

APTITUDE NOTES

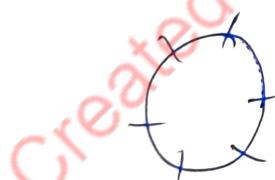
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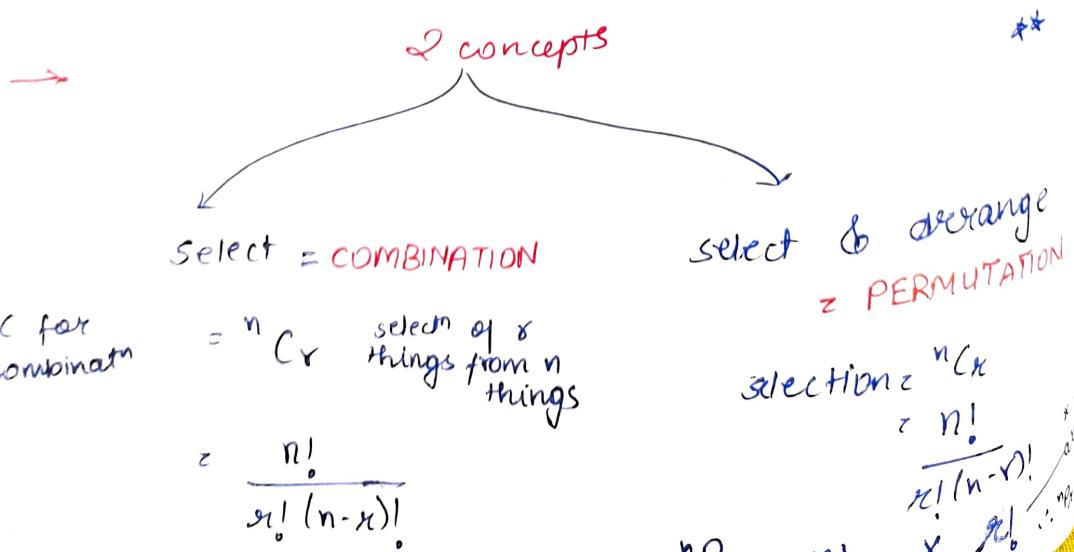
$$\begin{aligned} \rightarrow n! &= n(n-1)(n-2)\dots 0 \\ \rightarrow n! &= n(n-1)! \\ \rightarrow 9! &= 9 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \end{aligned}$$

$$6! = 6 \times 5 \times 4 \times 3 \times 2 \times 1 = 720$$

- we can arrange n things linearly in $n!$ ways
- a - b - c
 a, b, c can be arranged in $3!$ ways
 $= 6$ ways
- we can arrange n things in circular manner $(n-1)!$ ways



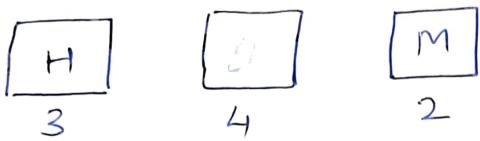
$$= (6-1)! = 120 \text{ ways}$$



→ n things i repeats x time $\Rightarrow \frac{n!}{x!}$ (Arrangement)

Q1. In Daya's bag there are 3 books of History, 4 books of Science & 2 books of Maths. In how many ways can Daya arrange the books so that books of the same subject are together.

Solⁿ:



These 3 can be arranged in $3!$ ways

$$3! \times \frac{3! \times 4! \times 2!}{\text{Books can arrange among themselves}} = 6 \times 6 \times 24 \times 2 = 36 \times 48 = 1728 \text{ ways}$$

Q2. In how many ways can we arrange the word 'FUZZTONE' so that all the vowels come together.

Solⁿ:

F U Z Z T O N E

vowels here = U, O, E

[U, O, E] ← Treat as 1
but these can arrange among themselves in $3!$ ways

$$F, Z, Z, T, N \leftarrow 5 + [U, O, E] = 6$$

$$\therefore \text{no of ways} = \frac{6! \times 3!}{2!}$$

$$= \frac{6 \times 5 \times 4 \times 3 \times 2! \times 3 \times 2}{2!}$$

$$= 2160 \text{ ways}$$

$$2! \leftarrow$$

because of Z's repetition

Q3. If Guraj doesn't want ways can be arr.
 'MARKER'? ?

Soln: Total no. of ways = No. of ways
 in which vowels are together +
 No. in which vowels are not together

$$z = x + y$$

$$z = x + y$$

$$y = z - x$$

$$z = 6 \times 5 \times 4 \times 3$$

$$z = \frac{6!}{2!} = 360$$

\leftarrow because of R

$$x = \frac{5! \times 2!}{2!} = 120$$

\leftarrow vowels can arrange among themselves
 \leftarrow because of R

MARKER

Vowels = A

$$z - x = 360 - 120 = 240 \text{ ways}$$

Q4. Without repetition, using digits 2, 3, 4, 5, 6, 8
 how many numbers can be made which lie b/w
 500 and 1000?

Soln:

$$\begin{array}{c} 3 (5, 6, 8) \\ \times \quad \times \quad \times \\ \hline \end{array}$$

LOGIC: $\begin{array}{c} 3 (5, 6, 8) \\ \times \quad \times \quad \times \\ \hline \end{array} = 3 \times 6 \times 5 = 90 \text{ ways}$

$$x \geq 500$$

$$x \leq 1000$$

FORMULA

$$\frac{3}{5, 6, 8} C_1 \quad \frac{6}{C_1} \quad \frac{5}{C_1}$$

(select = combination)

$$= 3 \times 6 \times 5 = 90 \text{ ways}$$

- Q5. 4 members form a group out of total 8 members
- (i) In how many ways it is possible to make the group if two particular members are always included.
- (ii) In how many ways it is possible to make the group if two particular members must not be included.

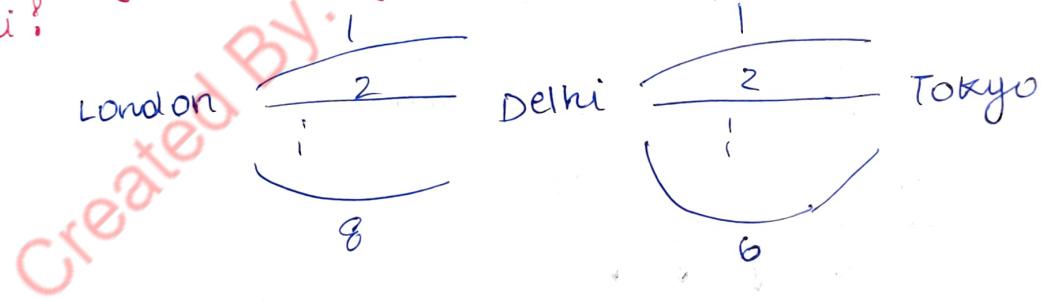
Solⁿ: (i) $n = 8$ 2 always included
 $\Rightarrow 2$ more to be selected out of 6

$$^6C_2 = \frac{6 \times 5 \times 4!}{2! \times 4!} = 15 \text{ ways}$$

(ii) $n = 8$ 2 are never to be selected
 \Rightarrow choose 4 out of 6 for 4 places
 $\Rightarrow ^6C_4 = \frac{6 \times 5 \times 4 \times 3!}{2! \times 4!} = 15 \text{ ways}$

Q6. There are 6 routes from London to Delhi. There are 8 routes from Delhi to Tokyo. In how many different ways can Raj travel from London to Tokyo via Delhi?

Solⁿ:



$$1 \rightarrow 6$$

$$8 \rightarrow 6 \times 8 = 48 \text{ ways}$$

Q7. There are 35 people in a group. There are 12 school girls, 10 school boys, 5 senior citizens and 8 babies in the group. The organizer of the group wants to select a school girl or a school boy as a leader of the group. In how many ways can he do so?

Soln:

OR = +

AND = X

$${}^{12}C_1 + {}^{10}C_1 = 22 \quad (\text{1 leader - boy or girl})$$

Q8. In a class there are 15 students. During a Christmas party all of them shook hands with each other only once. How many handshakes took place in the class?

Soln: If for a handshake 2 people are req
 $= {}^{15}C_2 = \frac{15 \times 14 \times 13!}{13! \times 2!} = 105$

→ If only once not given then $105 \times 2 = 210$
 $\begin{cases} A \rightarrow B \text{ (Only once)} \\ B \leftrightarrow A \text{ (Not only once)} \end{cases}$

Q9. A bank has 6 digit account number with no repetition of digits within a account number. The first and last digits of the account number is fixed to be 4 and 7. How many such account nos. are possible?

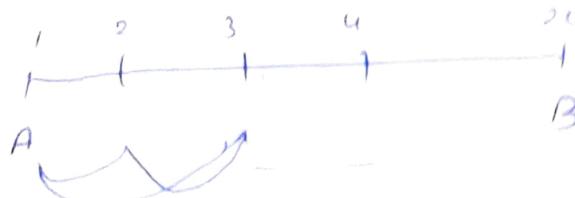
Soln: $\underline{\quad} \quad \underline{\quad} \quad \underline{\quad} \quad \underline{\quad} \quad \underline{7}$

options → $8 \quad 7 \quad 6 \quad 5 \quad = 8 \times 7 \times 6 \times 5 = 56 \times 30 = 1680$

Q10. A trekking group is to be formed having 6 members. They are to be selected from 3 girls, 4 boys and 5 teachers. In how many ways can the group be formed so that there are 3 teachers and 3 boys or 2 girls and 4 teachers?

Soln: ${}^5C_3 \cdot {}^4C_3 + {}^5C_4 \cdot {}^3C_2$
 $10 \cdot 4 + 5 \cdot 3 = 40 + 15 = 55$

Q11. On a railway line there are 20 stops. & tickets needed to travel b/w any 2 stops. How many different tickets would the government need to prepare to cater all possibilities?



${}^{20}C_2 \times 2$ considering backward journeys
also ($A \rightarrow B$, $A \rightarrow C$ but
 $C \rightarrow A$, $C \rightarrow B$ also)

$$= \frac{20 \times 19 \times 18!}{18! \times 2}$$

$$\text{No. of possibl} = 380$$

Q12. If 17 students are present in a class. In how many ways can they be made to stand in 2 circles of 8 and 9 students?

$$\text{Ans: } n = 17$$

$${}^{17}C_8$$

$$8 \\ \downarrow \\ 7!$$

$$9 \\ \downarrow \\ 8!$$

$$|$$

$$| \\ | \\ | \\ | \\ |$$

$${}^{17}C_9$$

$$9 \\ \downarrow \\ 8!$$

$$8 \\ \downarrow \\ 7!$$

$$= {}^{17}C_8 \times 7! \times 8!$$

$$= {}^{17}C_9 \times 8! \times 7!$$

$$= \frac{17 \times 16 \times 15 \times 14 \times 12 \times 11 \times 10 \times 9! \times 7! \times 8!}{8! \times 9!}$$

$$= \frac{17! \times 8! \times 7!}{8! \times 9!}$$

$$= \frac{17! \times 7!}{9!}$$

Both give same ans.

Q13. A locker has 3 digit lock. Mahesh forgot his password & was trying all possible combinations. He took 6 seconds for each try. The problem was that digit can't be from 0 to 9. How much time will be needed by Mahesh to try all the combinations?

Soln:

$$10 \times 10 \times 10 = 1000 \text{ combinations}$$

(repetition allowed)

$$1 \text{ combination} = 6 \text{ sec}$$

$$\therefore 1000 = 6000 \text{ sec}$$

$$= \frac{1000}{60} = 100 \text{ minutes}$$

Q14. In a room there are 2 green chairs, 3 yellow chairs and 4 blue chairs. In how many ways can Raj choose 3 chairs so that at least one chair is yellow.

