Quantitative Aptitude

1. Average:

Avg can be calculated in

↳ Mean, Median & Mode

$$\text{Avg} = \frac{\text{Sum of obs.}}{\text{No. of Obs.}}$$

Mean / Arithmetic mean :-

$$\text{Mean} = \frac{x_1 + \cdots + x_n}{n}$$

Median :-

$(n/2)^{th}$ no. — n is odd.

$$\frac{(n/2)^{th} + (\frac{n}{2}-1)^{th}}{2} \rightarrow n \text{ is even}$$

Mode :-

Most occuring number

~~2. Decimals & fractions~~ :

2. Divisibility :-

2 → even no's

3 → Sum of all no.

4 → last 2 digits

5 → last digit is 0 or 5.

6 → divisible by both 2 & 3

7 → double last digit $_{(\times 2)}$ & sub from remaining

8 → last 3 digits

9 → Sum of digits

10 → last digit → 0

11 → [Sum of digits odd places] − [Sum of digits even places]

is either 0 (or) divisible by 11

Eg - 1234

1 2 3 4

0 1 2 3

12 → both 3 & 4.

3. HCF & LCM :

LCM - least Common Multiple.

least

the × no. which is divisible by all the given no.

LCM
- listing multiples
- Prime factorization
- division method.

HCF - Highest Common Factor

(GCF / GCD)

HCF → listing factors

→ prime factorization

$LCM(a,b) \times HCF(a,b) = a \times b$

HCF of co-primes = 1

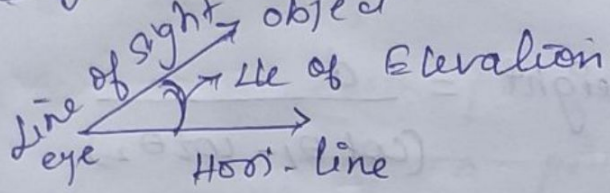
$$HCF = \frac{HCF\ (Nu)}{LCM\ (de)}$$

$$LCM = \frac{LCM\ (Nu)}{HCF\ (deno.)}$$

} of 2 fractions.

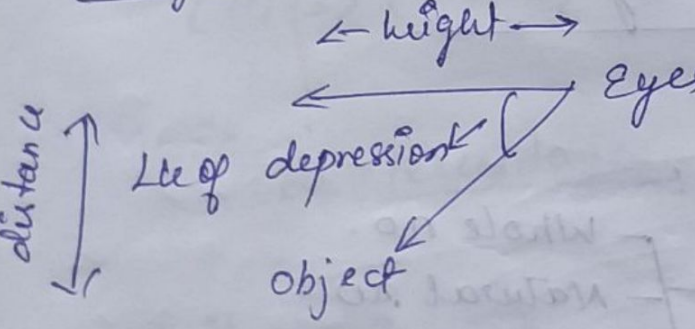
4. Height & distances:

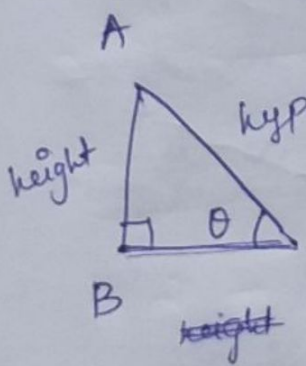
Angle of Elevation:



→ Lie of rise

Angle of depression:





$$\sin\theta = \frac{AB}{AC} = \frac{height}{hyp}$$

$$\cos\theta = \frac{BC}{AC} = \frac{distance\ (base)}{hyp}$$

$$\tan\theta = \frac{AB}{BC} = \frac{height}{distance\ (base)}$$

	0°	30°	45°	60°	90°
sin	0	1/2	1/√2	√3/2	1
cos	1	√3/2	1/√2	1/2	0
tan	0	1/√3	1	√3	N.D

