

UNIQUE STUDY POINT

By Sumeet Sahu

www.uniquestudyonline.com

Unique Study Point, Amitesh Nagar, Indore, MP | Contact: 8103405051

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 4-digit numbers are there in total?
(a) 8999
(b) 9000
(c) 9999
(d) 10000
- Q2.** What is the largest 4-digit palindrome?
(a) 9999
(b) 9889
(c) 9779
(d) 1001
- Q3.** In a supercell table, the cell with the largest number will:
(a) Never be a supercell
(b) Always be a supercell
(c) Sometimes be a supercell
(d) Cannot be determined
- Q4.** What is the digit sum of 789?
(a) 22
(b) 23
(c) 24
(d) 25
- Q5.** Which number pattern does NOT follow the Collatz Conjecture?
(a) None - all numbers follow it
(b) Even numbers only

- (c) Odd numbers only
- (d) Numbers ending in 5

Q6. How many 5-digit numbers are there?

- (a) 90000
- (b) 89999
- (c) 99999
- (d) 100000

Q7. The reverse-and-add process for creating palindromes was demonstrated with which number that takes many steps?

- (a) 12
- (b) 89
- (c) 45
- (d) 67

Q8. If five children of different heights stand in descending order of height, what will be the sequence of numbers they say?

- (a) 0, 1, 1, 1, 1
- (b) 1, 1, 1, 1, 0
- (c) 2, 2, 2, 2, 0
- (d) 0, 1, 2, 1, 0

Q9. What is the smallest number whose digit sum is 14?

- (a) 59
- (b) 68
- (c) 77
- (d) 86

Q10. D.R. Kaprekar discovered the Kaprekar constant in which year?

- (a) 1937
- (b) 1949
- (c) 1955
- (d) 1960

SECTION B - Short Answer Questions (2 marks each)

Q11. In a row of 9 cells, what is the maximum number of supercells possible? Explain your reasoning.

Q12. Write a 5-digit number and two 3-digit numbers such that their sum is 18,670. Show your calculation.

Q13. Identify and label all the missing numbers on this number line:

15,077 ____ ____ ____ 15,081 ____ 15,083

Q14. Find the digit sums of all numbers from 40 to 45. What do you observe about these sums?

SECTION C - Short Answer Questions (3 marks each)

Q15. Starting with the number 5683, perform the Kaprekar process. How many rounds does it take to reach the Kaprekar constant? Show all steps.

Q16. Create a 2×4 grid (total 8 cells) using 3-digit numbers between 100 and 1000 such that you get exactly

4 supercells. No number should repeat.

Q17. The time now is 10:01. How many minutes until the clock shows the next palindromic time? What is the palindromic time after that, and how many minutes from 10:01 will it be?

SECTION D - Long Answer Question (5 marks)

Q18.

(a) Write one example each for the following scenarios: (3 marks)

- (i) 5-digit + 5-digit giving a 5-digit sum more than 90,250
- (ii) 5-digit - 5-digit giving a 3-digit difference
- (iii) 4-digit + 4-digit giving a 6-digit sum

(b) Is the statement "5-digit number - 2-digit number gives a 3-digit number" always true, sometimes true, or never true? Justify your answer with examples. (2 marks)

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

Q19. Case Study 1: The Game of 21

Ravi and Meera are playing a number game. The rules are:

- The first player says 1, 2, or 3
- Players take turns adding 1, 2, or 3 to the previous number
- The first player to reach 21 wins

Ravi goes first and says "1". Now it's Meera's turn.

(a) If Meera wants to follow the winning strategy, what numbers should she aim to say during the game? List the pattern of numbers. (2 marks)

(b) Can the second player always win if they play correctly? Explain the winning strategy. (2 marks)

Q20. Case Study 2: Birthday Dates

Manish and his sister Meghana have special birthdays. Manish's birthday is 20/12/2012 where the digits '2', '0', '1', and '2' repeat in that order. Meghana's birthday is 11/02/2011 where the digits read the same from left to right and from right to left (palindrome date).

(a) Find three more dates from 2001 to 2030 that follow Manish's pattern (digits repeating in the same order). (2 marks)

(b) Find three palindrome dates like Meghana's from 2001 to 2030. (2 marks)

Made with ♥ by Sumeet Sahu

Unique Study Point, Amitesh Nagar, Indore, MP

Website: uniquetudyonline.com

DETAILED ANSWER KEY - PAPER 02

SECTION A - Answers to MCQs

Q1. (b) 9000

4-digit numbers range from 1000 to 9999.
Total = $9999 - 1000 + 1 = 9000$ numbers

Q2. (a) 9999

9999 is the largest 4-digit number and it is also a palindrome (reads the same forwards and backwards).

