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VEDIC MATHS



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MULTIPLICATION OF NUMBERS WITH 11

To multiply any number with 11

Step 1:- Write the last digit as it is

Step 2:- Add last digit to next digit and write the unit digit as it is and carry forward rest and so on

Step 3:- Write the last digit as it is

For example :- $23 * 11$

Step 1:- Keep last digit as 3

Step 2:- Add $3+2 = 5$

Step 3:- Write last digit as 2

So answer will be 253

APPLICATIONS

1. Find the value of 79×11 ?

- a) 869
- b) 789
- c) 909
- d) 809

2. Find the value of 123×11 ?

- a) 1323
- b) 1353
- c) 1333
- d) 1293



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MULTIPLICATION OF NUMBERS

WITH 9, 99 & 999...

To multiply any number with 9,99 & 999...

Step 1:- Write number of zeroes equal to number of 9s on the right hand side of the number to be multiplied

Step 2:- Now subtract the number to be multiplied from this number

For example:- $8 * 9$

Step 1 :- Write one zero with 8 to make the number as 80

Step 2 :- Now subtract 8 from 80 i.e $80 - 8 = 72$

So $8 * 9 = 72$

APPLICATIONS

1. Find the value of 257×9

- a) 2353
- b) 2303
- c) 2313
- d) 2363

2. Find the value of 58×99

- a) 5632
- b) 6182
- c) 6822
- d) 5742

APPLICATIONS

3. Find the value of 436×99

- a) 39452
- b) 43164
- c) 44724
- d) 42492

4. Find the value of 689×999

- a) 687431
- b) 688411
- c) 688311
- d) 688321



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MULTIPLICATION OF TWO DIGIT NUMBERS USING CRISS CROSS METHOD

Step 1:- First of all multiply the last digits and keep the unit digit only and carry forward rest

Step 2:- Now cross multiply the digits and again keep the unit digit only

Step 3:- Now again multiply the last digits.

It is shown on the next slide with an example

NUMBERS USING CRISS CROSS

METHOD

$$\begin{array}{r} 23 \\ \times 12 \\ \hline 6 \end{array}$$

A multiplication diagram showing the first step of calculating the units digit product. The tens digit of the top number (2) and the units digit of the bottom number (2) are circled in blue, and their product (4) is written above the multiplication line.

$$\begin{array}{r} 23 \\ \times 12 \\ \hline 76 \end{array}$$

A multiplication diagram showing the second step of calculating the total product. The tens digit of the top number (2) and the tens digit of the bottom number (1) are circled in blue, and their product (2) is written above the multiplication line. The entire intermediate result (23) is crossed out with a large blue X.

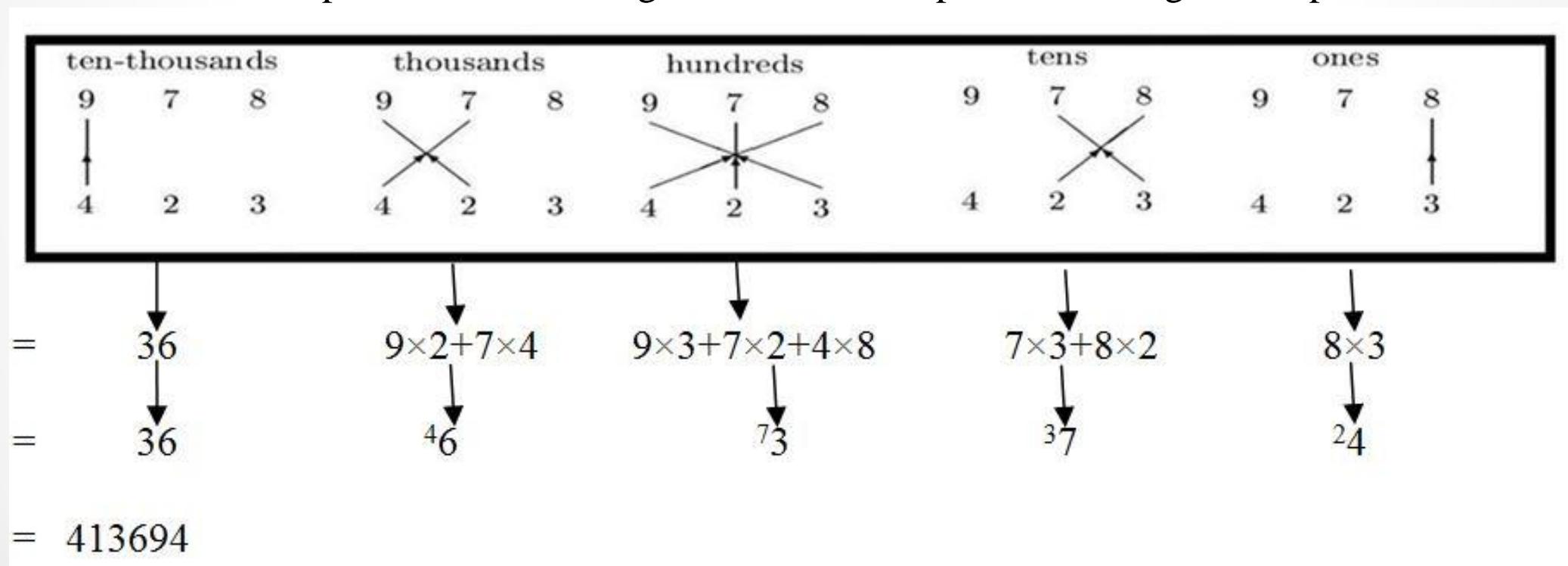
$$\begin{array}{r} 23 \\ \times 12 \\ \hline 276 \end{array}$$

A multiplication diagram showing the final result. The tens digit of the top number (2) and the tens digit of the bottom number (1) are circled in blue, and their product (2) is written above the multiplication line. The intermediate result (23) from the previous step is circled in blue, indicating it is part of the final answer.

MULTIPLICATION OF THREE DIGIT NUMBERS

(CRISS CROSS METHOD)

Multiplication of three digit numbers are explained in the given steps



APPLICATIONS

1. Find the value of 86×47

- a) 4042
- b) 4112
- c) 4052
- d) 4132

2. Find the value of 42×48

- a) 2026
- b) 2096
- c) 2016
- d) 2116



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APPLICATIONS

3. Find the value of 247×324

- a) 80228
- b) 80178
- c) 80128
- d) 80028

4. Find the value of 786×549

- a) 431574
- b) 431514
- c) 431534
- d) 431554

SQUARE

For Squares of 2-digit numbers

Select any number from 11-99 :- $(44)^2$

Step 1:- take it as $(40+4)^2 = 40^2 + 4^2 + 2*40*4$

Step 2:- $(44)^2 = 1600 + 16 + 320 = 1936$

OR

Using Base value

Take base as 40.

So, square will be $= (44+4)*40 + 4^2 = 1920 + 16 = 1936$

SQUARE

For Squares of three digit numbers

Select any number from 100-999 :- $(588)^2$

Step 1:- Take the difference of this number and the nearest number ending with zero. Lets take that number be 600, so difference will be $600 - 588 = 12$

Step 2:- Take square of this difference and that will be $12^2 = 144$

Step 3:- Now first add and then subtract the difference from step 1. i.e. 600 and 576

Step 4:- multiply 600 and 576 and then add 144(from step 2) in the result, so it will become $(588)^2 = 576 \times 600 + 144 = 345600 + 144 = 345744$

OR

Using base value

As $588 = 600 - 12$, so take the base value as 600.

So, square of the number will be $= (588-12) \times 600 + 12^2 = 345600 + 144 = 345744$

SQUARE OF NUMBERS ENDING WITH 5

$$45^2 = 2025$$

step 1 - multiply the first digit by the first digit plus one

$$4 \times (4+1) = 20$$

Step 2 - write the number 25 next to the result from step 1

$$\underline{20} _\underline{25}$$

APPLICATIONS

1. Find the square of 46?

- a) 2116
- b) 2378
- c) 2216
- d) 2316

2. Find the square of 396?

- a) 156216
- b) 156816
- c) 152664
- d) 161664

3. Find the square of 112?

- a) 11544
- b) 12544
- c) 11344
- d) 12444

SQUARE ROOT SHORTCUTS



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(For Perfect Square Numbers Only)

Step 1: Check unit digit of the no. (in pair).

Step 2: Select whose square less than remaining no.

Step 3: Multiply no. with consecutively next no.

Step 4: Compare & select

Number	Square	Last digit
1	1	1
2	4	4
3	9	9
4	16	6
5	25	5
6	36	6
7	49	9
8	64	4
9	81	1

Example: 12544
11 2 or 8

$$11^2 < 125 < 12^2$$

Now, $11 \times 12 = 132$

$125 < 132$; So, we'll choose the smaller number i.e. 11.

Answer will be 112

APPLICATIONS

1. Find the square root of 14641

- a) 121
- b) 91
- c) 111
- d) 141

2. Find the square root of 233289

- a) 587
- b) 377
- c) 483
- d) 733

Any Doubts???

Number Systems

NUMBER SYSTEM

Work with the
world of numbers



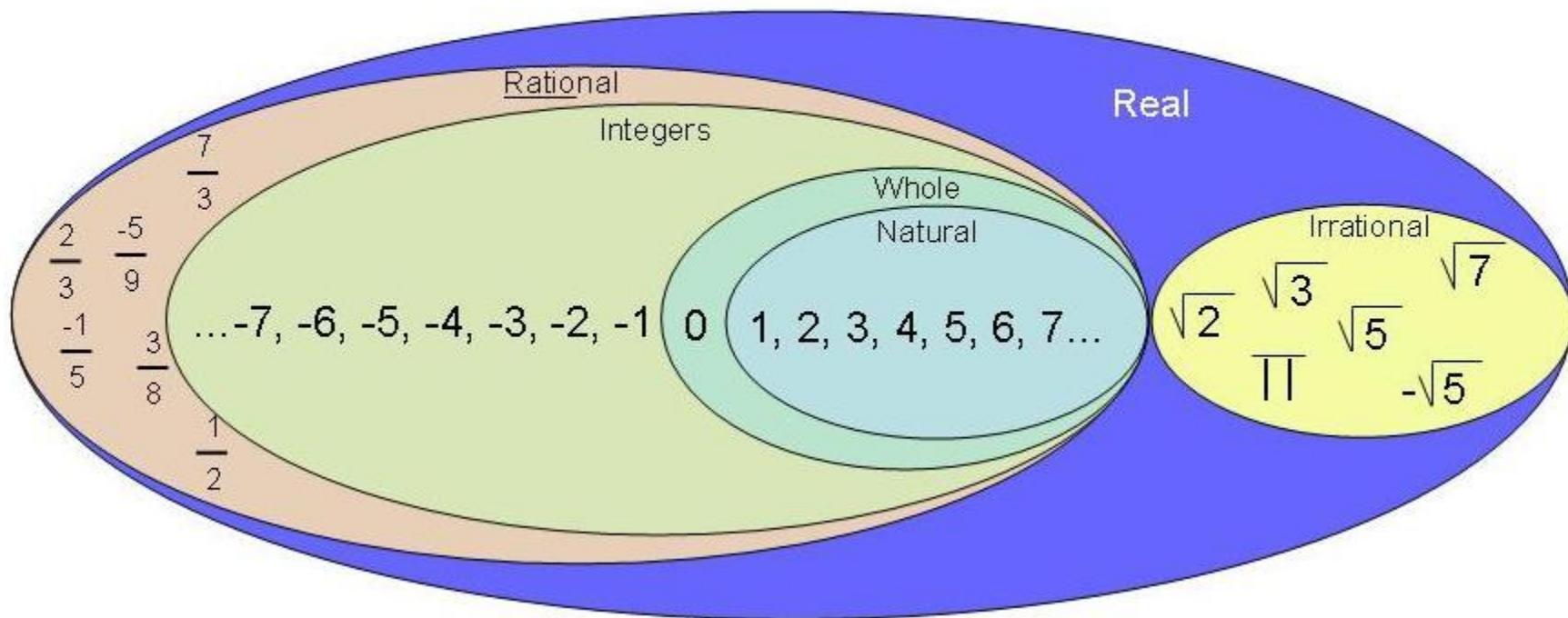
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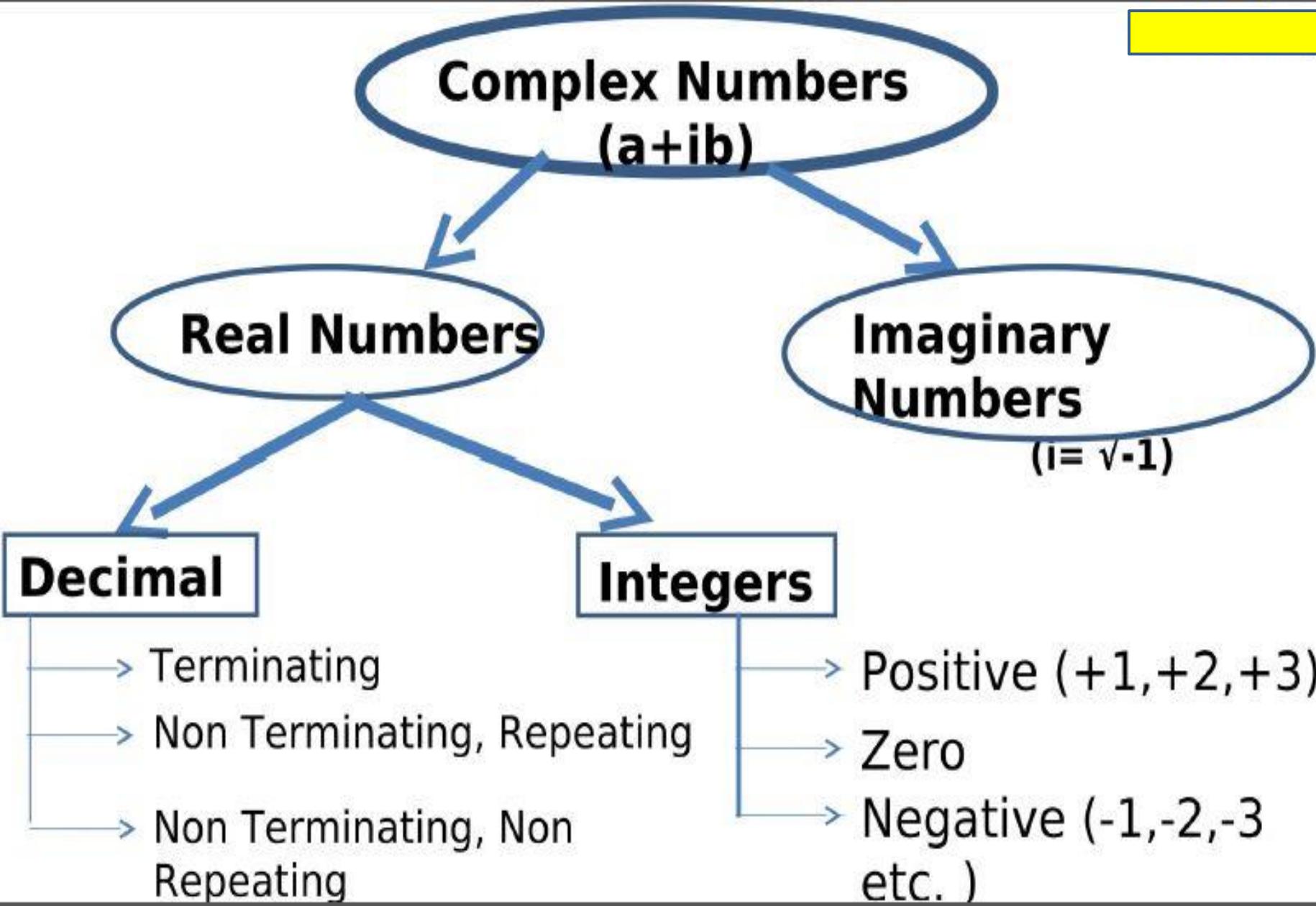
- TYPES OF NUMBERS
- Conversion of a decimal number to fraction
- DIVISIBILITY RULE
- REMAINDER THEOREM
- Power Cycle and Unit Digit Concept
- FACTORS AND MULTIPLES
- i) Number of factors
- ii) Sum of factors
- iii) Product of factors
- HCF & LCM
- AP & GP



Types of numbers

Real Number System





Real Numbers : All numbers which can be represented on number line are called Real numbers. Or we can say that all numbers from -infinity to +infinity are called Real numbers.

Decimal Numbers: Decimal Numbers are classified into 3 categories.

- 1.Terminating Decimals (e.g. 0.5, 0.2, 1.5 etc.)
- 2.Non terminating but repeating decimals (e.g. 0.3333.....)
- 3.Non Terminating and non repeating (π , $\sqrt{2}$, $\sqrt{3}$)

First two decimal number's type are Rational Number and third type is Irrational.

Rational Numbers : All numbers which can be written in the form of p/q , where $q \neq 0$ are called Rational Numbers. All other numbers are Irrational.

$0.5 = 5/10$, So terminating decimals are Rational Numbers.

$0.33333\dots = 1/3$, So Non terminating but repeating decimals are also Rational.

But Non terminating and non repeating decimals are Irrational numbers.

Note: Here one should know that value of π is not $22/7$ which we generally use for our convenience.



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Rational no. b/w a and b = $(ak+b)/(k+1)$

Irrational no. b/w a and b = \sqrt{ab} ,

Positive Integers: Positive integers can be categories in many ways.

1. Prime numbers: Numbers having exactly two factors are called prime numbers. They have factors as 1 and the number itself. e.g. 2, 3, 5 etc.

2. Composite Numbers: Numbers having more than two factors are called composite numbers. e.g. 4, 6, 8

3. Neither Prime nor composite: **1** is neither prime nor composite as it has only one factor.
• **2** is the smallest Prime number and the only prime number which is even.

Even number: Numbers divisible by 2 are even numbers. e.g. 2,4,6,8 etc.

Odd numbers: Numbers not divisible by 2 are odd numbers.

Co-Prime numbers: Set of two numbers having HCF=1 e.g. (2,3) , (5,7) etc.

Perfect number: If the sum of all the factors of a number (excluding that number) is equal to that number. Then that number is called perfect number.
E.g. $6 = 1, 2, 3, 6$ adding factor sum= $1+2+3=6$



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Important rules related to Even and Odd numbers:

odd \pm odd = even;

even \pm even = even;

even \pm odd = odd

odd \times odd = odd;

even \times even = even;

even \times odd = even.

odd^(any number) = odd

even^(any number) = even

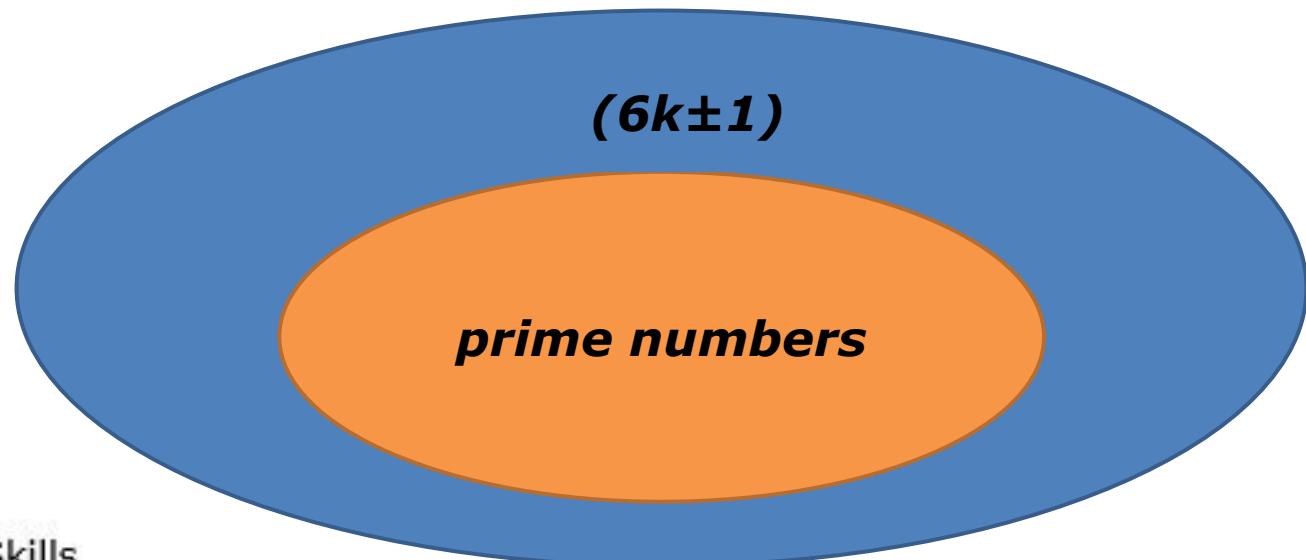
How to find if a number is prime or not?

N is a prime number if it is not divisible by numbers lesser than \sqrt{N} .

Example: 191 is a prime number since it is not divisible by 2, 3, 5, 7, 11 and 13 [numbers less than $\sqrt{191}$ (≈ 14)].

Note: Prime numbers will always be in the form $(6k\pm 1)$ where $k=1, 2, 3\dots$

But not all $(6k\pm 1)$ will be a prime number.



Conversion of a decimal number to fraction:

Example:

$$3.\overline{713} =$$

Solution:

$$3.\overline{713} = 3 + \frac{713}{999} = \frac{2997 + 713}{999} = \frac{3710}{999}$$

Example:

$$12.3\overline{45} =$$

Solution:

Here only 45 are recurring.

$$\text{Therefore, } 12.\overline{345} = 12 + \frac{345 - 3}{990} = 12 + \frac{342}{990} = 12 + \frac{38}{110} = 12 + \frac{19}{55} = \frac{679}{55}$$

Q. Find the rational form of the recurring rational
0.2333333333

[A] $11/99$

[B] $1/3$

[C] $7/30$

[D] $13/30$



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Q. Convert $37.565656565656\dots\dots\dots$ into P/Q



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Divisibility Rules

Divisibility rule of 2 : Numbers which ends with even number or zero is always divisible by 2.

