Module developed by

Sri T.V.Rama Kumar, H.M., Z.P.H.S., Mulumudi, SPSR Nellore District.
Sri G.V.B.S.N.Raju, S.A., M.H.School, Kasapa, Vizianagaram District.
Sri P.Suresh Kumar, S.A., GHS, Vijayanagar Colony, Hyderabad District.
Sri P.D.L.Ganapathi Sharma, S.A., GHS, Zamistanpur, Manikswarnagar, Hyderabad District.
Sri S.Prasada Babu, PGT, APTWRS, Chandra Sekhara Puram, SPSR Nellore District.

Subject Expert & Editing

Sri KRajender Reddy,
Co-ordinator, Maths Text Books,
SCERT, A.P., Hyderabad.

Editing & Co-ordination

Dr. N.Upender Reddy,
Professor,
Curriculum & Text Book Department,
SCERT, A.P., Hyderabad.

Chief Advisor

Sri G.Gopal Reddy,
former Director,
SCERT, Hyderabad.

Sri S.Jagannath Reddy
Director,
SCERT, TS, Hyderabad.
"Destiny of India is constructed in her classrooms" said Kothari Commission. It means the schools should play a great role of preparing rational citizens. (Moreover, RTE-2011 provided all the children the right of acquiring quality education. Quality in education means the child should be able to think, communicate, conduct with distremination, acquiring expected class wise and subject wise competencies etc. Development of these skills in a child is the duty of the school. And this has to be done by teachers.

The school should realise its duties in these commercialized days of education and subsequently the teachers must change themselves in performing roles and responsibilities. Knowledge is believed in information and remembering and retrieving that knowledge has become ultimate objective in the classroom. Main aim of exams is to test the quality of that memory but not the competencies those to be developed in learning of the subject. The attitude of teachers should be transformed from these old practices to innovative initiations. Thus the system of school can be rejuvenated.

Key principles of APSCF-2011 directs us that the children should learn meaningfully. They should construct their knowledge and utilize it in daily life situations : It also stated that the learning should not confine to classroom and it should encourage the children to research, explore, reflect through activities or projects.

It is thus believed that the children are knowledge constructors and the teachers should transform their teaching strategies so that the children can construct knowledge by critical teaching learning process of social constructivism. The evaluation system should be changed correspondingly. As per the above mentioned key principles, the syllabi, text books, teaching learning process and evaluation procedures in our state have been revived upto 10th class. SCERT has reformed the system and teaching learning processes and 9, 10 examination reforms are about to be implemented from 2014-15.

The SCERT has designed teachers handbooks to provide comprehensive understanding on new textbooks, modern teaching learning strategies and examination reforms. Philosophical aspects of new textbooks, special features of new textbooks, expected competencies, learning strategies for competencies, preparation of the teacher, year plan, lesson plan, examination reforms propositions, summative papers, formative exams and strategies have been distussed in this handbooks. This handbook is useful in implementing meaningful teaching learning strategies in the classroom. Therefore, we hope that the teacher will ruminate his experience, creativity in thinking and implement successful teaching learning strategies.

The teacher is able to utilise this book in understanding textbook and can write year and lesson plans in implementing teaching learning process accordingly. He can understand 9, 10 examination reforms and examination implementation process. He should also elevating himself as the best teacher by carving future generations by understanding truth. We appreciate the members of C&T department of SCERT, textbook writers and state resource group members who participated in designing this book.

Director,
SCERT, T.S., Hyderabad.
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OVERVIEW:

Textbooks guides is like a compass in teaching learning process to be conducted in the classroom. The textbook is helpful in improving the skills of children in the class. A textbook is designed on the basis of syllabus and educational objectives of a particular subject at a particular level. Based on that textbook, the teacher has to conduct teaching learning process. So, the teacher has to use the textbook to develop the expected skills but not to use as a tool for more transacting the information.

Nowadays, use of the textbook is confined only to solve problems which are given in the exercises. Generally, if the students are copying solutions from black board when every problem is solved on the board, some teachers are giving the problems to the children to solve after solving 1 or 2 problems. The teachers are considering this solving of problems in all exercises as completing syllabus can treat this process as mathematics learning if the students copy or imitate?

- What is the role of the textbook in learning Maths?
- How should be learning of maths?
- How to develop the skills among children in mathematics learning?

Learning Maths should enhance abilities in children like Problem Solving, Reasoning Proof, Communication, Connections; Visualisation & Representation. Subsequently the child would solve
problems which come across in daily life and motivated to discover new inventions. A textbook can be helpful in improving the Mathematical skills but not just to extract the content on information given in it. Present text books are designed in such a way that the students can search for different ways of solving problems by understanding connections between various concepts and logical reasoning behind them. The teachers and students may understand here that this textbook should encourage the children to understand the concept, prove the statements and solve problems themselves. consequently, the students develop Reasoning, communication, representation skills and trained accordingly. Let us look at the areas and concepts mentioned in textbooks and understand them.

CONTENTS OF TEXT BOOK :

- **Foreword**: It is discussed about nature and scope of textbooks. It mainly discussed universalisation of education, process of learning mathematics by children at secondary level, application of mathematical concepts in daily life, Role of a teacher (Execution of conducting T.L.P. by considering individual differences, positive approach towards mathematics, participation of all etc) at the end Exposing gratitude to all (SCERT all writers, DEOs, MEOs, HMs, C&DSC, AP and Vidyabhavan Society) and a welcome for comments and suggestions for the improvement of the textbook.

- **AREAS OF MATHEMATICS - CHAPTERS**: This textbook consists of 14 chapters. These chapters are related to various mathematical areas like Number System, Geometry, Co-ordinates, Trigonometry, Mensuration, Datahandling etc., The mathematical modelling has been introduced as appendix for the exposure of students on real life incidents. This is also a mathematical skill to be learnt by the children at this stage. Though the chapter cannot be considered for exams, children develop a capability to solve problems by mathematical modeling on their own.

- Every teacher has to read and understand instructions to teachers and visualise in various strategies that her / she would adopt in TLP. Mainly we can understand the development of syllabus from 6th to 10th, methods or strategies to solve exercises. Then, content flow has been discussed for each chapter when we teach this content every chapter, it doesn't mean completion of syllabus. The teachers instructions to given in the textbook guides the teacher to use the Textbook as an effective tool to achieve academic standards in the teaching learning
process. Understanding these instructions is a an important step in the readiness of teacher or
teacher preparation.

- What happens, if the 10th class mathematics book is filled with intermediate level content?

**Highlights of the Text Book:**

As per guidelines given by NCF-2005, RTE-2005 and APSCF-2011, Text Books should be
centred; and it should take into account interests, attitudes, learning style and background of the
children. These are key concepts in developing this 10th class Mathematics Text Book.

When we observe the new Mathematics Text Book for 10th class it has the following characteristics
/specialities.

The text book has been designed to make the children to learn mathematics based on one's natural
abilities / Dnate abilities and make the children think in mathematical perspective. Let us learn example
in page No : 215 of 10th Mathematics Text Book question has been asked in an exercise "Think-
discuss" as For a right angled triangle with integer sides atleast one of its measurements must be an even
number. Why? This question encourages the children to think about different ways of construction of a
right angled triangle with different combinations of measurements. The child can understand logic behind
the truth and he will be encouraged to give suitable reasons by the end of this activity.

In page no : 115 for solving "We have three methods to solve quadratic equation. Among these
three, which method would you like to use? Why? This problem is intended to enable the children to
think about various methods to solve a quadratic equation. And child is given opportunity to express
reason why he has chosen a particular method with proper reasons.

The text book is designed to bid adi an to rote learning methods and replacing them by the methods
which encourage mutual interactions, activities, project work, inventions, experiments and analysis.

For example, let us observe page no : 272 of Mathematics Text Book of 10th class, the way how
the trigonometric ratios are defined in a different way by an activity. Teachers most of the used to follow
the the traditional method for defining trigonomentic ratios simply by writing the formulae on the black
board. By which children could not understand, how trigonometric ratio are defined and what they are.
By participating in this activity children can able to give the relation between the sides of a triangle with
respect to an angle in it. Finally he can induce the trigonometric ratios on his own.
Similarly in page no: 307 an activity of tossing a coin 50 times, 100 times, 150 times and count the occurrence of head and tails (events). The students can define the meaning of the probability and state seasons.

In page no: 193, there is an activity on similarity. By participating in the activity children can frame the rules for similarity of two polygon with the same number of sides. Two are similar if (i) all the corresponding angles are equal and (ii) All the corresponding sides are in the same ratio on their own. Like this, there are many similar activities which encourage children to think and generalise or frame rules in the form of mathematical statements. There activities provide the ample opportunity for the children to utilize their abilities and enjoy mathematics learning. Observe and identify those activities and discuss.

- Children can utilise the mathematical concepts they have learnt. They understand the concepts which are given in text books on basis of their previous experiences and real life contexts. There conceptual understandings enhance problem solving skills in students. Thus a student constructs knowledge and applies it in his daily life.

For example, solving linear equations given in pgs 83 and 84 and the concepts of solving problems in chapter "Application of trigonometry'. Child can apply this knowledge in daily life.

- The content in text book does not restrict the children to limit their understanding and solving of the problems on the concepts in the Text book, but encourages the child to learn beyond the scope of the text book.

For example in page no: 252, 274 under 'Think-Discuss', the task makes the children to think beyond the concepts covered in the Text book. In these cases, the child interact within his peer group or with material and comes to conclusion by the reflections. Thus a child comprehends the concepts.

**Structure of lesson / unit:**

Each lesson/unit of the text book is designed in a systematic manner

- Strengthening the concepts learnt in the lower classes by revision. Thus extending the knowledge with various concepts in the present class.
• Understanding various mathematics concepts, which are given in the textbook by daily life situations / incidents / activities / games / puzzle / series / examples etc.

• Different example problems with solutions are given after understanding a concept and to understand strategies of solving problems by using the concept.

• In exercise is given with the title "Do this" to ensure that the children understood a particular concept. Aim of this "Do this" exercise is to solve the problems by children individually. When a student is unable to solve this exercise, we can say that the child has not understood the concept. The alternative strategies or activities should be designed to understand the concept for these children.

• Another type of exercise is given with name "Try this" to promote critical thinking in the child and understand the concept with more comprehension. These problems can be solved by discussing in groups. Support of teacher is needed.

• "Think discuss & write" - exercise is given to make the children to think elaborately and learn beyond the textbook, to improve, thinking process and for extensive understanding of the concepts. (In this task interactions plays vital role; (interactions - within peer group or with teacher or with material)

• Suitable activities / projects are given by which children can construct knowledge and learn by direct experience.

• An 'Exercise' is given in which the problems are included after understanding 3 or 4 concepts. Each exercise contains 7-15 problems, solving these problems children can develop their academic standards.

• Optional exercise is given to broaden thinking level of the child to stimulate student's internal quest and enthusiasm for problem solving to give, exposure for competitive exams. This exercise is not meant for examinations.
Exercises with in the chapter:

In the 10th class Mathematics Textbook various situations, activities are given to introduce concept. Besides given exercises, "Do this", "Try this" and "Think, discuss & write" exercises are given with few problems or questions.

