GS FOUNDATION (2023-24) BOOKLET 20
&
CSAT FOUNDATION 1.0 (2023-24) BOOKLET 19
SEQUENCE AND SERIES

Contents

1) INTRODUCTION

This topic is basically about pattern recognition. Question will give us some pattern of numbers or letters – in the form of sequence or a grid or some other geometrical shape.
We've to crack the pattern and predict the next or missing or wrong term in the question.
There are infinitely many possible patterns. We can't know or study all. We can however, study the most frequently appearing patterns and try to see if any of them fits the pattern in the question.
All the things we've studied in Arithmetic, Geometry and English will help us now.

2) KNOWN PATTERNS

- Consecutive natural/whole numbers or integers
- Consecutive even or odd numbers
- Consecutive prime numbers
- Consecutive multiples of some number
- Term is some multiple of previous number plus some fixed quantity
- Consecutive terms of AP/GP
- Consecutive powers of some number
- Consecutive squares or cubes
- Some group of terms is repeating

3) DIFFERENCE IS IN AP

(Revise AP in class)

Suppose we're given a sequence: 4, 5, 8, 13, 20, X.

- Look at the difference between consecutive terms. It is 1, 3, 5, 7, …
- It is an Arithmetic progression with 1 as first term and 2 as common difference (they're odd numbers)

Q. $24,28,35,X,58,72$
Q. $7564, 7064,6614,6214,X,5564$

4) DIFFERENCE IS IN GP

(Revise GP)
It's very similar to above case – differences here are in GP
Consider: 3, 5, 9, 17, 33, X
Q. 9, 13, 15, 16, 33/2, Y
Q. 75, 80, 95, X, 275,
Q. 30, 27, 36, 9, 90, X (-153)

5) DIFFERENCE FORMS SOME OTHER KNOWN PATTERN

Differences between successive terms can be:

- Consecutive prime numbers
- Consecutive Squares/cubes
- Consecutive Multiples of same number
- Consecutive terms of Fibonacci sequence

Q. $5,7,10,15,22,X$
Q. $20,420,861,1345,X$
Q. $5,8,14,23,X,50$
Q. $34,36,39,45,52,65$ – identify the wrong term.

6) DIVISION OF CONSECUTIVE TERMS

Here we simply divide second term by first, third term by second and so on. We do this especially when terms first decrease then increase or if sequence increases at fast pace. When we divide, resulting sequence of numbers can be

- Same
- Multiples
- AP/GP
- Consecutive primes/squares/cubes/terms of Fibonacci etc.

Q. $10,15,30,75,225,X$
Q. $4,8,24,120,840,X$

7) PRODUCT OR SUM OF PREVIOUS 2/3...ALL TERMS IS CURRENT TERM

In Fibonacci sequence, every term is sum of previous two terms. Some sequences can have similar pattern.

- Every term could be sum of 3 previous terms or all previous terms
- Every term could be product of 2 or 3 or all previous terms
- Every term could be sum of squares or cubes of previous terms and so on.

Q. $2,2,4,8,32,X$
Q. $1,1,1,3,5,9,17,31,X$
Q. $1,2,5,29,866,X$

8) ALTERNATE TERMS ARE RELATED

Very often, consecutive terms are completely unrelated but alternate terms form pattern and run parallelly in same or different pattern.
For example:
$2,10,4,8,6,6,8,X$ – What is X?

- We have to identify the pattern in between alternate terms.

- Such pattern can be any of the standard ones – AP/GP, multiples, primes, squares, cubes, Fibonacci etc.

9) EACH TERM IS ISOLATED

Each term is independent of other terms but sequence is due to underlying number system like natural numbers, integers etc.

- n^{th} term is sum of $n^2 and\ n^3$
- n^{th} term is difference between $n^2 and\ n^3$

If nothing else works, each term can be independent of next or previous term. We've to find out what is it that makes each term special. This kind of pattern is then followed in the subsequent terms as well.