Example: 122, 246, 230, 458 etc.

Divisibility rule of 3 : A number is divisible by 3 if sum of it's digit is divisible by 3.

Example: 1296, 342, etc.

1296, Sum of digits= $1+2+9+6=18$, which is divisible by 3.

Divisibility rule of 4: If the last two digit of a number are divisible by 4 or numbers ending with two or more zeros then that number is divisible by 4.

Example: 2332, 1240, 2500, 816000, etc. are divisible by 4.

Divisibility rule of 6: Now 6 is a composite number and whenever we discuss the divisibility rule of a composite number then we break that composite number into its two Co-Prime factors. For example 6 has (2,3) as its Co-Prime factors.

If a number is divisible by both 2 and 3 it means that number is also divisible by 6.

Example: 612, 2532, 5250 etc.

Divisibility rule of 8: A number is divisible by 8, if its last three digits

Divisibility rule of 9 : If sum of all digits of a number is divisible by 9, the number is also divisible by 9.

Example: 1296, 369, 1440, 25254 etc.

Divisibility rule of 10: if a number is ending with 0, it is divisible by 10.

Example : 1220, 320, 2500, 450 etc.

Divisibility rule of 12: Again it is a composite number whose two Co-Prime factors are (3,4)

We can say that if a number is divisible by 3 and 4 both then that number is also divisible by 12.

Example : 468, 1152, 1020 etc.

Any other numbers can be written in terms of the numbers whose divisibility is already known.

Example: $15 = 3 \times 5$

$$18 = 2 \times 9$$

$$33 = 3 \times 11$$

Note: The numbers expressed should be co-prime (i.e., the HCF of the two numbers should be 1)

Example: $40 = 4 \times 10$ is wrong because HCF(4,10) is 2.
 $\therefore 40 = 5 \times 8$ because HCF(5,8) is 1.



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Question: If number $1792N$ is divisible by 2. How many values N can take?

- [A] 4
- [B] 5
- [C] 3
- [D] 6



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Question: What should come in place of K if 563K5 is divisible by 9?

- [A] 7
- [B] 8
- [C] 9
- [D] 2



Question: For what values of P number 345472P34 is exactly divisible by 9.

- [A] 3
- [B] 4
- [C] 6
- [D] 7



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Question: For what values of N number $9724N$ is exactly divisible by 6.

- [A] 2 & 8
- [B] 4 & 6
- [C] 2 & 6
- [D] 6 & 8

Divisibility rule of 11 : A number is divisible by 11 if the difference between the sum of digits at odd places and sum of digits at even places is either 0 or divisible by 11.

Example: 10593, 9372 etc.

For 10593

$$(\text{Sum of digits at odd places}) - (\text{Sum of digits at even places}) = (3+5+1) - (9+0) = 9 - 9 = 0$$

For 9372

$$(2+3)-(9+7) = 5-16 = -11 \text{ which is divisible by 11.}$$



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Question: For what values of N number 857N32 is exactly divisible by 11.

- [A] 1
- [B] 0
- [C] 3
- [D] 4



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Question: What should come in place x if $4857x$ is divisible by 88?

- [A] 6
- [B] 8
- [C] 2
- [D] 4



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Remainder theorem

Divisor $\overline{6} \Big) \begin{array}{r} 4 \text{ — Quotient} \\ 25 \text{ — Dividend} \\ \hline 24 \\ \hline 1 \text{ — Remainder} \end{array}$

Dividend = (Divisor \times Quotient + remainder)



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Question: In a division process divisor is 5 times of quotient and remainder is 3 times of quotient. If remainder is 15. Find dividend.

- [A] 140
- [B] 150
- [C] 170
- [D] 190

Question: When a number is divided by 102 leaves remainder 87. If the same no. is divided by 17. Find remainder.

- [A] 1
- [B] 5
- [C] 7
- [D] 2

Important Rules

1. If x/D Remainder= R, then $2x/D$ Remainder= $2R/D$
2. If x/D Remainder= R, then $\frac{x^2}{D}$ Remainder= R^2/D
3. If x/D Remainder= R, then $\frac{x^3}{D}$ Remainder= R^3/D
4. If $\frac{A \times B}{D}$ then Remainder= $\frac{Ar \times Br}{D}$ (product of individual remainders)
5. If $\frac{A+B}{D}$ then Remainder= $\frac{Ar+Br}{D}$ (Sum of individual remainders)

Question: Find remainder for $\frac{63 \times 78}{9}$

Question: Find remainder for $\frac{63+78}{9}$

Question: When a number divided by a divisor m then remainder is 20. If the twice of that number is divided by the same divisor m then the remainder is 9. Find the divisor m.



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Important Formulas:

1. $\frac{(x+a)^n}{x}$ then remainder= a^n

2. $\frac{(tx+a)^n}{x}$ then remainder= a^n

3. $\frac{(x+1)^n}{x}$ then remainder= $1^n = 1$

4. $\frac{(x-a)^n}{x}$ then remainder= $(-1)^n$ if power even then R=1
if Power Odd then R=-1 or x-1

5. $\frac{(tx+1)^n}{x}$ then remainder= $1^n = 1$

6. $\frac{(tx-1)^n}{x}$ then remainder= $(-1)^n$ if power even then R=1
if Power Odd then R=-1 or x-1

Remainder Cyclicity:

Example: What is the remainder when 2^{202} is divided by 7?

$$2^1/7 = R(2)$$

$$2^2/7 = R(4)$$

$$2^3/7 = R(1)$$

The next three remainder values will be the same. i.e., The remainder pattern is 2,4,1, 2,4,1, 2,4,1.....The size of the pattern is 3.

Now divide the power by number of repeating values (3) to choose the remainder.

Choose the nth value in the cycle if the remainder is n except for the last value whose remainder should be 0.

$$202/3 = R(1).$$

The 1st value in the cycle is 2.

Note: While finding the remainder pattern if the remainder becomes 1, then the process can be stopped as it will always repeat after 1.

$$\therefore 2^{202}/7 = R(2)$$

Note: Do not cancel any numerator value with the denominator value as the remainder will differ.

$$R(6/4) \neq R(3/2)$$

$$6/4 = R(2)$$

$$\text{But } 3/2 = R(1)$$

If you want to cancel out numerator and denominator by a certain value then at last we also need to multiply the remainder by the same value in order to get correct remainder.



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Q) What is the remainder when 3^7 is divided by 8?

- [A] 3
- [B] 4
- [C] 5
- [D] 7



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Q) Remainder when 17^{23} is divided by 16?

- [A] 1
- [B] 2
- [C] 3
- [D] 4



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Q) Remainder when 35^{113} is divided by 9?

- [A] 1
- [B] 8
- [C] 3
- [D] 4



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Q) Remainder when 2^{33} is divided by 9?

- [A] 1
- [B] 4
- [C] 8
- [D] 5



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Q) Remainder when 2^{99} is divided by 10?

- [A] 1
- [B] 4
- [C] 2
- [D] 8



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Q) Remainder when 5^{500} is divided by 500?

- [A] 125
- [B] 1
- [C] 5
- [D] 250



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Unit Digit Concept

Right most digit of a number is called Unit digit.

For e.g. 278×623 what will be the unit digit?



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Unit digit questions can be asked in two ways:

1. Simple Product type Questions

e.g. What will be the unit digit of $123 \times 456 \times 789$.

2. Power Type Questions

e.g. Find the unit digit of $(127)^{23}$

It can also be the mixture of both.

We can categorize numbers in three categories:

1. Numbers ending with (0, 1, 5, 6)
2. Numbers ending with (4, 9)
3. Numbers ending with (2, 3, 7, 8)

Each category follows a certain rule.

1. **Numbers ending with (0, 1, 5, 6) :** Any number ending with 0, 1, 5, 6 raised to power any number (Except 0) will always have same number at unit place respectively.

For e.g. $(2350)^{234}$, $(531)^{34}$, $(245)^{321}$, $(776)^{321}$

2. Numbers ending with (4 and 9) : Cyclicity of 4 and 9 is 2. It means their unit digit repeats after every 2 powers. So we can say

$(4)^{odd}$ = 4 at unit place
 $(4)^{Even}$ = 6 at unit place

$(9)^{odd}$ = 9 at unit place
 $(9)^{Even}$ = 1 at unit place

3. Numbers ending with (2,3,7,8) : All numbers have cyclicity of 4, it means after every 4th power the unit digit pattern will be same.

In these type of questions we will divide the power by cyclicity (i.e. 4) so that we will know how many cycles have been completed and we will try to find remainder. And unit digit will be $(2,3,7,8)^{\text{Rem}}$

Note: If remainder is zero then we take highest power of that cycle which is 4. or we can say $(2,3,7,8)^4$

	Power			
Base	1	2	3	4
2	2	4	8	6
3	3	9	7	1
7	7	9	3	1
8	8	4	2	6
4	4	6		
9	9	1		

Number	Cyclicity
1	1
2	4
3	4
4	2
5	1
6	1
7	4
8	4
9	2
10	1

Choose the n th value in the cycle if the remainder is n except for the last value whose remainder should be 0.



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Example : What is the unit digit of $(123)^{42}$?

The unit digit pattern of 3 repeats four times. So find the remainder when the power value is divided by 4.

$$42/4 = R(2)$$

2nd value in 3 cycle is 9.

∴ Unit digit of $(123)^{42}$ is 9



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Question: Find the unit digit of $(2354)^{1048}$

- [A] 4
- [B] 6
- [C] 8
- [D] None of these



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Question: Find the unit digit of $(248)^{1587}$

- [A] 2
- [B] 4
- [C] 8
- [D] 6



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Question: Find the unit digit of $(127)^{223}$

- [A] 7
- [B] 9
- [C] 3
- [D] 1



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Question: Find the unit digit of $(456)^{87} \times (307)^{42}$

- [A] 1
- [B] 4
- [C] 5
- [D] 7



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Factors

Factors of a number are the values that divides the number completely.

Example: Factors of 10 are 1, 2, 5 and 10.

Multiple of a number is the product of that number and any other whole number.

Example: multiples of 10 are 10, 20, 30,.....

1. Total number of factors
2. Sum of Factors
3. Product of Factors
4. Prime factors
5. Composite factors
6. Even factors
7. Odd factors
8. In how many ways a number can be written as a product of its two factors
9. In how many ways a number can be written as a product of its two co-prime factors

1. Total Number of factors:

- Take any number “N” and it is to be converted into **product of prime numbers** (*Prime factorization*) i.e.
- $N = A^p \times B^q \times C^r$ here A, B , C are prime numbers and p, q, and r were respective powers of that prime numbers.
- **Total numbers of factors for $N = (p + 1)(q +1)(r +1)$.**



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Example: 3600

Step 1: Prime factorize the given number

$$3600 = 36 \times 100$$

$$= 6^2 \times 10^2$$

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

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

Step 2: Add 1 to the powers and multiply.

$$(4+1) \times (2+1) \times (2+1)$$

$$= 5 \times 3 \times 3$$

$$= 45$$

∴ Number of factors of 3600 is 45.



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Question: Find the total number of factors of 330.

- [A] 2
- [B] 8
- [C] 16
- [D] 32



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Question: Find the total number of factors of 1560.

- [A] 6
- [B] 16
- [C] 12
- [D] 32



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2. Sum of factors:

Example: 45

Step 1: Prime factorize the given number

$$45 = 3^2 \times 5^1$$

Step 2: Split each prime factor as sum of every distinct factors.

$$(3^0 + 3^1 + 3^2) \times (5^0 + 5^1)$$

The following result will be the sum of the factors

$$= 78$$



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Question: Find the sum of factors of 24.

- [A] 60
- [B] 46
- [C] 56
- [D] 59



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Question: Find the sum of factors of 98.

[A] 161

[B] 171

[C] 160

[D] None



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3. Product of factors:

Product of factors of a number N is given by $N^{(Total\ factor/2)}$

Question: Find the product of factors of 24.



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4. Prime factors:

Number of Prime factors used in prime factorization are prime factors.

5. Composite Factors:

(Total factors – Prime factors)-1



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Question: Find the number of prime factors of 300.

- [A] 2
- [B] 3
- [C] 4
- [D] 5



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Question: Find the number of composite factors of 42.

- [A] 1
- [B] 4
- [C] 5
- [D] 3

Even and Odd factors: We can find any one of two values and other we can find from subtracting from the total number of factors.

6. Odd factors: To find odd factors we will not consider power of 2 as it is an even Prime number.

Note: Do not consider even prime factor

7. Even factors: We can also find even factor directly. After prime factorization we will increase all power by 1 except power of 2. It will remain constant.



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Odd Factors:

Example: 4500

$$4500 = 45 \times 100 = 9 \times 5 \times 10 \times 10 = 3 \times 3 \times 5 \times 5 \times 2 \times 5 \times 2$$

$$4500 = 2^2 \times 3^2 \times 5^3$$
 Here consider $A = 2$, $B = 3$, $C = 5$, $p= 2$, $q = 2$ and $r = 3$

Here identifying that odd number are 3 and 5

$$\text{Numbers of odd factors of number } 4500 = (q + 1) (r + 1) = 3 \times 4 = 12$$

Note: Do not consider even prime factor



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Question: How many factors of 340 are even.

- [A] 12
- [B] 16
- [C] 8
- [D] 6



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Question: How many factors of 408 are even.

- [A] 12
- [B] 16
- [C] 8
- [D] 10

8. In how many ways a number can be written as a product of its two factors:

It is given by **(Total Factors/2)**

Note: If the total number of factors are odd then Product of two number= $(\text{total factors}+1)/2$

9. In how many ways a number can be written as a product of its two co-prime factors:

It is given by $2^{(N - 1)}$

Where N= no. of prime factors of that number



L
P
U

Question: In How many ways 320 can be written as a product of its two co-prime factors .

- [A] 2
- [B] 6
- [C] 1
- [D] 5



Question: In How many ways 12 can be written as a product of its two co-prime factors .

- [A] 2
- [B] 6
- [C] 8
- [D] 6



L
P
U

Factors will occur in pairs for the numbers except perfect squares.

Example 1: A non perfect square number- 10

$$1 \times 10 = 10$$

$$2 \times 5 = 10$$

∴ Factors of 10 are 1, 2, 5 and 10.

Non perfect squares will have even number of factors

Example 2: A perfect square number- 16

$$1 \times 16 = 16, 2 \times 8 = 16, 4^2 = 16$$

∴ Factors of 16 are 1, 2, 4, 8 and 16.

Every **perfect square** will have **odd number of factors** because its square root number will pair with itself.

This has odd number of factors because 4 will pair with itself.

Every **perfect square** will have **odd number of factors** because its square root number will pair with itself.



L
P
U

Example 3: A prime square number- 49

The factors of 49 are 1, 7 and 49.

Prime square number will have exactly **3 factors** (1, that number itself and square root of that number).

If **N** is a **prime square number** then the **factors** are 1, **N** and \sqrt{N} .



L
P
U

Trailing zeros (Number of zeros at the end)

Concept: In multiplication zero can be produced when we have a pair of 2 and 5. So, in order to find no. of zeros at the end, the pair of 2 and 5 need to be counted.

Example: $2^3 \times 5 \times 9 \times 8 \times 24 \times 15$ Find number of zeros at the end.

How to find Trailing zeros in any n! :

Ex: Find number of zeros in 10!

Answer: $10! = 1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 \times 8 \times 9 \times 10$

Note: For any factorial value number of 5s are always less than number of 2s. So our concern will be to find number of 5. For counting 5s in any n! value we divide n by powers of 5.

$$= [n/5] + [n/5^2] + [n/5^3] + [n/5^4] + \dots \dots \dots$$



L
P
U

Question: Find number of trailing zeros in $100!$

- [A] 24
- [B] 25
- [C] 26
- [D] 27



L
P
U

Question: Find number of trailing zeros in $154!$

- [A] 35
- [B] 31
- [C] 34
- [D] 37



L
P
U

Question: Find number of trailing zeros in $56!$

- [A] 13
- [B] 11
- [C] 12
- [D] 6



L
P
U

Question: Find number of trailing zero in $100! + 200!$

- [A] 24
- [B] 49
- [C] 73
- [D] None of these



L
P
U

Question: Find number of trailing zero in $100! \times 200!$

- [A] 24
- [B] 49
- [C] 73
- [D] None of these

LCM AND HCF

LCM- Least Common Multiple

LCM of given numbers X,Y,Z is the Least number which is exactly divisible by all the given numbers X,Y,Z.

OR we can say it is the least multiple of all the given numbers.

For e.g. $12 = 12, 24, 36, 48, 60, 72, 84, 96, \dots$

$16 = 16, 32, 48, 64, 80, 96, \dots$

So there are lots of multiple of 12 and 16 which will be common but the least multiple which is common is 48. That is the LCM of 12 and 16.



L
P
U

FINDING L.C.M. OF BIG NUMBERS

Step 1 Find all the prime factors of both numbers.

Step 2 Multiply all the prime factors of the larger number by those prime factors of the smaller number that are not already included



L
P
U

HCF- Highest Common Factor

HCF of given numbers X,Y,Z is the greatest number which exactly divides all the given numbers X,Y,Z. Sometimes called **Greatest Common divisor(G.C.D.)**

For e.g. $12 = 1, 2, 3, 4, 6, 12$

$16 = 1, 2, 4, 8, 16$

So there three common factor=1, 2, 4 but the Greatest factor is 4. That is the HCF of 12 and 16.



L
P
U

FINDING THE H.C.F. OF BIG NUMBERS

For larger numbers you can use the following method:

Step 1 Find all prime factors of both numbers.

Step 2 Write both numbers as a multiplication of prime numbers.

Step 3 Find which factors are repeating in both numbers and multiply them to get H.C.F



L
P
U

Important Formulae

Product of Two numbers = HCF × LCM

HCF of Fraction = $\frac{\text{HCF of numerators}}{\text{LCM of Denominator}}$

LCM of Fraction = $\frac{\text{LCM of numerators}}{\text{HCF of Denominator}}$



L
P
U

LCM Word Problems

Question	Answer
The Least number which is exactly divisible by x, y and z	$\text{LCM}(x, y, z)$
The least number which when divided by x, y, z leaves the same remainder R in each case	$\text{LCM}(x, y, z) + R$
The least Number which when divided by x, y and z, leaves remainder a, b and c respectively	$\text{LCM}(x, y, z) - K$ Where $K = (x-a) = (y-b) = (z-c)$



L
P
U

HCF Word Problems

Question	Answer
The greatest number that will exactly divide x, y and z	$\text{HCF}(x, y, z)$
The greatest number that will divide x, y, z and leaves remainder R in each case	$\text{HCF}(x-y, y-z, z-x)$ OR $\text{HCF}(x-R, y-R, z-R)$
The greatest Number that will divide x, y and z, leaving remainder a, b and c respectively	$\text{HCF}(x-a, y-b, z-c)$



L
P
U

Q) Find the lowest common multiple of 24, 36 and 40.

- [A] 120
- [B] 240
- [C] 360
- [D] 480



L
P
U

Q) The least number which is exactly divisible by 8, 16, 40 and 80 is:

- [A] 16
- [B] 120
- [C] 80
- [D] None



L
P
U

Q) The greatest number that will exactly divide 36 and 84 is:

- [A] 4
- [B] 6
- [C] 12
- [D] 18

Q) The greatest possible length which can be used to measure exactly the lengths 7 m, 3 m 85 cm, 12 m 95 cm is:

- [A] 15
- [B] 25
- [C] 35
- [D] 42

Q) Four bells ring at an interval 3min, 4min, 5min and 6 minutes respectively. If all the four bells ring at 9am first, when will it ring again?



L
P
U

Q) The H.C.F. of two numbers is 11 and their L.C.M. is 7700.

If one of the numbers is 275, then the other is:

- [A] 308
- [B] 310
- [C] 312
- [D] None



L
P
U

Q) The H.C.F of $9/10$, $12/25$, $18/35$, and $21/40$ is?

- [A] $3/1400$
- [B] $5/1400$
- [C] $7/1400$
- [D] None

Q) Which of the following fraction is the largest? $\frac{7}{8}$, $\frac{13}{16}$, $\frac{31}{40}$, $\frac{63}{80}$

[A] $\frac{7}{8}$

[B] $\frac{13}{16}$

[C] $\frac{31}{40}$

[D] $\frac{63}{80}$

Q) Three numbers are in the ratio of $3 : 4 : 5$ and their L.C.M. is 2400. Their H.C.F. is:

- [A] 40
- [B] 80
- [C] 120
- [D] 200



L
P
U

Q) The ratio of two numbers is 3 : 4 and their H.C.F. is 4. Their L.C.M. is:

- [A] 12
- [B] 16
- [C] 24
- [D] 48



L
P
U

Q) The least number, which when divided by 12, 15, 20 and 54 leaves in each case a remainder of 8 is:

[A] 504

[B] 536

[C] 544

[D] 548



L
P
U

Q) Find the smallest number, which when divided by 3, 4 and 5 leaves remainder 1, 2 and 3 respectively?

- [A] 60
- [B] 53
- [C] 58
- [D] None



L
P
U

Q) The greatest number which on dividing 1657 and 2037 leaves remainders 6 and 5 respectively, is:

- [A] 123
- [B] 127
- [C] 235
- [D] 305



L
P
U

Q) Find the greatest number that will divide 43, 91 and 183 so as to leave the same remainder in each case.