Soln:

Method I: Formula

$$\text{Total ways} = \underbrace{\text{choosing 1 Yellow}}_{z} + \text{Not choosing Yellow} \underbrace{y}_{x}$$

$$z = z - y$$

$$2G + 3Y + 4B = {}^6G_3$$

$${}^9C_3 = 84 \quad = 20 \text{ ways}$$

$$z = 84 - 20 = 64 \text{ ways}$$

Method II: Logic

$$\text{At least one yellow} = 1Y \text{ or } 2Y \text{ or } 3Y$$

$$(i) + (ii) + (iii)$$

$$\begin{aligned}
 & \text{(i) } 1Y \\
 \Rightarrow & \frac{^3C_1}{1Y} \times \frac{^2C_2}{2G} + \frac{^3C_1}{1Y} \times \frac{^2C_1}{1G} \times \frac{^2C_1}{1B} + \frac{^3C_1}{1Y} \times \frac{^4C_2}{2B} \\
 = & 3 + 24 + 18 = 45
 \end{aligned}$$

$$\begin{aligned}
 & \text{(ii) } 2Y \\
 \Rightarrow & \frac{^3C_2}{2Y} \times \frac{^2C_1}{1G} + \frac{^3C_2}{2Y} \times \frac{^4C_1}{1B} \\
 = & 6 + 12 = 18
 \end{aligned}$$

$$\begin{aligned}
 & \text{(iii) } 3Y \\
 \Rightarrow & \frac{^3C_3}{3Y} = 1 \\
 \text{Total} & = 45 + 18 + 1 = 64 \text{ ways}
 \end{aligned}$$

Q15. How many combinations are possible while selecting four letters from 'SMOKEJACK' with the condition that J must appear in it?
 Ans: S.M.O.K.E.J.A.C.K = 8 letters
 K - 2 times

J — — —

$$\text{Case(i) Both K's} \quad \underline{\text{K}} \quad \underline{\text{K}} \quad \underline{\overset{6}{C}_1} = \overset{6}{C}_1$$

$$\text{Case(ii) Only one K} \quad \underline{\text{K}} \quad \underline{\text{—}} \quad \underline{\overset{6}{C}_2} = \overset{6}{+} C_2$$

$$\text{Case(iii) No K} \quad \underline{\text{—}} \quad \underline{\text{—}} \quad \underline{\overset{6}{C}_3} = \overset{6}{+} C_3$$

$$\begin{aligned}
 & \text{only selection} \\
 & \therefore C = 41
 \end{aligned}$$

HCF & LCM

* HCF

Highest common factor / greatest common divisor

- Largest (+)ive whole number that divides given nos.

Method:- GCF of 20, 50, 120

$$\begin{array}{c|cc} 2 & 20 \\ \hline 2 & 10 \\ \hline & 5 \end{array}$$

$$\begin{array}{c|cc} 2 & 50 \\ \hline 5 & 25 \\ \hline & 5 \end{array}$$

$$\begin{array}{c|cc} 2 & 120 \\ \hline 2 & 60 \\ \hline 2 & 30 \\ \hline 3 & 15 \\ \hline & 5 \end{array}$$

HCF = common

$$= 2 \times 5$$

$$= 10$$

nos. in A 3 factorizat.

method : LCM

$$\begin{array}{c|cc} 2 & 12 \\ \hline 2 & 6 \\ \hline 3 & 3 \\ \hline & 1 \end{array}$$

* LCM of a,

explan

$$\begin{array}{c|cc} 2 & 6 \\ \hline 2 & 3 \\ \hline 2 & 3 \\ \hline 2 & 3 \\ \hline 3 & 3 \\ \hline & 1 \end{array}$$

other method
Prime

Formulas

* LCM

Least common Multiple

Lcm of a, b, c (smallest positive integer that is divisible by both a and b)

(i) Lcm

(ii) HCF

$$\text{Eg. } \text{LCM}(2, 3) = 6$$

(iii) Two

$$\text{LCM}(6, 10) = 30$$

method : LCM of 12, 18, 30

2	12, 18, 30
2	6, 9, 15
3	3, 9, 15
	1, 3, 5

$$\begin{aligned} &= 4 \times 9 \times 5 \\ &= 36 \times 5 \\ &= 180 \end{aligned}$$

* If LCM of a, b, c & $c \div a \Rightarrow R = 0$ then strike out a

explanation :- LCM of 6, 12, 16 = 24

$$12 \div 6 \Rightarrow R = 0$$

2	6, 12, 16
2	3, 6, 8
2	3, 3, 4
2	3, 3, 2
3	3, 3, 1
	1, 1, 1

$$= 8 \times 3 = 24$$

strike out 6

2	12, 16
2	6, 8
2	3, 4
2	3, 2
	3, 1

$$= 8 \times 3 = 24$$

other method for LCM
Prime Factorization \Rightarrow $6 = 2 \times 3$ $10 = 2 \times 5$ LCM = $2^{\text{highest power of } 2} \times 3^{\text{highest power of } 3} \times 5^{\text{highest power of } 5}$
 $= 30$

Formulas :-

(i) LCM of fraction = $\frac{\text{LCM of } N^x}{\text{HCF of } D^x}$

(ii) HCF of fraction = $\frac{\text{HCF of } N^x}{\text{LCM of } D^x}$

(iii) two nos A & B whose LCM & HCF
 $\Rightarrow A \times B = \text{LCM} \times \text{HCF}$

Q1. what is the LCM of $\frac{36}{225}$, $\frac{48}{150}$, $\frac{72}{65}$?

Solⁿ: LCM of fraction = $\frac{\text{LCM of } N^x}{\text{HCF of } D^x}$

LCM of $36, 48, 72$
since 72 is divisible by 36 , strike off 36

2	48, 72
2	24, 36
2	12, 18
2	6, 9
3	3, 9
	1, 3

$$\begin{aligned} \text{LCM} &= 2 \times 2 \times 2 \times 3 \times 3 \\ &= 16 \times 9 \\ &= 144 \end{aligned}$$

HCF of $225, 150, 65$

3	225
3	75
5	25
5	5

2	150
3	75
5	25
	5

5	65
	13

$$\text{HCF} = 5$$

∴

$$\therefore \text{LCM of fraction} = \frac{144}{5}$$

LCM_x

Q2. what is HCF of $\frac{36}{75}, \frac{48}{150}, \frac{72}{135}$?

Solⁿ: HCF of fraction = $\frac{\text{HCF of } N^x}{\text{LCM of } D^x}$

HCF of 36, 48, 72

2	36
2	18
2	9
3	3
	1

2	48
2	24
2	12
2	6
	3

2	72
2	36
2	18
3	9
	3

$$\text{HCF} = 2 \times 2 \times 3 = 12$$

LCM of 75, 150, 135

2	75, 150, 135
3	75, 75, 135
3	25, 25, 45
3	25, 25, 15
5	25, 25, 5
5	5, 5, 1
	1, 1, 1

$$\begin{aligned}\text{LCM} &= 2 \times 3 \times 3 \times 3 \times 5 \times 5 \\ &= 6 \times 9 \times 25 \\ &= 54 \times 25 \\ &= 1350\end{aligned}$$

Q3. What greatest number divides 17, 42 and 93 and leaves remainders 4, 3 & 15 respectively?

Soln:

\rightarrow HCF

Let no = x

$$\frac{17}{x} \Rightarrow R = 4 \quad \text{i.e. } \frac{17 - 4}{x} = \frac{13}{x} \Rightarrow R = 0$$

$$\frac{42}{x} \Rightarrow R = 3 \quad \text{i.e. } \frac{42 - 3}{x} = \frac{39}{x} \Rightarrow R = 0$$

$$\frac{93}{x} \Rightarrow R = 15 \quad \text{i.e. } \frac{93 - 15}{x} = \frac{78}{x} \Rightarrow R = 0$$

HCF 13, 39, 78

• 13

$$\begin{array}{r} 39 \\ \hline 13 \end{array}$$

$$\begin{array}{r} 78 \\ \hline 13 \end{array}$$

$$\text{HCF} = 13$$

$$\therefore n = 13$$

$$\text{check: } \frac{13}{13}$$

$$\begin{array}{r} 14 \\ \hline 13 \end{array} \Rightarrow R = 4$$

$$\begin{array}{r} 42 \\ \hline 13 \end{array} \Rightarrow R = 3$$

$$\begin{array}{r} 93 \\ \hline 13 \end{array} \Rightarrow R = 15$$

Q4. what least number when divided by 36, 24 and 16 leaves 11 as remainder in each case?

least \Rightarrow LCM

Sol:

$$\begin{array}{r} 36, 24, 16 \\ \hline 18, 12, 8 \\ \hline 9, 6, 4 \\ \hline 9, 3, 2 \\ \hline 9, 3, 1 \\ \hline 3, 1, 1 \end{array}$$

odd

$$\begin{array}{r} 11 \rightarrow \text{LCM} \\ \hline 155 \\ 153 \end{array}$$

$$\begin{aligned} \text{LCM} &= 8 \times 6 \times 3 \\ &= 144 \end{aligned}$$



* Same Remainder \rightarrow LCM \rightarrow add the remainders

Diff Remainder \rightarrow LCM \rightarrow subtract the remainders

Ques: What least number when divided by 20, 48 & 36 leaves remainders 13, 41 and 29 respectively?

Soln: Least = LCM

2	20, 48, 36
2	10, 24, 18
2	5, 12, 9
2	5, 6, 9
3	5, 3, 9
	5, 1, 3

$$= 16 \times 9 \times 5$$

$$= 720$$

$$= 720 - 7$$

$$= 713 \quad (\text{Diff. of remainders})$$

Ques: What least possible 4 digit number when divided by 12, 16, 18 and 20 leaves 21 as remainder?
Soln: Least = LCM

2	12, 16, 18, 20
2	6, 8, 9, 10
2	3, 4, 9, 5
2	3, 2, 9, 5
3	3, 1, 9, 5
	1, 1, 3, 5

$$\begin{aligned} \text{LCM} &= 16 \times 9 \times 5 \\ &= 16 \times 45 \\ &= 720 \end{aligned}$$

$$\text{req. no} = 4 \text{ digit} = 720 \times 2$$

$$= 1440$$

∴ it leaves 21 as remainder

$$\therefore \text{no} = 1440 + 21 = 1461$$

Ques: The ratio of two numbers is 5:6 and their LCM is 480, then their HCF is ??

Soln:

$$\begin{array}{cc} A & B \\ \text{LCM} & \text{HCF} \end{array}$$

$$AXB = \text{LCM} \times \text{HCF}$$

$$5:6 \Rightarrow 5k, 6k$$

$$\begin{array}{ccccc} \text{HCF} & : & K & 5K & 6K \\ & & & 5 & 6 \end{array}$$

$$5k \times 6k = K \times 480$$

$$\boxed{K = 16}$$

$$\boxed{\text{HCF} = K}$$

those numbers is
reciprocals?

Soln: $a+b = 56$

$$\text{Sum of reciprocals} = \frac{1}{a} + \frac{1}{b} = \frac{a+b}{ab} = \frac{56}{8 \times 96}$$

$$\Rightarrow \frac{a+b}{ab} = \frac{7}{96}$$

Q9. What largest number will divide 47, 35 and
leaving same remainder in each case? What will
common remainder be?

Soln: Largest = HCF

$$47 \quad 35 \quad 27$$

HCF of 12, 8, 20

$$\begin{array}{r} 2 | 12 \\ 2 | 6 \\ \hline 3 \end{array} \quad \begin{array}{r} 2 | 8 \\ 2 | 4 \\ \hline 2 \end{array} \quad \begin{array}{r} 2 | 20 \\ 2 | 10 \\ \hline 5 \end{array}$$

$$47 - 35 = 12$$

$$\text{HCF} = 4$$

$$35 - 27 = 8$$

$$27 - 47 = -20$$

(Ignore
the sign)

$$47 \div 4 \Rightarrow R = 3$$

$$35 \div 4 \Rightarrow R = 3$$

$$27 \div 4 \Rightarrow R = 3$$

$$\therefore \text{No} = 4 \quad \& \quad R = 3.$$

Q10. There are 3 equi as with sides 114 cm, 76 cm
152 cm. what max size scale can measure them exactly

Soln:

$$\begin{array}{r} 2 | 114 \\ 3 | 57 \\ \hline 19 \end{array}$$

$$\begin{array}{r} 2 | 76 \\ 2 | 38 \\ \hline 19 \end{array}$$

$$\begin{array}{r} 2 | 152 \\ 2 | 76 \\ 2 | 38 \\ \hline 19 \end{array}$$

$$\text{HCF} = 2 \times 19 = 38$$

$\therefore 38$ cm scale required

Q11. If $x-4$ is HCF of $x^2-8x+15$ and x^2-kx-1 , then what is k ?