Let us discuss how teachers can use these exercises in effective learning process.

1. Do this :-

- Do this exercise is intended to know how far the children understand the particular concept. Immediately after understanding a concept.
- It is limited for a single concept. Problems can be solved by applying the concept directly.

Example:

Find the distance between following points (page: 162)
(i) (3, 8), (6, 8), (ii) (-4, -3), (-8, -3)

- Children has to solve these problems on their own. By solving these problems, 'self confidence' is developed among the students.
- While students solving the problems from 'Do this' exercise, Teacher has to observe, whether they are doing correctly or not or facing any problem. If they make any mistake, correction can be done through healthy discussion.
- If children solve the problems effectively without mistakes, teacher can conclude that the children have understood the concept at minimum level.
- So the teacher has to encourage the children to solve the problems under 'Do this' exercise individually.

2. Try These :-

- The problems or questions in these exercises are given to learn the concept extensively, to understand the concept comprehensively and generalise new inventions on the concepts after understanding a concept.
- The problem in these exercises are (little bit complex).

Eg: page No : 49

(i) Write a quadratic polynomial and a cubic polynomial in variable x in the general form.
(ii) Write a general polynomial q(z) of degree 'n' with the coefficients $b_0, b_1, ..., b_n$ what are the conditions to write this.
So all the children of the class may not solve on their own hence teacher has to support or encourage the group activities.

While solving the exercises under "Try these" the teacher has to observe by going around the groups and watch what they are discussion about? Which strategy they have adopted? are there any misconceptions? and teacher may give proper suggestion to improve their understanding.

These questions are thought provoking and accepting challenges.

Reasoning and communication skills are developed in a child by solving problems in these exercises.

3. Think - Discuss :-

These exercises are intended to enhance the children to think beyond learned concepts.

Children can extend their computational understanding with solving of these problems / activities.

There are group activities.

Eg: Page No : 252 (T.B.)

These problems are helpful to extract the creativity of the children.

These problems are helpful as additional material on the concept for learners. They are useful to discuss with classmates to understand concepts.

Exercises like

- Do this, Try these, Thinking - Discuss are helpful to children to strengthen their mathematics knowledge by mathematical understanding concepts. They are useful to construct the knowledge through thinking mathematically. There exercises has to be solved in present of teacher only in the classroom.

4. Exercises :-

There are 5 to 8 exercises in each chapter depending the number of concepts and each exercises contains 10 to 15 problems.

All problems are not similar in these exercises. These problems strengthen the learnt concepts by applying them in the daily life and skills like critical thinking, communication, and connection will be developed.
• All the problems have to be solved by the children on their own.

• According to the length of exercises teacher has to discuss problem-solving strategies, so that they can solve the problems at homes or in leisure periods.

• Teacher has to take care for not to copy from their classmates note books, or from guide or copy for Black board. Try to engage children to solve the problems on their own.

5. Optional Exercises :-

• Problems in Optional Exercises are intended for extensive learning and to achieve academic standards comprehensively.

• The problems in these exercises are helpful in developing higher order thinking and applying the problem solving strategies in their daily life situations, more over these problems reinforce the mathematics learning.

• These problems help children to ready for competitive exams and to learn beyond the Text Book.

• Though these problems may not be covered in the Public Examinations, the teacher should not neglect to practice these problems.

• So by identifying the importance and objective of optional exercises teacher has to encourage the children to solve the problems in these exercises, and they should explain why and how the strategies are adopted. Here the role of teacher is very important.
LESSON-WISE ACADEMIC STANDARDS - INDICATORS

Introductions:

- Why should we teach mathematics?
- Why should we achieve through mathematics teaching?
- How to make the children to think mathematically?

In the process of education, the child not only learns in the classroom but also everywhere even outside the classroom. He learns everywhere every child has natural abilities to learn, but the education sharpens his abilities and converts those abilities into skills. Whatever child experiences even outside the classroom, the classroom should utilize those experiences to enhance them and help the child to even create new thoughts. Speaking mathematically, Mathematics learning should develop skills like problem solving, thinking logically, Reasoning, Representing, connecting etc. Therefore, we need some specific statements which guide us to develop those skills in our mathematics classroom. These statements are named as “Academic Standards”.

“Academic standards are clear statements about what students must know and be able to do within a stipulated period to perform skills in a particular content or connecting contents.

To understand about how to write academic standards, we have to understand clearly what are academic standards.
They are clear statements even normal public should understand them.

They guide as for the teaching learning process about what skill to be performed by the children after learning.

They guide us for the assessment of child’s performance.

Sometimes they may be defined for more than one content i.e. combination of contents.

Sometimes they may be defined with connecting of multiple skills.

Sometimes they may be defined with multi concepts.

Therefore, we can clearly say that academic standards are clear statements with contain single content or multiple contents, single skill or multiple skills and even with single concept or multiple concepts. Teachers should take the responsibility of performance of the child which is defined by the academic standards.

Now, let us book at the skills to be developed in our mathematics classrooms.

Problem solving:

Usually, students solve problems with a formula, substituting values in it and finding solution. Is this really problem solving skill, what we are expecting from the child? Whatever the mathematics concept is understood, it should be applied in various different situations. The student should think and establish relation with his different experience daily life. Then he seeks ways and means of mathematisation using symbols, processes like addition, subtraction, multiplication, division, squaring etc and gets solution in problem solving. Through problem solving, student gets the pleasure of finding solution when she verifies, gives reasons explains processes, concepts through easy communication, links or connects with different concepts. Mathematics learning should not force the child to find the alternative procedures / ways of finding solutions. When a student is habituated all the process of problem solving and be able to connect it with his daily life, she could create many more different problems with different situation and with different types of numbers.

Therefore to understand problem solving, we need to understand the following steps in problem solving.
Steps in problem solving

- Identify what is given?
- Identify what is to be found?
- Understanding what concepts are involved.
- Visualizing whole the above items.
- Get ideas about procedures, formulas for the solution.
- Selection of the best procedure or formula.
- Substitution.
- Manipulation / calculation.
- Arriving solution.
- Verification.
- Conclusion.
- Generalisation.
- Trying out other strategies, formulas, procedure for the solution.
- Finding shortcut.
- Explaining procedures and reasoning.
- Creating similar problems in various situation and with various types of numbers.

Though the term ‘Problem solving’ may look simple and even the process may look simple sometimes. There will be problems with more complexity. The complexity of the problems depends upon the following things.

- Making connections as defined in connections section.
- Number of steps.
- Number of operations.
- Context unraveling.
- Nature of procedures.

There are many types of problems like word problems (with single concept or multiple concepts, with single operation or multiple operations) pictorial problems, procedural problems, Mathematical abstract problems with equations or in equations, reading data, tables, graph etc.
Hence finally we can conclude that problem solving skill in mathematics learning should make the student to think logically, give reasons, connect concepts, visualise the things etc. Mathematization of child’s life would emerge the child into a mathematician.

**Reasoning — proof**

Every student has potential for higher order—thinking. The key is to unlock the world of mathematics through students’ natural inclination to strive for purpose and meaning. Reasoning is fundamental character to the knowing and doing of mathematics. Conjecturing and demonstrating logical validity of conjectures are the essence of the creative act of doing mathematics. Mathematics teacher has been felt so as learn everything from the teacher. This opinion is making the students to completely depend upon teachers have been felt so as learn everything from the teacher. This opinion is making the students to completely depend upon teachers and not allowing students to think on their own, generative and conclude. When a student is allowed to think, generative and conclude on his own, his ability of reasoning is developed. Then the student can give reasons mathematically. When a student understands, analysis the context, make intuitions, conjectures and finally generalizes, then we may that he concluded logically. This may be reflected by his justification of the argument or procedures. Reasoning skills allows a student to examine logical arguments. Most of the mathematical statements are the result of inductive and deductive logics.

The student should perform Reasoning — Proof

- Understanding and making mathematical generalizations, intuitions and conjectures.
- Understanding and justifies procedures.
- Examining logical arguments.
- Uses inductive and deductive logic.

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Communication

Is mathematics full of numbers or is it manipulation of numbers? If you want say 3 objects are more than 2 objects, then what would you like to do?

Communication is an essential part of mathematics and mathematics learning. It is a way of sharing, clarifying, reasoning, generating our understanding. Through communication, ideas become objects of reflection, refinement, discussion and amendment. The communication process also helps build meaning and permanence for ideas and makes them public. When students are challenged to think and give reason about mathematical concepts and to communicate the results of their thinking to others orally or in writing.

The communication skill is reflected in:

- Writing and reading mathematical expressions like $3 - 4 = 7$, $3 \times 4 = 12$, $3 < 4$ etc.
- Creating mathematical expressions.
- Explaining mathematical ideas in her own words. Ex: A square is closed figure having four equal sides and all equal angles.
- Explaining mathematical procedures. Eg: Adding two digit numbers involves first adding the digits in units place and then adding the digits at the tens place / keeping in mind carry over.
- Explaining mathematical logic.

As mathematics learning is carried out in mechanical, way, negligence on mathematics communication prevailed in mathematics classrooms. Wherever it is possible, the students should be allowed to speak on mathematical equations and expressions. For eg: If a student has been allowed to think about $x + 2 = 6$, he should visualize it as the sum of $x$ and $2$ gives $6$. Then it will be easy for him to solve the equation. Therefore, the student needs communication skills to give proper reasonings or proper conclusions or to solve problems in mathematics.
Connections:

As we discussed earlier, mathematics learning needs to develop logic in the child it helps the child to give reasons for him to conceptualise and solve problems wherever they come across. To develop in conceptualization process, the student has to link or connect things in logical manner one by one, finally generalizes and comes to conclusion. Moreover, if we look at problem solving the student decides a strategy to solve the problem after “making connection” in between the given things in the data of the problem. Therefore, in the process of development of logic or problem solving, “making connections” is an important skill in mathematics learning.

In the process of connecting things in mathematics learning, he needs to connect the abstractions in mathematics with the objects or contexts in his daily life or with concepts in other subjects. He even may need to connect the abstractions with the concepts within the mathematics. This performance of the child will help the child to link mathematics with his daily life. Hence mathematisation of child’s life is possible as expected by NCF-2005. Making “connections” is specified by the following performance in the children.

- Connecting concepts within a mathematical domain fore 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.

Hence, performance of the child in mathematics can be adjudged by how best the logical connections he is making and arriving at conclusions. These connections may be in between concepts
of mathematics or the concept and area or the concept and other subjects or the concept and daily life contexts.

**Visualization & representation**

We conduct many programs or do several works in our daily life. We visualize a plan or imagine a sequence of actions to make the program successful. Mathematics is involved in almost every program we conduct. For example, we deal with costs of objects, measurements to construct a building as perform a marriage. Like this, mathematical visualization skill is a necessary skill in our daily life.