- [A] 4
- [B] 7
- [C] 9
- [D] 13



L
P
U

Q) The product of two numbers is 4107. If the H.C.F. of these numbers is 37, then the greater number is:

- [A] 101
- [B] 107
- [C] 111
- [D] 185

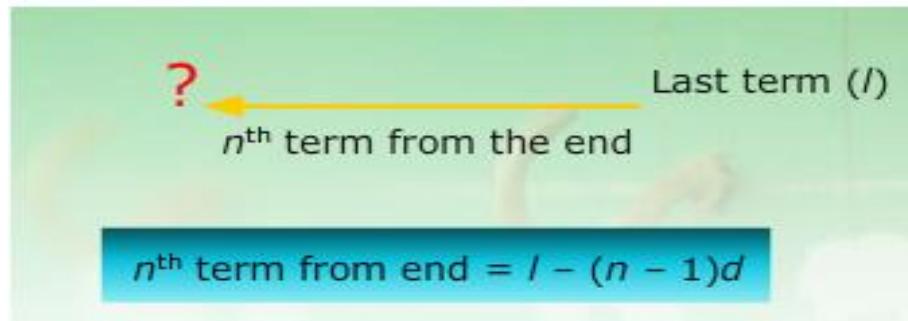
ARITHMETIC PROGRESSION

An Arithmetic Progression (A.P.) is a sequence in which the difference between any two consecutive terms is constant.

Let a = first term, d = common difference

- Then n th term

$$a_n = a + (n - 1)d$$



Sum of an A.P

The sum of n terms of an A.P. whose first term is a and common difference is d , is given by

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

The sum of n terms of an A.P. whose first term is a and last term is l is given by the formula:

$$S_n = \frac{n}{2} [a + l]$$



L
P
U

AM (Arithmetic mean)

If a, b, c are in AP then the arithmetic mean is given by

$$b = (a+c)/2$$

Inserting AM

To insert k means between a and b the formula for common difference is given by

$$d = (b-a) / (k+1)$$

For example: Insert 4 AM's between 4 and 34

$$d = (34 - 4) / (4+1)$$

$$= 30/5$$

$$= 6$$

∴ The means are $4+6=10$

$$10+6=16$$

$$16+6=22$$

$$22+6=28$$



L
P
U

Question: 1,3,5, 7, Which term of this AP is 55?

- [A] 25th
- [B] 26th
- [C] 27th
- [D] 28th



L
P
U

Question: Find the 15th term of the series 20,15,10,.....

- [A] -45
- [B] -50
- [C] -55
- [D] 0



L
P
U

Question: How many terms are there in the AP 20, 25, 30,
..... 130?

- [A] 21
- [B] 22
- [C] 23
- [D] 24



L
P
U

Question: Find the sum of the series 5,8,11,..... 221

- [A] 8249
- [B] 8239
- [C] 7886
- [D] 9000



L
P
U

Question: Find the sum of all 2-digit numbers, which are exactly divisible by 9?

[A] 525

[B] 565

[C] 575

[D] 585

Question: Find the first term of an AP whose 8th and 12th terms are 39 and 59 respectively?

- [A] 3
- [B] 4
- [C] 5
- [D] 6



L
P
U

GEOMETRIC PROGRESSION

A geometric sequence are powers r^k of a fixed number r , such as $\underline{2^k}$ and $\underline{3^k}$. The general form of a geometric sequence is

The n -th term of a geometric sequence with initial value a and common ratio r is given by

$$a_n = a r^{n-1}.$$

Such a geometric sequence also follows the recursive relation

$$a_n = r a_{n-1} \text{ for every integer } n \geq 1.$$

General term of a GP is $T_n = ar^{n-1}$



Sum of first n terms of G.P:

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

b. $S_n = \frac{a(1 - r^n)}{1 - r}$ where $r < 1$

c. $S_n = na$ where $r = 1$

Sum of infinite G.P:

If a G.P. has **infinite terms** and $-1 < r < 1$ or $|x| < 1$,

Sum of infinite G.P is $S_{\infty} = \frac{a}{1 - r}$.



L
P
U

GM (Geometric mean)

If a, b, c are in GP Then the GM is given by $b = \sqrt{ac}$

Inserting GM

To insert k means between a and b the formula for common ratio is given by

$$r = (b/a)^{1/(k+1)}$$

For example: Insert 4 GM's between 2 and 486

$$r = (486/2)^{1/(4+1)} = (243)^{1/5} = 3$$

∴ the means are $2 \times 3 = 6$

$$6 \times 3 = 18$$

$$18 \times 3 = 54$$

$$54 \times 3 = 162$$



L
P
U

Question: How many terms are there in the sequence

5, 20, 80, 320, 20480?

- [A] 5
- [B] 6
- [C] 7
- [D] 8



L
P
U

Question: If the first and fifth term of a GP are 16 and 81 respectively then find the fourth term?

- [A] 18
- [B] 24
- [C] 36
- [D] 54



L
P
U

Question: Find the sum of the series 2, 4, 8, 16.... 256.

- [A] 510
- [B] 1020
- [C] 520
- [D] None

Next Class Average



AVERAGE- TRICKS & TIPS

What is Average?



Average of n values is equal to the sum of n values divided by the total number of values (n)

$$\text{Averages} = \frac{\text{Sum of observation}}{\text{Number of observation}}$$

$$\text{Average} = \frac{\text{Sum}}{n}$$

Formulae

Numbers	Sum	Average= Sum/n
First n natural numbers	$\frac{n(n + 1)}{2}$	$\frac{(n + 1)}{2}$
First n odd numbers	n^2	n
First n even numbers	$n(n+1)$	(n+1)
First n natural numbers square	$\frac{n(n + 1)(2n + 1)}{6}$	$\frac{(n + 1)(2n + 1)}{6}$
Consecutive numbers or Numbers in A.P	$\frac{n(First\ term + Last\ term)}{2}$	$\frac{(First\ term + Last\ term)}{2}$

Some properties of Average:

If we have N number of observation as $a_1, a_2, a_3, a_4 \dots \dots \dots a_N$ and their average is A, then

1. If we add or subtract the same value (suppose x) from all the observations then average will be directly added or subtracted by x.
2. If we multiply or divide each observation by a same value (Suppose x), then average also multiplied or divided by the same value x.

If terms are in A.P or consecutives

1. If the terms are consecutives or are in A.P then average is always the middle term of the sequence if the number of observations are odd.

2. If number of observations are even then average is the average of two middle numbers.

Question : Find the average weight of 5 boys having weights
30kg, 40kg, 50kg, 60kg, 70kg?

(a) 50 kg

(b) 40 kg

(c) 45 kg

(d) 55 kg

Question : Find the average of 50, 52, 54, 56,150

- (a) 80
- (b) 90
- (c) 100
- (d) 110

Question : Find the average of all even numbers up to 100.

- (a) 50
- (b) 51
- (c) 52
- (d) 55

Question : Find the average of 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21

(a) 11

(b) 9

(c) 13

(d) 15

Question : Find the average of 13, 16, 19, 22, 25, 28

- (a) 22
- (b) 19
- (c) 19.5
- (d) 20.5

Question : If the average of 5 consecutive number is 21. Find the largest number.

- (a) 22
- (b) 23
- (c) 24
- (d) 25

Question : If the average of 5 consecutive odd number is 25, then find the smallest number.

- (a) 23
- (b) 21
- (c) 29
- (d) 19

Question : Find the average of first 100 natural numbers.

- (a) 50
- (b) 50.5
- (c) 51
- (d) 49

Question : Find the average of first 100 whole numbers.

- (a) 50
- (b) 50.5
- (c) 49.5
- (d) 49

Question : The average of first 10 even numbers is?

(a) 18

(b) 22

(c) 9

(d) 11

Question : Find the average of first 17 multiples of 5?

(a) 50

(b) 85

(c) 45

(d) 60

COMBINED AVERAGE

Class A

0

Class B

100

What is the combined average?

50 marks??

NO

We cannot determine the average without knowing the number of students in each class

The combined average depends on the number of students and the average in each class

$$\text{Combined Average} = \frac{n_1 w_1 + n_2 w_2}{n_1 + n_2}$$

Question : There are 36 students in a class A whose average weight is 30kg and 24 students in class B whose average is 40kg. What will be the average if the classes are combined?

- (a) 35
- (b) 34
- (c) 36
- (d) 32

Question : There are 63 students in a class A whose average weight is 32kg and 21 students in class B whose average is 44kg. What will be the average if the classes are combined??

- (a) 33
- (b) 35
- (c) 36
- (d) 38

Question : In a class there are 20 boys and 40 girls. The average age of boys is 18 years and that of girls is 15 years. What will be the average age of the whole class?

- (a) 16.5 Years
- (b) 17 years
- (c) 16 years
- (d) 14.2 Years

Question : The average of marks obtained by 120 candidates was 35. If the average of passed candidate was 39 and that of failed candidate was 15, the number of candidates who passed the examination is?

- (a) 100
- (b) 110
- (c) 120
- (d) 150

Question : A man goes from home to his office at speed of 40km/h and return from office to home at a speed of 60Km/h. Find the average speed during whole journey.

- (a) 45 Km/h
- (b) 48Km/h
- (c) 50Km/h
- (d) 55Km/h

Equal Distribution of Data

Example: Average of 5 students marks is 30. If one student having 90 mark is added to the team, then what will be the new average ?

All the problems in this concept are solved by assuming all the values as average itself.

Step1: Assume all the values to be 30.

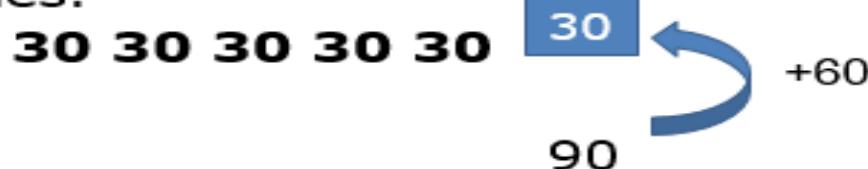
30 30 30 30 30

If the new mark is also 30 then the average will remain the same.

30 30 30 30 30 30

Step2: Finding the extra values-

But the actual new mark is 90, which means extra 60 is added to the values.



Step3: Distributing the extra values equally-

The extra 60 should be divided equally among 6 values as 10 each.

$$\begin{array}{ccccccc} 30 & 30 & 30 & 30 & 30 & 30 \\ +10 & +10 & +10 & +10 & +10 & +10 \\ \downarrow & \downarrow & \downarrow & \downarrow & \downarrow & \downarrow \\ 40 & 40 & 40 & 40 & 40 & 40 \end{array}$$

\therefore the new average is 40

Question : If the average weight of 10 students in a class is 30Kg, when weight of teacher is also included new average becomes 33. Find weight of teacher.

- (a) 63Kg
- (b) 54Kg
- (c) 66Kg
- (d) 70Kg

Question : The average weight of a class of 24 students is 30Kg when weight of the teacher is also included the average weight is increases by 1Kg.What is the weight of teacher in kg?

- (a) 60Kg
- (b) 61Kg
- (c) 37Kg
- (d) 55Kg

Question : The average weight of 8 person increases by 2.5 kg when a new person comes in place of one of them weighing 65 kg. What might be the weight of the new person?

(a) 70Kg

(b) 80Kg

(c) 75Kg

(d) 85Kg

Question : A teacher while calculating the average marks of 30 students of an examination, by mistake enter a student's marks as 68, instead of 86 and obtained the average as 58. Find the actual average.

- (a) 59
- (b) 60
- (c) 58.6
- (d) 60.5

Question : A Student's marks were wrongly entered as 83 instead of 63. Due to that the average marks of the class got increased by 2. The number of students in class is?

- (a) 10
- (b) 12
- (c) 15
- (d) 18

Question : The average age of a committee of 12 members is 48 Years. A member of age 62 retired and in place a new person aged 26 joined the committee. Find the new average of the committee.

- (a) 44
- (b) 45
- (c) 46
- (d) 47

Question : Average of 5 numbers is 27, if one number is excluded the new average becomes 25. Find the excluded number.

- (a) 35
- (b) 30
- (c) 38
- (d) 25

Question : The average of a family is 24 years which is consisting of 5 members, out of which the youngest being 6 years old. What would be the average age of family just before his birth?

- (a) 20
- (b) 22
- (c) 22.5
- (d) 23.5

Question : The average age of 10 members in a committee is increased by 3 years when two men whose ages are 25 years and 35 years are replaced by two new men. Find the average age of two new men.

- (a) 40
- (b) 45
- (c) 48
- (d) 52

Question : Average of 7 values is 20. If average of first 4 is 15 and that of last 4 is 25. Find the 4th number.

- (a) 20
- (b) 25
- (c) 30
- (d) 40

Question : The average marks of some students is 40 and 10 of them get 60 marks instead of 90 marks by mistake. After correction, the new average becomes 50. Find the number of students.

- (a) 20
- (b) 30
- (c) 25
- (d) 35

Question : In a hostel there are 30 students and if the number of students increased by 5 then the expense is increased by 40 per day. But the average expenditure diminishes by 3. Find the original expenditure.

- (a) 810
- (b) 870
- (c) 910
- (d) 950

Question : A batsman has a certain average of runs for 16 innings, In the 17th inning, he makes a score of 85 runs thereby increasing the average by 3 What is the average of 17 innings?

- (a) 38
- (b) 37
- (c) 36
- (d) 34

Question: A baller whose balling average is 12.4 runs/wicket. He played his next match and takes 5 wickets for 26 runs; therefore, his average is reduced by 0.4. Find the total number of wickets taken by the baller.

- (a) 80
- (b) 85
- (c) 90
- (d) 75

Question: The average temperature in Delhi for the first four days of the month was reported as 58°C . It reported as 60°C for 2nd, 3rd, 4th and 5th days. The ratio of the temperatures of 1st and 5th day was $7 : 8$. Find the temperature on the first day.

- (a) 42
- (b) 46
- (c) 63
- (d) 56

Question: The average temperature of Monday, Tuesday and Wednesday is 34°C . The average temperature of Tuesday, Wednesday and Thursday is 32°C . If the temperature of Thursday is 28°C , then find the temperature of Monday.

- (a) 34
- (b) 36
- (c) 40
- (d) 42

Question: 6 friends went to a hotel for taking their lunch. 5 of them spent Rs.32 each while the 6th person spent 80 more than the average expenditure of all the 6 person. Find the total money spend on lunch.

- (a) 280
- (b) 178
- (c) 285
- (d) 288

Question: 7 friends went to a hotel for taking their lunch. 6 of them spent Rs.60 each while the 7th person spent 240 more than the average expenditure of all the 7 person. Find the total money spend on lunch.

- (a) 280
- (b) 700
- (c) 750
- (d) 650



Percentage

Concept to discuss

1. Conversion of percentage to fraction and vice versa
2. $X\% \text{ of } Y = Y\% \text{ of } X$
3. Percentage change
4. Percentage Increase and decrease concept
5. Successive increase and decrease
6. Consumption and Expenditure
7. Examination , election and population

Percentage: Per means divided and cent means 100.

To convert any value on the base of hundred.

Conversion of percentage to fraction: To convert percentage to fraction, divide that percent value by 100.

$$\text{E.G. } 50\% = 50/100 = \frac{1}{2}$$

$$25\% = 25/100 = \frac{1}{4}$$

Conversion of fraction to percentage: To convert fraction to percentage multiply the fraction by 100.

$$\text{For e.g. } \frac{3}{8} = (\frac{3}{8}) * 100 = 37.5 \%$$

$\frac{1}{2} = 50\%$			
$\frac{1}{3} = 33 \frac{1}{3}\%$	$\frac{2}{3} = 66 \frac{2}{3}\%$		
$\frac{1}{4} = 25\%$	$\frac{3}{4} = 75\%$		
$\frac{1}{5} = 20\%$	$\frac{2}{5} = 40\%$	$\frac{3}{5} = 60\%$	$\frac{4}{5} = 80\%$
$\frac{1}{6} = 16 \frac{2}{3}\%$	$\frac{5}{6} = 83 \frac{1}{3}\%$		
$\frac{1}{7} = 14 \frac{2}{7}\%$	$\frac{2}{7} = 28 \frac{4}{7}\%$	$\frac{3}{7} = 42 \frac{6}{7}\%$	$\frac{4}{7} = 57 \frac{1}{7}\%$
		$\frac{5}{7} = 71 \frac{3}{7}\%$	$\frac{6}{7} = 85 \frac{5}{7}\%$
$\frac{1}{8} = 12 \frac{1}{2}\%$	$\frac{3}{8} = 37 \frac{1}{2}\%$	$\frac{5}{8} = 62 \frac{1}{2}\%$	$\frac{7}{8} = 87 \frac{1}{2}\%$
$\frac{1}{9} = 11 \frac{1}{9}\%$	$\frac{2}{9} = 22 \frac{2}{9}\%$	$\frac{4}{9} = 44 \frac{4}{9}\%$	$\frac{5}{9} = 55 \frac{5}{9}\%$
		$\frac{7}{9} = 77 \frac{7}{9}\%$	$\frac{8}{9} = 88 \frac{8}{9}\%$
$\frac{1}{10} = 10\%$	$\frac{3}{10} = 30\%$	$\frac{7}{10} = 70\%$	$\frac{9}{10} = 90\%$
$\frac{1}{11} = 9 \frac{1}{11}\%$	$\frac{2}{11} = 18 \frac{2}{11}\%$	$\frac{3}{11} = 27 \frac{3}{11}\%$	$\frac{4}{11} = 36 \frac{4}{11}\%$
$\frac{1}{12} = 8 \frac{1}{3}\%$			

Question : Find 55.55 % of 45.

Question : Find 45.45 % of 44

$$X\% \text{ of } Y = Y\% \text{ of } X$$

Question : Find 45% of 133.33

Answer : 45% of 133.33 = 133.33 % of 45

$$= (100+33.33)\% \text{ of } 45$$

$$= (1+1/3) * 45$$

$$= 4/3 * 45$$

$$= 60$$

Percentage Change

- 40 is what percent of 60?
- 60 is how much percent greater than 40?
- 40 is how much percent lesser than 60?

Question : If A's salary is 20 % more than B, then by how much
Percent B's salary is less than A.

- (a)20%
- (b)25%
- (c)16.66%
- (d)30%

Question : If A's marks in an exam is 40 % less than B then by how much % B's marks are more than A.

(a)40 %

(b)60 %

(c)66.66 %

(d)20 %

Question : If $16\frac{2}{3}\%$ of a number is added to itself the number becomes 700. Find original number.

(a)400

(b)600

(c)800

(d)700

Question: A student multiplied a number by $3/5$ instead of $5/3$

What is the percentage error in the calculation?

- (a) 44%
- (b) 64%
- (c) 40%
- (d) 60%

Question: The number was being multiplied by $5/6$. By mistake it is divided by $5/6$. Find percentage error in result.

- (a) 44%
- (b) 64%
- (c) 40%
- (d) 60%

Successive Increase and Decrease

$$\text{Net change} = a + b + \frac{ab}{100}$$

For Increase = Take positive sign

For decrease = Take negative sign

Question : Price of petrol first increased by 20% and then it is decreased by 10% . Find the net change in the price.

- (a)8 % increase
- (b) 2 % decrease
- (c) 10 % increase
- (d) 8 % decrease

Question : Demand of a car went down by 25 % in 2016 and 20 % in 2017. What is net % decrease in demand?

- (a) 45 %
- (b) 40 %
- (c) 50 %
- (d) 60 %

Question : If the length of a rectangle is increased by 20 % and width is decreased by 30% then find the resultant change in area.

(a) 16 %

(b) 20 %

(c) 24 %

(d) 28 %

Question : A number is first increased by 15% and then decreased by 20%. The number so obtained is 64 less than the original number. What is the original number?

(a) 600

(b) 750

(c) 800

(d) 860

Question :If the price of petrol is raised by 20% then the percentage by which a car owner must reduce his consumption so that there is no change in expenditure.

(a) 16.66 %

(b) 18 %

(c) 15 %

(d) 25 %

We know , **Expenditure = Price × Consumption**

Convert given % into fraction (a/n)

- If Increase $\frac{a}{n}$  Decrease $\frac{a}{n+a}$

For this case if $1/5$ increase ----- $1/6$ decrease

$$1/6 = 100/6 \% = 16.66 \%$$

- If Decrease $\frac{a}{n}$  Increase $\frac{a}{n-a}$

For this case if $2/5$ decrease ----- $2/3$ Increase

Question :If the price of sugar is decreased by 12.5% then the percentage by which one household must increase his consumption so that there is no change in expenditure.

(a) 10 %

(b) 8 %

(c) 14.28 %

(d) 12.5 %

Question :If the price of commodity is decreased by 20% and its consumption increased by 20%, what will be the change in expenditure.

- (a) 4 % increase
- (b) 4 % decrease
- (c) 8 % decrease
- (d) 8 % increase

Question: If the price of sugar is increased by 25% then by how much percent consumption should be reduced so that the expenditure will increase by only 5%

- (a) 25%
- (b) 15%
- (c) 16%
- (d) 20%

Question :If the price of sugar is reduced by 20% due to which a person can buy 2kg more sugar for Rs. 200. Find the original price of sugar per kg.

- (a) Rs. 25 per Kg
- (b) Rs. 20 per Kg
- (c) Rs. 22 per Kg
- (d) Rs. 16 per Kg

Question: The price of sugar is increased by 30% due to this a housewife purchase 12 kg less sugar so that her expenditure will increase by 10% only. Find her original consumption.

- (a) 70 kg
- (b) 80 kg
- (c) 75 kg
- (d) 78 kg

Question : A student scored 140 Marks and still failed by 35 marks. If the passing criteria of that exam is 35%. Then find the maximum marks of that exam.

- (a) 500
- (b) 600
- (c) 1000
- (d) 700

Question : A student scored 25 % in an examination and still failed by 30 marks while another candidate scored 50% marks and get 20 marks more than the passing marks. Then find the passing percentage.

- (a) 30 %
- (b) 40 %
- (c) 45 %
- (d) 50 %

Question : A student scored 30 % in an examination and still failed by 12 marks while another candidate scored 40% marks and got 28 marks more than the passing marks. Then find the maximum marks in the examination.

- (a) 300
- (b) 400
- (c) 500
- (d) 700

Question: In an Exam, 52% candidates failed in English, 42% in mathematics and 17% in both. What was the number of percentage of passed students in both subjects?

