

GATE - 7 to 8 Q's  $\simeq 11M$

# Numerical Ability Revision

GATE/ESE

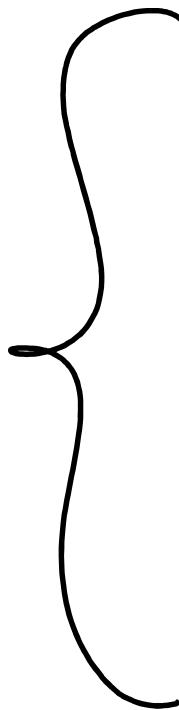
ESE  $\simeq 11Q's$   
(22M)



Hemanth J

ACE Engg. Academy/ ACE Online Faculty



- 
- 1 Quantitative Aptitude
  - 2 Reasoning, Spatial Aptitude

## Quantitative Aptitude

✓ Number System

✓ Percentages, Simple and Compound Interest, Profit, Loss, and Discount — 1Q

Power or Exponents (Surds & Indices), Progressions, Logarithms

✓ Ratios, Proportions, Variations, ✓ Partnership, Ages, Averages, Mixtures and Allegations

\*\* Data Interpretation — 1Q

\* Mensuration, Geometry, Areas & Volumes, Coordinate Geometry → 1Q

\* Time and Work, Pipes & Cisterns, Time, Speed and Distance → 1Q

Permutations & Combinations and Probability

## Verbal Reasoning

Coding-Decoding, Series, Analogy, Odd Man Out

Directions, Seating Arrangements **\*\*** — IQ

**\*\*** Venn Diagrams, Inequalities, Syllogism **\*\*** — IQ

Blood Relations \*

Dice, Counting Figures

Logical Puzzles **\*\***

## Spatial Aptitude or Non-Verbal/Visual Reasoning

Translation, rotation, scaling, " mirroring, assembling, & grouping, Paper folding, cutting," and patterns in 2D & 3D.

## Number System

aptitude hemanth

- ① unit's place
- ② factors
- ③ divisibility
- ④ LCM & HCF

Find the unit place digit in  $\underline{82^{102} + 183^{103}}$ ?

1

$$4) 102(25$$

$$\frac{100}{2}$$

$$4) 103(25$$

$$\frac{100}{3}$$

$$2^{102} + 3^{103}$$

$$\rightarrow 2^2 + 3^3$$

$$\rightarrow 4 + 7 \rightarrow 1$$

Procedure :

(i) Power is divided

by 4

(ii) Rem  $\rightarrow 1|2|3$

↓  
power

(iii) Rem = 0  $\Rightarrow$  power  $= 4$

$$82^{102} \times 183^{103}$$

$$\rightarrow 4 \times 7$$

$$\rightarrow 8$$

find unit's place

$$183^{100}$$

$$\rightarrow 3^{100}$$

$$\rightarrow 3^4$$

$$\rightarrow 1$$

②

Find the number of factors of 3600?

$$N = 3600$$

$$N = 36 \times 100 = 6^2 \times 10^2 = 2^2 \times 3^2 \times 2^2 \times 5^2$$

$$N = 2^4 \times 3^2 \times 5^2$$

$$\begin{aligned}\text{No. of factors} &= (4+1) \times (2+1) \times (2+1) \\ &= 5 \times 3 \times 3 = 45\end{aligned}$$

$$N = a^m \times b^n \times c^q \dots \quad a, b, c \dots$$

No. of prime factors =  $m + n + q + \dots$

Together | Simultaneously | Meeting



$$\text{LCM}(20, 30, 50) = 300 \text{ min}$$

$$= 5 \text{ hrs}$$

Three bells P, Q, and R are rung periodically in a school. P is rung every 20 minutes; Q is rung every 30 minutes and R is rung every 50 minutes.

If all the three bells are rung at 12:00 PM, when will the three bells ring together again the next time? (GATE-2022)

- (A) 5:00 PM ✓
- (B) 5:30 PM
- (C) 6:00 PM
- (D) 6:30 PM

$$12 \text{ pm} + 5 \text{ hrs} = 5 \text{ pm}$$

$$\text{LCM}(20, 30, 50) = 2^2 \times 3^1 \times 5^2$$

$$= 300$$

=

$$\left. \begin{array}{l} 20 = 2^2 \times 5^1 \\ \hline \end{array} \right\}$$

$$\left. \begin{array}{l} 30 = 2^1 \times 3^1 \times 5^1 \\ \hline \end{array} \right\}$$

$$\left. \begin{array}{l} 50 = 2^1 \times 5^2 \\ \hline \end{array} \right\}$$

What is the smallest number, which divided by

4

7, 18, 56 and 36, leaves a remainder zero?

A) 504       $\div 9$

~~B) 392~~

~~C) 390~~

~~D) 1012~~

$\sum = 4$

$$\text{LCM} (7, 18, 56, 36) =$$

|

$\div 9$



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5 A number  $35786x625$  is completely divisible by 3. Which of the following are the values of  $x$ ?

- A) 0
- B) 1
- C) 2
- D) 3

MSQ

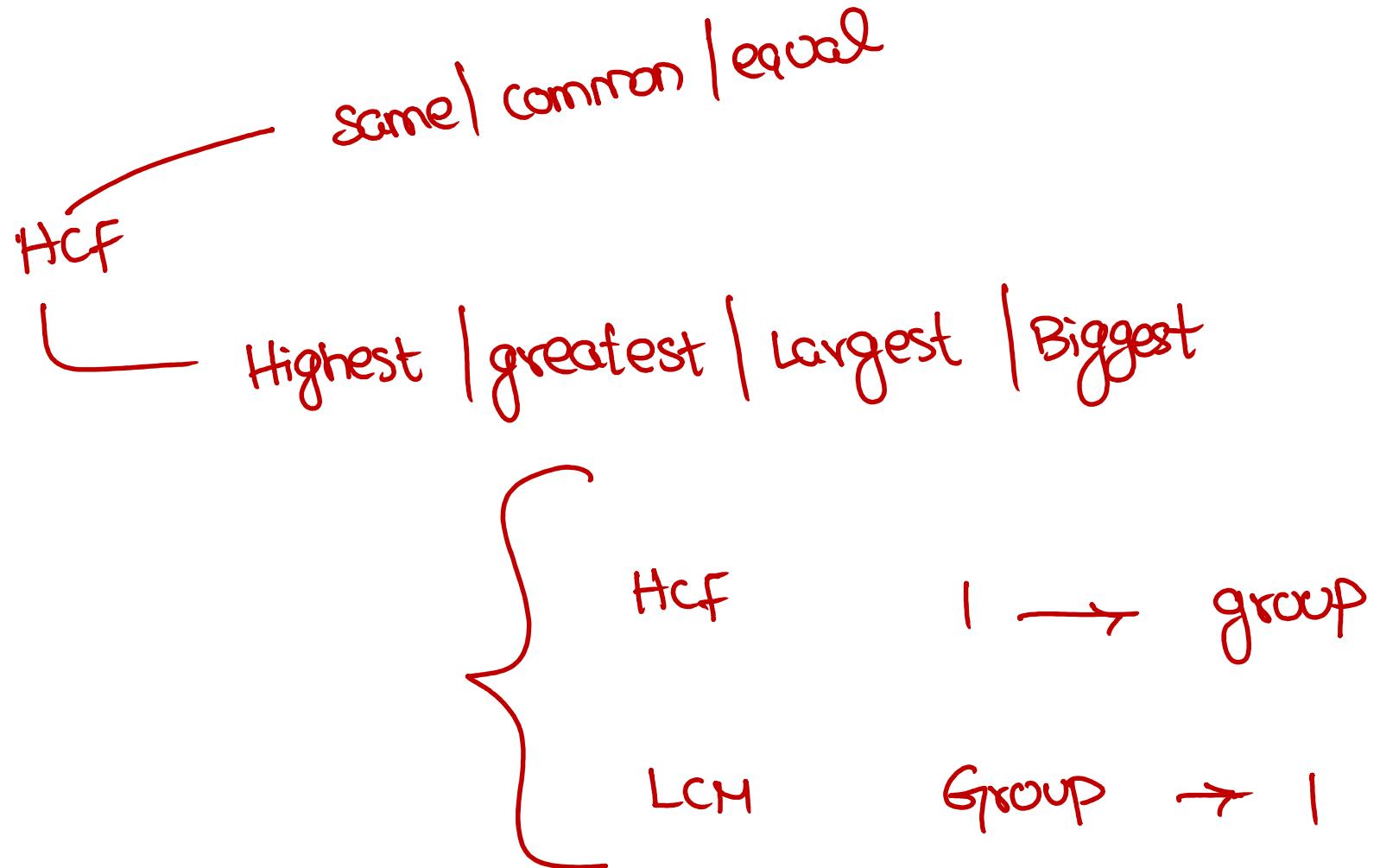
$$\cancel{3} \cancel{5} \cancel{7} \cancel{8} \cancel{6} \cancel{x} \cancel{6} \cancel{2} \cancel{5}$$

$\underbrace{\phantom{00}}$

$$18 + x$$

$\underbrace{\phantom{00}}$

$$x$$



## Time & Work, Pipes & Cisterns

/

chain Rule \*

$$\frac{M_1 D_1 H_1 E_1}{W_1} = \frac{M_2 D_2 H_2 E_2}{W_2}$$

⑥

24 men, working 10 hours a day, can build a wall in 18 days. In how many days will 15 men build the same wall working 12 hours a day?

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

A) 20 days

B) 24 days ✓

C) 8 days

D) 16 days

$$\frac{24 \times 18 \times 10}{6} = \frac{15 \times D_2 \times 12}{8}$$



Work = 192 pages

$$(P_l + P_t) - 48 \text{ days}$$

$$P_l - 192 \text{ days}$$

$$P_t - \frac{192}{3} \text{ days}$$

Paul and Peter can do a piece of work in 48 days. If Paul alone can do the work in 192 days. If  $P_l + P_t$  days, then calculate the number of days taken by Peter to complete the work alone.

$$1 P/d \rightarrow P_l$$

$$3 P/d \rightarrow P_t$$

- A. 64 days
- B. 85 days
- C. 54 days
- D. 84 days

$$\boxed{\text{LCM}(48, 192) = 192}$$

$$T = \frac{W}{E}$$

$$\left. \begin{array}{l} (A+B) - x \text{ days} \\ B - y \text{ days} \\ A - \frac{(x+y)}{|x-y|} \text{ days} \end{array} \right\}$$

8

P can dig a well in 5 hours. He invites Q and R, who

together can dig  $\left(\frac{5}{4}\right)$  th as fast as he can, to join him.

Speed

Td  $\frac{1}{S}$

$$P \Rightarrow 5 \text{ hrs} \quad a$$

$$(Q+R) \Rightarrow \frac{4}{5} \times 5 \text{ hrs} = 4 \text{ hrs} \quad b$$

He also invites S and T, who together can dig  $\left(\frac{8}{5}\right)$  th as

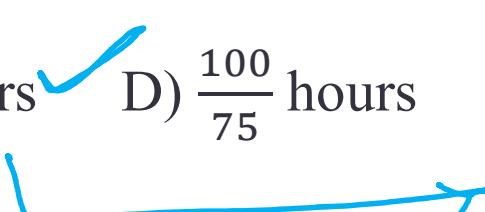
fast as he can, to join him. If these five people start digging the same well and they start together, how long

will it take for them to finish the job?

$$(S+T) \Rightarrow \frac{5}{8} \times 5 = \frac{25}{8} \text{ hrs} \quad c$$

A)  $\frac{100}{74}$  hours      B) None of the mentioned options

C)  $\frac{100}{77}$  hours      D)  $\frac{100}{75}$  hours



$$(P+Q+R+S+T) \Rightarrow$$

$$\text{Work} = \text{LCM}(5, 4, \frac{25}{8}) = \underline{\underline{100 \text{m}}}$$

Time

$$P \Rightarrow 5 \text{ hrs}$$

$$(Q+R) \Rightarrow 4 \text{ hrs}$$

$$(S+T) \Rightarrow \frac{25}{8} \text{ hrs}$$

$$P+Q+R+S+T \Rightarrow \frac{100}{77} \text{ hrs}$$

$$20 \text{m/h} - P$$

$$25 \text{m/h} - (Q+R)$$

$$32 \text{m/h} - (S+T)$$

Eff

$$\left( \frac{100}{\frac{25}{8}} \right)$$

$$\left( 20 + 25 + 32 - (P+Q+R+S+T) \right) = 77 \text{m/h}$$

$$\text{Tank}_c = 180 \text{ lit}$$

$A_f - 36 \text{ min}$

+ 5 lit/m

$B_f - 45 \text{ min}$

+ 4 lit/m

$C_e - 30 \text{ min}$

- 6 lit/m

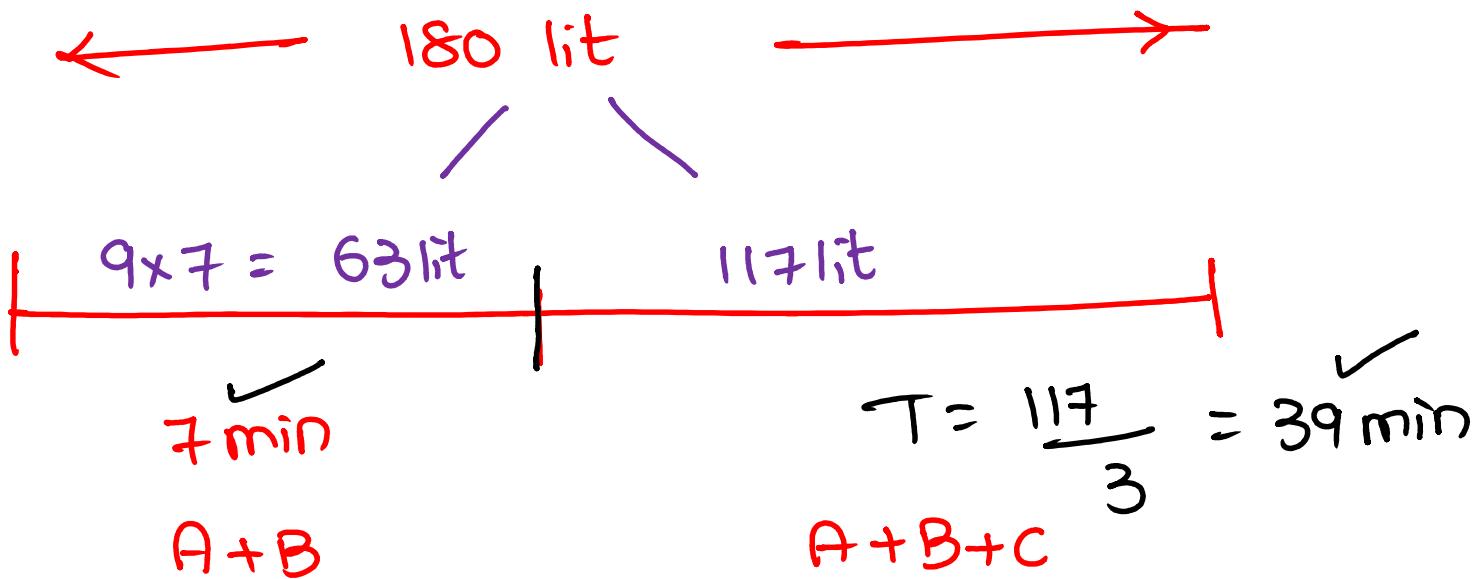
Time required by two pipes A and B working separately to fill a tank is 36 minutes and 45 minutes respectively. Another pipe C can empty the tank in 30 min. Initially, A and B are opened and after 7 minutes, C is also opened.

$$\text{LCM}(36, 45, 30) = 180 \text{ lit}$$

MSQ

Which of the following statements are true?

- A) Total time taken to fill the tank is 39 min.
- B) Time taken to fill the remaining tank is 39 min. ✓
- C) Total time taken to fill the tank is 46 min. ✓
- D) Time taken to fill the remaining tank is 30 min.



$$+ 5 + 4$$

$$= +9 \text{ lit/m}$$

$$+5 + 4 - 6 = +3 \text{ lit/m}$$

Total time = 46 min <sub>24</sub>



## Time & Distance

Average speed

Boats & streams

Trains

$$\text{Avg Speed} = \frac{\text{Total D}}{\text{Total T}}$$

$$= \frac{(240 + 660) \text{ kms}}{\left( \frac{240}{48} + \frac{660}{50} \right) \text{ hrs}}$$

10 A car travels first 240 kms of a journey at a speed of 48 kmph and the remaining 660 kms at a speed of 50 kmph. Find the average speed of the whole journey (in kmph)?

$$\begin{aligned} & \text{Time} = \frac{\text{Dist.}}{\text{Speed}} \\ & = \frac{900 \text{ kms}}{18.2 \text{ hrs}} \\ & \approx 49.45 \text{ kmph} \end{aligned}$$



(assume)  
 $D = 200 \text{ kms}$



3am  
R

$$(3\text{am} - 8\text{am}) \rightarrow 5\text{hrs}$$

$S_R$

40kmph

6 am

K

(6am - 10am)

← 4hrs

$S_R$

50kmph

6am - Late Time  
Ketuana Express leaves a city "Ramtam" at 3 a.m. and reaches another city "Ketuana" at 8 a.m on the same day. Another train

leaves "Ketuana" at 6 a.m. and reaches

"Ramtam" at 10 a.m on the same day. At

what time would the two trains meet at first?

A) 6:40 a.m.

B) 6:53 a.m.

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

C) 6:48 a.m.

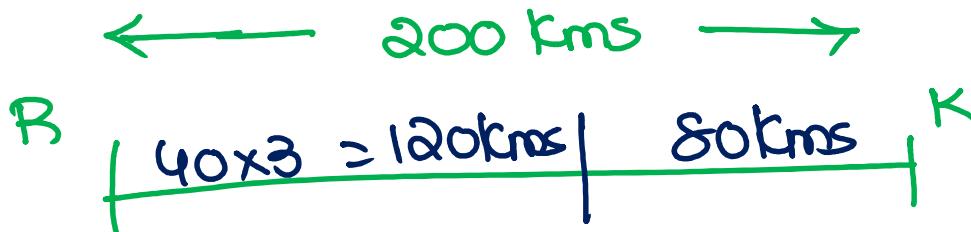
D) 6:28 a.m.

6am

3am - 6am  
3 hrs

$$T = 53 \text{ min } \frac{1}{3} \text{ min}$$

$$= 53 \text{ min } \frac{1}{3} \times \frac{20}{60} \text{ sec}$$



$s_R \rightarrow$   
40kmph

$s_K \leftarrow$   
50kmph

$T = 53 \text{ min}$   
20sec

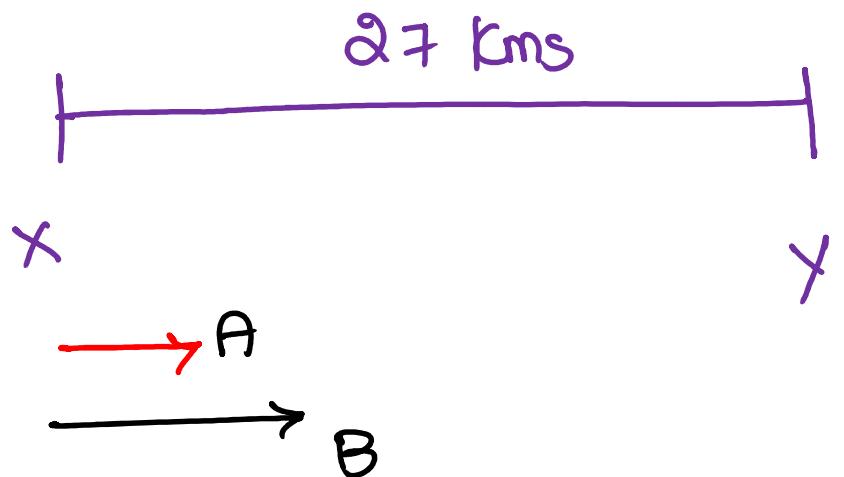
6am + 53 min  
20sec

= 6:53:20  
am

$$T = \frac{D}{RS} = \frac{80}{40+50} = \frac{80}{90} \text{ hrs}$$

$$T = \frac{8}{3} \times \frac{20}{60} \text{ min} = \frac{160}{3} \text{ min} = 53 \frac{1}{3} \text{ min}$$





(12)

Same Time

A and B walk from X to Y, a distance of 27 km at 5 kmph and 7 kmph respectively. B reaches Y and immediately turns back meeting A at Z. What is the distance from X to Z?

