

పాఠశాల గణితం - దార్శనికత
(Vision for School Mathematics)

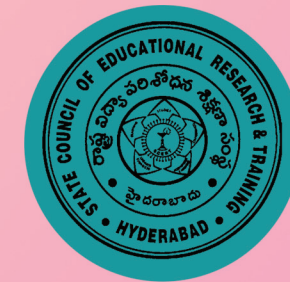
1. పిల్లలు, గణితమంటే భయం పోయి మక్కువతో ఆనందిస్తూ గణితాన్ని అభ్యసిస్తారు.
2. పిల్లలు గణితమనేది సూత్రాలు, యాంత్రిక పద్ధతులకన్నా చాలా గొప్పదని తెలుసుకుంటారు.
3. పిల్లలు గణితాన్ని, భావవ్యక్తీకరణ సాధనంగానూ, మాట్లాడుకోవడానికి, చర్చించుకోవడానికి, కలిసి పనిచేయడానికి ఉపయోగించే ఒక గొప్ప విషయంగానూ చూస్తారు.
4. పిల్లలు అర్థవంతమైన సమస్యలు రూపొందిస్తారు మరియు సాధనలు కనుక్కొంటారు.
5. పిల్లలు, గణితంలో సంబంధాలు కనుక్కోవడానికి, అంతర్గత నిర్మాణాలు తెలుసుకోవడానికి, కార్యకారణ విచారణకు, ఒక ప్రవచన సత్యాసత్య విలువలు నిర్ధారించడానికి, అమూర్త భావనలను ఉపయోగిస్తారు.

పిల్లలు తార్కికంగా ఆలోచించడానికి, చింతన చేయడానికి, విశ్లేషించడానికి మరియు వ్యక్తీకరించడానికి ఒక వాహనంగా గణితాన్ని చూడాలనేది ప్రత్యేకమైన విషయమే అయినా గణితాన్ని విశ్లేషణ, చింతన అవసరమున్న ఏ ఇతర విషయంతోనైనా సంబంధమున్నదానిగా చూడాలని, జాతీయ విద్యావిధానం 1986 చెప్పింది. జాతీయ విద్యాప్రణాళికా చట్రం NCF-2005 ఈ విషయాన్నే నినదించినా గణిత బోధన ఇంకా సంకుచిత లక్ష్యాల సాధన దిశగానే పోతుండడం విచారకరం.

- రాష్ట్ర విద్యా ప్రణాళిక పరిధి పత్రం - 2011

Handbook for Maths Teachers

Classes 8 & 9

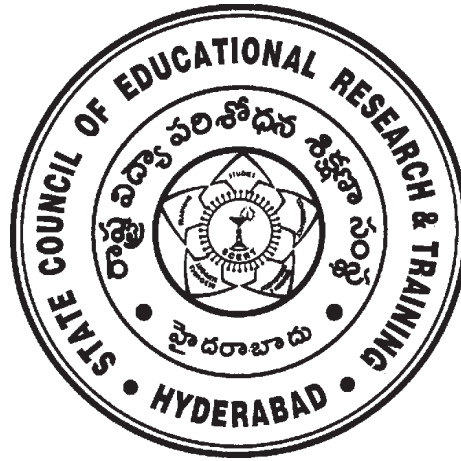


State Council of Educational Research and Training
A.P, Hyderabad.

Hand Book for Maths Teachers

8th, 9th Classes

2013-2014



**State Council for Educational Research
and Training
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Foreword

The secondary stage marks the beginning of the transaction 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 any subject involving analysis as reasoning.

The teacher has to encourage the children to understand and absorb critical issues and abstract concepts duly focusing on teaching learning process instead of scoring marks. It is essential to create a mixed classroom environment for effective transition of curriculum by involving children participation. Nurturing classroom culture to inculcate positive interest among children with difference in opinions and presumptions of the life style. The new text books make an attempt to concretize all the sentiments. So the teacher has a role and responsibility to create such an atmosphere with skill full thoughts.

To develop such skills among teachers in teaching learning process at different levels preparation, planning and evaluation, the hand book will guide them in as a useful instrument.

This Hand book contains seven chapters in which 1 to 3 chapters gives an idea about nature and scope of text book chapters.

Chapter 4 deals precisely with the new concepts introduced in the syllabus. Chapter 5 describes the importance and conceptual understanding of different areas of mathematics to promote teachers to understand deeply in the concerned area. Chapter 6 gives an idea about how to use the new text book in an effective way in teaching learning process such as role of teachers, preparation etc. Finally chapter 7 deals with how to implement continuous comprehensive evaluation in a success for manner.

The state council for Education research and Training appreciates the work done by the committee members, teachers and other technical staff in bringing the hand book in a precise and attractive manner for the benefit of mathematics teachers in the state. In the endeavor to continuously improve the quality of our work with respect to text books and hand books, we welcome the comments and suggestions in this regard.

Director,
SCERT, A.P., Hyderabad.

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Chapter 1

What is the need of training on New text books?

Secondary education is undergoing changes time to time. These are necessary as the knowledge widens and the needs of the society from teacher centered education to child centered education. But text books were not changed accordingly it becomes a dream until 2011-12.

Our state Government developed Andhra Pradesh state curriculum frame work (APSCF-2011) in accordance with NCF - 2005 and RTE - 2009. Which recommends that children's life at schools must be linked to their life outside the school. Thus it is mandatory to develop new syllabus and text books involving the children in participate, discuss and take an active part in the classroom processes includes project works, experiments, Analysis. Thus the new text books from class 1 to 10th were developed in a phased manner with a national perspective to prepare our students with a strong base of mathematics and science. Teaching learning strategies were given in accordance with new curriculum. In this occasion, the teachers have to revise their teaching strategies to fit into the new processes. So it is necessary that all the teacher have to undergo an in service training to understand the principles behind developing new text books and teaching strategies.

All the teachers in the state were undergone training last year on 6th and 7th class new text books. The survey conducted by SCERT in the month of Feb213 on "Implementation of New text books - observation of teaching learning processes" throughout the state does not reflect the positive outcome on training. Let us find some conclusion arrived at the end of survey.

Though most of the teachers said that the text books are good, exercises are good and concepts were introduced in a nice manner, but there were some errors observed by the surveyors.

- ◆ There were very less percentage of teachers read "Fore word", "teacher instructions" and academic standards given in the text books
- ◆ Only 10% of teachers are creating new situations in providing activities, discussions, text books reading in the classroom.
- ◆ Very few teachers were given importance to exercise like "Do this", "Try these" and "Think discuss" for better understanding the mathematical concepts.
- ◆ Only few teachers were providing opportunity for children participation in teaching learning process.
- ◆ Very less teachers are providing and working out projects.
- ◆ The understanding of continuous comprehensive evaluation among teachers is very less.

Thus the training programme is meant to provide opportunity to the teachers for better understanding of key principles behind the text books of class 8th and 9th.

Objectives of the training programme :

- ◆ To understand the philosophy and key principles in the new text books of 8th and 9th classes.
- ◆ To discuss and understand the nature and scope of various areas in mathematics.
- ◆ To understand the new and innovative strategies to develop lesson plans and activities.
- ◆ To understand the importance of constructive exercises such as Dothis, Try these and think-discuss.
- ◆ To know how to conduct activities in a maths class.
- ◆ To understand the spirit and assessment techniques through CCE.
- ◆ To prepare the text items based on academic standards.
- ◆ To prepare summative assessment question paper based on weightage tables.
- ◆ To understand about academic calendar and its implementation.

To narrow aim of school mathematics is to develop 'useful' capabilities, particularly those related to numeracy - numbers, number operations, measurements, decimals and percentages, The higher aim includes developing the child's resources to think and reason mathematically, to pursue assumptions to their logical conclusion and to handle abstraction. It includes a way of doing things, and ability and the attitude to formulate and solve problems

- NCF 2005

Chapter - 2

Introduction to New text books - Key principles

Introduction :

Education is a process of human enlightenment and empowerment. Recognizing the enormous potential of education, all progressive societies have committed themselves to the universalization of elementary education with an explicit aim of providing quality education to all. In this connection all the states of our country developed their own curricular keeping in view their self reliance under national perspective. 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. Our State Government has decided to revise the curriculum of all the subjects based on Andhra Pradesh state curriculum frame work (APSCF - 2011) and released 18 position papers on curricular and co-curricular subjects.

The state curriculum frame work 2011 emphasised to utilize the natural learning abilities of the children by creating opportunities in text books to think and apply their knowledge in widening beyond the text books. The exercises in the text books will provide children ample scope to reach the academic standards prescribed in each level.

The new text books were developed by SCERT for class 1, 2 in the year 2011-12, 3,6,7 classes in the year 2012-13 and 4,5,8,9, classes in 2013-14.

To understand the philosophical aspects of these new text books, let us think and discuss the following questions.

1. What are the key principles in the development of new text books?
2. What are the special features of new text books?
3. How the topics are selected for 8th and 9th classes?
4. Which topics are selected were given more importance in the text books
5. How the chapters are arranged in the text books?
6. What are the issues discussed in Fore word and preface of these Maths new text books.

◆ **Key principles in the development of new text books:**

The natural learning abilities of the children

Children language and experiences

Link between topics with outside classroom life

Shifting from bi hearing to knowledge construction

Topics related not only related to text books

Discoveries through projects

Continuous comprehensive evaluation

Sociological and constructive approaches

Freedom of expressions and questioning ability

Defined academic standards

Scope for creativity, intention

Different ways of problem solving approaches

Sl.no.	Topic	Need	Explanation in the Textbooks
1	Simple mathematical language to promote self learning ability	Children feel better to understand the topics in mathematical languages if these topics are linked with home language. If they can able to read and understand the activities and other topics it leads to self learning.	The language used in topics of the 8th and 9th maths books is very simple and understandable by all regions , most of the unfamiliar words were removed. More explanations given where there is a need to introduce new mathematical terminology
2	Activities related to previous knowledge of the child	To motivate the children towards learning a new topic, it is necessary to test them by question related to their previous knowledge through daily life experiences and situations Lines and angles - Homes, bridges temples etc and their figures	<p>8th class</p> <ul style="list-style-type: none"> 1. Rational numbers <ul style="list-style-type: none"> - Purchase of pens in a shop - Temperatures in simla 2. Construction of quadrilaterals - Types of quadrilaterals, then properties 3. Frequency distribution tables and graphs - Medals tally in Olympic games 4. Area of plane figures <ul style="list-style-type: none"> - House sites and shapes <p>9th class</p> <ul style="list-style-type: none"> 1. Polynomials <ul style="list-style-type: none"> - Plantation in a garden 2. సరళరేఖలు, కోణాలు <ul style="list-style-type: none"> - ఇళ్లు, పంటనలు, గోవురాలు మొ వాటి పటాలు.

