Important Formulae

PERMUTATION AND COMBINATIONS

1. Factorial Notation:

   Let n be a positive integer. Then, factorial n, denoted n! is defined as:

$$n! = n(n - 1)(n - 2) \ldots 3.2.1.$$

2. PERMUTATIONS:

   The different arrangements of a given number of things by taking some or all at a time, are called permutations.

3. Number of Permutations:

   Number of all permutations of n things, taken r at a time, is given by:

$$^{n}P_{r} = n(n - 1)(n - 2) \ldots (n - r + 1) = \frac{n!}{(n - r)!}$$

4. An Important Result:

   If there are n subjects of which p_1 are alike of one kind; p_2 are alike of another kind; p_3 are alike of third kind and so on and p_r are alike of r^{th} kind, such that $(p_1 + p_2 + \ldots p_r) = n$.

   Then, number of permutations of these n objects is $= \dfrac{n!}{(p_1!).(p_2)!\ldots\ldots(p_r!)}$

5. COMBINATIONS:

   Each of the different groups or selections which can be formed by taking some or all of a number of objects is called a combination..

   The number of all combinations of n things, taken r at a time is:

$$^{n}C_{r} = \frac{n!}{(r!)(n - r!)} = \frac{n(n - 1)(n - 2) \ldots \text{to r factors}}{r!}.$$

Note:

- $^nC_n = 1$
- $^nC_0 = 1$.
- $^nC_r = {^nC_{(n-r)}}$
- $n! = n(n-1)!$
- $^nP_n = {^nP_{n-1}}$
- $0! = 1$
- $1! = 1$
- $^nP_0 = 1$
- $^nP_2 = n(n-1)$
- $^nP_3 = n(n-1)(n-2)$
- $^nC_0 = 1$
- $^nC_n = 1$
- $^nC_r \leq {^nP_r}$
- $^nC_1 = {^nP_1} = 1$
- Relation between ^nP_r and ^nC_r is $^nP_r = {^nC_r} \times r!$
- $^nC_r = {^nC_{n-r}}$
- $^nC_2 = \frac{n(n-1)}{2!}$
- $^nC_3 = \frac{n(n-1)(n-2)}{3!}$

TIME AND WORK

1. Work from Days:

   If A can do a piece of work in n days, then A's 1 day's work = $\frac{1}{n}$

2. Days from Work:

   If A's 1 day's work = $\frac{1}{n}$, then A can finish the work in n days.

3. Ratio:

   If A is thrice as good a workman as B, then:

   Ratio of work done by A and B = 3 : 1.

   Ratio of times taken by A and B to finish a work = 1 : 3.

4. If M_1 persons does W_1 work in D_1 days and M_2 persons does W_2 work in D_2 days then the relationship is given

$$M_1D_1W_2 = M_2D_2W_1$$

5. If M_1 persons does W_1 work in D_1 days in T_1 hours and M_2 persons does W_2 work in D_2 days in T_2 hours then the relationship is given

$$M_1D_1W_2T_1 = M_2D_2W_1T_2$$

6. If A and B does the work in x days, B and C does the work in y days , C and A does the work in Z days then A + B + C does the work in $\frac{2xyz}{xy+yz+xz}$ = r days
   a. A alone does the work in $\frac{yr}{y-r}$
   b. B alone does the work in $\frac{zr}{z-r}$
   c. C alone does the work in $\frac{xr}{x-r}$

7. A does the work in x days, B does the work in y days then A and B does the work together in $\frac{xy}{x+y}$

8. A and B does the work together in x days, if A moves out of the work after a days then number of days taken by B to do the work is $\frac{(x-a)y}{x}$

9. A and B does the work together in x days, if B moves out of the work after a days then number of days taken by A to do the work is $\frac{(y-a)x}{y}$

10. A and B does the work in x days and A alone does the same work in y days then days taken by B to do the same work is $\frac{xy}{y-x}$

TIME AND DISTANCE

1. Speed, Time and Distance:

$$\text{Speed} = \left(\frac{\text{Distance}}{\text{Time}}\right), \text{Time} = \left(\frac{\text{Distance}}{\text{Speed}}\right), \text{Distance} = (\text{Speed x Time}).$$

2. km/hr to m/sec conversion:

$$x \text{ km/hr} = \left(X \ x \ \frac{5}{18} \right) \text{m/sec.}$$

3. m/sec to km/hr conversion:

$$x \text{ m/sec} = \left(X \ x \frac{18}{5} \right) \text{km/hr.}$$

4. If the ratio of the speeds of A and B is a : b, then the ratio of the

   the times taken by then to cover the same distance is $\frac{1}{a} : \frac{1}{b}$ or b : a.