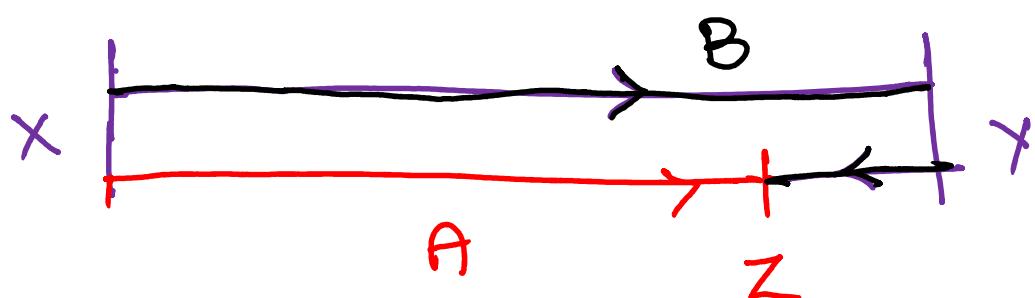
DdS

- A. 2.5 km      B. 20 km

C. 22.5 km

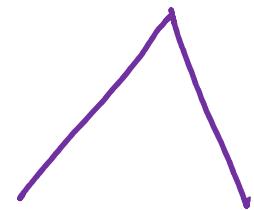
- D. 24 km

$$\frac{D_A}{D_B} = \frac{s_A}{s_B}$$



$$D_A : D_B = 5 : 7$$

$$D_A + D_B = 54 \text{ kms}$$



$$D_A : D_B = 5 : 7$$

$\underbrace{\phantom{0}}$

$$D_A = \frac{5}{12} (54) = 22.5 \text{ kms}$$

$\begin{matrix} 9 \\ 18 \\ \cancel{12} \\ 4 \end{matrix}_2$

## Boats & streams

(13)

To travel a certain distance in downstream it takes 10 hrs, to travel the same distance in upstream it takes 3 hrs more and stream rate is 6 kmph, find speed of boat still in water?

$$\rightarrow S_S = 6 \text{ kmph}$$

$$T_{DS} = 10 \quad | \quad T_{US} = 13 \text{ hrs}$$

- A) 23 km/hr      B) 40 km/hr  
 C) 46 km/hr      D) 28 km/hr

$$T \propto \frac{1}{S}$$

Distance  
- Constant

$$\frac{T_{DS}}{T_{US}} = \frac{S_{US}}{S_{DS}} \Rightarrow \left( \frac{10}{13} = \frac{S_B - S_S}{S_B + S_S} \right) \Rightarrow S_B = 46 \text{ kmph}$$





## Percentages

✓  $\% \text{ change} = \frac{\text{change}}{\text{initial value}} \times 100\%$

✓ Net Effect | Population

✓ Remaining | Left | Balance | Rest

M1

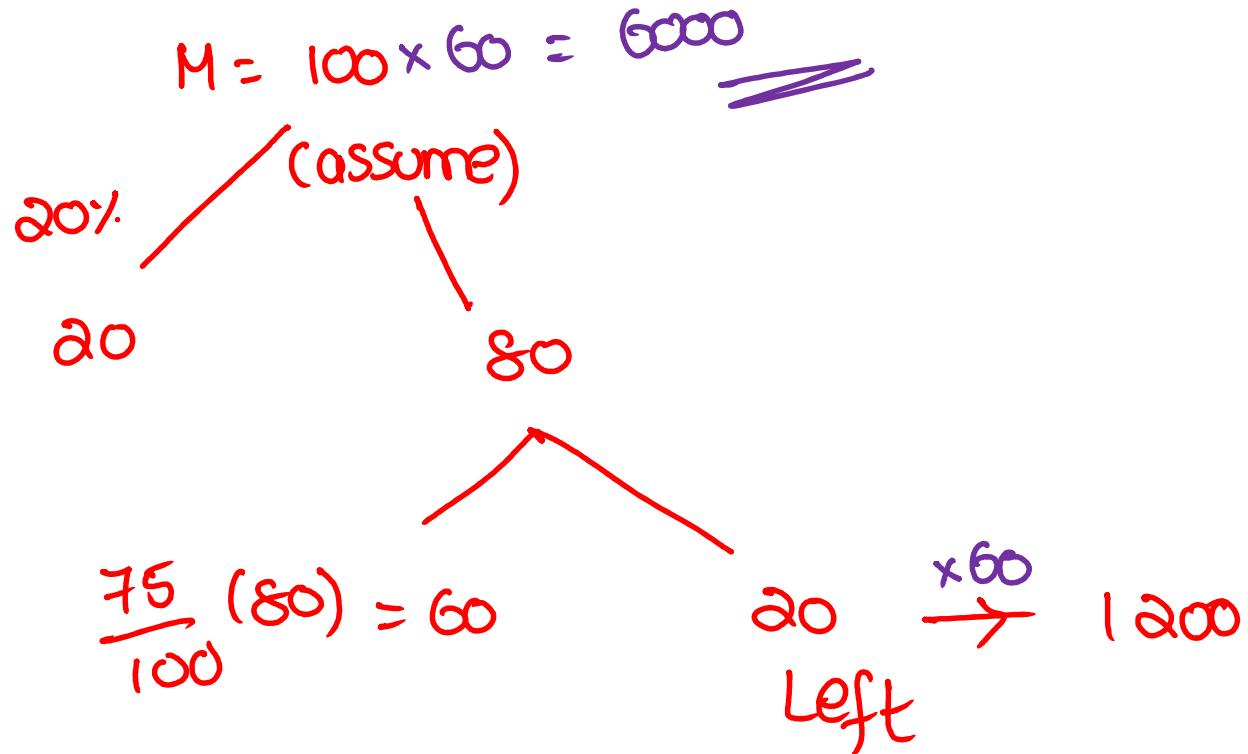
M 20%↓

75%↓ 1200

$$M \times \underbrace{80\% \times 25\%}_{\text{Remainder}} = 1200 \Rightarrow M \times \frac{20}{100} \times \frac{1}{4} = 1200$$

$$\Rightarrow M = \underline{\underline{6000}}$$

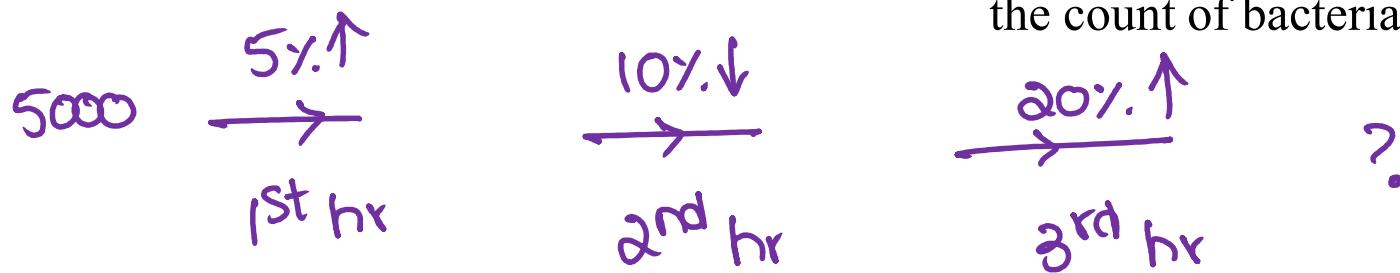
MQ



$$\frac{1200}{20} = 60$$

Net effect | population

15



GATE

$$5000 \times 105\% \times 90\% \times 120\%$$

$$= 5670$$

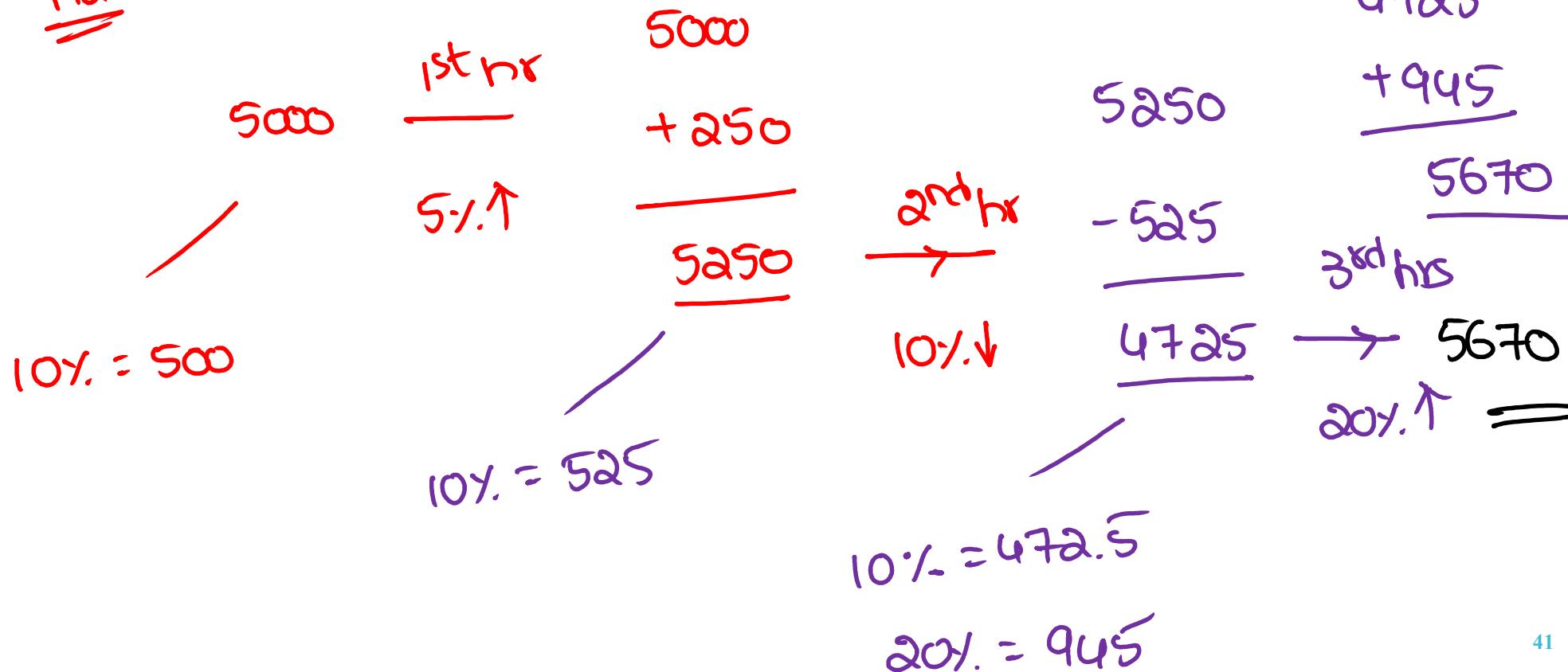
      

$$\Delta Y = \frac{\Delta}{100}$$

The bacteria in a culture grow by 5% in the first hour, decreases by 10% in the second hour and again increases by 20% in the third hour. If the original count of bacteria in a sample is 5000, find the count of bacteria at the end of 3 hours?

$$10\% = \frac{1}{10}$$

M2



$N = 100$  (assume)

16

A number is mistakenly divided by 5 instead of multiplied by 5; find the percentage change in the result due to the mistake.

Ans: 96%

$$100 \times 5 = 500 \text{ (correct)}$$

$$\cancel{500} \rightarrow 20$$

$$(i) \% \text{ error} = \% \text{ mistake} = \frac{480 \times 100\%}{500}$$

$$\frac{100}{5} = 20 \text{ (wrong)}$$

$$\% \text{ change} = \frac{\text{change}}{\text{initial}} \times 100\%$$

initial

$$(ii) \% \text{ Correction} =$$

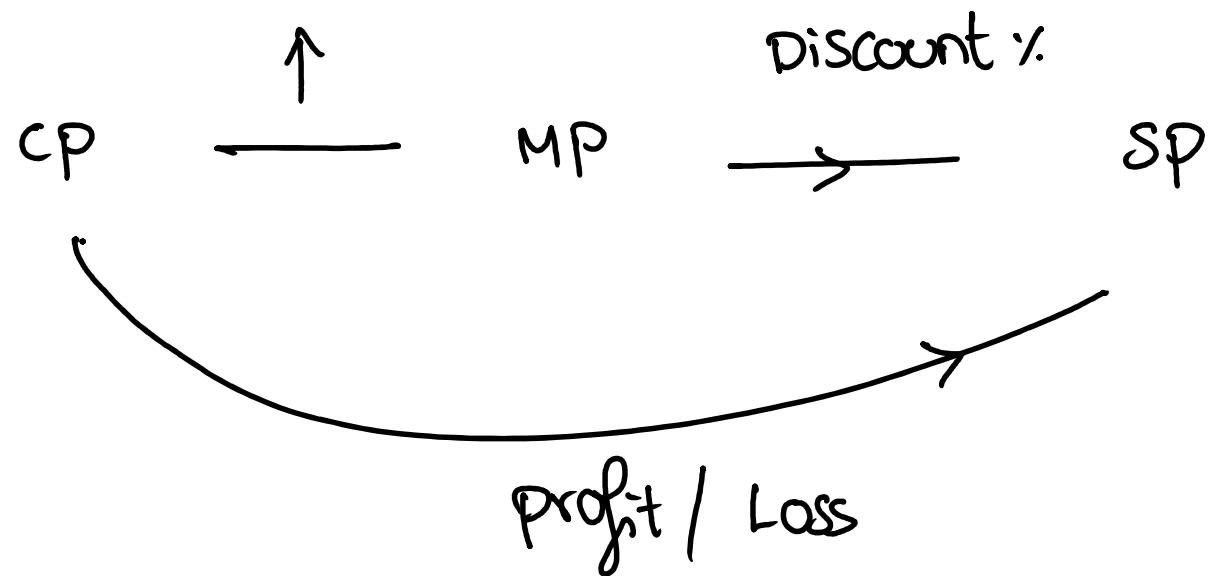
$$\cancel{20} - \checkmark 500$$

$$\frac{\cancel{480}}{20} \times 100\% = 2000\%$$

====



## Profit & Loss, Discount



Sahil purchased a machine at Rs 10000,

17

then got it repaired at Rs 5000, then gave its transportation charges Rs 1000.

$$CP = 10000 + R + T = 16000$$

Then he sold it with 50% of profit. At what price he actually sold it.

50%

$$SP = 16000 + 8000 = 24000/-$$

$$SP = 150\% CP = \frac{150}{100} \times 16000 = 24000 \quad \underline{\underline{}}$$



$$\begin{array}{l} \text{Gain} \\ = \\ \$60 \downarrow \end{array}$$

Gain

- John sold an article at 20% gain. If he had charged \$60 less, his gain would have been 15%. What is the cost price of the article?

- A) \$1200      B) \$1400  
C) \$1000      D) \$1100

CP - fixed

$$5\% \cdot CP = 60 \Rightarrow \frac{5}{100} CP = 60$$

20

$$\Rightarrow CP = 1200$$

SP ↓ ⇒ Profit ↓



(19)

Items	Cost (Rs.)	Profit %	Marked Price (Rs.)
P	5400 ✓	---	5860
Q	7200	25	10000

Details of prices of two items P and Q are presented in the above table. The ratio of cost of item P to cost of item Q is 3: 4. Discount is calculated as the difference between the  $D = MP - SP$  marked price and the selling price. The profit percentage is calculated as the ratio of the difference between selling price and cost, to the cost

$$\frac{CP_P}{CP_Q} : \frac{CP_Q}{CP_Q} = 3 : 4$$

$\cancel{\times 1800}$       |  $\cancel{\times 1800}$

5400      7200

CP<sub>Q</sub> (given)

$$\left( Profit\% = \frac{Selling\ price - Cost}{Cost} \times 100 \right)$$

The discount on item Q, as a percentage of its marked price, is \_\_\_\_\_

(GATE)

- A) 25      B) 12.5      C) 10      D) 5

$$SP = 125\% \cdot CP = \frac{5}{125} \times \frac{1800}{7200}$$

$$= \frac{1800}{7200}$$

$$= 9000$$

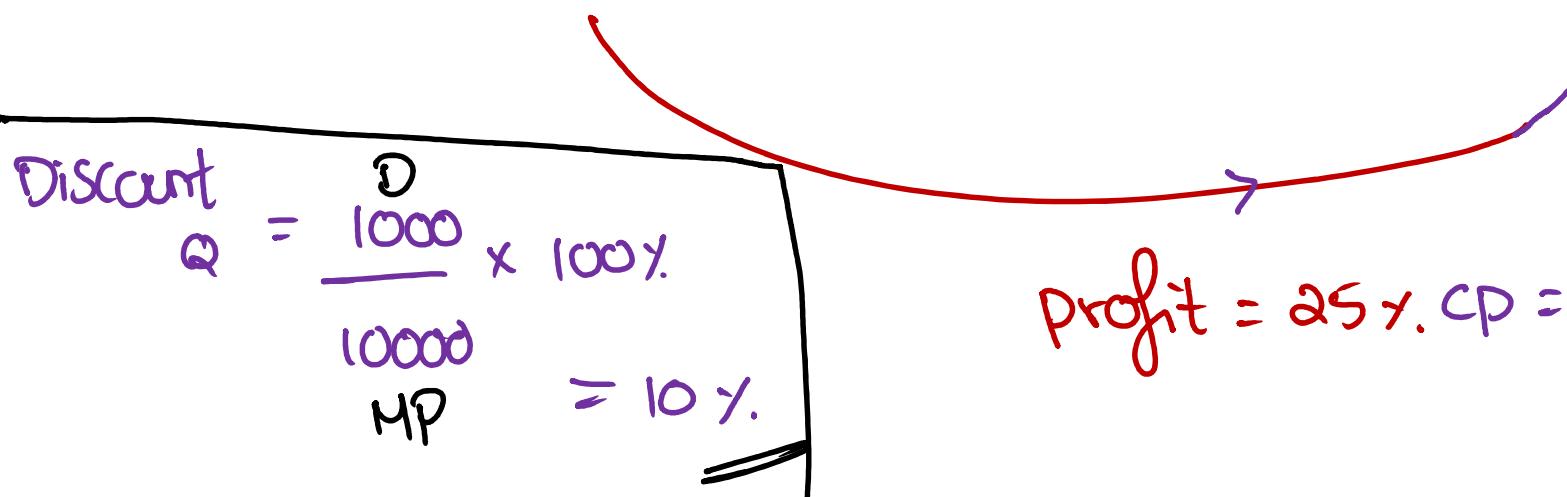
Discount = 1000

$$CP_Q = 7200$$

$$MP_Q = 10000$$

$$SP_Q = 7200 + 1800$$

$$SP_Q = 9000$$





M1

①  $SP_1 = SP_2$

② Two items

③  $\% \text{ Profit} = \% \text{ Loss}$

$$\text{overall} = \left( \frac{x^2}{100} \right) \% \text{ Loss}$$

20

Two cows were sold for Rs. 12,000 each, one at a loss of 20% and the other at a gain of 20%.

Which of the following statements are true?

Indicate all true statements.

MSQ

A) Whole transaction results to Rs. 1000 Profit.

B) Whole transaction results to Rs. 1000 Loss.

C) Whole transaction results to 4% Profit.

D) Whole transaction results to 4% Loss. ✓

$$\Rightarrow \frac{\cancel{20}}{\cancel{100}} \% \text{ Loss}$$

$$\text{Overall SP} = \text{SP1} + \text{SP2} = 24000/-$$

$$\text{Overall Loss} = 4\% \text{ CP} = 1000/-$$

$$\left. \begin{array}{l} \text{SP} = 96\% \text{ CP} \\ \\ 24000 = 96\% \text{ CP} \\ \quad \quad \quad \div 24 \\ 1000 = 4\% \text{ CP} \end{array} \right\}$$

M2

$$SP_1 = 12000$$

20% loss

$$SP_1 = 80\% CP_1$$

$$CP_1 = 15000$$

$$\text{Overall SP} = 24000/-$$

$$\checkmark \text{Overall CP} = 25000/-$$

$$SP_2 = 12000$$

20% profit

$$SP_2 = 120\% CP_2$$

$$CP_2 = 10000$$

$$\text{overall LOSS} = \frac{1000}{25000} \times 100\%$$

$$= 4\% \quad _{54}$$

## SI & CI



Compound Interest

Interest is default

calculated on principal

$$CI = CA - P$$

|

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

$$R = \underline{\underline{\%}} \text{ Per annum}$$

$$P = 6875$$

$$1^{\text{st}} \text{ year CI} = 20\% \cdot (6875)$$

$$1^{\text{st}} \text{ year CI} = 1375$$

$$2^{\text{nd}} \text{ year CI} = 1375 + 275 = 1650$$

21

On a sum of Rs. 6875, find difference between  
second year and third year C.I if rate of interest is  
 20% per Annum?

