prism type:

Volume = base area x height

Lateral surface area (or) curved surface area:

= base perimeter x height

Total surface area = LSA + 2* base area

cuboid

Volume = lbh cubic units

LSA = $2(l+b)*h$

TSA = $2(l+b)*h + 2*lb$

= $2(lb+bh+hl)$

Diag = $\sqrt{l^2+b^2+h^2}$

Surfaces = 6

Edges = 12

corner = 8

*Imp:

$f + V = E + 2$

f = no. of surfaces

V = Corners / vertices

E = Edges.

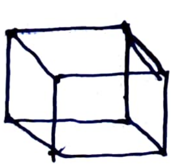
Cube:

Volume = $s \times s \times s = s^3$ cubic units

LSA = $4s^2$

TSA = $6s^2$

Diag = $\sqrt{3s^2}$



$1 \to 2, 3, 5, 4$ $\boxed{1 \to 6}$

26

30
25
20
15
10
100

8 cuts → same directione   two direction   three direction

9

~~10~~

(1,7) (1+1×7+1)

2+1×6+1 = (2,6) = 16.

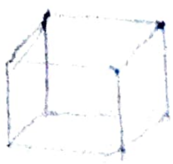
21

(3,5) = 3+1×5+1 = 24

$\boxed{5 \times 5 = 25}$ = (4,4)

Note: If you count maximum number of identical pieces we should cut the cube in all directions.

If you count minimum number of identical pieces we should cut the cube in same directions.



No. of ~~faces~~ pices with 2 ~~phases~~ faces visibles $= 12\times(n-2)$

No. of pices with 1 face visible $= 6\times(n-2)^2$

No. of pices with no face visible $= (n-2)^3$

1. If ~~statement~~ statement one alone is sufficient to answer the question.

2. If statement II alone is sufficient to answer the question.

3. Both the statement I & II are required to answer the question. But neither statement is alone to sufficient.

4. Both the statement I & II are not sufficient to answer the question & additional data is required to answer it.

If no. of equations = no. of variables then such type of linear Equations have unique solution otherwise no solution or infinte solution.

Analytical Reasoning

Arrangements are 3 types

1. Linear Arrangement
2. Circular Arrangement
   a) facing towards center
   b) Facing towards outward the center
   c) facing towards center and outside the center.
3. Puzzel based arrangement.

Study the following information to answer the given questions:

Eight friends: K, L, M, N, V, W, X & Y are seated in straight line, facing North but not necessarily in the same order.

* N sits fourth to left of X. X sits at one of the extreme ends of the line.
* V sits third to right of Y.
* Only one person sits b/w Y & W. Neither W or K is an immediate neighbour of V.
* M is not immediate neighbour of N

W K Y N ~~L~~ V M X

∴ W K Y N L V M X,

* what is the position of M with respect to N.
* How many ~~peopeple~~ people sit b/w M & Y.
* Exactly between V&Y (L,N).
* Extream leftend.

Nine persons C, D, E, F, I, J, K, L. & M are seated in a straight line facing North, with equal distance b/w each other but not necessarily in the same order.

- As many peoplesit to the left of D as to the right of D.
- Only two persons sit between F & D.
- J sits third to the right of E.
- E is not an immediate neighbour of D.
- E does not sit at any of the Extreme of people sitting between J & I is double as that between E & C.
- K is one of the immediate neighbours of M.
- L is not a immediate neighbour of J.

Time Distance & Speed

- The relation between distance speed & time is $D \propto S T$
- $\frac{D_1}{S_1T_1} = \frac{D_2}{S_2T_2}$ (or) $\frac{S_1T_1}{D_1} = \frac{S_2T_2}{D_2}$
- Distance = $S \times T$
- Speed = $\frac{D}{T}$
- Time = $\frac{D}{S}$

General units for speed are km/h or m/s

- To convert speed from km/h to m/s we have to multiple with $5/18$.
- To convert speed from m/s to km/h we have to multiple with $18/5$.
- If the ratio of speeds of two persons is a:b then the ratio of time taken by the two travel the same distance is $\frac{1}{a} : \frac{1}{b}$ (or) b:a
- If both speed and time increases by x% and y% respectively then the distance traveled increases by $x + y + \frac{xy}{100}$ %

- If both speed & time decreases by $x\%$ & $y\%$ respectively then distance is ~~decre~~ travelled is decreased by $x+y-\frac{xy}{100}\%$.

