

CHAPTER 6 : NUMBER PLAY

SUMMARY OF CONCEPTS



1. NUMBERS TELL US THINGS

A sequence can be represented by numbers showing a rule or pattern.

Example Rule:

Each child calls out the number of people in front of them who are taller than them.



0 0 1 0 3 0 3

Key Observations

- First person always says 0.
- Tallest person always says 0.
- Largest number said can be $(n - 1)$ in a group of n people.

2. PICKING PARITY

Parity means whether a number is EVEN or ODD.



Even Numbers

Can be arranged in pairs.



Examples:

2, 4, 6, 8, ...

Odd Numbers

Cannot be arranged in pairs.



Examples:

1, 3, 5, 7, ...

Important Parity Rules

- even + even = even
- odd + odd = even
- even + odd = odd
- even - even = even
- odd - odd = even
- even - odd = odd
- odd - even = odd

Helpful Facts

- Sum of two consecutive numbers is always odd.
- Sum of any two odd numbers is even.
- Sum of numbers 1 to $2n$ is even.

3. SUMS IN GRIDS & MAGIC SQUARES

Row and column sums help us check if a grid can be filled.

Example:

4	7	5	16
6	1	2	9
3	9	8	20
13	17	15	

Key Points

- In a 3×3 grid with numbers 1 - 9:
 - Each row sum = 15
 - Each column sum = 15
 - Total of all row or column sums = 45
- A magic square is a square grid in which each row, column and diagonal has the same sum.

General Form (with centre number m)

$m + 3$	$m - 4$	$m + 1$
$m - 2$	m	$m + 2$
$m - 1$	$m + 4$	$m - 3$

Magic sum
= $3m$
(three times the centre number)

4. VIRAHĀṆKA-FIBONACCI NUMBERS

The sequence : 1, 2, 3, 5, 8, 13, 21, 34, 55, ...

Rule:

Each number is the sum of the two previous numbers.

- Discovered in India in the context of poetry (rhythms of short (1 beat) and long (2 beats) syllables).
- First described by Virahāṅka (around 700 CE).
- Later known in the West as Fibonacci numbers.
- Appears in nature (flowers, leaves, pinecones, etc.), art, architecture and science.

Parity Pattern

Odd, Even, Odd, Odd, Even, Odd, Odd, Even, ...

1 2 3 5 8 13 21 34 55 89 ...
O E O O E O O E O E ...



5. CRYPTARITHMS (DIGITS IN DISGUISE)

Digits are replaced by letters.
Each letter stands for a digit (0 - 9).
Use logical reasoning to find the digits.

Example 1

$$\begin{array}{r} T \\ + T \\ \hline UT \end{array}$$

Solution:

$T = 5, U = 1$
Because
 $5 + 5 = 10$
 $5 + 5 + 5 = 15$
 $\rightarrow UT = 15$

Example 2

$$\begin{array}{r} K2 \\ + K2 \\ \hline HMM \end{array}$$

Solution:

$K = 6, M = 2, H = 1$
 $62 + 62 = 124$

Other Examples

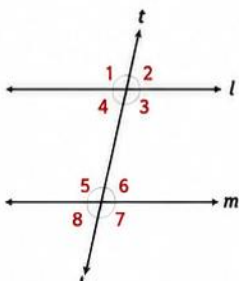
$$\begin{array}{r} YY \ B5 \\ + Z \ + 3D \\ \hline ZOO \ ED5 \end{array}$$

$$\begin{array}{r} KP \ C1 \\ + KP \ + C \\ \hline PRR \ 1FF \end{array}$$

6. IMPORTANT DEFINITIONS

- **Intersecting lines** : Lines that meet at a point.
- **Linear pair** : A pair of adjacent angles on a straight line; their sum is 180° .
- **Vertically opposite angles** : Opposite angles formed when two lines intersect; they are equal.
- **Perpendicular lines** : Two lines that intersect at right angles (90°).
- **Parallel lines** : Lines on the same plane that never meet, however far they are extended.
- **Transversal** : A line that intersects two (or more) lines at distinct points.
- **Corresponding angles** : Angles in the same relative position at each intersection.
- **Alternate angles** : Angles on opposite sides of the transversal and between the two lines.
- **Interior angles on the same side** : Angles between the two lines on the same side of the transversal; their sum is 180° .

7. KEY PROPERTIES (TRANSVERSALS & PARALLEL LINES)



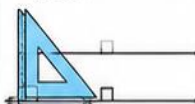
Properties

- ✓ If $l \parallel m$, then corresponding angles are equal.
($1 = 5, 2 = 6, 3 = 7, 4 = 8$)
- ✓ If corresponding angles are equal, then $l \parallel m$.
- ✓ Alternate angles are equal.
($3 = 5, 4 = 6$)
- ✓ Interior angles on the same side are supplementary.
($3 + 6 = 180^\circ, 4 + 5 = 180^\circ$)

8. DRAWING PARALLEL LINES

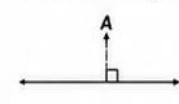
Using Set Square

1. Draw a line l .
2. Place set square against l .
3. Slide it along a ruler and draw a line $\perp l$.
4. Two $\perp$ lines to l are parallel.



Through a Point A

1. Draw l .
2. Draw a line $\perp l$.
3. Through point A on this line, draw another $\perp$ line.
4. This new line is $\parallel$ to l .



9. REAL LIFE CONNECTIONS



Railway tracks are parallel.



Window frames have perpendicular horizontal & vertical lines.



Zebra crossings have parallel white lines.



Stair rails and steps show parallel & perpendicular lines.



REMEMBER!

Think of parity before adding or subtracting.

Check row/column sums before filling a grid.

Use patterns to extend sequences.