- (a) Rs. 275
- (b) Rs. 300
- (c) Rs. 330
- (d) Rs. 325
- (e) Rs. 290

Interest for  
 interest

Compound Interest

$$R = 20\% - 1 \text{ year}$$

20%

$$2^{\text{nd}} \text{ year CI} = 1650 \quad | \quad 20\%$$

$$3^{\text{rd}} \text{ year CI} = 1650 + 20\% (1650) = 1980$$

330

Ma

$$\text{CI for 3 years} = 6875 (120\%)^3 - 6875$$

$$\text{CI for 2 years} = 6875 (120\%)^2 - 6875 \quad \rightarrow \text{CI for 3^rd year}$$

M3

P  
6875

1st yr  
→  
20%.

$$\begin{array}{r}
 & 6875 & & & \text{1st year CI} \\
 & + 1375 & & & \\
 \hline
 & 8250 & & & \\
 \text{P'} & & & & \\
 & & \xrightarrow{20\%} & & \\
 & & 9900 & & \\
 \text{P''} & & & & \\
 & & & \xrightarrow{20\%} & \\
 & & & 11880 & \\
 & & & & \\
 & & & \downarrow & \\
 & & & \text{CA} &
 \end{array}$$

1st year CI  
 2nd year CI  
 3rd year CI

22

At what rate% compound interest will a sum of money become eight times in 3 years?

$R = ?$

$$P \xrightarrow[3 \text{ years}]{\times 8} 8P$$

- A. 100%
- B. 200%
- C. 300%
- D. 400%

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

$$\Rightarrow \left( 1 + \frac{R}{100} \right)^3 = 2$$

$$2^3 = 8 \Rightarrow \left( 1 + \frac{R}{100} \right)^3$$

$R = 100\%$

M2

$$P \xrightarrow{x2} 2P \xrightarrow{x2} 4P \xrightarrow{x2} 8P$$

1st y                    2nd y                    3rd y

$$P \xrightarrow{100\% \uparrow} 2P$$

1 year

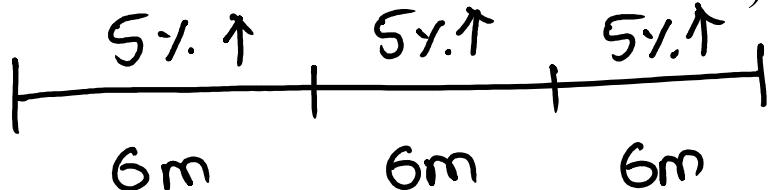
R = 100% per Annum

Compound interest of Rs. 3000 at 10% per annum for  $1\frac{1}{2}$

years will be (interest compounded half yearly).

23

- A) Rs. 473    B) Rs. 374    C) Rs. 495    D) Rs. 347



$$R = 10\% - \text{1 year}$$

GATE

$$CI = \underbrace{3000 (105\%)^3}_{CA} - \underbrace{3000}_P$$

$5\% - \frac{1}{2} \text{ year}$

$$CI = 472.875 \approx 473$$

ESE

$$CI_{\frac{1}{2}} = 5\% (3000) = 150$$

/ 5%

$$CI_{\frac{1}{2}} = 150 + 7.5 = 157.5$$

$$CI_{\frac{1}{2}} = 157.5 + 7.875 = 165.375$$

/ 5%

CI for  $1 \frac{1}{2}$  year = 472.875

Averages

maintain equality

equal distribution

$$\text{Average} = \frac{\text{Sum of terms}}{\text{No. of terms}}$$

$$\Rightarrow \text{Sum} = \text{Avg} \times \text{No. of terms}$$

24

Average of five positive numbers is 'm'. If each number is increased by 18%, then the value of 'm':

If each number is  $+/- \times \div$

- A. is increased by 18% ✓
- B. is increased by 110%
- C. remains unchanged
- D. is increased by 10%

by  $k$ , then average is also

$+/- \times \div$  by  $k$ .





The average of 7 numbers is 50. The average of  
 fist three of them is 40, while the average of the  
 last three is 60. What must be the remaining

25

number?

Sum = Avg x No. of

- A. 65
- B. 55
- C. 50 ✓
- D. 45

$$x_{1-3} + x_4 + x_{5-7} = 50 \times 7$$

/                    |

$$(40 \times 3) + x_4 + (60 \times 3) = 350$$

$$x_4 = \underline{\underline{50}}$$



26

The average score of Rahul Dravid in a certain number of  
 innings is 43. He then played another 8 innings in which he  
 $\overline{\text{Avg} = 96+1+22+67+39+48+69+2}$   
 scored 96, 1, 22, 67, 39, 48, 69, 2. What is the new average of  
 Dravid after those 8 innings?

- A) Cannot be determined without the total number of innings
- B) New average is higher
- C) New average is lower
- D) New average is same

$$\begin{array}{l} \text{New } \rightarrow (n+8) \text{ innings} \\ \text{Avg} \quad \downarrow \\ 43 \end{array} \left\{ \begin{array}{l} \text{Avg - } n \text{ innings - 43} \\ \text{Avg - } 8 \text{ innings - 43} \end{array} \right.$$



$$\underline{M + N + S} = 4000 \times 3 = 12000$$

$$\underline{N + S + P} = 5000 \times 3 = 15000$$

$$\Rightarrow P - M = 3000$$

$$P = 6000, M = 3000$$

27

The average of the monthly salaries of M, N and S is ₹ 4000. The average of the monthly salaries of N, S and P is ₹ 5000. The monthly salary of P is ₹ 6000. What is the monthly salary of M as a percentage of the monthly salary of P? (GATE – 2022)

- (a) 50%      (b) 75%  
 (c) 100%      (d) 125%

$$M = \frac{1}{2} P = 50\% P$$



# Ratio, Proportion, Variations, Partnership , Ages

Profit Share ratio  $\rightarrow$  Investment  $\times$  Time

28 In a partnership business the monthly investment by three friends for the first six months is in the ratio  $3: 4: 5$ . After six months, they had to increase their monthly investments by 10%, 15% and 20%, respectively, of their initial monthly investment. The new investment ratio was kept constant for the next six months.

What is the ratio of their shares in the total profit (in the same order) at the end of the year such that the share is proportional to their individual total investment over the year? (GATE – 2022)

- (a)  $22 : 23 : 24$  (b)  $22 : 33 : 50$  (c)  $33 : 46 : 60$  (d)  $\cancel{63 : 86 : 110}$

6 months

$$P:Q:R = 3:4:5$$

$$P = 3000$$

$$Q = 4000$$

$$R = 5000$$

next 6 months

$$P' = 3000 + 300$$

10%↑

$$Q' = 4000 + \underbrace{400 + 200}_{15\% \uparrow}$$

15%↑

$$R' = 5000 + 1000$$

20%↑

Profit share ratio

$$\Rightarrow 63: 86: 110$$

$$\Rightarrow (3000 \times 6 + 3300 \times 6) : (4000 \times 6 + 4600 \times 6) : (5000 \times 6 + 6000 \times 6)$$



29

$$\frac{P}{q} = \frac{1}{2}, \quad \frac{r}{s} = \frac{5}{3}$$

$$\frac{r}{s} = \frac{4}{5}, \quad \frac{s}{u} = \frac{2}{3}$$

Ratio

If

$$p : q = 1 : 2 \quad \frac{P}{u} = \frac{P}{q} \times \frac{q}{s} \times \frac{s}{u}$$

$$q : r = 4 : 3$$

$$r : s = 4 : 5$$

$$= \frac{1}{2} \times \frac{4}{3} \times \frac{4}{5} \times \frac{2}{3}$$

and  $u$  is 50% more than  $s$ , what is the ratio  $p : u$ ?

- (a) 2:15
- (b) 16 : 15
- (c) 1 : 5
- (d) 16 : 45 ✓

$$u = 150\% \cdot s$$

$$u = \frac{\frac{3}{2}}{\frac{100}{100+50}} s$$

$$\Rightarrow \frac{s}{u} = \frac{2}{3}$$



$$P \propto L^2$$

$$P = K L^2$$

$$P = 1600, \quad L = 10$$

$$1600 = K \times 10^2 \Rightarrow K = 16$$

(A) 768

(B) 832

(C) 1440

(D) 1600

$P = 16 L^2$

$$P' = 16(4^2 + 6^2) = 16 \times 52$$

$$= 832$$

30

The price of a wire made of a superalloy material is proportional to the square of its length. The price of 10 m length of the wire is Rs. 1600. What would be the total price (in Rs.) of two wires of lengths 4 m and 6m? (GATE 2018)

Variations

$$(a+b)^2 \neq a^2 + b^2$$



## Data Interpretation \*\*

Average

Ratio

percentage

Profit & Loss

Visualization

SCHOOL	2008	2009	2010	2011	2012
M	732	840	900	920	925
K	1035	940	1200	1400	1500
N	750	600	830	575	900
W	500 •	550 •	450 •	600 •	525 •
D	1500	1625	1700	1475	1800
A	800	840	875	925	785
<b>TOTAL</b>	<b>5308</b>	<b>5395</b>	<b>5955</b>	<b>5895</b>	<b>6434</b>

least

31

From which school did the least number of students go abroad over the years?

A) W

B) N

C) M

D) K



QP  
✓  
450 → 600  
SP

SCHOOL	2008	2009	2010	2011	2012
M	732	840	900	920	925
K	1035	940	1200	1400	1500
N	750	600	830	575	900
W	500	550	450 → 600	525	
D	1500	1625	1700	1475	1800
A	800	840	875	925	785
<b>TOTAL</b>	<b>5308</b>	<b>5395</b>	<b>5955</b>	<b>5895</b>	<b>6434</b>

32) What was the percentage increase in the number of students going abroad from school "W" from 2010 to 2011?  $\% \uparrow = \frac{150}{450} \times 100\%$

A) 50%

B)  $33\frac{1}{3}\%$

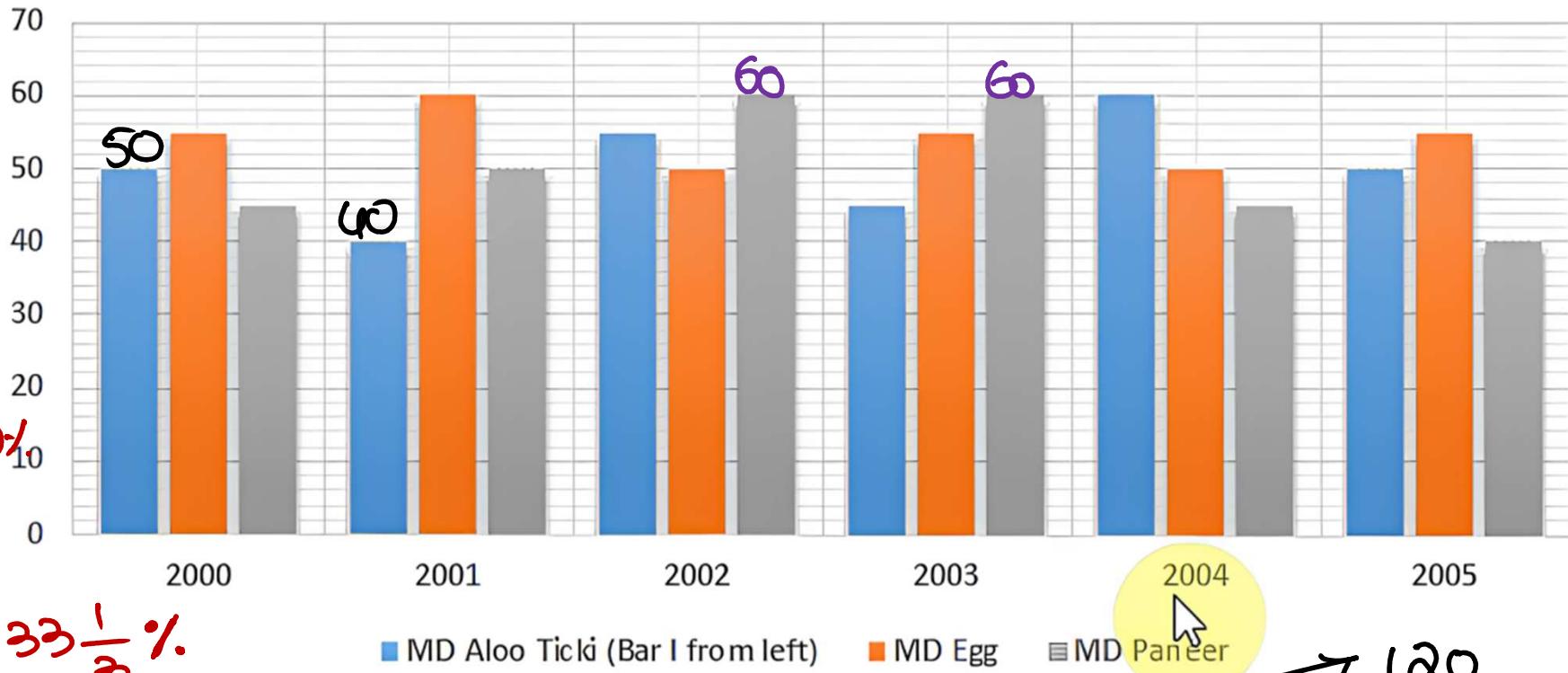
C)  $66\frac{2}{3}\%$

D) 25%

~~450~~  
3



## Production of 3 different kinds of burgers by MD over a period of 6 years



The total production of burger MD Paneer in 2002 and 2003 is what percent of

the total production of Burger MD Aloo Ticki in 2000 and 2001? → 90

- A) 115.55%    B) 133.33%    C) 122.22%    D) 96.67%



## Mixtures & Allegations

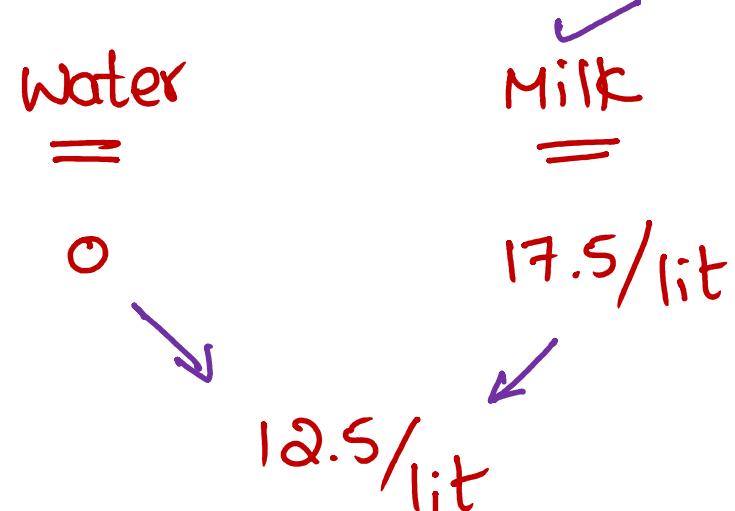
/  
added | melted



34

In what ratio a milkman should mix water with milk, costing Rs. 17.50 per litre so that the mixture is worth Rs. 12.50 per litre?

(Note: Consider that the water is available free of cost)



A. 2: 5

C. 5: 9

B. 3: 1

D. 5: 2

$$(17.5 - 12.5) : (12.5 - 0) \Rightarrow 2 : 5$$



$$C = A:B = 1:1$$

$$A = 10 \text{ kgs}$$

$$G_A:C_A = 2:3$$

$$G_B:C_B = 3:7$$

$$G_A = 4$$

$$C_A = 6$$

$$G_A:C_A = 2:3$$

$$5 \xrightarrow{\times 2} 10$$

35

Two alloys A and B contain gold and copper in the ratios of 2:3 and 3:7 by mass, respectively. Equal masses of alloys A and B are melted to make an alloy C. The ratio of gold to copper in alloy C is \_\_\_\_\_.

(GATE- 2018)

- (a) 5:10      (b) 7:13 ✓  
 (c) 6:11      (d) 9:13
- $$\frac{G_C}{C_C} = \frac{G_A + G_B}{C_A + C_B} = \frac{4+3}{6+7} = \frac{7}{13}$$



*initial Spirit*

$$S_{\text{left}} = 10 \left( 1 - \frac{1}{10} \right)^3$$

*Remove*  
 /      3      *no. of time*  
 Total

$$= 10 \times \frac{9^3}{10^3}$$

$$= 7.29 \text{ lit}$$

A container originally contains 10 litres of pure spirit. From this container 1 litre of spirit is replaced with 1 litre of water, Subsequently, 1 litre of the mixture is again replaced with 1 litre of water and this process is repeated one more time. How much spirit is now left in the container?

(GATE - 11)

- (a) 7.58 liters
- (b) 7.84 liters
- (c) 7 liters
- (d) 7.29 liters

$$S=10, \quad W=0$$

①

$$1 \text{ lit}^-$$

$$S=9, \quad W=0$$

$$1 \text{ lit}^+ w$$

$$\underbrace{S=9, \quad W=1}$$

$$\overline{T=10 \text{ lit}}$$

②

$$1 \text{ lit}^-$$

$$\left(\frac{1}{10}\right)$$

$$S' = 9 - \frac{1}{10}(9) = \underline{\underline{9-0.9=8.1}}$$

$$W' = 1 - \frac{1}{10} \times 1$$

$$W' = 1 - 0.1 = \underline{\underline{0.9}}$$

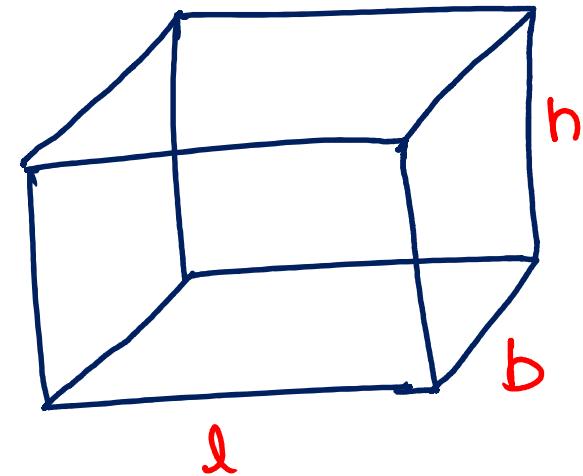
$$\text{TSA}_{\text{Cuboid}} = 2(lb + bh + hl)$$

ceiling      floor  
 Top, Bottom      |  
 L, R      /  
 f, Back

{

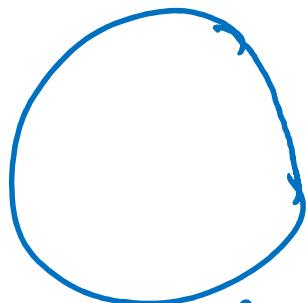
(Area 4 walls) =  $2bh + 2lh$

$$\text{Room} = 2h(l+b)$$



$$\pi r^2 = 616$$

$$\Rightarrow \frac{22}{7} \times r^2 = 616 \quad 28$$

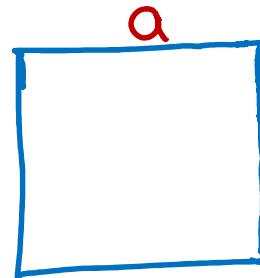


$$r = 14 \text{ cm}$$

$$\text{Length of wire} = 2\pi r = 88 = 4a \Rightarrow a = 22$$

(37) A wire bent in the form of a circle encloses an area of 616 sq. cms. If the same wire is bent in the form of a square what will be the area enclosed by it?

- A. 324 sq. cms
- B. 484 sq. cms
- C. 488 sq. cms
- D. 576 sq. cms



$$\text{Area} = a^2$$



$$l = 30, b = 50, h = 70$$

$$A_{\text{4walls}} = 2h(l+b) = 11200$$

$$l' = 15, b' = 25, h' = 100$$

$$A'_{\text{walls}} = 2 \times 140 \times 40 = 11200$$

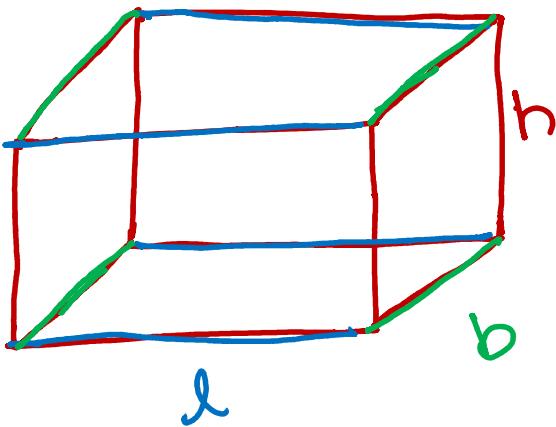
38

The ratio of length, breadth, and height of a room is 3: 5: 7. If the length and breadth of the room are halved while the height is doubled, then the area of four walls of the room will:

- A. increase by 20%
- B. remain same ✓
- C. decrease by 12.5%
- D. increase by 12.5%







c)  $2(l^2b^2 + b^2h^2 + h^2l^2)$

39

The product of the 12 edges of a rectangular box is the same as  $l^4 b^4 h^4$

MSQ

Which of the following statements are True?

