APTITUDE SHEET

NUMBER SYSTEM:- [Arithmetical Ability]

Sum of Series:-

TYPE-I => (Natural Numbers):-

1) $1+2+3+4+ \dots \dots +n$ [Simple Sum]

$= \left[\frac{n(n+1)}{2}\right]$, n = Last Digit

2) $1^2+2^2+3^2+ \dots \dots +n^2 = \left[\frac{n(n+1)(2n+1)}{6}\right]$ [Square Sum]

3) $1^3+2^3+3^3+4^3+ \dots \dots +n^3 = \left[\frac{n(n+1)}{2}\right]^2$ [Cube Sum]

TYPE-II:-

1) $1+3+5+7+ \dots 33 = \left[\frac{n+1}{2}\right]$ [Odd Sum] ($\because$ n -> last Digit)

2) $2+4+6+8+ \dots 50 => n = \left[\frac{n}{2}\right]$ [Even Sum]

3) $51+53+55+ \dots \dots +65$ => When series doesn't start from 1 or 2 & start from in between

↳ Solved by using/combining above two [Even Sum & Odd Sum].

Types

-> Diff No. Types

-> Remainders

-> Factors

-> Unit Digit

ARITH TOPICS

→ Number System ✓
→ Time & Work ✓
→ Time, Speed & Distance ✓
→ Averages
→ Mixture & Alligation
→ Percentages
→ Profit & Loss ✓
→ Simple & Compound Interest ✓
→ Ratio & Proportion
→ Probability
→ Permutation & Combination
→ Ages

Averages

$\text{Avg} = \frac{\text{Sum}}{\text{Total No.}} \Rightarrow \boxed{\text{Sum} = \text{Total Avg} \times N}$

$\boxed{\text{Low Value} \leq \text{Avg} \leq \text{High Value}}$

Conditions :-

→ ~~Avg) not~~ Avg = New Value (No Change in Average)
→ Avg < New Value (Average Decreases)
→ Avg > New Value (Average Increases)

Percentages

→ % Change = $\frac{\text{Final} - \text{Initial}}{\text{Initial}} \times 100$

→ Quantity I is % of Quantity II (Q2)
(Q1)
$= \frac{Q1}{Q2} \times 100$

→ Q1 is % more than Q2 = $\frac{Q_1 - Q2}{Q2} \times 100$

→ Q1 is % less than Q2 = $\frac{Q_2 - Q1}{Q2} \times 100$

→ Successive % Change = $a + b + \frac{ab}{100}$ (Multiplication)

→ Effective % Change = Similar

* % → Fraction
$/100$

* Fraction → %
$\times 100$

* xy = constant

Price ↑ Usage ↓ = Expense
Price ↑ sell ↓ = Profit
Speed ↑ time ↓ = Distance

⇒ $\left(\frac{r}{100 \pm r} \times 100\right)$
Increase → +
Decrease → −

Ratio & Proportion:-

Inverse/Reciprocal Ratio ⇒ $1/a : 1/b : 1/c$

Duplicate Ratio :- $a^2 : b^2$

Triplicate Ratio : $a^3 : b^3$

Sub-Duplicate Ratio :- $\sqrt{a} : \sqrt{b}$

Sub-Triplicate Ratio : $\sqrt[3]{a} : \sqrt[3]{b}$

Divisibility Rules

→ 0 is divisible by any number (except itself)

→ 1 ⇒ Any integer/fraction is divisible by 1

→ 2 ⇒ Last digit is even

→ 3 ⇒ Sum of digits / 3 → yes

→ 4 ⇒ Last 2 digits / 4 → yes

→ 5 ⇒ Last digit [0, 5]

→ 6 ⇒ if divisible by 2 & 3. [Even & /3 → yes]

→ 7 ⇒

→ 8 ⇒ Last 3 digits / 8 → yes

→ 9 ⇒ Sum of digits / 9 → yes ⇒ Repeated Such stuffs or

→ 10 ⇒ Last digits — 0

→ 11 ⇒

→ 12 ⇒ No / 3 → yes && No / 4

→ 13 ⇒

→ 14 ⇒ No / 2 && No / 7

yes

→ 16 ⇒ Last 4 digits / 16 → yes

→

Mixtures & Alligations

Mixture :- Combination of one/more types of Substances together

Alligation :- A Rule for Solving
↳ Ratio :-

Required
↳ $\boxed{y - a : a - x}$

Lower Price Item (x) Higher Price Item (y)

