



Arunachal Pradesh

CHSL

Arunachal Pradesh Staff Selection Board (APSSB)

Volume - 3

General Intelligence & Numerical Ability



INDEX

S No.	Chapter Title	Page No.
1	English Alphabet Test	1
2	Analogy Test	3
3	Classification Test	8
4	Number and Alphabet Series Test	12
5	Coding and Decoding	18
6	Blood Relation	23
7	Direction and Distance	27
8	Ranking and Sequence Test	32
9	Clock	36
10	Calendar	39
11	Dice	42
12	Inequality	46
13	Syllogism	50
14	Venn Diagram	56
15	Cube and Cuboid	60
16	Counting of Figures	62
17	Seating Arrangement	67
18	Puzzle Test	75
19	Statement and Argument	84
20	Statement and Assumptions	88
21	Statement and Conclusion	91
22	Statement and Inference	95
23	Statements and Course of Action	104

INDEX

S No.	Chapter Title	Page No.
24	Number System	107
25	LCM & HCF	117
26	Simplification	120
27	Ratio, proportion and variation	124
28	Partnership	128
29	Percentage	130
30	Average	135
31	Profit and Loss	139
32	Discount and Dishonest shopkeeper	143
33	Simple Interest	146
34	Compound Interest	150
35	Time and Work	154
36	Time Speed and Distance	158
37	Pipe and Cistern	163
38	Boat & Stream	165
39	Mensuration 2D	167
40	Mensuration 3D	179
41	Data Interpretation	188

1

CHAPTER

English Alphabet Test



- This chapter includes questions based on the English alphabet (A–Z). Candidates should know the positions of all 26 letters and basic related concepts clearly.
- **Letters are of two types:**
 - ✓ Vowels – A, E, I, O, U (There are 5 vowels in the English alphabet.)

- ✓ Consonants – B, C, D, F, G, H, J, K, L, M, N, P, Q, R, S, T, V, W, X, Y, Z (There are 21 consonants in the English alphabet.)
- **The alphabet is divided into two halves:**
 - ✓ First Half – A to M (The first half contains 13 letters, i.e., positions 1 to 13.)
 - ✓ Second Half – N to Z (The second half contains 13 letters, i.e., positions 14 to 26.)

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

Short trick:

- **EJOTY (इजोटी)**

5	10	15	20	25
E	J	O	T	Y

- **CFILORUX (सिफिलोरक्स)**

3	6	9	12	15	18	21	24
C	F	I	L	O	R	U	X

- **Finding letters from the right side can be simplified using the formula:**

- ✓ Position from left = 27 – Position from right

- **Trick to Remember Opposite Letters**

Pair	AZ	BY	CX	DW	EV	FU	GT
Trick	AZ	BYe	Cracks	DeW	EVening	Few / Uff	G.T. Road

Pair	HS	IR	JQ	KP	LO	MN
Trick	High School	Indian Railway	Jaipur Queen	KanPur	Life OK	MaN

Type-1 Position of a Letter in the English Alphabet

- If counting in the **same direction** (left to left or right to right), **subtract** both positions.
- If counting in **opposite directions** (left to right or right to left), **add** both positions.

Ex: In the English alphabet, what is the 10th letter to the left of the 21st letter from the left?

Ans: Using the trick: If counting in the same direction (left to left or right to right), subtract both positions.

English alphabet = 21-10= 11th alphabet = K

Ex: In the English alphabet, what is the 9th letter to the left of the 11th letter from the right?

Ans: In these types of question first we calculate from the left and then subtract from the 27.

Alphabet = $11 + 9 = 20^{\text{th}}$ from the left

Original alphabet = $27 - 20 = 7^{\text{th}}$ alphabet = G

Type-2 Forming Letter Pairs

- The letter pair can be formed in both forward and backward directions.
- Multiple pairs can be created from a single word.
- After forming a pair with a letter, you can form another pair with the same letter if they are at the same distance according to the English alphabet.

Ex: How many such pairs of letters are there in the word 'COMBINE', each of which has as many letters between them in the word (both forward and backward direction) as they have between them in the English Alphabet?

Ans: First of all, we will write number of positions of 'COMBINE' word according to English alphabet i.e. C is written as 3 and O will be written as 15 and so on.

C	O	M	B	I	N	E
3	15	13	2	9	14	5

Here we can see that only B and E is making one pair.

Type-3 Letter Problems

Ex: If the first and eighth letters of the word 'REPRESENTATIVE' are swapped, then the second and ninth letters, and so on, are also swapped, what will be the fourth letter to the left of the 6th letter from the left in the new arrangement?

Ans:

Position	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Original Letter	R	E	P	R	E	S	E	N	T	A	T	I	V	E
New Letter	N	T	A	T	I	V	E	R	E	P	R	E	S	E

Fourth letter to the left of the 6th letter from the left = $6 - 2 = 4^{\text{th}} = \text{T}$

Type-4 Arrangement of English Words

- Arranging English words in alphabetical or dictionary order is called arrangement of words.

Ex: Arrange the following words according to English dictionary arrangement:

(A) Epitaxy (B) Episode (C) Epigene

(D) Epitome (E) Epilogue

Ans: In a Dictionary, every word is arranged alphabetically. Also, in each word each and every letter is positioned alphabetically. So here, dictionary the arrangement of words in a Dictionary, every word is arranged alphabetically.

(C) Epigene (E) Epilogue (B) Episode

(A) Epitaxy (D) Epitome

Therefore, the correct answer is (C), (E), (B), (A), (D)

Type-5 Meaningful Logical Order of Words

Ex: How many meaningful words of 5 letters can be made with the alphabets K, E, D, H, I each being used only once in each word?

Ans: Given letters: K, E, D, H, I

Meaningful word can be formed out of the alphabets K, E, D, H, I:

HIKED: Walk for a long distance, Hence, only one such word is possible.

Ex: If a five-letter meaningful word can be formed by using the first, third, fifth, sixth and eighth letters from the word "HALLOWEEN", then what is the last letter from the left end of the newly formed word?

Ans: The 1st, 3rd, 5th, 6th, and 8th letters from the left end of the word "HALLOWEEN" are H, L, O, W, and E respectively. The only five-letter meaningful word that can be formed using the letters is WHOLE.



2

CHAPTER

Analogy Test



- Analogy tests involve identifying similarities between two terms. In this chapter, we explore the relationships between different elements. Such questions are included in exams to evaluate a candidate's knowledge, reasoning, and cognitive abilities.
- Analogy questions are based on specific relationships. To solve these questions effectively, candidates should follow these two steps:

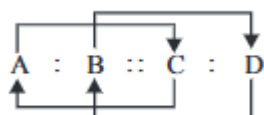
Step 1: Determine the relationship between the first two terms given in the question.

Step 2: Apply the identified relationship to the remaining terms and choose the correct answer.

