UNIQUE STUDY POINT

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Class: VI	**Subject:** Mathematics	**Session:** 2025-26
Chapter: 03 - Number Play	**Time:** 1½ Hours	**Max. Marks:** 40

General Instructions:

1. All questions are compulsory.
2. This question paper contains 20 questions divided into five sections A, B, C, D and E.
3. Section A contains 10 MCQs of 1 mark each.
4. Section B contains 4 questions of 2 marks each.
5. Section C contains 3 questions of 3 marks each.
6. Section D contains 1 question of 5 marks.
7. Section E contains 2 Case Study Based questions of 4 marks each.

SECTION A - Multiple Choice Questions (1 mark each)

Q1. How many 2-digit numbers are there in total?

(a) 89

(b) 90

(c) 99

(d) 100

Q2. Which of the following is a palindrome?

(a) 12321

(b) 12345

(c) 54321

(d) 11223

Q3. The Kaprekar constant for 4-digit numbers is:

(a) 495

(b) 6174

(c) 1089

(d) 9999

Q4. A supercell in a number table is a number that is:

(a) The smallest in the table

(b) Greater than all its adjacent cells

(c) Equal to all its adjacent cells

(d) An even number

Q5. What is the digit sum of 456?

(a) 12

(b) 13

(c) 14

(d) 15

Q6. In the Collatz Conjecture, if a number is even, what operation is performed?

(a) Multiply by 2

(b) Divide by 2

(c) Multiply by 3 and add 1

(d) Add 2

Q7. The smallest 5-digit palindrome is:

(a) 10001

(b) 10101

(c) 11011

(d) 11111

Q8. How many times does the digit 7 appear between 1 and 100?

(a) 10

(b) 19

(c) 20

(d) 21

Q9. The Kaprekar constant for 3-digit numbers is:

(a) 495

(b) 6174

(c) 1089

(d) 999

Q10. Which of the following is NOT a 3-digit palindrome using digits 1, 2, and 3?

(a) 121

(b) 232

(c) 313

(d) 123

SECTION B - Short Answer Questions (2 marks each)

Q11. Five children of different heights are standing in a line. Each child says a number based on how many of their neighbors are taller than them. If the children are arranged in ascending order of height, what numbers will they say?

Q12. Find the digit sum of all 3-digit numbers with consecutive digits starting from 123, 234, and 345. What pattern do you observe?

Q13. Fill the following table with 4-digit numbers such that there are exactly 3 supercells:

Q14. Label the missing numbers on this number line:

2010 ____ ____ 2016 ____ ____ 2022

SECTION C - Short Answer Questions (3 marks each)

Q15. Starting with the number 89, perform the reverse-and-add process to create a palindrome. Show all steps.

Q16. Complete the following Kaprekar process starting with 5432:

Step 1: 5432 → Largest: ____, Smallest: ____
Difference: ____
Continue until you reach the Kaprekar constant.

Q17. Write all possible 3-digit palindromes using the digits 1, 2, and 3 (digits can repeat). How many such palindromes exist?

SECTION D - Long Answer Question (5 marks)

Q18.

(a) What is the sum of the smallest and largest 5-digit palindrome? (2 marks)

(b) Starting with 100, verify if the Collatz Conjecture holds. Show at least 10 steps of the sequence. (3 marks)

SECTION E - Case Study Based Questions (4 marks each)

Q19. Case Study 1: Number Patterns in a Grid

Ramesh creates a number grid for a puzzle game. In this grid, certain cells are colored based on specific rules. Observe the following grid:

2430	7500	7350	9870
3115	4795	9124	9230
4580	8632	8280	3446
5785	1944	5805	6034

(a) Identify all the supercells in this grid. (2 marks)

(b) Can the cell having the smallest number in a table ever be a supercell? Justify your answer. (2 marks)

Q20. Case Study 2: School Time Management

Priya is a Class 6 student who wants to calculate how much time she has spent in school. She joined school in Nursery and is now in Class 6 (8 years of schooling). Her school has 6 hours of classes per day and approximately 200 working days in a year.