5. Suppose a man covers a certain distance at x km/hr and an equal distance at y km/hr. Then,

   the average speed during the whole journey is $\left(\frac{2xy}{x+y} \right)$km/hr.

6. A person is moving with speed of x km/hr, he takes t hours rest after covering each km then the time taken by him to cover the distance of y km is $\frac{y}{x} + (y-1)t$
7. A person covers the fixed distance between the two ends, If he moves with speed of x km/hr then he reaches x1 hours late, if he moves with speed of y km/hr then he reaches y1 hours early then the distance between the two ends is $\frac{xy\ (x1\ x\ y1)}{(y-x)}$
8. A person covers a fixed distance in x km/hr and covers the same distance while returning in y km/hr if he takes T hours to cover the distance then the distance he reached to the fixed distance is given by $\frac{xy}{x+y}\ x\ T$
9. A person covers the distance in T hours if he covers the first half distance in S1 km/hr and second half distance in S2 km/hr then the distance covered is $\frac{2\ x\ T\ x\ S1\ x\ S2}{s1+s2}$
10. The distance between two platforms A and B is D km, If a train starts form A towards B with average speed of x km/hr and another train starts t hours early form B to A with average speed of y km/hr then the two trains meet at the point is given by $(D - ty)\frac{x}{x+y}$ km
11. The distance between two platforms A and B is D km, If a train starts form A towards B with average speed of x km/hr and another train starts t hours delay form B to A

with average speed of y km/hr then the two trains meet at the point is given by $(D + ty)\frac{x}{x+y}$ km

SIMPLIFICATION

1. **'BODMAS' Rule:**

This rule depicts the correct sequence in which the operations are to be executed, so as to find out the value of given expression.

B - Bracket,
O - of,
D - Division,
M - Multiplication,
A - Addition and
S - Subtraction

Thus, in simplifying an expression, first of all the brackets must be removed, strictly in the order (), {} and [ ].

After removing the brackets, we must use the following operations strictly in the order:

(i) of (ii) Division (iii) Multiplication (iv) Addition (v) Subtraction.

2. Modulus of a Real Number:

Modulus of a real number a is defined as

$$|a| = \begin{cases} a, \text{ if } a > 0 \\ -a, \text{ if } a < 0 \end{cases}$$

Thus, $|5| = 5$ and $|-5| = -(-5) = 5$.

3. VIRNACULUM (OR BAR):

When an expression contains Virnaculum, before applying the 'BODMAS' rule, we simplify the expression under the Virnaculum.

PROBLEMS ON TRAINS

1. km/hr to m/s conversion:

   a km/hr = $\left(a \times \frac{18}{5}\right)$ m/s.
2.
3. m/s to km/hr conversion:

   a m/s = $\left(a \times \frac{5}{18}\right)$ km/hr.

4. Time taken by a train of length l metres to pass a pole or standing man or a signal post is equal to the time taken by the train to cover l metres.
5. Time taken by a train of length l metres to pass a stationery object of length b metres is the time taken by the train to cover (l + b) metres.
6. Suppose two trains or two objects bodies are moving in the same direction at u m/s and v m/s, where u > v, then their relative speed is = (u - v) m/s.
7. Suppose two trains or two objects bodies are moving in opposite directions at u m/s and v m/s, then their relative speed is = (u + v) m/s.
8. If two trains of length a metres and b metres are moving in opposite directions at u m/s and v m/s, then:

   The time taken by the trains to cross each other = $\frac{(a+b)}{(u+v)}$
9. If two trains of length a metres and b metres are moving in the same direction at u m/s and v m/s, then:

   The time taken by the faster train to cross the slower train = $\frac{(a+b)}{(u-v)}$ sec.