- If speed increases by $x\%$ & time decreases by $y\%$ then the distance travelled is changed by $x-y-\frac{xy}{100}\%$

  if it is +ve then it increases.
  if it is -ve then it decreases.
  if it is 0 then there is no change.

- If speed decreased by $x\%$ and time increased by $y\%$ then then distance travelled is changed by $y-x-\frac{xy}{100}\%$.

  if $y-x-\frac{xy}{100}$ is +ve then distance is incre.
  if $y-x-\frac{xy}{100}$ is -ve then distance is decre.
  if $y-x-\frac{xy}{100}$ is 0 then their is no change.

- If speed increases by $x\%$ due to that time decreases by $\left(\frac{x}{100+x}\right)\times100\%$ so that there is no change in distance travelled.

If speed decreases by $x\%$ due to that time increases by $\left(\frac{x}{100-x}\right)\times100\%$ such that there is no change in distance travelled.

Time increases by $x\%$ due to that speed decreased by $\left(\frac{x}{100+x}\right)\times100\%$ such that there is no change in distance travelled.

Time decreased by $x\%$ due to that speed increased by $\left(\frac{x}{100-x}\right)\times100\%$ such that there is no change in distance travelled.

Average speed:

Average speed is ratio of total distance travelled to that of time taken.

$$\text{Avg speed} = \frac{\text{Total distance}}{\text{Total time}}$$

If two equal distances travelled different speeds x km/h & y km/h then the avg speed during the whole journey is $\frac{2}{\frac{1}{x}+\frac{1}{y}}$ (or) $\frac{2xy}{x+y}$

- If a person travelled n equal intervals with different speeds $x_1, x_2, \ldots x_n$ km/h then his average speed during the whole journey is $\frac{n}{\frac{1}{x_1}+\frac{1}{x_2}+\cdots\frac{1}{x_n}}$

Relative speed:

Relative speed is the comparision of speed of 1 person with respect to another person.

Two persons travelled with different speeds x km/h & y km/h in the opposite direction.

- The relative speed of 1st person with respect to second person is $x+y$ km/h
- The relative speed of 2nd person with respect to 1st is $y+x$ km/h.

Two persons travelled in different speeds x km/h & y km/h in same direction.

- The relative speed of 1st person with respect to second person is $x-y$ km/h
- The relative speed of 2nd person with respect to 1st person is $y-x$ km/h.

Points for problems based on trains

- If a train crosses a stationary object of negligable length (man, tree..) then it travels a distance of length of the tree.

If a train crosses a stationary object having some length (bridge, platform, tunnel...) then it travels a distance of length of train + length of the object which it crosses.

- If a train crosses the moving objects the distances are same as above but speeds are considered as the relative speed.

If two trains of lengths 'x' meters & 'y' meters are moving in opposite direction with speed u m/sec & v m/sec then time taken by the trains to cross each other is $\frac{x+y}{u+v}$ s

If two trains of lengths x meters & y meters are moving in same direction with speeds u m/sec & v m/sec respectively then the time taken by the faster train to crosses the slower train is $\frac{x+y}{u-v}$ sec.

If two persons start at the same time in opposite directions from two stations a & b & after passing each other they complete the journey in a & b hours respectively then the ratio of their speeds is $\sqrt{b} : \sqrt{a}$.

Circular tracks:

If two persons running on a circular track of length c meters are moving in opp direction with speeds x m/s & y m/s then the first meeting time of two persons at any point is $c/x+y$ sec.

If two persons running on a circular track of length c meters in the same direction with speeds x m/sec & y m/sec then the first meeting time of two persons at any point is $\frac{c}{|x-y|}$ sec.

