**Averages**

A central value around which a group of values show a tendencyto concentrate is called an “Average”. It is measured in many ways

1. **Mode :** Mode is the number that occurs most frequently in a given set of numbers.

**Ex.**  As in set (2,4,4,5,78,4,6,4,7,4,6,2,6) mode is “4” as is occurs maximum (5) times.

1. **Median:** Median is the middle value of a group of numbers arranged in ascending or descending order. If the number of values (n) is odd, then median is th term.
2. **Arithmetic Mean:**  The most commonly used average is arithmetic mean (AM). The arithmetic mean of n numbers is sum of all n term divided by no. of terms (n). It is denoted by .

= =

If the values x1,x2,……xn are asigned weights w1, w2,………,wn respectively, then

Weighted arithmetic mean/ Arithmetic Mean =

1. **Geometric Mean:** Geometric mean (GM) of n numbers x1,x2,……xn is nth root of their products

**i.**e. GM =

5. **Harmonic Mean:**  Harmonic mean of n numbers x1,x2,……xn is calculated as

The HM of a and b is

**Interests**

When a sum of money is lent by A to B, A is called the lender (creditor), B the borrower (debtor).

The sum lent is called the principal (P).

Interest (I) is the extra money paid by the borrower to lender for the use of money for a specified time.

Time for which the money is borrowed is called period (N).

The interest paid per 100 in a year is called rate % per annum (R).

Sum of Interest (I) and principal is called Amount (A); A = P+I

**Simple Interest (SI)**

When interest is paid as it falls due, it is called simple interest, i.e., throughout the loan period, interest is charged on the original sum (principal) borrowed:

SI = PNR/100

**Compound Interest (CI)**

When interest is added to the principal over a fix period of time, and new interest is calculated on this increased principal, The difference between the amount and money borrowed is called compound interest.

Case 1: When interest is compounded annually:

A = P[1+(R/100)]^N

Case 2: When interest is compounded half yearly:

A = P[1+(R/200)]^2N

Case 3: When interest is compounded quarterly:

A = P[1+(R/400)]^4N

**Important Applications:**

1. In CI when rates are different for different years, say R1, R2, R3 then

A = P(1+ R1/100)(1+R2/100)(1+R3/100)

2. Value of machine or any other object decrease with time. This decrease is called depreciation.

Thus if U is the value at a certain time and R% per annum is the rate of depreciation, then the value V at the end of N years

V = U[1- (R/100)]^N

3. The original population of a town is P and the annual increase is R%, then the population of the town in N years

= P[1+(R/100)]^N

If the population decreases by R %, then the population of the town in N years

= P[1- (R/100)]^N

4. In hire purchase, the amount paid at the time of purchase is called down payment. The remainder is paid in equal monthly installments.

Monthly Installment = (Amount to be paid - Down payment)/ Number of installments

**Mixture & Alligation**

**Types of Mixtures**

Mixture is based on the concept of weighted average.

**Simple Mixture:** When two different ingredients are mixed together, it is known as a simple mixture.

**Compound Mixture:** When two or more simple mixtures are mixed together to form another mixture, it is known as a compound mixture.

Important Points:-

1. When two ingredients are mixed together in different ratios to form a mixture, the ratio of the quantities of the two constituents is given by

Qc: Qd = (d-m): (m-c)

Qc = Cheaper Quantity

Qd = Dearer Quantity

c = Cost Price of unit quantity of cheaper

d = Cost Price of unit quantity of dearer

m = Cost Price of unit quantity of mixture.

1. If P1 and P2 are the prices of two quantities Q1 and Q2, then the average price of the mixture, given by Pm

Pm =

=

This can also represented as:

P2 P1

Pm

Pm-P1 P2-Pm

**Partnership**

Partnership is the relation between two or more person who have agreed to run a business jointly and share the profits.

If the capitals of the partners are invested for the same period, the partnership is called simple, and for different period, is called compound.