- (a) 23
- (b) 77
- (c) 6
- (d) 94

Question: In an Exam, 70% candidates passed in English, 65% in mathematics and 27% failed in both. If 248 candidates was pass in both the subjects, then What was the total number of students?

- (a) 300
- (b) 400
- (c) 500
- (d) 600

Question : The population of a town is 50,000. It increases by 10% in the first year and 12% in the second year. What will be the population after 2 years.

- (a) 55000
- (b) 61600
- (c) 72700
- (d) 84600

Question : The current population of a town is 28,000. During the last 2 years the population increased at the rate of 16% and 20% per year. The population 2 years ago was (approximately)

- (a) 24000
- (b) 22000
- (c) 20000
- (d) 18000

Question : Raju invest 65% of his investment in a machine and 20% of his investment on raw material. If he has Rs. 6000 balance. Find the total money he had.

- (a) 30000
- (b) 40000
- (c) 50000
- (d) 60000

Question : Raju spend 40% of his salary on house rent. On the remaining 10% spend on travel. On remaining $16\frac{2}{3}\%$ spend on food and remaining is saved . Find the money he spent on food.

- (a) Rs. 450
- (b) Rs. 400
- (c) Rs. 500
- (d) Rs. 600

Question: In a library 20% of the books are in Hindi, 50% of the remaining in English and 30% of the remaining are in French and rest 6300 books are in regional language. Then find the number of books in library.

- (a) 20000
- (b) 22500
- (c) 35000
- (d) 15000

Question: In an Election between two candidates one got 65% of the votes and won by 300 votes. Find total no. of votes.

- (a) 1200
- (b) 1500
- (c) 1800
- (d) 1000

Question : In a election of 2 candidate the candidate who gets 40% of the total votes rejected by 80 votes. Find total number of votes.

(a) 450

(b) 400

(c) 500

(d) 600

Question : In a election of 2 candidate 12 % of the voters did not cast their votes. The winner by getting 45% of the total votes, defeated his rival by 2000 votes. Find the total number of voters.

(a) 25000

(b) 50000

(c) 80000

(d) 100000

Question: In an Election, 10% persons didn't cast their votes and 10% found to be invalid. The winner got 54% of valid votes and won by 1620 votes. Find total number of votes?

- (a) 12500
- (b) 17500
- (c) 25000
- (d) 35000

Question: In an election two candidates participated. 20% voters did not cast their votes, out of which 600 votes declared invalid and the winner get 75% of valid votes and wins by 1500 votes. Find the number of total votes.

- (a) 3600
- (b) 3000
- (c) 4000
- (d) 4500



Profit and Loss



Cost Price: The price, at which an article is purchased, is called its *cost price*, abbreviated as **C.P.**

Selling Price: The price, at which an article is sold, is called its *selling price*, abbreviated as **S.P.**

Profit or Gain: If S.P. is greater than C.P., the seller is said to have a *profit or gain*.

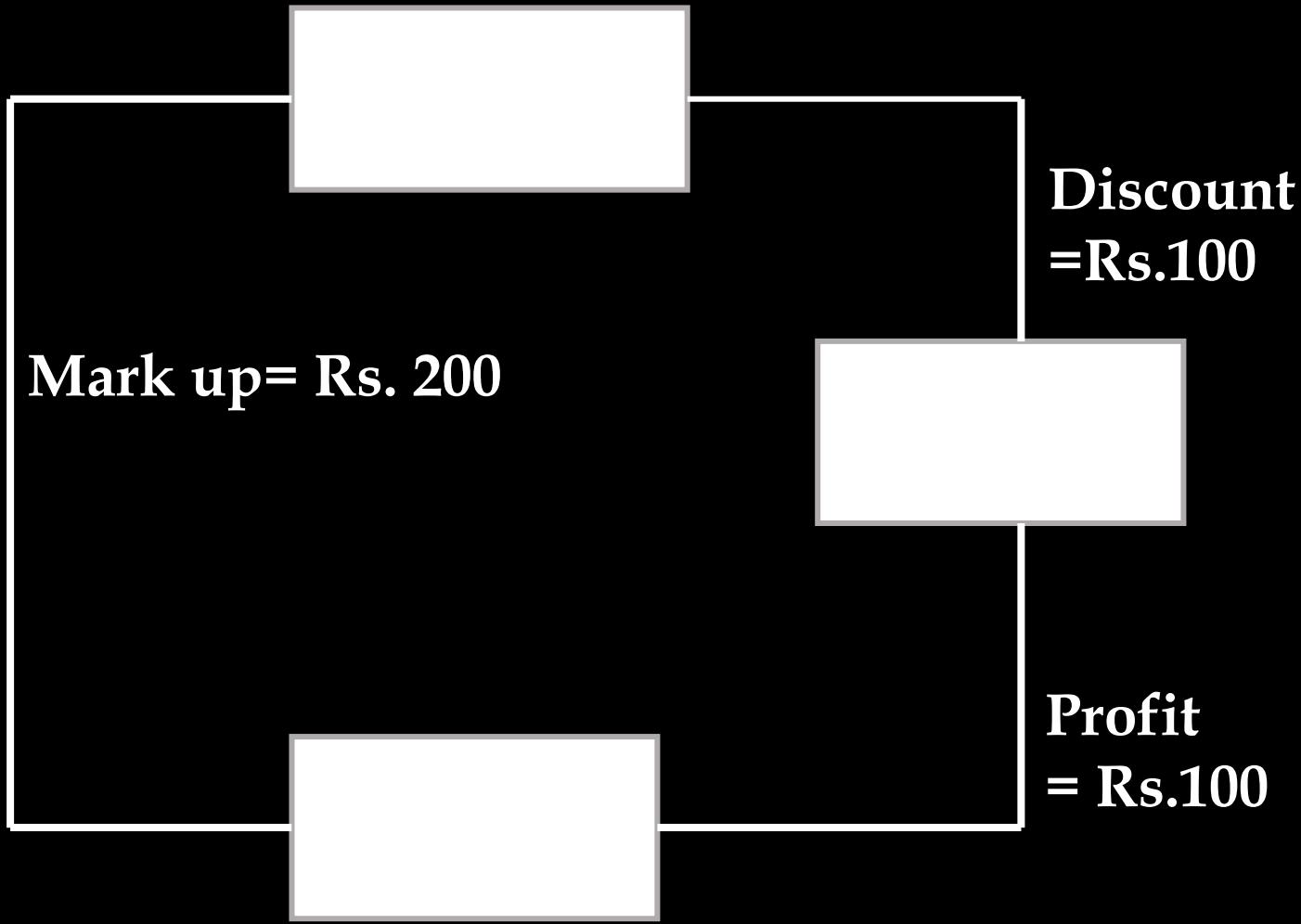
Loss: If S.P. is less than C.P., then the seller is said to have incurred a *loss*.

Profit = selling price - cost price

Percentage Profit (%) = $\frac{\text{profit}}{\text{cost price}} \times 100$

Loss = cost price - selling price

Percentage Loss (%) = $\frac{\text{loss}}{\text{cost price}} \times 100$



A shopkeeper buys a T-shirt from whole sale market at Rs.400 and marked that article Rs.200 above the CP. After giving a discount of Rs.100 he sold it at Rs.500.

In the previous situation:

Profit= Rs.100, Profit/Loss is always calculated on CP. So, %P= ?

Markup= Rs.200, M is always calculated on CP. So, %M= ?

Discount = Rs.100, Discount is always calculated on MP. So, %D= ?

Relationship between Markup, Discount and Profit or Loss

$$P\% \text{ or } L\% = M - D - \frac{MD}{100}$$

$$S.P. = \frac{(100+Gain\%)}{100} \times C.P.$$

$$S.P. = \frac{(100-Loss\%)}{100} \times C.P.$$

$$C.P. = \frac{100}{(100+Gain\%)} \times S.P.$$

$$C.P. = \frac{100}{(100-Loss\%)} \times S.P.$$

If an article is sold at a gain of say, 35%, then S.P. = 135% of C.P.

If an article is sold at a loss of say, 35%, then S.P. = 65% of C.P.

When a person sells two similar items, one at a gain of say, $x\%$, and the other at a loss of $x\%$, then the seller always incurs a loss given by:

$$\text{Loss\%} = \left(\frac{\text{Common Loss and Gain\%}}{10} \right)^2 = \left(\frac{x}{10} \right)^2$$

If a trader professes to sell his goods at a cost price, but uses false weights, then

$$\text{Gain\%} = \left[\frac{\text{Error}}{(\text{True Value}) - (\text{Error})} \times 100 \right] \%$$

Questions: A TV is purchased at Rs. 5000 and sold at Rs. 4000,
find the lost percent.

[A] 10%

[B] 20%

[C] 25%

[D] 28%

CP = Rs.500

P = 20 %

SP = ?

CP = Rs.800

L = 30 %

SP = ?

SP = Rs.720

P = 20 %

CP = ?

SP = Rs. 810

L = 10 %

CP = ?

Questions: When a plot is sold for Rs. 18,700, the owner loses 15%. At what price must that plot be sold in order to gain 15%?

[A] Rs.21000

[B] Rs.22500

[C] Rs.25300

[D] Rs.25800

Questions: Alfred buys an old scooter for Rs. 4700 and spends Rs. 800 on its repairs. If he sells the scooter for Rs. 5800, his gain percent is

[A] $6/19\%$

[B] $6/11\%$

[C] $60/11\%$

[D] $38/11\%$

Question: If CP of 25 articles is equal to SP of 20 articles. Find the profit or loss percent.

[A] 25% loss

[B] 25% profit

[C] 20 % profit

[D] 20 % loss

Question: If CP of 30 articles is equal to SP of 45 articles. Find the profit or loss percent.

[A] 33.33 % loss

[B] 33.33 profit

[C] 20 % loss

[D] 20 % profit

Question: By selling 12 articles a man earn a loss of which is equal to selling price of 4 articles. Find his loss percent.

[A] 20 %

[B] 25%

[C] 33.33%

[D] 16.66 %

Question: By selling 66m cloths a man earn a profit of equal to selling price of 6m cloths. Find his profit percent.

[A] 20 %

[B] 25 %

[C] 10%

[D] 33.33%

Question: By selling 40 articles a man earn a profit of equal to cost price of 5 articles. Find his loss or profit percent.

[A] 33.33 % profit

[B] 12.5 % loss

[C] 25 % loss

[D] 12.5 % profit

Question: A shopkeeper buy some number of article at the rate of 11 articles for Rs.10 and sold all of them at the rate of 10 articles for Rs.11. Find his profit or loss percent.

[A] 20 % profit

[B] 21% profit

[C] 25 % loss

[D] 21 % loss

Question: A shopkeeper buy some number of article at the rate of 12 articles for Rs.15 and sold all of them at the rate of 10 articles for Rs.14. Find his profit or loss percent.

[A] 20 % loss

[B] 33.33 % profit

[C] 12 % profit

[D] 12.5 % loss

Question: A Shopkeeper buy some lemons at rate of 2 for Rs.1. Again he bought the same number of lemons at rate of 1 for Rs.2. He mixed both the types and sold at 3 for Rs.3. find profit / loss %.

- [A] 20 % loss
- [B] 25 % loss
- [C] 20 % profit
- [D] 25 % profit

Question: A shopkeeper purchase some number of article for Rs.8400. He sold $\frac{3}{5}$ th of them at 15 % profit each. At what percent profit should he sell the remaining to gain overall 20 % profit.

[A] 26%

[B] 27%

[C] 27.5%

[D] None

Question: A shopkeeper purchase some number of article for Rs.5520. He sold $\frac{5}{7}$ th of them at 14 % profit each. At what percent profit should he sell the remaining to gain overall 18 % profit.

[A] 20%

[B] 25%

[C] 33.33%

[D] 28%

Question: A shopkeeper purchase some number of article for Rs.4500. He sold $\frac{1}{3}$ rd of them at 10 % loss each. At what percent profit should he sell the remaining to gain overall 20 % profit.

[A] 30%

[B] 25%

[C] 35%

[D] None

Question: A shopkeeper professes to sell his goods at its CP, But he uses 950 gm. In place of 1 kg. Find his profit percent.

[A] 12.5 %

[B] 5%

[C] 5.26%

[D] 4%

Question: A shopkeeper professes to sell his goods at its CP, But he uses 800 gm. In place of 1 kg. Find his profit percent.

[A] 25%

[B] 20%

[C] 33.33%

[D] 40%

Question: A shopkeeper professes to sell his goods at 10% profit, But he uses 20% less weight. Find his total profit percent.

[A] 37.5%

[B] 45%

[C] 25%

[D] 20%

Question: A shopkeeper professes to sell his goods at 44% loss, But he uses 30% less weight. Find his profit or loss percent.

[A] 20% profit

[B] 25% profit

[C] 25% loss

[D] 20% loss

Question: A shopkeeper selling his goods at 7% loss.
Had he sold it for Rs.800 more then he would get 9%
profit. Find the CP of that article.

[A] 500

[B] 6000

[C] 5000

[D] 4500

Question: A shopkeeper selling his goods at 20% profit. Had he purchase it 10% less and sold it for Rs.18 less then he would get 30% profit. Find the initial CP of that article.

[A] 540

[B] 600

[C] 1200

[D] 720

Question: A shopkeeper selling his goods at 10% profit. Had he purchase it 20% less and sold it for Rs.20 more then he would get 40% profit. Find the initial SP of that article.

[A] 1000

[B] 2000

[C] 1100

[D] 720

Question: A shopkeeper selling his goods at 30% profit. Had he purchase it for Rs.2700 less and sold it for Rs.2700 less then he would get 10% more profit. Find the initial CP of that article.

[A] 10000

[B] 10800

[C] 12500

[D] None

Question: A shopkeeper sold an article at 25% profit. If the CP and SP are decreased by Rs.20 and Rs.40 respectively then the profit percent would be decreased by 15 %. Find CP of the articles.

[A] 120

[B] 200

[C] 180

[D] 240

Question: A man purchase some number of articles at the rate of 11 articles for Rs.1. How many articles should he sell for Rs.1 to gain 10% profit.

[A] 11

[B] 10

[C] 12

[D] 14

Question: A man purchase 25 articles for Rs.1. How many articles should he sell for Rs.1 to gain 25% profit.

[A] 21

[B] 28

[C] 20

[D] None

Question: By selling 32 articles for Rs.1 a man earn loss of 40 %. How many articles should he sell for Rs.1 to gain 20% profit.

[A] 16

[B] 17

[C] 18

[D] 19

Question: By selling 45 articles for Rs.40 a man earn loss of 20 %. How many articles should he sell for Rs.24 to gain 20% profit.

[A] 20

[B] 27

[C] 18

[D] None

Question: A shopkeeper purchase 2 articles for Rs.9600. He sold the first article at 20% loss and second article at 60% profit then he find that both the articles being sold on the same price. Find the CP of first article.

[A] 6400

[B] 3200

[C] 6000

[D] 5400

Question: A shopkeeper sells 2 articles. He sold the first article at 15% loss and second article at 19% profit. During the whole transaction he earn a loss of Rs90. Find the CP of second article if the SP of both articles are same.

[A] 5000

[B] 4500

[C] 2000

[D] None

Question: A shopkeeper sells 3 articles. He sold the first article at 20% profit, second article at 10% loss and third at 25% loss. During the whole transaction he earn a loss of Rs60. Find the SP of first article if the SP of all the articles are same.

[A] 216

[B] 180

[C] 240

[D] None

Problems on Discount:

Questions: A bag marked at Rs80 is sold for Rs68. The rate of discount is:

[A] 20%

[B] 15%

[C] 17 ($11/17$)%

[D] 12%

Questions: An item was sold at a price after giving two successive discount of 30% and 50 %. If the selling price of the item was Rs 448, then what was the marked price of the item?

- [A] 840
- [B] 1280
- [C] 1140
- [D] none of these

Questions: If after giving a discount of 12%, a profit of 10% was made on an article, then by what % was the price marked up?

[A] 20%

[B] 25%

[C] 32.5%

[D] 35%

Questions: The cost price of a table is Rs 330. It is sold for a profit of Rs 30 after giving 10% discount find its marked price

[A] Rs.400

[B] Rs.380

[C] Rs.420

[D] None

Questions: A sold a table to B at a profit of 15%. Later on, B sold it back to A at a profit of 20%, thereby gaining Rs. 69. How much did A pay for the table originally?

- [A] Rs.300
- [B] Rs.320
- [C] Rs.345
- [D] Rs.350

Question: Buy 5 articles get 3 articles free. Find discount percent.

[A] 33.33%

[B] 12.5%

[C] 37.5%

[D] 60%

Question: Buy 2 articles get 1 article free. Find discount percent.

[A] 50%

[B] 33.33%

[C] 20%

[D] 25%

Question: A retailer purchase 70 pens at the mark price of 56 pens and sell them to a customer at their MP. Find the profit percent of shopkeeper.

[A] 25%

[B] 20%

[C] 33.33%

[D] 16.66%

Question: A retailer purchase 40 pens at the mark price of 36 pens and sell them at a discount of 1 %. Find the profit percent of shopkeeper.

[A] 20%

[B] 15%

[C] 10%

[D] None

Question: By how much percent a shopkeeper should mark his goods above its CP so that he will gain 10% profit after giving 30% discount.

[A] $200/7\%$

[B] $400/7\%$

[C] 100%

[D] None

Question: By how much percent a shopkeeper should mark his goods above its CP so that he will gain 10% profit after giving 10% discount.

[A] $200/9\%$

[B] $110/9\%$

[C] $100/9\%$

[D] None

Question: A shopkeeper gives 10% discount on an article and earn 20% profit then find his profit percent if he will give 20% discount on the same article.

[A] 16.66%

[B] 5.66%

[C] 6.66%

[D] None

Question: After giving 20% discount a shopkeeper earn 30% profit then find his profit percent if he will give 25% discount on the same article.

Question: A shopkeeper give 1 article free of every purchase of 15 article and also gives a discount of 4 % and after all that his profit percent is 35%. Find CP:MP.

[A] 3:2

[B] 4:5

[C] 3:4

[D] 2:3

Question: A shopkeeper give 4 articles free of every purchase of 12 articles and also gives a discount of 20 % and after all that his profit percent is 20%. Find CP:MP.

[A] 1:2

[B] 2:1

[C] 5:7

[D] 3:2





Simple Interest and Compound Interest

Principal

The money borrowed or lent out for a certain period is called the principal or the sum.

Interest

Extra money paid for using other's money is called **interest**.

Simple Interest

If the interest on a sum borrowed for certain period is reckoned uniformly, then it is called **simple interest**.

If P= Rs.1000, R=10% p.a. T=3 years. Find Simple Interest for 3 years.

Let Principal = P, Rate = R% per annum (p.a.)
and Time = T years. Then

Simple Interest = $(P \times R \times T)/100$



Question: Reena took a loan of Rs. 1200 with simple interest for as many years as the rate of interest. If she paid Rs. 432 as interest at the end of the loan period, what was the rate of interest?

- [A] 3.6
- [B] 6
- [C] 18
- [D] Can not be determined

Question: A man took loan from a bank at the rate of 12% p.a. simple interest. After 3 years he had to pay Rs. 5400 interest only for the period. The principal amount borrowed by him was:

- [A] Rs.2000
- [B] Rs.10000
- [C] Rs.15000
- [D] Rs.20000

Question: How much time will it take for an amount of Rs. 450 to yield Rs. 81 as interest at 4.5% per annum of simple interest?

[A] 3.5 years

[B] 4 years

[C] 4.5 years

[D] 5 years

Question: The interest for the 3rd year on a certain sum at a certain rate of simple interest is Rs.3000. find the sum of the interests accrued on it in the 6th, 7th and 8th years.

- [A] Rs.6000
- [B] Rs.9000
- [C] Rs.4500
- [D] Rs.12000

Question: A sum was invest for 2 years. It will give Rs. 300 more, if invested at 3% higher rate. Find the sum.

- [A] Rs.4000
- [B] Rs.5000
- [C] Rs.6000
- [D] Rs.10000

Question: A sum amounts to Rs.1008 in 2 years and amounts to Rs.1112 in 3 years at SI. Find the sum and rate of interest per annum.

- [A] Rs.800, 13% pa
- [B] Rs.600, 12 % pa
- [C] Rs.800, 12% pa
- [D] Rs.600, 13% pa

Question: S.I. On Rs 400 for 5 years together with that on Rs. 600, for 4 year to Rs. 132. If the Rate is same in both the case. Find rate % of interest?

[A] 2% pa

[B] 3% pa

[C] 5% pa

[D] 8% pa

Question: A shopkeeper borrow Rs. 20,000 from two money lenders. For one loan, he paid 12% pa and for other 14% pa. After one year he paid Rs. 2560 as total interest. How much did he borrow each?

[A] Rs.8000, Rs.12000

[B] Rs.12000, Rs.8000

[C] Rs.6000, Rs.14000

[D] Rs.14000, Rs.6000

Question: Rs. 1500 is invested in two such parts that if one part be invested at 6% and other at 5%, S.I= Rs. 85 for one year. Then how much was invested at 5%?

- [A] Rs.1000
- [B] Rs.500
- [C] Rs.600
- [D] Rs.800

Question: Rs. 8400 is invested in two such parts that if one part be invested at 8% and remaining at $6\frac{2}{3}\%$ pa, his total interest after one and half year was Rs. 882. Then how much invested at different rates?

- [A] Rs.6300, Rs.2100
- [B] Rs.6000, Rs.2400
- [C] Rs.2400, Rs.6000
- [D] Rs.2100, Rs.6300

Question: Rs. 950 is lend in two ways. The rate of S.I given on one part is 6% and on other part is 4%. If the S.I of 5 years is Rs. 200 then how much is given on 6%?