Sl.no.	Topic	Need	Explanation in the Textbooks
3	Giving importance to local art forms, culture, productive works, local needs in lessons	Every region has its own culture, art forms and people participation in useful productive works according to their needs. If these are incorporated in the lessons then children's problem solving abilities will increase and hence it leads to discover new problems	<p>8th class</p> <p>1. Linear equation in one variable</p> <ul style="list-style-type: none"> - Exercise 2.2, problems 6,7,14 relates to models of transport, preparation of pizza, valued the Indian currency (page 43) <p>2. Comparing quantities with proposition</p> <ul style="list-style-type: none"> - Collecting donations in percentage (P.99), value added tax (VAT) medical bill (P.109) etc <p>9th class</p> <p>1. Coordinate geometry</p> <ul style="list-style-type: none"> - order students in introduction and streets in a town (P. 107, 18) <p>2. Surface areas and volumes - volume of boxes, corn cop example if\n finding the surface area of cone etc.</p>

Sl.no.	Topic	Need	Explanation in the Textbooks
4	Academic standards through process skills using problem solving, logical reasoning, communication representation, connections.	Academic standards in maths will be stated combining with content areas and process skills. Academic standard is a statement leads to an output related with content with a process skill. Academic standards will helps us to assess the children	<p>All the chapters and contents in 8th and 9th class mathematics were developed by taking academic standards into consideration</p> <p>Eg:- Problem solving - 8th class(P.17)</p> <p>1) Simplify $\frac{2}{5} + \frac{3}{7} + \frac{6}{5} + \frac{13}{7}$</p> <p>2) Construct an isosceles triangle given box and box angle write its proof communication - 8th class (P.94).</p> <p>3) Express 32.5 x 10 in general from Representation - 9th class (P.136)</p> <p>4) Draw the graph of $x - 2, y = 3$ connection - 9th class (P.258)</p> <p>5) A villager Ramayya has a plot of land in the shape of a quadrilateral. The grampanchayat of the village decided to take over some portion of his plot from one of the corners to construct a school. Ramayya agrees to the above proposal with the condition that he should be given equal amount of land in exchange of his land adjoining his plot so as to form a triangular plot. Explain how this proposal will be implemented.</p>

Sl.no.	Topic	Need	Explanation in the Textbooks
5	Continuous comprehensive evaluation through "Do this", "Try these" and Think-discuss and write	Questions gives under the title 'Do this' will help the teacher to assess the children about their immediate understanding of the topics they have learning. The questions will also help the children for self assessment. The questions under "try these", "think - discuss and write" will help the children to give answer through reasons and discussing in groups.	<p>Question for</p> <p>Do this : Immediate responses about understanding the topics learned.</p> <p>Eg: Finding the medium of height of cricket players 8th class - Frequency tables and graphics</p> <p>Try these : Question related to reason and topic.</p> <p>Eg: Rehan said there are 37 non perfect square numbers between 92 and 112 Is it true? Give reason 8th class squares and square roots (P.128)</p> <p>Think - Discuss and write :</p> <p>Eg: How the compound interest change if interest is calculated for every three months? How many periods will be there in one year? What is the percent of rated interest of 3 months with annual interest?</p> <p>Discuss with your friends 8th class - Appreciation with ration and proposition</p>

Sl.no.	Topic	Need	Explanation in the Textbooks
6	Shifting from bi hearting to knowledge construction	Education should be used to construct knowledge rather than gaining. The structure of topics should help in this direction. Children should be able to discover new things their self experiences matching with topics they learn in the class rooms. It will avoid role learning of a topic or a concept.	<p>Many topics were introduced in new text books which promote knowledge construction</p> <p>Eg: 1. Constructing quadrilaterals - 8th class Activities were given to find the measured to construct a unique quadrilateral (P. 59,60)</p> <p>2. Statistics - 9th class Definitions were introduced by associating real life situations with 'data' (P.194,195)</p>
7	Developing freedom of	Construction of knowledge among children is possible only when they question themselves about every topic as how? Why? They have to question the book, teachers and their friends. The teacher has to create such an atmosphere in the classroom. The society should create this outside the classroom. Answer many differ but the conclusion should be carried only through proof on teaching of the topics	<p>More situations were provided in the new text books in topics and exercises to develop questioning ability</p> <p>Eg: 8th class - Exponents and power exercise 4.2 question 5 (P.95)</p> <p>9th class - "quadrilaterals" discussion on about "All squares are rhombuses" (P.176)</p>

Sl.no.	Topic	Need	Explanation in the Textbooks
8	Vie variety of examples to understand problem solving techniques and exercise to solve with joy.	Scope should given to children to solve problems on their own. So it is necessary to give more examples to understand the steps and logical process in which a problem can be solved. Every teacher must make the students to understand the problem solving techniques. It removes the fear to solve problems given in the exercises. Children must leads to create their problems by their own logic related to the given concepts	<p>More number of examples were given rather than problems in the exercise in the new text books</p> <p>Eg: 1. "Square roots - cube roots" (8th class) contain 5 exercise and 15 examples, not more than 10 problems were given in every exercise</p> <p>2. Triangles (9th class) consist of 4 exercises and 15 examples</p>
9	Geometrical construction with logic and reasoning	Geometrical constructions play a vital role in ancient times in the study of mathematics. The principles followed in the constructions were developed since enchild's period. Every geometrical construction involves not only beauty but topic construction were said to be accurate and standard only. When we use ruler and compass, children must adopt to use them in school days only will help them in engineering level.	<p>Two chapters "construction of quadrilaterals" (8th class) and "Geometrical constructions" (9th class) provide ample scope for the children to construct geometrical figures using ruler and scale. The geometrical proofs of these constructions will help them to understand the logic behind the constructions.</p> <p>Eg: construction 3.2.1 (P.65,66) - 8th class, construction 13.3.1 (P.284,285) 9th class</p>

New Mathematics Text Books Special Features

a) Cover Pages



b) Foreword

8th Class

Foreword

Education is a process of human enlightenment and empowerment. Recognizing the enormous potential of education, all progressive societies have committed to the Universalisation of Elementary Education with an explicit aim of providing quality education to all. As the next step, universalisation 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 any 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 daily 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 to knowledge is a thrust in the teaching job.

The afore said vision of mathematics teaching presented in Andhra Pradesh State Curriculum Framework work (APSCF - 2011) has been elaborated in its mathematics position paper which 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 Vidyapar Bhawan Society, Udayapur, Rajamaharajapuram 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

(9)

9th Class

Foreword

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Place : Hyderabad
Date : 03 December 2012

Director
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(10) Free Distribution by A.P. Government

c) Preface

8th Class

Preface

The Government of Andhra Pradesh has decided to revise the curriculum of all the subjects based on Andhra Pradesh State Curriculum Framework work (APSCF - 2011) which recommends that children 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 Framework 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 generalizations. The approach is to encourage the pupils to participate, discuss and take an active part in the classroom processes.

The present text books have been written on the basis of curricular 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) Measurement and (6) Data Handling. Teaching of the apparatus in 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 imitation 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 their.

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 $(a + b)^2 = a^2 + 2ab + b^2$, $(a + b)(a - b) = a^2 - b^2$ and $(x + a)(x + b) = x^2 + (a + b)x + ab$ 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 exercises 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).

More the production of good text books does not ensure the quality of education, unless the teachers transcend the curricular the way it is discussed in the text book. The involvement and participation of learner in doing the activities with their understanding is essential.

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

Text Book Development Committee

Teachers Hand Book

9th Class

Preface

The Government of Andhra Pradesh has decided to revise the curriculum of all the subjects based on Andhra Pradesh State Curriculum Framework work (APSCF - 2011) which recommends that children's life at school 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 Framework - 2005 is every much necessary especially in Mathematics and Science 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 1 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 written on the basis of curriculum and academic standards envisaged after a thorough review of the curriculum prepared by the APSCF.

The syllabus has been divided broadly into six areas namely, Number System, Algebra, Geometry, Measurement, Statistics and Coordinate Geometry. 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, define, and define 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-term 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.
- Some interesting and historical highlights are given under titles of brain teasers. Do you know will certainly help the children for creative thinking.
- Colourful pictures, diagrams, readable font size will certainly help the children to adopt the contents and care this book as their.

Chapter (1) Real Numbers under the area number system and irrational numbers in detail. The child can visualise the rational and irrational numbers by the representation of them on number line. Some history of numbers is also added e.g. value of e to create interest among students. The representation of real numbers on the number line through successive magnification help to visualise the position of a real number with a non-terminating recurring decimal expansion.

Chapter (2) Polynomials and Factorisation under the algebra deal with polynomials in one variable and discussed about how a polynomial is different from an algebraic expression. Factorisation of polynomials using remainder theorem and factors theorem is widely discussed with more number of illustrations. Factorisation of polynomials were discussed by splitting the middle term with a reason behind it. We have also discussed the factorisation of some special polynomials using the identities will help the children to counter various types of factorisation.

Chapter (3) Linear equations in two variables under the same area will enable the pupil to discover through illustrative examples the unifying face of mathematical structure which is the ultimate objective of teaching mathematics as a system. This chapter links the ability of finding unknown with every day experience.

There are 7 chapters of Geometry i.e. (3, 4, 7, 8, 11, 12, and 13) were kept in this book. All these chapters emphasise learning geometry using reasoning, intuitive understanding and insightful personal experience of meanings. It helps in communicating and solving problems and obtaining

new relations among various plane figures. Development geometry historically through centres is given and discussed about Euclid's contribution development of plane geometry through his collection "The Elements". The activities and theorems were given on angles, triangles, quadrilaterals, circles and areas. It will develop induction, deduction, analytical thinking and logical reasoning. Geometrical constructions were presented in such a way that the usage of an ungraduated ruler and a compasses are necessary for a perfect construction of geometrical figures.

Chapter (5) deals with coordinate geometry as an alternate approach to Euclidean geometry by means of a coordinate system and associated algebra. Emphasis was given to plot ordered pairs on a cartesian plane (Graph) with a wide variety of illustrative examples. Chapter (9) statistics deals with importance of statistics, collection of statistical data i.e. grouped and ungrouped, illustrative examples for finding mean, median and mode of a given data was discussed by taking daily life situation.

Chapter (14) Probability is entirely a new chapter for secondary school students was introduced with wide variety of examples which deals with finding probable chances of success in different fields, and solved proportion problems with a variety of daily life situations. Chapter (10) surface areas and volumes we discussed about finding curved (lateral) surface area, total surface area and volume of cylinder, cone and sphere. It is also discussed the relation among these solids in finding volumes and derive their formulae.

Chapter (15) Proofs in mathematics will help the students to understand what is a mathematical statement and how to prove a mathematical statement in various situations. We have also discussed about axiom, postulate, conjecture and the various stages in proving a theorem with illustrative examples.

The success of any course depends not so much on the syllabus as the teacher and the teaching methods she employs. It is expected that all concerned with the improving of mathematics education would extend their full cooperation in this endeavor.