$\sin^2\theta + \cos^2\theta = 1$

$1 + \tan^2\theta = \sec^2\theta$

$1 + \cot^2\theta = \operatorname{cosec}^2\theta$

$\sin(-\theta) = -\sin\theta$

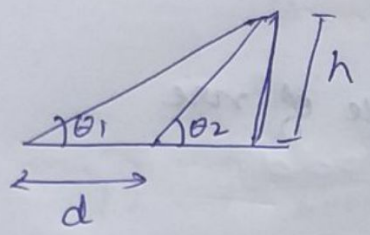
$\cos(-\theta) = \cos\theta$

$\tan(-\theta) = -\tan\theta$

$\operatorname{cosec}(-\theta) = -\operatorname{cosec}\theta$

$\sec(-\theta) = \sec\theta$

$\cot(-\theta) = -\cot\theta$



$$\text{height} = \frac{d}{(\cot\theta_1 - \cot\theta_2)}$$

5. Number systems

Types of Numbers:

- counting
  - Whole no.
  - Natural no
  - Integers
- divisibility
  - Prime
  - coprime
  - composite
- divisibility by 2
  - Even
  - odd

Natural no → 1, 2, 3...

Whole no → 0, 1, 2..

Integers → ..-1, 0, 1..

0 - Neither positive nor negative

Prime → factors → 1 & itself

Composite → factors → if has other than 1 & itself. (more)

Coprime → pair of no. with HCF = 1

(2,3) (4,5) (21,25)

- 1 is neither prime nor composite
- 2 is only even prime no.
- twin prime is a prime no that has a prime gap of 2

(11,13) (41,43) (71,9)

6. Percentages

$$a\% \rightarrow \frac{a}{100}$$

$$\frac{a}{b} \text{ in } \% = \frac{a}{b} \times 100\ \%$$

$$a\% \text{ in fraction} = \frac{a}{100}$$

If price of an article increases by P%, the necessary reduction in consumption to avoid inc. in expenditure as:

$$\frac{P}{(100+P)} \times 100\%$$

If the price of article dec. by P%, the necessary inc. in consumption to keep the same expenditure as:

$$\frac{P}{(100-P)} \times 100\%$$

Population:

Population, P
inc. by R% every year

Population:-
after 'n' years = $P \times \left(1 + \left(\frac{R}{100}\right)\right)^n$

before 'n' years = $P / \left(1 + \frac{R}{100}\right)^n$

Depreciation:

reduced by R% every year

Price:-
a/f n years = $P\left(1 - \frac{R}{100}\right)^n$

b/f n years = $P / \left(1 - \frac{R}{100}\right)^n$

7. Profits, loss & discounts

CP - purchased price - cost price

SP - Selling price - sold

Marked / List price - MP - price mentioned (mrp)

Profit / Gain (P):

→ Extra amount selling on SP

→ Profit w.r.to. CP

$$P = SP - CP$$

Loss (L):

$$L = CP - SP$$

Profit / Loss ?

$[SP - CP] \longrightarrow$ +ve - profit

$\longrightarrow$ -ve - Loss

Discount (D)

$$D = MP - SP$$

Profit %age: $P\% = \frac{P}{CP} \times 100\%$

Loss %age: $L\% = \frac{L}{CP} \times 100\%$

Discount %age: $D\% = \frac{D}{MP} \times 100\%$

- If 2 articles are sold at the same SP, one at gain A%, & one loss A%, then the seller always incurs a %age loss of $\left(\frac{A}{10}\right)^2$.

- If seller claims to sell at cost price but uses false weights,

$$P\% = \left(\frac{\text{true Value} - \text{Given Value}}{\text{Given Value}}\right) \times 100\%$$

8. Ratio & Proportions

Ratio : $a:b$

$a \rightarrow$ antecedent

$b \rightarrow$ consequent

proportion :

$a:b :: c:d$ $\quad a, d \rightarrow$ extremes, $b, c \rightarrow$ means

result of extremes = product of means

$$a \times d = b \times c$$

Compounded ratio :

$a:b \rightarrow ap:bq$

$p:q \nearrow$

Mean proportional :