**Simple Partnership.**

If the period of investment is same for each partner, then the profit or loss is divided in the ratio of investment

1. If A and B are partners in a business, then:

(Investment of A)/(Investment of B) = (Profit/Loss of A)/(Profit/Loss of B)

**Compound Partnership**

Monthly equivalent investment is the product of capital invested and the period for which it is invested

1. If A and B are partners in a business, then

(Monthly equivalent installment of A)/((Monthly equivalent installment of B) = (Profit/Loss of A)/(Profit/Loss of B)

**Percentages**

The term percent means for every hundred. A fraction whose denominator is 100 called a percentage and the numerator of the fraction is called the rate percent. It is denoted as symbol %

**Important Applications**

1. To find % equivalent of a fraction or decimal, multiply that fraction/decimal to 100.

Ex. 2/5 = (2/5)\*100 = 40%

2. To increase a number by a given rate (%), multiply the number to (100+ rate)/100

Ex. Increase 40 by 30%

= 40X (100+30)/100 = 40X130/100 = 52

3. To decrease a number by a given rate (%), multiply the number to (100- rate)/100

Ex. Decrease 40 by 30%

= 40X (100-30)/100 = 40X70/100 = 28

4. % increase of a number = (Total Increase/ Initial Value) X 100

Ex. Price of Car has been increased from 400,000 to 500,000, find the % increase.

= [(500,000-400,000)/400,000] X 100 = (100,000/400,000)X100 = 25%

5. % decrease of a number = (Total Decrease/ Initial Value) X 100

Ex. Price of Dell Laptop has Fallen from 25,000 to 20,000, find the % decrease.

= [(25,000-20,000)/25,000] X 100 = (5,000/25,000)X100 = 20%

6. If the present value of a machine is P and it depreciates by r% anually, the value of machine after n years is

= P\*[(1-(R/100))^n]

7. If A's income is r% more than of B, then B's income is less than of A by [(r/(100+r))\*100]%

8. If A's income is r% less than of B, then B's income is more than of A by [(r/(100-r))\*100]%

9. If the price of a commodity increase by r% then reduction in consumption, so as not to increase the expenditure is [(r/(100+r))\*100]%

10. If the price of a commodity decrease by r% then increasae in consumption, so as not to decrease the expenditure is [(r/(100-r))\*100]%

**Profit & Loss**

The price at which a person buys a product is the cost price of the product, known as CP

The price at which a person sells a product is the Sales price of the product, known as SP.

If SP>CP, the difference, SP-CP is known as profit or gain.

Profit = SP-CP

Profit % = (Profit/CP)\*100

SP = CP\*[(100+Profit%)/100]

CP = (100\*SP)/(100+Profit%)

If however, SP<CP, then the difference, CP-SP is Loss.

Loss = CP-SP

Loss % = (Loss/CP)\*100

SP = CP\*[(100-Loss%)/100]

CP = (100\*SP)/(100-Loss%)

**Important Points**

1. IF an article is sold at a profit of x%

SP = (100+x)% of CP

2. IF an article is sold at a loss of y%

SP = (100-x)% of CP

3. When a person sells 2 items of same cost as 1 at a profit of x% and other at a loss of x%, He will always incur loss.

Loss% = x2/100

4. If a shopkeeper sells his goods at C.P., but uses false weight of x kg, his profit is:

Profit% = [True weight - False weight)/False weight]\*100

5. While selling goods, adding a certain percentage on the cost price is known as Marked price, And this % addition is known as percentage mark up.

Marked Price = CP + Mark up

Marked Price = CP + % Mark up on CP

If discount is also given on this,

Selling Price = Marked Price - % discount.

6. If goods are sold as buy x get y free then

Discount % = [y/(x+y)]\*100

7. If 2 successive discounts x% and y% is given then,

Effective discount = [(x+y) - xy/100]%

**Ratio & Proportion**

**Ratio:**

Ratio is used to identify how many times a given number is in comparison to another. It is denoted as a:b. The numerator ‘a’ is called the ‘antededent’ and the denominator 'b' is called 'consequent'.