If two persons running on a circular track of length c meters are moving in any direction with speeds x m/s & y m/s then the first meeting time of two persons at starting point is LCM of $\frac{c}{x}, \frac{c}{y}$ sec

RACES & GAMES

- Race: A Race is a contest of speed in running, riding, driving, sailing, rowing etc, over a particular distance.
- Race Course: Race course is the ground or path on which contests are conducted.
- Starting point: the points where the race starts.
- Winning point: The point where the race ends or finishes is winning point or goal.
- Dead-heat Race: A race is said to be a Dead-heat Race if all the persons contesting the race reach the winning point exactly at the same time.
- Winner: Winner is the person who first reaches the goal is winner.

M.I of S.I in R & G:

- Let A & B be two participants in a race. Let examine some of the general statements & their mathematical interpretations.
- A beats B by 't' seconds. A finishes race 't' seconds before B.

i.e

If take x sec to finish the race B takes x+t sec to finish the race.

A gives B a start of t sec means that i.e A starts the race t sec after B starts from the same starting point. i.e

If B takes x sec to reach the goal A has to take x-t sec to ~~reach~~ & win the race.

A gives B a start of x m means that A starts from start point & B starts x m ahead of the starting point at the same time.

(or)

To cover a race of y m A will cover y m while B will cover only y-x m.

A beats B by x m in a race of y m means that while A reaches the goal in the same time. B is x m behind the goal.

i.e

In the same time ~~A~~ travels y m & B travels only y-x m.

A game of 100 points means that a game in which a participate who scores 100 points first is winner.

In a game of 100, A can give B 'x' points means that while A scores 100 points

Note

- If A is n times as fast as B & A gives B a start of x meters, then the length of the race cource, so that A & B reaches the winning post at the same time is $x\left(\frac{n}{n-1}\right)$ meters.

- If A can run x meters race in t_1 seconds & B in t_2 seconds where $t_1 < t_2$ the A beats B by distance of $\frac{x}{t_2}(t_2 - t_1)$ meters

1. A runs $1\frac{2}{3}$ times as fast B if A gives B a start of 80m how far must the winning ~~force~~ post be so that A & B reaches it at the same time.

$\Rightarrow 80\left(\frac{1^2/_3}{1\frac{2}{3}-1}\right)$

$\frac{5}{3} \times 80$

$\frac{5}{3} \cdot 1\frac{2}{3}$

$\Rightarrow$ 200m

• A is $2\frac{1}{3}$ times as fast as B. If A gives B a start of 80m how long should the races course be so that both of them reach at the same time.

$$\frac{\frac{7}{3} \times \overset{20}{\cancel{80}}}{\frac{4}{3}} = 140m$$

• A runs $1\frac{3}{8}$ times as fast B. If A gives B a start of 90m & they reach the goal at same time.

$$\frac{\frac{11}{8}}{\frac{3}{8}} \times \overset{30}{\cancel{90}} = 330m$$

A can run 224m in 28sec & B in 32 sec. By what distance A beat B.

$$\frac{224}{32}(32-28)$$

$$\Rightarrow \frac{224}{\cancel{32}_{8}}(\cancel{4})$$

$$\Rightarrow 28m$$

In a 100m race A can give B 10m & C 28m. In the same race B can give C.

$D_A : 100m$

$D_B : 90m$

$D_C : 72m$

$$\frac{90}{72} = \frac{100}{x}$$

$\Rightarrow 90 \times x = 100 \times 72$

$x = \frac{10\cancel{0} \times \cancel{72}8}{\cancel{90}} = 80m$

B gives $100 - 80 = 20m$ to c.

At a game of billiard A can give B 15pts in 60 & A can give c to 20pts in 60. How many points can B give to c in a game of 90.

$P_A : 60$

$P_B : 45$

$P_c : 40$

$\Rightarrow P_B : 90$

$$\frac{45}{40} = \frac{90}{x}$$

$\Rightarrow x = \frac{\overset{10}{\cancel{90}} \times \overset{8}{\cancel{40}}}{\underset{9}{\cancel{45}}}$

$x = 80$ ∴ 10pts.