More the production of good text books does not ensure the quality of education, unless the teachers transcend 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

d) Unit division

8th Class

Mathematics VIII Class

Contents

Chapter No.	Contents	Syllabus to be Covered during	Page No.
1	Rational Numbers	June	1-33
2	Linear Equations in One Variable	July	34-58
3	Construction of Quadrilaterals	July, August	59-80
4	Exponents and Powers	August	81-95
5	Comparing Quantities using Proportion	August	96-121
6	Square Roots and Cube Roots	September	122-147
7	Frequency Distribution Tables and Graphs	September/ October	148-180
8	Exploring Geometrical Figures	October	181-198
9	Area of Plane Figures	November	199-230
10	Direct and Inverse Proportions	November/ December	231-247
11	Algebraic Expressions	December	248-266
12	Factorisation	January	267-281
13	Visualizing 3-D in 2-D	February	282-296
14	Surface Areas and Volumes (Cube-Cuboid)	February/ March	297-310
15	Playing with Numbers	March	311-336

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9th Class

CONTENTS

Chapter No.	Contents	Syllabus to be Covered during	Page No.
1	Real Numbers	June	1-26
2	Polynomials and Factorisation	July	27-58
3	The Elements of Geometry	July	59-70
4	Lines and Angles	July, August	71-106
5	Co-Ordinate Geometry	August	107-123
6	Linear Equation in Two variables	September	124-147
7	Triangles	September/ October	148-173
8	Quadrilaterals	October	174-193
9	Statistics	November	194-213
10	Surface areas and Volumes	November/ December	214-243
11	Areas	December	244-259
12	Circles	January	260-279
13	Geometrical Constructions	February	280-291
14	Probability	February/ March	292-309
15	Proofs in Mathematics	March	310-327

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e) Syllabus

8th Class

Syllabus	Mathematics VIII	Mathematics IX
<p>Number System (50 hrs)</p> <p>(i) Playing with numbers</p> <ul style="list-style-type: none"> Writing and understanding a 2 and 3 digit number in generalised form (10^a × b + 10^c × d + e, where a, b, c, d, e are only digits (0-9) and engaging with various puzzles concerning this. (Like finding the missing number represented by alphabets in problems involving any of the four operations) Number puzzles and games Understanding the logic behind the divisibility tests of 2, 3, 4, 5, 6, 7, 8, 9, and 11 for a two or three digit number expressed in the general form. <p>(ii) Rational Numbers</p> <ul style="list-style-type: none"> Use general form of expression to describe properties. Approximation of properties. Representation of rational numbers on the number line Between any two rational numbers there lies another rational number (Making children see that if we take two rational numbers then unlike for whole numbers, in this case you can keep finding more and more numbers that lie between them.) Representation of rational numbers as decimal and vice versa (demonstration after 100, 1000, ...) Consolidation of operations on rational numbers. Word problems on rational numbers (all operations) Word problems (higher logic, all operations, including like like area) <p>(iii) Square numbers, cube numbers, Square roots, Cubes, Cube roots.</p> <ul style="list-style-type: none"> Square numbers and square roots Square roots using factor method and division method for numbers containing, no more than 4 digits each) no more than 2, 3 decimal places 	<p>Pythagorean triplet and verification of Pythagoras theorem</p> <ul style="list-style-type: none"> Cube numbers and cube roots (only factor method for numbers containing at most 3 digits). Estimating square roots and cube roots. Learning the process of finding nearest to the required number. Lines of Symmetry Simplification of fractions using BODMAS rule. <p>Algebra (20 hrs)</p> <p>(i) Exponents & Powers</p> <ul style="list-style-type: none"> Integers as exponents. Laws of exponents with integral powers Standard form of the numbers <p>(ii) Algebraic Expressions</p> <ul style="list-style-type: none"> Algebraic Expressions Multiplication algebraic exp. (Coefficient should be integer) <p>(iii) Linear Equations in one variable</p> <ul style="list-style-type: none"> Solving linear equations in one variable as contextual problem involving multiplication and division (word problems) <p>(iv) Factorisation</p> <ul style="list-style-type: none"> Factorisation (simple cases only) Factorisation by taking out common factor. Factorisation by grouping the terms. Factorisation by using identities Factors of the form (x + a)(x + b) Division of algebraic expressions 	<p>Arithmetic (20 hrs)</p> <p>(i) Comparing Quantities using proportion</p> <ul style="list-style-type: none"> Comparing Quantities using proportion Compound ratio - Word problems. Problems involving application on percentages, profit & loss, overhead expenses, Discount, tax. (Multiple transactions) Difference between simple and compound interest (compounded yearly up to 3 years or half yearly up to 3 steps only). Arising at the formula for compound interest through patterns and using it for simple problems. <p>(ii) Direct and Inverse proportion</p> <ul style="list-style-type: none"> Direct variation - Simple and direct word problems. Inverse variation - Simple and direct word problems. Time & work problems - Simple and direct word problems Time & distance - Simple and direct word problems <p>Geometry (40 hrs)</p> <p>(i) Construction of Quadrilaterals</p> <ul style="list-style-type: none"> Construction of quadrilaterals, given with Four sides and one angle Four sides and one diagonal Two adjacent sides, three angles Three sides and two diagonals. Three sides and two angles (if between them are given) Construction of special types of quadrilaterals with two diagonals. <p>(ii) Representing 3-D in 2-D</p> <ul style="list-style-type: none"> Identify and Match pictures with objects (more complicated e.g. nested, joint 2-D and 3-D shapes (not more than 2)) Drawing 2-D representation of 3-D objects (Continued and extended with isometric sketches. Constructing vertices, edges & faces & verifying Euler's relation for 3-D figures with flat faces (cubes, cuboids, tetrahedrons, prisms and pyramids)
<p>Exploring Geometrical Figures</p> <p>(i) Congruent figures</p> <ul style="list-style-type: none"> Similar figures Symmetry in geometrical figures w.r.t. to triangles, quadrilaterals and circles. <p>(ii) Area of Plane Figures</p> <ul style="list-style-type: none"> Area of triangles using Heron's formula (without proof) and its application in finding the area of a quadrilateral. Area of trapezium Area of the quadrilateral and other polygons. Area of the circle & circular paths. <p>(iii) Surface areas and Volumes</p> <ul style="list-style-type: none"> Surface area of a cube, cuboid Concept of volume, measurement of volume using cubic units, volume of cube, cuboid Volume and capacity 	<p>Frequency Distribution Tables and Graphs</p> <ul style="list-style-type: none"> Determination of mean by deviation method. Scope and necessity of grouped data. Preparation of frequency distribution tables Comparative frequency distribution tables Frequency graphs (Histogram, frequency polygon, frequency curve, cumulative frequency curve) 	<p>Statistics (15 hrs)</p> <p>(i) Area of Plane Figures</p> <p>(ii) Surface areas and Volumes</p> <p>(iii) Surface areas and Volumes</p> <p>(iv) Surface areas and Volumes</p> <p>(v) Surface areas and Volumes</p>

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9 th Class	
SYLLABUS	
Number System (50 hrs) (i) Real numbers	(i) Real numbers • Review of representation of natural numbers, integers, and rational numbers on the number line. • Representation of terminating/non-terminating recurring decimals, on the number line through successive magnification. • Rational numbers as recurring/terminating decimals. • Finding the square root of $\sqrt{2}$, $\sqrt{3}$, $\sqrt{5}$, $\sqrt{5}$ correct to 6-decimal places by division method • Examples of non-recurring/non-terminating decimals such as 1.0100101101111... 1.1211211121112... and $\sqrt{2}$, $\sqrt{3}$, $\sqrt{5}$ etc. • Existence of non-rational numbers (irrational numbers) such as $\sqrt{2}$, $\sqrt{3}$ and their representation on the number line. • Existence of each real number on a number line by using Pythagorean result. • Concept of a Surd. • Rationalisation of surds.
Algebra (20 hrs) (i) Polynomials (ii) Linear Equations in Two Variables	(i) Polynomials • Definition of a polynomial in one variable, its coefficients, with examples and counter examples, its terms, zero polynomial. • Constant, linear, quadratic, cubic polynomials; monomials, binomials, trinomials. Zero roots of a polynomial / equation. • State and motivate the Remainder Theorem with examples and analogy to positive integers (motivate). • Statement and verification of the Factor Theorem. Factorisation of $ax^2 + bx + c$, $a \neq 0$ where a, b, c are real numbers and of cubic polynomials using the factor Theorem.

9 th Class	
SYLLABUS	
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Algebra (20 hrs) (i) Polynomials (ii) Linear Equations in Two Variables	(i) Polynomials • Definition of a polynomial in one variable, its coefficients, with examples and counter examples, its terms, zero polynomial. • Constant, linear, quadratic, cubic polynomials; monomials, binomials, trinomials. Zero roots of a polynomial / equation. • State and motivate the Remainder Theorem with examples and analogy to positive integers (motivate). • Statement and verification of the Factor Theorem. Factorisation of $ax^2 + bx + c$, $a \neq 0$ where a, b, c are real numbers and of cubic polynomials using the factor Theorem.

9 th Class	
SYLLABUS	
Lines and Angles	• (Motivate) If a ray stands on a line, then the sum of the two adjacent angles so formed is 180° and the converse. • (Prove) If two lines intersect, the vertically opposite angles are equal. • (Motivate) Results on corresponding angles, alternate angles, interior angles when a transversal intersects two parallel lines. • (Motivate) Lines, which are parallel to given line, are parallel. • (Prove) The sum of the angles of a triangle is 180° . • (Motivate) If a side of a triangle is produced, the exterior angle so formed is equal to the sum of the two interior opposite angles.
Triangles	• (Motivate) Two triangles are congruent if any two sides and the included angle of one triangle is equal to any two sides and the included angle of the other triangle (SAS Congruence). • (Prove) Two triangles are congruent if any two angles and the included side of one triangle is equal to any two angles and the included side of the other triangle (ASA Congruence). • (Motivate) Two triangles are congruent if the three sides of one triangle are equal to three sides of the other triangle (SSS Congruence). • (Motivate) Two right triangles are congruent if the hypotenuse and a side of one triangle are equal respectively to the hypotenuse and a side of the other triangle. • (Prove) The angles opposite to equal sides of a triangle are equal. • (Motivate) The sides opposite to equal angles of a triangle are equal. • (Motivate) Triangle inequalities and relation between 'angle and facing side', inequalities in a triangle.

