

MATHEMATICS QUIZ BOOK

Rajiv Garg
M.Sc., M.Tech.



PUSTAK MAHAL®

MATHEMATICS

QUIZ BOOK

Rajeev Garg, M.Sc., M.Tech.

~~PUSTAK MAHAL~~



Publishers

Pustak Mahal®

© **Pustak Mahal, New Delhi**

ISBN 978-81-223-0363-6

Edition: 2010

The Copyright of this book, as well as all matter contained herein (including illustrations) rests with the Publishers. No person shall copy the name of the book, its title design, matter and illustrations in any form and in any language, totally or partially or in any distorted form. Anybody doing so shall face legal action and will be responsible for damages.

Preface

The study of mathematics has dealt with the ideas and assumptions about those concepts with which mathematics starts. Mathematics, commonly abbreviated to Maths or Math — has now become the interdisciplinary tool to all science. The subject was earlier regarded as an intricate one that could be mastered only by the elite of the scholarly world.

But, since 1900 — foundational investigations have come to include an inquiry into the nature of mathematical theories and scope of mathematical methods. Now, contrary to the earlier notion, anyone with a taste of figures and interest in reading can find a vast enjoyment in basic mathematics in solving mathematical problems related to every branch of science. This book tells all about.

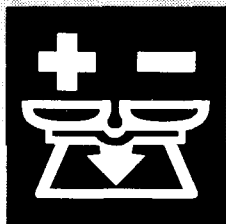
The present volume has now been revised and re-structured keeping in view of the latest trends involving the adoption of user-friendly computers in solving complex mathematical problems including the wide spectrum of related areas. It is particularly formulated with an aim to make mathematics interesting for younger generation and children.

The book has been divided under 28 chapters namely, the branches of mathematics, history of mathematics, ancient and modern numerals, set theory, arithmetics, algebra, geometry (plane, solid and analytical) trigonometry, vector analysis, famous mathematicians, contribution of Indian mathematicians, computer and mathematics, units measurement and common mathematical formulae etc.

The new edition has been re-designed in a simple question-answer form accompanied with several illustrations to make the matter reader-friendly, easy and interesting.

Although written for the benefit of teenagers and children, we hope this book will also be useful for other interested readers on the subject.

— Publishers



Contents

1. Branches of Mathematics	9
2. The History of Numerals	15
3. Modern Numerals	23
4. Binary Numerals	33
5. Set Theory	47
6. Arithmetic	54
7. Algebra	58
8. Plane Geometry	66
9. Solid Geometry	79
10. Analytical and Non-Euclidean Geometry	87
11. Vector Analysis	94
12. Trigonometry	100
13. Calculus	107
14. Statistics	113

15. Probability	121
16. Logic and Game Theory	127
17. Mathematical Tools and Instruments	132
18. Computer and Mathematics	141
19. Famous People in Mathematics	154
20. Mathematicians of India	163
21. Uses of Mathematics	167
22. Miscellany	172
23. Mathematical Brain Twisters	184
24. Units and Measurement System	194
25. Fun with Numbers	202
26. Mathematical Signs and Symbols	207
27. Measure for Measure	209
28. Common Formulae	212



1.

Branches of Mathematics

What is mathematics?

The word mathematics comes from the Greek word “*mathematika*”, meaning “things that are learned”. For ancient Greeks, mathematics included not only the study of numbers and space but also astronomy and music. Nowadays, astronomy and music are not included in mathematics. In fact, it is the interdisciplinary tool of science.

What are the two main branches of mathematics?

Mathematics is divided into two major branches: Pure mathematics and Applied mathematics. Pure mathematics is the study of quantities and their relationship, while applied mathematics is the use of pure mathematics to solve practical problems.

What are the main branches of pure and applied mathematics?

The main branches of pure mathematics are arithmetic, algebra, plane geometry, solid geometry, analytical geometry, Non-Euclidean geometry, trigonometry, calculus, etc. The main branches of applied mathematics are statics, computers, dynamics, hydrostatics, statistics, optics and atomic studies etc.

