Cubes & Dice

12/7/22

Solid figures

(base figure = top figure) prism

(top figure is point) pyramid

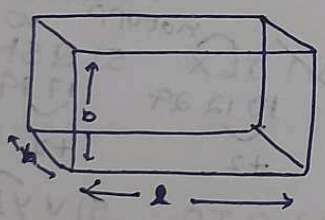
① Volume = base Area x h

② lateral surface Area / curved surface Area = base perimeter x h

③ total surface Area = lateral surface area + 2(base Area)

Eg: cube, cuboid, cylinder, octagonal prism.

Cuboid:



Volume = lbh Cubic Units

lateral Surface Area = 2(l+b)h Cubic Units

Total Surface Area = 2(l+b)h + 2lb

= 2(lb+bh+hl) Cubic Units

Diagnol $d = \sqrt{l^2+h^2+b^2}$ Units

↑ max distance.

faces/Surfaces - 6

Edges - 12

Vertices/Corners - 8

* Euler's formula:

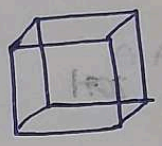
* $(f+v) = (e+2)$

f = faces / Surfaces

v = vertices / corners

e = edges.

cube:



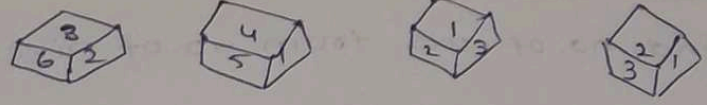
Volume = s^3 sq. units

lateral surface area = $4s^2$ sq. units

Total Surface Area = $4s^2 + 2s^2 = 6s^2$ sq. units

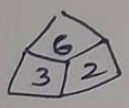
Diagonal = $\sqrt{3s^2} = \sqrt{3}s$ units

cube:

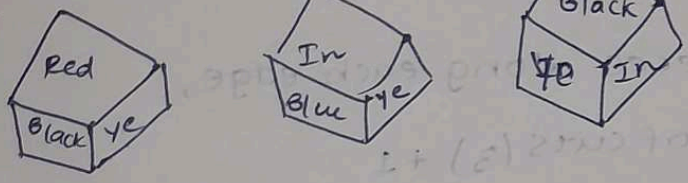


1 → 2, 3

1 → 4, 5



opp to red.



$^8C_3$

$\frac{8\times7\times6}{3\times2\times1}$

19|7

① 8 cuts

→ one direction : 9 pieces

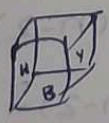
→ two direction:

1, 7 – 2×8 = 16

2, 6 – 3×7 = 21

3, 5 – 4×6 = 24

4, 4 – 5×5 = 25



→ 3 direction:

1, 1, 6 – 2×2×7 = 28

1, 2, 5 – 2×3×6 = 36

1, 3, 4 – 2×4×5 = 40

2, 2, 4 – 3×3×5 = 45

2, 3, 3 – 3×4×4 = 48

* To get maximum no. of pieces, divide no. of cuts equally otherwise, choose consequetive

* If you want max no. of identical pieces, then you should be cut the cubes in all direction.

* If you want min no. of identical pieces, then you should be cut the cube in same direction

Back Door Method:

To find no. of cuts from no. of pieces.

216
1×216
2×—
3×—
1

* In order to obtain max. no. of pieces the cuts given to a large cube must be divided as equal as possible, in 3 different directions

NOTE:

If no. of cuts is given, then How to find max. no. of pieces:

1. If n is no. of pieces along each edge,

$$n = (\text{Total no. of cuts}/3) + 1$$

2. max no. of identical pieces $= n^3$.
3. no. of pieces with 3 faces visible $= 8$
4. no. of pieces with 2 faces visible $= 12(n-2)$
5. no. of pieces with 1 face visible $= 6(n-2)^2$
6. no. of pieces with no face visible $= (n-2)^3$

2/7/22

Data Suficiency

① If statement I alone is sufficient to answer the question

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

③ If both the statements I and II are required to answer the question but neither statement alone is sufficient.

④ If statements I and II are not sufficient to answer the question and additional data are required to answer it.

(or)

options	statement 1	statement 2
1	✓	×
2	×	✓
3	✓	✓
4	×	×

① what is value of x?

I : $x^2 = 144$

II : x is integer

option ④

② How many students passed exam?