**Important Points:**

1. If we multiply or divide the numerator and denominator of a ratio by the same number, the ratio remains unchanged .

2. The ratio of two fractions can be expressed as a ratio of two integers. Thus the ratio:

a/b:c/d = ad/bc

**Proportion:**

When two ratios are equal, the four quantities composing them are said to be propotionals. Thus if a/b = c/d, then a,b,c,d are proportionals. It is written as

a:b::c:d

or

a:b = c:d

**Important Points:**

1. The terms a and d are called extremes while the terms b and c are called means.

2. If four quantities are in proportion, the product of extremes is equal to the product of means.

ad = bc

3. If three quantities a,b and c are in continued proportion, then

ac = b^2

4. If three quantities are proportional to the first is to the third is the duplicate ratio of the first to the second.

That is for a:b::b:c

a:c= a^2:b^2

5. If four quantities a,b,c and d from a proportion, many other proportions may be deduced these are

I Invertendo: if a/b = c/d, then b/a = d/c

II Alternando: If a/b = c/d, then a/c = b/d

III Componendo: If a/b = c/d, then (a+b)/b = (c+d)/d

IV Dividendo: If a/b = c/d, then (a-b)/b = (c-d)/d

V Componendo and Divinendo: If a/b = c/d, then (a+b)/(a-b) = (c+d)/(c-d)

**Time & Work**

Time and work are inversely proportional factors.

Time taken to complete a work =

Rules and Formulae for work related problems

1. If a man can do a piece of work in ‘a’ number of days, then in one day th of work is done. Conversly, if a man doesth of a work in 1 day, then he can complete the work in 1 ÷ = a days.
2. If A is ‘x’ times as good a workman as B, then he will take th of the time taken by B to do the same work.
3. If A and B can do a piece of work in ‘x’ and ‘y’ days respectively, then working together, they will take days to finish the work in one day, they will finish th part of the work.
4. To compare the work done by different people, first find the amount of work each can do in the same time.
5. If the number of the men to do a job is changed in the ratio a : b, then the time required to do the required to do the work will be in the ratio b : a, assuming the amount of work done by each of them is same, or they are identical.
6. If two men A and B together can finish a job in ‘x’ days and if A working alone takes ‘a’ days more than A and B working together and B working alone takes ‘b’ days more than A and B working together then x=
7. Ifn1 men take time t1 to complete a work and n2 men take time t2 complete the same work ,

Then, n1 X t1 = n2 X t2

1. If L, B, H are respectively the length , breadth and height of the wall to be built, while m,t and d are respectively the number of men, amount of time per day and the number of days. And we have two work situation then,

=

**Time, Speed & Distance**

The speed of a body is defined as the distance covered by it in unit time.

Speed = Distance/Time;

Time = Distance/Speed;

Distance = Speed X Time

Important Points:-

1. If a body travels d1, d2,d3…..dn distances at a speed of s1,s2,s3……sn km/hr, in time t1, t2,t3……tn, then the average speed = =
2. If a certain distance d, from A to B, is covered at ‘a’ km/hr and the same distance is covered again from B to A in ‘b’ km/hr, then the average speed during whole journey

= km/hr

Also, if t1 and t2 is the time taken to travel from A to B and B to A, respectively, the distance ‘d’ from A to B is given by:

d= (t1+t2)

d= (t1-t2)

d= (a-b)

1. While travelling a certain distance , if a man changes his speed in the ratio m:n, then the ratio of time becomes n:m
2. If two person A and B start at the same time in opposite directions from two points and arrive at the two points in ‘a’ and ‘b’ hrs, respectively after having met, then

=

1. To convert km/hr to m/s, multiply by 5/18 and to convert m/s to km/hr, multiply by 18/5.

Relative Speed:-

Relative speed means the speed of an object A with respect to another object B, which may be staitionary, moving (in the same direction or opposite direction)

Case 1(When one object is stationary and other is moving)

Relative speed of stationary object and moving object = Speed of the moving object

Case 2(When two objects are moving in opposite direction)

Relative speed = Sum of their speeds

Case 3(When two objects are moving in same direction)

Relative speed = Difference of their speeds

Important Points

1. Time taken by a moving object ‘x’ meters long in passing a stationary object ‘y’ meters long from the time they meet, is same as the time taken by the moving object to cover ‘x+y’ meters with its own speed.
2. If two objects of length ‘x’ and ‘y’ meters move in the same direction or in opposite direction at ‘a’ and ‘b’ m/s, then the time taken to cross each other from the time they meet

=

= (In case of same direction)

= (In case of opposite direction)

1. If the speed of a boat in still water is x km/hr and the speed of the stream is y km/hr

speed while travelling with the stream i.e., speed downstream = (x+y) km/hr

speed while travelling against the stream i.e., speed upstream = (x-y) km/hr

1. speed of the boat in still water =(Speed with Stream + Speed against stream)

speed of the river =(Speed with Stream - Speed against stream)