   If two trains (or bodies) start at the same time from points A and B towards each other and after crossing they take a and b sec in reaching B and A respectively, the(A's speed) : (B's speed) = (b : a)
10. Distance = Time x Speed
11. Time = $\frac{\text{Distance}}{\text{Speed}}$
12. Speed = $\frac{\text{Distance}}{\text{Time}}$
13. The time taken by a train to cross a signal lamp, telegraph pole, another trains standing on a platform is given by Time = $\frac{\text{Length of Train}}{\text{Speed of Train}}$
14. The time taken by a train to pass through a Platform or Canal is given by $\frac{\text{m+n}}{\text{Speed}}$

15. Time taken by a train moving fast to cross another train moving slowly is given by $\frac{m1+m2}{x1-x2}$
16. The time taken by a train to pass a person running in same direction is given by $\frac{m}{x-y}$
17. The time taken by a train to pass a person running in opposite direction is given by $\frac{m}{x+y}$

PROBLEMS ON NUMBERS

1. Natural Numbers – The numbers that are used in counting are called Natural Numbers represented by N, Ex : { 1, 2, 3, 4, ………….}
2. Whole Numbers – The counting numbers with zero are called Whole numbers, represented by W, Ex : {0, 1, 2, 3, ……….}
3. Integers – The positive and Negative numbers along with zero are called Integers, represented by Z, Ex : {…….-3, -2, -1, 0, 1, 2, 3, ……….}
4. Rational Numbers – The numbers in the form of P/q are called Rational numbers, represented by Q
5. Irrational Numbers – The rational root of a rational number is called Irrational Numbers
6. Even Numbers – The numbers which are exactly divisible by 2, Ex – 2, 4, 6, 8, ……
7. Odd Numbers – The numbers which are not exactly divisible by 2, Ex – 1, 3, 5, , 7 ………
8. Prime Numbers – The numbers which are divisible by 1 and itself is called Prime Numbers, Ex – 2, 3, 5 7, 11, --------
9. Square Numbers – The multiple of itself Ex – 1, 4, 9, 16, 25, 36, 49, 64……….
10. Cube Numbers – The numbers which are multiplied by itself thrice, Ex – 1, 8, 27, 64, 125……..
11. Square root is represented as $\sqrt{\ }$
12. Cube root is represent as $\sqrt[3]{\ }$

IDENTITIES

- $(a + b)^2 \equiv a^2 + 2ab + b^2$
- $(a - b)^2 \equiv a^2 - 2ab + b^2$
- $(a + b)^3 \equiv a^3 + b^3 + 3ab\ (a + b)$
- $(a - b)^3 \equiv a^3 - b^3 - 3ab\ (a - b)$
- $(a + b + c)^2 \equiv a^2 + b^2 + c^2 + 2ab + 2bc + 2ca$

- $(x + a)(x + b)(x + c) \equiv x^3 + x^2(a + b + c) + x(ab + bc + ca) + abc$
- $(x + a)(x + b) \equiv x^2 + x(a + b) + ab$
- $a^2 - b^2 \equiv (a + b)(a - b)$
- $a^3 + b^3 \equiv (a + b)(a^2 + b^2 - ab)$
- $a^3 - b^3 \equiv (a - b)(a^2 + b^2 + ab)$
- $a^3 + b^3 + c^3 - 3abc \equiv (a + b + c)(a^2 + b^2 + c^2 - ab - bc - ca)$
- $a^4 + a^2b^2 + b^4 \equiv (a^2 + b^2 + ab)(a^2 + b^2 - ab)$

CALENDAR

1. Odd Days:
   We are supposed to find the day of the week on a given date.
   For this, we use the concept of 'odd days'.
   In a given period, the number of days more than the complete weeks are called odd days.

2. Leap Year:
   (i). Every year divisible by 4 is a leap year, if it is not a century.
   (ii). Every 4^{th} century is a leap year and no other century is a leap year.
   Note: A leap year has 366 days.
   Examples:
   i. Each of the years 1948, 2004, 1676 etc. is a leap year.
   ii. Each of the years 400, 800, 1200, 1600, 2000 etc. is a leap year.
   iii. None of the years 2001, 2002, 2003, 2005, 1800, 2100 is a leap year.

3. Ordinary Year:
   The year which is not a leap year is called an ordinary years. An ordinary year has 365 days.

4. Counting of Odd Days:
   1. 1 ordinary year = 365 days = (52 weeks + 1 day.)
      1 ordinary year has 1 odd day.
   2. 1 leap year = 366 days = (52 weeks + 2 days)
      1 leap year has 2 odd days.
   3. 100 years = 76 ordinary years + 24 leap years
      = (76 x 1 + 24 x 2) odd days = 124 odd days.