Soln: $x-4$ is HCF \Rightarrow it is a factor of $x^2-8x+15$ & x^2-kx-1

$$\Rightarrow 16 - 8(4) + 15 = 0$$

$$16 - 4k - 1 = 0$$

$$\Rightarrow 16 - 32 + 15 = 16 - 4k - 1$$

$$\Rightarrow 4k = 1 + 17$$

$$\Rightarrow 4k = 16$$

$$\Rightarrow \boxed{k = 4}$$

Q12. 5 clocks ring automatically at intervals of 12 minutes, 8, 3, 4 & 10 mins. respectively. In 8 hrs from the moment they start, how many times will they ring together?

Soln: HCF / LCM = ??

Common multiple (next instance) = LCM

$$\begin{array}{c|cccc}
 & 12, 8, & \cancel{8}, \cancel{10} \\
 \hline
 2 & 6, 4, 5 \\
 \hline
 2 & 3, 2, 5 \\
 \hline
 \end{array}
 \quad \text{LCM} = 4 \times 6 \times 5 = 120 \text{ min} \\
 = 2 \text{ hrs}$$

... 4 times ...

Q13. 3 cyclists cycle along the circumference of a jungle. They complete one round in 27 minutes, 45 mins & 63 mins respectively. Since they start together, when will they meet again at the starting position?

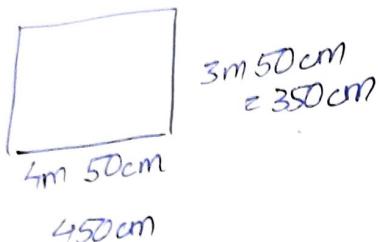
Soln: Next instance \Rightarrow LCM

$$\begin{array}{l}
 3 \quad 87, 45, 63 \\
 3 \quad 9, 15, 21 \\
 3 \quad 3, 5, 7
 \end{array}$$

$$\begin{aligned}
 LCM &= 27 \times 5 \times 7 \\
 &= 27 \times 35 \\
 &= 945 \text{ min.}
 \end{aligned}$$

Q14. Manoj wants to paste wallpaper on a wall of length and 3m 50cm in height. The wall is 4m 50cm high. The wall should be covered completely only by wallpaper squares having same size. What is the no. of squares needed to cover the wall completely?

Soln:



$$\begin{array}{r|rr}
 HCF & 2 & 350 \\
 & 5 & 175 \\
 & 5 & 35 \\
 & & 7
 \end{array}$$

$$\begin{array}{r|rr}
 2 & 450 \\
 3 & 225 \\
 3 & 75 \\
 5 & 25 \\
 & 5
 \end{array}$$

$$\begin{aligned}
 HCF &= 2 \times 5 \times 5 \\
 &= 50
 \end{aligned}$$

$$\begin{aligned}
 \therefore \text{No. of sq. req'd} &= \frac{\text{Total area}}{\text{Area of one sq}} \\
 &= \frac{350 \times 450}{50 \times 50} \\
 &= \frac{3150}{50} = 63
 \end{aligned}$$

~~Ans~~
Q15. The sum of two nos. is 156 and their HCF is 13. Find the no. of such pairs.

Soln:

HCF is 13

$\Rightarrow A, B$ must be multiples of 13

\Rightarrow	13	26	39	52	65	78
	1	1	1	1	1	1

\Rightarrow Two pairs whose sum = 156

and $HCF = 13$
 $(13, 143)$ & $(65, 91)$

Q16. What is
 3, 5, 6, 8
 but
 case

- A7 312
 B7 962
 C7 1582
 D7 1586

Ans:

A
 B
 C
 D

104

78 & 79

Q16. What is the least number which when divided by 3, 5, 6, 8, 10 and 12 leaves 2 as remainder in each case but when divided by 13 leaves no remainder?

- A) 312
- B) 962
- C) 1562
- D) 1586

Soln: A) $312 \div 6 \Rightarrow R = 0$ cancelled

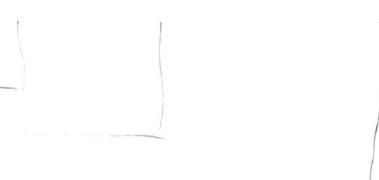
B) $962 \div 13 \Rightarrow R = 0$

C) $1562 \div 13 \Rightarrow R \neq 0$ cancelled

D) $1586 \div 10 \Rightarrow R \neq 2$

Ans = (B)

104 117 130 143 156



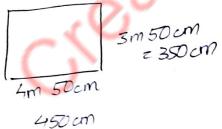
$$78 \& 78 \Rightarrow HCF = 78$$

$$\begin{array}{l} 3 \\ 3 \\ 3 \end{array} \quad \begin{array}{l} 84, 45, 63 \\ 9, 15, 21 \\ 3, 5, 7 \end{array}$$

$$\begin{aligned} LCM &= 2^3 \times 5 \times 7 \\ &= 24 \times 35 \\ &= 840 \text{ min.} \end{aligned}$$

Q14. Manoj wants to paste wallpaper on a wall of his room. The wall is 4m 50 cm in length and 3m 50 cm in height. The wall should be covered completely only by squares having same size. What is the no. of max. sized wallpaper squares needed to cover the walls completely?

Soln:



$$\begin{array}{r} HCF = 2 \\ \hline 350 & 450 \\ -50 & -50 \\ \hline 175 & 225 \\ -50 & -50 \\ \hline 75 & 75 \\ -50 & -50 \\ \hline 25 & 25 \\ -5 & -5 \\ \hline 5 & 5 \\ -5 & -5 \\ \hline 0 & 0 \end{array}$$

$$HCF = 2 \times 5 \times 5 \\ = 50$$

$$\therefore \text{no. of sq req'd} = \frac{\text{Total area}}{\text{area of one sq}} \\ = \frac{350 \times 450}{50 \times 50} \\ = \frac{3150}{50} = 63$$

Ans
Q5. The sum of two nos. is 156 and their HCF is 13. Find the no. of such pairs.

Befn:

$$\begin{array}{l} \text{HCF is 13} \\ \Rightarrow A, B \text{ must be multiples of 13} \end{array} \quad A + B = 156$$

13	26	39	52	63	78	91
1						

\Rightarrow Two pairs whose sum = 156
and HCF = 13
(13, 143) & (65, 91)

Q16. What is the least number which when divided by 3, 5, 6, 8, 10 and 12 leaves 2 as remainder in each case but when divided by 13 leaves no remainder?

A) 312

B) 962

C) 1582

D) 1586

Opn:

$$A > 312 \div 6 \Rightarrow R = 0 \quad \text{cancelled}$$

$$B > 962 \div 13 \Rightarrow R = 0$$

$$C > 1582 \div 13 \Rightarrow R \neq 0 \quad \text{cancelled}$$

$$D > 1586 \div 10 \Rightarrow R \neq 2$$

\therefore ans = (B)

104	117	130	143	156
1				

78 & 78 \Rightarrow HCF = 78

→ Probability = $\frac{\text{what I want}}{\text{Total}}$

Eg: $\begin{array}{|c|c|} \hline 0 & 0 \\ \hline 0 & 0 \\ \hline \end{array} \rightarrow 4R$ $\begin{array}{|c|c|} \hline 0 & 0 \\ \hline 0 & 0 \\ \hline \end{array} \rightarrow 2G$

$P(R) = \frac{4}{6}$

→ AND = \times (Multiply)
OR = $+$ (Add)

→ (i) Total Probability = 1

In the above eg. $\Rightarrow P_R + P_G = \frac{4}{6} + \frac{2}{6} = 1$

(ii) $P + \bar{P} = 1$

Prob of an event happening
Prob of that event not happening

52 cards

13 spades
(black)

13 hearts
(Red)

13 clubs
(Black)

13 diamonds
(Red)

each has cards as;
A, 2-10, J, K, Q

Q1. Suresh keeps all his socks in a single drawer. He has 24 pairs of white socks & 18 pairs of grey socks. Suresh picks 3 socks randomly. Find the probability of choosing a matching pair.

Solⁿ:

48 white
36 grey

G G G
W — —

G W W
W — —

In each case a pair will be formed
i.e. prob = 1 (\because event always occurs)

Q2. What will be the possibility of drawing a jack or a spade from a well shuffled standard deck of 52 playing cards?

Spade = 13
Jack = 4

$P = \frac{13}{52} + \frac{4}{52} = \frac{1}{52}$ — Prob of drawing jack of spade \because its already included

$$= \frac{13+4-1}{52} = \frac{16}{52} = \frac{4}{13}$$

Q3. A box has 6 black, 4 red, 2 white and 3 blue shirts when shirts are picked randomly, what is the probability that either both are white or both are blue

ratio: Both Blue OR Both White

$$\text{Both Blue} \quad \text{OR} \quad \text{Both White}$$

$$+ \quad \frac{2}{15} \times \frac{1}{14}$$

$$\frac{3}{15} \times \frac{2}{14} - \because 1 \text{ is already chosen}$$

Both
White

$$= \frac{3}{15} \times \frac{2}{14} + \frac{2}{15} \times \frac{1}{14} =$$

$$= \frac{6+2}{15 \times 14} = \frac{8}{15 \times 14} = \frac{4}{105}$$

white = 17

↓
4 imp

green = 13

↓
5 imp

Green card

$$\frac{13}{30}$$

OR

(+)

Imp card

$$\frac{9}{30} - \frac{5}{30}$$

$$= \frac{17}{30}$$

P of choosing green imp card \therefore it is already counted

Q7. A box has 6 black, 4 red, 2 white & 3 blue shirts. Find the probability of drawing 2 black shirts if they are picked randomly.

1st Black & 2nd Black

$$\frac{6}{15} \times \frac{5}{14} = \frac{1}{7}$$

Q8. A box has 6 black, 4 red, 2 white and 3 blue shirts. What is the probability that 2 red shirts and 1 blue shirt get chosen during a random selection of 3 shirts from the box?

3 → 1st & 2nd & 3rd

2R & 1B

R X R X R

OR

R X B X R

OR

R X R X B

$$\frac{3}{15} \times \frac{4}{14} \times \frac{3}{13}$$

$$\frac{9}{15} \times \frac{3}{14} \times \frac{3}{13}$$

$$\frac{4}{15} \times \frac{3}{14} \times \frac{3}{13}$$

$$= \frac{3 \times 36}{15 \times 14 \times 13}$$

$$= \frac{18}{455}$$

\Rightarrow for such scenarios \rightarrow find for one & multiply by 3

Q4. A pot has 2 white shirts & 4 black shirts. If one shirt is picked at least one shirt is white. What is the probability of picking a white shirt?

Ans: $\frac{1}{4} + \frac{1}{4} = \frac{1}{2}$ or $\frac{3}{4}$

$$\text{Soln: } Q) \text{ at least } = P + \bar{P} = 1$$

\downarrow
at least Red No Red

$$P = 1 - \bar{P}$$

$$\begin{array}{c} 15 \rightarrow 4 \text{ red} \\ \text{non-red} = 6 + 2 + 3 = 11 \text{ shirts} \end{array}$$

$$P = \frac{11}{15} \times \frac{10}{14} \times \frac{9}{13} \times \frac{8}{12} \quad \left(\begin{array}{l} 4 \text{ non-red} \\ \text{shirts} \end{array} \right)$$

$$= \frac{22}{91}$$

$$P = 1 - \frac{22}{91} = \frac{69}{91}$$

Q10. On rolling a dice 2 times, the sum of 2 numbers that appear on the uppermost face is 8. What is the probability that the first throw of dice yields 4?

Soln: 2 dice
 $= 6 \times 6$ possibilities

$$\text{Sum} = 8$$

$$\begin{array}{ccccccc} \cancel{(1,5)} & \cancel{(2,4)} & \cancel{(4,4)} & \cancel{(4,2)} & & & \\ (2,6) & (3,5) & (4,4) & (5,3) & (6,2) & & \\ \downarrow x & \downarrow x & \downarrow & \downarrow x & x & & \end{array}$$

Q5.
green
brown
pink
grey

Q11. A box has 5 black & 3 green shirts. One shirt is picked randomly and put in another box. The second box has 3 black & 5 green shirts. Now a shirt is picked from second box. What is the probability of it being a black shirt?

Soln:



$$\rightarrow P(B) = ??$$

1st is black 1st is green

$$\frac{5}{8} \times \frac{4}{9} + \frac{3}{8} \times \frac{3}{9} = \frac{29}{72}$$

Q12. What is the possibility of having 53 Thursdays in a non-leap year?