Look for relationships in positions of angles.

Use logic in cryptarithms!

WORKSHEET-1

a) 76 b) 81 c) 89 d) 90

MCQs (PART-2) ($10 \times 1 = 10$ marks)

11. Five consecutive numbers are added together. Which of the following is always true about their sum?
- a) It is always even. b) It is always odd.
c) It is always a multiple of 5. d) It is always prime.
12. Which expression always gives an even number for every whole number n ?
- a) $4n + 1$ b) $6n + 5$ c) $8n + 2$ d) $3n + 2$
13. A rectangle has 21 rows and 14 columns of unit squares. The total number of unit squares is:
- a) Odd b) Even c) Prime d) Cannot be determined
14. If one term in the Virahāṅka (Fibonacci) sequence is **55** and the previous term is **34**, the next term will be:
- a) 79 b) 88 c) 89 d) 90
15. Which of the following can **never** be the sum of four odd numbers?
- a) 28 b) 32 c) 30 d) 31
16. In a 3×3 magic square formed using nine consecutive numbers, if every entry is increased by **4**, the new magic sum increases by:
- a) 4 b) 8 c) 12 d) 16
17. Which of the following expressions represents all odd numbers?
- a) $2n$ b) $2n - 1$ c) $4n$ d) $6n$
18. A staircase has 6 steps. A child can climb either 1 step or 2 steps at a time. Which sequence helps determine the number of possible ways?
- a) Prime numbers b) Square numbers
c) Virahāṅka (Fibonacci) numbers d) Multiples of 6
19. A number puzzle replaces digits with letters, where each letter always represents the same digit. such puzzles are called:
- a) Sudoku b) Cryptarithms c) Tangrams d) Magic Triangles
20. Three odd numbers are added together. Which statement is always true?
- a) The sum is even. b) The sum is odd.
c) The sum is divisible by 4. d) The sum is prime.

WORKSHEET-2

Section B: Short Answer Questions ($10 \times 2 = 20$ Marks)

1. What is meant by parity?

2. Find the parity of: (a) Even + Even (b) Odd + Odd

3. What is the largest number possible in a group of 8 people in the height-arrangement activity?

4. Find the parity of: (a) Even – Even (b) Odd – Odd

5. What is the parity of the number of small squares in a 27×13 grid?

6. Write an expression that always gives odd numbers.

7. Write the formula for the n th even number.

8. Write the formula for the n th odd number.

9. Write the first six terms of the Virahāṅka sequence.

10. What is a magic square?

Section C: Short Answer Questions ($6 \times 3 = 18$ Marks)

11. Find the parity of:

- (a) Sum of 2 even numbers and 2 odd numbers
- (b) Sum of 2 odd numbers and 3 even numbers

12. Lakpa has an odd number of ₹1 coins, an odd number of ₹5 coins and an even number of ₹10 coins. Can the total amount be ₹205? Give reason.

13. Find the parity of the number of small squares in:

(a) 42×78 grid

(b) 135×654 grid

14. Write the next four terms: 1, 2, 3, 5, 8, 13, 21, 34, 55,

15. Explain why the magic sum of a 3×3 magic square using numbers 1–9 is 15.

16. What is the 100th odd number?

Section D: Long Answer Questions ($4 \times 5 = 20$ Marks)

17. A light bulb is ON. Dorjee toggles its switch 77 times. Will the bulb be ON or OFF? Explain.

18. The consecutive Virahāṅka numbers are 987 and 1597. Find:

- (i) Next two terms (ii) Previous two terms

19. Angaan wants to climb an 8-step staircase and can take either 1 step or 2 steps at a time. In how many different ways can he reach the top?

20. Solve the cryptarithm:

$$\begin{array}{r} \text{UT} \\ + \text{TA} \\ \hline \text{TAT} \end{array}$$

Section E: Case Study Based Questions ($2 \times 4 = 8$ Marks)

21. Magic Square

A 3×3 magic square is formed using numbers 1 to 9.

- (i) What number must be at the centre?
- (ii) What is the magic sum?

22. Virahāṅka Numbers

The sequence is 1, 2, 3, 5, 8, 13, 21, 34, 55, ...

- (i) What is the next term?
- (ii) What rule is used to obtain the next term?

Self Assessment:

I understood all the concepts:

☐ Yes

☐ No

I need more practice:

☐ Yes

☐ No

Name of Concepts having doubts/Not Cleared: _____

Parent's Assessment:

My ward understood all the concepts

☐ Yes

☐ No

He/She needs more practice

☐ Yes

☐ No

Name of Concepts having doubts/Not Cleared: _____

Signature of Parent:

Teacher's Assessment:

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Answers of Worksheet-1

Q.No.	1	2	3	4	5	6	7	8	9	10
Ans	b	b	b	b	b	c	c	c	b	c
Q.No.	11	12	13	14	15	16	17	18	19	20
Ans	c	c	b	c	d	c	b	c	b	b

Answers of Worksheet-2

Q.No.	1	2	3	4	5
Ans	Explanation	(a) Even (b) Even	7	(a) Even (b) Even	Odd
	6	7	8	9	10
Ans	$2x + 1$ or $2x - 1$	$2n$	$2n - 1$	1,1,2,3,5,8	Explanation
Q.No.	11	12	13	14	15
Ans	(a) Even (b) Even	No, Reason	(a) Even (b) Even	89 144 233 377	Explanation
Q.No.	16	17	18	19	20
Ans	199	Off, Explanation	(i)2584, 4181 (ii) 610, 377	34 different ways	$U = 9$ $T = 1$ $A = 0$
Q.No.	21	22			
Ans	(i)5 (ii) 15	(i) 89 (ii) Add previous two terms			