Q3. (b) Always be a supercell

The cell with the largest number will always be a supercell because it will always be greater than all its adjacent cells, satisfying the definition of a supercell.

Q4. (c) 24

Digit sum of 789 = $7 + 8 + 9 = 24$

Q5. (a) None - all numbers follow it

The Collatz Conjecture states that ALL positive integers will eventually reach 1 when following the process. While this is unproven, no counterexample has been found. All tested numbers follow the conjecture.

Q6. (a) 90000

5-digit numbers range from 10,000 to 99,999.
Total = $99,999 - 10,000 + 1 = 90,000$ numbers

Q7. (b) 89

The number 89 is famous for taking 24 steps in the reverse-and-add process before reaching a palindrome.

Q8. (a) 0, 1, 1, 1, 1

In descending order of height:
- Tallest child (at start): 0 taller neighbors → says 0
- 2nd child: 1 taller neighbor → says 1
- 3rd child: 1 taller neighbor → says 1
- 4th child: 1 taller neighbor → says 1
- Shortest child (at end): 1 taller neighbor → says 1
Sequence: 0, 1, 1, 1, 1

Q9. (a) 59

To get the smallest number with digit sum 14, we maximize the first digit and minimize subsequent digits:
 $5 + 9 = 14$
Therefore, 59 is the smallest number with digit sum 14.

Q10. (b) 1949

D.R. Kaprekar discovered the fascinating Kaprekar constant (6174) in 1949 while working as a mathematics teacher in Devlali, Maharashtra.

SECTION B - Answers to Short Answer Questions

Q11.

Maximum supercells in 9 cells:

For a row of n cells, the maximum number of supercells = $(n+1)/2$ for odd n

For 9 cells: $(9+1)/2 = 5$ supercells maximum

Reasoning: To maximize supercells, we place them alternately. Starting with a supercell, we get:

Position: 1 (supercell), 2 (smaller), 3 (supercell), 4 (smaller), 5 (supercell), 6 (smaller), 7 (supercell), 8 (smaller), 9 (supercell)

Example: 900, 100, 800, 200, 700, 300, 600, 400, 500

Maximum: 5 supercells

Q12.

One possible solution:

5-digit number: 18,000

First 3-digit number: 400

Second 3-digit number: 270

Sum = $18,000 + 400 + 270 = 18,670$ ✓

Other valid solutions:

- $17,500 + 800 + 370 = 18,670$
- $17,000 + 900 + 770 = 18,670$
- $16,000 + 999 + 1,671...$ (Wait, 1,671 is 4-digit)
- $10,000 + 4,335 + 4,335 = 18,670$

Q13.

The number line increases by 1 at each position:

15,077, 15,078, 15,079, 15,080, 15,081, 15,082, 15,083

Q14.

Digit sums from 40 to 45:

$$40 \rightarrow 4 + 0 = 4$$

$$41 \rightarrow 4 + 1 = 5$$

$$42 \rightarrow 4 + 2 = 6$$

$$43 \rightarrow 4 + 3 = 7$$

$$44 \rightarrow 4 + 4 = 8$$

$$45 \rightarrow 4 + 5 = 9$$

Observation: The digit sums form a consecutive sequence (4, 5, 6, 7, 8, 9), increasing by 1 each time. This happens because the tens digit remains constant (4) while the units digit increases by 1.

SECTION C - Answers to Short Answer Questions

Q15.

Kaprekar process for 5683:

Round 1:

Largest: 8653, Smallest: 3568
 $8653 - 3568 = 5085$

Round 2:

Largest: 8550, Smallest: 0558
 $8550 - 558 = 7992$

Round 3:

Largest: 9972, Smallest: 2799
 $9972 - 2799 = 7173$

Round 4:

Largest: 7731, Smallest: 1377
 $7731 - 1377 = 6354$

Round 5:

Largest: 6543, Smallest: 3456
 $6543 - 3456 = 3087$

Round 6:

Largest: 8730, Smallest: 0378
 $8730 - 378 = 8352$

Round 7:

Largest: 8532, Smallest: 2358
 $8532 - 2358 = 6174 \checkmark$

Answer: It takes 7 rounds to reach the Kaprekar constant 6174.

Q16.