= (17 weeks + days) ≡ 5 odd days.

Number of odd days in 100 years = 5.

Number of odd days in 200 years = (5 x 2) ≡ 3 odd days.

Number of odd days in 300 years = (5 x 3) ≡ 1 odd day.

Number of odd days in 400 years = (5 x 4 + 1) ≡ 0 odd day.

Similarly, each one of 800 years, 1200 years, 1600 years, 2000 years etc. has 0 odd days.

Day of the Week Related to Odd Days:

No. of days:	0	1	2	3	4	5	6
Day:	Sun.	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.

The months January, March, May, July, August, October, December are of 31 days each remaining months are of 3. Days each, except February

In a Leap year February is of 29 days, In ordinary year it is of 28 days.

A calendar year begins with January and ends with December

The first day of a week is considered as Sunday if not said otherwise

After each 7 days the same day occurs for example if 11^{th} of August if Sunday then 18 of August is also Sunday.

PROBABILITY

1. Experiment:
   An operation which can produce some well-defined outcomes is called an experiment.

2. Random Experiment:
   An experiment in which all possible outcomes are know and the exact output cannot be predicted in advance, is called a random experiment.
   Examples:
   i. Rolling an unbiased dice.
   ii. Tossing a fair coin.
   iii. Drawing a card from a pack of well-shuffled cards.
   iv. Picking up a ball of certain colour from a bag containing balls of different colours.

Details:

v. When we throw a coin, then either a Head (H) or a Tail (T) appears.

vi. A dice is a solid cube, having 6 faces, marked 1, 2, 3, 4, 5, 6 respectively.
When we throw a die, the outcome is the number that appears on its upper face.

vii. A pack of cards has 52 cards.
It has 13 cards of each suit, name Spades, Clubs, Hearts and Diamonds.
Cards of spades and clubs are black cards.
Cards of hearts and diamonds are red cards.
There are 4 honours of each unit.
There are Kings, Queens and Jacks. These are all called face cards.

3. Sample Space:
When we perform an experiment, then the set S of all possible outcomes is called the sample space.
Examples:
1. In tossing a coin, S = {H, T}
2. If two coins are tossed, the S = {HH, HT, TH, TT}.
3. In rolling a dice, we have, S = {1, 2, 3, 4, 5, 6}.

Event:
Any subset of a sample space is called an event.

Probability of Occurrence of an Event:
Let S be the sample and let E be an event.
Then, $E \subseteq S$.

$$P(E) = \frac{n(E)}{n(S)}$$

Results on Probability:
- $P(S) = 1$
- $0 \leq P(E) \leq 1$
- $P(\phi) = 0$
- For any events A and B we have : $P(A \cup B) = P(A) + P(B) - P(A \cap B)$
- If A denotes (not-A), then $P(A) = 1 - P(A)$.

CLOCKS

1. Minute Spaces:

   The face or dial of watch is a circle whose circumference is divided into 60 equal parts, called minute spaces.

   Hour Hand and Minute Hand:

   A clock has two hands; the smaller one is called the hour hand or short hand while the larger one is called minute hand or long hand.

2. **Note**
   - In 60 minutes, the minute hand gains 55 minutes on the hour on the hour hand.
   - In every hour, both the hands coincide once.
   - The hands are in the same straight line when they are coincident or opposite to each other.
   - When the two hands are at right angles, they are 15 minute spaces apart.
   - When the hands are in opposite directions, they are 30 minute spaces apart.
   - Angle traced by hour hand in 12 hrs = 360°
   - Angle traced by minute hand in 60 min. = 360°.
   - If a watch or a clock indicates 8.15, when the correct time is 8, it is said to be 15 minutes too fast.
   - On the other hand, if it indicates 7.45, when the correct time is 8, it is said to be 15 minutes too slow.
3. If the distance between the two hands measure is 900 then the both the hands of a clock are at right angle
4. A clock is said to be incorrect if the clock is fast or slow from the time shown by a correct clock
5. In 60 minutes the minute hand gains 55 minutes on the hour hand
6. In 12 hours the two hands are at right angle 22 times, the two hands are in the same direction 11 times
7. The hands of a clock are coincide 22 times in a day
8. The hands of a clock are 44 times at right angle in a day
9. The hands of a clock point 22 times towards each other in a day
10. In a railway time table the time is counted form 1 to 24 hours starting from 1.00 in the night and ending at 12.00 in the night.