In a 500m race, the ratio of the speeds of two contestants A & B is 3 : 4. A has a start of 140m then A wins by.

(1) 1-1 (2) 2-0

---

2 & 9

:Sequences:

- A sequence is a series of numbers or letters which maintains a common characteristic property through out the series
- Generally sequence are also called as progressions.
  - A P
  - G P
  - H P

A.P: The difference b/w any two consecutive terms through out the sequence is same then that sequence is called A. sequence or A. pro. Here the equal difference is called common difference.

Note: The terms of A.P are

- $a, a+d, a+2d, \dots a+(n-1)d$
- n^{th} term of AP whose first term is a & common difference d is $T_n = a+(n-1)d$

- Sum of n ter...

S...

- $T_n - T_{n-1} =$
- $T_n = S_n -$
- A/M of
- a, b, c are

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

- $S_n = n$ ...
- To insert

$x_1, x_2, \dots$

$d = \frac{b-a}{n+1}$

- The recip...
- To con... them as
- To cons... them b...

- sum of n terms in A.P.:

$$S_n = \frac{n}{2}\left[2a+(n-1)d\right] = \frac{n}{2}\left[T_1+T_n\right]$$

$T_n - T_{n-1} = d$, $T_n - T_m = (n-m)d$

- $T_n = S_n - S_{n-1}$
- A.M of a & b is $= \frac{a+b}{2}$
- a, b, c are in A.P. if & only if $b-a = \cancel{b}\ c-b$ or $b = \frac{a+c}{2}$.
- $S_n = n * AM$
- To insert n A.M b/w a & b they are considered as $x_1, x_2, \ldots x_n$ where $x_i = a + id$ where $i = 1, 2, 3 \ldots n$.

$d = \frac{b-a}{n+1}$

- The reciprocals of terms of A.P are in H.P
- To consider 3 terms in AP we have to take them as $a-d,\ a,\ a+b$
- To consider 4 terms in AP we have to take them as

$a-3d,\ a-d,\ a+d,\ a+3d$

GP

the ratio of any two consecutive terms throughout the sequence is same is called G.P. The equal ratio is called common ratio.

→ The general terms of G.P are
$a, ar^2, \ldots ar^{n-1}$

a → first term.

r → common ratio.

* n^{th} term of G.P whose first term is a then

$T_n = ar^{n-1}$

* $\frac{T_n}{T_{n-1}} = r$, $\frac{T_n}{T_m} = r^{n-m}$

* sum of n terms of GP is

$$S_n = \frac{a(r^n - 1)}{r-1} \quad r>1$$

$$S_n = \frac{a(1-r^n)}{1-r} \quad r<0$$

sum of ∞ terms of GP is $S_\infty = \infty$ if $r>1$

$\frac{a}{1-r}$ if $r<1$

G.M of a, b is $\sqrt{ab}$

G.M of numbers which are in G.P = $\sqrt{T_1 \times T_n}$

$b = \sqrt{ac}$ a b c are in G.P if and only if

$b = \sqrt{ac}$, b is G.M of a, c.

the reciprocals of ~~terms~~ terms of GP are again in G.P.,

To consider three terms in GP we have to take them as $\frac{a}{r}, a, ar$.

To consider four terms in GP we have to take them as $\frac{a}{r^3}, \frac{a}{r}, ar, ar^3$

HP

If the reciprocals of terms are in AP then the series is called H.P.

General terms of H.P are $\frac{1}{a}, \frac{1}{a+d}, \frac{1}{a+2d}, \ldots \frac{1}{a+(n-1)d}$

n^{th} term of H.P $T_n = \frac{1}{a+(n-1)d}$

3) $\frac{1}{T_n} - \frac{1}{T_{n-1}} = d$ $\frac{1}{T_n} - \frac{1}{T_m} = (n-m)d$