$a : x \rightarrow x = \sqrt{ab}$

$x : b \rightarrow$

componendo & dividendo :

if $\frac{a}{b} = \frac{c}{d}$

componendo :- $\frac{a+b}{b} = \frac{c+d}{d}$

dividendo :- $\frac{a-b}{b} = \frac{c-d}{d}$

$a \propto b \Rightarrow a = xb$

$a \propto \frac{1}{b} \Rightarrow a = \frac{x}{b}$

9. Sequence & Series

Sum of first n natural no's $= (1+2+\cdots n)$

$= \frac{n(n+1)}{2}$

Sum of sq. of first n natural no's $= (1^2+2^2+\cdots n^2)$

$= \frac{n(n+1)(2n+1)}{6}$

Sum of cube of first n natural nos $= (1^3 + 2^3 + \cdots n^3)$

$= \frac{n^2(n+1)^2}{4}$

Sequences: AP, GP, HP

Arithmetic progression:

diff b/w 2 consequtive / Adjacent no's is always same.

ie, common sum = same.
[common difference]

a - initial term
d - common diff.

n^{th} term $= a_n = a_1 + (n-1)d$

Sum of n-terms

$= S_n = \frac{n}{2}[2a + (n-1)d]$

Geometric progression (G.P)

common ratio.

→ ratio b/w 2 adjacent terms is always same.

a - initial term
r - common ratio

a, b, c

$\frac{b}{a} = r$

$\frac{c}{b} = r$

n^{th} term = $a_n = a_1 * r^{n-1}$

Sum = $\frac{a(r^n - 1)}{r - 1}$

Harmonic progression :

→ reciprocal of HP are in AP.

Eg: $\frac{1}{5}, \frac{1}{10}, \frac{1}{15}, \frac{1}{20}, \ldots$

a - initial term

d - common difference

Tn of HP = $\frac{1}{a + (n-1)d}$

Airthmetic mean :

$$AM = \frac{a+b}{2}$$

Geometric mean :

$$GM = \sqrt{ab}$$

Harmonic Mean :

$$HM = 2ab(a+b)$$

$$GM^2 = AM \times HM$$

11. Volume

Cube:

Volume: a^3 cubic units

S.A: $6a^2$ sq. units

diagonal: $\sqrt{3}a$ units

Cuboid:

Volume: lbh $unit^3$

S.A: $2(lb+bh+hl)$ $unit^2$

Diagonal: $\sqrt{(l^2+b^2+h^2)}$ units

Cylinder:

V: $\pi r^2 h$ $unit^3$

C.S.A: $2\pi rh$ $unit^2$

T.S.A $= 2\pi rh + 2\pi r^2 = 2\pi r(h+r)$ $unit^2$

Cone:

Slant height $= \sqrt{h^2 + r^2}$ unit

$V : \frac{1}{3}\pi r^2 h$

C.S.A : $\pi r L$ $\quad (L = h)$

T S A : $\pi r L + \pi r^2$

Sphere:

$V : \frac{4}{3}\pi r^3$

S.A : $4\pi r^2$

Hemisphere:

$V = \frac{2}{3}\pi r^3$

C.S.A $= 2\pi r^2$

T.S.A $= 3\pi r^2$

11. Boats & streams

downstream:

boat moving along the dir. of stream

upstream:

boat travelling opp. to stream

downstream speed:

boat speed - b
stream speed - w

downstream speed = d = b + w

upstream speed: = u = b - w

Speed of boat = b = (d + u)/2
Speed of stream = w = (d - u)/2

Average speed:

speed of boat = r km/hr in still water
speed of steam = s km/hr

Avg speed = $(\text{Speed}_d * \text{Speed}_u) / \text{Speed}_{\text{stillwater}}$

$$= \frac{(r+s)(r-s)}{r} \text{ km/hr.}$$

Speed of Man in still water :-

downstream distance in P_1 hrs
upstream distance in P_2 hrs

Stream speed = S km/hr

Man in still water = $S \times \frac{(P_2 + P_1)}{(P_2 - P_1)}$ km/hr