- ~~Statement A: 4<sup>th</sup> power of the volume of the box~~
- ~~Statement B: Product of the areas of 6 faces of the box~~
- Statement C: Sum of the squares of the areas of 6 faces of the box

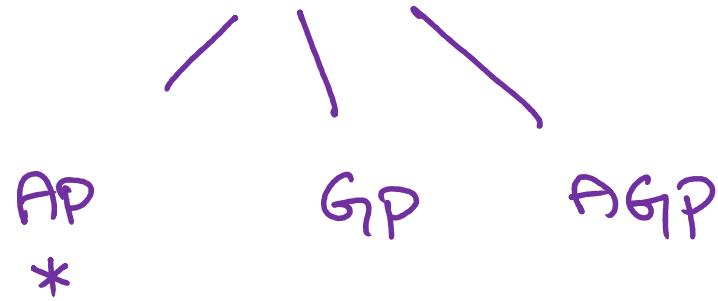
A)  $V^4 = (lbh)^4 \checkmark$

B)  $lb \times lb \times bh \times bh \times hl \times hl = l^4 b^4 h^4$

T, Bt                    L, R                    F, Br



## Progressions



$$\text{Sum}_{AP} = \frac{n}{2} (a + l)$$

40

The ratio of 'the sum of the odd positive integers from 1 to 100' to 'the sum of the even positive integers from 150 to 200' is \_\_\_\_\_.

(GATE – 2020)

151 to 200  
 {

$$\text{Sum} = \frac{50}{2} (1+99) = 50 \times 50$$

- a) 45:95 b) 1:2

25      25  
 even ' odd

$$150, 152, 154, \dots 200$$

c) 50:91 d) 1:1

$$\text{Sum} = \frac{26}{2} (150+200) = 13 \times 350$$

$$\frac{50 \times 50}{13 \times 350} = \frac{50}{91}$$



$$AM = \frac{a+b}{2} = 50$$

$$\Rightarrow a+b = 100$$

$$GM = \sqrt{a \times b} = 40 \Rightarrow a \times b = 40^2 = 1600$$

$$(a-b)^2 = (a+b)^2 - 4ab = 3600$$

$$(a-b) = 60$$

(41)

The arithmetic mean of 2 numbers is 50 and their geometric mean is 40. LCM of the numbers will be.

A) 150

B) 120

C) 100

D) 80

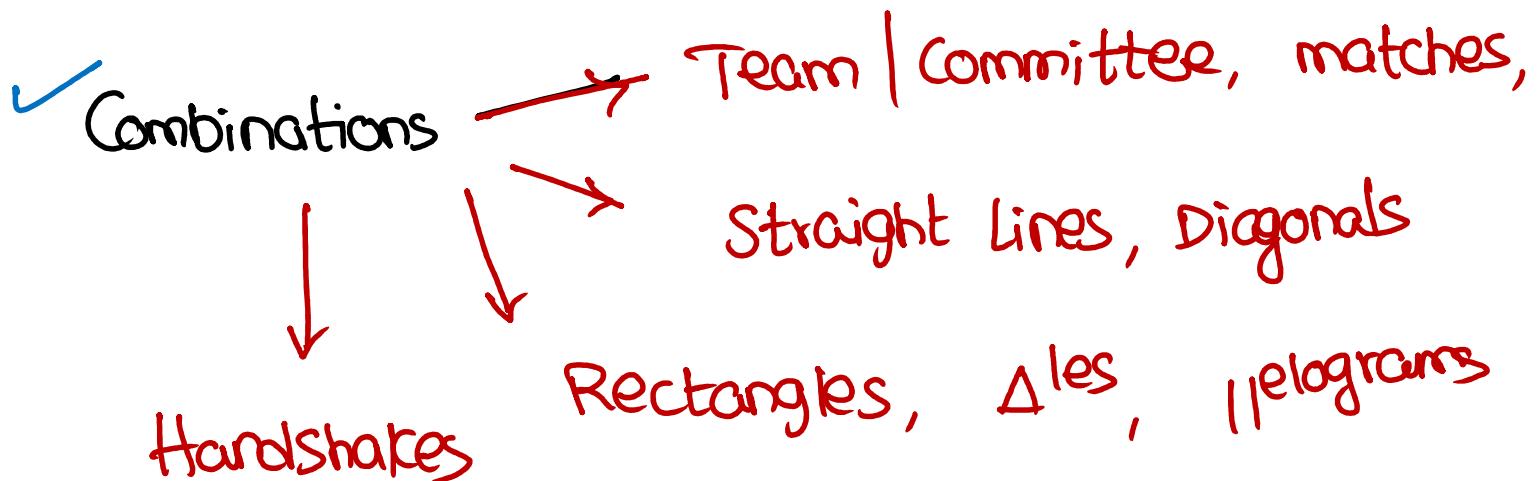
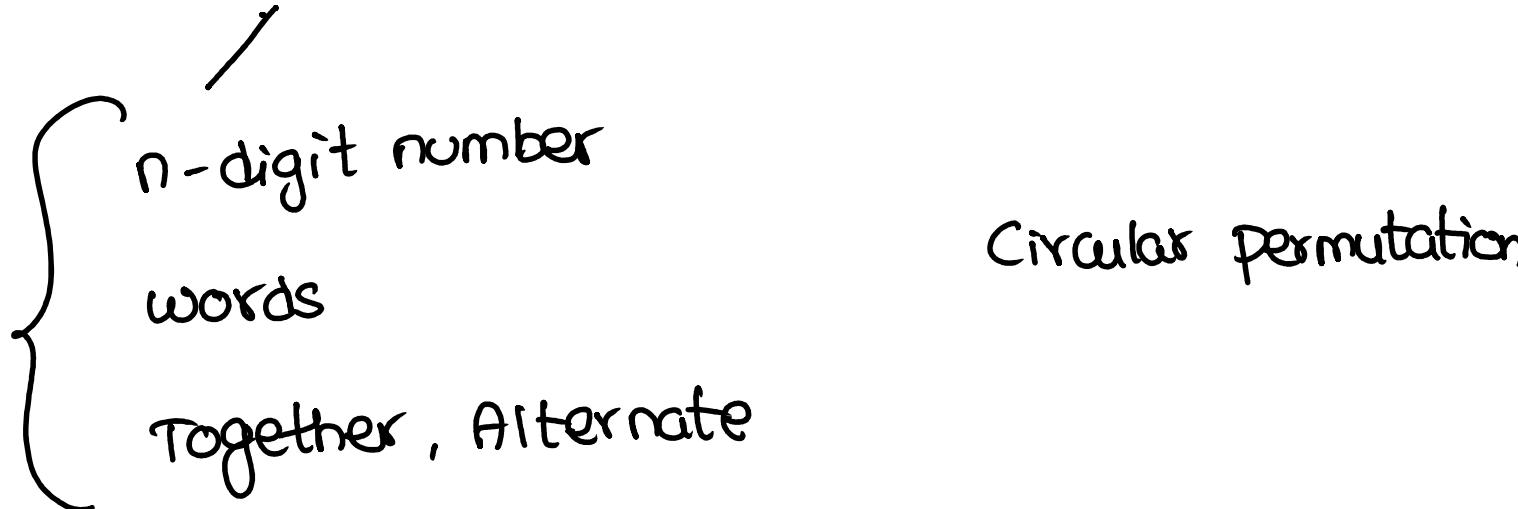
$$a = 80, b = 20$$

$$LCM(80, 20) = 80$$

Smallest number divided  
by 80 & 20 108



## Permutations & Combinations



Permutation → Selection & Arrangement

$$nP_r = nC_r \times r!$$

$\Rightarrow nC_r = \frac{nP_r}{r!}$

$$nP_1 = n$$

$$nP_2 = n(n-1)$$

$$nP_3 = n(n-1)(n-2)$$

$$nC_1 = n$$

$$nC_3 = \frac{n(n-1)(n-2)}{3!}$$

$$nC_2 = \frac{n(n-1)}{2!}$$

How many signals can be made using five different flags  
 by raising any number at a time?

(42)

A B C D E

AB

BA

$$\begin{array}{cccc}
 5 & \frac{5 \times 4}{\downarrow} & \frac{5 \times 4 \times 3}{\downarrow} & \frac{5 \times 4 \times 3 \times 2}{\downarrow} \\
 & 5P_3 & & 5P_4 \\
 & & & \frac{5 \times 4 \times 3 \times 2 \times 1}{\downarrow} \\
 & & & 5P_5
 \end{array}$$

$$5 + 20 + 60 + 120 + 120 = 325$$



words  
=

43

In how many ways can the letters of the word 'CONSTANT' be arranged such that the word always starts with a vowel?

A. 5,050      B. 1,440

C. 2,520      D. 10,080

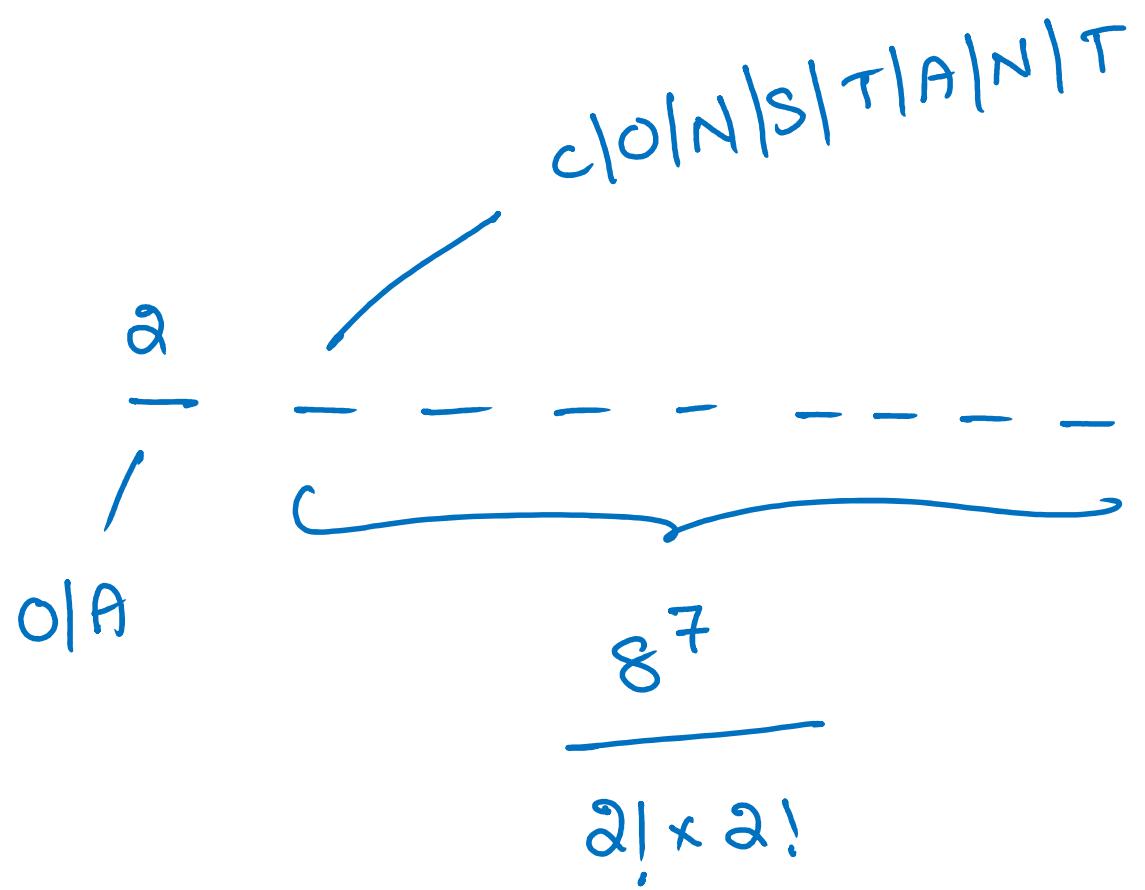
default

→ all letters

$$\begin{array}{c}
 \frac{2 \times}{\text{--- --- --- --- --- --- ---}} \\
 \uparrow \\
 \text{O/A} \\
 \curvearrowright \\
 \frac{7P_7}{(N,N) - 2! \times 2! (T,T)}
 \end{array}$$

$$\begin{aligned}
 &= \cancel{2 \times} \cancel{7!} \\
 &\quad \underline{\hspace{10em}} \\
 &= \cancel{2!} \times \cancel{2!} \\
 &= 2520^{114}
 \end{aligned}$$

Rep<sup>✓</sup>



$$\text{Total} = \frac{8^7}{2!}$$

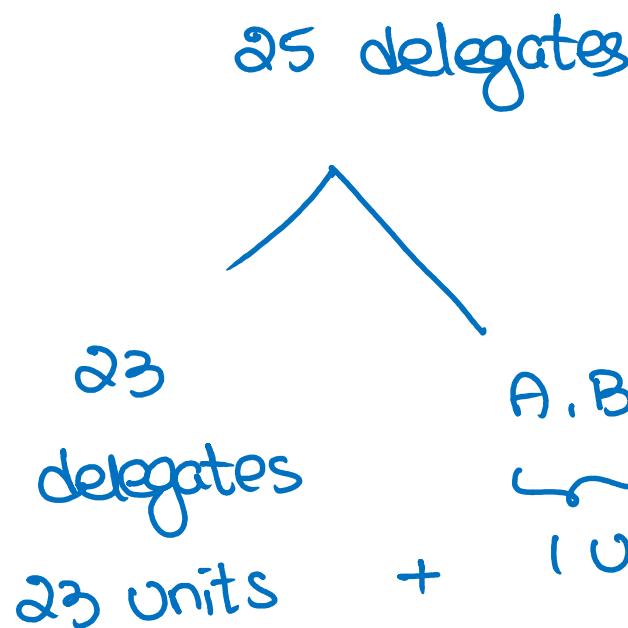
*n*-digit number

How many 3-digit numbers can be formed from the digits 2, 3, 5, 6, 7 and 9, which are divisible by 5 and none of the digits is repeated?

- A) 5      B) 10      C) 15      D) 20



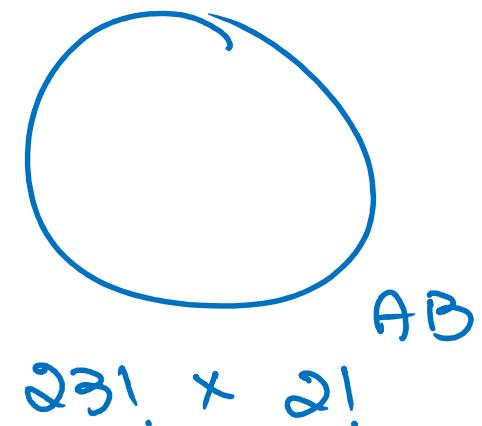
25 delegates



23 delegates  
23 units + A, B  
1 unit = 24 units

A round table conference is to be held among 25  
 45 delegates from 25 countries. In how many ways  
 can they be seated if two particular delegates are  
 always to sit together?

- A.  $23!$     B.  $2! \times 23!$  C.  $3! \times 23!$  D. None of these





46

How many arrangements are possible for 4 men and 5 women in a row, so that men occupy the even places?

- A)  $2! \times 4! \times 5!$       B)  $9!$   
 C)  $4! \times 5!$  ✓      D)  $5! \times 5!$

$$\begin{array}{cccccccc}
 - & \cancel{X} & - & \cancel{X} & - & \cancel{X} & - \\
 1 & ? & 3 & 4 & 5 & 6 & 7 & 8 & 9
 \end{array}$$

Men                          Women  
 $4! \times 5P_5 = 4! \times 5!$



*n*-Sided polygon



*n*-point

47

How many diagonals are there in a 13-sided polygon?

A. 78

B. 82

C. 54

D. 65

Straight lines = Sides + diagonals

78

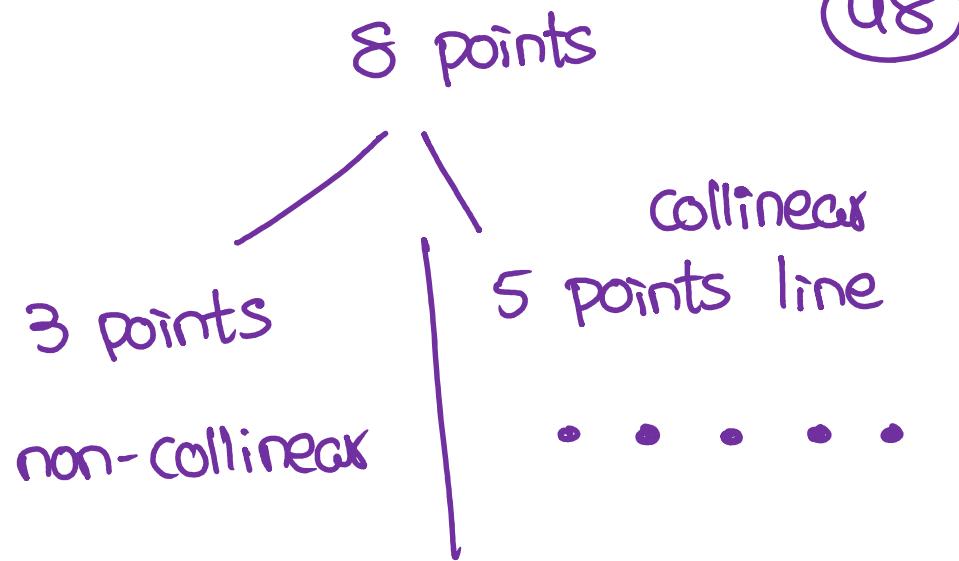
13 + D

$n_2$

=  $n$  + diagonals

No. of diagonals =  $n_2 - n = \frac{n(n-1)}{2} - n = \frac{n(n-3)}{2}$





There are 8 points in a plane, out of which 5 points lie on a straight line, and no other three points lie on a straight line. Find the number of triangles that can be formed using these points.

- A) 48       B) 46  
 C) 42      D) 52

$$8C_3 - 5C_3$$

$$56 - 10 = \underline{\underline{46}}$$



## Probability

$$P_r = \frac{\text{favorable}}{\text{Total}}$$

Toss a coin , Roll a dice , pick a ball ,  
Pack of Cards , permutations & combinations

101 to 550  
 ↴  
 49

Total = 450

In a hotel, rooms are numbered from 101 to 550. A room is chosen at random. What is the probability that room number starts with 1, 2 or 3 and ends with 4, 5 or 6?

A)  $\frac{1}{4}$

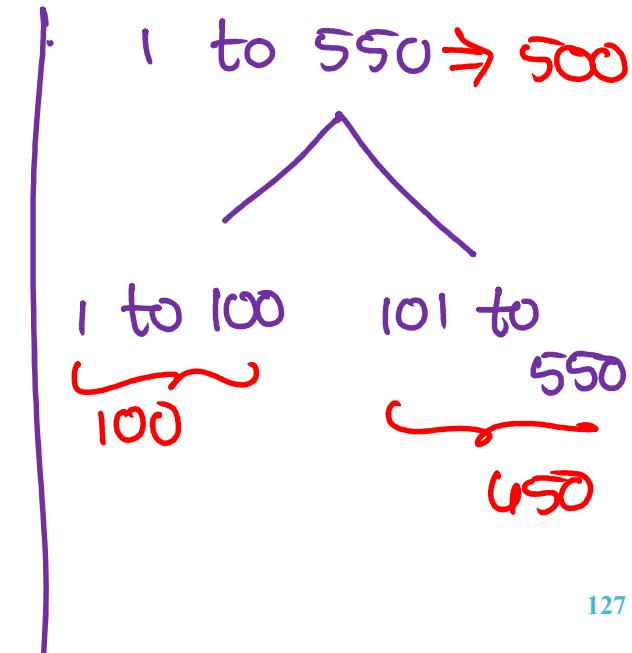
B) 0.188

C)  $\frac{1}{8}$

D)  $\frac{1}{5}$

favorable

$$\begin{array}{c} \text{0-9} \\ \swarrow \quad \searrow \\ \frac{3}{1} \times \frac{10}{2} \times \frac{3}{1} = \\ 450 \end{array}$$



$$\begin{array}{c}
 \text{101 to 550} \\
 \curvearrowleft \\
 \text{Total} = 450
 \end{array}
 \quad
 \begin{array}{c}
 \text{10} \\
 \underline{-} \\
 \text{1|2|5}
 \end{array}
 \quad
 \begin{array}{c}
 (0-9) \\
 \searrow \\
 \text{4|5|6}
 \end{array}$$

$$\begin{array}{c}
 \frac{2}{1} \times \frac{10}{1} \times \frac{3}{1} \\
 \underline{\underline{1|2}} \quad \underline{\underline{4|5|6}}
 \end{array}
 \quad
 \begin{array}{c}
 \frac{1}{5} \times \frac{5}{1} \times \frac{3}{1} \\
 \searrow \\
 (0-4) \quad \text{4|5|6}
 \end{array}$$

$$\begin{array}{c}
 60 \\
 + \\
 15
 \end{array}
 \quad
 \begin{array}{c}
 = 75 = \text{favorable}
 \end{array}$$

50 Coins of 1, 2 and 5 rupees are tossed. What is the probability of getting head on the 1 rupee, tail on the 2 rupee and a head on the 5 rupee coins?