[A] Rs.500

[B] Rs.400

[C] Rs.200

[D] Rs.100

Question: If a sum of money at simple interest doubles in 6 years, it will become 4 times in:

- [A] 12 years
- [B] 14 years
- [C] 16 years
- [D] 18 years

Question: If a sum of money at simple interest doubles in 8 years, it will become 4 times in:

- [A] 16 years
- [B] 24 years
- [C] 64 years
- [D] 32 years

Question: Find the present value (in Rs.) of Rs.3000 due after 5 years at 10% p.a. simple interest.

[A] Rs.1500

[B] Rs.1800

[C] Rs.2000

[D] Rs.2500

Compound interest

If P= Rs.1000, R=10% p.a. T=3 years. Find Compound Interest for 3 years.

Compound Interest:

Compound interest is the interest earned not only on the original principal, but also on all interests earned previously

Let Principal = P, Rate = R% per annum, Time = n years.

1. When interest is compounded Annually:

$$\text{Amount} = P(1+R/100)^n$$

2. When interest is compounded Half-yearly:

$$\text{Amount} = P[1+(R/2)/100]^{2n}$$

3. When interest is compounded Quarterly:

$$\text{Amount} = P[1+(R/4)/100]^{4n}$$

$$C.I - S.I \text{ for 2 years} = P \left(\frac{R}{100} \right)^2$$

$$C.I - S.I \text{ for 3 years} = P \left(\frac{R}{100} \right)^2 \left(\frac{R}{100} + 3 \right)$$

Question: Find the compound interest earned on Rs.20000 for 2 years at 10% p.a. the interest being compounded annually.

[A] Rs.2100

[B] Rs.4200

[C] Rs.6300

[D] Rs.5600

Question: Find the interest earned in the first year on Rs.400 at 20% p.a. compound interest, the interest being compounded half yearly.

[A] Rs.42

[B] Rs.72

[C] Rs.84

[D] Rs.144

Question: Find CI. If P= Rs. 10000, r = 10 % p.a. and T= 1 year and 73 days.

- [A] Rs.2220
- [B] Rs.3200
- [C] Rs.2120
- [D] Rs.1220

Question: Find CI. If P= Rs. 10000, r = 10 % p.a. and T= $2\frac{3}{5}$ year.

- [A] Rs.2226
- [B] Rs.826
- [C] Rs.2628
- [D] Rs.2826

Question: Find C.I. on Rs. 8000, 20% P.A. For 9 month compounded quarterly.

- [A] Rs.262
- [B] Rs.1261
- [C] Rs.9261
- [D] Rs.831

Question: If Rs.2000 amounts to Rs.2880 in 2 years at compound interest, what is the rate of interest per annum if the interest is being compounded annually?

[A] 10%

[B] 20%

[C] 15%

[D] 25%

Question: What will be the difference between the S.I and C.I. On Rs. 600 for one year at 10% P.A, if compounded half yearly.

[A] Rs.1.5

[B] Rs.15

[C] Rs.3.5

[D] Rs.35

Question: A sum of money lent at C.I. For two years at 20% pa give Rs. 723 more if the interest was half year in place of annually. The sum is.

- [A] 30000
- [B] 60000
- [C] 40000
- [D] 20000

Question: If the S.I of certain money for 3 years is Rs. 225 & C.I on same money, same rate for 2 years is Rs. 153. then what was the principal amount?

[A] Rs.875

[B] Rs.1875

[C] Rs.785

[D] Rs.1785

Question: If the difference between S.I and C.I at 4% P.A for 2 years is 20 Rs. What will be the value of principle amount?

- [A] Rs.50000
- [B] Rs.12000
- [C] Rs.12500
- [D] Rs.25000

Question: The difference between C.I and S.I at the same rate for Rs. 5000 for 2 years is Rs. 72. what is the rate of interest per annum?

[A] 6% pa

[B] 10% pa

[C] 12% pa

[D] 15% pa

Question: Divide Rs. 6100 between A & B, so that A's share at the end of 3 year = B's share at end of 5 year. C.I. Rate =20% pa.

- [A] 3600, 2500
- [B] 2000, 4100
- [C] 2500, 3600
- [D] 4100, 2000

Question: A sum doubles in 8 years at compound interest. In how many years will the sum become 4 times the original sum if the interest is compounded annually?

- [A] 16 years
- [B] 24 years
- [C] 64 years
- [D] 32 years

Question: A sum of money under compound interest doubles itself in 4 years. In how many years will it become 16 times itself?

- [A] 12 years
- [B] 16 years
- [C] 8 years
- [D] None of these

Question: The difference between the compound interest and simple interest on a certain sum at 12% per annum for 2 years is Rs.126.72. Find the sum.

- [A] Rs.8000
- [B] Rs.8800
- [C] Rs.10200
- [D] Rs.12400



Unit-3 (PEA-305)

- 1. Alphabet Test*
- 2. Series completion, Number and Alphabet series*
- 3. Coding Decoding*

Alphabet Test:

Types of Alphabet Test:

- Alphabetical Order of Words
- Letter-Word problems
- Word formation by Unscrambling letters
- Word formation using letters of a given word
- Alpha-Numeric Sequence Puzzle

Question: Which of the following words will come second in the English dictionary?

[A] Magical

[B] Magnify

[C] Maternal

[D] Marshal

[E] Magnetic

Question: Which of the following words will come in the middle if all of them are arranged alphabetically as in a dictionary?

- [A] Apology
- [B] Branch
- [C] Antigen
- [D] Antique
- [E] Antipathy

Question: How many such pairs of letters are there in the word **CORPORATE** each of which has as many letters in the same sequence between them in the word as in the English alphabet?

- [A] 1
- [B] 2
- [C] 3
- [D] More than 3
- [E] None of the above

Question: If the letters in the word **UNDERTAKING** are rearranged in the alphabetical order, which one will be in the middle in order after the rearrangement?

[A] G

[B] I

[C] K

[D] N

[E] T

Question: Which letter in the word **CYBERNETICS** occupies the same position as it does in the English alphabet?

[A] C

[B] E

[C] S

[D] I

[E] Y

Question: If the last four letters of the word **CONCENTRATION** are written in reverse order followed by next two in the reverse order and next three in the reverse order and then followed by first four in the reverse order, counting from the left, which letter would be eighth in the new arrangement?

[A] N

[B] T

[C] E

[D] R

Question: Select the combination of numbers so that the letters arranged accordingly in the form of meaningful word.

T	I	R	B	H	G
1	2	3	4	5	6

[A] 1, 3, 2, 4, 6, 5

[B] 3, 2, 6, 5, 3, 1

[C] 4, 3, 2, 6, 5, 1

[D] 4, 5, 2, 3, 6, 1

Question: Select the combination of numbers so that the letters arranged accordingly in the form of meaningful word.

T L P N A E
1 2 3 4 5 6

[A] 3, 2, 5, 4, 1, 6

[B] 3, 2, 5, 4, 6, 1

[C] 4, 5, 3, 6, 2, 1

[D] 4, 6, 1, 3, 5, 2

Question: If the letters of the word **ARTICULATES** can be used as many times as one wants to use, then which one of the following four words cannot be formed?

[A] COURTS

[B] LATER

[C] ELECTRIC

[D] ARTICLE

Question: Below are given four words in which some letters are missing. A group of three letters completes these words meaningfully. Select these three letters from the alternatives given.

___ vent, ___ nect, ___ duct, ___ dole

[A] Cor

[B] Coc

[C] Cov

[D] Con

Question: £= β F 2 * K S 7 5 # \$P L V 8 @ M U E 6 ∞ Q G © 9 3 & T Y ¥

How many such letters are there in the arrangement each of which is either immediately preceded by a symbol or immediately followed by a number, but not both?

- [A] 3
- [B] 4
- [C] 5
- [D] 6
- [E] None of these

Question: R E 5 D A P \$ 3 T I Q 7 9 B # 2 K % U 1 M W 4 * J 8 N

Which of the following is exactly in the middle between 3 and 1 in the above arrangement?

- [A] B
- [B] K
- [C] 9
- [D] #
- [E] None of these

Question: R E 5 D A P \$ 3 T I Q 7 9 B # 2 K % U 1 M W 4 * J 8 N

How many such numbers are there in the above arrangement, each of which is immediately preceded by a consonant and not immediately followed by a consonant?

- [A] None
- [B] 1
- [C] 2
- [D] 3
- [E] None of these

Question: R E 5 D A P \$ 3 T I Q 7 9 B # 2 K % U 1 M W 4 * J 8 N

Which of the following is seventh to the left of the sixteenth from the left in the above arrangement?

- [A] A
- [B] U
- [C] 4
- [D] T
- [E] None of these

Series completion

- In this type of questions, some numbers and/or alphabetical letters are given.
- They all form a series and the series changes in certain order.
- The series may also have one or more numbers/letters missing.
- The students are required to observe that specific order in which the series changes and then complete the series.
- Similarly, the students have to decide about the missing letter or number that would suit for the blank space if they continue to change in some order. Some common types are explained in the following slides.

Tricks to solve series completion

Step 1: Observe are there any familiar numbers in the given series like primes numbers, perfect squares, cubes and so on which are easy to identify.

Step 2: Calculate the differences between the numbers. Observe the pattern in the differences. If the differences are growing rapidly it might be a square series, cube series or multiplicative series. If the numbers are growing slowly, then it is an addition or subtraction series.

If the differences are not having any pattern then

- 1. It might be a double or triple series.** Here every alternate number or every 3rd number form a series
- 2. It might be a sum or average series.** Here sum of two consecutive numbers gives 3rd number or average of first two numbers give next number

Step 3: Sometimes number will be multiplied and will be added another number. So we need to check those patterns.

Question: Find the next term in the series.

2, 3, 5, 7, 11, 13,

[A] 15

[B] 17

[C] 19

[D] 21

Question: Find the next term in the series.

2, 5, 11, 17, 23,41.

[A] 29

[B] 31

[C] 33

[D] 37

Question: Find the next term in the series.

2, 5, 8, 11, 14, 17,.....,23.

[A] 21

[B] 19

[C] 20

[D] 22

Question: Find the next term in the series.

45, 38, 31, 24, 17,3.

[A] 15

[B] 14

[C] 10

[D] 12

Question: Find the next term in the series.

2, 6, 18, 54, 162,.....,1458

[A] 486

[B] 810

[C] 648

[D] 480

Question: Find the next term in the series.

3, 12, 48, 192,.....,3072.

[A] 384

[B] 576

[C] 768

[D] 960

Question: Find the next term in the series.

32, 48, 72, 108,, 243.

[A] 132

[B] 162

[C] 160

[D] 154

Question: Find the next term in the series.

0, 4, 16, 36, 64, 144.

[A] 100

[B] 81

[C] 121

[D] 94

Question: Find the next term in the series.

0, 3, 8, 15, 24, 35, 48,

[A] 54

[B] 58

[C] 61

[D] 63

Question: Find the next term in the series.

2, 5, 10, 17, 26, 37,, 65.

[A] 54

[B] 50

[C] 58

[D] 61

Question: Find the next term in the series.

2, 6, 12, 20, , 42.

[A] 30

[B] 34

[C] 38

[D] 39

Question: Find the next term in the series.

1, 8, 27, 64, 125, 216,

[A] 343

[B] 512

[C] 729

[D] 325

Question: Find the missing term in the series :

3, 20, 63, 144, 275, ?

[A] 354

[B] 468

[C] 548

[D] 554

Question: Find the missing term in the series :

2, 5, 9, 19, 37, ?

[A] 73

[B] 75

[C] 76

[D] 78

Question: In following alphabet series , one term missing as shown by question mark . Choose missing term from options.

Y, W, U, S, Q, ?, ?

[A] N, J

[B] M, L

[C] L, M

[D] O, M

Question: Find the missing term WFB, TGD, QHG, ?

- [A] NIJ
- [B] NIK
- [C] OJK
- [D] NLK

Question: Which term comes next in the sequence: AC, FH, KM, PR, ?

[A] UW

[B] VW

[C] UX

[D] TV

[E] None of these

Question: Find the next term in the alpha-numeric series:

Z1A, X2D, V6G, T21J, R88M, P445P, ?

[A] N2676S

[B] N2676T

[C] T2670N

[D] T2676N

Coding Decoding

Alphabets in natural series are:

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

The Word **EJOTY** is very helpful in finding the position of the alphabet as:

E	J	O	T	Y
5	10	15	20	25

For example, if we want to find the position of the alphabet 'S', then as we know that 'T' is 20, so 'S' is $20 - 1 = 19$. Also, we can find the position of an alphabet from the end by subtracting its value from 27. For example, the position of D from the end is $27 - 4 = 23$.

The pattern below is very useful to find many types of question in Alphabet Series when we write the last 13 alphabets in front of the first 13 alphabets of the English:

A	B	C	D	E	F	G	H	I	J	K	L	M
Z	Y	X	W	V	U	T	S	R	Q	P	O	N

Letter Coding:

Question: If **COURSE** is coded as **FRXUVH**, how is **RACE** coded as?

- [A] ABHF
- [B] UDFH
- [C] DUHF
- [D] WQYF

Question: In a certain code, **MONKEY** is written as **XDJMNL**. How is **TIGER** written in that code?

- [A] QDFHS
- [B] FHSQD
- [C] DQSFH
- [D] STFDQ

Question: If **BOMBAY** is written as **MYMYMY**, how will **TAMIL NADU** be written in that code?

- [A] YMNYMNYMN
- [B] ABHABHABH
- [C] ABCDABCD
- [D] MNUMNUMNU

Question: In a certain code, **TOGETHER** is written as **RQEGRJCT**. In the same code, what will **PAROLE** be written as?

- [A] PQJGN
- [B] CNGJPQ
- [C] NCPQJG
- [D] NCJQPG

Number Coding:

Question: If in a certain code, TWENTY is written as 863985 and ELEVEN is written as 323039, how is TWELVE written in that code?

- [A] 203863
- [B] 368302
- [C] 863203
- [D] 320368

Question: If **ENGLAND** is written as **1234526** and **FRANCE** is written as **785291**, how is **GREECE** coded?

- [A] 117186
- [B] 381191
- [C] 131871
- [D] 112235

Question: In a certain code, if **LOGIC** is coded as **1512201824**, how is **PEARL** coded as?

[A] 112226915

[B] 113331596

[C] 112226710

[D] 113336734

Question: If **APPLE** is written as **24991320**, how is **LOVELY** coded as?

[A] 13101310130

[B] 1310320130

[C] 13101350140

[D] 13101340120

Question: If **Z** = 52 and **ACT** = 48, then **BAT** will be equal to:

[A] 39

[B] 41

[C] 44

[D] 46

Mixed Coding:

Question: If tee see pee means drink fruit juice,

 see kee lee means juice is sweet,

 lee ree mee means he is intelligent,

then which word means sweet?

- [A] see
- [B] pee
- [C] kee
- [D] tee

Question: If in a certain code language,

'col tip mot' means 'singing is appreciable',

'mot baj min' means 'dancing is good'

'tip nop baj' means 'singing and dancing'.

Which of the following stands for 'good' in that language?

[A] mot

[B] baj

[C] min

[D] nop

Question: If in a certain code language,

'8 5 1' means 'good sweet fruit',

'7 8 3' means 'good red rose'

'3 4 1' means 'rose and fruit'.

Which of the following digits stands for 'sweet' in that language?

[A] 2

[B] 3

[C] 4

[D] 5

Question: If in a certain code language,

'2 5 6' means 'you are good',

'6 3 7' means 'we are bad'

'3 5 8' means 'good and bad'.

Which of the following digits stands for 'and' in that language?

[A] 5

[B] 6

[C] 7

[D] 8

Question: If white is called blue, blue is called red, red is called yellow, yellow is called green, green is called black, black is called violet and violet is called orange, what would be the color of human blood?

- [A] Blue
- [B] Yellow
- [C] Black
- [D] Violet

Question: If the animals which can walk are called swimmers, animals who crawl are called flying, those living in water are called snakes and those which fly in the sky are called hunters, then what will a lizard be called ?

- [A] Flying
- [B] Swimmers
- [C] Snakes
- [D] Hunters



thank you!

RATIOS AND PROPORTION



In the ratio $a : b$, we call a as the first term or **antecedent** and b , the second term or **consequent**.

E.g. The ratio $5 : 9$ represents with antecedent = 5, consequent = 9

Rule: The multiplication or division of each term of a ratio by the same non-zero number does not affect the ratio

Proportion:

The equality of two ratios is called proportion.

If $a : b = c : d$, we write $a : b :: c : d$ and we say that a, b, c, d are in proportion. Then,

$$a/b=c/d$$

Here a and d are called **extremes**, while b and c are called **mean terms**.

Product of means = Product of extremes.

Thus, $a : b :: c : d \quad (b \times c) = (a \times d)$

Question: If $0.75 : x :: 5 : 8$, then x is equal to:

- [A] 1.12
- [B] 1.2
- [C] 1.25
- [D] 1.30

Fourth Proportional:

If $a : b = c : d$, then d is called the fourth proportional to a, b, c .

Third Proportional:

$a : b = b : c$, then c is called the third proportion to a and b .

Mean Proportional:

Mean proportional between a and b is $(ab)^{1/2}$.

Question: The fourth proportional to 5, 8, 15 is:

[A] 18

[B] 24

[C] 19

[D] 20

Question: The third proportional to 9 and 12 is:

[A] 18

[B] 16

[C] 15

[D] 20

Question: The mean proportional to 36 and 25 is:

- [A] 35
- [B] 20
- [C] 30
- [D] 32

Duplicate Ratios:

Duplicate ratio of $(a : b)$ is $(a^2 : b^2)$.

Sub-duplicate ratio of $(a : b)$ is $(a^{1/2} : b^{1/2})$.

TriPLICATE ratio of $(a : b)$ is $(a^3 : b^3)$.

Sub-triplicate ratio of $(a : b)$ is $(a^{1/3} : b^{1/3})$.

Question: Find the duplicate ratio of 3:4?

[A] 3:4

[B] 4:3

[C] 9:16

[D] 27:64

Question: Find the sub-triplicate ratio of 64:125?

[A] 8:25

[B] 4:5

[C] 5:4

[D] 4:25

Compound Ratio:

- ✓ If the ratios are-- 4:3, 9:13, 26:5, 2:15

Then Ratio compounded = $(4*9*26*2)/(3*13*5*15) = 16:25;$

Combined Ratio:

- ✓ If the ratios are- A:B= 1:2, B:C= 3:4, C:D= 6:9, and D:E= 12:16

Then A:B:C:D:E = 3:6:8:12:16

- ✓ Speed ratio - A:B:C:D then Time ratio- $(1/A):(1/B):(1/C):(1/D)$

Question: If $x:y = 5:4$ and $x+y = 135$, find “y”?

[A] 75

[B] 60

[C] 50

[D] 90

Question: If $p:q = 9:7$ and $p - q = 40$, then find value of "p"?

- A. 90
- B. 140
- C. 180
- D. 320

Question: If $p:q = 2:3$, $q:r = 2:3$ then find $p:q:r$?

- A. 2:3:3
- B. 2:2:3
- C. 2:6:3
- D. 4:6:9

Question: If $p:q = 1:2$ $r:q = 2:3$ then find $q:r:p?$

- A. 1:2:3
- B. 3:1:2
- C. 6:4:3
- D. 4:3:6

Question: If $x:y = 3:4$ and $y:z = 8:9$, $z:a$ is $15:16$, find $x:y:z:a$?

- A. 78:82:65:45
- B. 30:40:45: 48
- C. 76:90:56:80
- D. None of these

Question: If $p:r=3:5$ the which of the following is the possible value of “ p ”?

- A. 10
- B. 11
- C. 12
- D. 13

Question: If $a:b=2:3$, $b:c=4:5$ and $c:d=3:2$ then find $a:d$.

- A. 5:4
- B. 4:5
- C. 24:45
- D. None

Question: If A is 60% of B and B is 40% of C then find A:C.

- A. 2:5
- B. 5:2
- C. 6:25
- D. 3:2

Question: If $x:y$ is 2:3, find the value of $(3x + 2y):(2x+5y)$

- A. $12/25$
- B. $11/27$
- C. $12/19$
- D. $11/23$

Question: If $2A = 3B = 4C$, then $A : B : C$ is equal to:

- A. 2:3:4
- B. 3:4:6
- C. 4:3:2
- D. 6:4:3

Question: If Rs.2000 is divided among three person x, y and z in the ratio x:y:z= 2:3:5, then find the share of y.

- A. Rs.400
- B. Rs.600
- C. Rs.800
- D. Rs.1000

Question: A sum of money is to be distributed among A, B, C and D in the proportion of 5:2:4:3. If C gets Rs.1000 more than D then find the share of B.

- A. Rs.500
- B. Rs.1500
- C. Rs.2000
- D. None

Question: If Rs.782 be divided into three parts, proportional to $(1/2 : 2/3 : 3/4)$, then the first part is:

- A. Rs.182
- B. Rs.190
- C. Rs.196
- D. Rs.204

Question: A sum of Rs.1240 is distributed among A, B and C such that the ratio of amount received by A and B is 6:5 and that of B and C is 10:9 respectively. Find the share of C.

- A. Rs.480
- B. Rs.360
- C. Rs.400
- D. Rs.630

Question: A sum of money is to be divided among A, B, C such that A's share is equal to twice B's share and B's share is 4 times C's share then their share are in the ratio:

- A. 1:2:4
- B. 1:4:1
- C. 8:4:1
- D. 2:4:1

Question: The ratio of the number of boys and girls in a college is 7 : 8. If the percentage increase in the number of boys and girls be 20% and 10% respectively, what will be the new ratio?

- A. 8 : 9
- B. 17 : 18
- C. 21 : 22
- D. Cannot be determined

Question: The ratio of Boys & Girls is 10:3, when 36 girl more joined the ratio becomes 10:7. Find the no. of boys?

- A. 90
- B. 60
- C. 100
- D. None

Question: The income ratio of A & B is 5:8, if income of A increases by 60000, then the new ratio is 5:4, Find current income of A.

- A. 120000
- B. 240000
- C. 360000
- D. None

Question: In an alloy ratio of Cu and Zn is 4:3. when 4 kg Zn is mixed into that alloy then the ratio of Cu and Zn becomes 6:5. Find the initial amount of Zn.