I : 300 issued halltickets

II : 10 failed

option ④

③ what is cost of 1 table, one bench & 1 chair together?

I : 2T, 3B, 5C - 24000/-

II : 5T, 4B, 2C - 25000/-

option 3

If no. of equations = no of variables then such type of linear eqns have unique solution otherwise no solution or infinite soln.

12/7/22

Time, Distance, Speed

1. The relation b/w distance, speed and time is

$d \propto S.t \Rightarrow D \propto S \times T$

$\Rightarrow \frac{D_1}{S_1 T_1} = \frac{D_2}{S_2 T_2}$ (or) $\frac{S_1 T_1}{D_1} = \frac{S_2 T_2}{D_2}$

2. Distance = Speed x Time

3. Speed = $\frac{\text{Distance}}{\text{Time}}$

4. Time = $\frac{\text{Distance}}{\text{Speed}}$

5. General units for speed are km/hr or m/sec

6. To convert speed from km/hr to m/sec, we have to multiply with 5/18.

7. To convert speed from m/sec to km/hr, we have to multiply with 18/5.

8. If the ratio of speeds of 2 persons is a:b, then the ratio of times taken by them to travel the same distance is $\frac{1}{a} : \frac{1}{b} \Rightarrow \frac{b}{a}$

9. If both speed and time increases by x% and y% respectively, then the distance travelled increases by $\left(x + y + \frac{xy}{100}\right)\%$

10. If both speed and time decreases by x% and y% respectively, then the distance travelled decreases by $x + y - \frac{xy}{100}$ %

11. If the sp... by y% then ... $x - y - \frac{xy}{100}$ ...

12. If x - y - ... is Incre...

13. If x - y - ... is Decre...

14. If x - y - ...

15. If spee... decreases ... in the d...

16. If spee... increases ... change i...

17. If tim... decrease... change i...

18. If time ... Increase... Change ...

Avg Spee...

1. Average ... travelled ...

Avg Sp...

11. If the speed increases by x% and time decreases by y% then the distance travelled is changed by

$$x - y - \frac{xy}{100} \%$$

12. If $x - y - \frac{xy}{100}$ is +ve, then the distance travelled is Increased.

13. If $x - y - \frac{xy}{100}$ is -ve, then distance travelled is Decreased.

14. If $x - y - \frac{xy}{100}$ is 0, then their is no change in the distance travelled.

15. If speed Increases by x% due to that time decreases by $\left(\frac{x}{100+x}\right)100$ % so that their is no change in the distance travelled.

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

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

18. If time Decreases by x% due to that speed Increases by $\left(\frac{x}{100-x}\right)100$ % so that their is no change in distance travelled.

Avg Speed

1. Average Speed is the ratio of total distance travelled to that of total time takem i.e.,

$$\text{Avg Speed} = \frac{\text{Total distance}}{\text{Total time taken}}$$

2. If two equal distances travelled with different speeds x km/hr and y km/hr then the average speed during the whole journey is $\frac{2}{\frac{1}{x}+\frac{1}{y}}$ (or) $\frac{2xy}{x+y}$

3. If a person travelled n equal distance with different speeds $x_1, x_2, --, x_n$ km/hr, then his Average speed during the whole journey is

$$\frac{n}{\frac{1}{x_1}+\frac{1}{x_2}+--+\frac{1}{x_n}}$$

Relative Speed

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

2. Two persons travel with different speeds x km/hr and y km/hr in the opposite direction then

i) The relative speed of 1st person w.r.t second person is $(x+y)$ km/hr

ii) The relative speed of 2nd person w.r.to 1st is $(y+x)$ km/hr

3. If two persons travel with different speeds x km/hr y kmph in the same direction, then the relative speed of 2nd person with respect to 1st person is $(y-x)$ kmph and Relative speed of 1st person w.r.to 2nd person is $(x-y)$ kmph.

19/7/22

Points for Problems Based on Trains

1. If a train crosses an object of negligible length Eg: man / pole then it travels distance of length of train

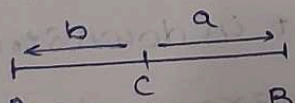
2. If a train travels & crosses a stationary obj having some length (Bridge, platform, another train/tunnel) then it travels a distance of sum of lengths of train and length of obj it crosses

3. If a train crosses the moving obj's then the distances are same as above but speeds are considered as relative speed.

i) If 2 trains of length x m and y m are moving in opp. direction with speeds u m/s & v m/s resp. then the time taken by trains to cross each other is $\frac{x+y}{u+v}$ sec.

ii) If 2 trains of length x m and y m are moving in same direction with speeds u & v m/s resp. then time taken by faster trains to cross slower train is $\frac{x+y}{|u-v|}$ sec.