11. Each subsequent number in a clock are equidistant
12. Each subsequent number in a clock is at 5 minute apart.

RATIO AND PROPORTIONS

1. Direct Proportion:

   Two quantities are said to be directly proportional, if on the increase (or decrease) of the one, the other increases (or decreases) to the same extent.

   Eg. Cost is directly proportional to the number of articles.
   (More Articles, More Cost)

2. Indirect Proportion:

   Two quantities are said to be indirectly proportional, if on the increase of the one, the orther decreases to the same extent and vice-versa.

   Eg. The time taken by a car is covering a certain distance is inversely proportional to the speed of the car. (More speed, Less is the time taken to cover a distance.)

   Note: In solving problems by chain rule, we compare every item with the term to be found out.

3. The comparison of two quantities of the same kind by division and expressing how many times one is than the other is called Ratio
4. The ratio between the two terms is given by a : b, where a is antecedent and b is consequent
5. A ratio can be reduced to its simplest form
6. The ratio which is expressed a fraction with unit numerator is called Representative Fraction
7. The equality of two ratios is called Proportions
8. When two ratios a : b and c : d are equal then the four terms a,b,c and d are said to be in proportion
9. In general if a : b : : c ; d the extreme terms a and d are called Extremes and the middle terms b and c are called Means
10. In a proportion the product of the extremes is equal to the product of the means, i.e a x d = b x c

11. If two numbers are a and b and the difference between them is x then the numbers is given by

1. a = $\frac{ax}{a-b}$ and b = $\frac{bx}{a-b}$ when a > b
2. a = $\frac{ax}{b-a}$ and b = $\frac{bx}{b-a}$ when a < b

12. The ratio of the terms A: B : C : D is given by the rule ace : bce: bde : bdf

AREA

1. Results on Triangles:
   - Sum of the angles of a triangle is 180°.
   - The sum of any two sides of a triangle is greater than the third side.
   - Pythagoras Theorem:
     In a right-angled triangle, $(\text{Hypotenuse})^2 = (\text{Base})^2 + (\text{Height})^2$.
   - The line joining the mid-point of a side of a triangle to the positive vertex is called the median.
   - The point where the three medians of a triangle meet, is called centroid. The centroid divided each of the medians in the ratio 2 : 1.
   - In an isosceles triangle, the altitude from the vertex bisects the base.
   - The median of a triangle divides it into two triangles of the same area.
   - The area of the triangle formed by joining the mid-points of the sides of a given triangle is one-fourth of the area of the given triangle.
2. Results on Quadrilaterals:
   - The diagonals of a parallelogram bisect each other.
   - Each diagonal of a parallelogram divides it into triangles of the same area.
   - The diagonals of a rectangle are equal and bisect each other.
   - The diagonals of a square are equal and bisect each other at right angles.
   - The diagonals of a rhombus are unequal and bisect each other at right angles.
   - A parallelogram and a rectangle on the same base and between the same parallels are equal in area.
   - Of all the parallelogram of given sides, the parallelogram which is a rectangle has the greatest area.

   Area of a rectangle = (Length x Breadth).

$$\text{Length} = \left(\frac{\text{Area}}{\text{Breadth}}\right) \text{and Breadth} = \left(\frac{\text{Area}}{\text{Length}}\right).$$

3. Perimeter of a rectangle = 2(Length + Breadth).
4. Area of a square = $(\text{side})^2 = \frac{1}{2}(\text{diagonal})^2$

5. Area of 4 walls of a room = 2 (Length + Breadth) x Height.
   1. Area of a triangle = $\frac{1}{2}$x Base x Height.
   2. Area of a triangle = s(s-a)(s-b)(s-c)

   where a, b, c are the sides of the triangle and s = $\frac{1}{2}$(a + b + c).

   Area of an equilateral triangle = $\frac{3}{4}$ $\frac{x}{(side)}^{2}$.