- A. 50 kg
- B. 36 kg
- C. 48 kg
- D. None

Question: In an alloy ratio of Cu and Zn is 5:2. when 15 kg Cu is extracted from the alloy then the ratio of Cu and Zn becomes 5:3. Find the initial amount of Zn.

- A. 18 kg
- B. 6 kg
- C. 45 kg
- D. None

Question: In a bag, there are coins of 25 p, 10 p and 5 p in the ratio of 1 : 2 : 3. If there is Rs. 30 in all, how many 5 p coins are there?

- A. 50
- B. 100
- C. 150
- D. 200

Question: A bag contains Rs. 600 in the form of one-rupee, 50 paisa and 25 paisa coins in the ratio 3 : 4 : 12. The number of 25 paisa coins is

- A. 600
- B. 900
- C. 1200
- D. 1400

Question: The ratio of income of A and B is 5:6 and their expenditure is 3:4. If their savings are 1800 and 1600 then find income of A.

- A. 5000
- B. 7200
- C. 6000
- D. 5400

Question: In 28 liter mixture of milk and water the ratio of Milk and water is 5:2. How much quantity of water is to be added so that the ratio of milk and water becomes 2:5.

- A. 60
- B. 42
- C. 40
- D. 36

Question: In a mixture of 25 L the ratio of acid to water is 4:1. Another 3 L of water is added to the mixture. The ratio of acid to water in the new mixture is:

- A. 5:2
- B. 2:5
- C. 3:5
- D. 5:3

Question: The price of diamond is directly proportional to the square of its weight. Diamond was broken into 4 parts. The ratio of wt. of each part is 1:2:3:4 and the price of diamond decreased by 140000. Find the initial price of diamond.

- A. 240000
- B. 300000
- C. 200000
- D. 350000

Question: A cat takes 5 leaps for every 4 leaps of a dog, but 3 leaps of the dog are equal to 4 leaps of the cat. What is the ratio of the speed of the cat to that of the dog?

- A. 13:14
- B. 16:15
- C. 17:15
- D. 15:16

Question: Time taken by A to take 5 steps is equal to time by B to take 6 steps and by C to take 7 steps. But distance covered in 6 steps of A are equal to 7 steps of B and 8 steps of C. Ratio of their steps is?

- A. 77: 144: 156
- B. 9: 14: 11
- C. 140: 144: 147
- D. 15: 21: 28

Question: By mistake instead of dividing RS. 117 among A, B and C in the ratio $1/2 : 1/3 : 1/4$ it was divided in the ratio of 2:3:4. Who gains the most and by how much.

- A. A, Rs.28
- B. B, Rs.3
- C. C, Rs.20
- D. C, Rs.25

Question: The milk and water in a mixture are in the ratio 7:5. When 15 L of water are added to it, the ratio of milk and water in the new mixture becomes 7:8. The total quantity of water in new mixture is:

- A. 35 L
- B. 40 L
- C. 60 L
- D. 96 L

*Partnership and Problems
on ages*

What is Partnership?

Important Concepts

Ratio of Divisions of Gains:

Suppose A and B invest Rs. x and Rs. y respectively for a year in a business, then at the end of the year:

$$(\text{A's share of profit}) : (\text{B's share of profit}) = x : y.$$

.

Suppose A invests Rs. x for p months and B invests Rs. y for q months then,

$$(\text{A's share of profit}) : (\text{B's share of profit}) = xp : yq$$

Question: A and B started a business with Rs.20000 and Rs.30000 respectively for 1 year. If they had profit of Rs.4000. What is the ratio of A in this profit?

- A. Rs.800
- B. Rs.1600
- C. Rs.2400
- D. Rs.1200

Question: A and B started a business with Rs.60000 and Rs.80000 respectively. What is the ratio of their profits after 3 years?

- A. 1:2
- B. 1:1
- C. 4:3
- D. 3:4

Question: A, B, C Started a business with capitals Rs.60,000, Rs.50,000 and Rs.40,000 respectively. After 9 months C left them. If profit after one year is Rs.14,000 then profit of C is:

- A. Rs.5000
- B. Rs.4000
- C. Rs.6000
- D. Rs.3000

Question: A, B, C subscribe Rs. 50,000 for a business. A subscribes Rs. 4000 more than B and B Rs. 5000 more than C. Out of a total profit of Rs. 35,000, A receives:

- A. Rs.8400
- B. Rs.11900
- C. Rs.13600
- D. Rs.14700

Question: Pradeep opened a shop investing Rs.30,000. Priyanka joined him 2 months later, investing Rs.45,000. They earned a profit of Rs.76,000 after completion of 2 year. What will be Priyanka's share of profit? :

- A. Rs.27000
- B. Rs.44000
- C. Rs.32000
- D. Rs.40000

Question: A and B invest in a business in the ratio 3 : 2. If 5% of the total profit goes to charity and A's share is Rs. 855, the total profit is:

- A. Rs.500
- B. Rs.1000
- C. Rs.1500
- D. Rs.2000

Question: Kiran is younger than Bineesh by 7 years and their ages are in the respective ratio of 7 : 9, how old is Kiran?

- A. 25
- B. 24.5
- C. 26
- D. 26.5

Question: The Ratio of Mona and Vikas's present age is 9:10. After 4years the ratio will become 11:12. What is the present age of mona?

- A. 20
- B. 18
- C. 15
- D. 24

Question: The Ratio of Ram and Shyam's present age is 2:1. After 5years the ratio will become 3:2. What is the present age of both?

- A. 10, 5
- B. 12, 8
- C. 15, 18
- D. 15, 10

Question: At present age of father is 5 times the age of the son. 3years hence the father would be 4 times that of the son. What is present age of father?

- A. 40
- B. 45
- C. 50
- D. 35

Mixture and Alligation

Mixture: Mixing of two or more than two type of quantities gives us a mixture.

Example:

Quantities of these elements can be expressed as percentage or ratio.(20% of sugar in water)

Fraction (A solution of sugar and water such that sugar : water = 1:4)

Alligation : Alligation is a rule which is used to solve the problems related to mixture and its ingredient.

It is the rule that enables us to find the ratio in which two or more ingredients at the given price must be mixed to produce a mixture of desired price.

Alligation Rule : When two elements are mixed to make a mixture and one of the elements is cheaper and other one is costlier then,

$$\frac{\text{Quantity of Cheaper}}{\text{Quantity of Costlier}} = \frac{\text{CP of Costlier} - \text{Mean Price}}{\text{Mean Price} - \text{CP of Cheaper}}$$

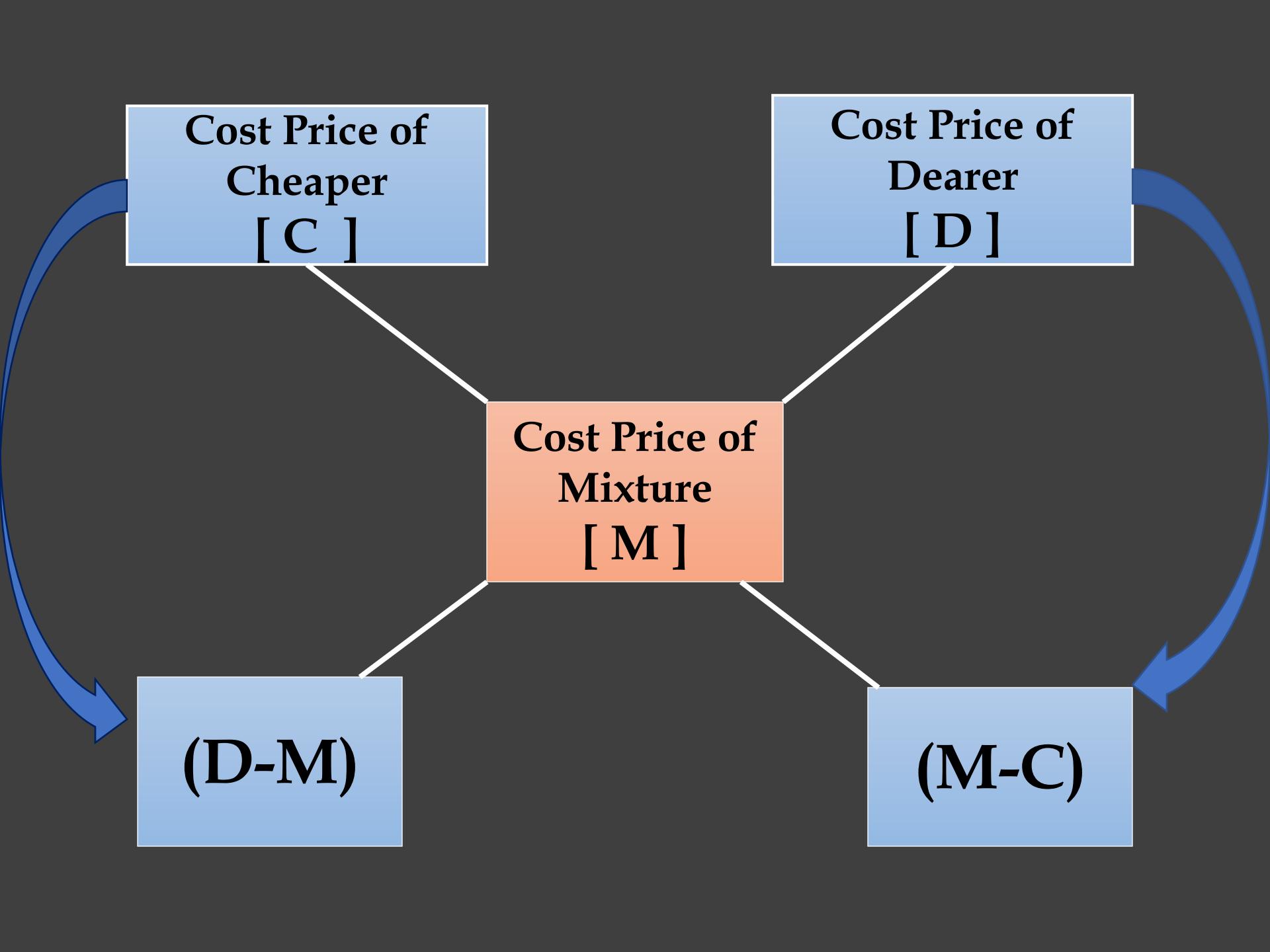
**Cost Price of
Cheaper**
[C]

**Cost Price of
Dearer**
[D]

**Cost Price of
Mixture**
[M]

(D-M)

(M-C)



$$\frac{\text{Quantity of Cheaper}}{\text{Quantity of dearer}} = \frac{(D-M)}{(M-C)}$$

Note: (1) Mean value lies between cheaper Value and dearer value.

(2) All the three values in alligation rule should be same type having same unit. For e.g. Cost price.

1. In what ratio must a grocer should mix two varieties of pulses costing Rs.15 /Kg and Rs.20/Kg respectively so as to get a mixture worth Rs.16.50/Kg?

[A] 7 : 3

[B] 4 : 5

[C] 6 : 4

[D] None of the above

2. Find the ratio in which rice at Rs.7.20 a Kg be mixed with rice at Rs. 5.70 a Kg to produce a mixture worth Rs. 6.30 a Kg?

- [A] 1 : 3
- [B] 2 : 3
- [C] 3 : 4
- [D] 4 : 5

3. In what ratio must a grocer mix two varieties of tea worth Rs. 60 a kg and Rs. 65 a kg so that by selling the mixture at Rs. 68.20 a kg he may gain 10%?

- [A] 3 : 2
- [B] 3 : 5
- [C] 3 : 6
- [D] None of the above

4. How many kg of tea worth Rs. 25/kg must be blended with 30 kg of tea worth Rs. 35/kg so that by selling the blended variety at Rs. 33/kg there should be a gain of 10%?

[A] 36 Kg

[B] 40 Kg

[C] 32 Kg

[D] None of the above

5. A dishonest milkman professes to sell his milk at cost price but he mixes it with water and thereby gains 25%. The percentage of water in the mixture is:

- [A] 20%
- [B] 10 %
- [C] 11 %
- [D] None of the above

6. In what ratio must water be added to spirit to gain 10% by selling it at the cost price?

[A] 1 : 11

[B] 1 : 5

[C] 1 : 10

[D] 1 : 9

7. Sea water contains 5% salt by weight. How many kilograms of fresh water must be added to 40kg of sea water for the salt content of the solution to be 2%?

[A] 50

[B] 60

[C] 65

[D] 70

8. A mixture of 45 L of spirit and water contains 20% of water in it. How much water must be added to it to make the water 25% in the new mixture?

[A] 3 L

[B] 4 L

[C] 5 L

[D] 6 L

9. In a zoo, there are rabbits and pigeons. If head are counted, there are 200 and legs are 580. How many rabbits are there ?

[A] 110

[B] 90

[C] 80

[D] 120

10. A man has 90 pens. He sells some of these at profit of 15 % and rest at 9% profit. On the whole transaction he gets a profit of 11%.How many pens did he sell at 9% profit.

[A] 60

[B] 50

[C] 40

[D] 70

11. A trader has 25 kg of rice. A part of which he sold at 4% profit and rest at 9% profit. His overall gain is 7%. What is the quantity he sold at 9% profit?

- [A] 9 Kg
- [B] 10 Kg
- [C] 12 Kg
- [D] 15 Kg

12. A man buys two cows for Rs. 1350 and sells one for loss of 6% and the other for gain of 7.5% and on the whole he neither gains nor loses. What does each cow cost?

- [A] Rs. 850, Rs.500
- [B] Rs. 650, Rs. 700
- [C] Rs. 750, Rs. 600
- [D] Rs. 550, Rs. 800

13. There are 50 students in a class, Rs. 320 are distributed among them so that each boy get 10 Rs. and each girl get 5 Rs. Find no. of girls.?

[A] 36

[B] 18

[C] 14

[D] 7

14. A merchant borrowed Rs.3500 from two money lenders. For one loan he paid 14% p.a. and for other 18% p.a. Total interest paid for one year was Rs.525. How much did he borrow at 18% p.a.

- [A] Rs.875
- [B] Rs.625
- [C] Rs.750
- [D] Rs.1000

15. A man travels 80 km in 7 hrs. Some part on foot with 8kmph and rest on cycle with 16kmph. Find the distance covered by cycle.

[A] 16 Km

[B] 32 Km

[C] 24 Km

[D] 48 Km

16. In what ratio must a person mix three kinds of tea costing Rs.60/kg, Rs.75/kg and Rs.100 /kg so that the resultant mixture when sold at Rs.96/kg yields a profit of 20%?

- [A] 1 : 2 : 4
- [B] 3 : 7 : 6
- [C] 1 : 4 : 2
- [D] None of these

17. Find out the ratio of new mixture so that it will cost Rs 1.40 per kg from the given three kinds of rice costing Rs 1.20, Rs 1.45 and Rs 1.74.

- [A] 39 : 20 : 20
- [B] 30 : 20 : 30
- [C] 30 : 29 : 29
- [D] None of these

Mixture Questions

18. In 28L mixture of milk and water the ratio of milk and water is 5:2. How much quantity of water is to be added so that the milk and water becomes 2:5

[A] 60 L

[B] 42 L

[C] 40 L

[D] 36 L

19. A mixture consist Milk and water in 5:1. On adding 5 L water, the ratio becomes 5:2. Find quantity of milk in original mixture.

[A] 5 L

[B] 10 L

[C] 15 L

[D] 25 L

20. Mixture consist Milk and water in 4:3. On adding 2 L of water, ratio becomes 8:7. find total quantity of final mixture.

[A] 15 L

[B] 30 L

[C] 45 L

[D] 60 L

21. Two bucket contains same amount of mixture of Milk and water in 9:5 and 4:3 resp. If these buckets are further mixed, find the ratio of milk and water in final mixture.

[A] 11 : 17

[B] 17 : 11

[C] 9 : 8

[D] 8 : 9

22. Two bucket contains same amount of mixture of Milk and water in 9:5 and 4:3 resp. If these buckets are further mixed in 1:2, find the ratio of milk and water in final mixture.

[A] 17 : 25

[B] 25 : 17

[C] 9 : 16

[D] 8 : 18

23. Three equal glasses are filled with mixture of Milk and water in 3 : 1, 5 : 3 and 9 : 7 resp. If these glasses are further mixed, find the ratio of milk and water in final mixture.

- [A] 11:17
- [B] 17:11
- [C] 31 : 17
- [D] 17 : 31

24. Mixture consist 80% Acid and rest water. A part of this mixture is replaced with same amount of water and new ratio becomes 4:3. find part of mixture which is replaced.

[A] $1/5$

[B] $2/5$

[C] $1/7$

[D] $2/7$

25. A tank is filled with mixture consist 3 part water & 5 part alcohol. A part of this mixture is drawn off and replaced with same amount of water. New mixture contains half water and half alcohol. find part of mixture which is replaced.

[A] $1/5$

[B] $2/5$

[C] $1/7$

[D] $2/7$

26. A bucket contains two liquids A and B in 5:3. If 16 L of mixture is drawn off and replaced with same amount of liquid B, the ratio becomes 3:5. How much Liter bucket holds?

[A] 40 L

[B] 24 L

[C] 26 L

[D] 80 L

27. Two vessels A and B contain M and W in 4:3 and 2:3 resp. In what ratio the liquids may be mix to obtain a new mixture containing half milk and half water ?

[A] 7 : 5

[B] 5 : 7

[C] 1 : 4

[D] 1 : 2

28. Two vessels A and B contain M and W in 8:5 and 5:2 resp. In what ratio the liquids may be mix to obtain a new mixture containing 69and(3/13) % milk ?

[A] 2 : 7

[B] 7 : 2

[C] 5 : 6

[D] 6 : 5

Removal and Replacement

If a vessel contains “x” liters of liquid A and if “y” liters be withdrawn and replaced by liquid B, then if “y” liters of the mixture be withdrawn and replaced by liquid B, and the operation is repeated ‘n’ times in all, then :

$$\frac{\text{Quantity of liquid A after } n^{\text{th}} \text{ operation}}{\text{Initial quantity of liquid of A}} = \left[\frac{x - y}{x} \right]^n = \left[1 - \frac{y}{x} \right]^n$$

$$F.C = I.C(1-y/x)^n$$

FC= Final concentration

IC= Initial concentration

y = no. of liters replaced

x = Total concentration

n = total number of iterations

29. A container contains 40 L milk. 4 L was taken out and replaced with water. This process is repeated further 2 times. Now how much milk is there in the mixture?

- [A] 28 L
- [B] 29.16 L
- [C] 27.16 L
- [D] 30 L

30. A vessel contains 125 liters of wine. 25 liters of wine was taken out of the vessel and replaced by water. Then, 25 liters of mixture was withdrawn and again replaced by water. The operation was repeated for third time. How much wine is now left in the vessel?

[A] 49 L

[B] 64 L

[C] 72 L

[D] 56 L

31. 8 L was taken out from a cask full of wine and replaced with water. This operation is performed 3 more times. The ratio of quantity of wine left in the cask to that of water is 16:65. how much wine did the cask hold initially?

[A] 12 L

[B] 18 L

[C] 24 L

[D] 30 L

32. A jar full of whisky contains 40% alcohol. A part of this is replaced with another containing 19% alcohol. Now there is 26% alcohol. Find the quantity of whisky which is replaced.

[A] $1/2$

[B] $1/3$

[C] $1/5$

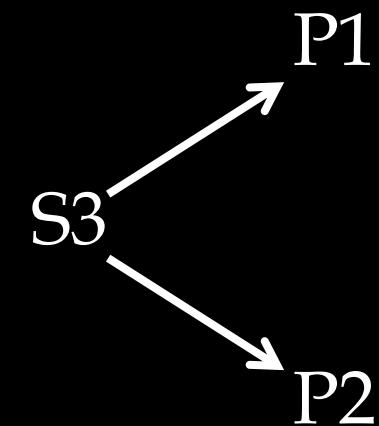
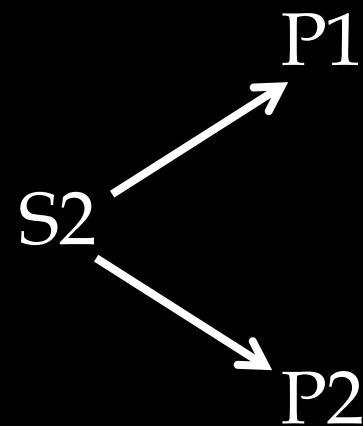
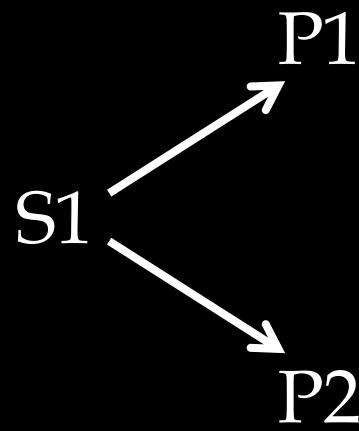
[D] $2/3$

Permutation & Combination

Fundamental Principal of counting

- **Rule of product :** If there are ‘m’ ways to do a process and there are ‘n’ ways to do another, then total number of ways of doing both process is given by ‘ $m \times n$ ’

- If there are 3 shirts and 2 pants then in how many ways a person can dress up for a seminar?



Directly, Total ways = $3 * 2 = 6$ ways

- **Rule of addition :** If there are ‘ m ’ ways to do a process and there are ‘ n ’ ways to do another and we can not do both at the same time, then there are ‘ $m + n$ ’ ways to choose one of the actions.

- If there are 3 formal shoes and 2 casual shoes then in how many ways we can choose a footwear for a party.

F1, F2, F3, C1, C2

F1 or F2 or F3 or C1 or C2

Total ways = 3 + 2 = 5 ways

Question: Let us assume you have 3 shirts, 4 pants, 3 shoes and 2 sandals to wear. Find in how many ways you can decide an outfit.