For instance:

$0,4,18,48,100,180, X$ – Each term is $(n^3 - n^2)$ for n = 1, 2, 3, 4, 5, 6

$4,9,25,47,121, X$ – Each term is a square of successive prime numbers

10) SEQUENCE OF ALPHABETS:

Sequence of English alphabets are arranged in some pattern in this type of questions. The pattern is mostly one of the following:

- **Group of 2/3/4/5 repeats or follows some pattern**

For example: abaababaababaab?baab; abcaaabca?ab; ab?abccbc?dcd?ed

- **Alternate alphabets are related**

For example: cfdgehfi?jh

- **Convert into corresponding numbers**

Often it clears the pattern when we convert alphabets into numbers.

For example: PQPQRPQRSPQRST? bcegkm?

11) ALGORITHM

Fundamentally, this chapter is about you identifying the pattern with your experience, knowledge with trial and error. We can still have following algorithm in mind to ease our troubles.

Is it sequence of numbers/alphabets

If numbers:

1. Is the sequence itself an AP/GP/primes/squares/cubes/multiples of some number
2. Difference between consecutive terms – check for all patterns
3. Check for pattern in alternate terms – do this first if alternate terms are close or consecutive terms are very far from each other
4. Division of consecutive terms (If numbers are decreasing and then increasing, check this first) – check for all patterns
5. If numbers are increasing too fast – check if numbers are multiplication or addition of previous 2/3/all terms; Check for squares and cubes or addition of squares and cubes

6. Try to study each isolated term to unearth something special about it – check if other terms follow this pattern – do this in the end (and after you finish attempting all other question)

If alphabets:

1. Check if only few alphabets are repeating or new alphabets are appearing in the pattern
2. If only few are there – try to see after how many terms the pattern repeats: check 2/3/4/5/6 term blocks for repetition. Pattern may start after initial few terms – check for it as well.
3. Check if alternate or after the gap of 2 letters, any pattern is forming
4. If new alphabets are appearing or if above doesn't work, convert alphabets into corresponding numbers and now check patterns as we check in numbers as well as any possible pairings

If both numbers and alphabets are there in the pattern:

1. Check if they follow separate pattern
2. Convert alphabets into corresponding numbers and find the pattern (alphabet may turn out to be digit at particular place value)

If there's a grid of numbers/alphabets given in the question:

1. Check if horizontal/vertical entries form any frequently appearing patterns
2. Check if any one entry of row/column is addition or multiplication or addition of squares/cubes of other entries of that row or column
3. Check if total addition or multiplication of each row or column is same
4. Check other possible clubbing like patterns in 2×2 grid from given larger grid

12) PYQS

CSE 2023: Consider the sequence ABC_ _ABC_DABBCD_ABCD that follows a certain pattern. Which of the following completes the sequence?
(a) DACB (b) CDAB (c) DCCA (d) DDCA

CSE 2023: What is the middle terms of the sequence Z, Z, Y, Y, Y, X, X, X, X, W, W, W, W, W,……..,A?
(a) H (b) I (c) J (d) M

CSE 2023: 40 children are standing in a circle and one of them (say child-1) has a ring. The ring is passed clockwise. Child-1passes on the child-2, child-2 passes on to child-4, child-4 passes on to child7 and so on. After how many such changes (including child-1) will the ring be in the hands of child-1 again?
(a) 14 (b) 15 (c) 16 (d) 17

CSE 2022: What is the value of X in the sequence 20, 10, 10, 15, 30, 75, X?
(a) 105
(b) 120
(c) 150
(d) 225

CSE 2022: In the series AABABCABCDABCDE.., which letter appears at the 100th place?
(a) G
(b) H
(c) I
(d) J

CSE 2022: What is the value of X in the sequence 2, 12, 36, 80, 150, X?
(a) 248
(b) 252
(c) 258
(d) 262

CSE 2021: Replace the incorrect term by the correct term in the given sequence
3, 2, 7, 4, 13, 10, 21, 18, 31, 28, 43, 40
where odd terms and even terms follow the same pattern.
(a) 0
(b) 1
(c) 3
(d) 6

CSE 2021: You are given two identical sequences in two rows:

Sequence-I:	8	4	6	15	52.5	236.5
Sequence-II:	5	A	B	C	D	E

Q. What is the entry in the place of C for the Sequence-II?
(a) 2.5
(b) 5
(c) 9.375
(d) 32.8125

CSE 2021: In the series_b_a_ba_b_abab_aab; fill in the six blanks (_) using one of the following given four choices such that the series follows a specific order.