Rule:1 Basic relationship: In the analogy A:B:: C:D, the relationship between A and B will be the same as the relationship between C and D or D and C.



Rule:2 Developed Relationship: In the analogy A:B:: C:D, the relationship between A and C, or C and A, will be the same as the relationship between B and D, or D and B. It is not necessary that the relationship is directly committed; it may vary.



Type-1 Word Analogy

Common Relationship Patterns

- **Synonym & Antonym:** Famous: Renowned :: Important: Significant (Same); Big: Small :: Sharp: Blunt (Opposite).

- **Tool/Instrument & Action/Function:** Needle: Sew :: Knife: Cut (Instrument-Action).
- **Unit/Part & Whole:** Petal: Flower:: Page: Book.
- **Worker & Tool/Working Place:** Artist: Brush:: Farmer : Plough; Doctor : Hospital :: Teacher : School.
- **Gender/Individual & Group:** Lion: Lioness:: Dog: Bitch.
- **Topic/Category:** Country: Capital (India: New Delhi):: State: Capital (Maharashtra: Mumbai).

Type of Relation	Example
Antonyms/ Synonyms	Believer: Atheist, Import: Export, Victory: Defeat, Living: Non-living
Country and Continent	India: Asia, Ghana: Africa, Canada: North America, France: Europe
Country and Capital	China: Beijing, Nepal: Kathmandu, Japan: Tokyo, Sri Lanka: Colombo
Country and Currency	China: Yuan, Japan: Yen, Italy: Lira, Myanmar: Kyat
Country and Parliament	India: Parliament, Afghanistan: Shora, Iran: Majlis, Japan: Diet
Country and National Symbol	India: Ashoka Chakra, Spain: Eagle, France: Lily, Iran: Rose

Country and National Sport	Britain: Cricket, India: Hockey, Japan: Judo, Spain: Bullfighting
Country and River	India: Ganga, China: Yangtze, Italy: Tiber, Britain: Thames
City and River	London: Thames, Rome: Tiber, Paris: Seine, Delhi: Yamuna
City and Industry	Mumbai: Film Production, Manchester: Cotton, Pittsburgh: Iron and Steel, Detroit: Automobiles
State and Capital	Uttar Pradesh: Lucknow, Uttarakhand: Dehradun, Jharkhand: Ranchi, Chhattisgarh: Raipur
Union Territory and Capital	Lakshadweep: Kavaratti, Dadra and Nagar Haveli: Silvassa
State and High Court	Uttar Pradesh: Allahabad, Uttarakhand: Nainital, Rajasthan: Jodhpur, Bihar: Patna
Product and Raw Material	Curd: Milk, Shoe: Leather, Sugar: Sugarcane, Liquor: Grapes
Worker and Product	Goldsmith: Jewellery, Cobbler: Shoes, Cook: Food, Masons: House
Person and Workplace	Doctor: Hospital, Teacher: School, Farmer: Field, Judge: Court
Person and Tool	Blacksmith: Hammer, Mason: Trowel, Farmer: Plough, Carpenter: Saw

Tool and Work	Pen: Writing, Scissors: Cutting, Spoon: Eating, Glasses: Seeing
Animal and Habitat	Lion: Cave, Horse: Stable, Rat: Hole, Bird: Nest, Bee: Beekeeping, Fish: Fishing
Revolution and Production Area	White Revolution: Milk Yellow Revolution: Oilseed
Animal and Sound	Dog: Barking, Lion: Roaring, Horse: Neighing, Cat: Meowing
Animal and Offspring	Dog: Puppy, Lioness: Cub, Cow: Calf, Sheep: Lamb
Disease and Affected Organ	Pyorrhoea: Teeth, Trachoma: Eyes, Jaundice: Liver, Tuberculosis: Lungs
Location and Place	Taj Mahal: Agra, Hawa Mahal: Jaipur, Jahaz Mahal: Mandu, Red Fort: Delhi
Person and Samadhi Place	Mahatma Gandhi: Raj Ghat, Lal Bahadur Shastri: Vijay Ghat, Chaudhary Charan Singh: Kisan Ghat
Sport and Court	Badminton: Court, Hockey: Field, Boxing: Ring, Shooting: Range
Sport and Cup/Trophy	Cricket: Dilip Trophy, Football: Durand Cup, Hockey: Dhyan Chand Trophy, Golf: Ryder Cup
Award and field	Booker Prize: Literature, Grammy Award: Music, Oscar Award: Film

Instructions: In the following question, select the related number from the given alternatives.

Ex: Car: Road :: Rail : ____.

- (A) Water (B) Air
(C) Road (D) Track

Ans: Just as a car runs on a road, a train (rail) runs on a track.

Ex: Light: Lumen:: __?__: __?__

- (A) Temperature: Candela
(B) Density: Kilogram
(C) Pressure: Pascal
(D) Force: Meter

Ans: Lumen is the unit of light, and Pascal is the unit of pressure. Both pairs represent the relationship between a physical quantity and its corresponding unit.

Ex: Person: Biography:: __?__: __?__.

- (A) World: Encyclopaedia
(B) Nation: History
(C) Place: Economy
(D) Country: Constitution

Ans: A biography is a written account of a person's life, and history is a written account of a nation's past. Both pairs reflect a relationship between a subject and its written or recorded account.

Ex: Just as 'Taj Mahal' is related to 'Agra', in the same way, 'Lal Bagh' is related to which place?

- (A) Bengaluru (B) Delhi
(C) Haridwar (D) Madhya Pradesh

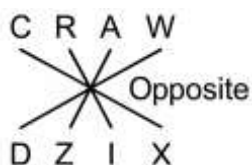
Ans: Just as 'Taj Mahal' is located in Agra, 'Lal Bagh' is located in Bengaluru.

Type-2 Letter Analogy

Ex: Select the option that is related to the third term in the same way as the second term is related to the first term.

CRAW: DZIX:: MOCK:?

Ans: For CRAW: DZIX

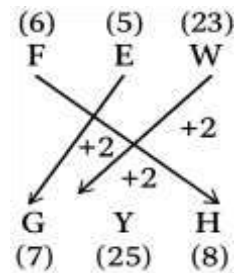


Similarly, for MOCK,

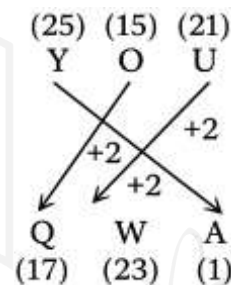


Ex: Select the option that is related to the third letter - cluster in the same way as the second letter - cluster is related to the first letter - cluster. FEW: GYH :: YOU : ?

