

Fully Revised

Shraddha Singh

MATHS OLYMPIAD

International Mathematics Olympiad

3

Number
System

Strictly according
to the latest
syllabus of Maths
Olympiad

Multiplication

Time

Fractions

Patterns

Geometrical
Shapes

Odd One
Out

Weight

Coding
Decoding

The
Gen X
Series

A SUCCESS PACKAGE FOR ASPIRANTS OF MATHS OLYMPIAD

IMO

INTERNATIONAL
MATHEMATICS
OLYMPIAD



Shraddha Singh



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PUBLISHER'S NOTE

V&S Publishers, after the grand success of a number of Academic and General books, is pleased to bring out a series of *Mathematics Olympiad books* under *The Gen X series – generating Xcellence in generation X* – which has been designed to focus the problems faced by students. In all books the concepts have been explained clearly through examples, illustrations and diagrams wherever required. The contents have been developed to meet specific needs of students who aspire to get distinctions in the field of mathematics and want to become Olympiad champs at national and international levels.

To go through Maths Olympiad, the students need to do thorough study of topics covered in the *Olympiad syllabus and those covered in the school syllabus as well*. The Olympiads not only tests subjective knowledge but Reasoning skills of students also. So students are required to comprehend the depth of concepts and problems and gain experience through practice. The Olympiad check efficiency of candidates in problem solving. These exams are conducted in different stages at regional, national, and international levels. At each stage of the test, the candidate should be fully prepared to go through the exam. Therefore, this test requires careful attention towards comprehension of concepts, thorough practice, and application of rules.

While other books in market focus selectively on questions or theory; V&S Maths Olympiad books are rather comprehensive. Each book of this series has been divided into four sections namely *Mathematics, Logical Reasoning, Achievers section, Model Papers*. The theory has been explained through solved examples. To enhance the problem solving skills of candidates, *Multiple Choice Questions (MCQs)* with detailed solutions are given at the end of each chapter. Two *Mock Test Papers* have been included to understand the pattern of exam. A CD containing Study Chart for systematic preparation, Tips & Tricks to crack Maths Olympiad, Pattern of exam, and links of Previous Years Papers is accompanied with this book. The books are also useful for various other competitive exams such as NTSE, NSTSE, and SLTSE as well.

We wish you all success in the examination and a very bright future in the field of mathematics.

All the best

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SECTION 1

MATHEMATICAL

REASONING



Unit-1 : Number System



Learning Objectives : In this unit, we will learn about:

- Numerals
- Skip Counting
- Face Value
- Place Value
- Expanded Form
- Number Name
- Ascending Order
- Descending Order
- Number Sense (4 Digit Numbers)
- Even and Odd Numbers
- Regional Numerals

Numerals

The digits 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9 are used to form numbers or numerals. These digits are called ones. The numerals formed by the digits 1, 2, 3, 4, 5, 6, 7, 8 and 9 are known as Hindu Arabic numbers.

Skip Counting

Skip counting is counting forward or backward by any number that is not 1. It helps us to count quickly and makes learning of table easier.

Example : Skip counting by 2 is 2, 4, 6, 8, 10

Skip count backward

Count in 3s

30, 27, 24, 21, 18

Skip count forward

Count in 4s

100, 104, 108, 112

Face Value

Face value of a digit in a given number is the digit itself. In the number 452, the face value of 4 is 4, the face value of 5 is 5 and the face value of 2 is 2.

Place Value

The place value of a digit in a given number is the digit multiplied by its place.

Example : Write place value of digit in 264.

Hundreds	Tens	Ones
↓	↓	↓
2	6	4

Place value of 2 = $2 \times 100 = 200$

Place value of 6 = $6 \times 10 = 60$

Place value of 4 = $4 \times 1 = 4$

Expanded Form

If a number is written as the sum of the place value of its digits, then it is said to be in expanded form.

Example : Write the expanded form of 356.

Solution : $356 = 3 \text{ hundreds} + 5 \text{ tens} + 6 \text{ ones}$
 $= 3 \times 100 + 5 \times 10 + 6 \times 1$
 $= 300 + 50 + 6$

Number Names

Number	Number Names
10	Ten
20	Twenty
50	Fifty
100	Hundred
500	Five Hundred
1000	One Thousand
5000	Five Thousand
10,000	Ten Thousand

Ascending Order

Arranging the given numbers from the smallest to the greatest is called ascending or increasing order.