Visualization creates mental images in the mind when there mental images are related or liked with a logic, visualization about a context or situation or procedure is formed. Hence, the child in our classroom needs visualization skill in the process of conceptualization or problem solving while mathematics learning. While conceptualization, he forms an idea or notion about a concept by visualizing the thing involved in it. Without visualizing, one cannot understand any concept. Not only in the process of conceptualization, But also in the process of solving problem, the child needs visualization skill. In the process of problem solving, a child needs to visualize all possible strategies to solve a problem and select the best way to solve it. This skill helps the child to develop his logic in mathematics.

When we want to convey our visualization, we represent it in the form of a flow chart or table or graph or any other pictorial form. Representation skill is another important skill to perform in mathematics learning.

Therefore, we need following specifications to perform in “Visualization & Representation”.

- Interprets and reads data in a table, number line, pictograph, bar graph, 2-D figures, 3-D figures, pictures etc.
- Making tables, representing number line, pictures etc.

Hence, Visualization & Representation skill provides easyness to convey our perceptions on ideas.
Till now, we have discussed about the skills on the basis of which we have to write academic
standards. When we decide and write an academic standard, it guides our teaching learning process to
achieve that standard in the child. Moreover, these academic standards ensure the “performance” of
the child and they are displayed in the form of performance.

ACADEMIC STANDARDS CHAPTER WISE

Class : IX
Area : NUMBER SYSTEM
Key concepts : Real Numbers

ACADEMIC STANDARDS AND LEARNING INDICATORS

1. Problem Solving
   - Pupils can find rational numbers between given two rational numbers.
   - Can solve the problems on real numbers. (Rationalizing the denominators, by using its conjugate
     or rationalizing factor.)

2. Reason & Proof
   - Can compare the given numbers (rational / irrational) and give reasons.
   - Can differentiate rational and irrational numbers.

3. Communication
   - Can express rational numbers in decimal forms.
   - Can give examples for rational / irrational numbers / surds.

4. Connection
   - -

5. Representation
   - Pupils can represent terminating / non-terminating recuing decimals on the number line
     through successive magnification.
   - Can represent rational & irrational numbers on number line.
Area : ALGEBRA
Key concepts : • Polynomials
              • Linear equations in two variables

ACADEMIC STANDARDS AND LEARNING INDICATORS

1. Problem Solving
   • Can solve the problems on polynomials (Finding the value of variable, finding zeros of polynomials, division and factorization of polynomial)
   • Can solve the problems on polynomials by using reminder theorem & factor theorem.
   • Can solve the linear equations in two variables.

2. Reason & Proof
   • Can differentiate various polynomials (monomials, binomials) and give examples.
   • Can verify the division & factorization of a polynomial by using reminder theorem and factor theorem.
   • Can verify algebraic identifies.
   • Can verify the solutions of given linear equations.

3. Communication
   • Can express and explain monomial, binomial, trinomial etc., according to the no. of terms in it, and give examples for the above.
   • Can explain about reminder theorem and factor theorem.
   • Can identify and explain the linear equations in two variables.
   • Can write daily life situations in the form of linear equations (Vice-versa).

4. Connection
   • Can solve the problems of day to day life by using linear equations (By using arithmetic, algebraic concepts)

5. Representation
   • Can represent linear equations in two variables on graphs (plane) and read the graph.
   • Can draw the equation of lines parallel to X-axis and Y-axis.
Area : CO-ORDINATE GEOMETRY

Key concepts :

- Cartesian system
- Plotting points in a co-ordinate plane

ACADEMIC STANDARDS AND LEARNING INDICATORS

1. Problem Solving
   - 

2. Reason & Proof
   - Can justify the position of points in a co-ordinate plane.

3. Communication
   - Can say abscissa and ordinate of a given point and also as X-co-ordinate, Y-co-ordinate.
   - Can express the point using brackets ( i.e. : (x, y) )

4. Connection
   - Can find the areas of given geometrical shapes joining the points in a plane (using graph).

5. Representation
   - Can locate a point in the co-ordinate plane.

Area : GEOMETRY

Key concepts :

- Elements of geometry
- Lines and angles
- Triangles
- Quadrilaterals
- Area
- Circles
- Geometrical constructions

ACADEMIC STANDARDS AND LEARNING INDICATORS

1. Problem Solving
   - Can solve the problems on linear pair of angles
Can solve the problems on linear pair of angles
Can solve the problems based on congruency of triangles.
Can solve problems parallelogram
Can solve problems on area of triangle and quadrilaterals.
Can solve problems on angle subtended by chord at a point in a circle.
Can solve the problem on angles made by major arc and minor arc of a circle.
Can solve problems on angles of a cycle quadrilaterals.

2. Reason & Proof

- Can prove theorems (Ex: Two distinct lines cannot have more than one point in common”)
- Can show and verify the axioms & postulates for given situations.
- Can differentiate between intersecting lines and concurrent lines.
- Can prove (The sum of angles of a triangle is 180”) theorems with lines and angles, lines of transversal etc.
- Can give reasons in constructions of geometrical figures.
- Can give reasons for congruency in triangles and inequalities in a triangle.
- Can prove theorems on based on congruency of triangle.
- Can verify rules of congruency of triangle (i.e, SAS, AAS, SSS, ASA, RHS etc.)
- Can verify and give reasons in finding angles in parallelogram.
- Can show and verify the given statements based on parallelogram and the mid point theorem of triangle.
- Can prove theorems ("Parallelograms on the same base and between the same parallels are equal in area" etc) and verify it.
- Can prove theorems based on angle subtended by a chord at a point in a circle.
- Can give reasons for determining angles made by a chord, major arc and minor arc and cycle quadrilaterals.

3. Communication

- Can give axioms from their day to day life.
- Can appreciate Euclidian geometry, axioms and postulates.
- Can identify and explain intersecting lines and non-intersecting lines.
- Can identify and say various types of angles.
- Can explain about linear pair of angles.
- Can explain the steps in construction geometrical figures.
- Can explain congruency of triangles and rules of congruency in triangle.
- Can explain properties of parallelogram.
- Can differentiate between congruency and similarity.
- Can give statements in mathematical language on conclusions he made.
- Can explain steps in construction of
  a) Perpendicular bisector of a given line segment.
  b) Bisector of a given angle.
  c) and a triangle.

4. **Connection**
   - Can solve problems on angles involving arithmetic and algebraic concepts.
   - Can solve problems on lines of transversal using different concepts.
   - Connect the rules of congruency to the other plane figures.
   - Can connect the concepts of angle made by a chord on the circle and angle made by a arc.
   - Can connect the generalization he made on angles made in different situations while problems solving.

5. **Representation**
   - Can draw geometrical figures with given measurements.
   - Can construct triangle with given measurements & circle segment also.
   - Represent the plane figure formed when the mid points of the sides of the given figure are joined.
   - Can construct circum circle with given measurements.
   - Can construct
     a) Perpendicular bisector of a given line segment.
     b) Bisector of a given angle.
Area : MENSURATION

Key concepts : Surface areas and volumes

ACADEMIC STANDARDS AND LEARNING INDICATORS

1. Problem Solving
   - Can solve problems on surface areas & volume of cube, cuboid, prism, cylinder, cone, sphere, hemisphere and right circular cylinders/cones.

2. Reason & Proof
   - Can compare and contrasts surface areas and volumes of cube, cuboid, prism, cylinder, cone, sphere, hemisphere etc.

3. Communication
   - Can explain formulae for surface areas and volumes of cube, cuboid, prism, cylinder, cone, sphere, hemisphere etc.
   - Can explain the relationship of surface areas of given figures and also for volumes of given figures.

4. Connection
   - Can solve the problems on surface areas, volumes of cube, cuboid, prism, cylinder, cone, sphere, hemisphere etc. by using algebraic, arithmetic concepts and more operations.
   - Can relate/connect area and volume of cube cuboid, prism, cylinder, cone sphere, hemisphere to each other infinding surface areas and volumes of 3D objects.

5. Representation
   - Can represent 3D figures (cube, cuboid, cylinder, etc) in 2D figures (net shapes)

Area : STATISTICS AND PROBABILITY

Key concepts : Statistics

ACADEMIC STANDARDS AND LEARNING INDICATORS

1. Problem Solving
   - Can calculate mean, median, mode of ungrouped data.
   - Can find the mean by deviation method.
2. Reason & Proof
   - Can give reasons for their judgments on mean, median, mode.
   - Can estimate mean, median for ungrouped data and verify them.

3. Communication
   - Can explain the terms and formulae for mean, median, and mode and their advantages and disadvantages.
   - Can explain scope and necessity of grouped data.

4. Connection
   - Can relate mean, median, mode with each other while problem solving.
   - Can we algebraic and arithmetic concepts in solving problems related to mean, median, mode.

5. Representation
   - Can prepare frequency distribution / cumulative frequency distribution tables for given data.
   - Can represent the data in frequency graphs (Histograms)

Key concepts : Probability

ACADEMIC STANDARDS AND LEARNING INDICATORS

1. Problem Solving
   - Can solve the problems on single event of a sample space of a random experiment.

2. Reason & Proof
   - Can estimate probability of an event of a random experiment and give reasons in finding probability.

3. Communication
   - Can explain the terms random experiment event, probability etc.,
   - Can explain the statements related to probability in mathematical language.

4. Connection
   - Can connect the previous arithmetic concepts to understand and solving problems.

5. Representation
   - Can represent the outcomes of the random experiment in the form of table.
Area : PROOF IN MATHEMATICS

Key concepts : -

ACADEMIC STANDARDS AND LEARNING INDICATORS

1. Problem Solving
   - -

2. Reason & Proof
   - Can generalize the observations into mathematical statements on the basis of inductive and deductive reasonings.
   - Can give reasons for different statements made by them.
   - Can prove the mathematical statements and verify them.

3. Communication
   - Can express their generalizations in mathematical statements.

4. Connection
   - Can connect their generalizations to form new statements.

5. Representation
   - -

Class : X

Area : NUMBER SYSTEM

Key concepts : Real Numbers

ACADEMIC STANDARDS AND LEARNING INDICATORS

1. Problem Solving
   - Pupils can solve the problems on finding LCM, HCF by using prime factorization method.
   - Can solve the problems on rational numbers, irrational numbers and logarithms.

2. Reason & Proof
   - Pupils can understand and verify the fundamental theorem of arithmetic and give conclusions for the above theorem.
• Can prove the results of irrationality of \( \sqrt{2}, \sqrt{3} \) etc., and decimal expansion of rational numbers in terms of terminating / non terminating recurring decimal (vice versa).
• Can understand and verify the properties of real numbers.
• Can prove and verify laws of logarithms through generalizations made by them by inductive reasoning & deductive reasoning.

3. Communication
• Can give examples and explain the fundamental theorem of arithmetic.
• Can state whether the given rational numbers will have terminating / non terminating, repeating decimal form by without performing division.
• Can convert the given number in exponential form to logarithm form (vice versa)
• Can explain the scope and necessity of logarithm and can explain laws of logarithms and terms in logarithms.

4. Connection
• Can connect some concepts of real numbers in solving problems.
• Can connect laws of exponents to laws logarithms and also each law of logarithms to derive other laws of logarithm.
• Can connect of logarithm in daily life situations.

