

Wonderland of Numbers

Vol. I



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SULTAN CHAND & SONS

WONDERLAND of NUMBERS

(VOLUME – 1)

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Preface

To The First Edition

Numbers are used to collect information relating to crimes, military strength, population, wealth, etc. for devising military and fiscal policies. They are of fundamental importance in various diversified fields such as agriculture, industry, planning, economics, business management, finance, insurance, health services, banking, accountancy and auditing, and so on. Numbers are used by the government or business or management organisations in planning future programmes and formulating policy decisions. We use numbers all the time, right from getting up in the morning to going to bed at night. There are hardly any times when we are not surrounded by numbers. In today's world, numbers are indispensable in every nook and corner of our social, professional as well as personal and private life (telephones number, house number, pan card, aadhaar card, credit card, ATM card, etc.) It is rather impossible to think of any sphere of human activity where numbers do not creep in. Throughout history, numbers had a tremendous effect on our culture. *It seems that numbers rule the universe. Infact the numbers dictate our lives.*

*“Mathematics is the queen of sciences and number theory,
the queen of mathematics”* — Carl Friedrich Gauss

Shakuntala Devi, the great Indian mathematician and so called ‘Human Computer’, said:

*“Without mathematics there is nothing you can do.
Everything around you is mathematics.
Everything around you is numbers”.*

It is generally said that:

“Mathematics is a dull, dry and boring subject”,
and does not find favour with most of the students and the public at large.

Our main objective in writing this book is to dispel these aspersions on mathematics. We believe that mathematics is very interesting and exciting subject. There is inherent beauty in mathematics, which only mathematics loving people can see, as the saying goes:

“Beauty lies in the eyes of the beholder”.

Prof. G.H. Hardy of Cambridge University said, *“There is no permanent place for ugly mathematics in the world”.*

It is said that *“if there is God, he is a great mathematician”.*

“Mathematics is the language with which God has written the Universe”. — Galileo

This book is intended for the school children in particular and the general public at large. In fact this book is for anybody, really : young or old; rich or poor, it does not matter — even for those who are not so enthusiastic about mathematics. The only requirement is that one should be well versed in the four basic operations of arithmetic, viz., addition, subtraction, multiplication and division. Knowledge of mathematics upto high school level will be quite helpful and beyond that an added qualification.

Keeping in mind the varied requirements at different levels (of people w.r.t. knowledge of mathematics), an attempt has been made to start with the explanation of elementaries of a topic and then the complexities have been explained and solved in a lucid manner. A number of illustrations have been given and explained in a simple manner to enable the reader to have a better and thoughtful understanding of the basic concepts of theory and its applications. At many places, explanation, remarks/notes, scattered here and there throughout the book, have been given to widen the reader's horizon. Proper reasoning, logic and short proofs (not requiring rigorous mathematics) have been given to satisfy the inquisitive minds — for answering how and why.

The book gives an exciting, stimulating and adventurous voyage of exploration into the realm of numbers.

Numbers + Imagination = New Ideas

New Ideas + Imagination = Great Fun

“WELCOME TO THE WONDERLAND OF NUMBERS”

The book demonstrates that mathematics cannot be separated from meaning and that numbers have semantic content that makes them easier to handle.

It is hoped that the book will increase the readers' appreciation for the inherent beauty that can be seen in mathematics and they will find mathematics more and more interesting and enjoyable.

The book contains Eight Chapters.

In Chapter 1, we have given a brief history of the development of various '*Numeration Systems*' all over the world and the classification of the numbers into natural numbers, integers, rational and irrational numbers, real and complex numbers, etc. We have also discussed briefly various important results, theorems and terminology used in addition, subtraction, multiplication and division. Moreover, we have also given briefly the basic concepts of some mathematical topics taught in school.

Chapter 2 is devoted to the digits (0, 1, 2, ..., 9), together with many interesting and fascinating informations concerning them, viz.,

- (i) their mathematical properties,
- (ii) their common usage in day-do-day life,
- (iii) their religious, cultural and mythological significance,
- (iv) their use in various branches of science, viz., physics, chemistry, biology, physiology, etc.,
- (v) their use in various diverse fields such as sports, movies, literature, history, etc.

Each digit reveals new excitement and delight.

In Chapter 3, '*Mathematical Tricks*', we have given number of mathematical tricks based on the numbers and the four basic arithmetical operations, viz., addition, subtraction, multiplication and division. After mastering these tricks you can amaze your friends, family members or the audience by some real '*number magic*' and claim to possess some extra sensory powers of predictions and telepathy, and look like a mathematical wizard whose brain is a mega fast calculator.

In Chapter 4, ‘*Some Interesting Numbers*’, we have described in detail some numbers which we thought to be more interesting than others because of their *unique, fascinating and exciting* properties. For example,

- (i) Amazing Number ‘1089’,
- (ii) Revolving Number ‘142857’,
- (iii) Fibonacci Numbers and Golden Ratio,
- (iv) Ramanujan Number ‘1729’,
- (v) Beast Number ‘666’, etc.,

to mention only a few.

