of del-credare commission100