Ans: For, FEW: GYH

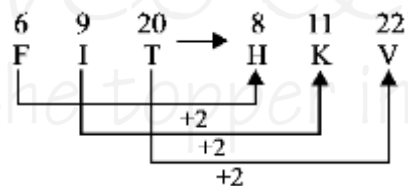


Similarly, YOU:?

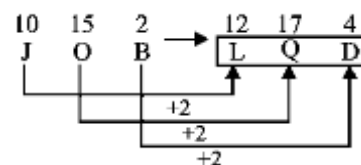


Ex: FIT: HKV:: JOB:?

Ans: logic



Similarly



Ans: JOB: LQD

Type-3 Number Analogy Square



Number	Square	Number	Square
1	1	2	4
3	9	4	16

5	25	6	36
7	49	8	64
9	81	10	100
11	121	12	144
13	169	14	196
15	225	16	256
17	289	18	324
19	361	20	400
21	441	22	484
23	529	24	576
25	625	26	676
27	729	28	784
29	841	30	900
31	961	32	1024
33	1089	34	1156
35	1225	36	1296
37	1369	38	1444
39	1521	40	1600

Cube

Number	Cube	Number	Cube
1	1	2	8
3	27	4	64
5	125	6	216
7	343	8	512
9	729	10	1000
11	1331	12	1728
13	2197	14	2744
15	3375	16	4096
17	4913	18	5832
19	6859	20	8000

Based on square

Ex: 6:36::11: ?

Ans: $6^2=36$, $11^2=121$

Based on cube

Ex: 8:512::10:?

Ans: $8^3=512$, $10^3=1000$

Based on addition

Ex: 389: 392:: 450:?

Ans: $389+3=392$ $450+3=453$

Based on subtraction

Ex: 389:384::450:?

Ans: $389-5=384$ $450-5=445$

Based on multiplication

Ex: 7:56::6:?

Ans: $7 \times 8=56$ $6 \times 8=48$

Based on division

Ex: 35:7::25:?

Ans: $35 \div 7=5$ $25 \div 5=5$

Based on number group

Select the set in which the numbers are related in the same way as are the numbers of the following sets. (NOTE: Operations should be performed on the whole numbers, without breaking down the numbers into its constituent digits. E.g. 13 - Operations on 13 such as adding /subtracting/ multiplying etc. to 13 can be performed. Breaking down 13 into 1 and 3 and then performing mathematical operations on 1 and 3 is not allowed)

Ex: (15, 25, 35) (45, 55, 65)

(1) (55, 65, 75) (2) (45, 55, 70)

(3) (55, 75, 85) (4) (55, 60, 70)

Ans: Logic

$15 \xrightarrow{+10} 25 \xrightarrow{+10} 35$
 $45 \xrightarrow{+10} 55 \xrightarrow{+10} 65$

We check each option.

$$55 \xrightarrow{+10} 65 \xrightarrow{+10} 75$$

The set that relates in the same way as the given sets is Option (1) (55, 65, 75).

Ex: (7, 49, 343) (8, 64, 512)

(1) (6, 36, 206) (2) (5, 25, 225)

(3) (11, 121, 1221) (4) (9, 81, 729)

Ans: Logic

$$(7, 49, 343) = (7, 7^2, 7^3)$$

$$(8, 64, 512) = (8, 8^2, 8^3)$$

(6, 36, 206): 36 is 6^2 , so it's the square of 6: 206 is not 6^3 (which is 216), so this does not follow the pattern.

(5, 25, 225): 25 is 5^2 , so it's the square of 5: 225 is 5^3 , so it's the cube of 5.

(11, 121, 1221): 121 is 11^2 , so it's the square of 11: 1221 is not 11^3 (which is 1331), so this does not follow the pattern.

(9, 81, 729): 81 is 9^2 , so it's the square of 9: 729 is 9^3 , so it's the cube of 9.

Option (4) seems to be the most accurate match in terms of following the same pattern.

Ex: (2, 7, 81) (5, 6, 121)

(1) (7, 5, 134) (2) (5, 4, 100)

(3) (6, 2, 36) (4) (6, 7, 169)

Ans:

$$2+7=9 \quad 9^2=81$$

$$5+6=11 \quad 11^2=121$$

$$7+5=12 \quad 12^2=144 \neq 134$$

$$5+4=9 \quad 9^2=81 \neq 100$$

$$6+2=8 \quad 8^2=64 \neq 36$$

$$6+7=13 \quad 13^2=169=169$$

Type- 4 Letter-Number Analogy

➤ In these types of questions, there is a relationship between English letters and numbers. This relationship can exist in the form of corresponding numbers for the English letters or in other forms.

Ex: Instructions: On the left side of the symbol, a letter/letter pair and numbers are given, and on the right side, a letter/letter pair and a question mark (?) are provided. You need to identify which number from the given options on the right side maintains the same relationship with the right-side letter/letter pair as the left-side letter/letter pair and number.

Ex: Vijay: 05 :: Shubham:?

Ans:

Number of alphabets in 'Vijay' = 5

So, from this logic

Number of alphabets in 'Shubham' = 7

Ex: Select the option that is related to the fifth letter-number cluster in the same way as the second letter-number cluster is related to the first letter-number cluster and fourth letter-number cluster is related to third letter-number cluster.

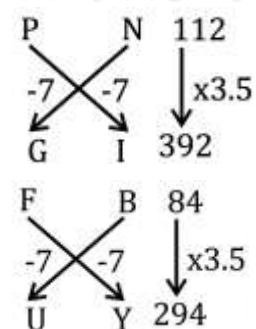
(NOTE: Operations should be performed on the whole numbers, without breaking down the numbers into its constituent digits. E.g. 13 Operations on 13 such as adding / subtracting / multiplying etc. to 13 can be performed. Breaking down 13 into 1 and 3 and then performing mathematical operations on 1 and 3 is not allowed)

PN112: G1392 :: FB84: UY294 :: AR56:?

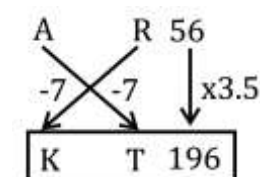
1. KT204 2. KT196

3. LS204 4. LS196

Ans:



Similarly,



The correct answer is option 2.

Classification Test



➤ Classification involves organizing words into groups, categories, or classes based on common characteristics, highlighting the differences between them. In this process, three or four words belong to the same group, sharing a common feature, while the remaining word does not fit with the others, making it the odd one out. The task is to identify the word that does not belong to the group.

➤ **Steps:**

- ✓ **Understand the Question:** Identify the set and goal (odd one out or grouping).
- ✓ **Identify Categories:** Group items based on common features (e.g., animals, objects).
- ✓ **Find the Odd One Out:** Look for differences or unrelated items.
- ✓ **Use Logical Reasoning:** Compare attributes like function, type, or properties.
- ✓ **Eliminate Items:** Remove similar items and focus on the odd one.
- ✓ **Check Patterns:** Look for sequences or relationships between items.