Average Price (a)

$y - a$ $a - x$

* For 3, always make pair (2) out of which one will get automatically rejected & ~~take~~ odd the common values & ~~odd~~ take the uncommon value

IMP Points :-

Original Data → (OD + 2) (OD − 3) (OD * 2) (OD / 5)

↳ Avg :- x → (Avg + 2) (Avg − 3) (Avg * 2) (Avg / 5)

		Sum
~~Sum~~ Avg of first 'n' odd	→ n	n^2
Avg of first 'n' even	→ $n+1$	$n(n+1)$
Avg of first 'n' natural	→ $\left(\frac{n+1}{2}\right)$	$n\left(\frac{n+1}{2}\right)$

Surds & Indices

→ Squares
→ Square Roots
→ Simplification
→ Linear Equations
→ Quadratic Equations
→ Decimals
→ Fractions

[Indices laws] :-

(i) $x^m \times x^n = x^{m+n}$

(ii) $(x^m)^n = x^{mn}$

(iii) $(xy)^n = x^n y^n$

(iv) $\frac{x^m}{y^n} = x^{m-n}$

(v) $\left(\frac{x}{y}\right)^n = \frac{x^n}{y^n}$

(vi) $x^{-1} = \frac{1}{n}$

Ages

Rules:-

→ Sum/Difference of Ages :- Linear eq.ⁿs in 1/2 variable
→ Product of Ages :- Quadratic eq.ⁿs
→ Age x years ago/before :- Present Age $-x$
→ Age after x years/x years hence ⇒ Present Age
→ If Ratio of Present Ages :- $m:n$, then Ages ⇒ mx & nx.

Mensuration & Geometry :-

Geometry Formules → Wikipedia

Probability :-

$P(E)$:- $\dfrac{\text{Favourable Outcomes}}{\text{Total Outcomes}}$

E → Event

+ → Choice → or
× → Compulsory → and

P(impossible event) = 0

$$\boxed{0 \leq P(E) \leq 1}$$

$P(E)$ → (Event Occurs)

$P(\bar{E}) = 1 - P(E)$ → (Event Not Occur) → Complementary Probability

$$\boxed{\underbrace{P(E) + P(\bar{E})}_{\text{Sure Event}} = 1}$$

compulsory | n

Types

- Playing Cards / Dices
- Venn Diagrams
- Dice Problems
- Leap years
- Coins
- Permutation & Combination
- Case by Case Type Qns

Permutation and Combination

(Selection + Arrangement) (Selection)

Permutation :- n students, r seats ($r < n$)

r _ _ _ _ _

$n \to r$ students (Select) — (i)

$r \to$ arrange

$$\boxed{{}^nP_r = \frac{n!}{(n-r)!}}$$

Combination :- (Selection) $\boxed{{}^nC_r = \frac{n!}{r!(n-r)!}}$

n students $\to r$

${}^nP_r$ = Select ($n \to r$) + arrange (r)

= combination + arrangement

$$\boxed{{}^nP_r = {}^nC_r \cdot r!} = \frac{n!}{\cancel{r!}(n-r)!} \times \cancel{r!}$$

$$= \boxed{\frac{n!}{(n-r)!}}$$

$$\boxed{\begin{array}{l} A \leftarrow \text{Compulsory} \\ t \leftarrow \text{Choice} \end{array}}$$

$$\boxed{{}^{n}C_{r} = \frac{n!}{r!(n-r)!}}$$

$$\boxed{n = n \times (n-1)!}$$

$$\boxed{{}^{n}P_{r} = \frac{n!}{(n-r)!}}$$

$$\boxed{{}^{n}C_{r} = {}^{n}C_{n-r}}$$

HCF & LCM

* 1 is the smallest factor of every number.
* Every number will have a minimum of two factors 1 and the number itself.

→ Factor divides the number whereas multiple is divided by the number

→ H.C.F :- ① Write each no. as a product of its prime factors

② The product of all common prime factors is the H.C.F.

$\boxed{\text{Product of 2 Nos} = \text{HCF} \times \text{L.C.M.}}$

* $\boxed{\text{HCF} \le \text{Smallest No} \;\&\; \text{L.C.M.} \ge \text{largest No}}$

* H.C.F. of 2 co-prime No.s = 1.