Soln:

365 days

\downarrow
52 weeks \rightarrow 52 Thurs

+
1 day

$$(m - T - S)$$

\downarrow
 $\frac{1}{7}$

Q13. In a drawer there are 4 white socks, 3 blue socks and 5 grey socks. Two socks are picked randomly. What is the possibility that both the socks are of same color?

$$\text{Soln: } 2 \rightarrow 2W \text{ or } 2B \text{ or } 2G$$

$$\frac{4}{12} \times \frac{3}{11} + \frac{3}{12} \times \frac{2}{11} + \frac{5}{12} \times \frac{4}{11}$$

$$= \frac{19}{66}$$

16. When two coins are tossed simultaneously, what are the chances of getting at least one tail?

2 → 1 tail or 2 tail

Two cases happens →

case 1) tailing after 1st

case 2) tailing after 2nd

$$P = \frac{1}{2} - \text{No tail}$$

or

2 coins

(H, H); (H, T); (T, H); (T, T)

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

1. An amount now of £6500 at simple interest will yield much in 2 and half years?

$$P = 6500 \times \frac{8}{4} \times 2.5$$

$$P = 6500 \times 2 \times 2.5$$

$$\Rightarrow SI = 21300$$

$$A = P + SI = 6500 + 1300 = 7800$$

2. An amount has become 7 times in 15 years. In how many years will the same amount become 10 times? Rate of interest remains same for both cases.

$$x = x + SI$$

$$SI = bx$$

$$\frac{x \times 8 \times t}{100} = bx$$

$$\frac{x \times 5 \times 15}{100} = bx$$

$$x = 40\%$$

03. A sum becomes £3000 at the rate of 12% p.a. (simple interest). The same sum becomes £3300 at the rate of 15% p.a. (simple interest) in the same duration. Find the sum and duration.

$$3000 = x + \frac{x \times 12 \times T}{100} \quad \text{--- (1)}$$

$$3300 = x + \frac{x \times 15 \times T}{100}$$

$$(2) - (1)$$

$$3000 = x + \frac{x \times 12 \times 100}{x \times 15}$$

$$\frac{300}{100} = \frac{3xT}{100}$$

$$3000 = x + 1200$$

$$x = 1800$$

$$xT = 10000$$

$$T = 10000$$

$$T = \frac{10000}{18000} = \frac{50}{9} = 5\frac{5}{9}$$

Q4. A man got ₹ 130 as simple interest for 2 years as compared to investing ₹ 2250 for same duration. What is the rate of interest?

$$\text{Soln: } \frac{2250 \times 4 \times x}{100} - \frac{2000 \times 4 \times x}{100} = 130$$

$$250 \times 4 \times x = 130 \times 100$$

$$x = 13\%$$

Q5. If $\frac{1}{5}$ part of an amount was given at 3% simple interest, $\frac{2}{5}$ part was given at 5% simple interest, $\frac{1}{3}$ part was given at 11% SI. The total interest received was ₹ 297. How much amount was originally given?

Q6. Let amt = x

$$\Rightarrow \frac{x \times 3 \times t}{5 \times 100} + \frac{x \times 5 \times t}{3 \times 100} + \frac{2x \times 9 \times t}{5 \times 100} + \frac{x \times 11 \times t}{15 \times 100} = 297$$

$$\Rightarrow 297 \times 100 = \frac{3x}{5} + \frac{5x}{3} + \frac{18x}{5} + \frac{11x}{15} = \frac{99x}{15}$$

$$x = 4500$$

Q6. ₹ 20,400 was divided into two parts and then invested. One part was invested at 6.25% for 8 years yields the same interest as the other part invested for 7% for 5 years. What is the value of smaller part?

$$\text{Soln: } x, 20400 - x$$

Given

$$\frac{x \times 6.25 \times 8}{100} = \frac{(20400 - x) \times 7 \times 5}{100}$$

$$x = 83400 \quad \text{Smaller part}$$

Q7. If the sum for 15 months at 7½% per annum exceeds SI on the same sum for 8 months at 12½% p.a. by ₹ 32.50 then the sum is _____?

$$\text{Soln: } \frac{x \times 12\frac{1}{2} \times \frac{8}{12}}{100} - \frac{x \times \frac{15}{12} \times 7\frac{1}{2}}{100} = 32.50$$

$$x = 3120$$

Q8. If SI for 2 yrs for a sum is ₹ 600 and CI for the same sum for 2 years & same rate of interest is ₹ 645, what will be the rate of interest?

Q9. For the first year CI & SI are same

$$\text{SI} \rightarrow 300 + 300$$

$$\text{CI} \rightarrow 300 + 345$$

Q9. Aman invests ₹ 8000 at some rate of interest. Being simple interest, the money doubles in 5 years. Raj invests this and invests ₹ 6250 for 3 yrs. How much interest does Raj get? $P + SI = 16000 \Rightarrow SI = 8000$

$$\text{Soln: } \frac{8000 \times x \times 5}{100} = \frac{8000}{20} \Rightarrow x = 20\%$$

$$\text{QI}' = \frac{6250 \times 3 \times 20}{100} = \frac{37500}{2} = 18750 \text{ Rs}$$

- Q10. Aman got a salary of ₹8600. He divided it in two parts. Find the diff. b/w the two parts, if his first part he got some SI at 15% p.a. in 4 yrs, which was same as second part in which he invested 20% for 3 yrs.
- Solⁿ:
- $$2x \frac{15 \times 4}{5} = (8600 - x) \times \frac{20 \times 3}{5}$$
- $$2x = 8600$$
- $$x = 4300$$
- $$\Rightarrow \text{Diff} = 0$$
- Q11. Ram gets ₹2600 for ₹2000 in 5 years at some rate of interest. Had he invested in other places where rate of SI is 3% more than the current rate, how much would Ram have got in the same time?
- Solⁿ:
- $$\frac{600}{30} = \frac{2000 \times x \times 5}{100} \Rightarrow x = 6\%$$
- Now $x' = 9\% (6+3)$
- $$\text{SI}' = \frac{2000 \times 9 \times 5}{100} = ₹900$$
- $$\therefore \text{amt}' = 2000 + 900 = ₹2900$$
- Q12. Raman paid ₹11400 as interest after 9 years. He had borrowed some money at the rate of 6% for first 2 years, 9% for next three years & 14% for the rest of the period. How much money did he borrow?
- Solⁿ:
- $$11400 = \frac{P \times 6 \times 2}{100} + \frac{P \times 9 \times 3}{100} + \frac{P \times 14 \times 4}{100}$$
- $$11400 = \frac{P}{100} (12 + 27 + 56) = \frac{P}{100} \times 95$$
- $$P = ₹12000.$$
- Q13. Suresh for 2 years invested Rs 500 in SBTI. He also invested ₹300 in LIC for 4 years. At the end he received ₹220 from both banks as SI. What must have been the rate of interest?

COMPOUND INTEREST

$$\rightarrow \text{Amt after } n \text{ years} \Rightarrow P \left(1 + \frac{R}{100}\right)^n = P + CI$$

n = no. of years
 R = rate of interest
 P = initial amt.
 CI = compound interest

~~$\rightarrow \text{Diff b/w CI \& SI} \Rightarrow P \left(\frac{R}{100}\right)^n = CI - SI$~~

$$\rightarrow \text{Population after } n \text{ years} = P \left(1 + \frac{R}{100}\right)^n$$

$+ \uparrow \quad - \downarrow$

$$\rightarrow CI = SI \quad \text{(for first year)}$$

$$\rightarrow P \left(1 + \frac{R}{100}\right)^{n \times b} = P \left(1 + \frac{R}{100}\right)^n \left(1 + \frac{a}{b} \frac{R}{100}\right)$$

$$\rightarrow \text{Diff b/w CI \& SI for 2 years}$$

$$\Rightarrow P \left(\frac{R}{100}\right)^2 = \frac{SI \times R}{200}$$

$$\rightarrow \text{Diff for 3 years} = P \left(\frac{R}{100}\right)^2 \left(\frac{R+3}{100}\right)$$

Q2. If sum of ₹ 6400 is kept for 2 years at 25% interest rate compounded quarterly $\rightarrow \frac{1}{4}$. There are 4 quarters
 Sol: 12 months \rightarrow 4 parts

$$T = 4T = 4 \times \left(\frac{6}{12}\right) = 2$$

$$R = \frac{P}{4} = \frac{25}{4}$$

$$\begin{aligned} A &= P \left(1 + \frac{R}{100}\right)^n \\ &= 6400 \left(1 + \frac{25}{4 \times 100}\right)^2 \\ &= \cancel{6400} \times \frac{17}{16} \times \frac{17}{16} \end{aligned}$$

$$\Rightarrow A = 7225$$

$$\therefore CI = 7225 - 6400 = ₹ 825$$

Q2. What CI will ₹ 5000 fetch in 3 years 10 months at 30% p.a?

Soln:

$n = 3 \text{ yrs } 10 \text{ months}$
 $= 3 \text{ yrs } \frac{10}{12} \text{ yrs}$
 $= 3\frac{5}{12} \text{ yrs}$

$$A = 5000 \left(1 + \frac{30}{100}\right)^3 \left(1 + \frac{\frac{5}{12} \times 30}{100}\right)$$

} using formula

$$= 5000 \times \left(\frac{13}{10}\right)^3 \left(\frac{5}{4}\right)$$

$$A = 13731.25 \text{ Rs} \quad \Rightarrow CI = 8731.25 \text{ Rs}$$

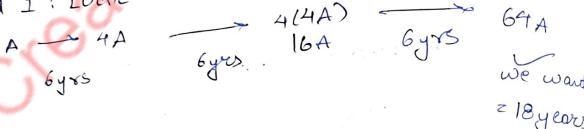
How much money invested at CI will yield £350 after 3 years? For the first year rate is 5%, 2nd → 12%, & third → 8%.

$$350 \cdot 40 = P \left(1 + \frac{5}{100}\right) \left(1 + \frac{12}{100}\right) \left(1 + \frac{8}{100}\right)$$

$$P = \text{£ } 5000$$

Q4. An amount becomes 4 times in 6 years. In how many years will it become 64 times if the rate of interest remains unchanged?

Soln: Method I: LOGIC



Method II: formula

$$4x = x \left(1 + \frac{x}{100}\right)^6$$

$$64x = x \left(1 + \frac{x}{100}\right)^n$$

$$n = 18$$

Q5. £ 400 is SI for a sum for 4 yrs at 10% rate of interest p.a., find the CI for same sum at same rate, the

$$\text{Soln: } 10\% \text{ of } 400 = \frac{x \times 4 \times 100}{100} \quad x = 1000$$

$$A = 1000 \left(1 + \frac{10}{100}\right)^4 = 1000 \times \frac{121}{100} \times \frac{121}{100} \\ = 14640$$

$$CI = 4640 \text{ Rs}$$

In 6 years of CI a sum becomes £ 900. But in simple interest the same sum becomes £ 1000. What is the rate of interest?