Descending Order

Arranging the given numbers from the greatest to the smallest is called descending or decreasing order.

Example : Arrange these numbers in descending order and ascending order.

Solution : Here 475 576 311 999 78

$$999 > 576 > 475 > 311 > 78$$

Decreasing order is 999, 576, 475, 311, 78 and

Ascending order is 78 , 311, 475, 576, 999

Number Sense (4 Digit Numbers)

We know that there are ten digits: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9. Numbers are written using these digits. These digits are called ones.

The greatest 3 digit number is 999. It can be written as

$$\begin{aligned} 999 &= 900 + 90 + 9 \\ &= 9 \text{ Hundreds} + 9 \text{ tens} + 9 \text{ ones} \end{aligned}$$

Add 1 to 999 to make a 4 digit number $1 + 999 = 1000$

It is the smallest number of four digits. 1000 is the successor of 999.

Even and Odd Numbers

Even numbers

The numbers having 0, 2, 4, 6 at ones place are called even numbers .

Odd numbers

The numbers having 1, 3, 5, 7 at ones place are called odd numbers.

Odd numbers – 11, 13, 15, 19, 23

Even numbers – 12, 20, 30, 36

Properties of odd and even numbers

1. When we add an even number to an odd number the answer is always an odd number.

$$\begin{array}{cccc} \text{Example :} & 2 & + & 3 & = & 5 \\ & \text{Even} & & \text{Odd} & & \text{Odd} \end{array}$$

2. When we add an odd number to an odd number the answer is always an even number.

$$\begin{array}{cccc} \text{Example :} & 3 & + & 5 & = & 8 \\ & \text{odd} & & \text{odd} & & \text{even} \end{array}$$

3. When we add two even numbers, the answer is always an even number.

$$\begin{array}{cccc} \text{Example :} & 2 & + & 4 & = & 6 \\ & \text{Even} & & \text{even} & & \text{even} \end{array}$$

Regional Numerals

Numbers can be written by using different symbols. The numbers represented by particular symbols are known as the digits of the system. Number is an idea whereas the symbols used to represent the numbers are called numerals.

Multiple Choice Questions

1. Which one of the following is the smallest number?
 A. 3116 B. 3316
 C. 3211 D. 3361
2. The place value of 8 in 978353 is
 A. 8000 B. 800
 C. 80 D. 8
3. Which one of the following is correct?
 A. $425 < 238$
 B. $9467 > 853$
 C. $750 < 915$
 D. $525 < 425$
4. The sum of two even numbers is
 A. an even number
 B. an add number
 C. both (i) and (ii)
 D. none of these
5. Which place value is used to prove that 5487 is less than 5874?
 A. Ones place
 B. Tens place
 C. Hundreds place
 D. Thousand place
6. Which one of the following is an even number?
 A. 733 B. 550
 C. 241 D. 89
7. Matching of columns
- | Column I | Column II |
|------------------------------|------------|
| (1) $7000 + 400 + 20 + 6$ | (i) 7067 |
| (2) $7000 + 400 + 0 + 6 + 0$ | (ii) 766 |
| (3) $700 + 60 + 6$ | (iii) 7406 |
| (4) $7000 + 0 + 60 + 6 + 7$ | (iv) 7426 |
- A. 1 – i, 2 – ii, 3 – iii, 4 – iv
 B. 1 – ii, 2 – iii, 3 – i, 4 – iv
 C. 1 – iv, 2 – iii, 3 – ii, – 4 i
 D. 1 – ii, 2 – iv, 3 – iii, 4 – i
8. A man bought 20 mangoes and distributes them to Sanjay, Ravi, and Vijay. Sanjay gets 5, Ravi gets 6 and Vijay gets _____ mangoes.
 A. 6 B. 7
 C. 8 D. 9
9. The largest 3 digit number is
 A. 999 B. 899
 C. 889 D. 988
10. Find the odd one out .
 14, 2, 12, 5, 10
 A. 2 B. 5
 C. 10 D. 14
- Direction (11-12) :** A box contains two dozen bananas, 2 apples, 1 pineapple and half dozen mangoes.
11. The total number of fruits in the box are _____.
 A. 21 B. 31
 C. 27 D. 33