(a) bababa

(b) baabba

(c) bbaabb

(d) ababab

CSE 2021: Consider the following statements:

1. The sum of 5 consecutive integers can be 100.
2. The product of three consecutive natural numbers can be equal to their sum.

Which of the above statements is/are correct?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

CSE 2021: What is the value of 'X' in the sequence 2, 7, 22, 67, 202, X, 1822?

(a) 603

(b) 605

(c) 607

(d) 608

CSE 2021: Following is a matrix of certain entries. The entries follow a certain trend row-wise. Choose the missing entry (?) accordingly.

7B	10A	3C
3C	9B	6A
10A	13C	?

(a) 9B

(b) 3A

(c) 3B

(d) 3C

CSE 2020: A simple mathematical operation in each number of sequences 14, 18, 20, 24, 30, 32, … results in a sequence with respect to prime numbers. Which one of the following is the next number in the sequence?

(a) 34

(b) 36

(c) 38

(d) 40

CSE 2020: One page is torn from a booklet whose pages are numbered in the usual manner starting from the first page as 1. The sum of the numbers on the remaining pages is 195. The torn page contains which of the following numbers.
(a) 5, 6
(b) 7, 8
(c) 9, 10
(d) 11, 12

CSE 2020: Consider the following arrangement that has some missing letters: abab_b_bcb_dcdcded_d the missing letters which complete the arrangement are
(a) a, b, c, d
(b) a, b, d, e
(c) a, c, c, e
(d) b, c, d, e

CSE 2019: What is X in the sequence 4, 196, 16, 144, 36, 100, 64, X?
(a) 48
(b) 64
(c) 125
(d) 256

CSE 2019: Consider the following sequence that follows some arrangement;
c_accaa_aa_bc_b
The letters that appear in the gaps are
(a) abba
(b) cbbb
(c) bbbb
(d) cccc

CSE 2018: Consider the sequence given below:
4/12/95, 1/1/96, 29/1/96, 26/2/96, ******
What is the next term of the series?
(a) 24/3/96
(b) 25/3/96
(c) 26/3/96
(d) 27/3/96

CSE 2018: What is the missing number X of the series 7, X, 21, 31, 43?
(a) 11
(b) 12
(c) 13
(d) 14

CSE 2015: Consider the following matrix:

3	8	10	2	?	1
6	56	90	2	20	0

What is the missing number?

(a) 5

(b) 0

(c) 7

(d) 3

CSE 2014: Consider the table given below in which the numbers bear certain relationship among themselves along the rows:

29	13	18
33	X	19
30	27	3

Which one of the following numbers is the missing number indicated above by X?

(a) 19

(b) 15

(c) 14

(d) 8

CSE 2013: Consider the following matrix:

3	370	7
2	224	6
1	730	X

X What is the number at 'X' in the above matrix?

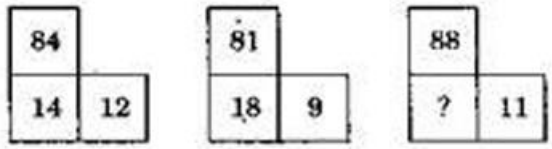
(a) 5

(b) 8

(c) 9

(d) 11

CSE 2013: Examine the following three figures in which the numbers follow a specific pattern:



The missing number (?) in the third figure above is

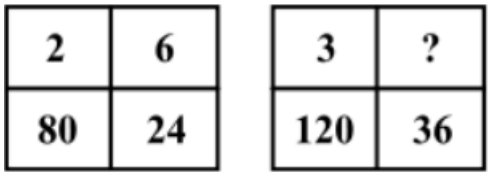
(a) 7

(b) 16

(c) 21

(d) 28

CSE 2011: Consider the following figures:



What is the missing number?