1. Shirt - Pants - Shoes
2. Shirt - Pants - Sandal

$$(3 \times 4 \times 3) + (3 \times 4 \times 2) = 60$$

Note : Multiplication ----- “ AND” (Stages)

Addition----- “ OR” (Choice)

Difference between Permutation and Combination

Permutation : Arrangement
: Order matters

Combination : Selection
: Order doesn't matter

Permutations and Combinations

Number of permutations
(order matters) of n things
taken r at a time:

$$P(n, r) = \frac{n!}{(n-r)!}$$

Number of combinations
(order does not matter) of n
things taken r at a time:

$$C(n, r) = \frac{n!}{(n-r)!r!}$$

Question: If suppose we have 3 objects A, B, C then find no. of ways in which any 2 items can be selected.

Answer:

1. AB (BA)
2. BC (CB)
3. CA (AC)

Question: If suppose we have 3 objects A, B, C then find no. of ways to arrange any 2 items.

Answer:

1. AB
2. BA
3. BC
4. CB
5. CA
6. AC

Practice Question

1. In how many ways can we select a team of 4 players out of 15 eligible players.

[A] 1365

[B] 1455

[C] 1295

[D] 1525

2. In a class there are 6 boys and 5 girls. In how many ways can a group of 5 members to be formed by selecting 3 boys and 2 girls.

[A] 350

[B] 300

[C] 250

[D] 200

3. In how many ways 3 VIPs can be seated in 3 seats of first row of a function.

[A] 3

[B] 4

[C] 5

[D] 6

Note : Number of ways of arranging 'n' different items in a row = $n !$

In previous question,



$$3 \times 2 \times 1 = 3! = 6 \text{ ways}$$

4. In how many ways 5 medals of different games can be arranged in a shelf.

[A] 100

[B] 110

[C] 120

[D] 150

5. Suppose you have to choose a 3 letter password. First letter is an alphabet, followed by a number and last one is an special character. There are 5 special character available. Find no. of ways to choose password.

[A] 1050

[B] 1200

[C] 1300

[D] 1560

Problems on Numbers

6. How many 2 digit numbers can be made from the digits 1, 2, 3 and 4 without repetition?

[A] 24

[B] 18

[C] 12

[D] 6

7. How many 4 digit numbers are possible with the digits 1, 2, 3, 6, 7, 8 and 9 without repetition?

[A] 720

[B] 480

[C] 840

[D] 320

8. How many 4 digit numbers are possible with the digits 1, 2, 3, 6, 7, 8 and 9 if repetition is allowed?

[A] 2401

[B] 820

[C] 343

[D] 729

9. How many 4 digit numbers can be made from the digits 7, 8, 5, 0, and 4 without repetition?

[A] 70

[B] 96

[C] 84

[D] 48

10. How many 3 digit numbers greater than 400 can be made with the digits 2, 3, 4, 0, 5, 6 (digits cannot be repeated)?

[A] 119

[B] 59

[C] 120

[D] 60

11. How many 3 digit numbers between 200 and 700 can be made with the digits 1, 3, 4, 0, 5, 6 (digits cannot be repeated) ?

[A] 80

[B] 120

[C] 60

[D] None of these

12. How many 3 digit number can be formed with the digits 5, 6, 2, 3, 7 and 9 which are divisible by 5 and none of its digit is repeated?

[A] 12

[B] 16

[C] 20

[D] 100

13. How many 4 digit number can be formed with the digits 0, 1, 2, 3, 4, 5, 6 which are divisible by 5 and none of its digit is repeated?

[A] 120

[B] 100

[C] 220

[D] 320

14. How many 4 digit odd number can be formed with the digits 0, 1, 2, 3, 4, 5, 6 if none of its digit is repeated?

[A] 120

[B] 100

[C] 220

[D] 300

15. How many 4 digit even number can be formed with the digits 0, 1, 2, 3, 4, 5, 6 if none of its digit is repeated?

[A] 120

[B] 420

[C] 220

[D] 200

16. Find the no of 3 digit numbers such that at least one of the digit is 6 (with repetitions)?

[A] 252

[B] 345

[C] 648

[D] 560

Problems on Words:

17. In How many different ways the letters of the word EQUATION can be arranged ?

[A] $7!$

[B] $8!$

[C] $9!$

[D] $6!$

18. In How many different ways the letters of the word EQUATION can be arranged, if it starts with letter Q ?

[A] $7!$

[B] $8!$

[C] $9!$

[D] $6!$

19. In How many different ways the letters of the word EQUATION can be arranged, if it starts with consonants?

[A] $7!$

[B] $8!$

[C] $2^*7!$

[D] $3^*7!$

20. In How many ways the word OPTICAL be arranged such that all vowels are together?

[A] 720

[B] 820

[C] 2160

[D] 1000

21. In How many ways the word OPTICAL be arranged such that all vowels are never together?

[A] 720

[B] 1000

[C] 2160

[D] 4320

22. In How many ways the word MANPOWER be arranged such that all vowels are together?

[A] $3! 6!$

[B] $2! 7!$

[C] $3! 5!$

[D] $4! 4!$

23. In How many ways letters of word PRAISE be arranged such that all consonants are together?

[A] $3! \cdot 4!$

[B] $4! \cdot 4!$

[C] $3! \cdot 5!$

[D] $4! \cdot 5!$

24. In How many ways letters of word PREVIOUS
be arranged such that all vowels always come
together?

[A] 1440

[B] 2880

[C] 4320

[D] 840

25. In how many ways can the letters of word FLEECED be arranged?

[A] 410

[B] 880

[C] 840

[D] 1260

26. Find the total arrangement of the letters of the word “MISSISSIPPI?

[A] 34650

[B] 32540

[C] 28450

[D] 24560

27. In how many different ways can the letter of the word “ELEPHANT” be arranged so that E's are never together?

[A] 5040

[B] 15120

[C] 20160

[D] 35280

28. Find the total arrangement of the letters of the word “INVISIBILITY” such that all ‘I’ always come together.

[A] $8!$

[B] $8! * 5!$

[C] $8! * 5$

[D] $7! * 5!$

29. In how many ways can the letters of the word “MACHINE” be arranged so that the vowels may occupy only odd positions?

[A] $4^*7!$

[B] 576

[C] 288

[D] $4 * 4!$

30. Find the rank of the word “CHASM” if all the words can be formed by permuting the letters of this word without repetition are arranged in dictionary order.

[A] 24

[B] 31

[C] 32

[D] 30

31. Find the rank of the word “JAIPUR” if all the words can be formed by permuting the letters of this word without repetition are arranged in dictionary order.

[A] 241

[B] 122

[C] 123

[D] 242

31. Find the rank of the word “INDIA” if all the words can be formed by permuting the letters of this word without repetition are arranged in dictionary order.

[A] 41

[B] 42

[C] 45

[D] 46

32. Find the rank of the word “GOOGLE” if all the words can be formed by permuting the letters of this word without repetition are arranged in dictionary order.

[A] 78

[B] 84

[C] 85

[D] 88

Problems on Combination (Group Formation)

33. In how many ways a group of 4 men and 3 women be made out of a total of 8 men and 5 women?

[A] 720

[B] 700

[C] 120

[D] 360

34. There are 8 men and 7 women. In how many ways a group of 5 people can be made such that the particular woman is always to be included?

[A] 860

[B] 1262

[C] 1001

[D] 1768

35. There are 4 men and 3 women. In how many ways a group of three people can be formed such that there is at least 1 women in the group.

[A] 40

[B] 20

[C] 34

[D] 31

36. In a group of 6 boys and 5 girls, 5 students have to be selected. In how many ways it can be done so that at least 2 boys are included.

[A] 124

[B] 526

[C] 154

[D] 431

37. A box contains ten balls out of which 3 are red and rest blue. In how many ways can a random sample of six balls be drawn so that at most 2 red balls are included.

[A] 105

[B] 189

[C] 168

[D] 175

38. In a party there are 12 persons. How many handshakes are possible if every person handshake with every other person?

[A] 66

[B] 24

[C] 72

[D] 68

Circular arrangements

n distinct objects ----- Linear----- $n!$

n distinct objects----- Circular---- $(n-1)!$

Note: In circle there is symmetry and hence there is no starting and end point, so when we need to arrange n distinct objects around a circle 1st object will break the symmetry (specify the position) and it can be done in 1 way and rest $(n-1)$ objects can be arranged in $(n-1)!$ Ways

Circular arrangement of n objects= $1 \times (n-1)! = (n-1)!$

If there is a difference between Clockwise and anti-Clockwise arrangement , and if

1. We need to arrange r objects out of n objects
then = nPr/r

2. We need to arrange all n distinct objects = nPn/n
 $= n!/n = (n-1)!$

If there is no difference between Clockwise and anti-Clockwise arrangement (like in case of Garlands, Bead and Necklace etc.) , and if

1. We need to arrange r objects out of n objects
then = $nPr/2r$

2. We need to arrange all n distinct objects =
 $nPn/2n = n!/2n = (n-1)!/2$

39. In how many ways 5 Americans and 5 Indians be seated along a circular table, so that they occupy alternative positions

[A] $5! 5!$

[B] $6! 4!$

[C] $4! 5!$

[D] $4! 4!$

40. A meeting of 20 delegates is to be held in a hotel. In how many ways these delegates can be seated around a circular table if 3 particular delegates always seat together.

[A] $17! \cdot 3!$

[B] $18! \cdot 3!$

[C] $17! \cdot 4!$

[D] None

41. How many triangles can be formed by joining the vertices of hexagon?

[A] 20

[B] 12

[C] 24

[D] 10

42. How many diagonals can be formed by joining the vertices of hexagon?

[A] 10

[B] 12

[C] 9

[D] 8

Probability

Probability

Probability is a measure of likelihood that an event will occur.

Example: Tossing a coin: When a coin is tossed, there are two possible outcomes : either heads (H) or tails (T). We say that the probability of the coin landing H is $\frac{1}{2}$. And the probability of the coin landing T is $\frac{1}{2}$

TERMINOLOGY

Random Experiment: Experiments whose outcomes are unpredictable is known as Random Experiments. For example: Tossing a coin

Sample Space(S): It is the collection of all possible outcome of an experiment. Example: In tossing a coin one time $S=\{H,T\}$

Event: The outcome of an experiment is known as Event. Mathematically we can say that event is a subset of sample space.

Example: Getting a head while tossing a coin one time is an event.

Types of Events:

For example If $S=\{1,2,3,4,5,6\}$ and $E=[\text{odd no.}]=\{1,3,5\}$
Then $E'=[\text{Even number}]=\{2,4,6\}$

2. Equally likely Events: If E and F are two events such that $P(E) = P(F)$ then these are called Equally Likely events. For e.g. In Tossing a coin probability of coming up of head and tail is Equal.

3. Mutually Exclusive Event: Two or more events are said to be mutually exclusive if both cannot occur simultaneously in the same experiment.

Example: In a throw of single coin, either head can come or tail can come. There will be no common outcome in those events. It means $E \cap F = \emptyset$ (null Set)

4. Collective Exhaustive Events: If E and F are two events and both events gives complete sample space then these are called Exhaustive events.

$$E \cup F = S$$

5. Independent Events: Two events are said to be independent of each other when the happening of one event does not affect the happening of other event and vice versa. Here sample spaces are different for both cases.

When two events A and B are independent, the probability of both occurring is:

$$P(A \text{ and } B) = P(A) \cdot P(B)$$

Probability: The probability of an event is defined as the ratio of no. of ways an event can happen to the no. of ways sample space can happen.

Let S be the sample space and let E be the event.

$$\text{PROBABILITY} = n(E)/n(S)$$

6. Dependent Events: Two **events** are **dependent** if the outcome or occurrence of the first affects the outcome or occurrence of the second so that the probability is changed.

When two events, A and B, are dependent, the probability of both occurring is:

$$P(A \text{ and } B) = P(A) \cdot P(B | A)$$

where $P(B | A)$ is the **conditional probability** of an event B in relationship to an event A is the Probability that event B occurs given that event A has already occurred.

Example: The probability of choosing a jack on the second pick given that a queen was chosen on the first pick (without replacement) is called a *conditional probability*.

Rules of Probability

1. $0 \leq P(E) \leq 1$
2. $P(S) = 1$ (Definite event)
3. $P(\Phi) = 0$ (Impossible event)
4. If A' denotes (not- A), then $P(A') = 1 - P(A)$.
5. For any events A and B we have :

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

But for mutually exclusive event $P(A \cap B)=0$

For mutually exclusive events

$$P(A \cup B) = P(A) + P(B)$$

$$6. P(A \cap B) = P(A) \cdot P(B/A) = P(B) \cdot P(A/B)$$

$$7. P(A \cup B \cup C) = P(A) + P(B) + P(C) - P(A \cap B) - P(B \cap C)$$

$$-P(C \cap A) + P(A \cap B \cap C)$$

Coins

One coin {H,T}= 2

Two coins={HH,HT,TH,TT}= 4

Three Coin={HHH,TTT,HHT,TTH,HTH,THT,THH,HTT}= 8

Four Coins={HHHH, TTTT

HHHT, TTTT

HHTH, TTHT

HTHH, THTT

THHH, HTTT,

HHTT, HTTT,

HTTH, HTHT

TTHH, THHT} =16

Question 1: In a simultaneous toss of 2 coins find the probability of 2 Tails?

[A] $1/2$

[B] $1/4$

[C] $2/3$

[D] $3/4$

Question 2: In a simultaneous toss of 2 coins find the probability of Exactly 1 Tail?

[A] $1/3$

[B] $2/3$

[C] $3/4$

[D] $1/2$

Question 3: In a simultaneous toss of 2 coins find the probability of No Tail?

[A] $1/3$

[B] $1/4$

[C] $1/2$

[D] $2/3$

Question 4: In a simultaneous toss of 2 coins find the probability of No head?

[A] $1/2$

[B] $1/4$

[C] $1/3$

[D] $2/3$

Question 5: Three coins are tossed simultaneously. Find the probability of all are heads.

[A] $1/4$

[B] $1/8$

[C] $2/3$

[D] $5/8$

Question 6: Three coins are tossed simultaneously. Find the probability of exactly two heads.

[A] $1/4$

[B] $1/8$

[C] $3/8$

[D] $5/8$

Question 7: Three coins are tossed simultaneously. Find the probability of at least two heads.

- [A] $1/3$
- [B] $1/8$
- [C] $1/8$
- [D] $3/8$

Question 8: Three coins are tossed simultaneously. Find the probability of no heads.

[A] $1/8$

[B] $1/4$

[C] $1/2$

[D] $5/8$

Question 9: Three coins are tossed simultaneously. Find the probability of at least 1 head and 1 tail.

[A] $1/8$

[B] $1/4$

[C] $3/4$

[D] $5/8$

Question 10: 4 coins are tossed simultaneously. Find the probability exactly 3 tails

- [A] $1/8$
- [B] $1/4$
- [C] $1/2$
- [D] $5/8$

Question 11: 4 coins are tossed simultaneously. Find the probability at least 1 tail.

[A] $1/16$

[B] $1/4$

[C] $1/2$

[D] $15/16$

DICE

When a dice is thrown= $\{1, 2, 3, 4, 5, 6\} = 6$

When two dice are thrown, $S =$

$\{(1,1), (1,2), (1,3), (1,4), (1,5), (1,6)$

$(2,1), (2,2), (2,3), (2,4), (2,5), (2,6)$

$(3,1), (3,2), (3,3), (3,4), (3,5), (3,6)$

$(4,1), (4,2), (4,3), (4,4), (4,5), (4,6)$

$(5,1), (5,2), (5,3), (5,4), (5,5), (5,6)$

$(6,1), (6,2), (6,3), (6,4), (6,5), (6,6)\} = 36$



Question 1: In a single throw of 2 Dice, What is the probability of a doublet?

[A] $1/3$

[B] $1/36$

[C] $1/6$

[D] $1/12$

Question 2: In a single throw of 2 Dice, What is the probability of getting sum equals to:

- I. 5
- II. Multiple of 5
- III. 7
- IV. Multiple of 3
- V. Greater than 9

Short Cut For Two Dice

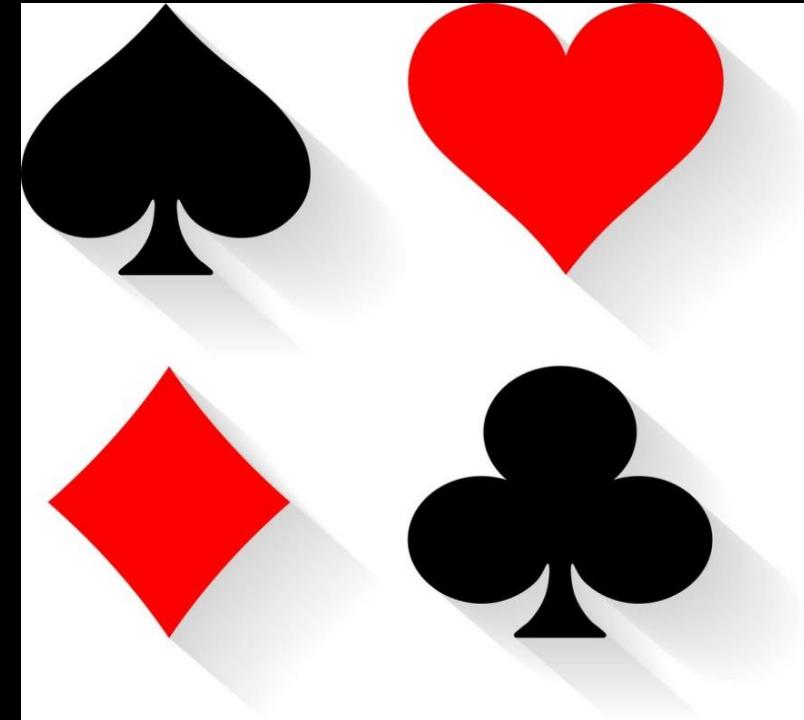
SUM	2	3	4	5	6	7	8	9	10	11	12
Fav.	1	2	3	4	5	6	5	4	3	2	1

Question 3: In a simultaneous throw of 3 Dice find the probability of getting a total of 5.

- [A] $1/6$
- [B] $1/36$
- [C] $1/216$
- [D] $5/216$

Cards

1. There are four Suits in a deck of Card viz. **Spade, Diamond, Heart, Club.**
2. **Red card=26** (13 Diamonds+ 13 Hearts)
3. **Black Card= 26** (13 Clubs+13 Spades)
4. Every suit contains 13 cards viz. **Ace, 2 to 10, Jack, Queen, King**



Face cards and Honored Card



Note: When ace is included in Face cards the combination is called Honored card.

Question 1: One card is drawn at random from the well shuffled pack of 52 cards. What is the probability of picking a black card?

- [A] $1/3$
- [B] $1/2$
- [C] $1/4$
- [D] $1/13$

Question 2: One card is drawn at random from the well shuffled pack of 52 cards. What is the probability of picking a Ace of spades or the jack of diamonds?

[A] $1/52$

[B] $1/26$

[C] $1/13$

[D] $1/4$

Question 3: One card is drawn at random from the well shuffled pack of 52 cards. What is the probability of picking an ace?

[A] $1/13$

[B] $1/52$

[C] $1/26$

[D] $1/4$

Question 4: One card is drawn at random from the well shuffled pack of 52 cards. What is the probability that the card is either a red card or a King?

[A] $5/13$

[B] $7/13$

[C] $9/13$

[D] $1/52$

Question 5: One card is drawn at random from the well shuffled pack of 52 cards. What is the probability that it is neither club nor queen?

[A] $4/13$

[B] $5/13$

[C] $7/13$

[D] $9/13$

Balls in a Bag OR marbles in a Bag

Questions 1: A bag contains 5 red balls and 7 blue balls. Two balls are drawn at random without replacement, and then find the probability of that one is red and other is blue.

[A] $\frac{33}{65}$

[B] $\frac{35}{66}$

[C] $\frac{37}{66}$

[D] $\frac{41}{65}$

Questions 2: . A urn contains 4 red balls, 5 green balls and 6 white balls, if one ball is drawn at random, find the probability that it is neither red nor white.

- [A] $1/3$
- [B] $1/4$
- [C] $1/5$
- [D] $2/3$

Questions 3: . A bag contains 6 red balls and 7 white balls. Another bag contains 5 red balls and 3 white balls. One ball is selected from each. Find the probability that one ball is red and one is white?

[A] $53/104$

[B] $47/104$

[C] $63/104$

[D] $51/104$

Questions 4: In a bag there are 4 white, 4 red and 2 green balls. Two balls are drawn at random. What is the probability that at least one ball is of red color?

[A] $4/3$

[B] $7/3$

[C] $1/3$

[D] $2/3$

Questions 5: . A bag contains 2 red caps, 4 blue caps, 3 yellow caps and 5 green caps. If three caps are picked at random, what is the probability that none is green?

[A] $2/13$

[B] $3/13$

[C] $1/13$

[D] $5/13$

Questions 6: A bag contains 5 red and 7 white balls. Four balls are drawn out one by one and not replaced. What is the probability that they are alternatively of different colors?

[A] $7/99$

[B] $11/99$

[C] $14/99$

[D] $19/99$

Questions 7: A basket contains 5 red 4 blue 3 green marbles. If three marbles picked up random, What is the probability that either all are green or all are red?

[A] $1/20$

[B] $7/20$

[C] $3/20$

[D] $9/20$

Questions 8: A bag contains 3 red balls and 8 blacks ball and another bag contains 5 red balls and 7 blacks balls, one ball is drawn at random from either of the bag, find the probability that the ball is red.