12. If three more bananas are added to these fruits, then the total number of fruits in the box will be _____.
- A. 1 Dozen B. 3 Dozen
C. 25 D. 26
13. The largest digit number which is even and is a multiple of 3 is _____.
- A. 999 B. 102
C. 888 D. 199
14. The sum of numbers from 1 to 12 is _____.
- A. 78 B. 59
C. 73 D. 71
15. Rahul has 961 coins with her. Write 9671 in words.
- A. Seven hundred ninety six
B. Seven hundred sixty nine
C. Nine hundred seventy one
D. Nine hundred sixty one
16. What is the face value of the underlined digit in the number given below
38, 455.
- A. Four B. Five
C. Three D. Eight
17. What is the expanded form of given number 12,554?
- A. $12 + 5 + 5 + 4$
B. $12,000 + 500 + 50 + 4$
C. $1200 + 54 + 5$
D. $1200 + 50 + 45$
18. Find the greatest three digit number from the following ;
- 341, 199, 111, 627, 245
- A. 341 B. 627
C. 199 D. 245
19. Find the smallest three digit number from the following :
- 341, 199, 111, 627, 245
- A. 627 B. 111
C. 245 D. 199
20. Choose the correct option :
- A. $371 > 231$ B. $591 < 326$
C. $140 > 200$ D. $529 = 226$
- Direction (21-25) :** In a group, there are 6 people i.e. grandfather, grandmother, father, mother, a boy and a girl. The age of the boy is 2 years. The girl is 3 years older than boy. Father's age is 7 times the age of the girl. Mother is three years younger than father. Grandfather's age is thirty times the age of the boy and grandmother is eleven times the age of the girl.
21. The age of grandmother is _____.
- A. 50 years B. 55 years
C. 60 years D. 65 years
22. The difference between age of grandfather and grandmother is _____.
- A. 05 years B. 10 years
C. 15 years D. None of these
23. Which of the following statement is true?
- A. Age of mother is 40 years
B. Age of father is 48 years
C. Grandfather is 18 years older than mot
D. Age of father is 35 years
24. The age of grandfather is _____.
- A. 50 years B. 55 years
C. 60 years D. 65 years

25. How many members in the family are aged more than 43 but less than 65?

- A. 01 B. 04
C. 02 D. 03

Direction (26-27) : Consider the following numbers to answer the questions :

4 17 9 45 22 19 12 34

26. If numbers are to be selected from the above list such that odd numbers are to be picked in ascending order, then what would be the sequence of numbers?

- A. 4, 12, 22, 34
B. 9, 17, 19, 45
C. 34, 22, 12, 4
D. 45, 19, 17, 9

27. If numbers are to be selected from the above list such that even numbers are to be picked in descending order, then what would be the sequence of numbers?

- A. 4, 12, 22, 34
B. 9, 17, 19, 45
C. 34, 22, 12, 4
D. 45, 19, 17, 9

Consider the following scenario to answer Questions (28-32) :

In a class in year 2011, there were 55 students out of which 30 are girls. Two more new boys joined the class from 2012.

28. The total numbers of boys in the class in 2012 were _____.

- A. 20 B. 30
C. 27 D. 55

29. The total numbers of boys in the class in 2011 were _____.

- A. 22 B. 25
C. 27 D. 55

30. What was the strength of the class in 2011?

- A. 50 B. 85
C. 65 D. 55

31. In year 2013, 3 girls leave and 1 more boy joined the class. What will be the strength of the class in 2013?

- A. 57 B. 55
C. 58 D. 61

32. The total numbers of girls in the class in year 2013 are _____.

- A. 27 B. 30
A. 40 B. 25

Answer Key

1. A	2. A	3. B	4. A	5. C	6. B	7. C	8. D
9. A	10. B	11. D	12. B	13. B	14. A	15. D	16. A
17. B	18. B	19. B	20. A	21. B	22. A	23. D	24. C
25. C	26. B	27. C	28. C	29. B	30. D	31. B	32. A