Type-1 Word Classification

In this type of question, a set of words is provided as options; with the exception of one, all the other words belong to the same group, category, or class, whereas the single remaining word belongs to a different—that is, distinct—group, category, or class. You are asked to select this specific word that belongs to a different group, category, or class—that is, the incongruous, mismatched, or dissimilar word. Some of the key similarities among words are as follows:

1. Semantic similarity
2. Functional similarity
3. Structural similarity

4. Numerical similarity
5. Positional similarity
6. Similarity of rank/status
7. Similarity of utility
8. Categorical similarity
9. Similarity based on specific domain relationships
10. Similarity based on internal relationships
11. Technical similarity

Ex: Directions: Out of four words, three have something in common and one is different. Identify the different one.

- | | |
|--------------|----------------|
| 1. Air fryer | 2. Shredder |
| 3. Scanner | 4. Fax machine |

Ans: The logic is based on types of devices.

Air fryer - A kitchen appliance used for cooking.

Shredder - An office device used to destroy documents.

Scanner - An office device used to scan documents.

Fax machine - An office device used to send documents.

Among these, Shredder, Scanner, and Fax machine are office-related devices, while Air fryer is a kitchen appliance.

Ex: Three of the following four words are alike in a certain way and one is different. Select the odd one.

- | | |
|-------------|-------------------|
| 1. Goggles | 2. Spectacles |
| 3. Bifocals | 4. Optical Reader |

Ans: Goggles, spectacles, and bifocals are worn by humans, whereas an optical reader is not worn. It is a device commonly found in computer scanners, which captures visual information and converts it into digital data that the computer can process and display. Therefore, option 4 is the correct answer.

Type-2 Word Pair Based Classification

Ex: Directions: In each of the following questions, certain pairs of words are given, out of which the words in all pairs except one, bear a certain common relationship. Choose the pair in which the words are differently related

1. Sky: Cloud
2. Purse: Wallet
3. Cupboard: Almirah
4. Chair: Stool

Ans:

- (1) Sky: Cloud → Cloud is not a type of Sky.
 - (2) Purse: Wallet → Wallet is a type of Purse.
 - (3) Cupboard: Almirah → Almirah is a type of Cupboard.
 - (4) Chair: Stool → Stool is a type of Chair.
- Hence, Sky: Cloud is the odd one out.

Ex: Four pair of words have been given, out of which three pairs are alike in some manner and one is different. Select the pair of words that is different.

1. Boxing: Ring
2. Golf: Course
3. Baseball: Diamond
4. Pool: Swimming

Ans:

Sports	Play area
Boxing	Ring
Golf	Course
Baseball	Diamond
Swimming	Pool

Here in Option 4, Play area is given first and then the sport. Whereas in other options, the sport is given first and then the play area.

Type-3 Letter Classification

Ex: Three of the four letter-clusters in the given options are alike in a certain way and thus form a group. Find the one that does not belong to that group

1. USX
2. OMR
3. LJO
4. RPV

Ans:

$$\begin{array}{l} \text{U} \xrightarrow{-2} \text{S} \xrightarrow{+5} \text{X} \\ \text{O} \xrightarrow{-2} \text{M} \xrightarrow{+5} \text{R} \\ \text{L} \xrightarrow{-2} \text{J} \xrightarrow{+5} \text{O} \\ \text{R} \xrightarrow{-2} \text{P} \xrightarrow{+4} \text{V} \end{array}$$

Thus, out of all 'RPV' is the odd one out.

Ex: Based on the English alphabetical order, three of the following four letter-cluster pairs are alike in a certain way and thus form a group. Which letter-cluster pair DOES NOT belong to that group? (Note: The odd one out is not based on the number of consonants/vowels or their position in the letter-cluster.)

1. WY-PS
2. PR-GI
3. RT-IK
4. VX-MO

Ans:

$$\begin{array}{cccc} \text{W (23)} & \text{Y (25)} & \text{P (16)} & \text{R (18)} \\ \downarrow -7 & \downarrow -6 & \downarrow -9 & \downarrow -9 \\ \text{P (16)} & \text{S (19)} & \text{G (7)} & \text{I (9)} \\ \text{R (18)} & \text{T (20)} & \text{V (22)} & \text{X (24)} \\ \downarrow -9 & \downarrow -9 & \downarrow -9 & \downarrow -9 \\ \text{I (9)} & \text{K (11)} & \text{M (13)} & \text{O (15)} \end{array}$$

Thus, out of all 'WYPS' is the odd one out.

Ex: Four words are given out of which three are alike in a certain way and one is different. Select the odd one out.

1. CHEST
2. NIGHT
3. BLACK
4. TRUTH

Ans: The pattern follows here is;

- (1) CHEST (E i.e. Vowel in the middle of the Word)
- (2) NIGHT (I i.e. Vowel is not in the middle of the Word)
- (3) BLACK (A i.e. Vowel in the middle of the Word)
- (4) TRUTH (U i.e. Vowel in the middle of the Word)

Hence, the correct answer is "NIGHT".

Ex: Choose the odd one out of the given options.

1. BIJ
2. DGJ
3. FGH
4. CHI

Ans:

Option	Letter	Position Value of Letter
1	BIJ	2 + 9 + 10 = 21
2	DGJ	4 + 7 + 10 = 21
3	FGH	6 + 7 + 8 = 21
4	CHI	3 + 8 + 9 = 20

Hence, "CHI" is the correct option.

Ex: Three of the following four letter-clusters are alike in a certain way and is different. Find the odd one out.

1. KORVA 2. TXBFJ
3. NRVZD 4. PTXBF

Ans:

KORVA $\rightarrow K+4=O, O+3=R, R+4=V, V+5=A$
TXBFJ $\rightarrow T+4=X, X+4=B, B+4=F, F+4=J$
NRVZD $\rightarrow N+4=R, R+4=V, V+4=Z, Z+4=D$

PTXBF $\rightarrow P+4=T, T+4=X, X+4=B, B+4=F$
Hence, 'KORVA' is the odd one out.

Ex: Four letter-clusters have been given, out of which three are alike in some manner and one is different. Select the letter-cluster that is different.

1. BASK 2. SPIT
3. TRAM 4. MOVE

Ans:

1. BASK $\rightarrow$ 3 Consonants, 1 Vowel
2. SPIT $\rightarrow$ 3 Consonants, 1 Vowel
3. TRAM $\rightarrow$ 3 Consonants, 1 Vowel
4. MOVE $\rightarrow$ 2 Consonants, 2 Vowels
Hence, 'MOVE' is the odd one out.

Type-4 Number Classification

Priority lists to be followed in exams according to their preferences are:

1. Prime number.
2. Square.
3. Cube.
4. Multiplication and divisions
5. Addition and subtraction.

Ex: Find the odd one out in each of these questions.

