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 3-digit numbers are there in total?

(a) 899

(b) 900

(c) 999

(d) 1000

Q2. What is the digit sum of 678?

(a) 19

(b) 20

(c) 21

(d) 22

Q3. Which of the following is the smallest 4-digit palindrome?

(a) 1000

(b) 1001

(c) 1010

(d) 1111

Q4. In the Collatz Conjecture, if a number is odd, what operation is performed?

(a) Divide by 2

(b) Multiply by 2

(c) Multiply by 3 and add 1

(d) Multiply by 3 and subtract 1

Q5. Can the smallest number in a supercell table be a supercell?

(a) Yes, always

(b) Yes, sometimes

(c) No, never
(d) Cannot be determined

Q6. What is the largest 5-digit number whose digit sum is 14?
(a) 95000
(b) 94100
(c) 93200
(d) 92300

Q7. How many times does the digit 3 appear between 1 and 50?
(a) 14
(b) 15
(c) 16
(d) 17

Q8. Which time on a 12-hour clock is a palindrome?
(a) 1:23
(b) 2:22
(c) 3:45
(d) 4:56

Q9. D.R. Kaprekar was a teacher in which place?
(a) Mumbai, Maharashtra
(b) Devlali, Maharashtra
(c) Pune, Maharashtra
(d) Nagpur, Maharashtra

Q10. In a row of 6 cells, what is the maximum number of supercells possible?
(a) 2
(b) 3
(c) 4
(d) 5

SECTION B - Short Answer Questions (2 marks each)

Q11. Starting with the number 47, show the first 5 steps of the reverse-and-add process. Does it form a palindrome within these steps?

Q12. Color or mark the supercells in the following table:

345	678	234	890	456

Q13. Find the digit sum of all 3-digit numbers from 100 to 105. What pattern do you observe?

Q14. Five children stand in line such that the sequence of numbers they say (based on taller neighbors) is 0, 1, 2, 1, 0. Draw or describe how they might be arranged by height.

SECTION C - Short Answer Questions (3 marks each)

Q15. Starting with 1980, perform the Kaprekar process and find how many rounds it takes to reach the Kaprekar constant. Show all steps clearly.

Q16. Verify the Collatz Conjecture for the number 27. Show all steps until you reach 1.

Q17. What is the difference between the largest and smallest 5-digit palindrome? Show your calculation.

SECTION D - Long Answer Question (5 marks)

Q18.

(a) Answer the following: (3 marks)

(i) Can 4-digit + 2-digit give a 6-digit sum? Explain.
(ii) Can 5-digit - 5-digit give a 5-digit difference? Give example.
(iii) Is "5-digit + 3-digit = 6-digit sum" always, sometimes, or never true?

(b) Create a number pattern using numbers between 20 and 50 that sums to 280. Show your pattern clearly. (2 marks)

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

Q19. Case Study 1: Digital Clock Patterns

Rahul is observing patterns on his digital clock. He notices some interesting times where digits repeat or form patterns.

On a 12-hour digital clock, he wants to find all the palindromic times (times that read the same forwards and backwards when written without the colon).

For example: 1:01 reads as 101 (palindrome), 12:21 reads as 1221 (palindrome)

(a) List all palindromic times between 1:00 and 12:59 on a 12-hour clock. (2 marks)

(b) How many such palindromic times are there in a 12-hour period? (2 marks)

Q20. Case Study 2: Estimation Challenge

A school library has multiple sections. The librarian needs to estimate the total number of books:

- Fiction section: Approximately 45 shelves with about 35 books per shelf
- Non-fiction section: Approximately 30 shelves with about 40 books per shelf
- Reference section: Approximately 15 shelves with about 25 books per shelf

(a) Estimate the total number of books in the library. Show your calculation. (2 marks)

(b) If each book costs approximately ₹250, estimate the total value of all books in the library. Is this a reasonable approach for estimation? Explain. (2 marks)

DETAILED ANSWER KEY - PAPER 03

SECTION A - Answers to MCQs

Q1. (b) 900

3-digit numbers range from 100 to 999.
Total = 999 - 100 + 1 = 900 numbers

Q2. (c) 21

Digit sum of 678 = 6 + 7 + 8 = 21

Q3. (b) 1001

The smallest 4-digit number is 1000, but it's not a palindrome.
The smallest 4-digit palindrome is 1001 (reads same forwards and backwards).

