

# MATHEMATICS

## CLASS - VIII

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## Foreword

Education is a process of human enlightenment and empowerment. Recognizing the enormous potential of education, all progressive societies have committed to the Universalization of Elementary Education with an explicit aim of providing quality education to all. As the next step, universalization of Secondary Education has gained momentum.

The secondary stage marks the beginning of the transition from functional mathematics studied upto the upper primary stage to the study of mathematics as a discipline. The logical proofs of propositions, theorems etc. are introduced at this stage. Apart from being a specific subject, it is to be treated as a concomitant to every subject involving analysis as reasoning.

I am confident that the children in our state of Andhra Pradesh learn to enjoy mathematics, make mathematics a part of their life experience, pose and solve meaningful problems, understand the basic structure of mathematics by reading this text book.

For teachers, to understand and absorb critical issues on curricular and pedagogic perspectives duly focusing on learning rather than of marks, is the need of the hour. Also coping with a mixed class room environment is essentially required for effective transaction of curriculum in teaching learning process. Nurturing class room culture to inculcate positive interest among children with difference in opinions and presumptions of life style, to infuse life in to knowledge is a thrust in the teaching job.

The afore said vision of mathematics teaching presented in Andhra Pradesh State Curriculum Frame work (APSCF -2011) has been elaborated in its mathematics position paper which also clearly lays down the academic standards of mathematics teaching in the state. The text books make an attempt to concretize all the sentiments.

The State Council for Education Research and Training Andhra Pradesh appreciates the hard work of the text book development committee and several teachers from all over the state who have contributed to the development of this text book at different levels. I am thankful to the District Educational Officers, Mandal Educational Officers and head teachers for making this mission possible. I also thank the institutions and organizations which have given their time in the development of this text book. I am grateful to the office of the Commissioner and Director of School Education, (A.P) and Vidya Bhawan Society, Udaipur, Rajasthan for extending co-operation in developing this text book. In the endeavor to continuously improve the quality of our work, we welcome your comments and suggestions in this regard.

Place : Hyderabad

Date : 03 December 2012

Director

SCERT, A.P., Hyderabad

## Preface

The Government of Andhra Pradesh has decided to revise the curriculum of all the subjects based on Andhra Pradesh State Curriculum Frame work (APSCF - 2011) which recommends that childrens life at schools must be linked to their life outside the school. Right to Education (RTE - 2009) perceives that every child who enters the school should acquire the necessary skills prescribed at each level upto the age of 14 years. The introduction of syllabus based on National Curriculum Frame Work - 2005 is every much necessary especially in Mathematics and Sciences at secondary level with a national perspective to prepare our students with a strong base of Mathematics and Science.

The strength of a nation lies in its commitment and capacity to prepare its people to meet the needs, aspirations and requirements of a progressive technological society.

The syllabus in Mathematics for three stages i.e. primary, upper primary and secondary is based on structural and spiral approaches. The teachers of secondary school Mathematics have to study the syllabus of classes 8 to 10 with this background to widen and deepen the understanding and application of concepts learnt by pupils in primary and upper primary stages.

The syllabus is based on the structural approach, laying emphasis on the discovery and understanding of basic mathematical concepts and generalisations. The approach is to encourage the pupils to participate, discuss and take an active part in the classroom processes.

The present text book has been written on the basis of curriculum and Academic standards emerged after a thorough review of the curriculum prepared by the APSCERT.

- The syllabus has been divided broadly into six areas namely, (1) Number System, (2) Algebra, (3) Arithmetic, (4) Geometry, (5) Mensuration and (6) Data Handling. Teaching of the topics related to these areas will develop the skills prescribed in academic standards such as problem solving, logical thinking, mathematical communication, representing data in various forms, using mathematics as one of the disciplines of study and also in daily life situations.

The text book attempts to enhance this endeavor by giving higher priority and space to opportunities for contemplations. There is a scope for discussion in small groups and activities required for hands on experience in the form of 'Do this' and 'Try this'. Teacher's support is needed in setting the situations in the classroom.

### Some special features of this text book are as follows

- The chapters are arranged in a different way so that the children can pay interest to all curricular areas in each term in the course of study.

- Teaching of geometry in upper primary classes was purely an intuition and to discover properties through measurements and paper foldings. Now, we have stepped into an axiomatic approach. Several attempts are made through illustrations to understand, defined, undefined terms and axioms and to find new relations called theorems as a logical consequence of the accepted axioms.

Care has been taken to see that every theorem is provided initially with an activity for easy understanding of the proof of those theorems.