Quadrilaterals	• (Prove) The diagonal divides a parallelogram into two congruent triangles. • (Motivate) In a parallelogram opposite sides are equal and conversely. • (Motivate) In a parallelogram opposite angles are equal and conversely. • (Motivate) A quadrilateral is a parallelogram if one pair of its opposite sides are parallel and equal. • (Motivate) In a parallelogram, the diagonals bisect each other and conversely. • (Motivate) In a triangle, the line segment joining the mid points of any two sides is parallel to the third side and (motivate) its converse.
Area	• Review concept of area, area of planar regions. • Recall area of a rectangle. • Figures on the same base and between the same parallels. • (Prove) Parallelograms on the same base and between the same parallels have the same area. • (Motivate) Triangles on the same base and between the same parallels are equal in area and its converse.
Circles	• Through examples, arrive at definitions of circle related concepts radius, circumference, diameter, chord, arc, subtended angle. • (Prove) Equal chords of a circle subtend equal angles at the centre and (motivate) its converse. • (Motivate) The perpendicular from the centre of a circle to a chord bisects the chord and conversely, the line drawn through the centre of circle to bisect a chord is perpendicular to the chord.

Constructions	• (Motivate) There is one and only one circle passing through three given non-collinear points. • (Motivate) Equal chords of a circle (or of congruent circles) are equidistant from the centre (and conversely). • (Prove) The angle subtended by an arc at the centre is double the angle subtended by it at any point on the remaining part of the circle. • (Motivate) Angles in the same segment of a circle are equal. • (Motivate) A line segment joining any two points subtends equal angles at two other points lying on the same side of it then the four points are concyclic. • (Motivate) The sum of the either pair of the opposite angles of a cyclic quadrilateral is 180° and its converse.
Surface Areas and Volumes	• Construction of a triangle given its base, sum/difference of the other two sides and one base angles. • Construction of a triangle when its perimeter and base angles are given. • Construct a circle segment containing given chord and given angle.
Statistics and Probability (15 hrs)	(i) Surface Areas and Volumes • Revision of surface area and volume of cube, cuboid, surface area of cylinder, cone, sphere, hemisphere, sphere, volume of cylinder, cone, sphere (including hemi-sphere) and right circular cylinder/cones. (ii) Statistics • Revision of ungrouped and grouped frequency distributions. • Mean, Median and Mode of ungrouped frequency distribution (with weighted scores). (iii) Probability • Fundamentals of probability using data through experiments. Notion of chance in events like tossing coins, dice etc. • Tabulating and counting occurrences of 'through 6' in a number of throws.

Proofs in Mathematics (5 hrs)	• Comparing the observation with that for a coin. Observing strings of throws, notion of randomness. • Consolidating and generalizing the notion of chance in coin-like tossing coins, dice etc. • Visual representation of frequency outcomes of repeated throws of the same kind of coins or dice. • Throwing a large number of identical dice/coins together and aggregating the result of the throws to get large number of individual events. • Observing the aggregating numbers over a large number of repeated events. Comparing with the data for coin. Observing strings of throws, notion of randomness.
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f) Academic Standards

8 th Class	
Academic Standards	
<p>Academic standards are clear statements about what students must know and be able to do. The following are categories on the basis of which we lay down academic standards</p> <p>Problem Solving</p> <p>Using concepts and procedures to solve mathematical problems</p> <p>(a) Kinds of problems:</p> <p>Problems can take various forms- puzzles, word problems, pictorial problems, procedural problems, reading data, tables, graphs etc.</p> <p>(b) Problem Solving</p> <ul style="list-style-type: none"> Reads problems Identifies all pieces of information/data Separates relevant pieces of information Understanding what concept is involved Recalling of (synthesis of) concerned procedures, formulae etc. Selection of procedure Solving the problem Verification of answers of readers, problem based theorems. <p>(c) Complexity:</p> <p>The complexity of a problem is dependent on</p> <ul style="list-style-type: none"> Making connections(as defined in the connections section) Number of steps Number of operations Context unraveling Nature of procedures <p>Reasoning Proof</p> <ul style="list-style-type: none"> Reasoning between various steps (involved invariably conjecture). Understanding and making mathematical generalizations and conjectures 	

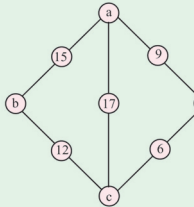
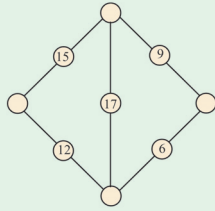
8 th Class	
Academic Standards	
<ul style="list-style-type: none"> Understands and justifies procedures- Examining logical arguments. Understanding the notion of proof Uses inductive and deductive logic Testing mathematical conjectures <p>Communication</p> <ul style="list-style-type: none"> Writing and reading, expressing mathematical notations (verbal and symbolic forms) Ex: $3 + 4 = 7$, $3 < 5$, $n_1 + n_2 = n_2 + n_1$, Sum of angles in a triangle = 180° Creating mathematical expressions Explaining mathematical ideas in her own words like- a square is closed figure having four equal sides and all equal angles Explaining mathematical procedures like adding two digit numbers involves first adding the digits in the units place and then adding the digits at the tens place/ keeping in mind carry over. Explaining mathematical logic <p>Connections</p> <ul style="list-style-type: none"> Connecting concepts within a mathematical domain- for example relating adding to multiplication, parts of a whole to a ratio, to division. Patterns and symmetry, measurements and space Making connections with daily life Connecting mathematics to different subjects Connecting concepts of different mathematical domains like data handling and arithmetic or arithmetic and space Connecting concepts to multiple procedures <p>Visualization & Representation</p> <ul style="list-style-type: none"> Interprets and reads data in a table, number line, pictograph, bar graph, 2-D figures, 3-D figures, pictures Making tables, number line, pictograph, bar graph, pictures. Mathematical symbols and figures. 	

g) Puzzles

8th Class

A magic Diamond

Find numbers to put in the circles so that the total along each line of the diamond is the same.



Hint: The number will be of the form
 $a = x, b = 5 + x, c = 3 + x, d = 11 + x$

where x is any number and the total along each line will be $20 + 2x$
 for example if $x = 1$, then $a = 1, b = 6, c = 4, d = 12$ and each line total will be 22.

9th Class h) Do you know?

Do You Know?

Making an 8×8 Magic Square

Simply place the numbers from 1 to 64 sequentially in the square grids, as illustrated on the left. Sketch in the dashed diagonals as indicated. To obtain the magic square on the bottom, replace any number which lands on a dashed line with its complement (two numbers of a magic square are complements if they total the same value as the sum of the magic's square smallest and largest numbers).

1	2	3	4	5	6	7	8
9	10	11	12	13	14	15	16
17	18	19	20	21	22	23	24
25	26	27	28	29	30	31	32
33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48
49	50	51	52	53	54	55	56
57	58	59	60	61	62	63	64

64	2	3	61	60	6	7	57
9	55	54	12	13	51	50	16
17	47	46	20	21	43	42	24
40	26	27	37	36	30	31	33
32	34	35	29	28	38	39	25
41	23	22	44	45	19	18	48
49	15	14	52	53	11	10	56
8	58	59	5	4	62	63	1

* A magic square is an array of numbers arranged in a square shape in which any row, column total the same amount. You can try more such magic squares.

i) Brainteaser

9th Class

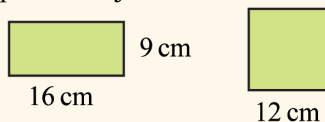
Brain teaser

1. Creating triangles puzzle



Add two straight lines to the above diagram and produce 10 triangles.

2. Take a rectangular sheet of paper whose length is 16 cm and breadth is 9 cm. Cut it into exactly 2 pieces and join them to make a square.



j) Highlight from History

8th Class

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

I. Understand the problem

This principle seems so obvious that it need not be mentioned. However students are often agitated 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 problem? 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 or you restate the problem in your own words.
- Is there yet another way to state the problem?
- What does (they 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 doesn't 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.



George Polya (1887-1985)

9th Class

Highlight from History

"The Wonder of Discovery is especially keen in childhood"

How a child become Ramanujan a great mathematician of all time?



Ramanujan

$\frac{1}{4} + 2 = \left(\frac{5}{2}\right)^2$

$\frac{1}{4} + (2 + 3) = \left(\frac{7}{2}\right)^2$

$\frac{1}{4} + (2 + 3 + 5) = \left(\frac{9}{2}\right)^2$

$\frac{1}{4} + (2 + 3 + 5 + 7) = \left(\frac{11}{2}\right)^2$

and so on.

Srinivasa Ramanujan was the one who never lost his joy at learning something new. As a boy he impressed his classmates, senior students and teachers with his insight and intuition.

One day an arithmetic class on division the teacher said that if three bananas were given to three boys, each boy would get a banana and he generalised this idea. Then Ramanujan asked "If no banana is distributed to no student will every one still get a banana?"

Ramanujan's math ability won several friends to him. Once his senior student posed a problem "If $\sqrt{x} + y = 7$ and $x + \sqrt{y} = 11$, what are x and y ?"

Immediately Ramanujan replied $x = 9$ and $y = 4$. His senior was impressed and became a good friend to him.

In his school days, along with school homeworks, Ramanujan worked with some patterns out of his interest.

Srinivasa Aiyangar Ramanujan is undoubtedly the most celebrated Indian Mathematical genius. He was born in a poor family at Erode in Tamil Nadu on December 22, 1887. Largely self-taught, he focused on "Loney's Trigonometry" at the age of 13, and at the age of 15, his senior friends gave him synopses of Elementary results in pure and Applied Mathematics by George Carr.

He used to write his ideas and results on loose sheets. His filled note books are now famous as "Ramanujan's Frayed note books". Though he had no qualifying degree, the university of Madras granted him a monthly Scholarship of Rs. 75 in 1913. He had sent papers of 120 theorems and formulae to great mathematician G.H. Hardy (Cambridge University, London). They have recognized these as a work piece and invited him to England. He had worked with Hardy and others and presented numerical theories on numbers, which include circle method in number theory, algebra inequalities, elliptical functions etc. He was second Indian to be elected fellow of the Royal Society in 1918. He became first Indian elected fellow of Trinity college, Cambridge. During his illness also he never forgot to think about numbers. He computed the tax number of Hardy, 1729 is a singularly unexceptional number. It is the smallest integer that can be represented in two ways by the sum of two cubes; $1729 = 1^3 + 12^3 = 9^3 + 10^3$. Unfortunately, due to tuberculosis he died in Madras on April 26, 1920. Government of India recognised him and released a postal stamp and declared 2012 as "Year of Mathematics" on the eve of his 125th birth anniversary.

and so on ...

$3 = \sqrt{9} = \sqrt{1+8}$

$= \sqrt{1+(2 \times 4)}$

$= \sqrt{1+2 \times 6}$

$= \sqrt{1+2 \times 11}$

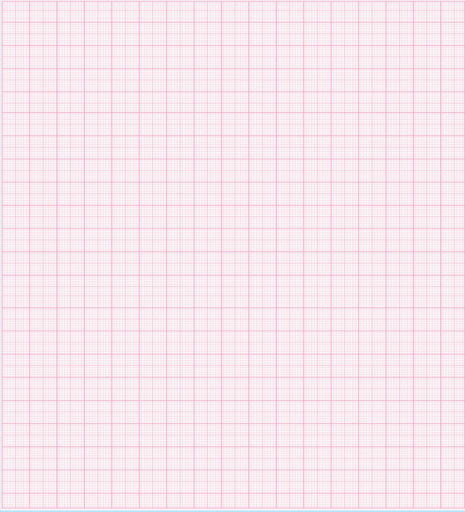
and so on ...