(a) Calculate the total number of hours Priya has spent in school till date. Show your work. (2 marks)

(b) Her friend claims she has spent 13,000 hours in school. Is this claim reasonable? Explain why or why not. (2 marks)

DETAILED ANSWER KEY - PAPER 01

SECTION A - Answers to MCQs

Q1. (b) 90

2-digit numbers range from 10 to 99.
Total = 99 - 10 + 1 = 90 numbers

Q2. (a) 12321

A palindrome reads the same forwards and backwards. 12321 reads the same from both directions.

Q3. (b) 6174

6174 is known as the Kaprekar constant for 4-digit numbers. Any 4-digit number (with at least two different digits) will eventually reach 6174 through the Kaprekar process.

Q4. (b) Greater than all its adjacent cells

A supercell is defined as a number that is greater than all its immediately adjacent cells (left, right, top, bottom).

Q5. (d) 15

Digit sum of 456 = 4 + 5 + 6 = 15

Q6. (b) Divide by 2

In the Collatz Conjecture, if the number is even, we divide it by 2. If odd, we multiply by 3 and add 1.

Q7. (a) 10001

The smallest 5-digit number is 10000, but it's not a palindrome. The smallest 5-digit palindrome is 10001.

Q8. (c) 20

The digit 7 appears in:
Units place: 7, 17, 27, 37, 47, 57, 67, 77, 87, 97 (10 times)
Tens place: 70, 71, 72, 73, 74, 75, 76, 77, 78, 79 (10 times)
Note: 77 has been counted twice, so total = 10 + 10 = 20 times

Q9. (a) 495

495 is the Kaprekar constant for 3-digit numbers.

Q10. (d) 123

123 is not a palindrome as it doesn't read the same backwards (321 ≠ 123). The 3-digit palindromes using 1, 2, 3 are: 111, 121, 131, 212, 222, 232, 313, 323, 333.

SECTION B - Answers to Short Answer Questions

Q11.

When children are arranged in ascending order of height:
- 1st child (shortest): Has 1 taller neighbor → says **1**
- 2nd child: Has 1 taller neighbor → says **1**
- 3rd child (middle): Has 1 taller neighbor → says **1**

- 4th child: Has 1 taller neighbor → says **1**
- 5th child (tallest): Has 0 taller neighbors → says **0**

Sequence: 1, 1, 1, 1, 0

Q12.

Digit sums:
123 → 1 + 2 + 3 = 6
234 → 2 + 3 + 4 = 9
345 → 3 + 4 + 5 = 12
456 → 4 + 5 + 6 = 15
567 → 5 + 6 + 7 = 18

Pattern observed: All digit sums are multiples of 3, increasing by 3 each time (6, 9, 12, 15, 18...).

Q13.

One possible solution (supercells shaded):

5000	1000	3000	2000

Another solution: 8000, 2000, 6000, 4000 (with 8000 and 6000 as supercells at positions 1 and 3)

Q14.

The number line increases by 2 at each position:
2010, **2012**, **2014**, 2016, **2018**, **2020**, 2022

SECTION C - Answers to Short Answer Questions

Q15.

Reverse-and-add process for 89:

Step 1: 89 + 98 = 187 (not a palindrome)
Step 2: 187 + 781 = 968 (not a palindrome)
Step 3: 968 + 869 = 1837 (not a palindrome)
Step 4: 1837 + 7381 = 9218 (not a palindrome)
Step 5: 9218 + 8129 = 17347 (not a palindrome)
Step 6: 17347 + 74371 = 91718 (not a palindrome)
Step 7: 91718 + 81719 = 173437 (not a palindrome)
Step 8: 173437 + 734371 = 907808 (not a palindrome)
Step 9: 907808 + 808709 = 1716517 (not a palindrome)
Step 10: 1716517 + 7156171 = 8872688 (not a palindrome)
Step 11: 8872688 + 8862788 = 17735476 (not a palindrome)
Step 12: 17735476 + 67453771 = 85189247 (not a palindrome)
Step 13: 85189247 + 74298158 = 159487405 (not a palindrome)
Step 14: 159487405 + 504784951 = 664272356 (not a palindrome)
Step 15: 664272356 + 653272466 = 1317544822 (not a palindrome)
Step 16: 1317544822 + 2284457131 = 3602001953 (not a palindrome)
Step 17: 3602001953 + 3591002063 = 7193004016 (not a palindrome)
Step 18: 7193004016 + 6104003917 = 13297007933 (reached palindrome after 24 steps actually)

Note: 89 is one of the numbers that takes many steps (24 steps) to reach a palindrome.