   Radius of in circle of an equilateral triangle of side a = $\frac{a}{23}$

   Radius of circumcircle of an equilateral triangle of side a = $\frac{a}{3}$

   Radius of in circle of a triangle of area Δ and semi-perimeter s = $\frac{\Delta}{s}$

   1. Area of parallelogram = (Base x Height).
   2. Area of a rhombus = $\frac{1}{2}$x (Product of diagonals).
   3. Area of a trapezium = $\frac{1}{2}$x (sum of parallel sides) x distance between them.
   1. Area of a circle = πR^2, where R is the radius.
   2. Circumference of a circle = $2\pi R$.

BLOOD RELATIONS

1. Father's Father – Paternal Grand Father
2. Father's Mother – Paternal Grand Mother
3. Mother's Father – Maternal Grand Father
4. Mother's Mother – Maternal Grand Mother
5. Cousin → Mother's or father's brothers or sister's son or daughter
6. Parents' siblings' son or daughter (or) Uncle's or aunt's son or daughter.
7. Nephew → Brother's or sister's son.
8. Niece → Brother's or sister's daughter.
9. Uncle → Father's or mother's brother.
10. Aunt → Father's or mother's sister.
11. Father – in – law → Spouse's father (or) wife's or husband's father.
12. Mother – in – law → Spouse's mother (or) wife's or husband's mother.
13. Son – in – law → Daughter's husband.
14. Daughter – in – law → Son's wife.
15. Brother – in – law → Spouse's brother (or) Sister's husband.
16. Sister – in – law → Spouse's sister (or) Brother's wife.
17. Maternal = of or related to mother.

18. Paternal = of or related to father.
19. Siblings = brothers or sisters.
20. Spouse = husband or wife.

Note: Cousin is a common gender. There are no such words cousin brother and cousin sister.

GENERATIONS – PERSONS OR RELATIONS

2 generation – Grand father and grand mother (maternal & paternal).
1 generation – Mother, father, uncle& aunt (maternal & paternal),father-in-law, mother-in-law..
0 generation – I, spouse, brother, sister, brother-in-law, sister-in-law, cousin.
+1 generation – son, daughter, son-in-law, daughter-in-law, nephew, niece.
+2 generation – grand sons and grand daughters.

IMPORTANT POINTS TO REMEMBER

1. If the question is "how is A related to B", we must know the gender of A to answer this question.
   Without knowing A's gender, we can not determine the relation from A to B.
2. If a person is uncle or aunt to 'A', A is that person's nephew (if A is a male) or niece (if A is a female)
3. Cousin is a common gender.

AVERAGE

1. Average:

   $$\text{Average} = \frac{\text{Sum of observations}}{\text{Number of observations}}$$

2. Average Speed:

   Suppose a man covers a certain distance at x kmph and an equal distance at y kmph.
   Then, the average speed druing the whole journey is $\frac{2xy}{x+y}$ kmph.
3. If average of m students is x and average of n students is y then total average is given by $\frac{mx+ny}{m+n}$

4. The formula to find the number of observations is

$$\frac{\text{Sum of observations}}{\text{Average}}$$

5. The average of n numbers is x if one of the observation is removed then the average is y the formula to find the value of removed observation is [n(x – y) + y]

6. The average of n numbers is x if one of the observation is added then the average is y the formula to find the value of added observation is [n(y – x) + y]

7. If the average of n numbers is m and every number is added or subtracted then average of n terms is (m + x) or (m – x)

8. If the average of n numbers is m and every number is multiplied or divided then average of n terms is mx or $\frac{m}{x}$
9. The average of n students is T, Average Marks of passed students is P and average of Failed students is F then number of passed students is given by $\frac{n\,(T-F)}{P-F}$
10. The average of n students is T, Average Marks of passed students is P and average of Failed students is F then number of failed students is given by $\frac{n\,(P-T)}{P-F}$
11. A batsman scores x in his nth innings if his average increases by y then his average after the nth innings is given by [x – {y (n – 1)}]
12. The average of odd numbers form 1 to n is given by $\frac{Last\ odd\ number+1}{2}$
13. The average of even numbers from 1 to n is given by $\frac{Last\ odd\ number+2}{2}$
14. The average of squares of natural numbers till n is given by $\frac{(n+1)(2n+1)}{6}$
15. The average of cubes of natural numbers till n is given by $\frac{n(n+1)^2}{4}$

PARTNERSHIP

1. Partnership:

When two or more than two persons run a business jointly, they are called partners and the deal is known as partnership.