Q4. (c) Multiply by 3 and add 1

In the Collatz Conjecture:
• If number is even → divide by 2
• If number is odd → multiply by 3 and add 1

Q5. (c) No, never

The smallest number cannot be a supercell because a supercell must be greater than all its adjacent cells.
The smallest number, by definition, cannot be greater than any other number in the table.

Q6. (a) 95000

To get the largest 5-digit number with digit sum 14:
Start with 9 (largest digit), then 5, then zeros
9 + 5 + 0 + 0 + 0 = 14
Therefore, 95000 is the largest.

Q7. (b) 15

Digit 3 appears in:
Units place: 3, 13, 23, 33, 43 (5 times)
Tens place: 30, 31, 32, 33, 34, 35, 36, 37, 38, 39 (10 times)
Note: 33 has been counted twice
Total = 5 + 10 = 15 times

Q8. (b) 2:22

2:22 written as 222 is a palindrome.
Other palindromic times: 1:01, 1:11, 2:02, 3:03, 3:33, etc.

Q9. (b) Devlali, Maharashtra

D.R. Kaprekar was a mathematics teacher in a government school in Devlali, Maharashtra, where he discovered the famous Kaprekar constant in 1949.

Q10. (b) 3

For a row of n cells:
• If n is even: maximum supercells = n/2
• If n is odd: maximum supercells = (n+1)/2

For 6 cells: 6/2 = 3 supercells maximum

SECTION B - Answers to Short Answer Questions

Q11.

Reverse-and-add process for 47:

Step 1: 47 + 74 = 121 (Palindrome! ✓)

Yes, it forms a palindrome in just 1 step. 121 reads the same forwards and backwards.

Q12.

Supercells marked:

345	678	234	890	456

Explanation:

• 678 > 345 and 678 > 234 → Supercell ✓

• 890 > 234 and 890 > 456 → Supercell ✓

Total supercells: 2

Q13.

Digit sums from 100 to 105:

100 → 1 + 0 + 0 = 1

101 → 1 + 0 + 1 = 2

102 → 1 + 0 + 2 = 3

103 → 1 + 0 + 3 = 4

104 → 1 + 0 + 4 = 5

105 → 1 + 0 + 5 = 6

Pattern observed: The digit sums form a consecutive sequence (1, 2, 3, 4, 5, 6), increasing by 1 each time because only the units digit is changing.

Q14.

Sequence: 0, 1, 2, 1, 0

This sequence indicates the children are arranged in ascending order up to the middle, then descending:

Arrangement (S=Shortest, T=Tallest):

Position 1 (Shortest): 0 taller neighbors

Position 2 (Short): 1 taller neighbor (middle child)

Position 3 (Tallest/Middle): 2 taller neighbors (none, this is tallest)

Actually, let me reconsider: 0, 1, 2, 1, 0

Correct arrangement:

Shortest → Medium-Short → Tallest (middle) → Medium-Tall → Short

The middle child is the tallest, and height decreases towards both ends, creating a mountain/pyramid shape.

SECTION C - Answers to Short Answer Questions

Q15.

Kaprekar process for 1980:

Round 1:

Digits: 1, 9, 8, 0

Largest: 9810, Smallest: 0189

9810 - 189 = 9621

Round 2:

Largest: 9621, Smallest: 1269

9621 - 1269 = 8352

Round 3:

Largest: 8532, Smallest: 2358

8532 - 2358 = 6174 ✓

Answer: It takes 3 rounds to reach the Kaprekar constant 6174.

Q16.

Collatz Conjecture for 27:

27 (odd) → 27 × 3 + 1 = 82

82 (even) → 82 ÷ 2 = 41

41 (odd) → 41 × 3 + 1 = 124

124 (even) → 124 ÷ 2 = 62

62 (even) → 62 ÷ 2 = 31

31 (odd) → 31 × 3 + 1 = 94

94 (even) → 94 ÷ 2 = 47

47 (odd) → 47 × 3 + 1 = 142

142 (even) → 142 ÷ 2 = 71

71 (odd) → 71 × 3 + 1 = 214

214 (even) → 214 ÷ 2 = 107

107 (odd) → 107 × 3 + 1 = 322

322 (even) → 322 ÷ 2 = 161

161 (odd) → 161 × 3 + 1 = 484

484 (even) → 484 ÷ 2 = 242

242 (even) → 242 ÷ 2 = 121

121 (odd) → 121 × 3 + 1 = 364

364 (even) → 364 ÷ 2 = 182

(Continuing...) 182, 91, 274, 137, 412, 206, 103, 310, 155, 466, 233, 700, 350, 175, 526, 263, 790, 395, 1186, 593, 1780, 890, 445, 1336, 668, 334, 167, 502, 251, 754, 377, 1132, 566, 283, 850, 425, 1276, 638, 319, 958, 479, 1438, 719, 2158, 1079, 3238, 1619, 4858, 2429, 7288, 3644, 1822, 911, 2734, 1367, 4102, 2051, 6154, 3077, 9232, 4616, 2308, 1154, 577, 1732, 866, 433, 1300, 650, 325, 976, 488, 244, 122, 61, 184, 92, 46, 23, 70, 35, 106, 53, 160, 80, 40, 20, 10, 5, 16, 8, 4, 2, 1 ✓

The sequence eventually reaches 1, confirming the Collatz Conjecture for 27.

Q17.

Calculation:

Largest 5-digit palindrome = 99999

Smallest 5-digit palindrome = 10001

Difference = 99999 - 10001

= 89998

Answer: The difference is 89,998

SECTION D - Answer to Long Answer Question

Q18.

(a) Answer the following:

(i) Can 4-digit + 2-digit give a 6-digit sum?

No, it's impossible.

Even the largest 4-digit and 2-digit numbers:

9999 + 99 = 10,098 (only 5 digits)

Therefore, a 6-digit sum is never possible.

(ii) Can 5-digit - 5-digit give a 5-digit difference?

Yes, sometimes.

Example: 99,999 - 10,000 = 89,999 (5-digit) ✓

But: 10,500 - 10,000 = 500 (3-digit)

It depends on the numbers chosen.

(iii) Is "5-digit + 3-digit = 6-digit sum" always, sometimes, or never true?

Sometimes true.

Example 1: 99,999 + 999 = 100,998 (6-digit) ✓

Example 2: 10,000 + 100 = 10,100 (5-digit)

It's only true when the sum exceeds 99,999.

(b) Number pattern summing to 280:

One possible pattern:

40	40	40	40
30	30	30	30

Calculation: (40 × 4) + (30 × 4) = 160 + 120 = 280 ✓

Alternative pattern:

Using 35 eight times: 35 × 8 = 280 ✓

SECTION E - Answers to Case Study Based Questions

Q19.

(a) All palindromic times between 1:00 and 12:59:

Palindromic times (written without colon):

1:01 (101) ✓
1:11 (111) ✓
2:02 (202) ✓
2:12 (212) ✓
2:22 (222) ✓
2:32 (232) ✓
2:42 (242) ✓
2:52 (252) ✓
3:03 (303) ✓
3:13 (313) ✓
3:23 (323) ✓
3:33 (333) ✓
3:43 (343) ✓
3:53 (353) ✓
4:04 (404) ✓
4:14 (414) ✓
4:24 (424) ✓
4:34 (434) ✓
4:44 (444) ✓
4:54 (454) ✓
5:05 (505) ✓
5:15 (515) ✓
5:25 (525) ✓
5:35 (535) ✓
5:45 (545) ✓
5:55 (555) ✓
10:01 (1001) ✓
11:11 (1111) ✓
12:21 (1221) ✓

(b) Total count:

Total palindromic times in 12-hour period: 29

Q20.

(a) Estimate total number of books:

Fiction section: 45 shelves × 35 books = 1,575 books
Non-fiction section: 30 shelves × 40 books = 1,200 books
Reference section: 15 shelves × 25 books = 375 books

Total estimated books = 1,575 + 1,200 + 375
= 3,150 books

(b) Estimate total value and reasonableness:

Total books = 3,150
Cost per book = ₹250

Estimated total value = 3,150 × 250
= ₹787,500

Is this reasonable?
Partially reasonable, but has limitations:

Pros:
• Gives a quick ballpark figure
• Easy to calculate
• Useful for rough budgeting

Cons:
• Not all books cost the same
• Reference books are often more expensive
• Fiction books vary widely in price
• Old books may have different values

Better approach: Estimate different average prices for each section (e.g., fiction ₹200, non-fiction ₹300, reference ₹400) for more accuracy.