One possible solution (supercells marked with *):

900*	200	700*	300
150	600*	250	500*

Verification:

- $900 > 200$ (right) and 150 (below) → Supercell ✓
- $700 > 200$ (left), 300 (right), and 250 (below) → Supercell ✓
- $600 > 150$ (left), 250 (right), and 200 (above) → Supercell ✓
- $500 > 250$ (left) and 300 (above) → Supercell ✓

Total: 4 supercells achieved

Q17.

Starting time: 10:01

Next palindromic time: 11:11

Time difference: From 10:01 to 11:11
 $= 1 \text{ hour } 10 \text{ minutes} = \mathbf{70 \text{ minutes}}$

Palindromic time after that: 12:21

Time difference: From 10:01 to 12:21

= 2 hours 20 minutes = **140 minutes**

SECTION D - Answer to Long Answer Question

Q18.

(a) Examples for given scenarios:

(i) 5-digit + 5-digit = 5-digit sum > 90,250:

Example: $45,000 + 45,300 = 90,300$

$90,300 > 90,250$ ✓

(ii) 5-digit - 5-digit = 3-digit difference:

Example: $50,999 - 50,100 = 899$

899 is a 3-digit number ✓

Alternative: $10,500 - 10,001 = 499$

(iii) 4-digit + 4-digit = 6-digit sum:

This is NOT POSSIBLE.

Even the sum of the two largest 4-digit numbers:

$9,999 + 9,999 = 19,998$ (only 5 digits)

Therefore, no example exists for this scenario.

(b) Is "5-digit - 2-digit = 3-digit" always, sometimes, or never true?

Answer: NEVER TRUE

Justification:

Smallest 5-digit number = 10,000

Largest 2-digit number = 99

Even in the most extreme case:

$10,000 - 99 = 9,901$ (4-digit number)

Since even the smallest 5-digit number minus the largest 2-digit number gives a 4-digit result, it's impossible to get a 3-digit difference.

Additional example:

$99,999 - 10 = 99,989$ (5-digit number)

The statement is **NEVER TRUE** - the result will always be at least a 4-digit number.

SECTION E - Answers to Case Study Based Questions

Q19.

(a) Winning strategy numbers for Meera:

If Meera wants to win, she should aim to say these key numbers:

5, 9, 13, 17, 21

Reasoning: These numbers are all 4 apart. If Meera reaches any of these "magic numbers," she can always win because:

- From 17, whatever Ravi adds (1, 2, or 3), Meera can make it to 21
- From 13, Meera can always reach 17
- From 9, Meera can always reach 13
- From 5, Meera can always reach 9

Since Ravi started with 1, Meera should respond with 4 or 5 (adding 3 or 4... but she can only add 1-3, so she adds 3 to make it 4, or better yet adds to make 5).

(b) Can the second player always win?

No, the FIRST player can always win if they play correctly.

Winning strategy for first player:

The first player should say 1, and then ensure they always say the numbers: 1, 5, 9, 13, 17, 21

Pattern: Keep the total at multiples of 4 plus 1 (1, 5, 9, 13, 17, 21)

Whatever the opponent adds (1, 2, or 3), the first player adds just enough to make the total the next multiple of 4 plus 1:

- If opponent adds 1, you add 3
- If opponent adds 2, you add 2
- If opponent adds 3, you add 1

By following this strategy, the first player will always reach 21 and win.

Q20.

(a) Three dates following Manish's pattern (20/12/2012):

Pattern: The digits repeat in the same order in date/month/year
20/12/2012 → digits are 2, 0, 1, 2 repeating

Three more such dates:

1. **10/10/1010** → Not in range (too old)
2. **20/02/2002** → digits 2, 0, 0, 2
3. **20/04/2004** → digits 2, 0, 0, 4
4. **20/06/2006** → digits 2, 0, 0, 6
5. **20/08/2008** → digits 2, 0, 0, 8
6. **10/10/1010** → Too old
7. **12/12/1212** → Too old

Best answers: 20/02/2002, 20/04/2004, 20/06/2006

(b) Three palindrome dates like Meghana's (11/02/2011):

Palindrome dates read the same forwards and backwards.

11/02/2011 → 11022011 reads same both ways

Three more palindrome dates (2001-2030):

1. **01/02/2010** → 01022010 (palindrome)

2. **02/02/2020** → 02022020 (palindrome)

3. **03/02/2030** → 03022030 (palindrome)

Additional ones:

4. 10/02/2001 → 10022001

5. 20/02/2002 → 20022002

6. 21/02/2012 → 21022012

Made with ♥ by Sumeet Sahu

Unique Study Point, Amitesh Nagar, Indore, MP

Website: uniquestudyonline.com