4. If 2 persons start at the same time in opp. directions from 2 stations A & B and after passing each other they complete the journeys in a & b hrs resp. then the ratio of their speeds is $\sqrt{b} : \sqrt{a}$.



$S_A : S_B = \sqrt{b} : \sqrt{a}$

Circular Tracks

1. If 2 persons running on a circular track of length 'c' meters with diff speeds x m/s & y m/s resp, then 1st meeting time of 2 persons at any point on track is

i) If they travel in opp. direction is $\frac{c}{x+y}$ sec

ii) if they travel in same direction is $\frac{c}{|x-y|}$ sec.

2. If 2 persons running on circular track of length 'c' m with diff speeds x & y m/s resp, then the 1st meeting time of 2 persons at starting point is L.C.M of $\left(\frac{c}{x}, \frac{c}{y}\right)$ sec.

Boats AND Streams

Down stream: If a boat travels on the same direction of water flow then the speed of boat increases. In this case we say that boat travels in downstream or with tide.

Upstream: If a boat travels in the opp. direction of water flow then the speed of boat decreases. In this case we say that boat travels in upstream or against tide.

1. If a boat travels in stationary water with speed x kmph and if speed of water is y kmph, then
   i) Speed of boat in downstream is $x+y$ kmph
   ii) Speed of boat in upstream is $x-y$ kmph

2. If the speed of boat in downstream is 'a' kmph & speed of boat in upstream is 'b' kmph, then
   i) speed of boat in stationary water = $\frac{a+b}{2}$ kmph
   ii) speed of water or stream = $\frac{a-b}{2}$ kmph

Q. If speed ↑'s by 20% and time ↓'s by 10%, then what is the % change in distance travelled?

$x = 20, y = 10$ ∴ Distance ↑d by 8%

$d = x - y - \frac{xy}{100}$

$= 10 - 2 = 8\%$ ↑

Q. If speed ↑'s by 30% and then what is the % decrease in its time so that distance travelled increased by 4%.

$$\Rightarrow \quad d = x - y \mp \frac{xy}{100}$$

$$4 = 30 - y - \frac{30y}{100}$$

$$+26 = \frac{13y}{10} \quad \Rightarrow \quad \boxed{y = 20\%}$$

Q. If both speed and time ↑'s by 20% and 40% resp. then the distance travelled is ↑d by $\Rightarrow 20 + 40 + \frac{800}{100}$

$$\boxed{d = 68\%}$$

Q. If a person travelled with a speed of 20 kmph, from his House to office and return back with a speed 30 kmph in the same route, then what is his Avgspeed during the whole journey. $\Rightarrow \frac{2}{\frac{1}{x}+\frac{1}{y}}$

$$\Rightarrow \quad \frac{2xy}{x+y} = \frac{2(20)(30)}{50} = \boxed{24 \text{ kmph}}$$

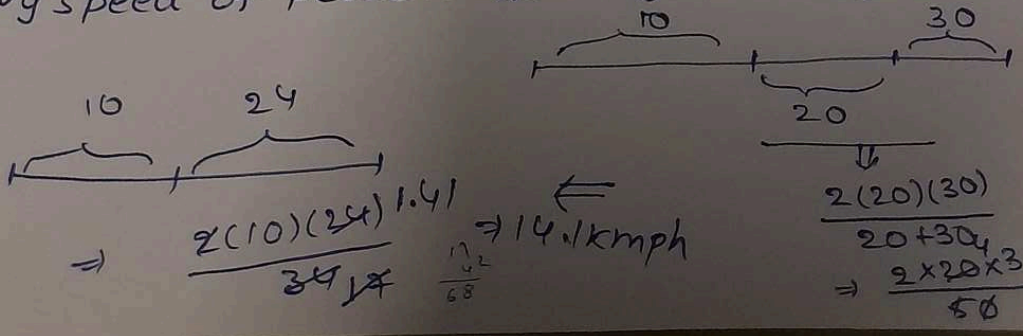
Q. If a person travelled 3 equal distances with diff speeds 10 kmph, 20 kmph and 30 kmph resp. what is his avg speed during the whole journey is.