Soln: If 900 is treated as P then 1000 will be the amt. after SI

$$\Rightarrow 100 \cdot (1000 - 900) = \frac{900 \times x \times 1}{100}$$

$$\Rightarrow x = \frac{100}{9}$$

$$\Rightarrow x = 11.11\%$$

$$A = P \left(1 + \frac{100}{9 \times 100}\right)^3 = 900$$

$$\Rightarrow P = 656.10 \text{ £}$$

Method II: FORMULA

$$900 = x \left(1 + \frac{x}{100}\right)^3 \quad \text{--- (1)}$$

$$1000 = x \left(1 + \frac{x}{100}\right)^4 \quad \text{--- (2)}$$

$$(2) \div (1)$$

$$\frac{1000}{900} = \frac{1 + \frac{x}{100}}{\left(1 + \frac{x}{100}\right)^3}$$

$$x = 11.11$$

$$x = \left(\frac{1000}{\frac{111.11}{100}}\right)^4 = 656.126 \text{ £}$$

Q7. The population of a city is 500000 at present. If it increases at the rate of 10% p.a. what will be its population 3 years from now?

$$\text{Soln: } P' = 500000 \left(1 + \frac{10}{100}\right)^3 \\ = 500000 \times \frac{11}{10} \times \frac{11}{10} \times \frac{11}{10}$$

$$P' = 66550$$

Q8. The population of a city is 50000 at present. If it increases at the rate of 10% p.a., what was its population 4 years ago from present?

$$\text{Soln: } 50000 = x \left(1 + \frac{10}{100}\right)^4$$

$$x = 34150.67 \approx 34151$$

Q9. What will be the difference in population 3 years ago and 2 years ago of Devon village, whose current population is 100000 and which is increasing at the rate of 25% per year?

$$\text{Soln: } 100000 = P_3 \left(1 + \frac{25}{100}\right)^3 \quad \text{--- (1)}$$

$$100000 = P_2 \left(1 + \frac{25}{100}\right)^2 \quad \text{--- (2)}$$

$$(2) - (1)$$

~~$$P_2 \left(\frac{55}{4}\right)^2 - P_3 \left(\frac{55}{4}\right)^3 = 0$$~~

~~$$P_2 - \frac{5}{4}P_3 = 0$$~~

$$P_3 = \frac{100000}{\left(\frac{5}{4}\right)^3}$$

$$P_2 = \frac{100000}{\left(\frac{5}{4}\right)^2}$$

$$P_2 - P_3 = 12800$$

Q10. If a certain sum of money is invested at 4% p.a. for 2 years at interest, and a certain sum of money for 2 years at 4% p.a. is Re 1. The sum of money is?

$$\text{Soln: Diff} \Rightarrow P \left(\frac{R}{100}\right)^2 = \frac{SI \times R}{100}$$

$$\Rightarrow 1 = P \left(\frac{4}{100}\right)^2$$

$$\Rightarrow P = 26.25$$

Q11. Sarang invested some money in HDFC at 3% rate of interest. What would be the corresponding SI after 2 yrs if Sarang got ₹ 101.50 as CI.

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

\downarrow
CI

$$\Rightarrow P + CI$$

$$\left(1 + \frac{R}{100}\right)^n = 101.50$$

$$P \left(1 + \frac{3}{100}\right)^2 = 101.50$$

$$\frac{103 \times 103}{100}$$

Long

Method (2)

CI - SI 2 years

$$CI - SI = P \left(\frac{R}{100}\right)^2 = \frac{SI \times R}{200}$$

$$101.50 - SI = \frac{SI \times 3}{200}$$

$$\Rightarrow SI = ₹ 100$$

RATIO & PROPORTION

: comparison of two or more quantities is expressed as ratio.

Eg. $P:Q = 5:1 \Rightarrow P = 5Q$

$\Rightarrow P$ is 5 times as Q

section : when we equate two ratios, it is known as proportion.

Eg. $a:b :: c:d$
↓
as

TRICKS :

$\frac{a}{b} = \frac{c}{d} \Rightarrow ad = cb$

3. componendo

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

2. compare

$$\frac{a}{b}, \frac{c}{d}$$

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

\Rightarrow compare ad, cb

(Adding the D)

if $ad > bc$

$$\Rightarrow \frac{a}{b} > \frac{c}{d}$$

4. Dividendo

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

if $ad < bc$

$$\Rightarrow \frac{a}{b} < \frac{c}{d}$$

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

if $ad = bc$

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

(Subtracting +)

5. Componendo & Dividendo

Divide 3 and 4

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

6. Invertendo

$$\frac{a}{b} < \frac{c}{d} \Rightarrow \frac{b}{a} = \frac{d}{c}$$

If $a:b::c:d$

↑ ↑ ↓	↓
1 2 3	extreme
extreme ↓	mean

$\frac{a}{b} < \frac{c}{d} \Rightarrow a:b::c:d$

8. $\frac{5}{6}$ is given $\Rightarrow 5k, 6k$ for solving sums

Q1. Which of the foll. two ratios is greater?

Soln: $\frac{17}{18}, \frac{10}{11}$

$$\frac{17 \times 11}{18 \times 10} > 1$$

$$ad > bc$$

$$\therefore \frac{17}{18} > \frac{10}{11}$$

Q2. The third proportional to 18 & 54 is?

Soln: $a:b:c \Rightarrow \frac{a}{b} = \frac{b}{c} \quad \{ a:b::b:c \}$

$$54 \times 54 = 18 \times c \\ c = 162 \rightarrow \text{Ans}$$

OR shortcut

$$18 \times 3 = 54$$

$$54 \times 3 = 162$$

What is the 4th proportional in 9, 13 & 153?

Soln: $\frac{9}{13} = \frac{153}{d} \Rightarrow d = \frac{153 \times 13}{9} = 221$

Q4. Find the mean proportional b/w 7 and 63.

$$b^2 = ac$$

$$b = \sqrt{7 \times 63}$$

$$b = \sqrt{441} = 21$$

Soln: $\frac{10}{13} = \frac{11}{28} = \frac{21}{11} = \frac{12}{7} \cdot k$. What is k?

Soln: $\frac{\text{Add N}^x}{\text{Add N}^y} \Rightarrow \frac{10+11+21+12}{13+28+11+11} = \frac{54}{63} = \frac{6}{7} = k$

Q6. Income ratio of Ramesh & Suresh is 5:6. Income & spending ratios is 7:9. Ramesh saves ₹4000 & Suresh saves ₹3000. Income & spending of Ramesh & Suresh

Soln: Income ratio = 5:6

Ramesh's I = 5k

Suresh's I = 6k

Income = Savings + Spending

Ramesh's Spending = 5k - 4000

Suresh's Spending = 6k - 3000

Given $\frac{7}{9} = \frac{5k - 4000}{6k - 3000} \Rightarrow k = 5000$

\therefore Ramesh's I = 25,000
Gunesh's I = 30,000

Q7. $a:b = 3:7$ & $b:c = 9:5$. What is $a:b:c$?

Soln:

$$\begin{array}{l} a:b \\ 3:7 \\ \text{Same} \\ \hline b:c \\ 9:5 \end{array}$$

$$\begin{array}{l} 3 \times 9 : 7 \times 9 \\ 27:63 \\ 3 \times 7 : 5 \times 7 \\ 63:35 \end{array}$$

$$\Rightarrow a:b:c = 27:63:35$$

Q8. How to divide 3395 in the ratio of 42:32:23?

Soln: $42k + 32k + 23k = 3395$

$$97k = 3395$$

$$k = 35$$

$$\therefore 42k = 42 \times 35 = 1470$$

$$32k = 32 \times 35 = 1120$$

$$23k = 23 \times 35 = 805$$

OR

$$\begin{array}{r} 42 \\ \hline 42+32+23 \\ \hline 1470 \\) \\ 80 \text{ cm} \end{array}$$

Q9. $6:5$, ratio b/w 1st & 2nd is 3:7. The third no. is?

$$a:b = 3:7$$

$$\times 6$$

$$18:42$$

$$b:c = 6:5$$

$$\times 7$$

$$42:35$$

$$a:b:c = 18:42:35$$

$$3^{\text{rd}} \text{ no} \Rightarrow \frac{35}{18+42+35} \times 285 = 105$$

Q10. Ratio of two nos. is 3:8. On adding 5 to both nos. the ratio becomes 2:5, which is the smaller no. of the two?

Soln: $A:B = 3:8$
 $3K, 8K$

$$\frac{3K+5}{8K+5} = \frac{2}{5}$$

$$K = 15$$

$$\text{Smaller} = 3K = 45$$

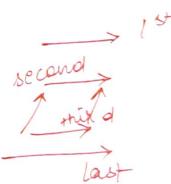
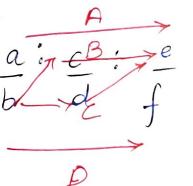
Q9

$$\frac{x}{y} = \frac{3}{8} \quad \frac{x+5}{y+5} = \frac{2}{5} \quad \text{On solving } x=45, y=120$$

Q10.

Find A:B:C:D when A:B = 2:3; B:C = 7:9; C:D = 5:7

Soln:



$$\frac{2}{3} : \frac{7}{9} : \frac{5}{7}$$

$$A:B:C:D = 70:105:135:189$$

$$\text{ie. } P:B = a:b \quad B:C:d \quad C:D:e:f$$

$$A:B:C:D = a:c:d : b:c:e : b:d:f$$

Method ①: $\frac{x}{y} = \frac{3}{4}$

$$\Rightarrow \frac{7x}{3y} = \frac{21}{12}$$

Method ②: $\frac{x}{y} = \frac{3}{4}$

put $x=3$
 $y=4$

Q12. Price of each article of type P, Q, R is ₹300, ₹180, ₹120.
Swarna buys articles of each type in the ratio 3:2:3 in
Rs 6480. How many articles of type Q did he purchase?

$$\text{Soln: } \begin{array}{ccc} 3K & 2K & 3K \\ P & Q & R \end{array}$$

$$\begin{aligned} 3K + 2K + 3K &= 6480 \\ 8K &= 6480 \\ K &= 810 \end{aligned}$$

(X)

$$\begin{array}{ccc} P & Q & R \\ ₹300 & ₹180 & ₹120 \\ 3K & 2K & 3K \end{array}$$

$$6480 = 900K + 360K + 360K$$

$$6480 = 1620K$$

$$K = 4$$

$$2K = 8 \quad \text{Ans}$$

Q13. Ajay and Raj together have ₹1050. On taking ₹150 from Ajay, Ajay will have same amount as Raj had earlier. Find the ratio of amounts with Ajay and Raj initially.

$$\begin{array}{l} \text{Ajay} = x \\ \text{Raj} = y \end{array}$$

$$\begin{aligned} \Rightarrow (1) + (2) \\ \Rightarrow 2x = 1200 \\ x = 600 \end{aligned}$$

$$x+y = 1050 \quad (1)$$

$$x-150 = y$$

$$\Rightarrow x-y = 150 \quad (2)$$

$$\Rightarrow y = 1050 - 600 = 450$$

$$\frac{x}{y} = \frac{600}{450} = \frac{4}{3}$$

$$\begin{array}{l} \text{Method ①: } \frac{x}{y} = \frac{5}{7} \\ \Rightarrow \frac{2K}{3K} = \frac{5}{7} \\ \Rightarrow \frac{10K}{21K} = \frac{5}{7} \\ \Rightarrow \frac{10}{21} = \frac{5}{7} \\ \Rightarrow 50 = 147 \\ \Rightarrow K = 144 \end{array}$$

$$\therefore \text{in ₹6480 no of articles} = \frac{1620}{180} = 9$$

$a:b = 5:7 \text{ and } c:d = 20:3b \text{ then } ac:bd = ??$

$$\frac{a}{b} = \frac{5}{7} - (1) \quad \frac{c}{d} = \frac{20}{3b} - (2)$$

$$(1) \times (2)$$

$$\Rightarrow \frac{ac}{bd} = \frac{10a}{21b} = \frac{10 \times 5}{21 \times 7} = \frac{50}{147} = \frac{10}{21}$$

Q16. The three numbers are in the ratio $\frac{1}{2} : \frac{2}{3} : \frac{3}{4}$. The difference between greatest and smallest nos. is 36. Find the nos.

$$\text{Soln: } \begin{array}{ccc} \frac{k}{2} & \frac{2k}{3} & \frac{3k}{4} \\ \text{Lcm } (2, 3, 4) = 12 \end{array}$$

$$\begin{array}{ccc} \frac{k \times 6}{2 \times 6} & \frac{2k \times 4}{12} & \frac{3k \times 3}{12} \end{array}$$

$$\begin{array}{ccc} \frac{6k}{12} & \frac{8k}{12} & \frac{9k}{12} \end{array}$$

Smallest Greatest

$$\frac{3k}{4} - \frac{k}{2} = 36$$

\therefore nos are 72, 96, 108

Q17. The ratio of market prices of wheat and paddy is 2:3 and the ratio of quantities consumed in a family is 5:4. Find the ratio of expenditure of wheat and paddy.

$$\text{Soln: Price}(P) \Rightarrow \frac{2k}{3k}$$

$$\begin{aligned} \text{Exp} &= P \times Q \\ &= \frac{2k}{3k} \times \frac{5m}{4m} \\ &= \frac{5}{6} \end{aligned}$$

Q18. Rs 8400 is divided among A, B, C and D in such a way that the shares of A and B, B and C, C and D are in the ratios of 2:3, 4:5 and 6:7 respectively. The share of D is.

$$\begin{matrix} A & B & C & D \\ 3 & 8 & 5 & 0 \end{matrix} = \frac{2}{3} : \frac{4}{5} : \frac{6}{7}$$

$$A:B:C:D = 48:72:90:105$$

$$\begin{aligned} \text{Share of } A \text{ is } & \frac{48}{48+72+90+105} \times 8400 \\ &= \frac{48}{315} \times 8400 \\ &= 9120 \end{aligned}$$

Q19. In a library the ratio of story books to the no. of non-story books was 4:3 and the total no. of story books was 1248. When some more story books were bought the ratio became 5:3. Find the no. of story books bought.

$$\begin{matrix} S & N \\ 4 & 3 \end{matrix} \quad S = 4k \quad N = 3k \quad 4k = 1248 \quad k = 312$$

$$\frac{4k+x}{3k} = \frac{5}{3}$$

$$\frac{1248+x}{312} = \frac{5}{3}$$

$$1248 + x = 1560$$

$x = 312 = \text{no. of new story books bought}$

Tip:

17	Time ↑ Money ↑
17	↑ Work ↑ Money
17	A - 2 days Fast Money B - 3 days ↓ Money ↓ Days ↑ Money

Income $\propto \frac{1}{\text{Days}}$

Ratio of Days
A:B = 2:3

Income A:B = 3:2

$$\begin{aligned} \text{A7 Share of } A \text{ of Income of } A &= \frac{3}{3+2} \times \text{Total} \\ \text{---} - B &= \frac{2}{3+2} \times \text{Total} \end{aligned}$$

Q20. Ramesh can do a work in 5 days. Suresh can do the same work in 7 days. The total amount given for this work to them is Rs 480. If both are working together, then what will be the share of Suresh?