There are two types of partnerships

1. Simple Partnership

2. Compound Partnership

2. Ratio of Divisions of Gains:
   1. When investments of all the partners are for the same time, the gain or loss is distributed among the partners in the ratio of their investments.

      Suppose A and B invest Rs. x and Rs. y respectively for a year in a business, then at the end of the year:

      (A's share of profit) : (B's share of profit) = x : y.

   2. When investments are for different time periods, then equivalent capitals are calculated for a unit of time by taking (capital x number of units of time). Now gain or loss is divided in the ratio of these capitals.

      Suppose A invests Rs. x for p months and B invests Rs. y for q months then,

      (A's share of profit) : (B's share of profit)= xp : yq.

3. Working and Sleeping Partners:

   A partner who manages the business is known as a working partner and the one who simply invests the money is a sleeping partner

4. Simple Partnership : If the period of investment in the case of each partner is the same whether the capitals invested are equal or not, in this case the profit made or loss incurred is divided among the partners in the ratio of their capitals

5. Compound Partnership : If the period for which the capitals invested differ form partner to partner inspite of the capitals invested (Equal of unequal), In this case the profit made or loss incurred will be divide in the ratio of their equivalent capitals calculated in the ratio of their capitals for unit time.

PROFIT AND LOSS

Cost Price:
The price, at which an article is purchased, is called its cost price, abbreviated as C.P.

Selling Price:
The price, at which an article is sold, is called its selling prices, abbreviated as S.P.

Profit or Gain:

If S.P. is greater than C.P., the seller is said to have a profit or gain.

Loss:

If S.P. is less than C.P., the seller is said to have incurred a loss.

IMPORTANT FORMULAE

1. Gain = (S.P.) – (C.P.)
2. Loss = (C.P.) – (S.P.)
3. Loss or gain is always reckoned on C.P.
4. Gain Percentage: (Gain %)

   $$\text{Gain \%} = \frac{\text{Gain} \times 100}{\text{C.P.}}$$

5. Loss Percentage: (Loss %)

   $$\text{Loss \%} = \frac{\text{Loss} \times 100}{\text{C.P.}}$$

6. Selling Price: (S.P.)

   $$\text{SP} = \frac{(100 + \text{Gain \%})}{100} \times \text{C.P}$$

7. Selling Price: (S.P.)

   $$\text{SP} = \frac{(100 - \text{Loss \%})}{100} \times \text{C.P.}$$

8. Cost Price: (C.P.)

   $$\text{C.P.} = \frac{100}{(100 + \text{Gain \%})} \times \text{S.P.}$$

9. Cost Price: (C.P.)

   $$\text{C.P.} = \frac{100}{(100 - \text{Loss \%})} \times \text{S.P.}$$

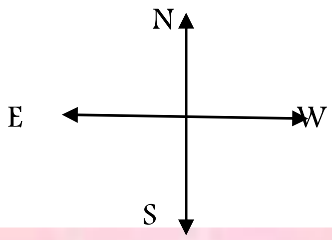
10. If an article is sold at a gain of say 35%, then S.P. = 135% of C.P.
11. If an article is sold at a loss of say, 35% then S.P. = 65% of C.P.
12. If a trader professes to sell his goods at cost price, but uses false weights, then

    $$\text{Gain \%} = \frac{\text{Error}}{(\text{True Value}) - (\text{Error})} \times 100\%.$$

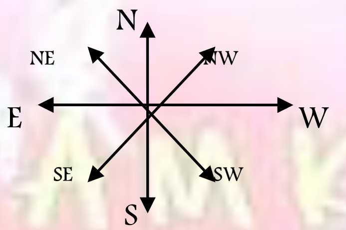
DIRECTION SENSE TEST

Introduction:

There are four main directions - East, West, North and South as shown below:



There are four cardinal directions - North-East (N-E), North-West (N-W), South-East (S-E), and South-West (S-W) as shown below:



1. At the time of sunrise if a man stands facing the east, his shadow will be towards west.
2. At the time of sunset the shadow of an object is always in the east.
3. If a man stands facing the North, at the time of sunrise his shadow will be towards his left and at the time of sunset it will be towards his right.
4. At 12:00 noon, the rays of the sun are vertically downward hence there will be no shadow.
5. If the direction of the movement is on the left side of the four directions then the direction begins with Left of North
6. If the direction of the movement is on the right side of the four direction then the direction begins with the Right of the North

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