- A.  $\frac{1}{2}$
- B.  $\frac{1}{4}$
- C.  $\frac{1}{8}$
- D.  $\frac{1}{16}$

$$\frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = \frac{1}{8}$$



$$P = \frac{3}{4}$$

$$V = \frac{7}{10}$$

$$P' = \frac{1}{4}$$

$$V' = \frac{3}{10}$$

51

Padmavati speaks the truth 3 times out of 4 and Vareesha speaks the truth 7 times out of 10. Both of them assert that a white hat has been "removed" from a basket containing hats of 6 different colours.

What is the probability of finding the white hat in the basket?

A.  $\frac{21}{40}$

B.  $\frac{19}{40}$

C.  $\frac{3}{40}$

D.  $\frac{1}{36}$

$$P' V' = \frac{1}{4} \times \frac{3}{10} = \frac{3}{40}$$



52

In an objective exam which has 2 answer options each for all the 20 questions, what is the probability that Sushant all the questions correctly?

~~A)  $\frac{1}{20^{20}}$~~

~~B)  $\frac{20}{2^{20}}$~~

~~C)  $\left(\frac{1}{2}\right)^{20}$~~

~~D)  $2^{20}$~~

$$P_r = \frac{1}{2^{20}}$$

$$\left. \begin{array}{l} \text{Total} = \frac{2}{Q_1} \times \frac{2}{Q_2} - \dots \times \frac{2}{Q_{20}} = 2^{20} \\ \text{fav} = 1 \end{array} \right\}$$

# Logarithms

53

$$\frac{1}{2} \log_{10} 25 - 2 \log_{10} 3 + \log_{10} 18 =$$

$$\log_{10} \frac{25^{\frac{1}{2}}}{3^{-2}} + \log_{10} \frac{18}{10}$$

$$= \log_{10} \left( \frac{\sqrt{25} \times \frac{1}{3^2} \times 18}{10} \right) = \log_{10} \frac{10}{10}$$

$$= \frac{\log 10}{\log 10} = \underline{\underline{1}}$$

Reasoning, 'Spatial Aptitude'

Quantitative Aptitude ✓

## Series Completion

Number series

Letter series

Repeated  
series

54

0 1 2 -- 26 27 28  
 Z A B - - Z A B  
 (a) EJ

GH, JL, NQ, SW, YD, ?

(b) FJ H, L, Q, W, D, L

(c) EL

(d) FL

$$32 - 26 = 6$$

G J N S Y F  
 7 10 10 19 25 32 | 6  
 3 4 5 6 7



fast ↑

$$4, 23, 122, \underline{621}, 3120$$

$\times 5 + 7$        $\times 5 + 15$   
 $\times 5 + 3$        $\times 5 + 11$

55

Choose the correct alternative from the given ones that will complete the series.

3120, ?, 122, 23, 4

- (a) 488      ✓ (b) 621  
(c) 610      (d) 732



56

$$\begin{array}{ccccccc}
 C & - & B & \underline{D} & A & - & B B D D \\
 \downarrow & & \downarrow 4 & \downarrow & \downarrow 4 & & \downarrow \downarrow \downarrow \downarrow \\
 2 & - & - & 4 & 3 & - & ? ? ? ? \\
 \downarrow & & \downarrow c & \downarrow b & \downarrow a & - & d \\
 - & a & - & c & b & - & d \\
 \end{array}$$

(A, B, C, D)

(1, 2, 3, 4)

(a, b, c, d)

A) 2, 2, 1, 1

c A D B  
 2 4 1 3  
 d c b a

B) 2, 2, 3, 3

c A D B  
 2 4 1 3  
d c b a

C) 3, 3, 4, 4

D) 3, 3, 1, 1

B B D D  
 ↓ ↓ ↓ ↓  
 3 3 1 1  
 a a b b



A, B, B, C, C, C, D, D, D, D, .....  
 6<sup>th</sup>  
 10<sup>th</sup>

A, B, B | C, C, C | D, D, D | E, - - E

1      2      3      4

15<sup>th</sup>

Find 110<sup>th</sup> term in the series?

3 terms

$$\frac{2 \times 3}{2} = 3$$

6 terms

$$\frac{3 \times 4}{2} = 6$$

10 terms

$$\frac{4 \times (4+1)}{2} = 10$$

$$\frac{5 \times 6}{2} = 15$$

$210^{\text{th}}$  term  $\neq T$

$$\frac{20 \times 21}{2} = 210$$

Select the related word/letters/number from the given alternatives.

58

Analogy

BONUS : ACNPMMOTVRT :: BUCKET : ?

- (a) ACMNMOTURT
- (b) ACTVBDJLDFSU
- (c) ACMNMOTVRT
- (d) SUOBN

BONUS  
AC N P M O T V R T

ACTVBD



## Seating Arrangements



\*\*

Row arrangement ✓

Circle Arrangement ✓

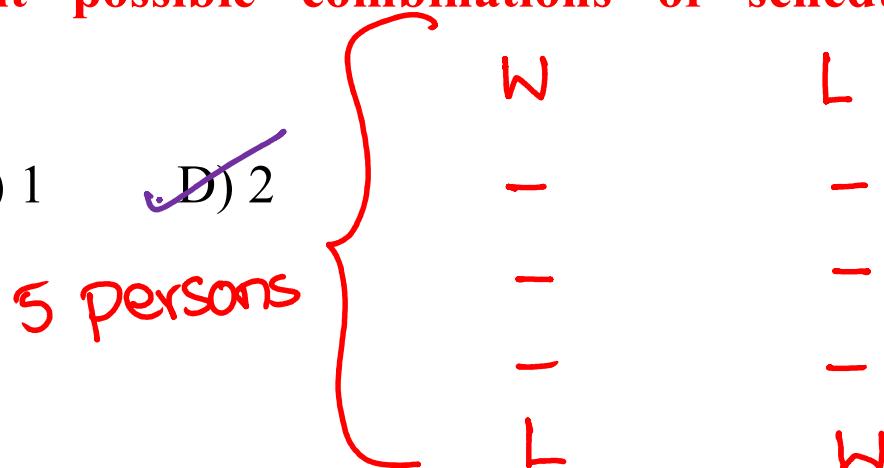
59

Six persons - Jacob, William, Liam, Alexander, Ethan, and Andrew have to give presentations, not necessarily in the same order.

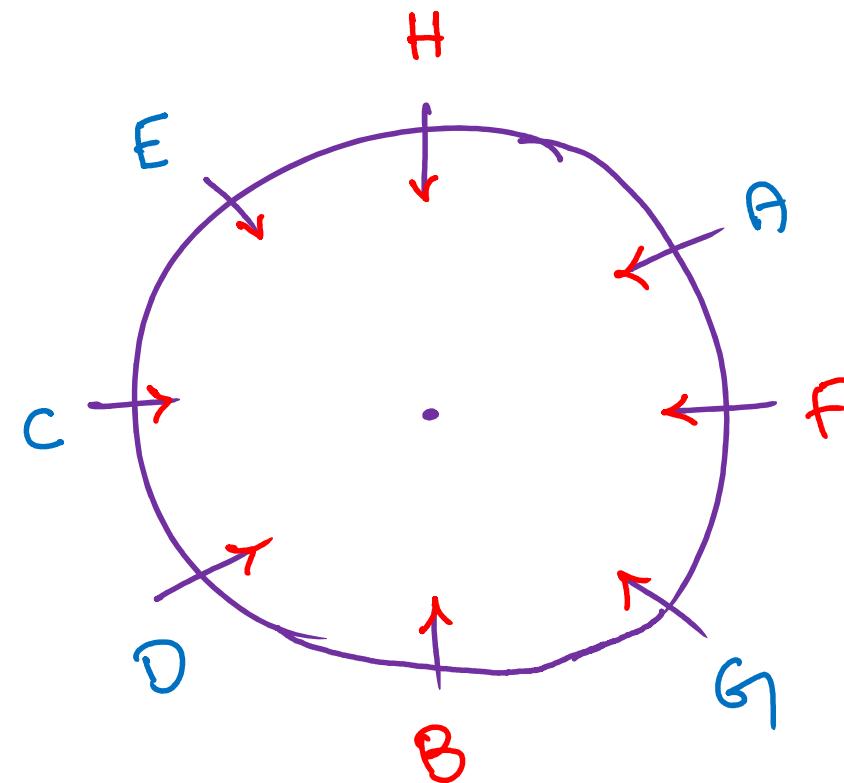
- I. Andrew either delivers his presentation at the start or at the end      E
- ~~II. Jacob delivers his presentation immediately after Ethan~~      J
- ~~III. There are exactly three presentations between William and Liam~~
- ~~IV. Alexander is the second person to deliver his presentation~~

How many different possible combinations of scheduling are possible?

- A) 4      B) 3      C) 1      D) 2







60

A, B, C, D, E, F, G and H are sitting around a circular table facing center. H is fourth to the left of B and second to the right of F. A is third to the left of C, who is not an immediate neighbor of F. G is second to the left of A. D is second to the right of E.

MSQ

Which of the following statements are True?

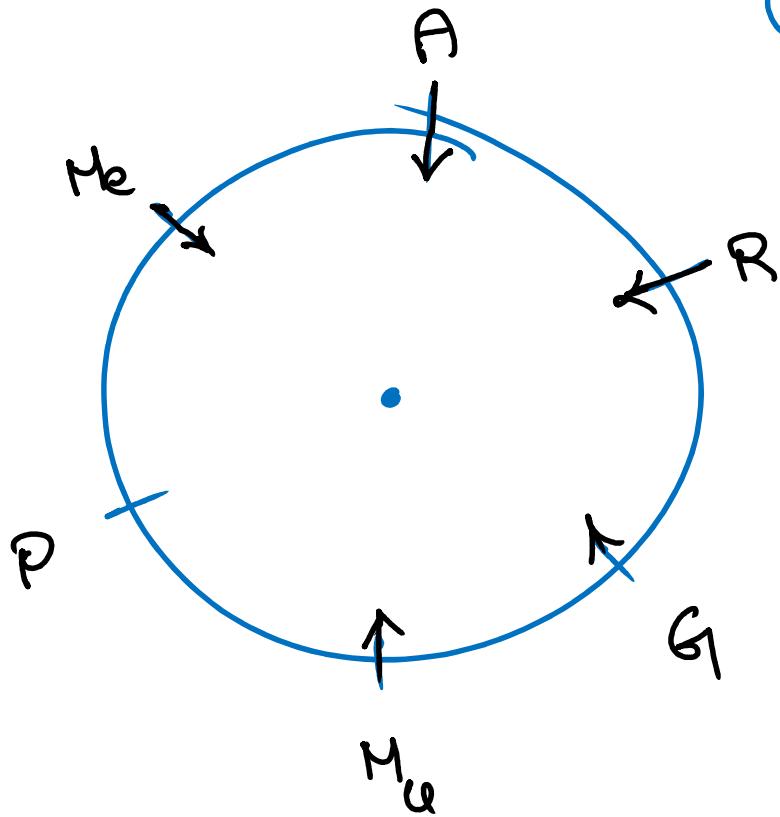
- A) A is one the immediate right on the F.
- B) E is the immediate neighbors of H.
- C) B is immediate left of A.
- D) D is immediate right of A.

facing Center

right - ACW ↘ | left - cw ↗

A is 2<sup>nd</sup> left of B and = 4<sup>th</sup> right of C  
and | but | while

A is 2<sup>nd</sup> left of B, who is 4<sup>th</sup> right of C  
= who | which | whose



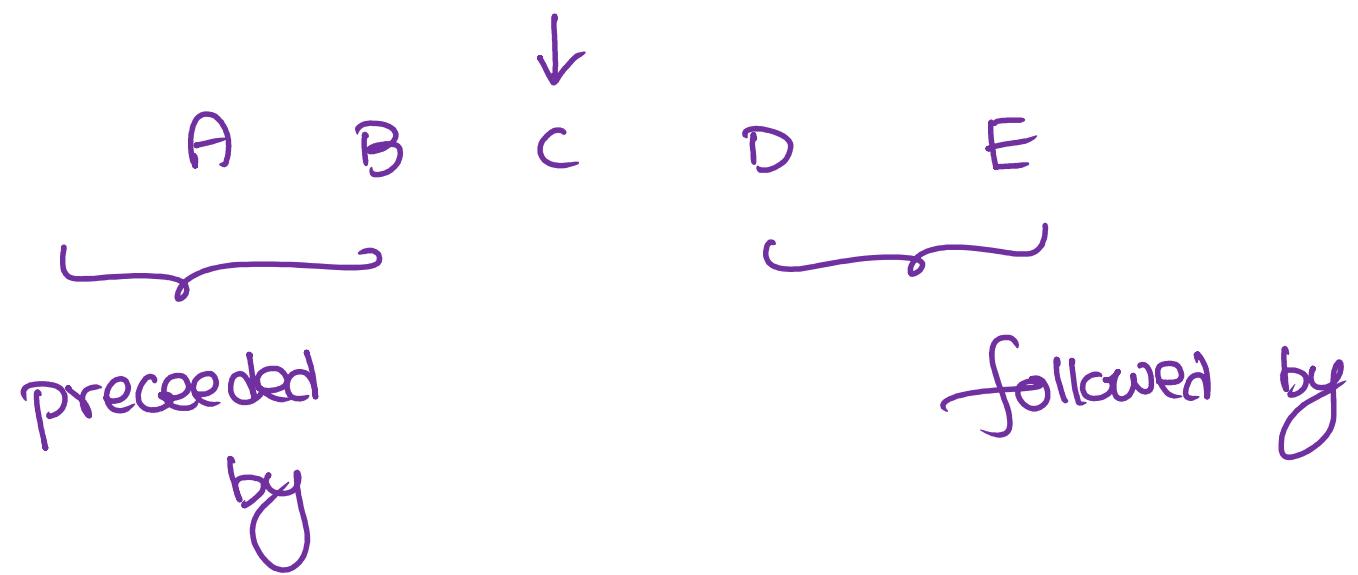
61

Ashwini, Priya, Rani, Meeta, Geeta and Mukta are sitting along a circle facing at the centre.

Ashwini is third to the left of Mukta and to the immediate right of Rani. Priya is second to the left of Geeta, who is not an immediate neighbour of Meeta.

Which of the following pairs of persons has first person sitting to the immediate left of the second person?

- (a) Rani-Meeta      (b) <sup>1<sup>st</sup></sup> Ashwini- Rani      (c) <sup>1<sup>st</sup></sup> Mukta-Priya      (d) <sup>2<sup>nd</sup></sup> Geeta-Rani

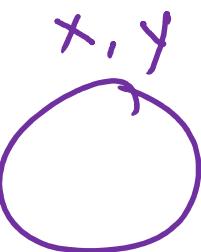
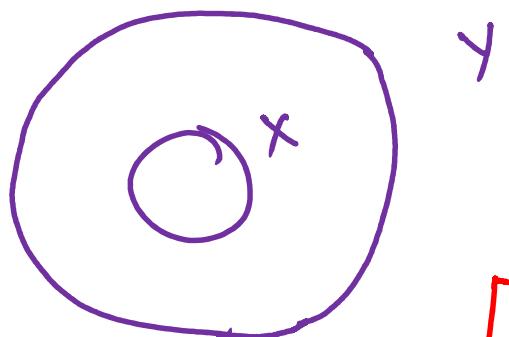


## Syllogism \*\*

Conclusion — definitely True | always True

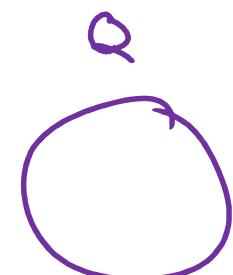
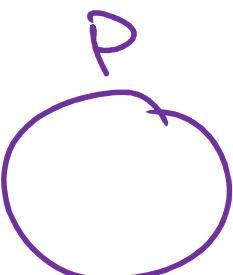
1

All X are Y



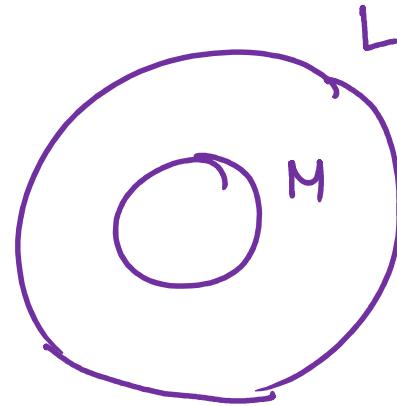
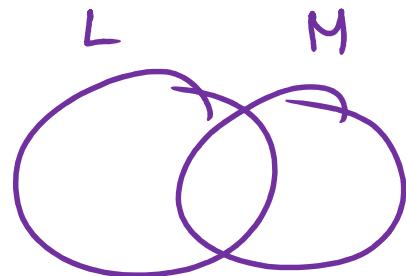
2

No P is Q



(3)

Some L are M



\*\*\*

All A are B  $\rightarrow$  Some A are B

All students are good  $\rightarrow$  *Some students*  
*(students in my class)* are good

"Procedure"

"either A (or) B"

$A \rightarrow B^x$ ,  $B \rightarrow A^x$

"either I or II"

① Draw all possible diagrams,  
'Satisfying given stnts'

② Given Conclusion follows, only  
 if satisfies all diagrams

- ① Both conclusions not true/false at a time in any diagram
- ② Conclusion I True in few diagrams & Conclusion II True in remaining diagrams

Given below are three conclusions drawn based on the following three statements.

Statement 1: All teachers are professors.

Statement 2: No professor is a male.

Statement 3: Some males are engineers.

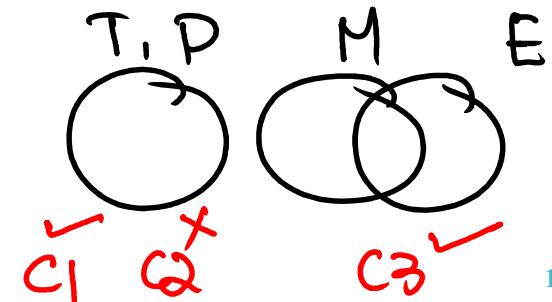
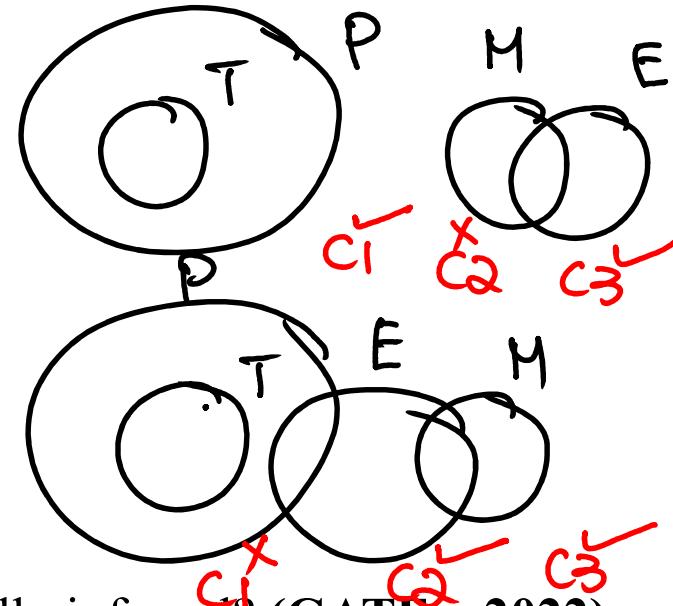
~~Conclusion I: No engineer is a professor.~~

~~Conclusion II: Some engineers are professors.~~

~~Conclusion III: No male is a teacher.~~

Which one of the following options can be logically inferred? (GATE – 2022)

- (a) Only conclusion III is correct
- (b) Only conclusion I and conclusion II are correct
- (c) Only conclusion II and conclusion III are correct
- (d) Only conclusion I and conclusion III are correct





Given below are three statements and four conclusions drawn based on the statements. (GATE – 2022)

63

Statement 1: Some engineers are writers.

Statement 2: No writer is an actor.

Statement 3: All actors are engineers.

Conclusion I: Some writers are engineers.

Conclusion II: All engineers are actors.

Conclusion III: No actor is a writer.