1. 69, 43 2. 63, 47
3. 34, 85 4. 65, 23

Ans:

69, 43 Composite number and prime number
63, 47 Composite number and prime number
34, 85 Both Composite numbers
65, 23 Composite number and prime number

In the following question, four number pairs are given. In each pair the number on left side of (-) is related to the number of the right side of (-) with some Logic/Rule/Relation. Three pairs are similar on the basis of same Logic/Rule/Relation. Select the odd one out from the given alternatives.

(NOTE: Operations should be performed on the whole numbers, without breaking down the number into its constituent digits. E.g. 13 Operations on 13 such as adding / subtracting / multiplying etc. to 13 can be performed. Breaking down 13 into 1 and 3 and then performing mathematical operations on 1 and 3 is not allowed)

- Ex:** 1. 13-169 2. 12-144
 3. 11-121 4. 10-110

Ans: Logic: (First number)² = Second number

$$(13)^2 = 169 \quad (12)^2 = 144 \\ (11)^2 = 121 \quad (10)^2 = 100 \neq 110$$

Hence, the correct answer is "Option 4".

- Ex:** 1. 11408-10818 2. 10806-10216
 3. 9762-9182 4. 8644-8054

Ans:

$$11408-10818 = 590 \\ 10806-10216 = 590 \\ 9762-9182 = 580 \\ 8644-8054 = 590$$

Hence, the correct answer is "Option 3".

- Ex:** 1. 28125-3125 2. 11322-1258
 3. 49374-5483 4. 49401-5489

Ans: Logic: 1st number $\div$ 9 = 2nd number.

$$28125 \div 9 = 3125 \\ 11322 \div 9 = 1258 \\ 49374 \div 9 = 5486 \neq 5483 \\ 49401 \div 9 = 5489$$

So, '49374-5483' odd among the given options.

- Ex:** 1. 829 2. 643
 3. 821 4. 237

Ans: Logic: Numbers are prime numbers except only one number.

- 1) 829: Prime number (divisible only by 1 and 829)
- 2) 821: Prime number (divisible only by 1 and 821)

- 3) 643: Prime number (divisible only by 1 and 643)
 4) 237: Not prime number (divisible by 1, 3, 79 and 237)

Ex: Four options have been given out of which three are alike in some manner, while one is different. Choose the odd one.

1. 2321 2. 825
 3. 1521 4. 968

Ans: All the numbers except option (3), the given numbers are the multiple of 11.

Option 1: 2321 → Multiple of 11

Option2: 825 → Multiple of 11

Option3: 1521 → Not a multiple of 11

Option4: 968 → Multiple of 11

Therefore, 1521 is the odd one option.

Ex: Three of the following four number-pairs are alike in a certain way and one is different. Select the one that is different.

1. 5:105 2. 6:180
 3. 7:294 4. 3:18

Ans:

$$5:105 \rightarrow 5^3 - 5^2 \rightarrow 125 - 25 = 100$$

$$6:180 \rightarrow 6^3 - 6^2 \rightarrow 216 - 36 = 180$$

$$7:294 \rightarrow 7^3 - 7^2 \rightarrow 343 - 49 = 294$$

$$3:18 \rightarrow 3^3 - 3^2 \rightarrow 27 - 9 = 18$$

Hence, 5: 105 is different from other three alternatives.

Ex: In the following question, four number groups are given. In each group the three numbers are related to each other by some Logic/Rule/ Relation. Three are similar on basis of same Logic/Rule/Relation. Select the odd one out from the given alternatives.

1. (12, 24, 41) 2. (13, 26, 43)
 3. (16, 32, 49) 4. (17, 34, 53)

Ans:

$$(12, 24, 41) \rightarrow 12 \times 2 = 24$$

$$24 + 17 = 41$$

$$(13, 26, 43) \rightarrow 13 \times 2 = 26$$

$$26 + 17 = 43$$

$$(16, 32, 49) \rightarrow 16 \times 2 = 32$$

$$32 + 17 = 49$$

$$(17, 34, 53) \rightarrow 17 \times 2 = 34$$

$$34 + 17 = 51 \neq 53$$

Hence, "(17, 34, 53)" is the odd one out.

Ex: Four number-pairs have been given, out of which three are alike in some manner and one is different. Select the one that is different.

1. 548-105 2. 113-15
 3. 166-73 4. 316-46

Ans:

$$\text{Option 1} \rightarrow 5^2 + 4^2 + 8^2 = 105$$

$$\text{Option 2} \rightarrow 1^2 + 1^2 + 3^2 = 11 \neq 15$$

$$\text{Option 3} \rightarrow 1^2 + 6^2 + 6^2 = 73$$

$$\text{Option 4} \rightarrow 3^2 + 1^2 + 6^2 = 46$$

All option follows the same pattern, except '113-15'

Ex: Select the odd numbers from the given alternatives.

1. 94 2. 63 3. 35 4. 18

$$\text{Ans: } 94 \rightarrow \text{reverse } 49 \rightarrow 7^2$$

$$63 \rightarrow \text{reverse } 36 \rightarrow 6^2$$

$$35 \rightarrow \text{reverse } 53 \rightarrow \text{no square}$$

$$18 \rightarrow \text{reverse } 81 \rightarrow 9^2$$

Ex: In the following question, four groups of three numbers are given. In each group, numbers are related by a Logic/Rule/Relation. Three are similar on the basis of the same Rule/Relation/Logic. Select the odd one from the given alternatives.

1. (8, 43, 29) 2. (11, 58, 38)
 3. (14, 73, 47) 4. (17, 72, 90)

Ans:

$$(8, 43, 29) \rightarrow (8 \times 5) + 3 = 43, (8 \times 3) + 5 = 29$$

$$(11, 58, 38) \rightarrow (11 \times 5) + 3 = 58, (11 \times 3) + 5 = 38$$

$$(14, 73, 47) \rightarrow (14 \times 5) + 3 = 73, (14 \times 3) + 5 = 47$$

$$(17, 72, 90) \rightarrow (17 \times 5) + 3 = 88 \neq 72; (17 \times 3) + 5 = 56 \neq 90$$

Hence, (17, 72, 90) is the odd one out.