What is arithmetic?

Arithmetic is used to solve problems using numbers. It comes from a Greek word — “*arithmos*” meaning the science of number. It is the oldest and simplest branch of mathematics. The fundamental operations of arithmetic are addition, subtraction, multiplication and division.

What do we study in algebra?

Algebra deals with the whole group of numbers by means of symbols. Letters are used as symbols for numbers. Algebra uses equations and inequalities in solving problems. Sometimes algebra is also known as “Generalized Arithmetics.”

What is fluid dynamics?

It deals with the motion of bodies in liquids and gases.

What is geometry?

It is a branch of mathematics, concerned with the properties of space, usually in terms of plane (two dimensional) and solid (three dimensional) figures. (Fig. 1.1)

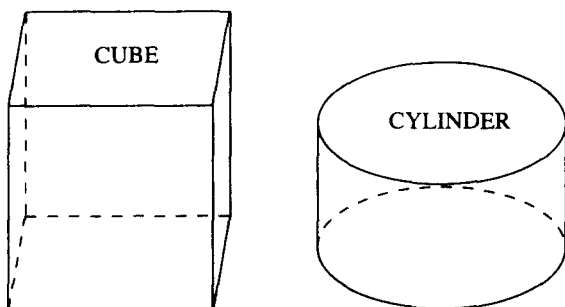


Fig. 1.1 Some geometrical figures

What do we study in trigonometry?

Trigonometry is concerned with the triangle measurement. It makes use of the ratios of the sides of the triangle. It is of practical importance in navigating surveying and simple harmonic motion in physics.

What is analytical geometry?

It deals with generalized numbers and space relationship. In analytical geometry we study plane and solid shapes with the help of coordinates. In analytical geometry problems are solved using algebraic methods. It is also called coordinate geometry.

What is calculus?

It deals with the study of different functions. It requires a knowledge of algebra, trigonometry and geometry. The two main branches of calculus are: Integral calculus and Differential calculus.

Define integral calculus and differential calculus.

Integral calculus deals with the method of summation or adding together the effects of continuously varying quantities, while differential calculus deals in a similar way with rates of change.

What do we study in biometry?

Biometry literally is the measurement of living things, but generally used to mean the application of mathematics to biology. The term is now largely obsolete, since mathematical and statistical works are the integral parts of most biological disciplines.

What is demography?

The study related to population statistics is called demography.

What is statistics?

Statistics is a branch of mathematics concerned with the manipulation of numerical information. It has two branches: descriptive statistics, dealing with the classification and presentation of data and analytical statistics, which studies the ways of collecting data, its analysis and interpretation. Sampling is the fundamental to statistics.

What is statics?

Statics is an applied branch of mathematics which deals with the mathematics and physics of the bodies at rest. It deals with the forces acting on structures.

What is dynamics?

Dynamics is the mathematical and physical study of the behaviour of bodies under the action of forces that produce changes of motion in them.

What is hydrostatics?

It deals with the properties and behaviour of liquids, specially the forces in liquids at rest.

What is aerodynamics?

It deals with the motion of bodies in air. It is closely related to aeronautics because it studies the flight of aeroplanes and other machines that are heavier than air. (Fig. 1.2).

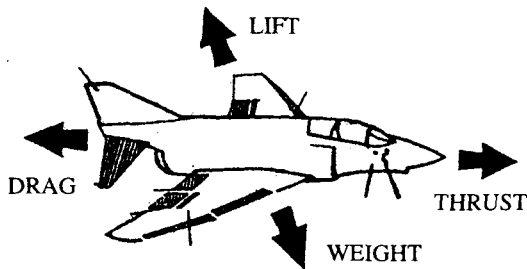


Fig. 1.2 Aerodynamics

What is hydrodynamics?

It deals with the motion of bodies in liquids. Hydro stands for water and dynamics for motion.

What is dimensional analysis?

Dimensional analysis deals with the dimensions of physical quantities such as mass (M), length (L) and time (T) and the derived units are obtainable by multiplication or division from such quantities.