5. Representation
• Can represent a real number on a number line.

Key concepts : Sets

ACADEMIC STANDARDS AND LEARNING INDICATORS

1. Problem Solving
• Can solve the problems related to sets and their basic operations.
  (Union, interest, difference)

2. Reason & Proof
• Can differentiate empty set, finite set, infinite sets and universal sets and give reasons.
• Can justify whether the given statements belong to set or not.
• Can identify equal sets and give reasons.
• Can justify that the intersection of two disjoint sets is a null set.
3. **Communication**
   - Can give examples for sets.
   - Can express the given set in roster form and set builder form.
   - Can convert roster form of a set to set builder form (vice-versa).
   - Can use the signs / symbols regarding sets at the appropriate time / situation.
   - Can explain about subsets.

4. **Connection**
   - Can connect the concept of set in daily life situations.
   - Can interlink number, arithmetic algebraic concepts in sets.

5. **Representation**
   - 

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**Area** : **ALGEBRA**

**Key concepts** : Progression

**ACADEMIC STANDARDS AND LEARNING INDICATORS**

1. **Problem Solving**
   - Can find the required term of given arithmetic progression and also find common difference of A.P.
   - Can calculate the nth term and sum of first n terms of an A.P.
   - Can calculate the nth term in G.P.

2. **Reason & Proof**
   - Can give generalizations from arithmetic progression, geometric progression for common difference in AP and common ratio in GP and nth term in AP and GP.
   - Can generate the formula for sum of n terms in AP.

3. **Communication**
   - Can express and explain the general form of AP, GP.
   - Can explain the formula and terms in AP and GP.
   - Can give examples for AP and GP.
4. Connection
   - Can connect arithmetic and algebraic concepts while solving the problems on AP and GP.

5. Representation
   - 

Key concepts : Polynomials

ACADEMIC STANDARDS AND LEARNING INDICATORS

1. Problem Solving
   - Can find the zeros of polynomial (quadratic polynomial and cubic polynomial).
   - Can solve the simple problems on division algorithm for polynomials with integral coefficients.

2. Reason & Proof
   - Can verify/check and give for reasons zeros of a given polynomial.
   - Can make some generalizations by observing zeroes of polynomials and justify them.

3. Communication
   - Can express "degree" of a polynomial, zeroes of a polynomial terms of the polynomial (linear, quadratic & cubic polynomial)

4. Connection
   - Can connect/interlink the zeroes and coefficients of a polynomial to each other whole solving problems.

5. Representation
   - Can represent a linear polynomial on the graph and also quadratic polynomial, cubic polynomial.

Key concepts : Pair of linear equations

ACADEMIC STANDARDS AND LEARNING INDICATORS

1. Problem Solving
   - Can find solutions on pair of linear equations in two variables.
     (Model methods algebraic method, elimination method) and substitution method.
   - Can solve the simple problems on linear equations.

2. Reason & Proof
   - Can verify and given reasons for solutions of pair of linear equations.
3. **Communication**
   - Can express their daily life situational issues in the form pair linear in two variables. (Vice-versa).

4. **Connection**
   - Can relate between co-efficients and nature of system of equations.
   - Can solve the problems of different situations (by using algebraic and arithmetic and geometrical concepts) from day to day life related to pair of linear equations.

5. **Representation**
   - Can represent the pair of linear equations in two variables through graph. And find/identify the solutions for them in graphical method.

**Key concepts**: Quadratic equation

**ACADEMIC STANDARDS AND LEARNING INDICATORS**

1. **Problem Solving**
   - Can solve the simple problems on quadratic equations by using factorization, and the method of completing the square.

2. **Reason & Proof**
   - Can give reasons for the solutions (nature roots) for a quadratic equation.
   - Can verify that whether the solutions of a given quadratic equation are correct or not (or)
     - Can verify that whether given solutions are roots of the quadratic equation and give reasons for that.
   - Can estimate the roots of quadratic equations and give reasons through verifying them.

3. **Communication**
   - Can express day to day life situations in the form of equations (Vice-versa).
   - Can express the nature of the roots of quadratic equations.

4. **Connection**
   - Can solve the problems on quadratic equations involving algebraic, geometric concepts.

5. **Representation**
   - Can draw the graph for quadratic equations.
Area : GEOMETRY

Key concepts : Similar triangles

ACADEMIC STANDARDS AND LEARNING INDICATORS

1. Problem Solving
   - Can solve the problem based on theorems, (Thales theorem etc.) (properties of similar triangles)
   - Can find the area of similar triangles.
   - Can solve the problems on Pythagoras theorem.

2. Reason & Proof
   - Can prove theorems based on similarity of triangles.
   - Can made the conclusions that all the congruent figures are similar but the converse is not true.
   - Can prove & give converse for the theorems by examining through some activities.
   - Can prove theorems related to similarity properties of triangle.

3. Communication
   - Can give statements by their generalizations in mathematical form.
   - Can explain properties of triangles.
   - Can give converse statement, negation of statement for given statements.

4. Connection
   - Can connect Algebraic and various geometrical concepts in solving the problems in different daily life situations.

5. Representation
   - Can draw the line segment and division of that wish-given measurements.
   - Can draw triangles with given measurements.

Key concepts : Co-ordinate geometry

ACADEMIC STANDARDS AND LEARNING INDICATORS

1. Problem Solving
   - Can calculate distance between two points a co-ordinate plane.
   - Can find area, perimeter of given geometrics figures joining points in plane.
• Can solve the problems on section formula. (dividing line in two segments with a point in given ratio)
• Can find the tri-sectional points of a line segment.
• Can solve the problems on finding mid point, centroid and slope of a line.

2. Reason & Proof
• Can give the reasons for the location of a plotted points in a coordinate plane and for the distance between those points.
• Can generalize the mid point of a line segment through some activities related section formula.
• Can generalize the slope of a line and can give reasons for its. (Based on angle (inclined) of a line a plane.)

3. Communication
• Can explain the formulae for distance between two points in a plane and the area of a figure formed by joining points in a plane etc..
• Can express their conclusions had made from co-ordinate geometry in mathematical statements (Vice-versa)

4. Connection
• Can connect various geometrical concepts in solving problems on coordinate geometry. (Ex: perimeter, area of circle, triangle, Quadrilaterals etc.)
• Can use Heron's formula to find the area of a given triangle joining three points in a plane.
• Can connect the concept of linear equations to co-ordinate geometry. (i.e. straight line)

5. Representation
• Can plot the given points on a coordinate plane.
• Can draw the figures by joining given points in a plane.

Key concepts : Tangents and secants to a circle

ACADEMIC STANDARDS AND LEARNING INDICATORS
1. Problem Solving
• Can solve the problems in finding length of the tangent of a circle.
• Can solve the problems in finding the area of the segment.

2. Reason & Proof
• They can made conclusions on tangents / secants of a circle and can give reasons.
Can distinguish and differentiate tangents and secants of a circle.

Can prove theorems on tangents and secants of a circle and their converse also.

Can made generalization and differentiate area of the minor / major segment of a circle.

3. Communication

Can explain about tangents and secants of a circle.

Can explain theorems / statements in his own and in mathematical statements.

4. Connection

Can connect the idea of the chord in understanding tangent and secants of a circle.

Can connect various geometrical concepts in solving tangents and secants of a circle, and area of the segment in the circle.

5. Representation

Can draw / construct tangents at different points of a circle.

Can draw / construct secants of the circle.

Can draw a pair of tangents of circle.

Area : TRIGONO METRY

Key concepts : Trigonometric ratios

ACADEMIC STANDARDS AND LEARNING INDICATORS

1. Problem Solving

Can solve the problems on trigonometric ratios for the angles from 00 to 900.

Can solve simple problems on trigonometric identities.

2. Reason & Proof

Can give reasons in finding values of trigonometric ratios from 00 to 900 and lengths of a line etc. in given triangle.

Can generalize trigonometric ratios and can verify them.

3. Communication

Can explain the terms "Hypotenuse, opposite side, adjacent side of given triangle.

Can explain the terms sin, cos, tan etc and using by them they can give their conclusions in mathematical statements.
4. Connection
   - Can use Algebraic concepts while solving problems on trigonometric ratios.

5. Representation
   - Can prepared a table of for trigonometric ratios for the angles from 00 to 900.

**Key concepts : Applications of trigonometry**

**ACADEMIC STANDARDS AND LEARNING INDICATORS**

1. Problem Solving
   - Can solve simple problems on application of trigonometry. (heights, distance etc).

2. Reason & Proof
   - Can differentiate the angle of elevation, angle of depression in a triangle (while solving problems)

3. Communication
   - Can explain and give their conclusions of angle of elevation, angle of depression in mathematical statements.

4. Connection
   - Can solve the daily life problems by using trigonometry. (by connecting Algebraic and geometrical concepts)

5. Representation
   - Can draw figures related to problems on trigonometry.

**Area : PROBABILITY**

**Key concepts : Probability of single event**

**ACADEMIC STANDARDS AND LEARNING INDICATORS**

1. Problem Solving
   - Can solve the problems on simple space of a random experiment in different methods.

2. Reason & Proof
   - Can give conclusions and generalizations by experimentally and theoretical on probability on single event and sure event, impossible event.
   - Can assume and gives reasons of equally likely outcomes.
4. **Connection**
   - Can connect the previous arithmetic concepts to understand and solving problems on probability.

5. **Representation**
   - Can give the outcomes or represent outcomes of the random experiment in the form of table.

**Area** : MATHEMATICAL MODELLING

**Key concepts** : Mathematical models

**ACADEMIC STANDARDS AND LEARNING INDICATORS**

1. **Problem Solving**
   - 

2. **Reason & Proof**
   - Can give reasons for steps in solving problems and in modeling

3. **Communication**
   - Can give some mathematical models for previous class that they already learnt.
   - Can express the advantages/limitations of mathematical modeling.

4. **Connection**
   - Can interlink various concepts for modeling.

5. **Representation**
   - 

**Area** : MENSURATION

**Key concepts** : Surface areas and volumes

**ACADEMIC STANDARDS AND LEARNING INDICATORS**

1. **Problem Solving**
   - Can solve the problems on finding surface area, volumes of combinations of any two of the given solid shapes.
2. **Reason & Proof**
   - Can give generalizations and can conclude through area, volume of simple solid shapes to each other and to combination of two solid shapes and give reasons for them.

3. **Communication**
   - Can explain terms and formulae in mensuration areas, volumes of various solid shapes.

4. **Connection**
   - Can use various geometrical, algebraic, arithmetic concepts in solving problems on mensuration.

5. **Representation**
   - Can draw simple solid shapes and combination of solid shapes with given shapes.

**Area**: DATA HANDLING

**Key concepts**: Statistics mean, median, mode

**ACADEMIC STANDARDS AND LEARNING INDICATORS**

1. **Problem Solving**
   - Can solve simple problems on finding mean, median, mode for given ungrouped / grouped data with different methods.