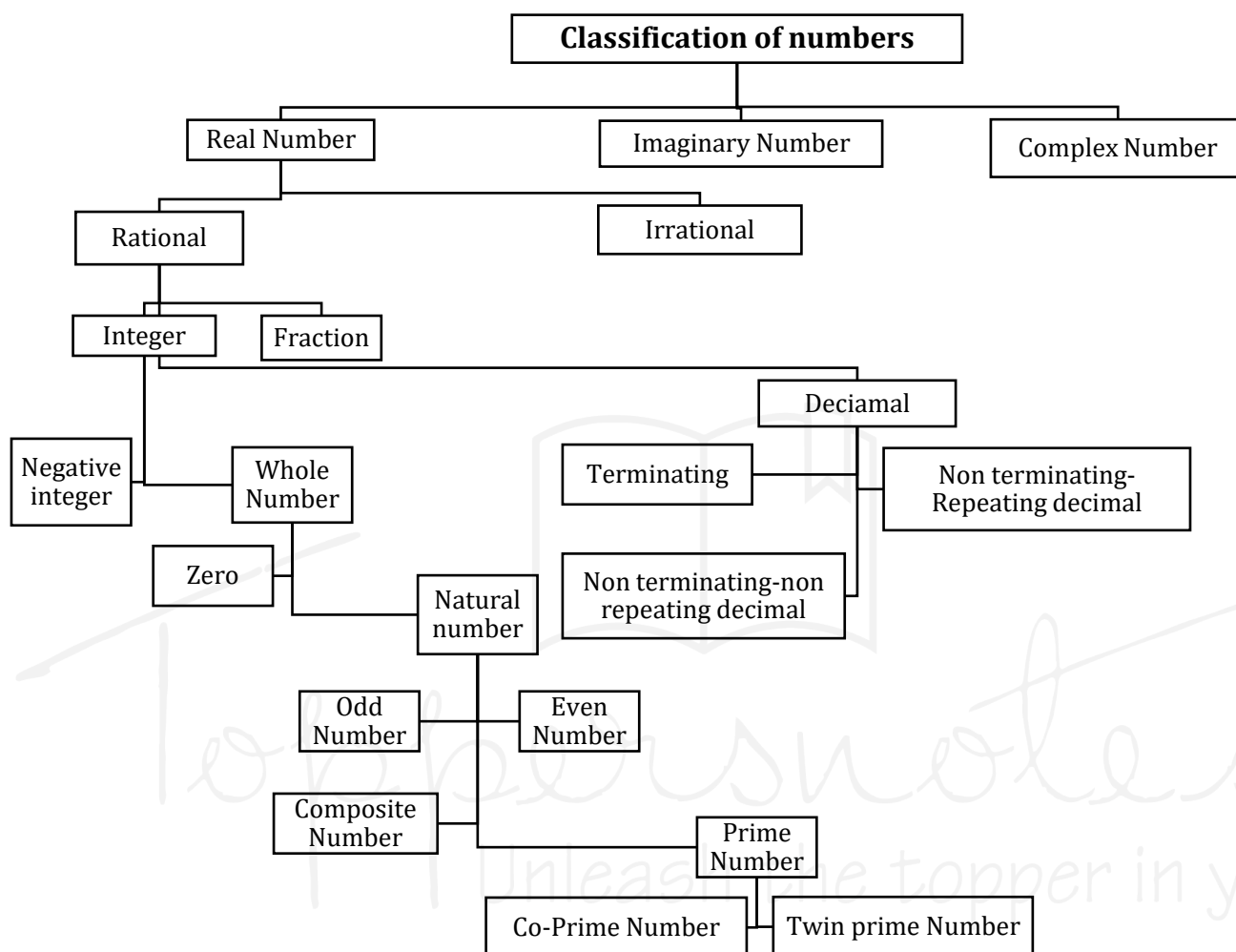
24

CHAPTER

Number System



- **Number System:** A number system is a **method of representing and working with numbers** using a defined set of symbols and rules.



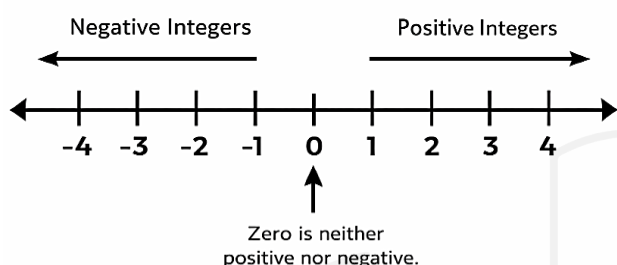
Types	Definition
Real Number	A real number is any number that can be represented on the number line. A real number is a number that includes all rational and irrational numbers and can be expressed as a point on the number line.
Rational Number	A rational number is a number that can be expressed in the form $\frac{p}{q}$, where p and q are integers and $q \neq 0$.

Irrational Number	An irrational number is a number that cannot be expressed in the form $\frac{p}{q}$, where p and q are integers and $q \neq 0$
Fraction	A fraction is a number that represents a part of a whole or a ratio of two quantities. It is written in the form $\frac{a}{b}$.
Integer	An integer is a whole number that can be positive, negative, or zero, and does not include any fractional or decimal part

Negative Integer	Negative integers are whole numbers with a negative sign, such as $-1, -2, -3, \dots$	Co-Prime Numbers	Two or more numbers are called co-prime (or relatively prime) if their only common factor (HCF) is 1. ➤ 1 is neither prime or composite.
Whole Number	A whole number is a non-negative integer, including zero.	Twin Prime Numbers	Twin numbers (twin primes) are a pair of prime numbers whose difference is exactly 2. ➤ 5 is only prime which is in 2 twin prime pairs. (3, 5) (5, 7) ➤ Sum of twin prime number (except 3 and 5) is always divisible by 12.
Natural number	Natural numbers are the numbers starting from 1 and increasing by 1 each time. 1, 2, 3, 4, ...	Decimal Number	A decimal number is a number that has a decimal point (.) and consists of a whole part and a fractional part. Ex- 3.5, 12.75 etc
Odd Number	An odd number is a natural number that is not divisible by 2 or in the form of $2n + 1$	Terminating Decimal	A terminating decimal is a decimal number that ends after a finite number of digits after the decimal point. Ex- 2.5, 0.75
Even Numbers	An even number is a natural number that is completely divisible by 2 or in the form of $2n$.	Non-Terminating Repeating Decimal	A non-terminating repeating decimal is a decimal number that does not end and in which one or more digits repeat continuously after the decimal point. Ex- 0. 333., 0. 1212
Prime number	A prime number is a natural number greater than 1 that has exactly two distinct factors: 1 and the number itself. 2, 3, 5, 7. ➤ 2 is the smallest prime number. ➤ 2 is only even prime number. ➤ All prime number (except 2 and 3) can be written in the form of $6n + 1$ or $6n + 5$ where n is natural number however, the converse is not true. ➤ (3, 5, 7) is only group of three primes, which are consecutive odds. ➤ 101 is smallest 3-digit prime number. ➤ 997 is largest 3-digit prime number.	Non-Terminating Non-Repeating Decimal	A non-terminating non-repeating decimal is a decimal number that does not end and does not repeat any digit or pattern after the decimal point. Ex- 1.1412, 3.14
Composite Number	A composite number is a natural number greater than 1 that has more than two factors. A composite number can be divided exactly by 1, itself, and at least one other number. 4, 6, 8, 9, 10, 12, 14... ➤ The smallest composite number is 4. ➤ The smallest odd composite number is 9 If a and b are any two odd primes then $a^2 + b^2$ and $a^2 - b^2$ is composite numbers.	Imaginary Number	An imaginary number is a number that can be written in the form $= bi$ b is a real number i is the imaginary unit, defined by

Complex Number	A complex number is a number that consists of two parts—a real part and an imaginary part—and can be expressed in the standard form $z = a + ib$ a is a real number, called the real part of z b is a real number, called the imaginary part of z i is the imaginary unit, defined by the property
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Integer Number Line



How to check the given number is prime or not?