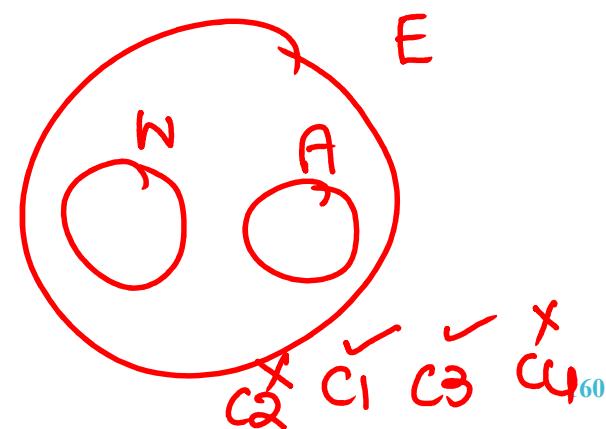
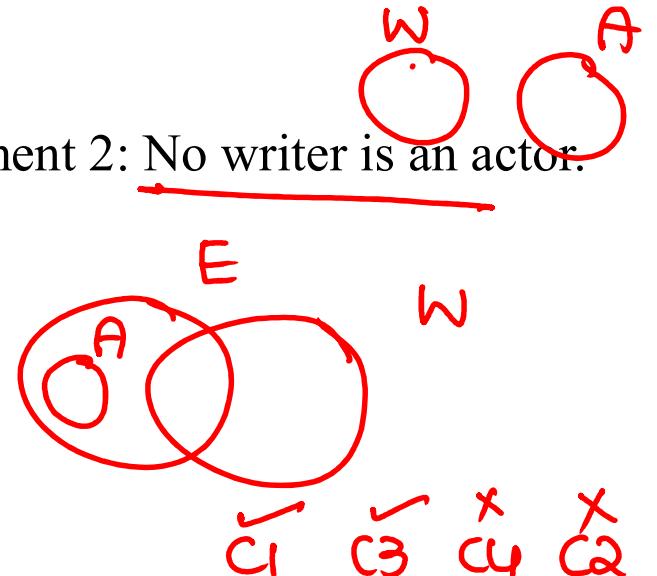
Conclusion IV: Some actors are writers.

(A) Only conclusion I is correct

(B) Only conclusion II and conclusion III are correct

(C) Only conclusion I and conclusion III are correct

(D) Either conclusion III or conclusion IV is correct



60



Given below are three statements and four conclusions drawn based on the statements.

64

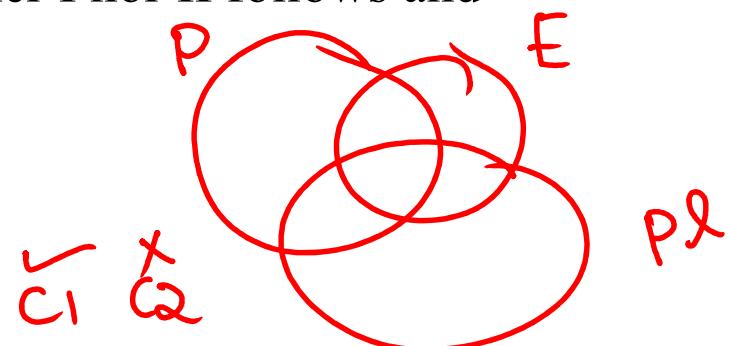
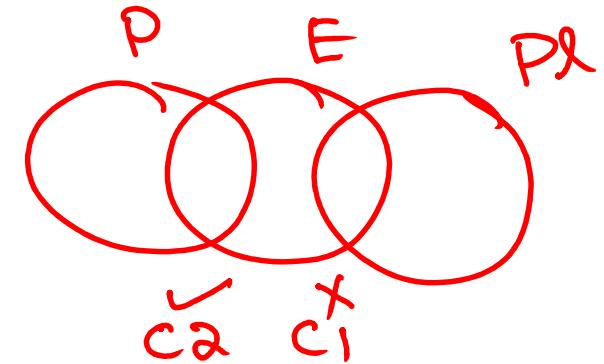
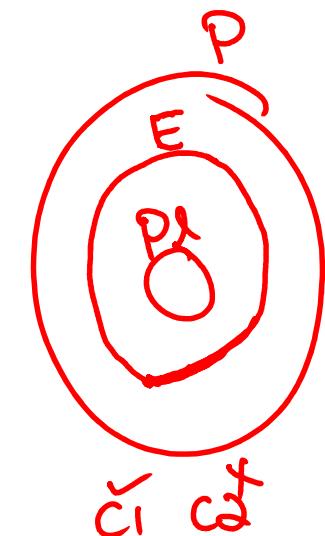
Statement 1: Some pens are erasers.

Statement 2: Some erasers are pencils.

Conclusion I: Some pens are pencils.

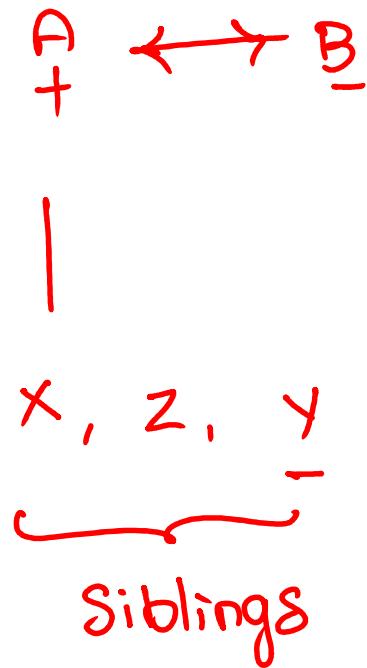
Conclusion II: No pen is a pencil.

- (a) if only I follows;
- (b) if only II follows;
- (c) if either I or II follows;
- (d) if neither I nor II follows and
- (e) if both I and II follow



## Blood Relations

- ① Mixed Blood Relation
- ② Coded " "
- ③ Single person " "



65

A is father of X, B is mother of Y. The sister of X and Z is Y. Which of the following statement is definitely true

- (a) B is the mother of Z
- (b) X is the sister of Z
- (c) Y is the son of A
- (d) B has one daughter
- (e) B is the wife of A

MSQ



⑥

P is Mother-in-law of K  
 ⇒ P-female

(a), (b)

P+Q ⇒ P is father of Q  
 P-male

Study the following information and answer the

question that follows

M × N means M is the daughter of N

M + N means M is the father of N

"MSQ"

M % N means M is the mother of N

M - N means M is the brother of N

Question: Which of the following indicates that P is mother-in-law of K?

- (a) ~~P+Q%R-T×K~~    (b) ~~P+Q-R+T%K~~  
 (c) P%Q+R-T×K    (d) P%Q-R+T×K

$$P \times Q + R - T \times K$$

~~(c)~~

$$\begin{array}{r}
 -P \\
 - \\
 +Q \quad \longleftrightarrow \quad -K \\
 - \\
 +R \quad -T \\
 \hline
 \end{array}$$

Husband  
Mother  $\rightarrow$  MIL

$$\cancel{(d)} \rightarrow P \times Q - R + T \times K$$

(d)

$$\begin{array}{r}
 -P \\
 - \\
 +Q \quad - \\
 \hline
 \end{array}$$

$+R$

$$\begin{array}{r}
 - \\
 \hline
 -T
 \end{array}$$



67

**Mani**

"~~My~~ father's wife is the sister of the captain of the hockey team",  
 said mani. How is mani's mother related to captain?

- A. Uncle      ✓ B. Sister
- C. Cousin      D. Uncle /Aunt

How is Captain related to Mani?

uncle | Aunt  
(Mother Sibling)

How is Mani related to Captain?

Nephew

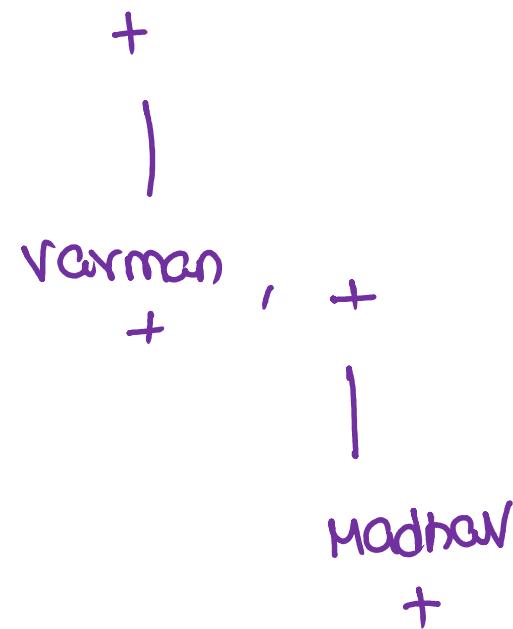
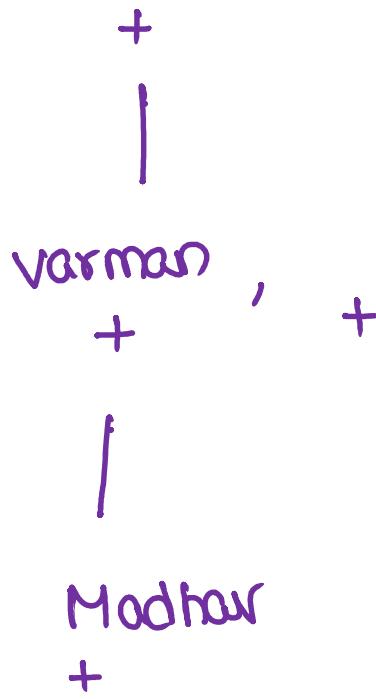




(68)

Pointing to Varman, Madhav said, "I am the only son of one of the sons of his father." How is Varman related to Madhav?

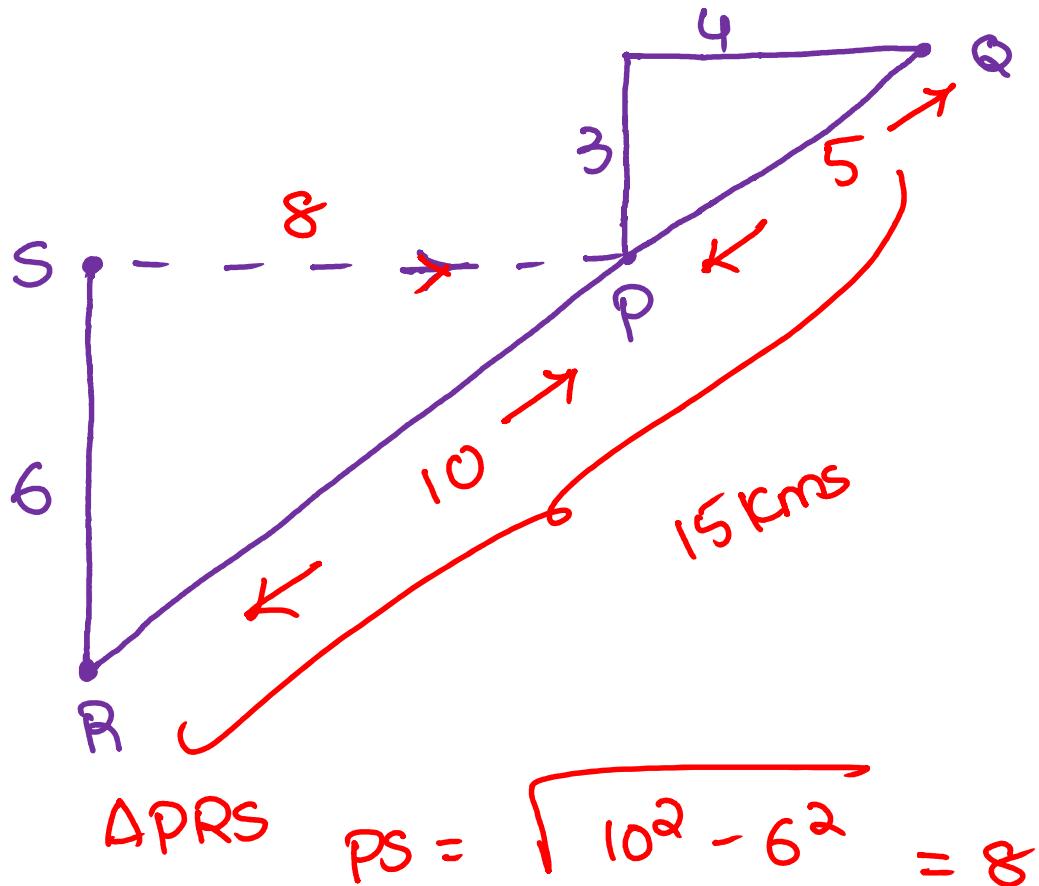
- A) Nephew
- B) Uncle
- C) Father or Uncle
- D) Father







## Directions



69

GATE - 17: Fatima starts from point P, goes North for 3 km, and then East for 4 km to reach point Q. She then turns to face point P and goes 15 km in that direction. She then goes North for 6 km. How far is she from point P, and in which direction should she go to reach point P?

$$\sqrt{3^2 + 4^2} = 5$$

- a) 8 km, East      b) 12 km, North
- c) 6 km, East      d) 10 km, North



## Venn Diagrams

- {
- ① Data Based Q's
  - ② Diagram Based Q's

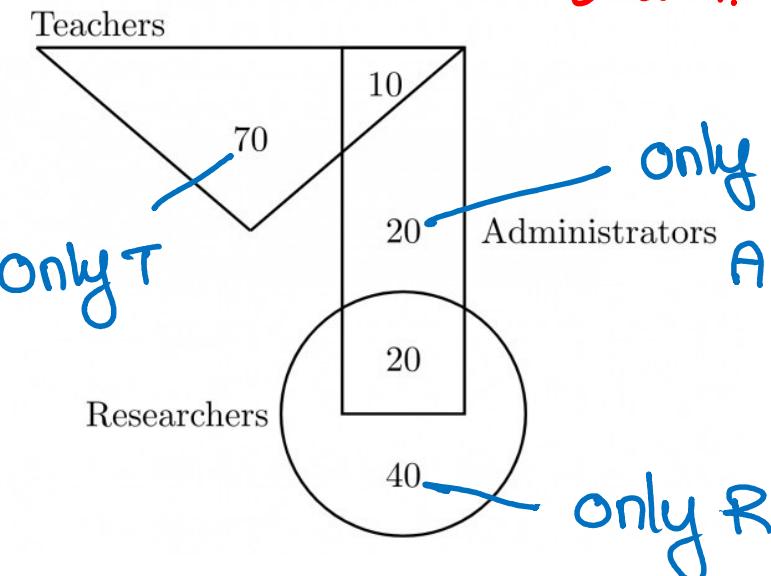
70

In the given diagram, teachers are represented in the triangle, researchers in the circle and administrators in the rectangle. Out of the total number of the people, the percentage of administrators shall be in the range of \_\_\_\_\_

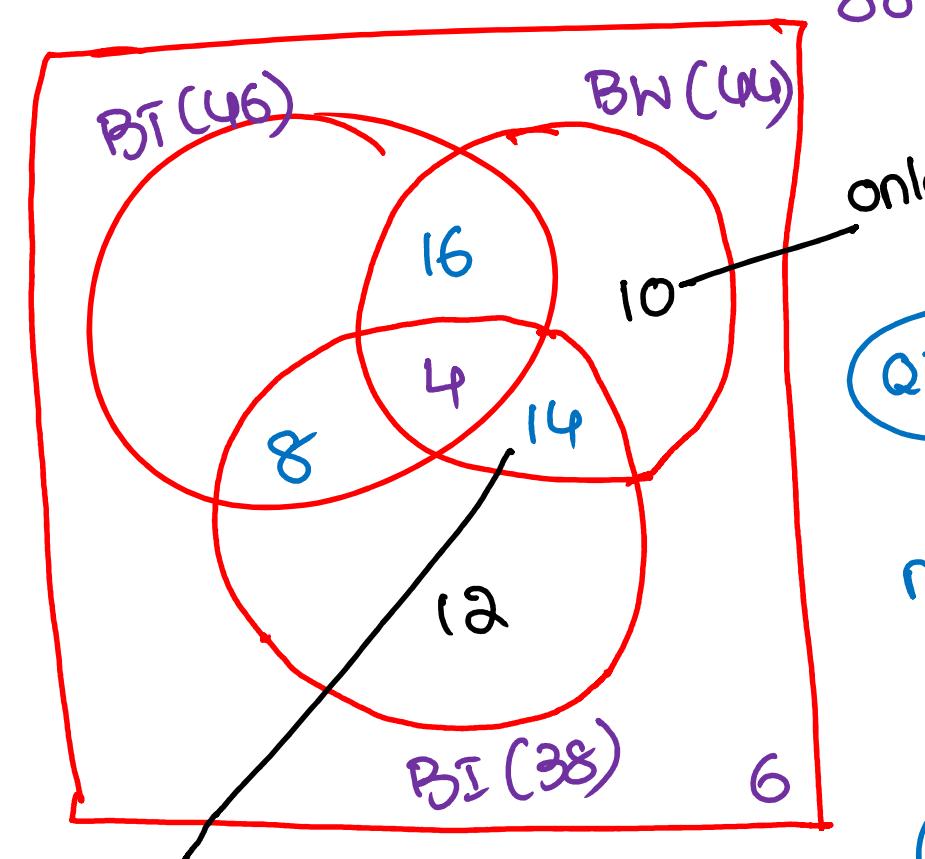
(GATE-19)

- a) 0 to 15      b) 16 to 30
- c) 31 to 45      d) 46 to 60

$$\frac{\text{Admin}}{\text{Total}} \times 100\% = \frac{50}{160} \times 100\% = 31.25\%$$





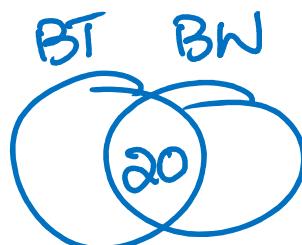


In a survey conducted in a colony of 88 families. 46 families read BT; 44 families read BW; 38 families read BI; 20 families read BW and BT; 18 families read BW and BI; 12 families read BT and BI; 6 families read none of the three magazines.

How many families read BW or BI but not BT?

- (A) 14      (B) 82      (C) 54      (D) 36

$$n(BT \cup BW \cup BI) = 88 - 6 = 82$$



BW or BI but not BT

$$10 + 14 + 12 = 36$$

82

$$n(BT \cup BW \cup BI) = n(BT) + n(BW) + n(BI) - n(BT \cap BW) - n(BW \cap BI)$$

$$- n(BI \cap BT) + n(BW \cap BI \cap BT)$$

$$n(BW \cap BI \cap BT) = 4$$

## Coding - Decoding

- {
  - ① Number Coding
  - ② Letter Coding
  - ③ Mixed Coding
  - ④ Substitution Coding

forward code  $\rightarrow$  1 A 2 B -- 26 Z ✓

Reverse code  $\rightarrow$  26 A 25 B -- 1 Z ✓

1	2	3	4	5	6	7	8	9	10	11	12	13
A	B	C	D	E	F	G	H	I	J	K	L	M
26	25	24	23	22	21	20	19	18	17	16	15	14
Z	Y	X	W	V	U	T	S	R	Q	P	O	N

pairs  $\rightarrow$  AZ | ZA, BY | YB — MN | NM  
 (Sum = 27)

72

In a certain code “BEGINS” is coded as “QLGECZ”,  
then how would “CALCULATE” be coded

-2 logic

28 5                  14 19  
 B E G I N S  
 Q L G E C Z  
 17 12                  3 26

- A. DPZJSBJYB
- B. CSYJSBKYB
- C. DPZJTAKYA
- D. CRYJSAJYA

C A L C U L A T E  
 -2 logic  
 C A

73

In a certain code, DEEP is written as 60 and HAIR is written as 72. How is RABIT written in that code?

Answer: 100

DEEP

$$4+5+5+16 = 30 \xrightarrow{\times 2} 60$$



~~relibftaga~~ - carefree

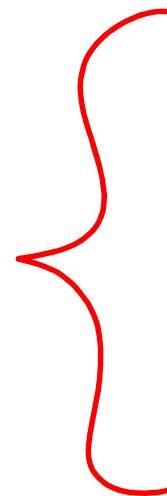
~~otaga~~ - careful

~~fertaga~~ - careless

fer - less

- 74
- GATE\_16: If 'relibftaga' means carefree, 'otaga' means careful and 'fertaga' means careless, which of the following could mean 'aftercare'?
- o-ful
- (X) zentaga
  - (B) tagafer
  - (C) tagazen
  - (X) relffer
- (D)      tagopen
- new  
aftercare
- X
- toga      zen

## Cubes & Dice

- 
- 1 folded dice
  - 2 unfolded dice

folded Dice

2      adj  
 OPP.      4, 6, 3, 1  
 5

75

A dice is thrown four times and its four different positions are shown below. Find the number on the face opposite the face showing 2.