[A] $93/264$

[B] $95/264$

[C] $91/264$

[D] $97/264$

Miscellaneous Questions:

Questions 1: A fair dice is rolled twice. The probability that an odd number will follow on even number is? GATE-2005

- [A] $1/2$
- [B] $1/6$
- [C] $1/3$
- [D] $1/4$

Questions 2: An examination consists of two papers, Paper1 and 2. The probability of failing in Paper1 is 0.3 and that in paper 2 is 0.2. Given that a student has failed in paper2, the probability of failing in paper 1 is 0.6. the probability of failing in both the papers is? **GATE-2007**

- [A] 0.5
- [B] 0.18
- [C] 0.12
- [D] 0.06

Bayes' Theorem:

Let S be the sample space and let $E_1, E_2, E_3, \dots, E_n$ be n mutually exclusive and exhaustive events associated with a random experiment. If A is any event which occurs with E_1 or E_2 or $E_3\dots$ or E_n . then,

Question : A card from a pack of 52 cards is lost. From the remaining cards of the pack, two cards are drawn and are found to be both hearts. Find the probability of the lost card being a heart?

[A] $12/50$

[B] $8/50$

[C] $11/50$

[D] $9/50$

Binomial Distribution:

If **p** is the probability of success of any event and **q** is the probability of failure of that event, then probability of event success **x times** in **n trials**(i.e. **x** success and **n-x** failure) is given by:

Where **X**= Random variable, **x**= no. of success in **n** trials
P= probability of success, **q**= $1-p$ = probability of failure

Question: Find the probability of getting sum 9 exactly two in three times with a pair of dice.

Answer= $8/243$

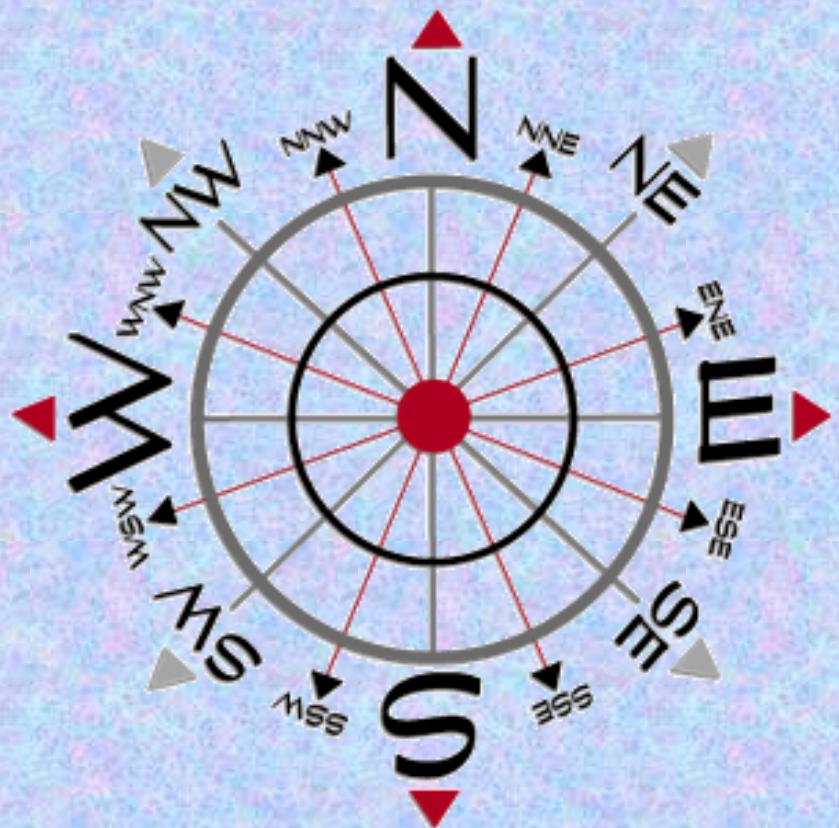


thank you!

Unit-6

- Direction Sense
- Blood Relation

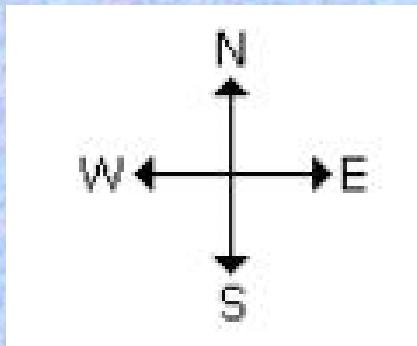
Direction Sense



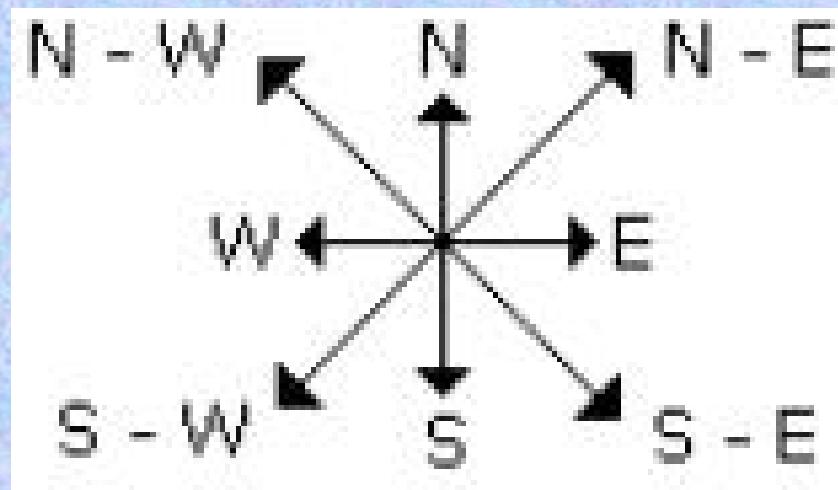
- Direction sense is one of the prime topics in logical reasoning.
- Questions from this topic generally involve an individual travelling certain distances in certain directions.
- The best way to solve these problems is to represent the traces of the path traversed by the person, as found in the information provided by the question.



- There are four main directions –
North, South, East and West.



- There are four cardinal directions – **North-East(N-E), North-West(N-W), South-East (S-E), South-West(S-W).**



Things to be noted:

- At the time of sunrise if a man stands facing the east, his shadow will be towards west.
- At the time of sunset the shadow of an object is always in the east.
- If a man stands facing the North, at the time of sunrise his shadow will be towards his left and at the time of sunset it will be towards his right.
- At 12.00 noon, the rays of the sun are vertically downward hence there will be no shadow.
- Always rainbow will occur opposite to the sun.
- Always shortest distance should be calculated.

Practice Questions

1. Santosh goes first 7 Km north then turns left and move 10 Km, again he turns left and moves 7 Km, how far is he from the starting point?

[A] 7 Km

[B] 10 Km

[C] 17 Km

[D] 24 Km

2. Mohan travels 7 Km to north direction from where he is standing and turns to his right. He then walks straight for another 3 Km. Turning to his right he moves 7 Km. How many Km away from starting point is he?

[A] 1

[B] 2

[C] 3

[D] 5

3. A man walks 5 Km towards south and then turns to the right. After walking 3 Km he turns to the left and walks 5 Km. Now in which direction is he from the starting place?

[A] West

[B] South

[C] North east

[D] South west

4. Ranuka started walking from her house, she first walked for 3 Km towards west, then she turned towards north and moved 4 Km in that direction. How far is Ranuka from her house?

[A] 3 Km South

[B] 3 Km South-East

[C] 5 Km West

[D] 5 Km North-West

6. A man walks northwards. After a while he turns to his right and a little further to his left. Finally, after walking a distance of 1km, he turns towards his left again. In which direction is he moving now?

[A] South

[B] North

[C] West

[D] East

7. A man started walking positioning his back towards the sun. After sometime, he turned left, then turned right and then towards the left again. In which direction is he going now?

[A] North or South

[B] East or West

[C] North or West

[D] South or West

8. A man went 10 Km towards south. Then turned East and covered 10 Km and turned to the right. Again after 10 Km he turned to the left and covered 10kms to reach the destination. How far and in which direction is he to his starting point?

[A] $20\sqrt{2}$ km, South- East

[B] $20\sqrt{2}$ km, North- East

[C] $20\sqrt{2}$ m, South- East

[D] 20 km, South East

9. A man went 15 Km to the North. Then he turned West and covered 10 Km. Then he turned south and covered 5 Km. Finally, turned to East, he covered 10 Km. In which direction is he from his house?

[A] West

[B] East

[C] North

[D] South

10. If South-East becomes North, North-East becomes West and so on. What will West become?

[A] North East

[B] North West

[C] South East

[D] South West

11. Rahul put his timepiece on the table in such a way that at 6 PM hour hand points to north. In which direction the minute hand will point at 9:15 PM?

[A] South East

[B] South

[C] North

[D] West

12. K is 40m South-West of L. If M is 40m South-East of L, then M is in which direction of K?

[A] East

[B] West

[C] North-East

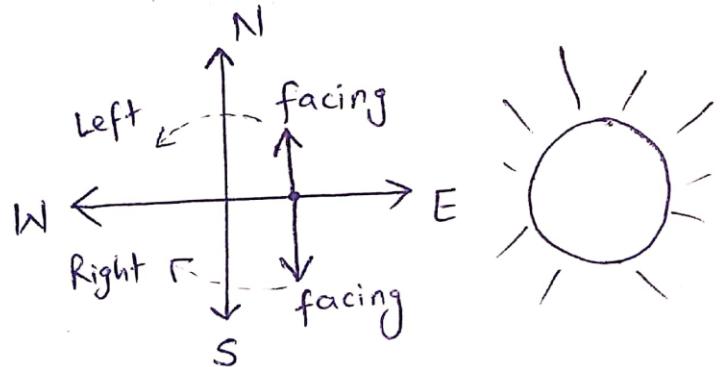
[D] South

Shadow Type Questions:

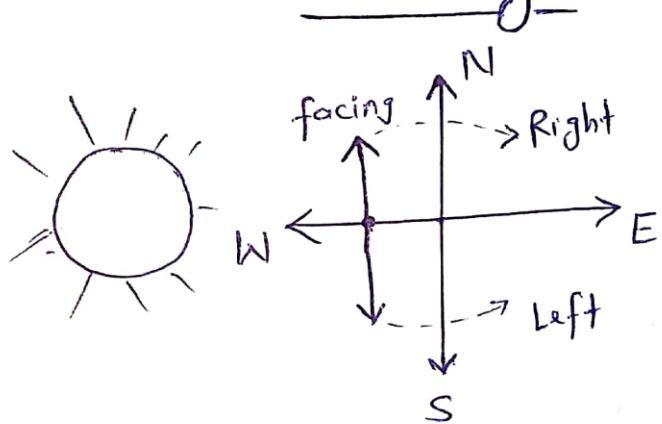
- Shadow of any object is always opposite of SUN, if it is the case of **Morning** then Shadow will fall in the **WEST** and if it is the case of **Evening** then shadow will fall in the **EAST**.

- Shadow Concepts : (1) At the time of sunrise shadow of object will be towards West direction.
- (2) At the time of sunset (Evening) shadow of object will be towards East direction.

Morning



Evening



- If a man stands facing **North** in the **Morning** his shadow will be towards his **left** and if he is facing **North** in **Evening** his shadow will be towards his **Right.**
- If a man stands facing **South** in the **Morning** his shadow will be towards his **Right** and if he is facing **South** in **Evening** his Shadow will be towards his **Left.**

13. One evening before sunset Rekha and Hema were talking to each other face to face. If Hema's shadow was exactly to the right of Hema, which direction was Rekha facing?

[A] North

[B] South

[C] East

[D] West

14. One morning Udai and Vishal were talking to each other face to face at a crossing. If Vishal's shadow was exactly to the left of Udai, which direction was Udai facing?

[A] East

[B] West

[C] North

[D] South

15. Roshan walks 10 meters westwards, then turns left and walks 10 meters. He then again turns left and walks 10 meters. He takes a 45 degree turn to his right and walks straight. In which direction is he walking now?

[A] South-East

[B] South

[C] South West

[D] East

16. After his office hours in the evening, Gautam starts walking facing the sun. First he turns to his right, then he turns to his left and after walking for some meters to his left, he turns to his right. In what direction is he moving now?

[A] South

[B] North

[C] West

[D] East

17. Amit's office is situated 5 kilometers North of Ben's office. Ben starts from his office and walks 2 kilometers towards Amit's office. He then turns right and walks 3 kilometers and then turns left and walks 3 kilometers. To which direction will he turn to reach Amit's office?

[A] West

[B] North

[C] South

[D] East

18. A lady leaves her home and walks 30 meters in North-West direction and then 30 meters in South-West. Next, she walks 30 meters in South-East direction. Finally, she turns towards her house. In which direction is she moving now?

[A] North-East

[B] North-West

[C] South-East

[D] South-West

19. Deepak walks 8 kilometers East, turns South-West and walks another 8 kilometers. He again takes a turn towards North-West and walks another 8 kilometers. In which direction from his starting point is he standing now?

[A] North-East

[B] South

[C] West

[D] East

20. The school is to the West of the hospital. The hospital is to the South of the police post. The workshop is to the North of the school. If the 4 places are equidistant from each other, then to which direction of workshop is the police post?

[A] East

[B] West

[C] North

[D] South

Directions for Q21 to Q25:

Joe walks 2 kilometers towards North and turns to his right and walks 4 kilometers more. He then turns to his right and walks 4 kilometers and turns again to his right and walks another 4 kilometers. Here he meets Renu who is coming from the opposite direction. They both stop there.

21. After taking the first turn, in which direction was Joe going?

- [A] South
- [B] North
- [C] West
- [D] East

22. If the starting point is marked 'A' and finishing point is marked 'B'. What will be the distance between these points?

- [A] 10 Km
- [B] 8 Km
- [C] 6 Km
- [D] 2 Km

23. From which direction was Renu coming?

- [A] West
- [B] North
- [C] East
- [D] South-East

24. After taking the second turn, in which direction was Joe walking?

[A] South

[B] West

[C] North

[D] East

25. If Joe is to again reach the point from where he started, in which direction will he have to go from where he's standing now?

[A] East

[B] North

[C] North-East

[D] South-East

26. A clock is so placed that at 12 noon its minute hand points towards North-East. In which direction does its hour hand point at 1.30 pm?

- [A] North
- [B] South
- [C] East
- [D] West

27. One evening before sunset, two friends Jane and Jackie were talking facing each other. If Jackie's shadow was exactly to his right side, which direction was Jane facing?

- [A] North
- [B] South
- [C] East
- [D] West



thank you!

Blood Relationship



Definition and Concept

- Questions in Test of Reasoning on Family/Blood Relationship are about the relationship of a particular person with another person of the family, based on the chain of relationships between other members of that family.

- Family/Blood Relation Tests are an exercise to test the student's ability to comprehend and come to the crux of an issue from complex, lengthy and even confusing data.

Relation	Commonly Used Terms
Grandfather's or Grandmother's only son	Father
Grandfather's or Grandmother's only daughter-in-law	Mother
Father's father or Mother's	Grandfather
Father's Mother or Mother's	Grandmother
Father's brother or Mother's	Uncle
Father's sister or Mother's	Aunt
Son's wife	Daughter-in-law
Daughter's husband	Son-in-law
Husband's or wife's sister	Sister-in-law
Husband's or wife's brother	Brother-in-law
Brother's wife	Sister-in-law
Brother's or sister's son	Nephew
Brother's or sister's daughter	Niece
Uncle's or aunt's son or daughter	Cousin
Sister's husband	Brother-in-law
Brother's wife	Sister-in-law
Grand son's or grand daughter's daughter	Grand Grand Daughter
Grand son's or grand daughter's son	Great Grand Son

Great-Uncle/Aunt: A brother/sister to any of one's grandparents.

In-laws

In-laws only apply to brother, sister, and parents.

e.g. There is no relationship between you and your spouses cousins.

My sister-in-law could be:

1. the sister of my spouse, or
2. the wife of my brother, or
3. the wife of my spouse's brother.

UNCLE: Uncle in American society this term can refer to a man in four different relative positions: father's brother; mother's brother; father's sister's husband; mother's sister's husband.

NEPHEW - NIECE: Nephew or Niece is one who is the child of a sibling (or a half-sibling, or step-sibling, or a child of a spouse's sibling, or your spouse's sibling. Since the term derives from the Latin term, "Nepos" meaning grandson, it is possible an early colonial reference may have this meaning.

Four thumb rule to solve Blood Relation Problems

1. Male is denoted by + sign and female by - sign in a family tree.
2. Father/mother and Son/daughter are joined by a vertical line to show generation gap between them.



3. Siblings(Brother sister) are joined by a horizontal line because there is no generation gap between them.

Brother ————— Sister

Note: We never joined cousins by any line in a family tree as they are siblings from different parents.

4. Married couples are always written adjacent to each other but joined by a couple sign.

Husband → Wife

- Only use the details provided in the question to form the tree. **DO NOT** assume values on your own-Unless specifically provided or logically concluded.
- Relations on the mother's side is called 'Maternal' while on Father's side is called 'Paternal'.

In every competitive exam and placement exam, Blood relation can be asked in the following three forms:

Type 1 : Indicating type or Deciphering jumbled up description

Type 2 : Relation puzzle (A set of statements)

Type 3 : Coded blood relation (In the form of Symbols)

Type 1: Indicating type Problems

1. Introducing Neeta, Anil(Male) said "She is the wife of my mother's only son". How is Neeta related to Anil?
 - A. Wife
 - B. Sister
 - C. Mother
 - D. Aunt

2. If Kamal says , " Ravi's mother is the only daughter of my mother", how is Kamal related to Ravi ?
- A. Grandfather
 - B. Father
 - C. Brother
 - D. None of these

3. Pointing towards photograph, Vipul said, "She is the daughter of my grandfather's only son." How is Vipul related to the girl in the photograph ?
- A. Mother
 - B. Father
 - C. Brother
 - D. Grand Mother

4. Pointing towards a person in a photograph, Anjali said, "He is the only son of the father of my sister's brother." How is that person related to Anjali ?

- A. Father
- B. Cousin
- C. Brother
- D. Maternal Uncle

5. Pointing out to a lady, Rajan said, "She is the daughter of the woman who is the mother of the husband of my mother". Who is that lady to Rajan?

- A. Aunt
- B. Grand daughter
- C. Daughter
- D. Sister

6. If Neha says, "Amrita's father Raj is the only son of my father-in-law Mahesh," then how Bindu, who is the sister of Amrita related to Mahesh?
- A. Daughter
 - B. Wife
 - C. Niece
 - D. Grand daughter

7. The son of M is the father of N and grandfather of R. S is the daughter of N and sister of B. How is M related to B?

- A. Grand father
- B. Grand mother
- C. Grand father's father
- D. Data inadequate

Type 2: Relation Puzzle

In these types of problems, relations will be given in the form of puzzle i.e. a set of statements. We need to draw the family tree according to given statements and answer the questions based on those relations.

1. 'Ram' is the father of 'Kusha' but 'Kusha' is not his son. 'Mala' is the daughter of 'Kusha'. 'Shalaka' is the spouse of 'Ram'. 'Gopal' is the brother of 'Kusha'. 'Hari' is the son of 'Gopal'. 'Meena' is the spouse of 'Gopal'. 'Ganpat' is the father of 'Meena'. Who is the grand daughter of 'Ram'?

- A. Mala
- B. Meena
- C. Hari
- D. Shalaka

2. X is the husband of Y. W is the daughter of X. Z is the husband of W. N is the daughter of Z. What is the relationship of N to Y.
- A. Cousin
 - B. Niece
 - C. Daughter
 - D. Grand daughter

Directions (3-5):In a family there are eight members. A is mother of B, who is brother of C. C and Q are siblings. Y is daughter of P. Z is brother in law of B, who is son of D. A has only one son. There are only two married couples in the family. P is married to B.

3. How is P related with Z?

- A. Brother
- B. Daughter
- C. Nephew
- D. None of these

4. How is C related with Y?

- A. Aunt
- B. Daughter in Law
- C. Uncle
- D. Grand father

5. How many male members are there in the family?

- A. Four
- B. Three
- C. five
- D. Two

Type 3: Coded Blood Relation

In these types of problems, relations will be given in the form of codes and symbols. We need to draw the family tree according to given symbols and answer the questions based on those relations.

1. ‘P +Q’ means that P is the son of Q, ‘P-Q’ means that P is the wife of Q, ‘P*Q’ means that P is the brother of Q, ‘P/Q’ means that P is the mother of Q and ‘P=Q’ means that P is the sister of Q. then, what does X+Y-Z mean?

- A. Z is the father of X
- B. Z is the son of X
- C. Z is the uncle of X
- D. Z is the brother of X

2. If ' $A \times D$ ' mean 'D is the sister of A', ' $A + D$ ' means 'D is the daughter of A', ' $A \div D$ ' means 'A is the wife of D', and ' $A - D$ ' means 'A is brother of D' then which of the following expression shows 'J is sister of K' ?
- A. $J - K \div P + L$
 - B. $K + P + M \times J$
 - C. $J - K \div L + P$
 - D. $K - J \div L + P$

Direction for Q3 & Q4: Study the following information carefully to answer these questions.

'A\$B' means 'A is mother of B'

'A#B' means 'A is the father of B'

'A@B' means 'A is the husband of B'

'A%B' means 'A is daughter of B'

3. P@Q\$M#T indicates what relationship of P with T?

- A. Maternal Grandfather
- B. Maternal Grandmother
- C. Paternal Grandfather
- D. None of the above

4. Which of the following expressions indicates ‘R is the sister of H’?

- a) R\$D@F#H
- b) H%D@F\$R
- c) R%D@F\$H
- d) H\$D@F#R

Directions (5-6):

'A \times B' means 'A is mother of B'.

'A – B' means 'A is brother of B'.

'A + B' means 'A is sister of B'.

'A \div B' means 'A is father of B'.

5. If the expression M \times N + R \div T is true, then which of the following is true?

- A. M is father of R
- B. N is aunt of T
- C. M is grandfather of T
- D. T is sister of N

6. Which of the following means 'Q' is brother of 'T'?

- A. $Y \div Q - T + R$
- B. $T \div Q - Y - R$
- C. $T \times M - R + Q$
- D. $T + M \div Y + Q$



thank you!