4) H.M of a & b is $= \frac{2ab}{a+b}$

5) $G.M = \sqrt{A.M * H.M}$

Sum of Internal angles of a polygon with n sides is

$(n-2)180$

$a-2d, a-d, a, a+d, a+2d = (n-2)180$

$5a = 3(180)$

$a = \frac{540}{5} = 108$

The sum of all even natural numbers less than 100 is

2 98

$T_n = a+(n-1)d = 98$

$= 2+(n-1)2 = 98$

$\Rightarrow 1+(n-1) = 49$

$n = 49$

$S_n = \frac{n}{2}(T_1+T_n)$

$= \frac{49}{2}(2+98)$

$= \frac{49(100)}{2}$

$= 2450$

101 199

$\Rightarrow$ (2)

$a = 101$

$d = 2$

$101+(n-1)2 = 199$

$S_{50} = \frac{50}{2}[101+199]$

$= 25(300)$

$= 7500$

43×182

$\frac{1}{3}$

$3\times$

$= 3$

$= 5$

$6 \times 3 = 18$

$$\begin{array}{r} 546 \\ \times\ 7\cancel{7}8 \\ \hline 7\cancel{8}26 \\ 8 \end{array}$$

1
2
3
4
5
8

odd digit in unit place i.e unit place can have 3 ways

tens place have 6 ways.

Hence the root two digit odd num that can form is 18, (6×3)

$a = 35$

$d = 7$

$7 \overline{)\,329}\,(47$
28
49

322

$35 + (n-1)7 = 329$

$35 + \cancel{7}n - 7 = 329$

$7n + 28 = 329$

$7n = \cancel{294}\ 47 - 9$

$n = 43$

$$\begin{array}{r} 322 \\ -\ 28 \\ \hline 294 \end{array}$$

$7)\,329$

$$\begin{array}{r} 182 \\ 364 \\ \hline 2 \end{array}$$

$S_{43} = \frac{43}{2}[35 + 329]$

$\Rightarrow$

$$\begin{array}{r} 182 \times 43 \\ \hline 546 \end{array}$$

$$\begin{array}{r} 546 \\ 7\cancel{28} \\ \hline 8226 \end{array}$$

$\Rightarrow 546$

• remainders divisible by 7 two digit number.

$a = 10$
$d = 7$

$S_{13} = \frac{13}{2}[10+94]$

$= \frac{13}{2}[104]$

$= 13 \times 52$

$10+(n-1)7 = 94$

$\Rightarrow 10+7n-7 = 94$

$7n = 91$

$n = 13$

$= 676$

• Sum of all 3 digit numbers that give a remainder of 4 when it is divisible by 7.

$\Rightarrow a = 102$

$d = 7$

$102+(n-1)7 = 998$

$7n = 889$

$n = 127$

$S_n =$

998
102
896
7
889

• Sum of 4th & 12th terms of an A.P is 120 then sum of 15th terms

$\Rightarrow a+3d+a+11d=120$

$\Rightarrow 2a+14d=120$

$\Rightarrow a+7d=60$

$\frac{15}{2}[2a+14d]$

$\frac{15}{2}(\overset{60}{120}) \Rightarrow 900$

• $a+5d+a+14d=a+6d+a+9d+a+11d$

$\Rightarrow 2a+19d=3a+26d$

$a+7d=0$

$a+(8-1)d=0$

$\Rightarrow$ 8th term

• $a+2d+a+14d=a+5d+a+10d+a+12d$

$\Rightarrow 2a+16d=3a+27d$

$a+11d=0$

$\Rightarrow$ 12th term

$3, 9, 15, 21 \ldots$

$a = 3$

$d = 6$

$a_{15} = 3 + (14)6$

$= 3 + 84$

$= 87$

• $-3, -(1/2), 2, \ldots$

$a = -3$

$d = \frac{5}{2}$

$-\frac{1}{2} + 3$

$-1 + \frac{5}{2}$

$T_n = -3 + (n-1)\frac{5}{2}$

$= -3 + \frac{5n}{2} - \frac{5}{2}$

$\Rightarrow \frac{5n - 11}{2}$

• $1, 11, 21, 31$

$a = 1$

$d = 10$

$S_{10} = \frac{10}{2}[2 + 9(10)]$

$= 5[92]$

$= 460$

• Find the sum of all the numbers / by 6 in bet
100 to 400

12,550

12,450

11,450

11,550