(i)



(ii)



(iii)



(iv)

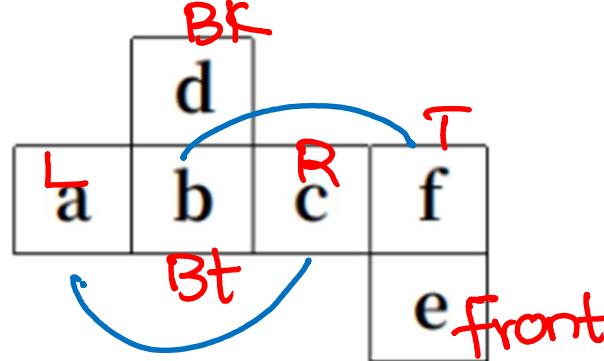
2      OPP.  
 —      5

Row | column wise alternate sides are opposite

Select the box that CANNOT be formed by folding the given unfolded box.

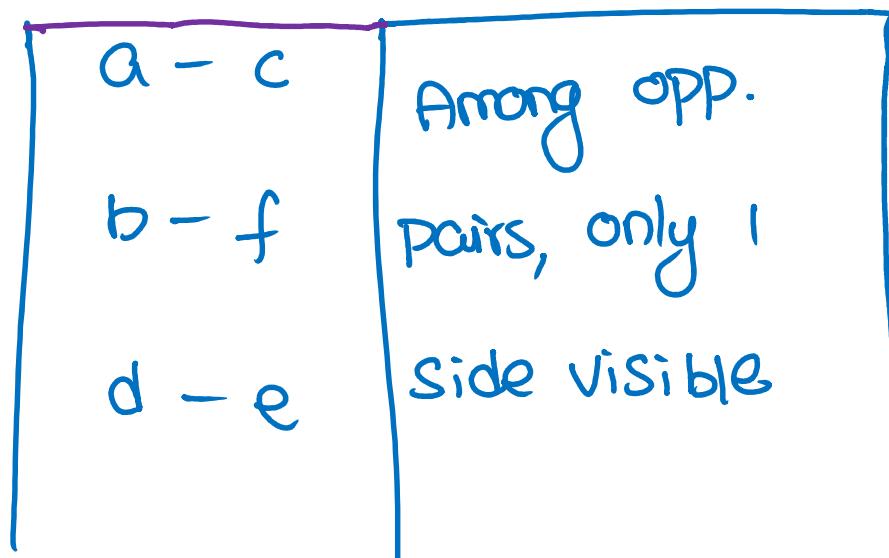
76

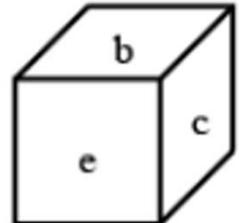
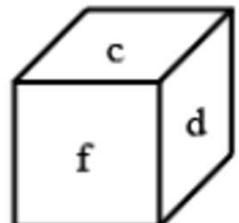
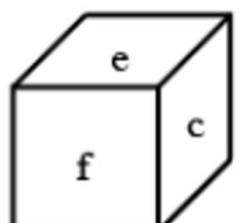
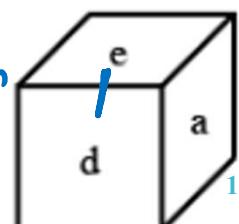
unfolded Dice



$a - c$   
 $b - f$   $\Rightarrow d - e$

unfold - fold - OPP. Pairs

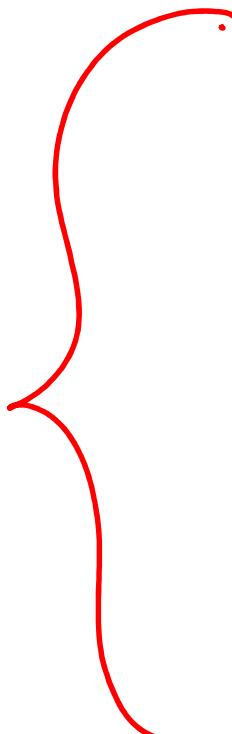


- A 
- B 
- C 
- D 





## Spatial Aptitude

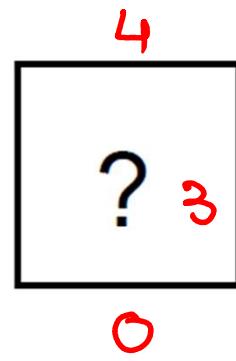
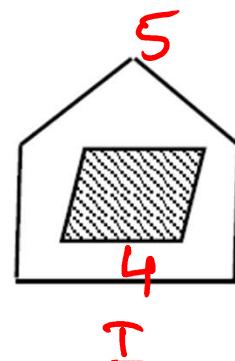
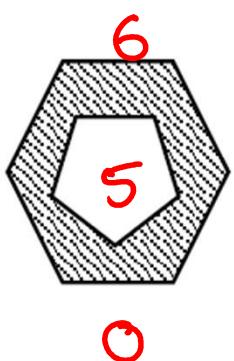
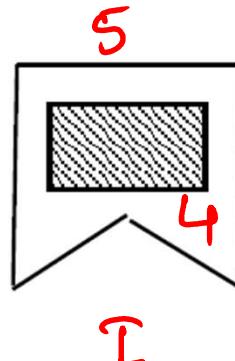
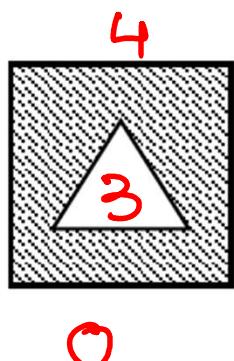
- 
- ① Mirroring < Mirror Image  
water Image
  - ② paper folding
  - ③ paper cutting
  - ④ Assembling, Grouping
  - ⑤ 2D patterns

No. of sides

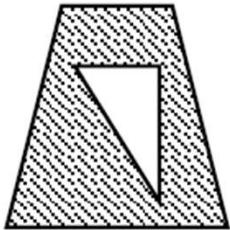
77

Shaded

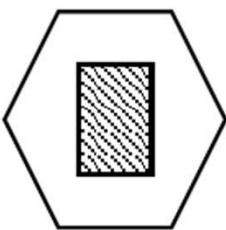
Which of the images A to E is next in the sequence?



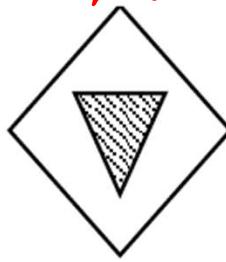
A



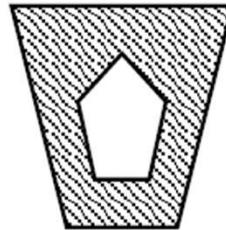
B



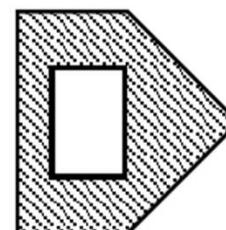
C



D



E



Odd one out



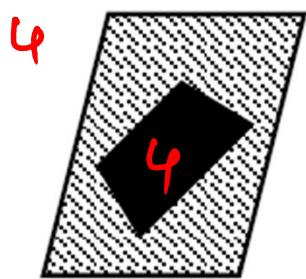
1 different  
option

Remaining  
options 11<sup>tar</sup>

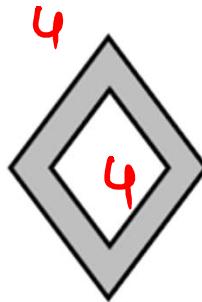
Which of the images A to E is the odd one out?

78

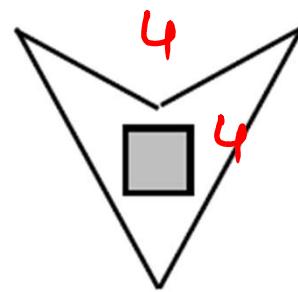
NO. of sides



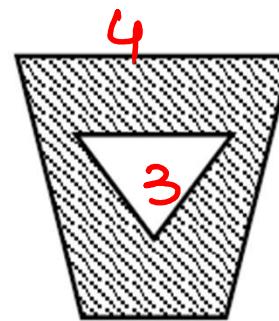
A



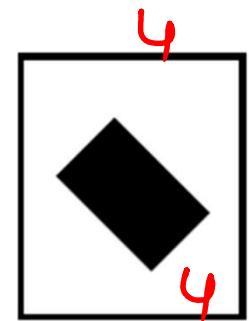
B



C



D



E

79

Analogy

Figures 1 and 2 in Problem figures are related in a particular manner. Establish the same relationship between figures 3 and 4 by choosing a figure from among the four alternative answer figures, which would replace the question mark in problem figures.



1      2      3      4



a      b      c      d

✗

✓

Same logic

Mirror Image | water Image

$L \rightarrow R$  | T, B - Same

$T \rightarrow B$  | L, R-Same

N  
M

Left (Or) Right  $\Rightarrow$  MI

wrt y-axis

M' N  $\Rightarrow$  WI

Top or Bottom  
wrt x-axis

APL

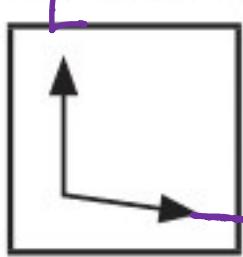
$\stackrel{MI}{\equiv}$   
J9A

$\stackrel{WI}{\equiv}$   
AbF

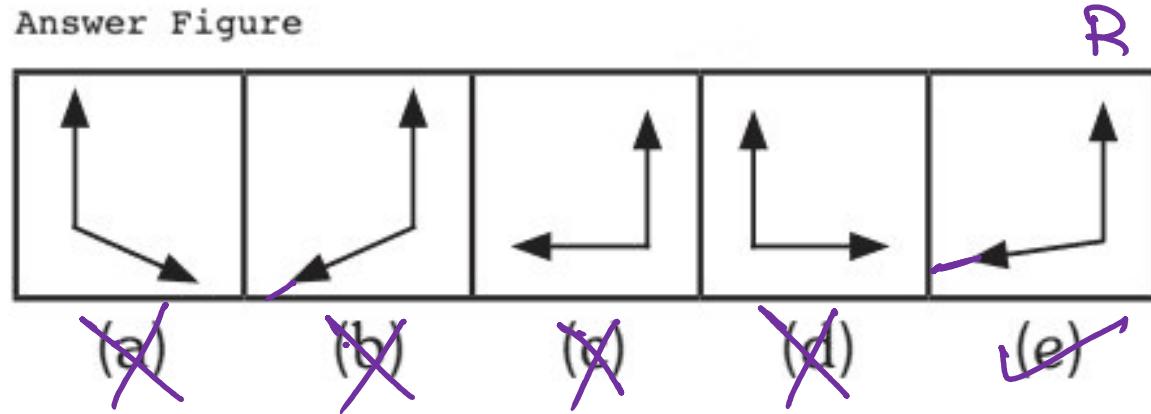
Choose the alternatives which closely resembles the mirror image  
of the given combination.



### Question Figure



### Answer Figure



81

Choose the alternatives which is closely resembles the mirror image  
of the given combination.

REASONING

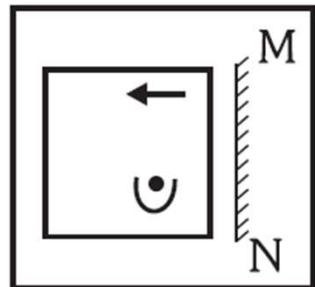
E

R

- (a) GNINOSAER
- (b) GNINOSAER
- (c) MI  
GNINOSAER  
S - Z
- (d) GNINOSAER

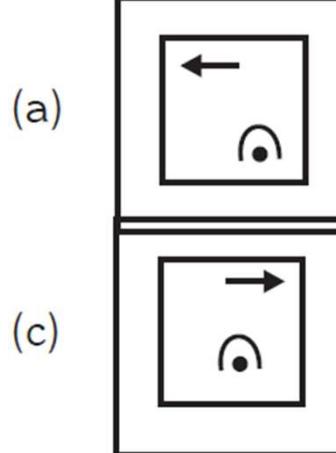
82

Question Figure:

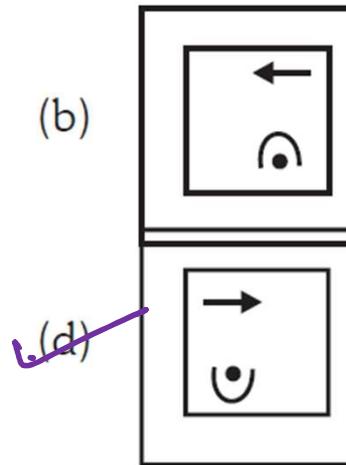


MI

Answer Figures:

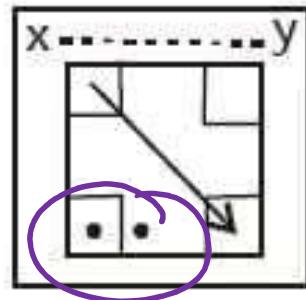


(c)



**Question Figure :**

83

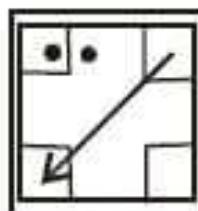


water

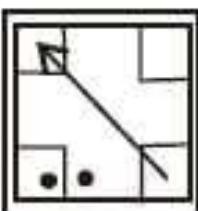
Right

Right

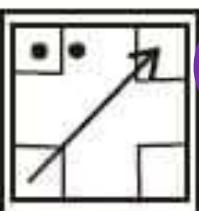
**Answer Figures :**



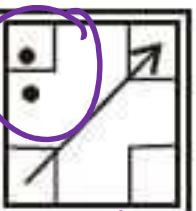
(1)



(2)



(3)

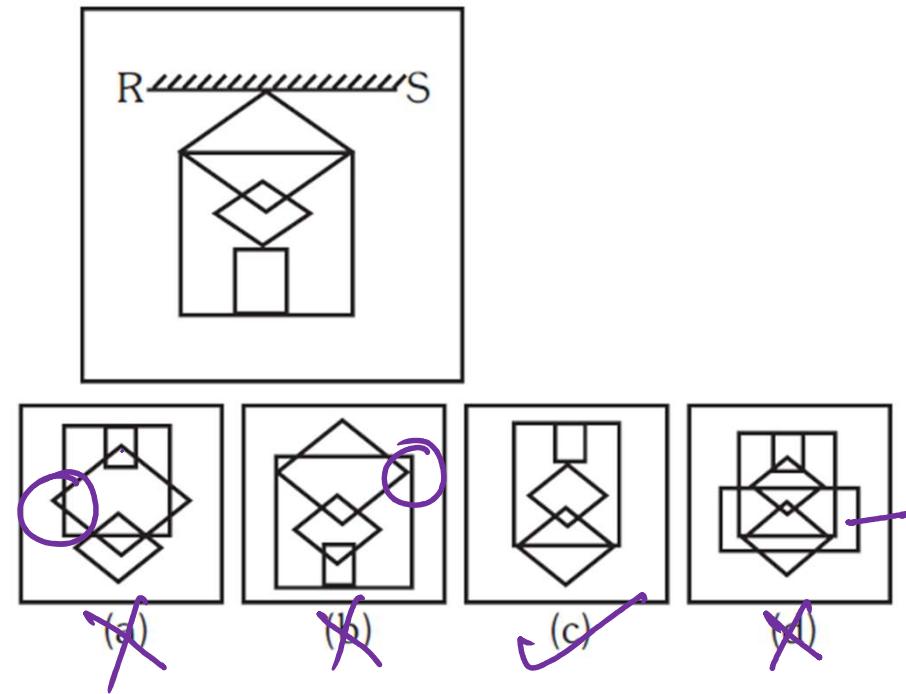


(4)

84

Best Suitable

NI

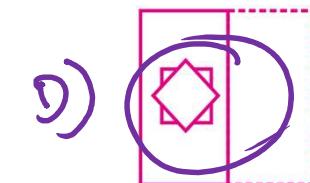
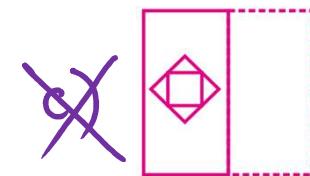
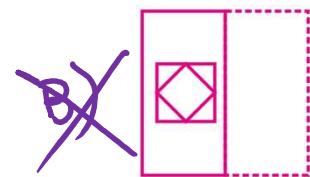
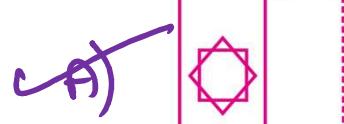
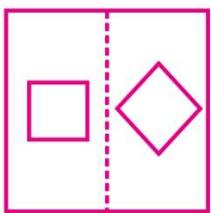


Pape folding | Paper cutting



fold - cut - unfold

Transparent Sheet ←



85

In the following problems, a square transparent sheet with a pattern is given. Figure out from amongst the four alternatives as to how the pattern would appear when the transparent sheet is folded at the dotted line.

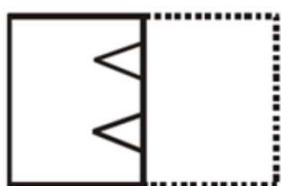
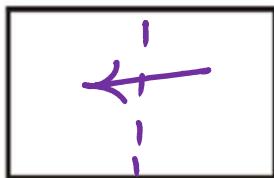
Square , Rhombus

visible

86

The drawings show a sheet of paper which has been folded. The dashed lines indicate the whole sheet, each drawing represents a single fold. The black square shows where a hole was punched. manner in which the folded paper has been cut. These two figures are followed by four answer figures from which you have to choose a figure which would most closely resemble the unfolded form.

Problem Figures:

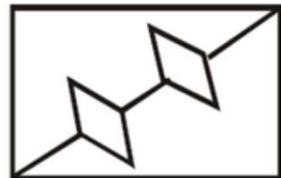


fold - cut - unfold

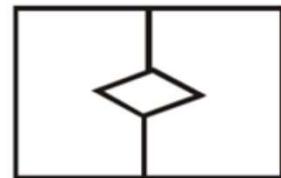
Answer Figures:



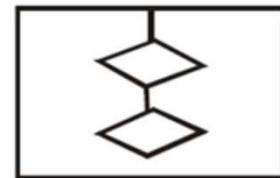
A



B



C

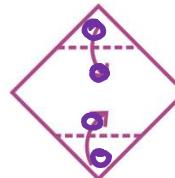


D

87

The following questions consist of a set of three figures X, Y, and Z showing a sequence of folding of a piece of paper. Fig (Z) shows the manner in which the folded paper has been cut.

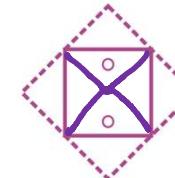
These three figures are followed by four answer figures from which you have to choose a figure which would most closely resemble the unfolded form fig. (Z)



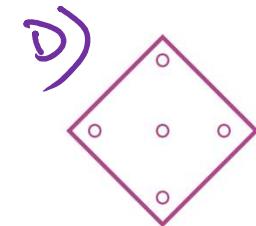
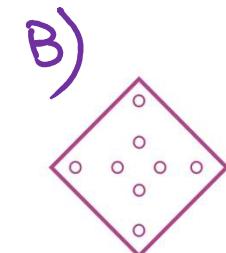
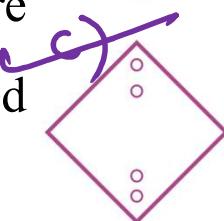
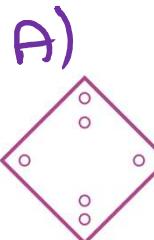
X



Y



Z



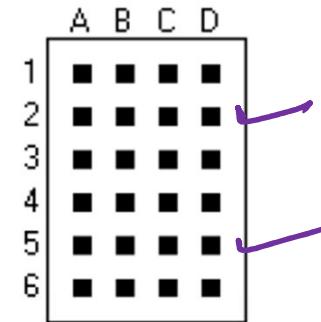
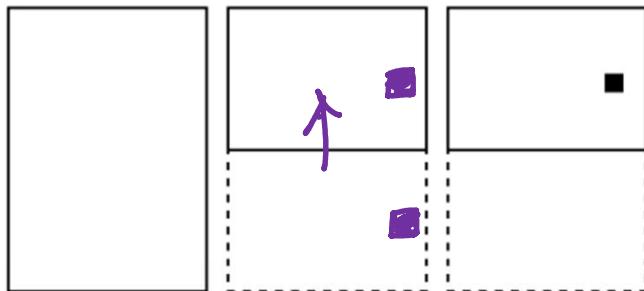
fold — cut — unfold





MSQ

The drawings show a sheet of paper which has been folded. The dashed lines indicate the whole sheet, each drawing represents a single fold. The black square shows where a hole was punched. Where do the holes appear when the sheet is unfolded?