Soln: Work ↑ Money ↑

$$R:S = 5:7 \text{ (Days)}$$

$$\therefore \text{Income} \Rightarrow R:S = 7:5$$

$$\text{Suresh} = \frac{5 \times 480}{5+7} = \text{Rs} 200$$

⇒ 1 woman for 1 day costs ₹ 12

1 man 1 day = $5 \times 12 = ₹ 60$

M men 1 day = $60 \times M$

M men 47 days = $60M \times 47$

$$60M \times 47 = 16920$$

$$M = 6 \text{ men}$$

Q4. P, Q and R take a job for ₹ 640. P and Q together finish $\frac{2}{5}$ th of the work & the rest is done by R alone. What is the share of R?

Total work = 1

$$\begin{array}{ccc} P & Q & R \\ \cancel{\frac{2}{5}} & = 1 - \frac{2}{5} & = \frac{3}{5} \end{array}$$

$$\therefore \text{Share of R} = \frac{3}{5} \times \frac{128}{640}$$

$$= 384 \text{ Rs}$$

Q5. P can do a job in 30 days, while Q can alone do it in 45 days. They work together for 15 days and $\frac{1}{5}$ th of the job is done by R in 6 days. They get ₹ 15000 for the whole job. What will be R's share?

$$P \rightarrow 30 \text{ days}$$

$$1 \text{ day} \rightarrow \frac{1}{30}$$

$$\begin{aligned} \text{Work done by P & Q} \\ \text{in 1 day} &= \frac{1}{30} + \frac{1}{45} = \frac{1}{18} \end{aligned}$$

$$Q \rightarrow 45 \text{ days}$$

$$1 \text{ day} \rightarrow \frac{1}{45}$$

$$\therefore \text{in 15 days} = 15 \times \frac{1}{18}$$

$$= \frac{5}{6}$$

$$\text{Rs. spent} = \frac{1}{6} \times 15,000 = 2500 \text{ Rs}$$

A man and a boy received ₹ 1800 as wages for a job they did together. The man's efficiency was 5 times that of the boy. What is the wage of the boy?

$$m + b = 1800 \text{ (3 days)}$$

$$m = 5b \text{ (efficiency)}$$

$$b = 1800$$

$$b = 360$$

$$b = k \text{ (for 3 days)}$$

eff ↑ money ↑

$$= 300$$

$$\text{for 1 day} = \frac{300}{3} = ₹ 100$$

Q7. Pavanir was appointed for a 100 days' job. The condition was that he will be paid ₹ 24 for every working day. But he will also be fined ₹ 12 for every day he is absent. At the end, he got ₹ 420. For how many days was he absent?

Soln: Let r_2 was absent for k days
 \Rightarrow present for $(100 - k)$ days

$$\therefore (100 - k) \cdot 24 - k \cdot 12 = 420$$

$$2400 - 24k - 12k = 420$$

$$36k = 1980$$

$$\boxed{k = 55}$$

wages of 6 men, 4 women and 8 boys is ₹ 26. If 6 men is equal to that of 8 women and the 4 women is equal to that of 6 boys, then find out wages of 8 men, 6 women & 4 boys?

$$1 \text{ Man} = M$$

$$1 \text{ Woman} = W \text{ Rs}$$

$$1 \text{ Boy} = B \text{ Rs}$$

$$6M = 8W$$

$$4W = 6B$$

$$M = \frac{8W}{6}$$

$$B = \frac{4W}{6}$$

$$6M + 4W + 8B = 26$$

$$8W + 4W + 8 \times \frac{4W}{6} = 26$$

$$W = 1.5 \Rightarrow \text{wage of 1 woman}$$

$$1 \text{ man} = \frac{8 \times 1.5}{6} = 2$$

$$1 \text{ Boy} = \frac{4 \times 1.5}{6} = 1$$

$$\text{total wages} = 8M + 6W + 4B$$

$$= 16 + 9 + 4 = ₹ 29$$

Q8. P, Q and R get ₹ 10800 for doing a work in 18 days. P and R get ₹ 3760 for doing the same work in 10 days, while Q and R get ₹ 6080 for doing the same work in 20 days. Find the amount received by R per day.

$$\text{Soln: } P + Q + R = ₹ 10800 \text{ (18 days)} = \frac{10800}{18}$$

$$= \frac{600}{(P+Q+R)} \text{ (1)}$$

$$P + R = ₹ 3760 \text{ (10 days)} \quad 1 \text{ day} = ₹ 376 \text{ (P+R)}$$

$$Q + R = ₹ 6080 \text{ (20 days)} \quad 1 \text{ day} = ₹ 304 \text{ (Q+R)}$$

$$P + R = ₹ 304$$

$$Q + R = ₹ 304$$

$$P = 224$$

$$Q = 224$$

$$Q + R = ₹ 304$$

$$224 + R = ₹ 304$$

$$\Rightarrow R = ₹ 80$$

Q10. The amount of money be paid for 18 days, when A is working alone with A's wage for 12 days, when B is working alone. A and B start together for wages for the both same amount would be enough for the both how many days?

Soln: Let amount = M money
 $A \rightarrow 18 \text{ days}$

$$A \text{ 1 day} = \frac{M}{18}$$

Q3
in
dc
so

$$B \text{ 1 day} = \frac{M}{12}$$

$$A+B = \frac{M}{18} + \frac{M}{12} = \frac{5M}{36} \quad (1 \text{ day for } A \text{ and } B)$$

$$1 \text{ d} \rightarrow \frac{5M}{36}$$

$$M \rightarrow ?? \text{ over}$$

Q7 $\Rightarrow \frac{36}{5}$ no of days in which M will be enough.

Q7
wa
B.
at
WQ11. Johnny employs 8 workers to work for 6 hrs day
soln in total he pays £ 630 for a week. How much should Johnny pay 18 workers working 4 hrs per day for a week

$$\text{Soln} \quad 8 \text{ workers} \rightarrow 6 \text{ hrs} = 630$$

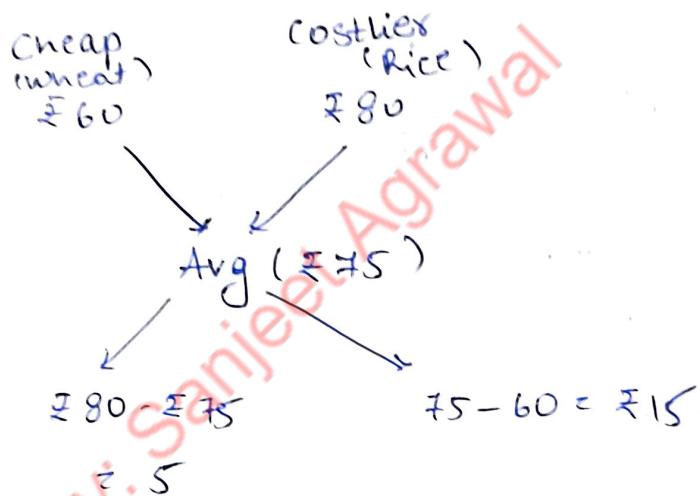
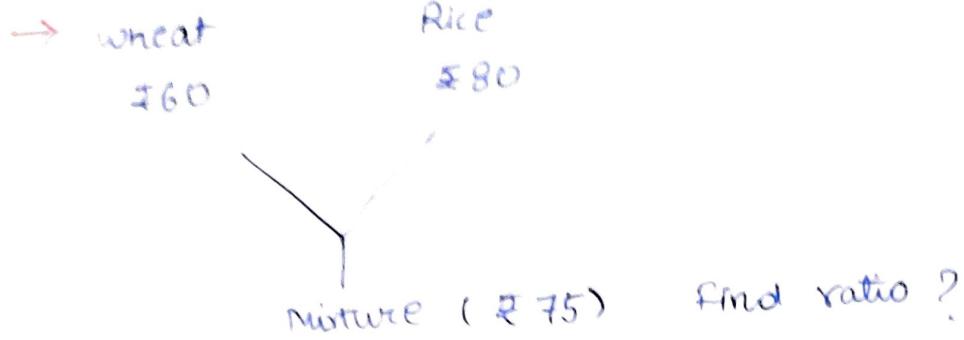
$$\text{1 worker 6 hrs} = \frac{630}{8}$$

$$\text{1 worker 1 hr} = \frac{630}{8 \times 6}$$

By does,

$$\Rightarrow 18 \text{ workers 1 hr} = \frac{630}{8 \times 6} \times 18$$

MIXTURE & ALLIGATION



whenever we remove some amount from a mixture it will be removed in the same ratio.

Q1. One can is completely filled and contains 100% water. Another can (same type) is filled 50% wine & 50% water. When both cans are emptied in a single vessel, what will be the ratio of water to wine in the vessel?

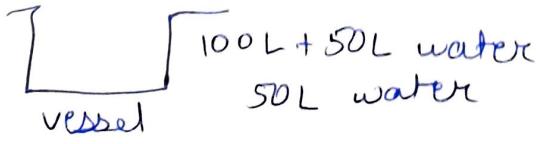
Soln:

Can 1

100L water

Can 2

50L water
50L wine



$$\text{H}_2\text{O : Wine} = 150 : 50 \\ = 3 : 1$$

Resultant price of mixture of golden rice is £400/kg.
which is made from two varieties of golden rice
which are having a price of £420 per kg & 2520/kg.
should be the ratio of both types of golden rice?

$$\begin{array}{ccc} 420 & & 520 \\ \downarrow & \downarrow & \\ 480 & & \\ \downarrow & & \\ 60 & & \end{array}$$

$$\text{cheap : costly} = 40 : 60 \\ = 2 : 3$$

A mixture consists of some amount of sandalwood oil and 240 L of water. It is priced at £275/l. Sandalwood oil is priced £325/l. How much oil is in the mixture?

water sandalwood oil

$$\begin{array}{ccc} 240 \text{ L} & & x \text{ L} \\ \text{£0/L} & & \text{£325/L} \\ \downarrow & & \downarrow \\ 50 & & 275 \end{array}$$

$$\frac{W}{O} = \frac{2}{11}$$

$$\frac{240}{O} = \frac{2}{11} \Rightarrow O = 1320 \text{ L}$$

$$W : O = 50 : 275 \\ = 2 : 11$$

$$2x = 240 \\ x = 120$$

$$11x = 11 \times 120 \\ = 1320 \text{ L of oil}$$

How much milk should be added in a milk soln to make the milk quantity in it 75%, if 80L of milk has 25% milk in it.

$$\frac{45}{100} \times \frac{4}{9} = 36 \text{ L}$$

$$\frac{36+L}{80+L} \times 100 = 75^3$$

$$144 + 4L = 240 + 3L$$

$$L = 96 \text{ Litres}$$

we add 'L' L of milk

$$\text{milk} = 36 + L$$

$$\text{Total} = 80 + L$$

Q5. A pot contains 40L of juice. How much juice will there be in the pot, if 4L of juice was removed and was replaced by water & this process was repeated twice.