* Smallest no exactly divisible by a, b & c is L.C.M (a, b, c)

*

Simple Interest & Compound Interest

$$SI = \frac{P \cdot R \cdot T}{100}$$

$$A = P\left[1 + \frac{RT}{100}\right]$$

P = Principal

R = Rate of Interest

T = Time Duration

A = Total Amount

Annually

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

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

P = Principal

R = Rate of Interest

n = No of Years

A — Total Amount / Maturity Amount / Amount Becomes

→ Half-Yearly :-

$$A = P\left[1 + \frac{R/2}{100}\right]^{2n}$$

→ Quarterly :-

$$A = P\left[1 + \frac{R/4}{100}\right]^{2n}$$

Profit & Loss

→ $\% \text{ gain} = \frac{SP - CP}{CP} \times 100$ → $\text{Gain} = SP - CP$

→ $\% \text{ loss} = \frac{CP - SP}{CP} \times 100$ → $\text{Loss} = CP - SP$

→ $CP = \frac{100}{100 - \text{loss}\%} \times SP$

SP → Selling Price

CP → Cost Price

→ $CP = \frac{100}{100 + \text{gain}\%} \times SP$

→ $SP = \frac{100 + \text{gain}\%}{100} \times CP$

→ $SP = \frac{100 - \text{loss}\%}{100} \times CP$

→ $\% \text{ Change} = a + b + \frac{a \times b}{100}$

Type-III (Usu...lu..

Time and Work

Type-I (Chain Rule)

$$\boxed{\frac{M_1 D_1 H_1}{W_1} = \frac{M_2 D_2 H_2}{W_2}}$$

(∵ M → Persons
D → Days
H → Hours
W → work)

Type-II (Contractor work)

Similar Formula

Type-III (Together ~~1 Day's~~ work ⇒ ~~Efficiency Rule~~)

If A takes x days & B takes y days, then A & B (A+B) ~~together~~ will takes how many days to do the same piece of work ⇒ $\cancel{\frac{A \times B}{A+B}}$

$$\boxed{\frac{A \times B}{A+B}}$$

A → x
B → y
C → z

L.C.M. = 24 (1)

(2) $\frac{24}{x} + \frac{24}{y} + \frac{24}{z}$ = 10

(3) $\frac{24}{10}$ → Ans.

Type-IV (Puzzle Concept (Fractional Work))

$$\boxed{\frac{\text{Days}}{\text{Fractional work}} \times 1}$$

* Pay attention to extra & total

Type-V (People Come & Go)

→ A – 15
→ B – 20

60 (total work)

$\boxed{A+B = 4}$ (7)

1/3 (Given)

7 × 4 = 28 of work Done

∴ Work Left = 60 – 28
= 32

Work Fraction Left = $\frac{32}{60} \times 100 = \frac{160}{3} \times \frac{1}{100} = \frac{8}{15}$

Type - VI (Efficiency Rule)
A 30% ↑ B
⇒ A = 130 ⇒ B = 100 Optional

Type - VIII (Money Distribution)

B - 10 ×
G - 12 × 60 — 6 (1500)
R - 15 × — 5 Total
— 4 Amt

B : G : R
6 : 5 : 4

$B = \frac{6}{15} \times 1500 = 600$
$G = \frac{5}{15} \times 1500 = 500$
$R = \frac{4}{15} \times 1500 = 400$

Type - VII (~~Missing work~~ Alone work)

A → x days (10)
A+B → y days
L.C.M. (30)
B alone ⇒ (6)

$\frac{L.C.M.}{x} = a$ (3)

$\frac{L.C.M.}{y} = b$ (5)

A	B
~~(b)~~	~~(y - a)~~
3	2

$$\boxed{\text{Total Days} = \frac{\text{Total work}}{\text{1 Day's work}}}$$

Time, Speed & Distance

$$\boxed{S = \frac{D}{T}}$$

$\frac{1 \text{ Km}}{1 \text{ hr}} - \frac{1000 \text{ m}}{60 \times 60 \text{ sec}}$ ⇒ $\times \frac{5}{18}$

Reverse ⇒ $\times \frac{18}{5}$

Type - I (Normal Speed)

$$\boxed{\begin{array}{l} \frac{Km}{hr} \to \frac{m}{sec} \times \frac{5}{18} \\ \frac{m}{sec} \to \frac{km}{hr} \times \frac{18}{5} \end{array}}$$