- To determine whether a number is prime, first find its square root and round it down to the nearest whole number. Then check whether the number is divisible by any prime number up to this value. If it is not divisible by any of them, the number is a prime number.

Between	Number or prime number
1-50	15
1-100	25
1-200	46

Ramanujan number

A Ramanujan number is a number that can be expressed as the sum of two positive cubes in two different ways. It is also known as the Hardy–Ramanujan number or taxi-cab number.

Smallest Ramanujan number = 1729

$$1729 = 1^3 + 12^3 = 9^3 + 10^3$$

Perfect number

A perfect number is a natural number that is equal to the sum of its proper divisors (that is, all its positive divisors excluding the number itself).

Ex: 4 is divisible by 1 and 2, so $1 + 2 = 3 \neq 4$; therefore, 4 is not a perfect number.

6 is divisible by 1, 2 and 3, so, $1 + 2 + 3 = 6 = 6$; therefore, 6 is a perfect number.

Key points

Even + Even = Even

Even $\times$ Even = Even

Even + Odd = odd

Even $\times$ Odd = Even

Odd + odd = Even

Odd $\times$ Odd = Odd

Sum Of ' n ' odd number is odd, if n is odd.

Sum of ' n ' odd number is even, if n is even.

Type 1: Question based on definitions



Ex: 173 is prime number or not?

Sol: The Square root of 173 is approximately 13.

The Prime number less than or equal to 13 are 2, 3, 5, 7, 11 and 13,

Since 173 is not divisible by any number, it is a prime number.

Ex: x, y and z are distinct prime number where $x < y < z$ if $x + y + z = 70$, then what is the value of z ?

Sol: Now, sum is 70, means at least one of the numbers is even. As we know, only one even prime number exists, and that is 2.

2 is also the smallest prime number.

Means $x = 2$

Now, $70 - 2 = 68 = y + z$

By substituting the values of different prime numbers, we obtain the result.

$y = 31$ and $x = 37$

Ex: How many composite numbers are there from 53 to 97?

Sol: If we find the total number of integers between 53 and 97 and then subtract the number of prime numbers between them, we obtain the number of composite numbers.

Total number = $97 - 53 + 1 = 45$ (+1 when both numbers are included)

Total prime number from 53 to 97 is 10

So, composite number = $45 - 10 = 35$

Ex: Which one of the following is TRUE?

- (A) All irrational numbers are real
- (B) All real numbers are irrational.
- (C) Rational numbers are not real.
- (D) Integers are not rational.

Sol: Irrational numbers form a subset of real numbers, so all irrational numbers are real.

Not all real numbers are irrational; rational numbers are also real.

Rational numbers are real numbers.

Integers are a subset of rational numbers since any integer can be written as $\frac{p}{q}$ (e.g., $5 = \frac{5}{1}$).

So, Answer is (A).

Special concept: based on sum of digits for special types of numbers

Number	Square	Sum of digits
11^2	121	3
111^2	12321	9
So, on		
111111111^2	12345678987654321	81

Ex: Each digit of a 9-digit number is 1. It is multiplied by itself. What is the sum of digit of the resulting number.

Sol- using the concept

$$111111111^2 = \gg 81$$

Type 2: Unit digit based

To find the units digit of an expression, consider only the unit digits of the numbers instead of evaluating the entire expression.

Unit digit of $(a + b)$ = unit digit of a + unit digit of b

Unit digit of $(a - b)$ = unit digit of a - unit digit of b

Unit digit of $a \times b$ = unit digit of $a \times$ unit digit of b

Ex: What are the unit digit of 435×433 .

Sol: Unit digit of $a \times b$ = unit digit of $a \times$ unit digit of b

$$5 \times 3 = 15 \text{ so, unit digit is } 5$$

Cyclicity

Cyclicity in the number system means the repeating pattern of digits or remainders when a number is raised to higher powers. The unit digit remains unchanged for all powers.

$$0 \rightarrow 0 \quad 1 \rightarrow 1$$

$$5 \rightarrow 5 \quad 6 \rightarrow 6$$

Cycle of Length 2-The unit digit alternates between two values.

$$4 \rightarrow 4, 6$$

When the power is odd, the unit digit is 4, and when the power is even, the unit digit is 6.

$$9 \rightarrow 9, 1$$

When the power is odd, the unit digit is 9, and when the power is even, the unit digit is 1.

Cycle of Length 4- The unit digit repeats after four powers.

$$2 \rightarrow 2, 4, 8, 6$$

$$3 \rightarrow 3, 9, 7, 1$$

$$7 \rightarrow 7, 9, 3, 1$$

$$8 \rightarrow 8, 4, 2, 6$$

$$\text{Let } N = x^y$$

To find the unit digit of (N) , we only need to consider the unit digit of the base number (x) .

The unit digit of an exponential expression can be determined by finding the remainder when the power is divided by 4.

Type 3: Cyclicity - Unit Digit Based on Arithmetic Equations



Ex: If $x = (164)^{169} + (333)^{337} - (727)^{726}$ then what is the unit digit of x ?

Sol: In the expression, the **first term** has an odd power of 4, so the unit digit of the first term is 4. For the **second term**, dividing 337 by 4 gives a remainder of 1 so the unit digit of the second term is 3. For the **third term**, dividing 726 by 4 gives a remainder of 2; hence, the unit digit of the third term is 9.

So, unit digit of the expression $4 + 3 - 9 = -2$. If the unit digit comes out negative, add 10 to obtain the correct unit digit. Unit digit is $10 - 2 = 8$.

Ex: What is the unit digit of $1^5 + 2^5 + 3^5 + 4^5 + \dots + 20^5$

Sol: In each term, the cyclicity is 1. Therefore, for every term, the units digit is the same as the number itself.

The Unit digit for 1 to 10 is zero.

$$= (1 + 2 + 2.. + 9 + 0)$$

$$+ (1 + 2 + 3.. + 9 + 0) = 0$$

Ex: Find the unit digit $x = 187^{280} \times 529^{320} \times 343^{236}$

Sol: If remainder is 0 then put power equal to the 4.