Soln:

40L Juice

$$40 - 4 = 36 \text{ L of Juice}$$

+ 4L of water

Now repeat twice

(i) 4L removed

$$\text{Juice} = 36 - \frac{36}{40} \times 4 = 36 - 3.6 = 32.4 \text{ L}$$

4L of water added

$$\therefore J = 32.4 \text{ L}$$

$$\text{Water} = 4 - \frac{4}{40} \times 4 = 3.6 \text{ L}$$

$$W = 3.6 + 4 = 7.6 \text{ L}$$

(ii) 4L removed again

$$\text{Juice} = 32.4 - \frac{32.4}{32.4 + 7.6} \times 4 = 29.16 \text{ L}$$

Add 4L H₂O

$$J = 29.16 \text{ L}$$

$$\text{Water} = 7.6 - \frac{7.6}{40} \times 4 = 0.76 \text{ L}$$

$$W = 6.84 + 4 = 10.84 \text{ L}$$

Q6. One glass has juice and water in the ratio 5:2 while other glass has them in the ratio 7:4 respectively. If both glasses are poured in a vessel then what's the final ratio of water to juice in the vessel?

Soln: (i) $J:W = 5:2$

$$J = \frac{5}{7}, W = \frac{2}{7}$$

$$J = \frac{5}{7} + \frac{7}{11}, W = \frac{2}{7} + \frac{4}{11}$$

$$= \frac{55 + 49}{77} = \frac{22 + 28}{77}$$

$$= \frac{104}{77} = \frac{50}{77}$$

(ii) $J:W = 7:4$

$$J = \frac{7}{11}, W = \frac{4}{11}$$

$$\therefore J:W (\text{vessel}) = 52:55$$

Ramesh mixes 60L of acid with some litres of Type 2 acid. Type 1 acid rate is ₹32/l while Type 2 acid sells this acid mix at ₹28/l. How much Type 2 acid is needed to make no profit no loss.

Type 2 acid cost ₹23/l

Type 1 acid cost ₹32/l

$$60 \times 32 + x \times 23 = 28(60+x)$$

$$18x = 48$$

$$x = 48 \text{ L}$$

₹28/l

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₹23/l

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Q9. 3 types of sugar got mixed by a shopkeeper. The 1st type was of rate ₹ 145/kg, 2nd of 165/kg. Only thing the shopkeeper knew that quantities of 3 sugar types were in the ratio 2:1:3 respectively. He finally sold the mixture at ₹ 180/kg. What was the price of the 3rd type?

Soln: Let 3rd type = ₹ R

$$1^{\text{st}} \rightarrow 2K \quad 2^{\text{nd}} \rightarrow K \quad 3^{\text{rd}} \rightarrow 3K \rightarrow \text{total}$$

$$2K(145) + K(165) + 3KR = (6K) \times 180$$

$$\Rightarrow 3R = 1080 - 455$$

$$R = ₹ 175/\text{kg}$$

Q10. A mixture of two food items has salt to sugar ratio of 7:32. The ratio of salt to sugar is 2:11 and 5:21, in the two individual types of food items. In what proportion are the two food items mixed?

Soln:

$$\begin{array}{ll} \text{Type 1} & \text{Type 2} \\ \frac{2}{13} & \frac{5}{26} \end{array}$$

Type 1 : Type 2

$$= \frac{1}{78} : \frac{1}{39}$$

$$\Rightarrow 1:2$$

$$\text{Avg} \frac{7}{39}$$

$$\frac{5}{26} - \frac{7}{39}$$

$$\frac{2}{13} - \frac{7}{39}$$

$$\frac{6 - 7}{39}$$

$$\frac{1}{13} \left(\frac{5}{2} - \frac{7}{3} \right)$$

$$= \frac{1}{39}$$

$$\frac{1}{13} \left(\frac{15 - 14}{6} \right) = \frac{1}{78}$$

A solution of honey and water is 20L
 honey and water in ratio 4:3. To this
 honey-water soln is added that has honey
 ratio as 2:1. Again a 51 L honey-water
 has honey to water ratio as 9:8 is
 mis. After this 10L of soln is replaced
 in the final mixture?

$$\text{Total amount} = 28 + 51 + 21 = 100 \text{ L of soln}$$

$$H:W = 2:1$$

$$H:W = 9:8$$

$$21 \text{ L}$$

$$H:W = 4:3$$

$$28 \text{ L}$$

$$4 \times 28 = 16 \text{ L}$$

$$H = \frac{2}{3} \times 21 = 14 \text{ L}$$

$$H = \frac{9}{17} \times 51 = 27 \text{ L}$$

$$3 \times 28 = 12 \text{ L}$$

$$W = \frac{1}{3} \times 21 = 7 \text{ L}$$

$$W = \frac{8}{17} \times 51 = 24 \text{ L}$$

$$\text{Total honey} = 57 \text{ L}$$

$$\text{Total water} = 43 \text{ L}$$

$$\text{Ratio of } H:W = 57:43$$

10 L removed from the mixture

$$W_{\text{removed}} = \frac{43}{100} \times 10 = 4.3 \text{ L}$$

$$\therefore H_{\text{removed}} = \frac{57}{100} \times 10 = 5.7 \text{ L}$$

$$\text{Left honey} = 57 - 5.7 = 51.3 \text{ L}$$

$$\text{Left water} = 43 - 4.3 \text{ L}$$

10 L Honey added

$$\therefore H = 51.3 + 10 = 61.3 \text{ L}$$

$$W = 38.7 \text{ L}$$

$$\text{Ratio } H:W = \frac{61.3}{38.7} = \frac{613}{387}$$

Q12. Ranit buys some rice at ₹10.40/kg. He mixes it with some rice at ₹8.8/kg. The final mixture becomes 15 kg in weight and with total worth ₹146.40. What is the quantity of rice priced at ₹8.8/kg?

(Soln):

Method 1:

8.8/kg

10.40/kg

$$\frac{146.40}{15} = 9.6 \text{/kg}$$

0.8

1.2/kg

$$2k + 3k = 15$$

~~2k=6~~

$$\boxed{k=3}$$

$$2k = 6 \text{ kg} \Rightarrow \underline{\underline{\text{Ans}}}$$

\Rightarrow cheap : costly = 2 : 3

Method 2:

Let there be x kg of ₹8.8/kg rice
 $\Rightarrow (15-x)$ kg of ₹10.40/kg rice

$$\text{So } x \times 8.8 + (15-x) \times 10.40 = 146.40$$

(Total cost)

$$8.8x + 156 - 10.4x = 146.40$$

$$1.6x = 9.6$$

$$\boxed{x = 6}$$

$\Rightarrow 6$ kg of ₹8.8/kg rice



If we take x for 10.40 & $(15-x)$ for 8.8

then also answer is same.

Bunil started a juice (lemon syrup + water) counter. Initially we had 140L of juice which had 30% water. He sold 20L of the juice. Then he added some amount of lemon syrup and water. Now the ratio of water to lemon syrup became 1:2. How much water was added later on?

140 L initially

120 L left \rightarrow 30% water

$$\text{lemon} = \frac{70 \times 120}{100} \quad \text{Water} = \frac{30 \times 120}{100}$$
$$= 84 \text{ L} \quad = 36 \text{ L}$$

He adds equal amount of lemon syrup & water, let it be x

$$\text{Now, } L = 84 + x \quad W = 36 + x$$
$$\text{ratio } \Rightarrow \frac{W}{L} = 1:2$$

$$\Rightarrow \frac{36+x}{84+x} = \frac{1}{2}$$

$$\Rightarrow 72 + 2x = 84 + x$$

$$\Rightarrow x = 12$$

A milkman had water and milk mixture in a can with water to milk ratio 5:7. He accidentally spills 9L of the mixture. He then fills the can with equal quantity of water. This makes the water to milk ratio 9:7. How much milk did initially have?

80L: He spills 9L
in the spilled mixture Initially mixture
is in the ratio 5:7

$$W = \frac{5}{12} \times 93 \quad M = \frac{7}{12} \times 93$$
$$= 3.75L \quad = 5.25L$$

$$\Rightarrow W = 5k$$
$$M = 7k$$

~~Ans 9L of water~~

$$\Rightarrow W = 12.75L \quad \Rightarrow W = 5k + 9 - 3.75 = 5k + 5.25$$
$$\therefore M = 7k - 5.25$$
$$\Rightarrow W =$$

Finally

$$\frac{W}{M} = \frac{9}{7}$$

$$\Rightarrow \frac{5k + 5.25}{7k - 5.25} = \frac{9}{7}$$

$$\Rightarrow 35k + 36.75 = 63k - 45.75$$
$$\therefore 84 = 28k$$

$$\Rightarrow \boxed{k = 3}$$

\therefore initially there was 21L of milk
Ans.

Percentages

Q1. 56% of Y is 182. What is Y?

$$\text{Soln: } \frac{56}{100} \times Y = 182 \Rightarrow Y = \frac{182 \times 100}{56} = 325$$

$$\Rightarrow Y = 325$$

Q2. What % is 42 kg of 336 kg?

$$\text{Soln: } \frac{42}{336} \times 100 = 12.5\%$$

Q3. If 15% of Y is same as 21% of Z, then 12.5% of Y is equal to what % of Z?

$$\text{Soln: } \frac{15}{100} Y = \frac{21}{100} Z$$

$$Y = \frac{7Z}{5}$$

$$12.5\% \text{ of } Y = \frac{12.5}{100} \times \frac{7}{5} Z \\ = 17.5\% \text{ of } Z$$

Q4. If price of rice is 30% less than that of wheat then price of wheat is how much % more than that of rice?

Soln: Let price of wheat = ₹ 100

$$\text{acc to ques. price of rice} = \frac{70}{100} \times 100 = ₹ 70$$

wheat more than rice = ?

$$\frac{\text{wheat}}{\text{rice}} \times 100 = \frac{100}{70} \times 100 \\ = 142.85\%$$

max = 100%
 $142.85 - 100 = 42.85\%$ more than
that of rice.

if the price of apple is first increased by 10% and then decreased by 10% what is the change in the price of the apple?

apple's price = ₹100.

$$+ \text{by } 10\% = ₹110$$

$$+ \text{by } 10\% = ₹99$$

$$\text{change} = ₹(100 - 99) = ₹1$$

if the price of sugar is raised by 25%. how much % consumption of sugar should a person reduce so that his expenditure remains same?

expenditure = same

Let initial rate = ₹100/kg

initial expenditure = final expenditure

$$100 \times 1 = 125 \times x$$

(1 kg of sugar)

$$x = \frac{100}{125} = \frac{4}{5} = 0.8 \text{ kg}$$

∴ he should reduce $1 - 0.8 = 0.2$ kg sugar

$$\% = 0.2 \times 100 = 20\%$$

Q7. Y has to score 40% marks to pass. He gets 20 marks and fails by 40 marks. The maximum marks of the exam are?

Soln: Let max. marks = M

$$\text{Marks to pass} = \frac{40M}{100}$$

$$20 = \frac{40M}{100} - 40$$

$$60 = \frac{40M}{100} + 25$$

$$M = 150 \text{ marks}$$

Q8. A scores 10%, and fails by 30 marks. B scores 40% marks and gets 30 marks more than the min. marks needed to pass the exam. What are the max. marks for the exam?

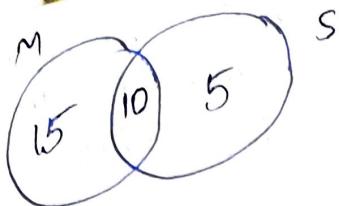
Soln: $\frac{10M}{100} + 30 = \frac{40M}{100} - 30$

$$\frac{\text{Student 1 pass marks}}{10} = \frac{\text{Student 2 pass marks}}{40}$$

$$60 = \frac{30M}{100}$$

$$M = 200 \text{ marks.}$$

e.g. In a class, 15% of total number of students failed in Science, 25% of total number of students failed in Maths and 10% of total number of students failed in both. How much percentage of students passed in both Maths and Science?