2. **Reason & Proof**
   - Can estimate mean, median, mode for given ungrouped data and can give reasons.
   - Can distinguish he ogives boundaries

3. **Communication**
   - Can explain the terms mean, median, mode grouped data, ungrouped data.
   - Can explain usage of different values of central tendencies through ogives.
   - Can explain the terms in the formulae.

4. **Connection**
   - 

5. **Representation**
   - Can represent the data in the form of distributive / cumulative frequency tables.
   - Can represent the data in graphical way.
TEACHING STRATEGIES TO ACHIEVE COMPETENCIES

INTRODUCTION:

- How is the teaching mathematics in our schools?
- Why are lot of children afraid of mathematics?
- Though the students are getting good marks, how many of them have standards of mathematics?
- The teachers have been given many handbooks and trainings for the last 10 years. To what extent these handbooks and trainings brought changes in the process of teaching learning process?
- What should be done to bring changes in the teaching methods?
- What should we do to make the students to enjoy mathematics learning?
- How a teacher should prepare to carry out exciting and successful learning activities in the classroom?

Let us think about the above questions. If these questions incite us to think and make us to learn, we can carry out interesting activities which make learning joyful. Thus mathematics learning will be simplified. Expected competencies and skills are developed as we expected. For achievement of academic standards in the students, let us discuss the strategies should be adopted in the class room.

According to educational psychology, learning means "the permanent relative change in behaviour" that means a child has already innate abilities in him which will be developed as skills in
course of learning. But in the present classroom, the teacher shares some information with the children and memorising this information is treated as knowledge. After memorising, whosoever presents this knowledge in oral or written aspects is considered to be intelligent and talented. The main reason for this is nothing but present teaching method.

In accordance with the instructions and suggestions that laid in NCF-2005, APSCF-2011 and RTE-2009, the subject wise skills should be developed in the students along with the basic understanding of the concepts in the subjects. In case of mathematics, teaching learning activities should develop problem solving, reasoning-proof, communication, connections and representation-visualisation skills in the students, according to mathematics position paper. The skills developed in the classroom should be useful in their day-to-day lives and can be associated with other branches of knowledge. The application of these mathematical skills makes them able to invent new things.

Let’s discuss the competence wise strategies to be adopted which develop the mathematics skills in the students.

PROBLEM SOLVING:

Problem solving in mathematics means whenever a problem arises it should be solved by a process or method. Problem solving strategies has to be habituated by the students to develop problem solving competency in them. If it is habituated, the children can solve any problem on the given concept.

Steps in problem solving:

- Reading the problem
- Identifying the components in the data of the problem
- Identifying "what is to be found?"
- Separating the required data
- Understanding the concept involved in the problem
- Visualising as many as strategies to solve the problem
- Selecting a strategy among them (selecting a formula and procedure to solve)
- Implementing the strategy and computing by substituting the values in the data
- Arriving to the solution
- Verifying the solution
- Testing another ways of solution
But, to make the children understand the problem solving method

- Teacher should write the problem on the blackboard
- Ask the children to read the problem on the blackboard
- Discussing with the students about the data given in the problem and what to be found?
- Identifying the concepts involved in the problem and relation between them by the children
- Writing the required data on the blackboard by identifying them by the children
- Deciding the strategies to solve the problem and writing the formulae on the blackboard on discussing with the children
- Substituting the values in the appropriate formula and solving the problem with various computations through discussing with the children
- Arriving to the solution
- Verifying the solution or result through the discussion with the children
- Giving opportunity to the students to ask doubts in the process of problem solving and clarifying them through discussion.
- Like this, students should be habituated the problem solving strategies gradually through discussions with them.

Then, another model problem should be given to the students for assessing the comprehension of the students in problem solving strategy. For that we have to

- Write a model problem on the board (similar but not same)
- Ask the children to write the problem in their note books and solve it individually.
- Observe procedure of problem solving by the students personally by moving around in the classroom
- After problem solving, ask the student to discuss in the groups about their problem solving.
- Observe their discussion of problem solving by the students by moving around in the classroom identify their misconceptions and errors made by them
- Small errors made by the children in the problem solving can be clarified in the groups
- Misconceptions can be written on the board and can be understood by applying inductive or deductive logics. And these logics should be discussed in the whole class and thus clarify the misconceptions in problem solving.

- If most of the children in the class room are committing more mistakes, the teacher should write another similar problem on the board and discuss strategies of solving problem.

The children must be able to solve the problems individually on their own. Therefore the students should understand strategies of problem solving and they should be able to explain the process of solving any problem. The teacher should discuss each step of the problem and connections in between each step and antecedent step. These steps should be elicited through the discussions so that they can explain the process of problem solving. The students should be given chance to solve the problems in the exercises on their own. Thus, they should be encouraged to solve any problem on their own.

**REASONING PROOF :**

Instead of problem mechanically, in the class room children has to explain appropriate reasons through logic in the understanding of concepts and also in problem solving.

For this, the teacher in the class room has to develop the competency of reasoning and proof among the children.

The indicators for this are

- Generalizing concepts into mathematics statements or proving theorems in mathematics should be done the basis of inductive or deductive reasoning's.
- Making the hypotheses in generalizations through understanding the patterns.
- To test hypothesis in some particular cases and making conclusions.
- Giving reasons for various steps in problem solving
- Understanding the procedural pattern in problem solving.
- Verification of solution in problem solving.

All the above indicators indicate the development of reasoning and proof competency in the students. To enhance this competency among the children in the mathematics class the teacher may follow these following suggestions.

- Make the children to real comprehensively the text given in the text book to understand the concept.
- Let the students to understand the logic in the concept by discussing with peer groups.
• Provide some activities to understand the concept which can be discussed in groups or conducted individually.
• The understanding of the children should be discussed in the whole class.
• By asking a sequence of questions the children develop the logic in the concept.
• The children should be asked to test the hypothesis made in the concept in particular cases.
• The discussion of problem solving procedures with giving reasons to each step. This has to be done in the whole class discussion with the student to understanding problem solving strategies.
• While proving the theorems the students should be habituated to give reasons for each step.

COMMUNICATION:

Mathematics has its own language. It has symbols sings and terms with good grammar. Therefore communication in mathematics is very important. In mathematics any problem solved or concept understood I based on the communication in mathematics only. Through these communications only mathematics logics can be understood. Therefore communications skills in the learning of mathematics should be developed among the students.

The indicators for communication performance are:

• Reading, writing and expressing mathematical concepts or generalizations.
• Reading writing and expressing mathematical sentences through sings and symbols.
• Explaining thoughts and logics in mathematics in own sentences.
• Explaining procedures of problem solving
• Generating or preparing new problems.

The teacher should adopt these following strategies in the class room while teaching learning process to develop above mathematical communication skills

• Encourage the children to read the text given in the textbook for understanding the concept the important mathematical terms and symbols, which comes across at the time of reading should be written on the blackboard.
For extensive understanding of the concept the teacher should provide activity to be performed in groups or individually. In this process whatever the new terms and symbols come across should be practiced by children.

While understanding the strategies of problem solving on a concept, the teacher should be make the children read problem comprehensively and identify the terms and symbols involved in it.

After problem solving the children should be encouraged to explain the procedure of problem solving and expressing different methods to solve that problem.

After solving the problem by the children individually all through the chapter the children should be encouraged to prepare or generate new problems.

CONNECTIONS:

Connections of various concepts will be required while understanding of mathematical concepts. Whenever a problem is solved connections between the various concepts are utilized. These connections may be in between to various mathematical concepts or mathematics concepts with concepts of other subjects or mathematics concepts with concepts in daily life. Therefore in the learning of mathematics connection skill is very important to be developed among the students.

The indicators for the performances of skill of connections are

- Connecting the concepts in an area with the concepts of other area in mathematics.
- Connecting the concepts in mathematics with the concepts in mathematics with the concepts in other subjects.
- Connecting the concepts in mathematics with mathematics with the concepts in daily life.
- Connecting various concepts while problem solving.

A teacher can adopt following strategies to develop above skills in the students.

- The students read the text in the process of understanding a concept. He connects his previous notions to understand the given text in the textbook.
- Then, the student is provided an activity to understand a new concept. In this process, the student uses inductive or deductive logic to understand the concept. He needs to connect the previous notions and present experience in the activity in process of using inductive or deductive logics.
- The teacher has to use connections more comprehensively in whole class activity to have a complete understanding on the concept.
Making use of logics which are developed in other areas of mathematics to understand a new concept. I.e. connecting a concept in an area with the concept of another area. For example, using similar triangles in understanding trigonometric ratios. Connecting or using the concepts to understand a new concept in mathematics, connecting the daily life concepts or notions to understand a concept can also be used in understanding a concept.

The students should be habituated to see logical connections in between the things.

Besides connections in understanding a concept, a student should also be able to connect the concepts in the process of problem solving.

A teacher has to make the children use connections in between the concepts in solving problems.

In the first step, the teacher writes a problem on the board and asks the students to read it. Then, he asks them to identify given information in the problem. Based on the given information, he then asks the students to identify the concepts involved in the problem.

The teacher should elicit connections in between the concepts involved in the problem through the discussion with the students.

Then based on these connections, the teacher habituates the students to visualise the strategies to solve the problem.

Thus, the students develop connecting skill in mathematics in process of understanding a concept or problem solving.

**REPRESENTATION - VISUALISATION**:

The students visualise while understanding a concept or strategy to solve a problem by connecting the things involved in it holistically. If the students are not able to visualise the things with appropriate logic, they cannot solve problems or cannot understand the concepts.

When we try to represent the visualised concept in pictorial form, we need to have representation skills. These representations make anyone to understand that concept easily. These representations may be in the form of a histogram or a curve or a straight line in graph or may be in the form of a pie chart, flow chart, constructions. These representations normally facilitate us to show complex information or more information in simpler form in the form a picture. It may look simple but it provides us much information in a simple picture. The children should show following indicators to present the skill of representation.
• Reading the information in a table, number line, pictorial diagrams, graphs, 2-D and 3-D pictures and flow charts.

• Representing the information in the form of a table, number line, pictorial diagrams, graphs, 2-D and 3-D pictures and flow charts.

A teacher may adopt following strategies to develop the representation and visualisation skill in the students.

• We should make the students to visualise the contexts or content in the textbook in the process of understanding a concept.

• The students should be encouraged to visualise the strategies of problem solving with appropriate logical connections in between the steps.

• Habituate the children to represent those visualisations in the form pictorial flow charts.

• Besides above skills of representations, there some more standard representational styles created in mathematics like graphs, pie charts, tables, etc.

• Whenever we provide learning strategies to understand standards representations, the child should be habituated follow fundamentals involved in it.

• When we represent graphs, we need decide the scale of the graph. In the case of frequency distribution table deciding class intervals should be decided.

• When a student needs to construct geometrical figures, he needs to visualise the figure in the form of a rough figure and decide the procedure to construct.

• Above discussed fundamentals should be discussed in peer groups of students and made them to understand in whole class.

• The teacher should give suggestions or directions in these processes wherever they need help and thus skill of representation should be developed in the students.

Thus students develop representation and visualisation skills and solve the problems that come across in his life. They also present their skills wherever the necessity arises.