$$\frac{3}{\frac{1}{x}+\frac{1}{y}+\frac{1}{z}} = \frac{3xyz}{xy+yz+zx} = \frac{3(30)(20)(10)}{300+200+600}$$

$$= \frac{3(30)(20)10}{1100}$$

$$= \frac{180}{11} = 16.36$$

Q. If a person travelled half of the distance at 10kmph and half of the remaining at 20kmph and remaining at 30kmph. what is the avg speed of person during whole journey:



$$\Rightarrow \frac{2(10)(24)}{34} \quad 1.41 \Rightarrow 14.1 \text{ kmph}$$

$$\frac{2(20)(30)}{20+30} \Rightarrow \frac{2\times20\times30}{50} = 24$$

Quant

12) distance travelled = 110

speed = 60 + 6 $= \frac{\cancel{66}^{11}}{\cancel{18}_{3}} \times \frac{5}{\cancel{3}} = \frac{55}{3}$ m/s

time = $\frac{\text{distance}}{\text{speed}} = \frac{110}{\frac{55}{3}} = \frac{\cancel{110} \times 3}{\cancel{55}} = 6$ sec.

13)

Let two trains meet after x hrs from 7 AM

$D_1 = 20x$; $D_2 = 25(x-1)$

$D_1 + D_2 = 110 \Rightarrow 20x + 25x - 25 = 110$

$45x = 135 \Rightarrow x = 3$ hrs $\Rightarrow 7 + 3 = 10.00$ AM

11) distance = 120 + 120

Time = 12

speed $= \frac{240}{12} = \frac{\cancel{20}^{4}}{} \times \frac{18}{\cancel{5}} = 18 \times \cancel{4}^{2}$

speed = 36 kmph.

14) Length of train = x m

speed of train = $\frac{x}{8}$ m/s

$\frac{264+x}{20}$ = speed. $\Rightarrow \frac{264+x}{20} = \frac{x}{8}$

$264 \times 8 + 8x = 20x$

$12x = 8 \times \frac{264}{22} \Rightarrow x = 176$ m/s

speed $= \frac{x}{8} = \frac{\overset{22}{\cancel{176}}}{8} = 22$ m/s

$= \frac{\overset{4.4}{\cancel{22}} \times 18}{\cancel{5}} = 79.2$ kmph

15) $\frac{250+x}{26}$

$\frac{250+x}{26}$

$x = 520$

16) length

man

time

sp

10

10x

(12

17) dist

spe

ti

18)

15) $\frac{250+x}{26} = \overset{4}{\cancel{72}} \times \frac{5}{\cancel{18}}$

$\frac{250+x}{26} = 20 \Rightarrow 250+x = 20\times 26$

$x = 520-250 = 270$ m

16) length of train = 125 m

man speed $= 5\times\frac{5}{18} = \frac{25}{18}$ m/s

time = 10 sec.

speed of train = x.

$10 = \frac{125}{x-\frac{25}{18}} \Rightarrow 10x - \frac{250}{18} = 125$

$10x = 125 + \frac{250}{18} \Rightarrow x = 12.5 + \frac{25}{18}$ m/s

$\left(12.5+\frac{25}{18}\right)\times\frac{18}{5} = (2.5\times 18) + 5$

$= 45+5 = 50$ kmph

17) distance travelled = 240 + 120 = 360 m

speed = 45 − 9 = 36 kmph $= \overset{2}{\cancel{36}}\times\frac{5}{\cancel{18}} = 10$ m/s

time $= \frac{\text{distance}}{\text{speed}} = \frac{360}{10} = 36$ sec.