In Chapter 5, ‘*Arithmetic Potpourri (Marvels in Arithmetic)*’, we have discussed briefly a potpourri (or an assortment) of a number of beautiful flowers selected from the garden of mathematics in the form of some interesting topics, problem or results, primarily concerning numbers and their connection with various other areas of mathematics. These are bound to give you an insight into the inherent beauty in mathematics.

In Chapter 6, ‘*Square Numbers*’, we have given the geometric interpretation of square numbers, their important properties, algebraic formulae and the beautiful patterns exhibited by them. We also discussed briefly the conditions under which any positive integer can be expressed as:

- (a) The difference of two squares of integers.
- (b) The sum of two squares of integers.

Chapter 7 is devoted to the study of ‘*Cube Numbers*’ — their important properties, algebraic formulae and the beautiful patterns exhibited by them. Moreover Ramanujan’s Number, Taxi-Cab Numbers and Cab-Taxi Numbers are also discussed in brief.

In Chapter 8, ‘*Srinivasa Ramanujan*’, we have given a brief life history of the great Indian mathematical genius ‘Srinivasa Ramanujan’ and some of his important contributions to the world of mathematics.

We unreservedly acknowledge our deep debt of gratitude we owe to the numerous authors whose great and masterly works we have consulted during the preparation of the book.

We take this opportunity to express our sincere gratitude to Prof. Kamal Nain Kapoor for his valuable help in the preparation of this book, and number of friends, and near and dear ones for their constant encouragement to write this book. A special thanks is due to Ms. Alisha Mahajan for her help in designing the cover page and icons for various chapters.

Last but not the least, we express our deep sense of gratitude to our publisher M/s Sultan Chand and Sons, Darya Ganj, New Delhi, particularly Shri Pratap Vaish, Dr. Shubhra and Smt. Shikha for their untiring efforts and unfailing courtesy and cooperation in bringing out this book in such an elegant form.

An attempt has been made to eliminate the mistakes and printing errors as far as possible. We shall be obliged if any such errors are brought to our notice. Valuable suggestions and criticism for the improvement of the book will be highly appreciated and duly incorporated in subsequent editions.

August 2021

S.C. GUPTA , ALKA MAHAJAN
VIKAS GUPTA , VISHAL GUPTA

Plato said, “*God is a Geometer*”. Jacobi changed it to, “*God is an arithmetician*”. Then came Kronecker and fashioned the memorable expression, “*God created the natural numbers, and all the rest is the work of man*”.

— *Felix Klein*

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About the Book

The book, a result of extensive research on numbers is intended for the general public - even for those who are not so enthusiastic about mathematics. It conveys the message that mathematics is a very exciting and interesting subject. Numbers possess some amazing properties which will not only amaze you but also provide thrill, excitement, fun and keep you spell bound. The mathematical ideas in the book provide hours, days and months, if not years of "entertaining numbers". Moreover, it will also result in increasing the general knowledge of the readers. The book takes you through a thrilling, stimulating and adventurous voyage of exploration into the realm of numbers.

Numbers + imagination = New ideas;
New ideas + imagination = Great fun,
"Welcome to the Wonderland of Numbers"

S.C. Gupta, was an eminent and dedicated faculty member of Hindu College, University of Delhi since 1963 and retired in 2002 as Associate Professor in Statistics. His teaching career spanned over four decades. A well established author of international repute, he has written books on Mathematical Statistics, Fundamentals of Statistics, Applied Statistics, Business Statistics, Engineering Mathematics and Matrices. For the last few years he had developed special passion for numbers and researched them extensively, resulting in this book for the general public.



Alka Mahajan, a Statistics major from Delhi University, has 15+ years of experience of working as a mathematics teacher in international schools, both in India and England. She has done Montessori Teacher Training from MMI, London and is certified Primary Years Programme (PYP) International Baccalaureate from Cambridge University. She has an unparalleled ability to explain complicated concepts in an easy understandable manner, making this book engaging and fun for learners of all ages.

Vikas Gupta, a technology professional, IT leader and an author has a brilliant academic record; Master of Computer Applications and B.Sc. Hons. in Mathematics from Delhi University. He has done executive MBA from Cass Business School, University of London and is currently working as Business Head with Motherson Infotech and Solutions UK Ltd. (MIND) and lives in Reading (Berkshire), UK. He is also the co-author of the books: "Problems and Solutions in Mathematical Statistics" and "Mathematics Digest X".



Vishal Gupta, B.E. (Computer Science), is a young executive in a top multinational IT consulting firm. As a software engineer, he is passionate about applying the principles of software engineering along with his love for mathematics in designing, developing and maintaining computer software. His love for analysing games and puzzles led him down this journey to explore and discover the magic of numbers. He brings a unique perspective exploring numbers from a non-mathematical point of view and helps examine them in comfort without fear, usually associated with mathematics.

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