Prepared by A.P. GOUDAR

k) Wonderful Circle
(Back Page)

9th Class

Graph Paper



Wonderful Circle

Constructing the Nine-Point Circle of a triangle

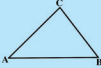
The circle which passes through the feet of the perpendiculars, dropped from the vertices of any triangle on the sides opposite them, passes also through the midpoints of these sides as well as through the midpoints of the segments which join the vertices to the point of intersection of the perpendiculars.

Do you know all that? This circle is called the Nine-Point Circle. This Nine-Point circle result was known to Leonard Euler 1765, but was rediscovered by German Mathematician Karl Feuerbach in 1822.

Constructing the nine-point circle is a good test of your construction skills and your ability.

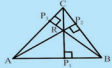
Just follow the instructions and try this

Step 1



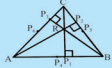
Construct a large scalene triangle on a sheet of white paper. Label it $\triangle ABC$.

Step 2




Construct the altitude to each side of the triangle and label the points of intersection with the sides P_1, P_2 , and P_3 . Name the orthocenter as R .

Step 3




Construct the midpoint of each side of the triangle. Label the points P_4, P_5 , and P_6 , so that P_4 is the midpoint of AB and P_5 is the midpoint of BC .

Step 4




Construct the midpoints of BR, CR and AR and label the points P_7, P_8 and P_9 , so that P_7 is the midpoint of BR and P_8 is the midpoint of CR .

Step 5



Construct the line segments connecting points P_7 to P_8 , P_8 to P_9 , and P_9 to P_7 . They should all intersect in one point. Mark that point as ' O '.

Step 6



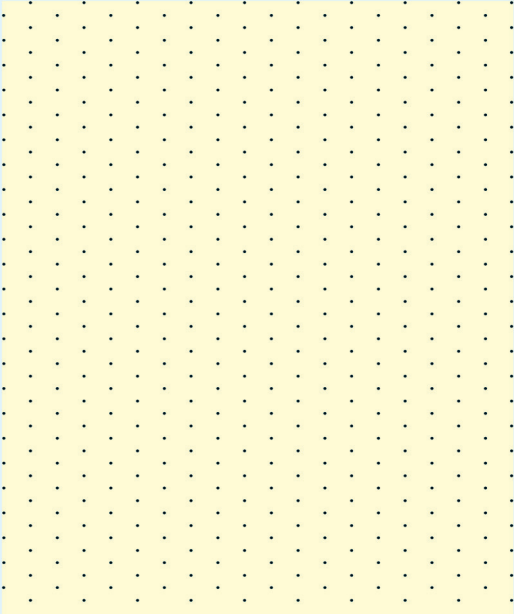
Construct a circle with radius OP_1 and center at point O . It should pass through all nine points $P_1, P_2, P_3, P_4, P_5, P_6, P_7, P_8, P_9$.

This is the wonderful circle. You might have observed that how "compass" play a major role in this Geometrical construction.

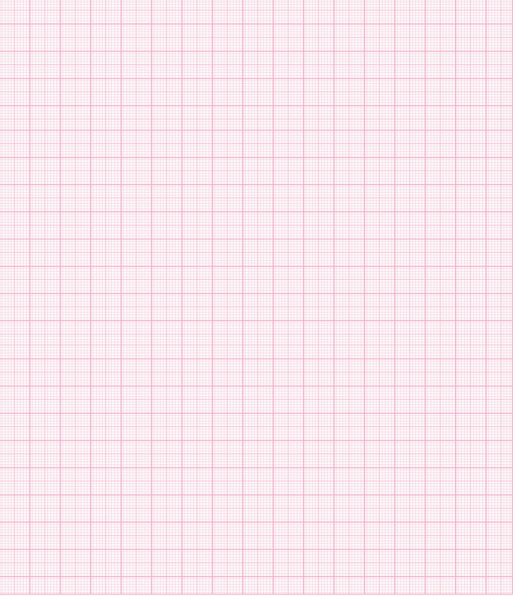
l) Graph Sheet / Isometricsheet

8th Class

Isometric dot paper



Graph Paper



Discuss : How these special features in new text books are helpful to the children of 8th and 9th classes?

◆ **A review of 8th Class New Text Book :**

The new text book has 352 pages where as the used in the past contain 311 pages. The size of the book is increased as the chapters were developed with more illustrations, tables, Graphs etc., The number of chapters remains same as 15. Taken care to reduce the content without changing the contextual part. All the topics were arranged in a systematic and logical order following spiral approach. The chapter include sufficient material for children to enjoy and donot feel boredom in solving problems. Chapters like "Sets`relations", Linear equations and in equations, some position of commercial mathematics were deleted from the syllabus as these are to be learned throughly in higher classes. The rational numbers were discussed in detailed manner with more illustrations and examples to understand their properties. Learning of Geometry in the class was confined to construction of quadrilaterals, Exploring geometrical ideas were stifled to next higher classes. Concepts like Sales Tax, VAT etc were introduced along with ratio and proportion. A chapter 'playing with numbers' was introduced in a different manner in which children will explore fomulae based on pattern and dissibily rules of number with reasoning. In Algebra, more emphasis is given to understand Linear equations, exponents, Algebraic expressions with more classroom activities and analysis. Factorisation and special products were shifted to next class. In every chapter more examples were given to understand the problem solving approach in solving problems. By reducing the member of exercises, the text book writers tried to reduce the stress in learning mathematics. All concepts in a chapter were linked with small exercises under 'Dothis', try these. There exercises will help the teachers and students every stage. The questions were also useful in building up the confidence individually as well as in groups.

◆ **A review of 9th Class New Text Book :**

The new 9th class text book has been changed throughly componing to the previous book. Geometry has been given more importance as per the prescribed syllabus and physical and mental age of the children at this level. This year Geometry includes Elements from Enclidian Geometry, lines and angles, Triangles, quadrilaterals, Areas, Cricles and Geometrical constructions witht justifications. All are were linked with concepts learned previously in 8th class. But the understanding the activities followed by logical conclusions which leads to proving of the theorems were given. Many worked examples were given to understand the application of theorems in solving problems.

The new text book consists of 342 pages comparring to the previous one with 439 pages. Motst of the unxlated topics were removed such us logarithms, squareeroots of algebraic expressions, eyclic expressions, quadratic equations, sets, relations, Linear equations and ineqations, matrices and computing. As per the Curriculum and syllabus prescribed at this level, every topic should have relevance to the context. Some new concepts like remainder

theorem, factor theorem, co-ordinate geometry were associated and statistics chapter was much strengthened which includes finding mean, median and mode of semigrouped data and through graphs. Probability was introduced as a new chapter and understanding of mathematical proofs were given with daily life examples. The new text book reduces the burden of much content and includes problems which makes children to think and discuss in peer groups.

The new text books were good in size, shape and colourful. Some additional information about History of Mathematicians, problem solving approaches were included. Also added some puzzles and Brain teasers to create interest among children for joyful learning of Mathematics.

Conclusion :

The text books written on the basis of new curriculum and syllabus will provide ample scope to learn all mathematical concepts in all the three classes 8th, 9th and 10th classes.

The teachers should plan accordingly with the concepts and syllabus with their innovative teaching strategies to provide new ideas to the children which reads mathematician among them.

The National policy on Education, 1986 states that Mathematics should be visualised as the vehicle to train a child to think, reason, analyse and articulate logically. Apart being a specific subject it should be treated as concomitant to any subject involving analysis and reason. The national curriculum framework for school education (NCFSE-2005) echoes such statements, but despite this mathematics education has remained much the same, focussed on narrow aims.

- SCF 2011

Chapter - 3

Analysis of a chapter in the New Text Book

Unit Plan

Arithmetic

8th Class

Unit : Comparing quantites with proportion

16 periods (12 hours)

(Chapter - 5)

S.No.	Sub topic	Concepts	Periods	Material
1.	Ratio (2)	i) Concept of ratio	1	Charts, news papers
		ii) Golden ratio	2	Golden ratio pictures related
		iii) Compund ratio		
		iv) Peoblems on Compount ratio	1	Monuments
2.	Percentage (3)	i) Comparing quantities with percentage	1	Charts
		ii) Finding increase and decrease of quantities with percentage	3	
		iii) Varbal problems related to ratio and percentages	1	
		iv) Estimating percentage	1	
3.	Discount (2)	i) Concept of discount	1,2	Charts
		ii) Verbal problems on discount	1	
4.	Profit and Loss (4)	i) Concepts of profit and loss	1	Charts
		ii) Finding differences between profit and loss	4	
		iii) Calculation of profit and loss percentage	1	
		iv) Verbal problems relating to profit and loss		

S.No.	Sub topic	Concepts	Periods	Material
5.	Sales Tax and VAT (1)	i) Concept of VAT	1	Charts Modle Bills
		ii) Verbal Problems	4	
6.	Compound Interest (4)	i) Concept of compound Interest	1	Charts
		ii) Derivation of the formula of Compound interest		
		iii) Calenlation of compound interest per annum or halfyearly	3	Pomphlets of different banks
		iv) Application and verbal problems on compound interest		Documents downloaded from interest

Topic : Arithmetic

Chapter : Companing quantities with proportion

Class : 8th Class

1. Academic Standards Prescribed :

- 1) **Problem solving** :
 - Solve problems related to compound ratio.
 - Solve verbal problems.
- 2) **Giving reasons** :
 - Finds difference between ratio and percentage.
 - Estimates percentage.
 - Finds difference between profit and loss.
 - Derives formula to find compound interest.
- 3) **Communication** :
 - Express the ideas about compoundratio in ownwords.
 - Explains different methods to solve problems on percentages, profit and loss and compound interest.
 - Explains the logic behind deriving the formula of compoud interest.
- 4) **Connection** :
 - Connects division with ratio and percentage.
 - Connects percentage with profit and loss, discount and VAT.