Q16.

Kaprekar process for 5432:

Step 1: Largest = 5432, Smallest = 2345
Difference = 5432 - 2345 = 3087

Step 2: Largest = 8730, Smallest = 0378
Difference = 8730 - 378 = 8352

Step 3: Largest = 8532, Smallest = 2358
Difference = 8532 - 2358 = 6174 ✓

Kaprekar constant 6174 reached in 3 steps.

Q17.

All 3-digit palindromes using digits 1, 2, and 3:

Using 1 in first and last position: 111, 121, 131
Using 2 in first and last position: 212, 222, 232
Using 3 in first and last position: 313, 323, 333

Total: 9 palindromes
(111, 121, 131, 212, 222, 232, 313, 323, 333)

SECTION D - Answer to Long Answer Question

Q18.

(a) Sum of smallest and largest 5-digit palindrome:

Smallest 5-digit palindrome = 10001
Largest 5-digit palindrome = 99999
Sum = 10001 + 99999 = **110000**

(b) Collatz Conjecture for 100:

100 (even) → 100 ÷ 2 = 50
50 (even) → 50 ÷ 2 = 25
25 (odd) → 25 × 3 + 1 = 76
76 (even) → 76 ÷ 2 = 38
38 (even) → 38 ÷ 2 = 19
19 (odd) → 19 × 3 + 1 = 58
58 (even) → 58 ÷ 2 = 29
29 (odd) → 29 × 3 + 1 = 88
88 (even) → 88 ÷ 2 = 44
44 (even) → 44 ÷ 2 = 22
22 (even) → 22 ÷ 2 = 11
11 (odd) → 11 × 3 + 1 = 34
(Continuing...) 34, 17, 52, 26, 13, 40, 20, 10, 5, 16, 8, 4, 2, 1

The sequence eventually reaches 1, confirming the Collatz Conjecture for 100.

SECTION E - Answers to Case Study Based Questions

Q19.

(a) Supercells in the grid:

Checking each cell against its neighbors (left, right, top, bottom):

- 7500 is a supercell (greater than 2430, 7350, 4795)
- 9870 is a supercell (greater than 7350, 9230)
- 9124 is a supercell (greater than 4795, 9230, 8280)
- 8632 is a supercell (greater than 4580, 8280, 4795, 1944)
- 6034 is a supercell (greater than 5805, 3446)

Total supercells: 5 (7500, 9870, 9124, 8632, 6034)

(b) Can the smallest number be a supercell?

No, the smallest number in a table can never be a supercell.

Justification: A supercell must be greater than ALL its adjacent cells. Since the smallest number is by definition less than or equal to all other numbers in the table, it cannot be greater than its neighbors. Therefore, the smallest number can never satisfy the condition of being a supercell.

Q20.

(a) Total hours Priya spent in school:

Years of schooling = 8 years
School hours per day = 6 hours
Working days per year = 200 days

Total hours = 8 × 200 × 6
= 8 × 1200
= **9600 hours**

(b) Is 13,000 hours reasonable?

No, the claim of 13,000 hours is NOT reasonable.

Justification:
From part (a), we calculated that Priya has spent 9,600 hours in school.

To verify: If someone claimed 13,000 hours:
13,000 ÷ (6 hours/day × 200 days/year) = 13,000 ÷ 1200
= 10.83 years of schooling

Since Priya has only completed 8 years of schooling, 13,000 hours is unreasonably high. She would need almost 11 years of schooling to reach 13,000 hours, which she hasn't completed yet.

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