- Continuous Comprehension Evaluation Process has been covered under the tags of 'Try this' and 'Think, Discuss and Write'. Exercises are given at the end of each sub item of the chapter so that the teacher can assess the performance of the pupils throughout the chapter.
- Entire syllabus is divided into 15 chapters, so that a child can go through the content well in bit wise to consolidate the logic and enjoy the learning of mathematics.
- Colourful pictures, diagrams, readable font size will certainly help the children to adopt the contents and care this book as theirs.

Chapter (1) : Rational numbers under the area of number system deal with how a rational number is different from a fraction. Properties of rational numbers are discussed through illustrative examples. Children has been given an opportunity to see the rational number on a numberline, the representation of rational numbers on a numberline in decimals and vice versa. In chapter (6) Squares and Square roots, we try to make the child, to understand the perfect squares, properties of square numbers and finding square root of a number by factorisation and long division methods. Cubes and Cube roots are also discussed with various illustrative examples.

Chapters (2) (4) (11) and (12) deal with Algebra. In the chapter Linear Equation in one variable, the child is given an opportunity to identify a variable in a verbal problem and finding its value through transposition method. In the chapter Exponents and Powers, some algorithms were given to write bigger numbers in exponential notation. The laws of exponents were discussed with a variety of illustrative examples. In the chapters Algebraic Expression and Factorisation we mostly deal with algebraic expression monomials and binomials. Algebraic identities such as  $(a + b)^2 \equiv a^2 + 2ab + b^2$ ,  $(a + b)(a - b) \equiv a^2 - b^2$  and  $(x \pm a)(x \pm b) = x^2 \pm (a + b)x + ab$  with geometrical verification are discussed with various values. Factorisation of algebraic expression of these forms are given, along with number of problems to make child to practice.

Chapter (5) Comparing Quantities discussed about ratio, proportion, compound ratio, percentage discount, profit and loss, sales tax/VAT simple interest and compound interest compounded annually, half yearly and quarterly and also application of compound interest formula. Chapter (10) Direct and Inverse Proportion deals with direct proportion, inverse proportion and mixed proportion problems with a variety of daily life situations.

Chapter (15) Playing with Numbers, provides an opportunity to the children to develop algorithms and to find a rule through some patterns of numbers. The divisibility rules are discussed to explore new methods. Ample number of examples and puzzles are given to create interest.

Geometry is discussed with an aim to appreciate the figures the child has seen around him through visualisation and drawing and construction. In the Chapter (3) Constructions of Quadrilaterals, the focus is given for the construction of a unique quadrilateral by revisiting its properties. All models of constructions were given with illustrative examples. In Chapter (8) Exploring Geometrical Figures and Chapter (13) Visualising 3D in 2D, the child has been given enough opportunities to explore various plane figures through 3D.

Data Handling is a key area in which the child will be able to perceive the knowledge of his surroundings through tables diagrams and graphs. Chapter (7) Frequency Tables and Graphs deals with how to classify the data using tables and to present the data in frequency graphs such as histograms, polygons and O'give curves. Some examples are also given to revise mean, median and mode of an ungrouped data. Alternative methods of finding the values of central tendency and complex problems are discussed.

Finally in chapter (9), the Surface Areas of Plane Figures, we have discussed about finding the area of Trapezium, Quadrilateral, Circle, Circular ring and Sector and also the surface area and volume of cubes and cuboid in Chapter (14).

Mere the production of good text books does not ensure the quality of education, unless the teachers transact the curriculum the way it is discussed in the text book. The involvement and participation of learner in doing the activities and problems with an understanding is ensured.

Therefore it is expected that the teachers will bring a paradigm shift in the classroom process from mere solving the problems in the exercises routinely to the conceptual understanding, solving of problems with ingenuity.

- Text Book Development Committee

## Highlight from History

### George Polya (1887 - 1985)

Over the years, many have thought about the question whether the art of problem solving can be taught or is it a talent possessed by only a few? An effective and definite answer was given by the late George Polya. He maintained that the skill of problem solving can be taught.

Polya was born in Hungary in 1887 and received his Ph.D. in mathematics from the University of Budapest. He taught for many years at the Swiss Federal Institute of Technology in Zurich.

Among the numerous books that he wrote he seemed most proud of 'How to Solve It' (1945) which has sold nearly one million copies and has been translated into 17 languages.