Mathematical competencies develop confidence in the child to perform any activity in his daily life actively. He always uses logics to perform better. Mathematical competencies are useful for a child to save the time in various activities. Hence, a teacher can mathematisate the life of a child by developing above competencies in him.
Mathematics has been developed as per the demand of requirements of mankind. The invention of numbers and their operations have been defined as the requirements of human beings demanded. When the demands of the society increased and these numbers and operations became insufficient, the branches of the subject like algebra, trigonometry, data handling, probability etc. have evolved out the needs of changing society. The concepts like solutions of equations, logarithms, trigonometric ratios, sets, etc. made problem solving in various situations easy. But, is mathematics problem solving only? Of course not! It has its own beauty in it in the form of logic everywhere. This beauty has been expressed in various contexts by many wits (like Euclid, Pythagoras, Aryabhata, Bhaskaraclarya) in the form of axioms, theorem, statements, formulas, etc. These are stated either by applying inductive logic or deductive logic by connecting various earlier various general statements and testing them in some peculiar cases.

As it is mentioned earlier, logic is like spine in all these processes. Whatever it is stated in mathematics, it is not stated without logic. This logic makes us enjoy mathematics.

As we discussed earlier, mathematics should be useful for us to solve problems which come across in our daily life and have fun. Mathematics should also encourage the children to test the logical statements and enjoy with the results. But, how is the learning of mathematics in our classrooms? Are your children in classroom enjoying the beauty in mathematics? Is a student having fun with mathematics?

If we want to achieve the objectives in the children which are expected in mathematics learning, is it enough to teach the problems from only textbook? The answer may be no. We cannot achieve the
academic standards decided for a class, if we teach the only problems from the mathematics textbook. We, the teachers should understand the backdrop of each concept mentioned in the textbook to enjoy the teaching learning process in the classroom.

Therefore, we should know about the key elements in each chapter to take up successful strategies in the class room. Hence, let us discuss about the key elements in the chapters in the mathematics textbook of tenth class.

1. **REAL NUMBERS**

    When we look at the first chapter Real numbers, the properties of rational and irrational numbers have been discussed in the beginning. Some basic theorems or general statements were stated on the basis of inductive or deductive logics by using some earlier basic properties of rational and irrational numbers. If they comprehend these logical statements, they could explore some more logics and evolve as good mathematicians.

    Fundamental theorem of arithmetic is discussed initially in the chapter. It is not only discussed with respect to solve problems but also it is discussed in the view of stating different types of statements. Here, we as mathematics teachers should only encourage the students to generalize and state mathematical statements of the basis of their observations. We should also discuss various types of statements like converse, inverse, etc. Similarly, we should encourage students to similar kinds of statements on the basis of properties of rational and irrational numbers.

    Moreover, logarithms were discussed in the later part of the chapter. Thus we have to understand the backdrop and key elements of the concept. Is it necessary to learn logarithms at tenth class stage? What happens, if they won’t learn logarithms? If we could answer these questions, we would easily understand the backdrop and the key elements of logarithms in the tenth class textbook.

    Let’s understand it by an example

    How would children respond, if they are asked these questions?

    \[
    10^4 = 10000 \\
    10^2 = 100 \\
    10^1 = 10 \\
    10^{1/2} = ?
    \]
Moreover, what should be the value of \(x\), if \(10^x = 2\)?

What should be the value of \(x\), if \(10^y = 3\)?

Are there any ways to find the values of \(x\) or \(y\)? What can be the value of \(x + y\)?

When we allow the children to think over these types of questions, they may understand the necessity of logarithms easily. Logarithms would be merely a mechanical procedure, if we introduce them merely as a process of converting a power into a logarithmic form.

**Questions for teachers:**
- Is there any relationship in between progressions (A.P & G.P.) and logarithms?
- What are the limitations of values of base and logarithmic number? How can you say?

2. **SETS**

Fundamentals of sets and terms & symbols related to set theory are discussed in Sets chapter besides operations on sets. Actually, these concepts of sets are base for abstract algebra. That's why, the children can understand how Cantor introduced sets in higher education only. But, as recent globalization (higher studies like commerce, arts, management) demanded for the basics of sets, we are forced to introduce the basic concepts of sets. Therefore, we confine ourselves to the basic concepts of sets at this level of learning.

3. **POLYNOMIALS**

Children of tenth class have notions of polynomials already. Those knowledge of polynomials utilized here for extended learning. Zero values of different types of polynomials in single variable have been discussed in the beginning of the chapter. But, a basic question is, what is the need of finding zero values for polynomials? Are they useful in our daily life situations or any other areas like business, management, technology, etc. When we could answer these questions, we would try to find them in many ways. A few of the simple ways of finding zero value for a polynomial are drawing graphs, relation between their coefficients, etc.

Let \(p(x) = a_0 x^n + a_1 x^{n-1} + a_2 x^{n-2} + \ldots + a_n\) is polynomial of \(n\)th degree in single variable.

Here, \(a_0, a_1, a_2, \ldots, a_n\) are coefficients. If \(a_1, a_2, a_3, \ldots, a_n\) are zero values.

Then, we can generalise like this.

\[
\sum a_1 = \frac{-a_1}{a_0}
\]

\[
\sum a_1 a_2 = \frac{a_2}{a_0}
\]
\[ \sum a_1 \alpha_2 \alpha_3 = \frac{-a_3}{a_0} \]

\[ \sum a_1 \alpha_2 \ldots \alpha_n = (-1)^n \frac{a_n}{a_0} \]

4. **PAIR OF LINEAR EQUATIONS IN TWO VARIABLES:**

Solutions of different equations shown us simple ways of problem solving in various situations of our daily life. The value of an equation doesn’t change when a value is added or subtracted both sides. And also the value is not changed when it is multiplied or divided by a non-negative number. This property of equations is very much useful in the elimination process of variables. The skill of eliminating a variable determines the skill of solving equations most of the times. But, all these processes have been discussed in previous classes. Here, the objective of this chapter is to know the types of pairs of linear equations on the basis of their solutions. And it can be related with the nature of coefficients in the following way.

\[
\begin{align*}
a_1 x + b_1 y + c_1 &= 0 \\
a_2 x + b_2 y + c_2 &= 0
\end{align*}
\]

\[
\begin{array}{c}
a_1 \\
a_2
\end{array}
\neq
\begin{array}{c}
b_1 \\
b_2
\end{array}
\]

\[
\begin{array}{c}
a_1 \\
a_2
\end{array} = \begin{array}{c}
b_1 \\
b_2
\end{array}
\]

- **Consistent equations**
  - Unique solution
  - Infinite solutions
  - Dependent equations

- **Inconsistent equations**
  - No solutions
  - Parallel lines
5. **QUADRATIC EQUATIONS:**

Quadratic equations are considered as extension of polynomials in this textbook. Can it be said that if a child has the ability to solve a quadratic equation, he has competencies expected in him? The logic of solving a quadratic equation provides us many ways of solving many complex problems. Chapter begins with the communication in mathematics in our daily life. The beginning of the chapter discusses conversion of daily life situational problems into the quadratic equations. This is considered as a very important skill in mathematics. Then, it is continued discussion of various types of solving procedures of quadratic equations. We, the role of teachers is to make children to find the connections in between them. Besides this, children are encouraged to generalize the relation between nature of roots and coefficients. This gives them joy while deciding nature of roots without finding them. Here, the students should be allowed to think about the importance of the “discriminant” and why it should be considered. We have to make them visualize the nature of roots and their uses.

6. **PROGRESSIONS:**

The concepts of progressions give us logic of solving problems related to patterns as well as joy of learning. Concept of progressions can be used for the building concept of numbers and algebra. When we look at the nature mathematically, many things surprise us with their patterns. Sunflower, rabbits, reproduction of rabbits, etc. are utilized in the process of introducing progressions in this textbook. Then A.P. and G.P. were discussed gradually. Finding general term and sum of the terms in a progression are discussed in this chapter. Here, we must understand that the child should be habituated generalization process and formulation process in handling progressions. These skills will be useful when students handle concepts of algebra, arithmetic, geometry, etc. and formulate some formulae in the due process.

7. **COORDINATE GEOMETRY:**

Coordinate geometry facilitated us in solving problems of geometry with the help of concepts of algebra and vice versa. Coordinate geometry has taken birth by contributions of great mathematicians like Rene- de-carte and Format in mathematics. There are some exciting stories which are useful in our teaching learning process to increase attention of students towards mathematics. This chapter does not only discuss the formulae and solving of problems using them but it discusses the backdrops of the formulae. The distance between the given two points, section formula and its uses as midpoint, trisection points and centroid were discussed in the beginning of the chapter. The formulae are not directly introduced but they have been gradually deduced from simple to complex formula. Then after, finding the area of a triangle when three vertices of a triangle are given has been discussed. Collinear property
of collinear points has been discussed based on three properties viz. distance between points, area of the triangle and slopes three parts of the line. Finally, the slope of a line has been elaborately deduced and ways to find slope have been discussed.

8 & 9 SIMILAR TRIANGLES & TANGENTS AND SECANTS TO A CIRCLE:

Similar triangles & tangents and secants to a circle are the two chapters which are discussed in tenth class mathematics textbook I geometry area. These chapters are extension of learnt concepts in geometry in previous classes. The student understands the basics and some properties in the form of theorems in geometry in previous classes. The student learns deductive logics in geometry in the form of proving theorems in this class. He connects different previously known properties or rules in geometry to prove some theorems. Most of the discussion in these chapters is based on similar triangles & properties of tangents and secants to a circle.

Finally, finding areas of segments of a circle and areas of different beautiful designs involving segments of circles are discussed at the end of the chapter. The student develops problem solving strategies by solving problems on different combination of solids in mensuration. He also develops the skill to connect the things mathematically. This skill helps him in higher studies like various engineering courses. He not only learns the concept but also he enjoys the logic in the chapter by finding areas of different designs involving segments of circle.

10. MENSURATION:

Mensuration in tenth class is the extension of the learnt concepts in mensuration ninth class. The student develops the logics in basics of mensuration in the ninth class. The student has already learnt the concepts of volume and surface areas of different regular solids like cube, cuboid, cylinder, cone, sphere, etc. The child has to find the volumes and surface areas of combination of solids. The child has to visualize the parts of a solid into different regular solids and visualize the strategies to find the volume and surface areas of the solid. When we look at our surroundings we come across various shapes which do not contain a single shape. We need to find various measurements of these solids to solve problems in our daily life like painting, finding capacity, etc.
11 & 12. TRIGONOMETRY & APPLICATIONS OF TRIGONOMETRY

Many geometric concepts help us in solving problems we come across in our daily life in various situations. We may know the properties of similar triangles and theorems regarding them formally, but they may not help in connecting the ratios of sides in a triangle with its angles. When we proceed to define these relationships many problems in mathematics are facilitated to solve. This procedure was in use during 500 B.C. Different astronomical calculations were done by using this procedure.