Type - II (Average Speed)

$$\boxed{\text{Speed} = \frac{2xy}{x+y}}$$

Type - III (Given Constant Distance/Speed/Time find Ratio)

$$\boxed{S = \frac{D}{T}}$$

→ Constant

Inversely Proportionality

	K	A
S	40 :	60
	2 :	3
T	3 :	2

Speed ⇒ 2 : 3 : 4
Time ⇒ $\left(\frac{1}{2} : \frac{1}{3} : \frac{1}{4}\right) \times 12 = 6 : 4 : 3$
↳ L.C.M

Type-III (Usual Time V/S Late Time)

$$\boxed{S \times T = \frac{3S}{4}(T + 16)}$$

Type-IV (Train/Man Problems)

→ A 100m train crossed a still man / Pole, distance travelled = Train Length

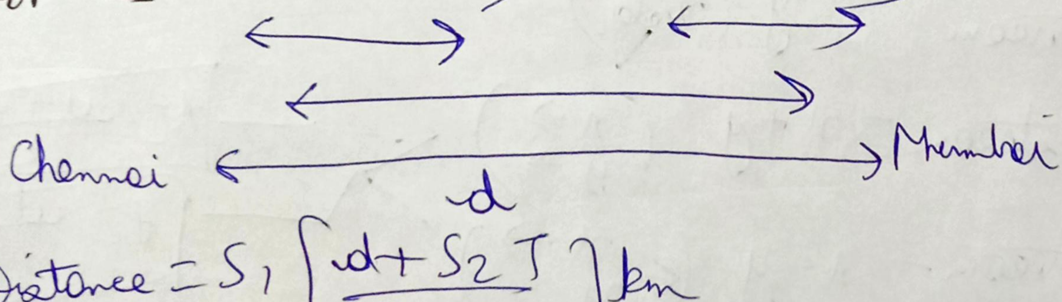
→ " " (Platform/Tunnel) of length 200m?
Distance travelled = Train Length + Platform Length

→ (−) Subtract Speed
- Train 1 overtakes Train 2
- Train 1 & Train 2 running in parallel direction

→ (+) Add Speed
- Train 1 crosses Train-2
- Train-1 & Train 2 moving oppositely

$\boxed{\text{Trains Meeting}}$ [Train speed, Station Distance, Trains Length]

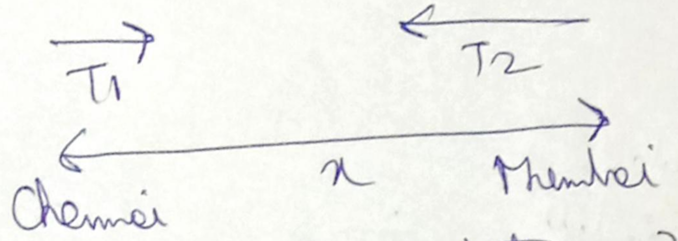
Type-I :- T1 (Train 1) T2 (Train 2)



$$\text{Distance} = S_1\left[\frac{d + S_2 T}{S_1 + S_2}\right] \text{km}$$

$$\text{Time} = \left[\frac{d + S_2 T}{S_1 + S_2}\right] \text{hrs}$$

Type-II



To find distance between 2 stations

$d\left[\frac{S_1+S_2}{S_1-S_2}\right]$ km

Type-III

CSK $\longrightarrow$ T1 Mumbai

CSK $\longrightarrow$ T2

(Trains starting from same station but with a delay)

Meeting Distance of 2 Trains :- $\boxed{\frac{S_1 \times S_2 \times T}{S_1 \sim S_2}}$ km

Trains Meeting Time :- $\left[\frac{S_1 T}{S_1 \sim S_2}\right]$ hrs

$\boxed{\text{Boats \& Streams}}$

Still Water = x (Person)

Stream = y (water)

Downstream = $x+y$ $\begin{pmatrix} x \rightarrow \\ y \rightarrow \end{pmatrix}$

Upstream = $x-y$ $\begin{pmatrix} x \rightarrow \\ \leftarrow y \end{pmatrix}$

$\boxed{x = \frac{d+u}{2}}$

$\boxed{y = \frac{d-u}{2}}$