With which branch of mathematics the system analysis is associated?

The system analysis is associated with computer science.

What is econometrics?

The application of mathematics and statistics to solve the problems of economics is called econometrics.

How do we define logic and theory of games?

The logic and the theory of games are two fields of mathematics concerned with the study of decision making. Logic and game theory are closely related and, in some circumstances, a combination of both may be required.

What is topology?

Topology is a branch of geometry concerned with general transformation of shapes in which certain correspondence between points is preserved. Topology mainly deals with surfaces. (Fig. 1.3).

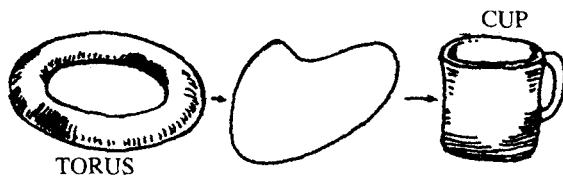


Fig. 1.3 Examples of Topology

What is numerical analysis?

Numerical analysis is the general study of methods for solving complicated problems using basic operations of arithmetic. Development of digital computers has made numerical analysis a very important area of applied mathematics.

What is Linear programming?

Linear programming is a mathematical modelling technique useful for guiding quantitative decisions in business planning, industrial engineering and in the social and physical sciences. It is of recent origin but has become an important part of applied mathematics.

What is operational research?

It is a branch of mathematics which makes use of scientific methods to the management and administration of organised military, governmental, commercial and industrial systems.

What is number theory?

It is the branch of mathematics concerned with the abstract study of the structure of number systems and the properties of positive integers of natural numbers such as 1, 2, 3, 4.

What is mathematical theory of optimisation?

Mathematical theory of optimisation is a technique of improving or increasing the value of some numerical quantity that in practice may take

the form of temperature, air flow, speed, pay off in a game, information, monetary profit and the like.,

How do we define Probability?

The branch of mathematics which expresses chance in number statements is called probability. For example, if a person tosses a coin, there are two ways it can fall, head or tail. So probability or chance of getting a tail or head in a toss of a coin is one half.

Which branch of science belongs to both physics and mathematics?

Computer science belongs to both physics and mathematics. This deals with the structure and operation of computer systems, their underlying design and programming principles and techniques for the practical implementation of computer hardware and software in various areas.

Which branch of mathematics deals with informations?

Information theory. It is the branch of mathematics which deals with the transmission and processing of information. It was developed by an American engineer Claude E. Shannon in 1948. It has been found very useful in automation of communication systems.

What is matrix in mathematics?

Matrix in mathematics, is a square or rectangular array of elements. They are a means of condensing information about mathematical systems and can be used for among other things, solving of simultaneous linear equations.



2.

The History of Numerals

How did our ancestors count the things?

The people first used pebbles or knots or marks of ten fingers of hands for counting the number of animals in a herd.

When did people use symbols to represent numbers?

The man created symbols to represent numbers as soon as he learned to write.

What is the meaning of word numeral?

The symbol that is used to write a number is called numeral.

How did our ancestors keep count of their sheep?

Every morning as they let the sheep out, they made marks on a tree — one mark for each sheep. In the evening, when they brought the sheep back, they matched each sheep with the mark on the tree. In this way, they could tell if there was any change in the number of sheep (Fig. 2.1).

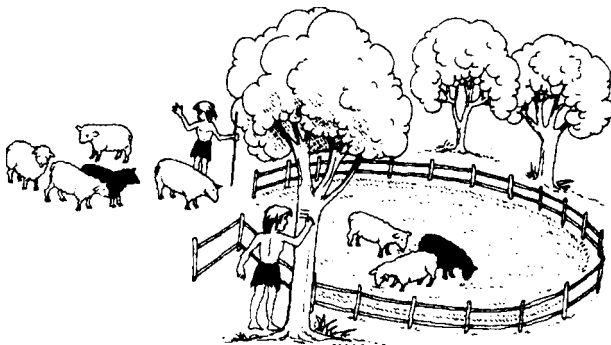


Fig. 2.1 Ancient method of counting the sheep

What familiar things were used for counting by the ancient man?