- Connects compound interest and VAT with daily life problems.
 - Connects problems related with profit, loss and compound interest with algebra.
- 5) Representation** :`
- Explains compound ratio using tables.
 - Explains percentages with tables.
 - Prepare bills using discount and VAT.
 - Understand different tables and information given in the chapter.
- 2. Teaching learning material** :
- Textbooks Graphsheets, Charts, Sketches, Bills collected from shops, Brochers distributed by banks pictures of historical monuments.
- 3. Introduction** :`
- Divide whole class into two groups as A and B and create a situation for comparison of different aspects like height, weight etc.
- 4. Teaching Strategies** :`
- The concept of compound ratio is to be introduced by taking an example from dialy life situation.
 - The child has to find the compound ratio of $a : b$ and $C : d$ with examples.
 - Creating a situation in the classroom to konw how the percentage increases and decrease.
 - Motivate the children to participate in groups and whole class activity to solve verbal problems relating to compound ratio and percentage.
 - Discuss the importance of Discount in the classroom with tables and charts.
 - By observing different types of bills students understand the difference between profit and loss.
 - Some textual problem about profit and loss must be showed.
 - Develop the concept of profit and loss with daily life examples and by showing shopping bills.
 - Develop the concepts of VAT and compound interest with bills and Bantery Brochers.
 - Derive the formula of compound interest with pattern and activity.
 - Solving verbal problems in classroom leads to the application.

Implementation of teaching strategies**Ratio :**

- ◆ Refer page 97 and 98 of text books and make the children to understand the tables of investments.
- ◆ Students will comprehend the compound ratio.
- ◆ Group activity is to be given for "Try these" item in page.99.
- ◆ Ask the children to find more pictures related to goldin ratio.
- ◆ Students must be provided an oportunity to understand and appreciate the Golden Ratio.
- ◆ Motivate the children to solve problems in exercise 5.1 on their own.

Percentage :

- ◆ Create a situation to develop the concept of ratio through the example in page.99.
- ◆ Encourage children to think and understand different methods given in page no.101.
- ◆ Ask the students to solve problems 7, 11 in the exercise 5.1.

Discount :

- ◆ Display the charts representing prices of articles and discount given by shopping malls as given in page no.102 to make the children to understand concept of discount.
- ◆ Use the item 'try these' in page no.104 to make the children to discuss about discount used in various daily life situations.
- ◆ Make the children to discuss and solve the problems given in page.105.
- ◆ In the items 'Try these' and 'Think discuss and write' to understand houw to estimate the percentages.

Profit and Loss :

- ◆ Make the children to observe the situations written on the chart of page.105.
- ◆ Idea of "Profit", "Loss" must be inclucated by observing the above discussion.
- ◆ Ask the children to solve problems given in p.106 and 107 by discussing with friends.
- ◆ Motivate the children to solve problems 8, 9, 10, 11, 12 of exercise 5.2 on their own.

Discount and VAT :

- ◆ Ask the children to collect bills from shops and customers for observing discount on items.
- ◆ Make the children to understand about VAT by taking them to some shops / Hotels / malls.
- ◆ Motivate children to discuss the example problem given in page 109.
- ◆ Ask the children to solve problems 5, 6, 13, and 14 on their own.

Compound interest :

- ◆ Make the children to observe the information given by the Banks on their brochures about deposits, interest rates on loans etc.
- ◆ By discussion on such brochures in the classroom, idea of compound interest must be developed among the students.
- ◆ Generalise the idea of compound interest through examples to arrive the formula to find compound interest (Page.113)
- ◆ Ask the children to solve problems given in Page 114, Page 115
- ◆ Through 15th example on the page no.118, application of compound interest in physical interest in physical science must be highlighted.
- ◆ Make the children to understand the relation between the application of physical science problems with compound interest.
- ◆ Problems 1, 3, 6, 8, 10, 14 and 15 of exercise 5.3 must be solved on the black board, while discussing with the students.

Additional Information :

- ◆ Collecting pamphlets of business organisations and insurance companies and discussing with the children about discount, interest, profit / loss.
- ◆ Inspiring the students to collect beautiful photographs or pictures and to identify the 'Golden Ratio'.

Key Concepts :

Golden Ratio, Compound Ratio, percentage as a ratio, discount, VAT, profit / loss, compound interest, derivation of formula for compound interest.

Activities of modern citizen like trade, business, industry and administrative machinery can be displayed by using logic of mathematics ` smith.

Chapter-4

Special Items -An Analysis

1. Verbal problems

Mathematical equation:

Know What + Know how + Know why = Know more

According to a research conducted by Institute of Educational Science, department of Education, U.S.A., the steps to solve verbal problems are as follows:

I. I. Read the Given verbal problem.

- ◆ Understand the problem
- ◆ Understand the mathematical language
- ◆ Identifies the type of the problem
(Construction, proof, graphs, fill the table etc.,)

II. Fill the following chart and solve.

1.	Identify "what are given, What are to be find" in the given verbal problem. <ul style="list-style-type: none"> ◆ Can you understand the given problem and can you explain it in your own words? ◆ Can you explain the given problem in another form? ◆ What is the meaning of important terms in the given problem? ◆ Can you draw a needed figure to solve the problem? 	
2.	To solve the problem what information is needed? <ul style="list-style-type: none"> ◆ Identify whether the given information is helpful to solve the problem ◆ Write the given problem in your own words to identify what to find in the given problem ◆ Write the steps in order ◆ Refer the solutions of identical problems ◆ Write "what do you find" in the given problem in mathematical language 	
3.	Does the given information is sufficient to solve the problem? <ul style="list-style-type: none"> ◆ Whether extra information is given? ◆ Identify the extra information that is needed to solve the problem 	

	<ul style="list-style-type: none"> ◆ Identify which operation, principle or activity to be used to solve the problem ◆ Identify the necessary theorem to solve the problem 	
4.	<p>How is the solution?</p> <ul style="list-style-type: none"> ◆ Prepare a plan/algorithm to solve the problem ◆ Try to find a pattern ◆ Write the steps in order ◆ Draw a relevant figure ◆ Identify what is needed and what is unnecessary. Remove unnecessary things ◆ Using of symmetry ◆ Using of a tool ◆ Identify the relevant activity and implement it ◆ Act accordingly and wisely 	
5.	Solve the Problem	
	Recaptulation:	
6.	What is your answer?	
7.	How did you solve the problem? What was the method?	
8.	Explain the reasons for using that particular method?	

Worksheet / Verbal Problems

1. Resolve into factors: $2y(y + z) - (x + y)(x + z)$

(Note: don't remove the brackets)

2. Find the value of
$$\frac{(1986^2 - 1992)(1986^2 + 3972 - 3)(1987)}{(1983)(1985)(1988)(1989)}$$

3. A right angle triangle with measurement 15cm, 20cm, is rotated through its hypotenuse. Find the volume and total surface area of so formed bi-conical shape?

4. A cylindrical shaped vessel whose inner radius is 21cm. Is filled with water. A solid sphere whose diameter is 10.5 cm. Is being dipped in the water/vessel. Find the increase in water level?

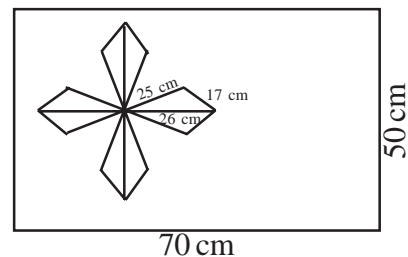
5. a, b, c, x, y, z are real numbers:
$$\frac{a + b + c}{x + y + z}$$

$a^2 + b^2 + c^2 = 25$; $x^2 + y^2 + z^2 = 36$ and $ax + by + cz = 30$, then find the value of $\frac{a^2 + b^2 + c^2}{x^2 + y^2 + z^2}$

6. In a right angle triangle the length of the smallest side is 2003 units. If the lengths of remaining sides are positive integers, find the perimeter of the triangle?

7. Radius of a sphere is 5 cm. Surface area of the sphere is 5 times of the lateral surface area of a cone whose radius is 4 cm. Find the height, volume of the cone ($\pi = \frac{22}{7}$)

8. In the adjacent figure the measurement of each triangle is 26 cm., 17 cm, and 25 cm., figure, as in the Telugu version. All such 8 triangles (forms a design) are drawn in rectangular shaped slate with measurements 50 x 70 cm. Find the area of the design and area of the remaining place?

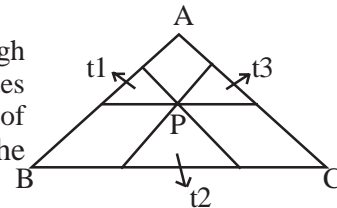


9. Prove that $2222^{5558} + 5555^{2222}$ is divisible by 7?

10. In a rectangle ABCD, AB = 16 Units, BC = 12 units and F & E are points on AB, CD respectively, if AFCE is rhombus, then find the measurement of EF?

11. $1 + \frac{1}{1+2} + \frac{1}{1+2+3} + \dots + \frac{1}{1+2+3+\dots+2013} = ?$

12. A and B are four digit numbers, $a > b$, if a number is reversed, then we will get another number and if $\frac{a+b}{5} = \frac{b-1}{5}$, then find the value of 'b'?
13. $x + y + z + t = 1$
 $x + 3y + 9z + 27t = 81$
 $x + 4y + 16z + 64t = 256$
 Find the value of 'x' if $x + 167y + 167^2z + 167^3t = 167^4$
14.
$$\frac{(1 + 17) (1 + \frac{17}{2}) (1 + \frac{17}{3}) \dots\dots (1 + \frac{17}{9})}{(1 + 19) (1 + \frac{19}{2}) (1 + \frac{19}{3}) \dots\dots (1 + \frac{19}{17})}$$
15. A line parallel to 'x' axis, intersects the graph $y = \frac{x-1}{(x-2)(x-3)}$ at $x = a, x = b$ then find the value of $(a-1)(b-1)$?
16. Sides of a right angle triangle are " a and b" and $a > b$. If the angle bisector of right angle divides the given triangle into two similar right angle triangles then find the distance between two Ortho centres of so formed two right angle triangles.
17. Find the remainder when x^{2013} is divided by $(x^2 - 1)$?
18. If [YE] [ME] = [TTT] then find the value of $Y+E+M+T$ (YE, ME are two digit numbers and TTT is a three digit number)
19. P is a point inside of triangle ABC. Three lines, which are drawn through the point P and each line is parallel to each side of the triangle, divides the triangle into 6 small parts as shown in the figure. If the areas of smaller triangles $\Delta t_1, \Delta t_2, \Delta t_3$ are 4,9,16 respectively, then find the area of triangle ABC.



20. If the length of sides of right angle triangle are integers then show that radius of the Incircle of the triangle is also an integer.
21. If $x, y \in z$ and $x < y, x^2 + y^2 = 2000$ then show that $31 < y < 45$.
22. In triangle ABC, the incircle touches the sides BC, CA and AB at D, E and F respectively. Radius of the incircle is 4 cm. And the lengths of BD, CE, AF are consecutive integers, find the lengths of sides of the triangle.
23. If $(a^2 + b^2)^3 G (a^3 + b^3)^2$ and $ab \neq 0$ then find the value of $\frac{a}{b} + \frac{b}{a}$
24. Find the digits in the following addition

T I C K
 T O C K
 T I C K
 T O C K
 A

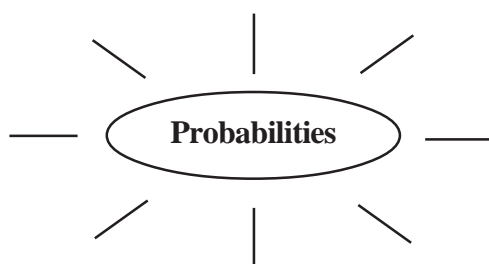
 C L O C K

(T,I,C,K,O,L,A are non repeated digits)

2. Probability

1. (a) What is Probability ?
- (b) What is the need of learning probability?