For the first terms - 7^4 cyclicity is 1

For the second terms - power of 9 is even so the unit digit is 1

For the third terms - 3^4 cyclicity is 1

Unit digit is $= 1 \times 1 \times 1 = 1$

Ex: What is the unit digit in the expansion of $(57242)^{9 \times 7 \times 5 \times 3 \times 1}$?

Sol: We only check only for digit 2. Power will be divided by 4.

$$= 2^{1 \times (-1) \times 1 \times (-1) \times 1} = 2^1$$

So, the unit digit is 2

Type 4: Counting based Questions (a digit or page counting or key strokes)



1 to 9 $\rightarrow$ required digit is = 9

10 to 99 $\rightarrow 90 \times 2 = 180$

Ex: What is the number of digits required for numbering a book with 428 pages?

Sol: 1 to 9 $\rightarrow$ required digit is = 9

10 to 99 $\rightarrow 90 \times 2 = 180$

100 to 428 $= (428 - 100 + 1) = 329 \rightarrow 329 \times 3 = 987$

Total number of digits required = $9 + 180 + 987 = 1176$

Type 5: Perfect Square Based Questions



How to check if a number is a perfect square (it shows the possibility)

1. The last two digits of any perfect square number must be among the squares from 1 to 24.
2. The units digit should not be 2, 3, 7, or 8.
3. The number of zeros in the number and the denominator should both be even.
4. After dividing a perfect square by 9, the remainder must be 0, 1, 4, or 7.

Ex: Is it possible that 562576 is a perfect square or not?

Sol: The number ends in 76, which is possible for a perfect square. The unit digit is 6, so it is possible for the number to be a perfect square.

Sum of digit of 562576 = 21

after dividing remainder is 3.

So, this number is not perfect.

Type 6 Decimal to fraction conversion



- The number of zeros in the denominator is equal to the number of digits after the decimal point.

$$0.abc = \frac{abc}{1000}$$

- The number of 9 in the denominator is equal to the number of digits after the decimal point.

$$0.\overline{abc} = \frac{abc}{999}$$

- When some digits are not covered by the overline

$$0.a\overline{bc} = \frac{abc - a}{990}$$

$$0.ab\overline{cd} = \frac{abcd - ab}{9900}$$

- Mix concept

$$a.b\overline{cd} = a + \frac{bcd - b}{990} = \frac{abcd - ab}{990}$$

Ex: If $A = 0.3\overline{12}$, $B = 0.4\overline{15}$ and $C = 0.30\overline{9}$ what is the value of $A + B + C$.

Sol:

$$A + B + C = \frac{312 - 3}{990} + \frac{415 - 4}{990} + \frac{309 - 30}{900}$$

$$A + B + C = \frac{720}{999} + \frac{279}{900}$$

$$A + B + C = \frac{10269}{9900} = \frac{1141}{1100}$$



Type 7: Number of zeros

- Zeros at the end of a number are determined by the number of 10s and in its factorization, primarily based on the pairs of 5s and 2s.
- **Factorial** is a mathematical operation defined for non-negative integers.

- For a positive integer n , the factorial of n , denoted by $n!$, is the product of all positive integers from 1 to n .

$$n! = n \times (n-1) \times (n-2) \times \dots \times 1$$

$$0! = 1, 1! = 1$$

- ✓ The unit digit of numbers after $4!$ is zero.
 - ✓ $4!$ and all factorials after it are divisible by 4.
 - ✓ Product of ' n ' consecutive natural number is divisible by n
- **Power of number contained in a factorial:** Highest power of a prime number ' p ' contained in $n!$ is given by
- $$= \left[\frac{n}{p} \right] + \left[\frac{n}{p^2} \right] + \left[\frac{n}{p^3} \right] + \dots$$
- The product of n consecutive natural number is always divisible by $n!$

Ex: The three numbers 24, 25, and 26 are divisible by.

Sol: The product of n consecutive natural number is always divisible by $n!$

Means 24,25,26 is divisible by 3!

Ex: Find the number of trailing zeros in 100!

Sol: In $100!$ factors of 2 are abundant, we only count factors of 5.

Each multiple of 5 contributes at least one factor of 5. Numbers like 25, 50, 75, 100 contain an extra factor of 5 because $25 = 5^2$.

$$\left[\frac{100}{5} \right] + \left[\frac{100}{25} \right] + \left[\frac{100}{125} \right] = 20 + 4 + 0 = 24$$

Number of trailing zeros = 24

Ex: Find the number of trailing zeros in $2 \times 4 \times 6 \dots \times 250$.

Sol: factors of 2 are abundant, we only count factors of 5.

$$2 \times 4 \times 6 \dots \times 250$$

$$= (2 \times 1) \times (2 \times 2) \dots (2 \times 125)$$

$$(2 \times 1) \times (2 \times 2) \dots (2 \times 125)$$

$$= 2^{125} (1 \times 2 \times \dots \times 125)$$

$$2^{125} (1 \times 2 \times \dots \times 125) = 2^{125} \times 125!$$

$$\left[\frac{125}{5} \right] + \left[\frac{125}{25} \right] + \left[\frac{125}{125} \right] = 25 + 5 + 1 = 31$$

Number of trailing zeros = 31

Divisibility

Number	Divisibility Rule
2	Last digit is 0, 2, 4, 6, 8
3	Sum of digits divisible by 3
4	Last two digits form a number divisible by 4
5	Last digit is 0 or 5
25	Last two digit is 00 or divisibly by 25
6	Number divisible by both 2 and 3
7	Subtract twice the last digit from the remaining; result divisible by 7
8	Last three digits divisible by 8
9	Sum of digits divisible by 9
11	Difference between sum of digits at even and odd places is 0 or divisible by 11

Special cases

$$1. 1001 = 7 \times 11 \times 13$$

$$1001 \times abc = abcabc$$

$$2. 10101 = 3 \times 7 \times 13 \times 37$$

$$10101 \times ab = ababab$$

Type 8: Based on

Divisibility rules

Ex: A number N is formed by writing 9 for 99 times. What is the remainder if N is divided by 13?

Sol: When any number is repeated n times, the combination of the 6-digit number is divisible by 7, 11, and 13.

96 times 9 will be divisible by 13, and only three 9s will remain.

$$\frac{999}{13} \Rightarrow R \rightarrow 11$$

Ex: Find the greatest possible value of $(a + b)$ for which the 8-digit number 143b203a is divisible by 15.

Sol: Divisibility of 3 - if sum of its digits is divisible by 3.

Divisibility of 5- if the last number is either 0 or 5, the entire no. is divisible by 5.

Factors of 15 = (3×5) Hence, the number should be divisible by both 3 and 5.

So, a can be 0 or 5. But since the question asks for greatest value, a must be 5.

After that sum of the number is = $18+b$

For greatest = $b=9$

$$\text{So, } (a + b) = (9 + 5) = 14$$