Several familiar things were used for counting by the ancient man. Lion's head was used to indicate one, wings of an eagle to indicate two, leaves of a clover to indicate three and so on (Fig. 2.2).

How did the Babylonians represent numbers?

They used to write numbers on flat bricks of wet clay with sharp-edged sticks. Their number representations from 1 to 10, 100, 1000 are shown in Fig. 2.3.

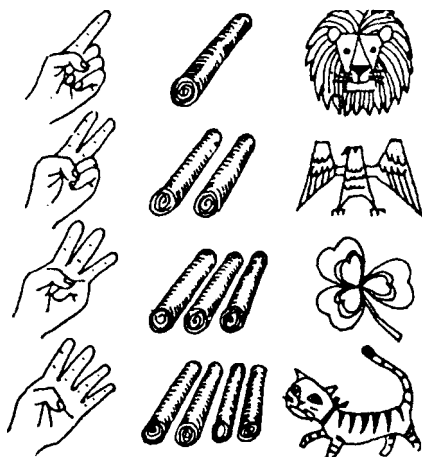


Fig. 2.2 Use of familiar things for counting by the ancient man

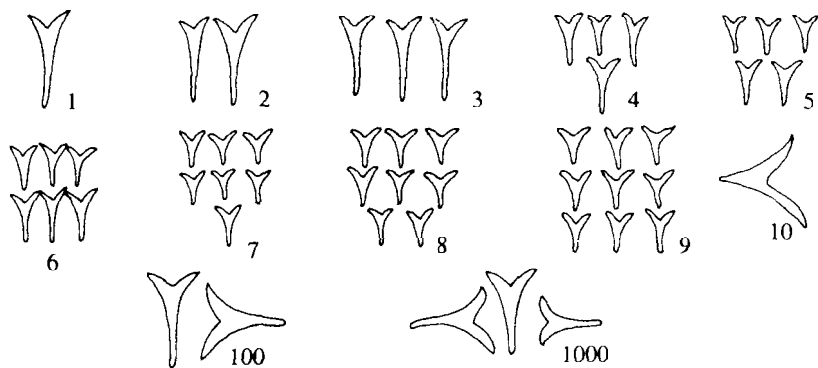


Fig. 2.3 Babylonian numerals

When did the Babylonians develop cuneiform numerals?

The Babylonians developed cuneiform or wedge-shaped writing for numbers some 5000 years ago.

How can we write 243 in Babylonian numerals?

We write symbol of 100 twice, symbol of 10 four times and then the symbol of 3 (Fig. 2.4).



Fig. 2.4 Representation of 243 in Babylonian cuneiform writing

What was the system of numerals developed by the ancient Egyptians?

Hieroglyphic system. They used this system for decorative purpose on stone monuments.

How were the numbers represented in the hieroglyphic system?

See Fig. 2.5.

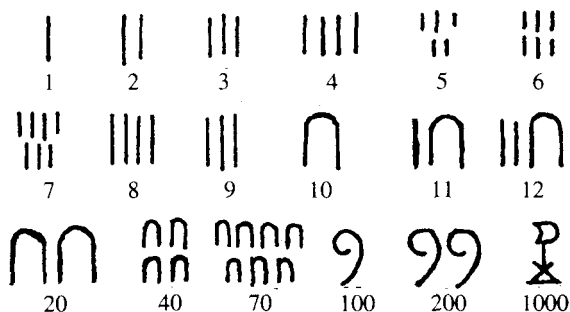
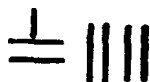


Fig. 2.5 Number representation in hieroglyphic system

Was there any symbol for zero in the ancient Chinese system?

No, there was no symbol for zero, and a gap had to be left in to indicate it. For example, the number 7004 was written as



What was the other numeral system of the ancient Egyptians?

Another number system used by the ancient Egyptians was called hieratic number system. It was more efficient than the hieroglyphic system. It served them in their day-to-day computations.