Polya's Four principles of Problem solving



George Polya  
(1887-1985)

#### I. Understand the problem

This principle seems so obvious that it need not be mentioned. However students are often stymied in their efforts to solve a problem because they don't understand it fully or even in part. Teachers should ask students such questions as

- Do you understand all the words used in stating the problems? If not, look them up in the index, in a dictionary or wherever they can be found.
- What are you asked to find or show can you restate the problem in your own words.
- Is there yet another way to state the problem
- What does (key word) really mean?
- Could you work out some numerical examples that would help make the problem clear?
- Could you think of a picture or diagram that might help you to understand the problem.
- Is there enough information to enable you to find a solution.
- Is there extraneous information?
- What do you really need to know to find a solution.

#### II. Devise a plan

Devising a plan for solving a problem once it is fully understood may still require substantial effort. But don't be afraid to make a start you may be on the right track. There are often many reasonable ways to try to solve a problem and the successful idea may emerge only gradually after several unsuccessful trials. A partial list of strategies include.

- guess and check
- look for a pattern
- make an orderly list
- draw a picture
- think of the problem as particularly solved
- think of a similar problem already solved
- eliminate possibilities
- solve simpler problem
- solve an equivalent problem
- solve an analogous problem
- use symmetry
- use a model
- consider special cases
- work backward
- use direct reasoning
- use a formula
- solve an equation
- be ingenious

#### III. Carry out the plan

Carrying out the plan is usually easier than devising the plan. In general all you need is care and patience, given that you have the necessary skills. If a plan does not work immediately be persistent. If it still does not work, discard it and try a new strategy. Don't be misled this is the way mathematics is done, even by professionals.

#### IV. Look back

Much can be gained by looking back at a completed solution to analyze your thinking and ascertain just what was the key to solving the problem. This is how we gain "Mathematical power", the ability to come up with good ideas for solving problems never encountered before.



# Mathematics

## VIII Class

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## OUR NATIONAL ANTHEM

- *Rabindranath Tagore*

Jana-gana-mana-adhinayaka, jaya he

Bharata-bhagya-vidhata.

Punjab-Sindh-Gujarat-Maratha

Dravida-Utkala-Banga

Vindhya-Himachala-Yamuna-Ganga

Uchchala-Jaladhi-taranga.

Tava shubha name jage,

Tava shubha asisa mage,

Gahe tava jaya gatha,

Jana-gana-mangala-dayaka jaya he

Bharata-bhagya-vidhata.

Jaya he, jaya he, jaya he,

Jaya jaya jaya, jaya he!

## PLEDGE

“India is my country. All Indians are my brothers and sisters.  
I love my country, and I am proud of its rich and varied heritage.

I shall always strive to be worthy of it.

I shall give my parents, teachers and all elders respect,  
and treat everyone with courtesy. I shall be kind to animals

To my country and my people, I pledge my devotion.  
In their well-being and prosperity alone lies my happiness.”

# Rational Numbers

## 1.0 Introduction

Salma wants to buy three pens at five rupees each. Her friend Sathesh wants to buy two similar pens. So they went to a wholesale shop. Shopkeeper said that a packet of five pens costs ₹ 22. How much does each pen cost? We can easily

calculate the cost of each pen ₹  $\frac{22}{5}$ . Is there any natural number to represent this cost? Is there any whole number or integer to represent this?

Consider one more example.

Observe the following various readings of temperature recorded on a particular day in Simla.



Timings	10.00 a.m.	12.00 Noon	3.00 p.m.	7.00 p.m.	10.00 p.m.
Temperature	11 °C	14 °C	17 °C	10 °C	5 °C

In each case what is the change in temperature per hour?

Case I Morning hours : change in temperature per hour  $\frac{14^{\circ}\text{C} - 11^{\circ}\text{C}}{2} = \frac{3}{2}^{\circ}\text{C/hr.}$   
(10.00 A.M. - 12.00 Noon)

Case II Afternoon hours : change in temperature per hour  $\frac{17^{\circ}\text{C} - 14^{\circ}\text{C}}{3} = 1^{\circ}\text{C/hr.}$   
(12.00 Noon - 3.00 P.M.)

Case III Evening hours : change in temperature per hour  $\frac{10^{\circ}\text{C} - 17^{\circ}\text{C}}{4} = \frac{-7}{4}^{\circ}\text{C/hr.}$   
(3.00 P.M. - 7.00 P.M.)

Case IV Night hours : change in temperature per hour  $\frac{5^{\circ}\text{C} - 10^{\circ}\text{C}}{3} = \frac{-5}{3}^{\circ}\text{C/hr.}$   
(7.00 P.M. - 10.00 P.M.)

In the above cases we come across numbers like  $\frac{3}{2}^{\circ}\text{C}$ ,  $1^{\circ}\text{C}$ ,  $\frac{-7}{4}^{\circ}\text{C}$ ,  $\frac{-5}{3}^{\circ}\text{C}$ .