18) time $= \frac{0.9+1.10 \text{ km}}{90+60} = \frac{2 \text{ km}}{150 \text{ kmph}} = \frac{2}{150}$ hrs

$\frac{2}{150}\times 60$ min $= \frac{4}{8}\times 60 = 48$ sec

O/W ecl ... & Internet

19) distance = speed x time

$= 54 \times \frac{5}{18} \times 4 \times 60$

$= 15 \times 240$

$= 3600$ m

2 | 24 | 15 | 120 | 3600

20) $speed_b = \frac{15}{5} = 3$ kmph $= 3 \times \frac{5}{18} 6 = \frac{5}{6}$ m/s

$x - y = 3$ kmph

$x - \frac{1}{4}x = 3 \Rightarrow \frac{3x}{4} = 3 \Rightarrow x = 4$

boat speed = 4 kmph

current speed = 1 kmph

required time $= \frac{15}{5} = 3$ hrs

21) Avg speed $= \frac{2xy}{x+y} = \frac{2 \times 6 \times 3}{6+3} = \frac{2 \times 18}{9} = 4$ km/hr

upstream $= 4.5 - 1.5 = 3$ (x)

downstream $= 4.5 + 1.5 = 6$ (y)

22) $2 \times \frac{x}{4.5 - x} = \frac{x}{4.5 + x}$

$9 + x = 4.5 - 2x$

$3x = -4.5 \Rightarrow x = \frac{4.5}{3}$ kmph $= 1.5$

$x = 1.5$ kmphr

23) $\frac{a}{(x+y)} = 8$ hr 48 min

$\frac{a}{(x+y)} = 4$ hr

$\frac{x}{y} = \frac{8}{3}$

$\frac{x}{y} = ?$

$\frac{a}{x-y} = 8 + \frac{48}{60} = \frac{44}{5}$

$\frac{a}{x+y} = 4$

$\frac{44}{5}(x-y) = 4(x+y)$

$11x - 11y = 5x + 5y$

$6x = 16y$

24) $(x-y) = 16$ $\quad 2x = 40 \Rightarrow x = 20$

$(x+y) = 24$ $\quad y = 4$

$\frac{y}{x} = ?$ $\quad \frac{y}{x} = \frac{4}{20} = \frac{1}{5}$

25) $(x-y) + (x+y) = 82$ kmph

$2x = 82$

$x = 41$ kmph

$\frac{105}{41-x} = 3 \Rightarrow 123 - 3x = 105$

$3x = 18 \Rightarrow x = 6$

current speed $= 6$ kmph.

$\frac{126.9}{41+6} = \frac{126.9}{47} = 2.67$

47)126.9 (2.6
94
31.9
282
370

6/9/22

Analytical Reasoning.

Arrangements are 3 types

1. Linear Arrangement
2. Circular "
   a) facing towards centre
   b) " " outward the center
   c) " " centre & outside center
3. Puzzle based arrangement

Q: N ↑ _ _ X

_____ Y X W N V _ _ X

Study the info & answer:

8 frds. K, L, M, N, V, W, X, Y are seated in straight line, facing N, but not neccessarily in same order.

- N sits 4th to left of X. X sits at 1 of extreme ends of line ⇒ N _ _ _ X
- V sits 3rd to right of Y ⇒ Y _ _ V
- Only 1 person sits b/w Y & W. Neither W nor K is an immediate neighbour of V ⇒ W _ V (or) Y _ W
- M is not an immediate neighbour of N. ⇒ _ V _ _ Y N

Ans: ⇒ W K Y N L V M X

1 2 3 4 5 6 7 8

_ _ _ N _ _ _ X

_ Y _ N V _ _ X

Q) what is the position of M w.r.to N? 3rd to right

Q ii) w.r.to L which among is the given are T?

→ Both W, K are imm neigh of L ✗

* only 3 persons sit to R of L

Q iii) How many persons are seated b/w M & Y? 3

Q iv) who sit exactly b/w V & Y? N, L

v) extreme left end - W

6-10 :

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

W K Y N L V M X

- As many people sit to left of D as to right of D
- Only 2 persons sit b/w F & D.
- J sits 3rd Right of E.
- E is not imm neighbour of D
- E doesn't sit at any extreme ends of line
- Only 2 persons sit b/w J & I
- No. of people sitting b/w J & I is double as that b/w E & C.
- K is 1 of immediate neighbours of M.
- K is not immediate neighbour of J.

y N W _ X

① - - - - D - - - -

② F _ _ D _ _ F _

③ I _ _ J _ _

④ J _ _ I

A : ~~K M E K D J F C I~~

F D F

E _ _ J _ _ I _ _

C F E L D J M K I

C F E L D J _ M K I

i) w.r.to L → None

ii) even no. of people sitting among → L, I

iii) who sit exactly b/w F & D? → E, L

iv) 3rd left of K? → D

v) choose diff? - M, D K, M J, L L, F E, C

~~Q3~~: cho