How did the Greeks write numbers?

The Greeks used all the letters of their alphabet plus three additional symbols for writing numbers. The first nine symbols represented the numbers from one to nine; the next nine, the tens from ten to ninety; the last nine, the hundreds from one hundred to nine hundred (Fig. 2.6). They had no symbol for zero. To represent thousands, the Greeks added a bar to the left of the first nine letters.



Fig. 2.6 Ancient Greeks used letters of their alphabet to write numbers

What was the method used by Hebrews for writing numbers?

The Hebrews also used their alphabet for writing numbers (Fig. 2.7).



Fig. 2.7 Hebrews' way of representing numbers

What was the system for writing numbers used by the ancient Chinese? How did the Chinese write numbers more than ninety?

The ancient Chinese used rod like symbols to represent numbers (Fig. 2.8). The hundreds were written in the same way as the units. For example, the symbol || would stand for either two or two hundred depending upon its position in the number. Thousands were written in the same way as tens, the ten thousand in the same way as the units and so on.

The number 7684 was written as $\perp \tau \perp |||$

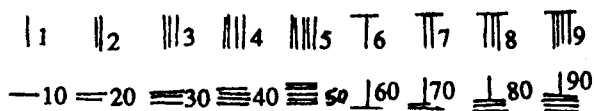


Fig. 2.8 Ancient Chinese used rod like symbols for writing numbers

How did the ancient Japanese write numbers?

The ancient Japanese used short wooden sticks to represent numbers as shown in Fig. 2.9.

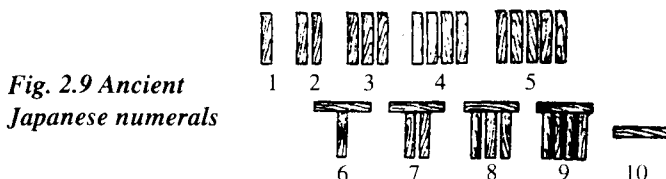


Fig. 2.9 Ancient Japanese numerals

During the thirteenth and fourteenth century what was the form of receipt in former USSR for taxes collected by officers?

The form of receipts of the taxes was as shown in Fig. 2.10. This receipt shows an amount of 3674 rubles and 46 kopecks (1 ruble equals 100 kopecks).

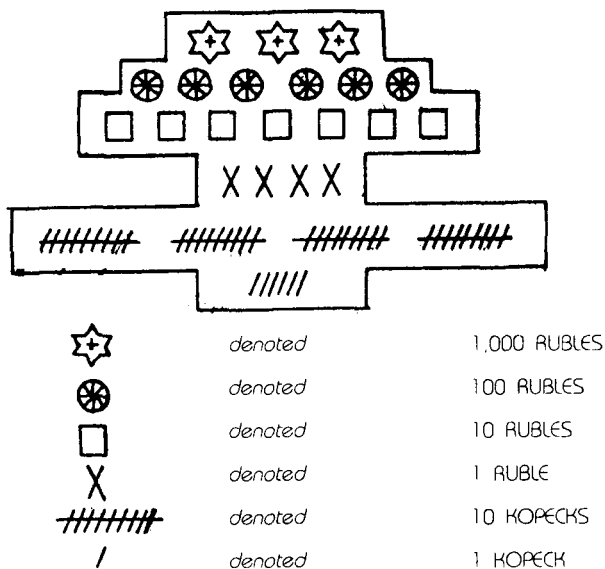


Fig. 2.10 Form of a receipt of taxes

What is the Roman system of numerals?

The Roman system of numbers was probably derived from Etruscans, the earlier inhabitants of Italy. Letters were used for numerals. I stood for one, V stood for five, X for ten, L for fifty, C for a hundred, D for five hundred and M for a thousand (Fig. 2.11).

I	II	III	IV	V	VI	VII	VIII	IX
1	2	3	4	5	6	7	8	9
X	XX	L	C	D	M	CMC		
10	20	50	100	500	1000	10000		

Fig. 2.11 Roman system of numerals