For this, the child has to visualize right angle triangles in his daily life situations. Then he should be able to identify opposite and adjacent sides of an angle. This competency helps the children in understanding the meanings of basic trigonometric ratios. They can easily visualize these ratios in terms of functions. These ratios make problem solving easy related to heights and distances in our daily life. In this chapter the child is provided to think about the trigonometric ratios of special angles like 30°, 45°, 60°, etc and the problems related to them.

This chapter is not only confined to define the trigonometric ratios and find their values for some particular angles but also it discusses the deducing of new formulae and identities. Generally the students are forced to memorize the definitions of trigonometric ratios, their values for particular angles, identities, etc., though they do not know the meanings of what they are memorizing. If they understand the logic hidden in the definitions and formulae they can easily explore, invent many things on their own. They can even enjoy the learning of mathematics.

Generally, we the teachers make the students solve the problems of trigonometry regarding heights and distances. But these problems have utilitarian values and they need to be applied in daily life situations. If a student can visualize what he has learnt, he enjoys solving problems regarding heights and distances.

13. PROBABILITY

In our daily life we come across many situations in which we have to estimate the results. In the areas like technology, business, surveys the results have to be estimated and we have to take decisions based upon our assumptions. Probability helps us in estimating these results. Probability has been introduced in the mathematics of class 9 informally. But basic understanding of probability has been
discussed in class 10. Moreover, basic concepts like mutually exclusive, complementary events have been discussed so that it can be useful in further studies.

14. STATISTICS:

In human evolution process, many systems have been created as the necessities have been increased of the society. Market system, technology, government machinery, schools, etc. have been introduced and undergone many changes as the needs of the society. In the management of these systems much data is to be collected, manipulated, concluded and interpreted. For all this process, statistics helps us to solve many problems in these systems.

Measures of central tendency have been discussed in statistics chapter in present tenth class mathematics textbook. It not only meant to calculate on the basis of some formula, but also it is discussed with its meaning elaborately. Student has been given opportunity to interpret on result. It is not only discussed finding the median by formula, but also by drawing ogive curves. This also helps the children in visualizing the measures of central tendency. Can we find mean or mode by using these ogive curves? If yes, how? If no, why? Discuss.

Appendix: (Mathematics modelling)

We have discussed the traditional areas of mathematics and the concepts included in each chapter in each area. We also discussed the key elements and focusing competencies for each concept. Mathematics modelling is introduced first time in the history of tenth class mathematics textbooks. Modelling in mathematics is very important strategy which is useful in solving some unbelievable problems. We think some problems are difficult to be solved but proper modelling the situation can be useful in solving the problem. For example, finding the distance between the sun and the earth can be solved by modelling of the situation. Or finding the height of Mt. Everest is another example of modelling.

Some unbelievable problems are discussed in the beginning of the chapter which creates eagerness in the children to proceed further reading the chapter. Connecting the various operations, visualizing the strategies to solve a problem, selecting a procedure and representing it in the form of a flow chart are the steps in mathematics modelling. Flow chart representation of the problem solving is nothing but the mathematics modelling. This mathematics modelling skills are very much useful for a student in his further studies like engineering, management, administration etc. or respective working areas.
CONCLUSION:

We should have a good understanding about how to understand the various concepts in each chapter, how to handle activities in the classroom, how to make the children think, how to conclude, how to encourage the children to solve the problems in exercises besides understanding the key elements in each chapter. Though the textbook gives us freedom and flexibility in deciding activities to understand concepts, “instructions to teachers” is given at the end of the chapter for designing better activities to understand concepts. We can utilize these instructions as a guide to teachers better maneuvering activities.

“Instructions to students” are provided at the backside of the cover page for better usage of the textbook besides instructions to teachers. The role of the teacher and students, purpose of various exercises, procedures of solving them, etc. are provided in these instructions to the students. For better learning of mathematics, the students should read instructions to the students and follow it in the classroom transactions.

We have discussed the key elements in all the chapters of tenth class mathematics textbook till now. Besides this, we have also discussed the strategies, backdrops of each concept. Let us hope that this portion of chapter may help us in better achieving of the objectives in mathematics.
INTRODUCTION:

- What is a plan? And why is it needed?
- What should be the parts of teaching strategies?
- When we look at the plans in teacher’s preparation, what we come to know about plans?
- What should be preparation of a teacher to have a comprehensive understanding on a concept by the student?

Large percentage of teachers have been writing the concepts, contents of teaching and teaching strategies in the form of teaching notes or teaching dairy. But, researches at state level and national level revealed that the strategies become helpless in providing fruitful learning to the students. These become to show to officers of the monitoring teams.

We observe the limitations in teaches preparation such as his readiness and planning, implementation of learning activities in the classroom as reasons for ineffective teaching strategies in the classroom learning. We have to realise that the textbook is meant for students and it is meant for their self-learning and understanding concepts through experience in activities for the successful learning of the concept. This should encourage the child to construct the knowledge.
The development of the units in the textbook is also helpful in learning as it follows a systematic and logical sequence of concepts. We, the teachers, can understand the sequences of learning when we understand each and every concept by reading and understanding them. And hence the teaching learning strategies will be successful. Sometimes the activities, examples, additional information and additional problems may not be sufficient for extensive understanding of the concept. Therefore, we should not confine to teach only the textbook. We ought to refer the materials like reference books, internet or attending seminars and gather additional information pertaining to the concept and realise the importance of it. Let’s discuss about them now.

Planning is required to achieve specified objectives in the specified time. A plan helps us in utilising human as well as material resources successfully and in overcoming obstacles and failures.

We need to plan to conduct Independence Day celebrations or a seminar or to perform a marriage. Then, is a plan needed to implement teaching learning activities in the classroom or not? As teaching learning process is so equalled important as earlier.

Let’s look at the plans we need to prepare as teachers.

We have misconceptions that a month wise division of chapters in textbook is a year plan and a period wise division of a chapter is only the unit plan.

A plan which guides us to achieve the objectives in a child by the end of the year, to divide the chapters monthly, to collect resources for implanting classroom processes and to conduct extra-curricular activities in each month is termed as “year plan” of a teacher. This gives us a perspective over the competency wise objectives to be achieved in an year and facilitates to overcome obstacles. This also guides us in conducting evaluation processes as per the expected objectives set at the beginning of the year.

Is it enough preparing a year plan for a teacher to conduct successful classroom activities though it provides us objectives? Can we achieve expected objectives on the basis of this year plan? Therefore we need another plan to prepare, i.e., a unit plan or a lesson plan. We term it as a unit plan for mathematics. It is a similar kind of plan with year plan. It decides the objectives to be achieved by the completion of a unit and it contains period wise plan for a whole unit. Besides all these, it guides us in preparing TLM and enterprise learning strategies in the class room. It also indicates our professional development in the form of additional information gathered and teacher’s reflections. It also helps in evaluating a child formatively as well as summatively. Therefore, it is very much important to prepare a unit plan for a teacher.
Is there any need for a teacher to write a lesson plan? Can anyone carry out a successful classroom transaction by following it exactly? If we cannot implement it successfully in a classroom, why should we write it? Do children answer our questions which are written in the period plan as we expected? Therefore, even a teacher writes a lesson plan, it won’t help us in the classroom. But, it does not mean that we need not plan. We should realize the need of designing teaching learning strategies and implementing them to achieve expected competencies of the classroom. We have to design classroom strategies as per our objectives set by a unit plan. We carry out objective motivated activities in the classroom as per our classroom strategies designed.

We have discussed the need and importance of planning and types plans to be prepared by a teacher. Let’s know the formats of the plans now.

**YEAR PLAN**

We have discussed the need and importance of a year plan and what it should contain. An year plan should be in the following format.

I. Class : 

II. Subject : 

III. Required no. of periods : instructional periods + practice periods + project presentation periods

IV. Expected learning outcomes (Academic standards): (these should be clear statements and written under competencies such as problem solving, reasoning and proof, communication, connections, representation and visualisation)

V. Month wise planning:

<table>
<thead>
<tr>
<th>MONTH</th>
<th>UNIT</th>
<th>REQUIRED NO. OF PERIODS</th>
<th>TLM/RESOURCES</th>
<th>PROGRAMS TO BE CONDUCTED</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</tbody>
</table>

VI. Reflections of the teacher : (we should write our reflections on unit wise classroom transaction)

VII. Suggestions and reflections of head master:
MODEL YEAR PLAN

I. Class : 10th class
II. Subject : Mathematics
III. Required no. of periods : a) total periods : 290
     b) Instructional periods: 180 + project presentation: 32
IV. Expected learning outcomes :

1) Problem solving:
   Students can
   - Find the values of given rational and irrational numbers and write in finite and infinite decimals (recurring and non-recurring)
   - Solve problems of logarithms with the help of laws logarithms.
   - Solve problems on basic operations on sets.
   - Solve problems related to zero values of polynomials of various types (linear, quadratic and cubic)
   - Solve linear equations of various types (consistent and inconsistent) in different methods and apply them in daily life situations.
   - Find the roots of a quadratic equation in three methods and nature of roots.
   - Find nth term and sum of the terms in arithmetic and geometric progressions
   - Find the distance between the given points, the required ratio or points using section formula, area of the triangle and the slope of a line.
   - Solve the problems by using concepts of similar triangles, basic proportionality theorem and Pythagoras theorem.
   - Solve geometric problems on tangents and secants of a circle.
   - Finds the area of a given segment of a circle and areas of different designs involving combination of segments of circles.
   - Find surface areas and volumes of combinations of solids like sphere, cone, cylinder, hemisphere, pyramid, cube, etc.
   - Solve the problems based of basic trigonometric ratios, identities and complementary angles.
   - Solve problems related to applications of trigonometry involving single and two right triangles.
   - Find the probability of events by using basic probability, complementary events, and mutually exclusive events.
   - Find mean, median and mode of a grouped data by using respective formulae and graphs.
2) **Reasoning and Proof:**

Students can

- Decide a number as a rational or irrational with appropriate reasoning (indirect method)
- Decide whether an element belongs to a particular set or not with reasoning and explain the reasons of various basic conceptual understanding.
- Give the reasons for deciding the zero values of polynomials and generalises the relation between coefficients of a polynomial and its zero values in the form of formulae.
- Decides the linear pairs of equations whether they are consistent or not with reasons.
- Deduces the formulae for roots of quadratic equation, sum of its roots and product.
- Generalises the distance between two points in the form of formulae and deduces section formula, mid-point, trisection points, area of a triangle and slope of line formulae.
- Decides whether the three given points are collinear or not.
- Proves the theorems which explain similarity of two triangles and basic proportionality theorem, Pythagoras theorem.
- Proves the relation between a tangent of a circle and its radius. And proves the theorems on tangents of a circle.
- Finds the relation between the area of segment of a circle and the line segment intersecting it.
- Generalises trigonometric ratios and formulises them and deduces the trigonometric ratios for 0,30,45,60 and 90 degrees angles.
- Deduces the relations between the trigonometric ratios of complementary angles.
- Decides the procedures to find the volume or surface areas of combination of solids.
- Estimates the measures of central tendency with appropriate reasons.
- Gives the reason in estimating the probability of an event. Decides whether two events are mutually exclusive or not with reasons.