A	B	C	D
2C,5C	2D,5D	3D,3D	2C,2D

A B C D

Figure formation

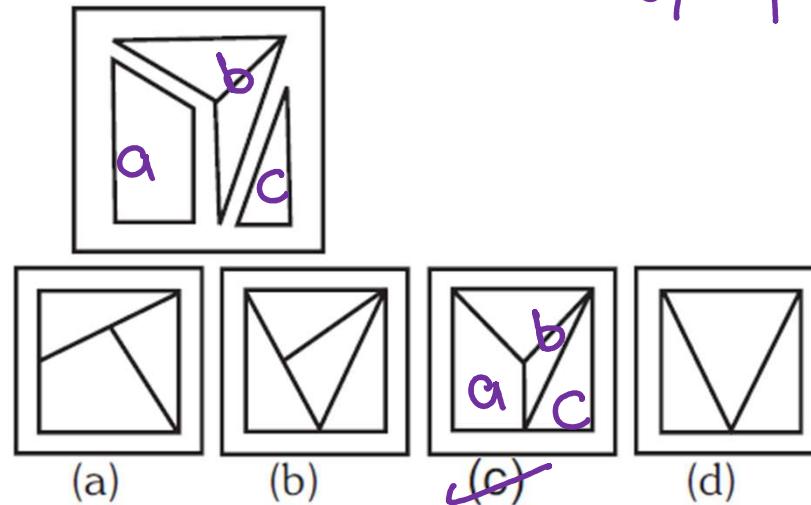
Assembling

Grouping

Among the four answer figures, which one can be formed from the cut out pieces given below in the problem figure?

89

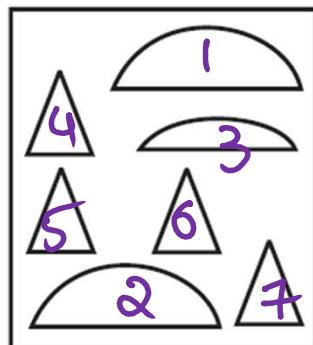
-Grouping



Among the four answer figures, which one can be formed from the cut out pieces given below in the problem figure?

90

Question Figures:



Answer Figures:

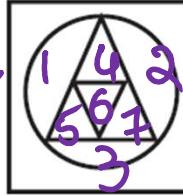
(a)



(b)



✓ (c)



(d)

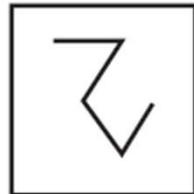




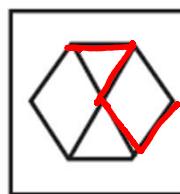
Spotting out embedded  
ai

From the given answer figures, select the one in which the question figure is hidden/embedded.

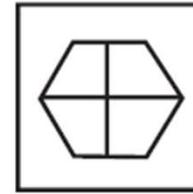
Figure  
Question Figure:



Answer Figures:



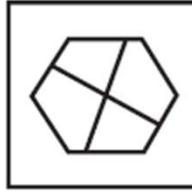
(a)



(b)



(c)



(d)

"Logical puzzles"

92

Read the information given below and answer the questions that follow.

$$p(a) = a^2 + a$$

$$q(a) = 3a$$

$$r(a) = a + 9$$

$$q(-1) = -3$$

Find the value of  $r(p(q(a)))$  at  $a = -1$ .

- A. 15
- B. 342
- C. 600
- D. 9

$$= r(p(-3))$$

$$= r(6) = 6+9 = 15$$

==

$$\begin{aligned}
 p(-3) &= (-3)^2 - 3 \\
 &= 6
 \end{aligned}$$



93

$$A\%B = (A + B)^2$$

$$A\#B = (A^2 - B^2)$$

$$A?B = (A - B)^2$$

$$6?9 = (6-9)^2 = 9$$

$$4\#9$$

$$= 4^2 - 9^2$$

$$= -65$$

Find the value of  $4\#(6?9)$ .

- A. - 65      B. 135
- C. - 135      D. 65



94

### Knights, Knaves, Spy

$\textcircled{0}, \textcircled{1}, \textcircled{x} \rightarrow \text{spy}$

C - Knight  $\rightarrow$  Truth

C - 'I am the spy'

B - Knight  $\rightarrow$  Truth

$\Downarrow$   
A - Knight

On the fabled Island of Knights and Knaves, we meet three people, A, B, and C, one of whom is a knight, one a knave, and one a spy.

The knight always tells the truth, the knave always lies, and the spy can either lie or tell the truth.

- A says: "C is a knave".
- B says: "A is a knight."
- C says: "I am the spy."

A - Knight  
C - Knave  
B - Spy

Who is the knight?



q5

S → X  
 R ↗ Home  
 ↙ Finance  
 NO portfolio

GATE: The head of newly formed government desires to appoint five of the six selected members P, Q, R, S, T and U to portfolios of Home, Power, Defense, Telecom, and Finance. U does not want any portfolio if S gets one of the five. R wants either Home or Finance or no portfolio. Q says that if S gets Power or Telecom, then she must get the other one. T insists on a portfolio if P gets one.

(2M)

Which is the 'valid distribution' of portfolios?

- A) P-Home, Q-Power, R-Defense, S-Telecom, T-Finance
- B) R-Home, S-Power, P-Defense, Q-Telecom, T-Finance
- C) P-Home, Q-Power, T-Defense, S-Telecom, U-Finance
- D) Q-Home, U-Power, T-Defense, R-Telecom, P-Finance

GATE: For submitting tax returns, all resident males with annual income below Rs. 10 lakhs should fill up Form P and all resident females with income below Rs. 8 lakhs should fill up Form Q.

RM < 10L → P

RF < 8L → Q

RM, RF > 10L - R

NRM,  
NRF > 15L → S

All people with incomes above Rs. 10 lakhs should fill up Form R, except non residents with income above Rs. 15 lakhs, who should fill up Form S. All others should fill Form T. An example of a person who should fill Form T is (QM)

A) A resident male with annual income Rs. 9 lakhs → P

B) A resident female with annual income Rs. 9 lakhs → T

C) A non-resident male with annual income Rs. 16 lakhs → S

D) A non-resident female with annual income Rs. 16 lakhs → S



A house has a number which needs to be identified. The following three statements are given that can help in identifying the house number.

Q7

- If the house number is a multiple of 3, then it is a number from 50 to 59.
- If the house number is NOT a multiple of 4, then it is a number from 60 to 69.
- If the house number is NOT a multiple of 6, then it is a number from 70 to 79.

What is the house number?

$\div 3$   
~~not  $\div 4$~~

(A) 54

(B) 65

~~not  $\div 6$~~

(C) 66

$\div 3$

(D) 76

$\not\div 3$

$\div 4$

$\not\div 6$

(GATE - 2M)



Each of the letters arranged as below represents a unique integer from 1 to 9. The letters are positioned in the figure such that  $(A \times B \times C)$ ,  $(B \times G \times E)$  and  $(D \times E \times F)$  are equal. Which integer cannot be represented by the letters A, B, C, D, E, F or G?

98

5, 7

1, 2, 3, 4, 6, 8, 9

can't reproduce using

$$A \times B \times C = B \times G \times E = D \times E \times F$$

MSQ

A		D
B	G	E
C		F

(GATE-2M)

A, B, C, D, E, F, G

1, 2, 3, 4, 5, 6, 7, 8, 9

Answer: 5, 7

$$\begin{array}{ccc} A & D & \\ B & G & E \\ C & F & \end{array} \Rightarrow \begin{array}{c} 3 \\ \times \\ 4 \\ \times \\ 2 \\ \underline{\times} \\ 6 \end{array} = \begin{array}{c} 8 \\ \times \\ x \\ \times \\ 4 \\ \times \\ 2 \\ \underline{\times} \\ 9 \\ \times \\ 1 \end{array}$$

$$A = 1$$

↓  
4-digit

$$\begin{array}{r}
 ABCD \times 9 \\
 \hline
 DCBA
 \end{array}$$

$$\begin{array}{r}
 2 \mid 3 \mid 4 - 18 \mid 9 \\
 \Rightarrow 5\text{-digit}
 \end{array}$$

99

If  $ABCD \times 9 = DCBA$ , where A, B, C and D are unique integer from 0 to 9.

Find A = ? D = ?

$$\begin{array}{r}
 1089 \times 9 \\
 \hline
 9801
 \end{array}$$

A, B, C, D

0 to 9

A, D ≠ 0

$ABCD$  → 4-digit number  
 $DCBA$  → 4-digit number

$$A = 1$$

$$\begin{array}{r}
 \begin{array}{r} \downarrow \\ 1 B C D \end{array} \times 9 \\
 \hline
 D C B 1
 \end{array}$$

$$9 \times 8 + 8$$

$$= 80$$

$$\begin{array}{l}
 A = 1 \\
 D = 9 \\
 B = 0 \\
 C = 8
 \end{array}$$

$$D = 9$$

$$\begin{array}{r}
 \begin{array}{r} \swarrow \\ 1 B C 9 \end{array} \times 9 \\
 \hline
 \underline{\underline{9}} C B 1
 \end{array}$$

$\Rightarrow$

$$\begin{array}{r}
 \begin{array}{r} 8 \\ 1 0 C 9 \end{array} \times 9 \\
 \hline
 \underline{\underline{9} C 0 1}
 \end{array}$$

CIM)

100

GATE: If  $(1.001)^{1259} = 3.52$  and  $(1.001)^{2062} = 7.85$ ,  
then  $(1.001)^{3321} =$

powers (or)  
Exponents

$$\left. \begin{array}{l} a^m \times a^n = a^{m+n} \\ 3.52 \times 7.85 = 27.632 \end{array} \right\}$$

(Q)  $11^3, 13^3, 17^3, 19^3$   
 $1331, 2197, 4913, ?$

progressions

$$q + qq + qqq + \dots - n \text{ terms} = \frac{10(10^n - 1)}{q} - n$$

$$n=1, \text{ Ans}=9$$

$$n=2 \Rightarrow \text{Answer} = 9+99=108$$

101

work = 12 pages

A - 6 hrs → 2P/h

B - 4 hrs → 3P/h

1st hr  
⇒ A - 2P

B - 3P

GATE: Ananth takes 6 hours and Bharath takes 4 hours to read a book. Both started reading copies of the book at the same time.

After how many hours is the number of pages to be read by Ananth, twice that to be read by Bharath? Assume Ananth and Bharath read all the pages with constant pace. (QM)

A) 1 Left      B) 2      C) 3      D) 4

10P

9P

3hrs

$$A \Rightarrow 2 \times 3 = 6P$$

$$B \Rightarrow 3 \times 3 = 9P$$

R - Read | L - Left

Left

R  
6P

3P

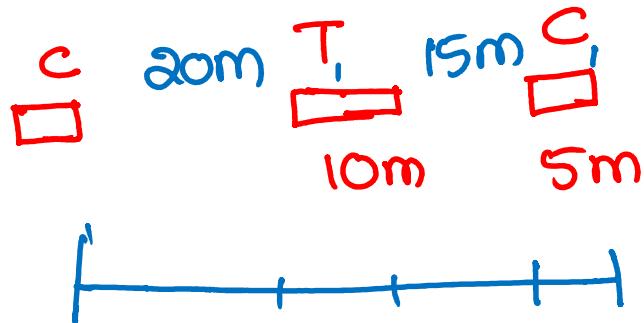


aptitudemonth

1 hr

$$D = 36 \times 1 = 36 \text{ kms}$$

36000 m



$$20 + 10 + 15 + 5$$

$\Rightarrow 50\text{m} - 2 \text{ Vehicles}$

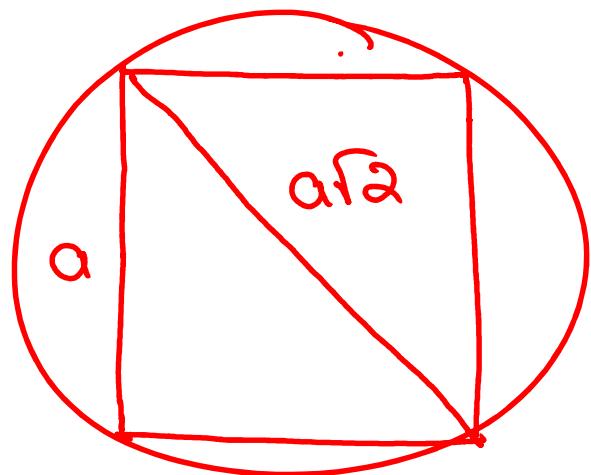
GATE: Trucks (10m long) and cars (5 m long) go on a single lane bridge. There must be a gap of atleast 20 m after each truck and a gap of atleast 15m after each car. Trucks and cars travel at a speed of 36 km/h. If cars and trucks go alternatively, what is the maximum number of vehicles that can use the bridge in one hour?

(Q2M)

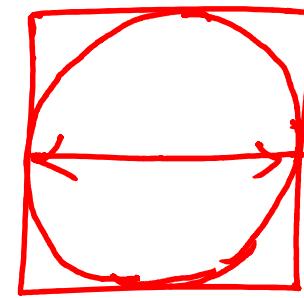
- A) 1440      B) 1200

- C) 720      D) 600

$$\begin{aligned} & \frac{720}{36000} \\ & \frac{720}{50} \\ & \Rightarrow 720 \times 2 \\ & = 1440 \end{aligned}$$



$$2R = a\sqrt{2}$$



$$a = 2r$$

103

GATE: Given  $(9 \text{ inches})^{1/2} = (0.25 \text{ yards})^{1/2}$ ,

which one of the following statements is TRUE?

(1M)

$$\sqrt{0.25 \text{ yards}}$$

$$= 0.5 \sqrt{\text{yards}}$$

$$\left( (9 \text{ inches})^{\frac{1}{2}} \right)^4$$

$$= 81 \text{ inches}^2$$

- A) 3 inches = 0.5 yards.
- B) 9 inches = 1.5 yards.
- C) 9 inches = 0.25 yards.
- D) 81 inches = 0.0625 yards.

$$P^m = q^m$$

$$\Rightarrow P = q$$

Analogy

$$\begin{array}{rcl} 6 \times 7 & 7 \times 8 & \\ | & | & \\ 42 : 56 & :: & 110 : 132 \\ | & | & | \\ 6^2 + 6 & 7^2 + 7 & 10^2 + 10 \\ & & 11^2 + 11 \end{array}$$

104

GATE: In the summer, water consumption is known to decrease overall by 25%. A water Board official states that in the summer household consumption decreases by 20%,

overall

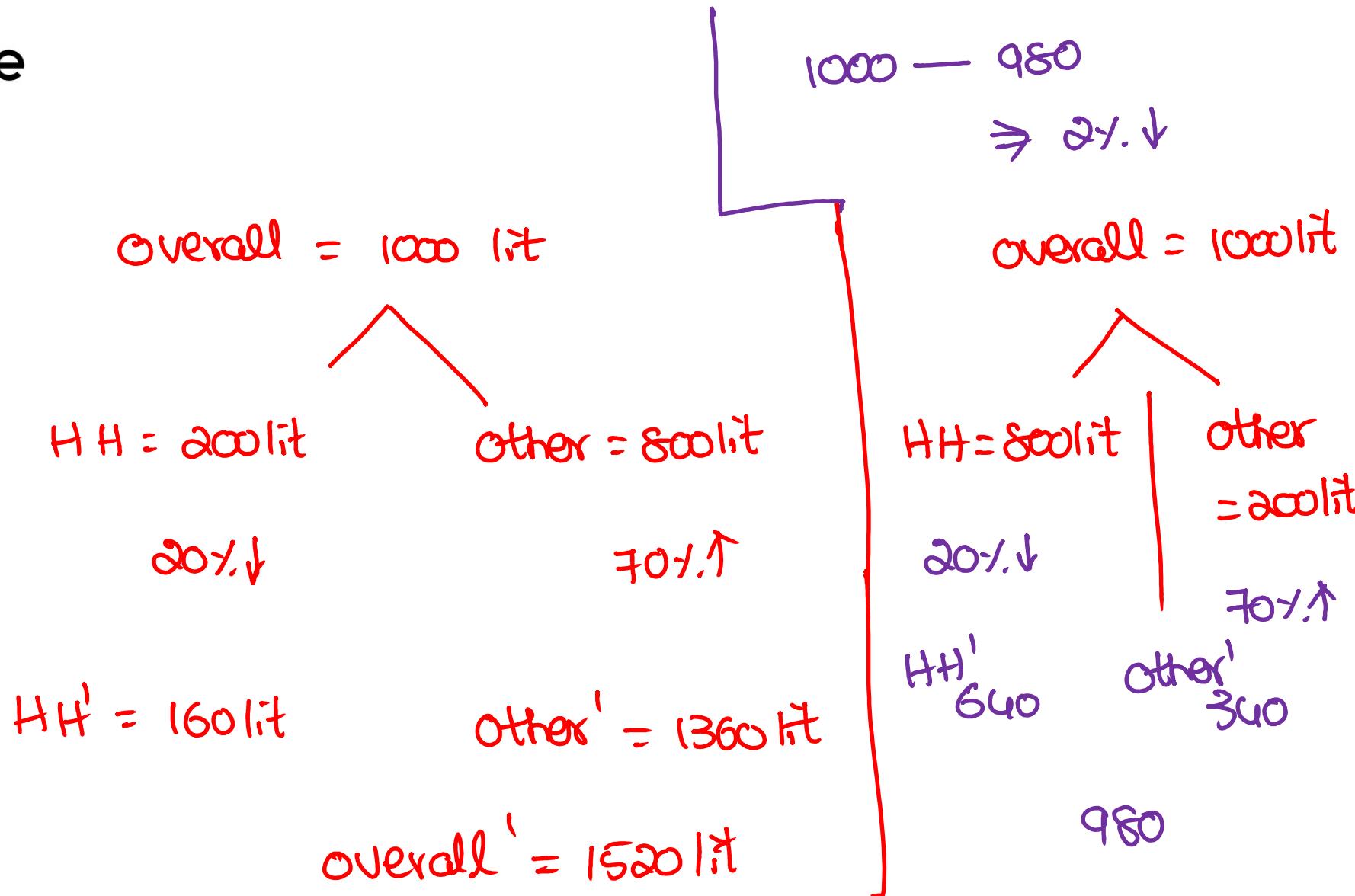
$\angle 20\% \downarrow$

while other consumption increases by 70%.

(Q.M)

Which of the following statement is correct?

- HH      other
- $20\% \downarrow$        $70\% \uparrow$
- (A) The ratio of household to other consumption is 8/17
  - (B) The ratio of household to other consumption is 1/17
  - (C) The ratio of household to other consumption is 17/8
  - (D) There are errors in the official's statement



105

GATE: What is the sum of the missing digits in the subtraction problem below?

$$\begin{array}{r}
 5 \quad - - - \\
 - 4 8 \underline{\quad} 8 9 \\
 \hline
 = \quad 1 1 1 1
 \end{array}$$

- (A) 8      (B) 10      (C) 11      (D) Cannot be determined

$$\begin{array}{r}
 5 \quad - - - \\
 - 4 8 \underline{\quad} 8 9 \\
 \hline
 \textcircled{0} \quad 1 \quad 1 \quad 1 \quad 1
 \end{array}$$

$$a - b = c$$

$$\Rightarrow a = b + c$$

$$\begin{array}{r}
 0 \ 1 \ 1 \ 1 \ 1 \\
 + 4 \ 8 \ \underline{8} \ 8 \ 9 \\
 \hline
 = 5 \ \underline{0} \ \underline{0} \ \underline{0} \ \underline{0}
 \end{array}$$

Sum missing = 8

$$\begin{array}{r}
 0 \ 1 \ 1 \ 1 \ 1 \\
 + 4 \ 8 \ \underline{q} \ 8 \ 9 \\
 \hline
 5 \ \underline{0} \ \underline{1} \ \underline{0} \ \underline{0}
 \end{array}$$

Sum missing = 10

$$\frac{0}{0} \rightarrow \text{undefined}$$

$$\frac{1}{1}, \frac{2}{2}, \frac{3}{3}, \dots \frac{0}{0} = 1$$

$$\frac{0}{1}, \frac{0}{2}, \frac{0}{3}, \dots \frac{0}{0} = 0$$

$$T_{ankc} = 8 \text{ lit}$$

$$f + 12H \rightarrow 4 \text{ hrs}$$

$$-2 \text{ lit/h}$$

$$f + 10H \rightarrow 8 \text{ hrs}$$

$$-1 \text{ lit/h}$$

$$f + nH \rightarrow 2 \text{ Hrs}$$

$$-4 \text{ lit/h} = f + nH$$

$$-2 = f + 12H$$

$$-1 = f + 10H \Rightarrow H = -\frac{1}{2}$$

$$F = H$$

106

fill

A steady stream flows into a cistern partly full

which has a number of equal holes at the bottom.

If 12 holes are opened, the cistern is emptied in 4

hrs and if 10 holes are opened the cistern is

emptied in 8 hrs. How many holes should be

opened so as to empty the cistern in 2 hrs?

$n=16$

$$\left. \begin{array}{l} -4 = 4 + n (-\cancel{2}) \\ \hline \frac{n}{2} = 8 \\ n = 16 \end{array} \right\}$$