Failed

$$\text{Passed} = 100 - \left(\frac{15+10}{5} \right)$$

$$= 100 - 30$$

$$= 70\%$$

~~By buying 10 kg more rice in ₹ 100.~~ 20% decrease in the price of rice, people

original price of 1 kg of rice?

$$\frac{80P}{100} \times (x) = P \times x - \underset{\text{Price}}{kg^3}$$

$$\begin{cases} \text{final expenditure} \\ = \underset{\text{initial expenditure}}{(x)} \end{cases}$$

$$x = 40 \text{ kg}$$

∴ 40 kg possible in ₹ 100 originally

$$\text{price of 1 kg} = \frac{100}{40} = ₹ 2.5/\text{kg}$$

In an election which was contested by candidates, one candidate got 40% of the votes and yet lost by 1000 votes. What is the number of votes casted in the election?

$$\frac{40V}{100} + 1000 = \frac{60V}{100}$$

$$\frac{20V}{100} = 1000$$

$$V = 5000 \text{ votes.}$$

Q12. In a country 55% of population is female. 80% of male population is literate. How much females are literate if total literacy is 58%?

$$\text{Ans: Female} = \frac{55}{100} P$$

$$\text{Male} = \frac{45}{100} P$$

$$80\% \text{ male} = \frac{80}{100} \times \frac{45}{100}$$

$$\text{Total literate} = 58\%$$

$$\frac{80}{100} \times \frac{45}{100} + \text{female} = \frac{58}{100} P$$

$$\text{female} = \frac{22}{100} P$$

$$\% \text{ literate female} = \frac{\frac{22}{100} P}{\frac{55}{100} P} \times 100 \\ (\text{literate female}) \\ (\text{Total female})$$

$$= \frac{22 \times 100}{55 \times 100} = 40\% \\ \text{females are literate}$$

Q13. If 20% of an electricity bill is deducted then £100 is still to be paid. How much was the original bill?

$$\text{Ans: Bill} = £B \text{ (originally)}$$

$$\frac{80B}{100} \text{ (After deduction)}$$

$$100 - \frac{80B}{100} = 12.5$$

$$\cancel{B = 125}$$

^{Q14.}
A's salary is 50% more than B's. How
much % is B's salary less than A's?
^{soln:} Let $B = ₹ 100$

$$\Rightarrow A = 100 + \frac{50 \times 100}{100} = ₹ 150$$

² $\frac{100}{150} \times 100 = 66\frac{2}{3}\%$

$\Rightarrow 100 - 66\frac{2}{3}\% = 33\frac{1}{3}\%$ less than
A's salary

^{Q15.} Two nos. are less than a third number by
30% and 37%. respectively. How much % is
second no. less than the first?
^{soln:} third number = N

$$\text{First} = \frac{70N}{100} \quad \text{Second} = \frac{63N}{100}$$

^{1st} $= \frac{\frac{63N}{100}}{\frac{70N}{100}} \times 100$
 $= \frac{9}{10} \times 100 = 90\%$

$$100 - 90 = 10\%$$

\Rightarrow 2nd is 10% less than first!

Q16. 10% of inhabitants of a village having a disease of cholera, a panic set in, during which 25% of remaining inhabitants left the village. The population is then reduced to 4050. The number of inhabitants originally was.

Sol: Original = P (let)

$\frac{90P}{100}$ left after 10% died

Now 25% of remaining left the village

$$\therefore \text{now population} = \frac{75}{100} \times \frac{90P}{100}$$

$$\frac{3}{4} \times \frac{90P}{100} = 4050 - 450$$

$$P = \frac{18,000}{3} = 6,000$$

PROFIT & LOSS

$$SP = CP + \text{Profit (in Rs.)}$$

$$(i) \% \text{ Profit} = \frac{\text{Profit (₹)}}{CP} \times 100$$

$$(ii) \% \text{ Loss} = \frac{\text{Loss (₹)}}{CP} \times 100$$

$$(iii) SP = (100 + P\%) \% \times CP$$

$$(iv) SP = (100 - L\%) \% \times CP$$

If a person sells 2 objects one at less and other at profit but at same SP & $P\% = L\%$, then person will always suffer a LOSS.

$$\text{LOSS \%} = \frac{(P\% / L\%)^2}{100}$$

Ajay incurred loss of 20% by selling a vase for ₹ 2880. To get a profit of 20%. what price should he sell the vase?

$$\frac{2880}{3600} = \frac{80}{100} \times CP \Rightarrow CP = 3600$$

$$SP = \frac{120}{100} \times 3600$$

$$SP = 4320$$

Q2. Raju sells paper planes at the rate of 20 planes for ₹1. If he gets profit of 20%, how many planes did he buy in 1 rupee?

$$\text{Soln: SP of 1 plane} = \frac{1}{20} = 0.05$$

$$\frac{1}{20} = \frac{120}{100} \times \text{CP of 1 Plane}$$

$$\text{CP of 1 plane} = \frac{1}{24} = 0.042$$

$$\text{No. of planes in } ₹1 = \frac{1}{0.042}$$

$$= \frac{1}{0.042} \approx 24$$

OR

$$\text{SP} = 1 = 120\% \text{ of CP} = \frac{120}{100} \text{ CP}$$

$$\text{CP} = \frac{100}{120} \Rightarrow 20 \text{ planes}$$

Planes	Cost
20	$\frac{100}{120}$
?	1

$$\Rightarrow 20 \times 1 = \frac{100}{120} \times ?$$

$$? = 24 \text{ planes}$$

Uma wants to gain 15% profit on her sale sugar. She buys 120 kg sugar at ₹ 24 per kg. She mixes it with 180 kg of sugar bought at ₹ 28/kg. She sells the sugar mixture at -?

₹ 24/kg
120 kg
₹ 28/kg
180 kg

$$\frac{28 \times 180 + 24 \times 120}{120 + 180} = \frac{5040 + 2880}{300} = \frac{7920}{300} = ₹ 26.4$$

$$SP = \frac{115}{100} \times$$

Guddi buys some oranges in a shop at 5 per rupee. She goes to other shop and buys the same number of oranges at 4 per rupee. She then combines them in a basket and sells them at 4 per rupee. Will she get a profit or loss? And how much?

1st shop : 4 oranges Re 1 1 orange = $\frac{1}{4}$ ₹

2nd shop : 5 oranges Re 1 1 orange = $\frac{1}{5}$ ₹

Suppose 1 orange of both shops are taken up we get 2 oranges of these 2 oranges

$$= \frac{1}{4} + \frac{1}{5} = \frac{9}{20}$$

$$CP \text{ of 1 orange} = \frac{\frac{9}{20}}{2} = \frac{9}{40}$$

Sp 4 oranges $\rightarrow 1\text{ ft}$

$$1 \text{ orange} = \text{₹ } \frac{1}{4}$$

$$SP - CP = \frac{1}{4} - \frac{9}{40} = \frac{1}{40} = \text{Profit}$$

$$P\% = \frac{\frac{1}{40}}{\frac{9}{40}} \times 100 = \frac{100}{9}\%$$

Sol
Q5. Ramesh gets a profit of 20% in one trade and suffers a loss of 20% in second when he sells 2 cycles for ₹ 4000 each. What is his profit or loss in the entire trade?

$$\text{Soln: Loss \%} = \frac{(20)^2}{100} = \frac{400}{100} = 4\%$$

Sol
Q6. Simran bought pet food worth ₹ 56000. She then sold 1/3rd of its incurring loss of 40%. What profit must she earn on rest of the supplies to nullify this loss?

Soln:

1	2	3
-40%	+20%	+20%

A sold a car to B at a profit of 25%. B resold it to C at a loss of 15% while selling the same car £50000 for this car. At what price did C buy it.

$$SP_A = \frac{125}{100} \times 50000$$

$$SP_B = CP_C = \left(\frac{125}{100} \times 50000 \right) \times \frac{85}{100}$$
$$\approx 53125$$

A cheater manipulated his weighing machine so that it shows 1 kg for 970 g. How much profit does he get?

$$\text{Profit} = 1\text{kg} - 970 = 30\text{g}$$

$$\% \text{ Profit} = \frac{30}{970} \times 100 = \frac{300}{97} \%$$

$$\frac{\text{Actual value}}{CP} = 3 \frac{9}{97} \%$$

Rohit got profit of 11 1/2% by selling his old car. However he realised that had he sold it for £8100 more, his profit would be 38.5%. What price did he buy the car?

$$\frac{111.5}{100} \times CP + 8100 = \frac{138.5}{100} CP$$

$$\frac{27}{100} CP = \frac{8100}{300}$$

$$CP = 30000$$

Q10. Chaman sells 40 fans at ₹100 each. He wants a total of 20% profit on the entire sale. Since he got 160 fans at rate of ₹100 each, at what profit must he sell the remaining fans?

$$\text{Soln: SP of 40 fans} = \frac{40 \times 110}{100} \times 100$$

$$\text{He wants} = \frac{160 \times 120}{100} \times 100$$

CP of a fan
 \downarrow
 $40 \times 110 + \frac{(100+x)}{100} \times 120 \times 100 = 160 \times 120$
 \downarrow
 no. of fans remaining
 $\Rightarrow x = 23.33\%$

Q11. Suman buys 160 chocolates for ₹480. She wanted to earn 30% profit by selling them. But Rakesh visited her and she gave him 25% of those chocolates at CP itself. But even after doing this, she earned a profit of 30% as decided. For how much did she sell each chocolate?

$$\text{Soln: CP of 1c} = \frac{480}{160} = ₹3$$

∴ 75% remaining = 120 chocolates

$$30\% \Rightarrow \%P = \frac{\text{Profit}}{CP} \times 100$$

$$30 = \frac{P}{3} \times 100$$

$$P = ₹144$$

→ She wanted to earn ₹ 144 as profit.

Now

$$120 \text{ C} \rightarrow ₹ 144 \text{ profit}$$

$$1 \text{ C} \rightarrow \frac{144}{120} = ₹ 1.2 \text{ profit}$$

$$SP = CP + Profit = 3 + 1.2 = ₹ 4.2$$

Q12. Ramesh sold a statue for a price 25% higher than the original price of the statue. He had bought the statue at 20% discount on the original price. With the profit of ₹ 2025 find the original price of the statue.

Soln:

$$SP = \frac{125}{100} \times OP$$
$$SP - CP = \text{Profit}$$
$$\frac{45OP}{100} = 2025$$

$$CP = \frac{80}{100} \times OP$$
$$OP = ₹ 4500.$$

Q13. A shopkeeper earns a profit of 15% after selling a book at 20% discount on the printed price. The ratio of cost price and printed price of the book is?

Soln:

$$SP = \frac{115}{100} \times CP$$

$$SP = 80\% \text{ of PP} = \frac{80PP}{100}$$

$$\frac{115CP}{100} = \frac{80PP}{100}$$

$$\frac{CP}{PP} = \frac{16}{23}$$

Q14. The ratio of cost price is to SP is 4:5. The profit % is.

Soln: Let CP = 4x

$$SP = 5x$$

$$P = 5x - 4x = x$$

$$P\% = \frac{P}{CP} \times 100 = \frac{x}{4x} \times 100 = 25\%$$

Q15. If SP of 40 articles is equal to CP of 50 articles, the loss or gain % is?

Soln: Let SP of 50 a = ₹ 100

$$1a = ₹ 2$$

$$\text{SP of } 40a = \text{CP of } 50a \\ = ₹ 100$$

$$\text{SP of } 1a = ₹ 2.5$$

$$P = 2.5 - 2 = ₹ 0.5 \text{ per article}$$

$$P\% = \frac{0.5}{2} \times 100$$

$$P = 25\%$$

Q16. A fruit seller buys lemons at 2 for a rupee and sells them at ₹ 5 for ₹ 3. His gain % is?

Soln: CP = $\frac{1}{2}$, 0.5 Rs

$$SP = \frac{3}{5} = 0.6 \text{ Rs}$$

$$P\% = \frac{0.1}{0.5} \times 100 \\ = 20\%$$

2 lemons \rightarrow ₹ 1

$$P = SP - CP$$

$$= ₹ 20$$

₹ 100 \rightarrow 200 lemons
(CP)

selling 5 lemon \rightarrow ₹ 3

$$P\% = \frac{20 \times 100}{100}$$

200 lemons \rightarrow $\frac{3}{5} \times \frac{200}{40}$
= 20%

200 lemons \rightarrow ₹ 120 (SP)

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