What is Probability? (Brain storming)



The world where we live is not stable. All surroundings of human beings are not under his/her control. Some of them are ruled by the nature. For example to reach a certain place, if there are many ways generally we think that which way is safe and in which way we can reach quickly? To perform a cardiac operation to our friend we think that which hospital is better one? How the weather is going to be, for the next 3 days? The train scheduled to start at 10.00 'O' clock will start at right time?

Frequently we will face such questions in our daily life. We show interest in guessing how the things are going to be done in the future. Many reasons will help us to take a decision on what we guess. To take a decision on what we guess, we need the knowledge of Probability. To express the probability we use fractions, decimals or percentages. **Probability is a digital expression to show how the incident will probably occur.**

◆ Uses of Probability :

We take many decisions without our concern by using the probability.

Medical related decisions : To get an operation for our near and dear we will think of about a good hospital , we will bring them to that hospital only and finally we will try to get a most successful doctor in this field.

Sports and Games : To select a player, all his/her records will be taken in to consideration. By making rating on his/her performance we will decide whether he /she is eligible?

Insurance Sector : when the companies extending insurance to a person, his/her age, his/her health grounds, probability of death rate of that particular age group are to be taken into consideration.

Weather forecast : The weather of coming few days will be guessed according to the temperatures of the past few days and cyclones happened in that year.

1. The probability of an event lies between 0 and 1 (including 0 and 1). Probability can be found in two ways:

- i) Experimental Probability
 - ii) Theoretical probability
- i) **Experimental Probability** : To find/estimate the probability in this method, the experiment is done for more times and records the number of occurrences that our favourable event occurred.

If A is an event then its experimental probability is

$$P(A) = \frac{\text{number of favoured out comesd}}{\text{total number of out comes}}$$

This probability is in deductive method.

Experimental probability v/s theoretical probability

Generally before the experiment, we estimate its theoretical probability. But after experiment we can find that there is difference between experimental and theoretical probability. If the experiment is done for more times, then the experimental probability closes to the theoretical probability.

Experimental probability	Theoretical probability
If a coin is tossed for 10 times , if we get 3 times head and 7 times tail then what is the probability of getting head $P(\text{head}) = \frac{3}{10} = 0.3$	If a coin is tossed then what is the probability of getting head? total number of possibilities = 2 number of favoured possibilities = 1 $P(\text{head}) = \frac{1}{2} = 0.5$

Here there is difference between experimental probability and theoretical probability. But the experiment is done for many times then the experimental probability is approaches to the theoretical probability. Some mathematicians had tossed the coin for many times and registered the results. Let us observe some of them:

Name	Number of times that the coin tossed	Number of heads	Number of tails
Buffer (French)	4040	2048	$\frac{2048}{4040} = 0.5069$
John Ker rich (English)	10000	5067	$\frac{5067}{10000} = 0.5069$
Carle Pearson	24000	12012	$\frac{12012}{24000} = 0.5069$

If the coin is tossed for one time then the theoretical probability = $\frac{1}{2} = 0.5$. From the table it is clear that when Carle Pearson tossed the coin for 24000 times the experimental probability is 0.5005 which is very close to the theoretical probability.

b) If two dice are rolled two times then the number of possible outcomes = _____

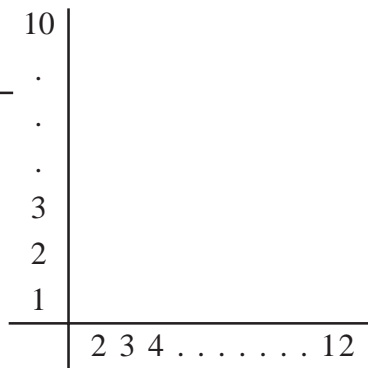
c) If the two dice are rolled three times then the number of possible outcomes = $\frac{108}{(Why?)}$

Roll a dice for 108 times (why is it rolled more times?) then note the sum of the scores on the top faces of dice in the following table:

Possible total	Tally marks	Frequency
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
Total		108

Draw a bar graph by using the above table.

From the bar graph the possible maximum score = _____



Theoretical probability (B) :

Note the possible total score on first two dice in the following table :

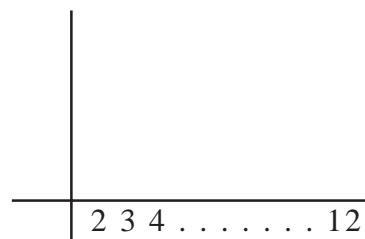
	Total	1	2	3	4	5	6
1 st dice	1						
	2						
	3						
	4						
	5						
	6						

From the table fill the following :

Total	2	3	4	5	6	7	8	9	10	11	12
Number of time occurred											

Draw a bar graph for the above information

The possible maximum score = _____



Discuss the following questions in both the methods (A,B).

1. Do the length of the bars is same? _____
2. Maximum occurred score _____
3. Are all bar graphs symmetrical? _____

Note :

If an experiment is done for many times then the experimental probability closes to the theoretical probability. This concept is the base for statistics and probability. It was established by Bernoulli in 1713.

It is called Law of Large Numbers.

Text Book is important resource for the teacher as well as student. Teacher uses the textbook to know the mathematical concepts that he has to teach, methods of teaching and to prepare lesson plans. Students use the text book to know the concepts and methods.

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Worksheet / Probability

How the headlines in today's news probably?

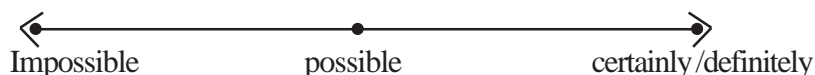
Aim/objective : After completion of the activity the participants/trainees can able to express their daily life situations and chance of their occurrence in the language of probability

Groups : Make the participants in to 6-7 groups, each consisting of 4 members

Material : Chart, Sketch pens, Glue, scissors, old news papers

After discussion with the group members, imagine the 5 important news items which will be telecasted at 9.p.m to night (10 minutes)

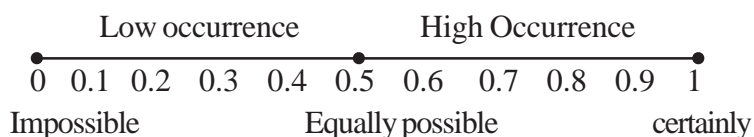
(On board)



After 10 minutes a group come forward and write their first probable news item on the board. This will be discussed in the class and its probable occurrence is noted on the above scale

If it is to note its probable occurrence at more than the above points in the scale the following terms may be used. They are

High occurrence, Low occurrence



Trainees will read the chapter "Probability" (Chapter -4.1), page 292 (10 minutes)

Then the group discuss and rewrite their news items in the order.

Presentation:

Every group will Present their news head lines by using the terms impossible, equally possible, highly possible, certainly, etc.

3. Proofs in Mathematics

1. Un defined terms :

Mathematics is the independent of all other subjects. So to define the terms in this subject, we have to use another mathematical terms. After defining the first term with its help and with the help of other mathematical terms we can now able to define another (one more) term. By using this another term we can define some other termwe have to go in this process only. But In this way when we try to define the terms in mathematics, at some junction we will again reach to the first term. Aristotle proposed that if we wanted to get rid of this situation we would have some undefined terms. Up to 19th century no mathematician had looked into this undefined terms. This undefined terms got important due to Maritz Patch in the year 1882.

Undefined terms are explained with their meaning only but not with definition. We adopted- Point, Line, surface, number, space zero etc., are undefined terms in mathematics. Because of the entry of set theory their number was decreased why because set theory links the different branches of the mathematics.

Definitions:

If we want to define a term first of all we have clear understanding about what it explains. Defining a term means explaining its meaning with other terms.

A good definition consist of (1) the term which is going to be defined is to be mentioned (2) to define it, the undefined or previously defined terms only are to be used (3) the class to which it belongs and how it differs and in which issues it differs from the other terms is to be indicated (4) No scope is to be given for unnecessary issues/terms (5) converse has to be existed.

Ex: A polygon with three sides is a triangle.

Explanation: (1) triangle, the term which is going to be defined, is mentioned (2) it belongs to polygons which is mentioned (3)How it differs with other polygons with respect to sides is also mentioned

Ex: A Polygon with three sides and three angles is a triangle

Explanation: Here three angles is not necessary

2. Axioms :

Any subject which has scientific and logical base is started with universally agreed fundamental concepts. These fundamental concepts don't have proofs. These are to be taken as true and with the help of them some other concept are to be developed. These concepts are agreed by all as true concepts.

In mathematics such concepts without proofs are considered as Axioms. For example (1) part is always bigger than the whole (2) if equal parts are added to equal s then the resulting wholes are also equals.

In geometry (1) through the given two points only one line can be drawn (2) circle can be drawn for any given diameter

But at present we are using all fundamental concepts as axioms.

3. Theorems-Conjectures :

Theorems are statements which are made from deductive method on the basis of Scientific and logical deductions of undefined words, defined words and axioms. All theorems are conditional statements

Conjectures are statements which are made by observing different patterns/configurations in mathematics. All these are conditional statements. These conjectures don't have proofs. They are made by observation only. Whenever a conjecture is proved then it becomes as a theorem.

- Ex:-
- 1) Gold Back conjecture
 - 2) Riemann conjecture
 - 3) 144 is the only square number in Fibonacci numbers

We felt that four colour problem was a conjecture. But it was proved recently

Truly speaking all theorems/conjectures are statements made by observing patterns and by linking the mathematical facts/issues/concepts. Every theorem in the beginning days stated as a conjecture. Proof will be given later. Pythagorean Theorem was also in the beginning stated as a conjecture and later it was proved.

4. Statements :

Statements are sentences which we can decide whether they are true or false but not both. That means every definition is a true statement.

In mathematics all statements are proved, but in other subjects they are just examined or verified only. Mathematical statements are deducted from already known facts. In other subjects they are established from the results and conclusions taken from the experiments or by observing the facts. That is why the theory of relativity is just examined and verified only, but not proved.

5. What is a Proof?

Proof of mathematical statement means the truth value of the statement is being proved with the help of logical and scientific arguments. In this process all the steps which we use are conditional statements. Proof means a universally agreed argument.