(a) 7

(b) 8

(c) 9

(d) 10

13) COMPREHENSION

An Indian military officer who fought for the Indian Peace Keeping Force (IPKF) in Sri Lanka and battled insurgencies in Nagaland now finds himself helming a different kind of mission: leading the United Nations and its 26 agencies in China. Siddharth Chatterjee's rise to becoming the UN Resident Coordinator for China — one of the agency's key global positions given Beijing's rising importance in the UN system — leaves a former Indian soldier in an unlikely position — the equivalent of a former PLA soldier guiding the UN's agencies in India. In his job, Mr. Chatterjee engages every day with senior Chinese Communist Party officials and assists China in achieving its development targets. In an interview, the National Defence Academy (NDA) graduate and former 10 Para special forces officer said he was himself surprised by how his military past did not matter to his Chinese hosts, either when he applied for the UN position in China or during the course of his work in the country, which happened to coincide with the worst period in India-China relations in decades following the tensions along the Line of Actual Control (LAC).

When the China vacancy came up, Mr. Chatterjee was in Kenya in 2020, and expected to continue working in Africa, where he had previously been posted in Darfur in Sudan, Somalia and South Sudan. "I doubted it was possible," he said, "but throughout the process, and in my stint here, my background has never been an issue. The Chinese have said to me, we see

you as an international civil servant, and their attitude has been completely professional. Even after 25 years in the UN system, I found this to be exceptional."

Q. Which of the following assumptions have been made in the passage?

1. Position in China is much more lucrative than that in Africa
2. Chinese and Indians would oppose appointment of retired military officials from other country even as part of international agencies

Chose the most appropriate option.

(a) 1 only
(b) 2 only
(c) Both 1 and 2
(d) Neither 1 nor 2

In India, over the last decade or so, labour has been departing agriculture, but is only going to construction and unregistered manufacturing which are not markedly better jobs. Services, where labour tends to be most productive, are not generating the additional jobs the country needs. India will need 24 million or so jobs over the next decade. The new sector, e-commerce, can at best close only half the jobs gap. Only those sectors that drive domestic demand such as health and education can comfortably fill the other half.

Q. Which one of the following is best implied in the passage?

(a) Strong measures need to be taken to reduce the rural to urban migration of labour.
(b) The working condition in construction and unregistered manufacturing needs to be improved.
(c) Service sector has been reducing the problem of unemployment.
(d) Increased social sector spending is imperative for large-scale job creation.

In India, the current focus on the right to privacy is based on some new realities of the digital age. A right is a substantive right only if it works in all situations, and for everyone. A right to free expression for an induvial about her exploitation, for instance, is meaningless without actual availability of security that guarantees that private force cannot be used to thwart this right. The role of the State, therefore, is not just to abstain from preventing rightful free expression, but also to actively ensure that private parties are not able to block it.

Q. On the basis of the above passage, the following assumptions have been made:

1. State should have some institutions to ensure its appropriate role in a digital society.
2. State should ensure that private parties do not violate the citizens' right to privacy.
3. Digital economy is not compatible with the idea of not violating the citizens' privacy.

Which of the above assumptions is/are valid?

(a) 1 and 2
(b) 3 only
(c) 1 and 3
(d) 2 only

The RBI has been intervening in the market — selling dollars from its foreign exchange kitty — to defend the rupee. Presumably, the effort is to prevent volatility but not target any specific exchange rate. Experience shows that any attempt to prop up the rupee against fundamentals will be a costly and futile endeavour. All the RBI can — and indeed should — do is to engineer the trajectory of the fall, not prevent the fall itself. There is in fact a good case for the RBI to allow some depreciation of the rupee. If that movement towards equilibrium is allowed, it will support exports, restrain non-oil imports, and help narrow the current account balance.

For sure, a weaker rupee will be inflationary, but the RBI should deal with that with its monetary policy as it already is doing. We live in a difficult world where macroeconomic management is hostage to global economic conditions. Former U.S. Treasury Secretary John B. Connally famously told his G-10 counterparts in 1971 that "the dollar is our currency, but it's your problem". That is even truer today because of deepened financial globalisation and the continuing hegemony of the dollar.

Q. Which of the following assumptions have been made by the author?

(a) RBI must contain the fall of the rupee using monetary policy rather than selling its forex
(b) Dollar's hegemony in the global economy needs to be halted
(c) Selling of forex is to contain exchange-rate volatility
(d) RBI cannot prevent fall of the rupee using any of the policy instruments