Importance of proof:

Let us observe the following examples:

Ex:-Prove that $\frac{1}{1000} - \frac{1}{1001} < \frac{1}{1000000}$

Proof: $\frac{1}{1000} - \frac{1}{1001} = \frac{1001-1000}{1001000} = \frac{1}{1001000}$

But $1001000 > 1000000$ Therefore $\frac{1}{1000} - \frac{1}{1001} < \frac{1}{1000000}$

With the help of calculator or computer it can be checked or verified. If doing so we can escape from establishing the proof. But in mathematics, understanding is important. A machine can answer for a problem but it does not give answer for the question why? Further proof leads to generalisation.

For example we can prove that $\frac{1}{n} - \frac{1}{n+1} < \frac{1}{n^2}$

There is limit for digits in the computers or in calculators, if the limit exceeds they give only approximate values.

6. How is a mathematical statement proved?

There are no special methods to prove mathematical statements. Because of this Fermat theorem took 300 years to be proved. Still many conjectures are not yet proved. But if we think in the way as shown by Polya we may find some clue.

First we must understand clearly, what is required to prove, and then we should have a rough idea about how to proceed. First we have to understand the statement which has to be proved i.e., we have to know what is our aim? For this purpose you have to question yourself about what is given (Hypothesis) and what is to be proved (Conclusion), what constraints are given. Draw a graph or picture/diagram if it is needed /possible and Hypothesis and conclusion are shown by relevant symbols.

Then the relation between Hypothesis and conclusion is to be identified. If there is no direct relation between these two, we have to try to make a relation with the help of sub objects.

7. How to write a proof?

- i) Draw a diagram which has to be shown all information.
- ii) Write the given part (Hypothesis) with relevant words.
- iii) Write the to be proved part (Conclusion) with relevant words.
- iv) To reach the object, study the diagram for further information/understanding.
- v) Then start to write proof. Explain reason for every step. The following items can be used as reasons. (i) axioms (ii) definitions (iii) given part (iv) statements which are proved earlier .

8. Method of proving :

a) Hypothesis	
b) Conclusion	
c) Figure	
d) Proof steps/statements	Reasons
1) _____	1) _____
2) _____	2) _____
3) _____	3) _____
4) _____	4) _____
5) _____	5) _____

9. Methods of Proofs :

1) Direct Proof : (i) in direct proof, in a theorem $H \rightarrow C$ (Hypothesis-Conclusion) H is taken as true and with logical reasons , by using the known facts we will reach C . If we explain this steps as $H \rightarrow C_1 \rightarrow C_2 \rightarrow C_3 \dots \rightarrow C$, then C_1, C_2, C_3, \dots are used as sub objects/aims.

Ex:- Show that $a^2 < b^2$ if a, b are real numbers and $a < b$.

Proof:

$$a < b \Rightarrow a^2 < ab \text{ (by multiplying with } a \text{ on both sides)}$$

$$\Rightarrow ab < b^2 \text{ (by multiplying with } b \text{ on both sides)}$$

$$\Rightarrow a^2 < ab < b^2 \text{ (associate property)}$$

$$\Rightarrow a^2 < b^2$$

(ii) Backward method/Reverse method : In this method we will move from conclusion to Hypothesis. Steps are written in opposite/reverse direction. This will be used when the process of moving from Hypothesis to conclusion is difficult.

Ex : a, b are real numbers and $a < b$, then $4ab < (a + b)^2$

Solution :

$$4ab < (a + b)^2 \Rightarrow 4ab < a^2 + 2ab + b^2$$

$$\Rightarrow 0 < a^2 - 2ab + b^2$$

$$\Rightarrow 0 < (a - b)^2$$

$$\Rightarrow a - b \neq 0$$

$$\Rightarrow a \neq b$$

$$\Rightarrow a < b$$

\therefore If $a < b$ then $4ab < (a + b)^2$

2) Indirect method : In this method all alternatives are to be considered to prove the statement. We will show that only one of these alternatives is true and remaining are all false. i.e., conclusion is only remains true

Ex: if two lines are intersected, they intersect at only one point

Here the Conclusion is "two lines intersect at only one point". The alternative for this is "they intersect at many points".

Therefore "two lines intersect at two points "is to be taken and it will be proved that it is a wrong statement. That implies two lines may not intersect at two or more than two points i.e., it is proved that "two lines intersect at only one point". So the statement is proved.

(i) Don't exist natural number x and y such that $x^2 - 4y = 3$

Hypothesis: $X^2 - 4y = 3$

Conclusion: x and y are not natural numbers

Proof: let x and y are natural numbers (alternative for conclusion)

Then x and y may be even or odd

Case (i) : if x is even then

let $x = 2z$

$$\therefore (2z)^2 - 4y = 3 \Rightarrow 4z^2 - 4y = 3 \Rightarrow 4(z^2 - y) = 3$$

So 3 is a multiple of 4. It is wrong/false

Case (ii) if x is odd then

let $x = 2z + 1$

$$(2z + 1)^2 - 4y = 3 \Rightarrow 4z^2 - 4y + 1 - 4y = 3$$

$\Rightarrow 4(z^2 + z - y) = 2 \Rightarrow 2$, is the multiple of 4. It is also wrong or false statement Therefore x is neither even nor odd. So x is not a natural number.

3) Counter Example : Truly speaking it is not a proof. It is logic to prove that the given statement is wrong/false. In this method we will give example which makes the statement wrong

Ex: (i) all prime numbers are odd

For this the counter example is 2

Ex: (ii) there is no biggest prime number

Solution: let p is the biggest prime number then

$(2.3.5.7.11.....p) + 1$ is bigger than the prime number p

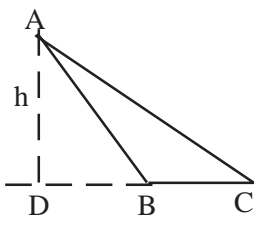
In the class room management, the separatist views are to be noted. For example mathematics is not necessary for a particular group people; girls are not able to learn mathematics. Such faiths will effect class room management. Similarly some unfaiths are there towards some casts. All these are questioned and clarified in the class room.

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Activity Sheet / Work sheet on proofs

1. Some questions are given below. Write answers in space provided.
2. Answers should be short, clear and reasonable.

	Questions	Answers
1.	This is a 5 words sentences This is not a 5 words sentences Truth values of both sentences	
2.	Definition-Which kind of statement	
3.	The angles which have a common vertex and a common side are called adjacent angles. Is this a correct definition? If not, correct it	
4.	We take the Hypothesis is always true. Why?	
5.	All acids are sour to taste. Liquid 'A' is sour to taste. So liquid 'A' is	
6.	The Gold Back conjecture is not yet proved so it is not a statement. What is your opinion?	
7.	The quadrilateral which has four equal angles is a square- give counter example. Change the statement as a true statement	
8.	At least two persons with same number of hair will exist in the world. How can you say?	
9.	Watson told that-I have been waiting for news paper boy since morning. Sherlock Homes told that -Why are you waiting, today here there is no paper, so the paper boy not yet come. What is the difference between their arguments	
10.	If the capital of Russia is Masco then the capital of India is New Delhi. Here there is no relation between Hypothesis and Conclusion, but it is a true statement. Why?	
11.	This is the month of February. So there are 28days only. Give a counter example	

	Questions	Answers
12.	The equidistant point from the sides of an angle is lie on the line of angle bisector. Draw a diagram and mention Hypothesis and Conclusion.	
13.	Who of the following was awarded with Nobel Prize for two times (1) Neopolien (2) Newton (3) Linnaeus Paling (4) Gaalab	
14.	In triangle ABC, $AC \neq BC$ and in triangle ADC, $AD \neq AB$, then CD bisect the angle ACB- write a flow chart for its proof <div style="display: flex; align-items: center; justify-content: center;"> <div style="margin-right: 10px;"> $AC \neq BC$ $AD \neq BD$ $CD \neq CD$ </div> <div style="margin-right: 10px;"> \rightarrow </div> <div style="border: 1px solid black; padding: 5px; text-align: center;"> $\triangle ADC \neq \triangle BDC$ </div> <div style="margin-right: 10px;"> \downarrow </div> <div style="border: 1px solid black; padding: 5px; text-align: center;"> $\angle ACD \neq \angle BCD$ </div> </div>	
15.	In a problem on finding the area of a triangle, the adjacent figure is drawn. Write relevant Hypothesis and Conclusion. <div style="text-align: center;">  </div>	

Chapter- 5 APPROACH PAPERS

A) Approach Paper on Number System

A. Necessity :

In natural number system we have the freedom to do addition and multiplication operations only. Always it is not possible to do their reciprocals i.e., subtraction and division. We get the freedom to do subtraction if the negative numbers are added to the natural numbers. To perform division operation we need rational numbers. For the solution of quadratic equations irrational numbers are needed.

B. Fractions :

Normal fraction is an ordered pair of 'a, b'. It can be written in the form of $\frac{a}{b}$. Here $b \neq 0$. 'a' is called as numerator and 'b' is called denominator

Ex : $\frac{2}{3}, \frac{4}{3}$ etc.,

Ex : $\frac{x^3 + 1}{x^2 + 1}, \frac{x^2 + 3x + 4}{x}$ etc., all these are called algebraic fractions.

Ex: a fraction which is in the form of $\frac{a}{10^n}$ is called as decimal fraction. In this fraction 'a' is an integer and 'n' is a natural number.

C. Rational Number - Definition :

If 'a & b are integers and $b \neq 0$ then the numbers which can be written in the form $\frac{a}{b}$ are called Rational Numbers.

(i) Here b is taken as non zero number, i.e. $b \neq 0$,

(a) If $a = 27, b = 3$ then $\frac{a}{b} = \frac{27}{3} = 9$, here b is divisor.

(b) If $a = 27, b = 7$ then $\frac{a}{b} = \frac{27}{7} = 3 \frac{2}{7}$ Here generally we consider b as divisor, 23 as dividend, 3 quotient and 2 remainder. In $\frac{a}{b}$, b is divisor. Zero is not considered as divisor so $b \neq 0$.

(ii) Here we noted that "the numbers which can be written in the form....." but not "the numbers which are in the form of" . To understand this let us consider the following examples:

Consider $\frac{\sqrt{20}}{\sqrt{5}} = \frac{\sqrt{4} \sqrt{5}}{\sqrt{5}} = \sqrt{4} = 2 = \frac{2}{1}$

Here $\sqrt{20}$ and $\sqrt{5}$, both are not integers. These are not in the form of $\frac{a}{b}$, but we are able to write them in the form of $\frac{a}{b}$. Therefore $\frac{\sqrt{20}}{\sqrt{5}}$ is a rational number.

(iii) Consider $\frac{\sqrt{15}}{\sqrt{5}} = \frac{\sqrt{3} \sqrt{5}}{\sqrt{5}} = \sqrt{3}$. This cannot be written in the form of $\frac{a}{b}$. So it is not a rational number.

(iv) Generally when writing $\frac{a}{b}$, b is considered as positive number.