3) **Communication:**

Students can

- Represent the rational numbers in recurring and non-recurring decimals to communicate mathematically effectively.
- Convert index form into logarithmic form and explain parts of the forms.
4) **Connections:**

Students can

- Connect logarithms with concepts of other subjects.
- Connect polynomials, linear pair of equations and quadratic equations with daily life situations, concepts of other subjects or other areas in mathematics and solve the problems.
- Connect patterns in nature and forms number patterns and subsequently understand progressions. Solve problems in daily life situations or concepts in other subjects or concepts in other areas of mathematics by using progressions.
- Connect the geometrical concepts with coordinate system to understand concepts.
- Connect concepts of various solids and solve the problems.
- Connect trigonometric concepts and algebraic concepts with daily life situations and apply them to find heights and distances.
- Connect statistical concepts and graphs to find the median.

5) **Representation – visualisation:**

Students can

- Represent algebraic equations in the form of graphs and solve the problems.
- Represent geometrical shapes into required figures by constructions in geometry.
- Represent daily life situations into figures to find heights and distances of various objects.
- Represent a grouped data into graph to find median.
- Visualise the strategies to solve problems of mensuration, trigonometry, geometry, algebra etc.
## V. MONTH WISE PLANNING

<table>
<thead>
<tr>
<th>MONTH</th>
<th>UNIT</th>
<th>REQUIRED NO. OF PERIODS</th>
<th>TLM RESOURCES</th>
<th>PROGRAMS TO BE CONDUCTED</th>
</tr>
</thead>
<tbody>
<tr>
<td>June</td>
<td>Real numbers</td>
<td>8</td>
<td>Chart of numbers with special properties</td>
<td>Sharing experiences of children summer vacations with respect to learning in 9th class</td>
</tr>
<tr>
<td>July</td>
<td>Sets</td>
<td>6</td>
<td>Charts showing Venn diagrams and symbols</td>
<td>Formation of math club</td>
</tr>
<tr>
<td>July</td>
<td>Polynomials</td>
<td>8</td>
<td>Graph board, graph charts</td>
<td>Collecting resources for maintenance of math club</td>
</tr>
<tr>
<td>August</td>
<td>Pair of linear equations in 2 variables</td>
<td>8</td>
<td>9</td>
<td>Materials mentions in the introduction of the chapter.</td>
</tr>
<tr>
<td>August</td>
<td>Similar triangles</td>
<td>13</td>
<td>Grid paper, Mathematical instrumental box</td>
<td>Exhibition of collected puzzles.</td>
</tr>
<tr>
<td>September</td>
<td>Trigonometry</td>
<td>8</td>
<td>Chart of trigonometric ratios, Mathematical instruments box</td>
<td>Conducting a seminar</td>
</tr>
<tr>
<td>September</td>
<td>Statistics</td>
<td>7</td>
<td>Data collected in the school or village</td>
<td>Display of information and analysis</td>
</tr>
<tr>
<td>October</td>
<td>Quadratic equations</td>
<td>7</td>
<td>Graph board</td>
<td>Math mela</td>
</tr>
<tr>
<td>November</td>
<td>Progressions</td>
<td>6</td>
<td>Patterns collected from nature</td>
<td>Display of projects</td>
</tr>
<tr>
<td>MONTH</td>
<td>UNIT</td>
<td>REQUIRED NO. OF PERIODS</td>
<td>TLM/RESOURCES</td>
<td>PROGRAMS TO BE CONDUCTED</td>
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<tr>
<td></td>
<td></td>
<td>INSTRUCTION</td>
<td>PRACTICE</td>
<td>M.I. box</td>
</tr>
<tr>
<td></td>
<td><em>TA tangents and secants of a circle</em></td>
<td>9</td>
<td>6</td>
<td>Collection of designs to find area</td>
</tr>
<tr>
<td></td>
<td>Coordinate geometry</td>
<td>8</td>
<td>6</td>
<td>Graph papers</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Drawing sheets</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>M.I. box</td>
</tr>
<tr>
<td></td>
<td>Mensuration</td>
<td>6</td>
<td>9</td>
<td>Models of hemisphere, pyramid, cube, cylinder, etc.</td>
</tr>
<tr>
<td></td>
<td>Applications of trigonometry</td>
<td>3</td>
<td>5</td>
<td>Instruments to find angle of elevation and depression</td>
</tr>
<tr>
<td></td>
<td>Probability</td>
<td>5</td>
<td>6</td>
<td>Pack of cards, cons, dice</td>
</tr>
<tr>
<td></td>
<td>Mathematics modelling</td>
<td>6</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total periods</td>
<td>110</td>
<td>106</td>
<td></td>
</tr>
</tbody>
</table>

VI. Reflections of the teacher:

VII. Suggestions and reflections of head master:

Note: The above mentioned plan is suggestive plan only. A teacher can adjust these periods and make his own plan. A teacher should prepare a year plan before beginning of an academic year and it should be submitted to HM. The HM should write his suggestions and reflections in the plan. A teacher should allot a note book for a subject and write a year plan and followed by unit plans. For example, if a teacher teaches 4 subjects for 4 classes, he has to maintain 4 subjects plans.
LESSON PLAN / UNIT PLAN

A unit plan contains following steps

I. Class : 10th
II. Unit : Coordinate Geometry
III. Required no. of periods : Instructional Periods + Practice / Exercise

IV. Expected academic standards by completion of this unit :

1. Problem solving:
   - Find the distance between any two points in between two points and solving related problems.
   - Find the area and perimeter of given polygon by given vertices.
   - Find the ratio in which a line segment is divided by given point on the line by using section formula.
   - Find mid point and trisection points for a line segment and centroid of a triangle.
   - Find the slope of line.

2. Reasoning – proof:
   - Generalize the ways of finding distance between two points with different properties like segment on axes, segment parallel to axes, segments with end points on the line and give reasons.
   - Generalize distance between two point and find formula.
   - Generalize the section formula.
   - Deduce new formulas like mid point of a segment and centroid of a triangle.
   - Deduce the formula for area of the triangle.
   - Prove three points are collinear or not with reasons.
   - Deduce the formula for slope of a line.

3. Reasoning – proof:
   - Express the formula for distance between given points and variables in it.
   - Explain the terms mid point, trisection points, centroid of a triangle and slope of a segment.
   - Express the formulae of mid point of a segment and centroid of a triangle and variables in it.
   - Express the formulae for slope of line and variables.
4. **Connection:**
   - Connect the concept of phythogoros theorem in find distance between two points.
   - Connect the are of triangle with concept of area of trepezium in deducing area of triangle.
   - Connect algebraic concepts with geometrical concepts on solving problems.
   - Use coordinate geometric concepts in finding area of a triangle by using Herone formula.
   - Connect the concepts of linear equations in understanding straight lines.

5. **Representation & Visualisation:**
   - Represent the given points on a graph with different scales.
   - Represent the conceptual understanding of above concepts on graphs.

V. **TLM:** Graph board, Graph paper, Gemetrical box, Char, Chess board.

VI. **Period-wise plan:**

<table>
<thead>
<tr>
<th>Period no.</th>
<th>Concept to be taught</th>
<th>Strategies</th>
<th>TLM / Resources</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>• Introduction&lt;br&gt;• The distance between the two points on a line parallel to any axis</td>
<td>• Introduction of the topic in whole class&lt;br&gt;• Group activity for conceptual understanding&lt;br&gt;• Problem solving strategies in whole class&lt;br&gt;• Model problem solving by students individually</td>
<td>• Graph sheets&lt;br&gt;• Graph board</td>
<td>• What is the distance between (0,-3) and (0,-8)?&lt;br&gt;• What is the distance between (4,3) and (8,3)?</td>
</tr>
<tr>
<td>2</td>
<td>• The distance between any two points</td>
<td>• Solving problems individually</td>
<td>• Graph sheets&lt;br&gt;• Graph board</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>• Exercise 7.1 problems 1 to 8</td>
<td>• Strategies of problem solving in whole class and solving the problems individually</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Period no.</td>
<td>Concept to be taught</td>
<td>Strategies</td>
<td>TLM / Resources</td>
<td>Evaluation</td>
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<tr>
<td>4</td>
<td>• Exercise 7.1 problems 9 to 15</td>
<td>• Strategies of problem solving in whole class and solving the problems individually</td>
<td></td>
<td>• Which point divides the segment joined by (3,5) and (8,10) in the ratio 2:3?</td>
</tr>
<tr>
<td>5</td>
<td>• Section formula</td>
<td>• Understanding the concept in whole class</td>
<td>• Graph sheets</td>
<td>• Find the mid-point of AB if A=(2,7) and B=(-1,3)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Group activity for conceptual understanding</td>
<td>• Graph board</td>
<td>• What are points of trisection of the segment joining (2,-6) and (-4,8)?</td>
</tr>
<tr>
<td>6</td>
<td>• Mid-point and points of trisection of a segment</td>
<td>• Understanding the concept in whole class</td>
<td>• Graph sheets</td>
<td>• Find the centroid of the triangle with vertices (3,-5), (-7,4) and (10,-2).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Group activity for conceptual understanding</td>
<td>• Graph board</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Problem solving strategies in whole class</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Model problem solving by students individually</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>• Centroid of a triangle</td>
<td>• Understanding the concept in whole class</td>
<td>• Drawing sheet</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Group activity for conceptual understanding</td>
<td>• Graph board</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>• Problem solving strategies in whole class</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>• Model problem solving by students individually</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>• Exercise 7.2 problems 1 to 5</td>
<td>• Strategies of problem solving in whole class and solving the problems individually</td>
<td></td>
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</tr>
<tr>
<td>Period no.</td>
<td>Concept to be taught</td>
<td>Strategies</td>
<td>TLM / Resources</td>
<td>Evaluation</td>
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<tr>
<td>9</td>
<td>Exercise 7.2 problems 6 to 10</td>
<td>- Strategies of problem solving in whole class and solving the problems individually</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| 10        | Area of a triangle | - Understanding the concept in whole class  
- Group activity for conceptual understanding  
- Problem solving strategies in whole class  
- Model problem solving by students individually | - Drawing sheet  
- Graph board | - Find the centroid of the triangle with vertices (1,-1),(-4,6) and (-3,-5).  
- Whether (1,-1),(2,3) and (2,0) are collinear? Verify |
| 11        | Exercise 7.3 | - Strategies of problem solving in whole class and solving the problems individually | | |
| 12        | Slope of a line/segment | - Understanding the concept in whole class  
- Group activity for conceptual understanding  
- Problem solving strategies in whole class  
- Model problem solving by students individually | - Drawing sheet  
- Graph board | - Find the slope of a segment (4,-8) and (5,-2)  
- Find the slope of a segment (-3,-8) and (5,-2) |
| 13        | Exercise 7.4 | - Strategies of problem solving in whole class and solving the problems individually | | |
| 14        | Optional exercise | - Encourage the children to think higher order apply it in problem solving | | |
VII. Teaching notes: (additional information collected by teacher)  

VIII. Reflections: (the reflections of the teacher should be written on how the class room transactions among the students conducted in this column like process of learning, success of strategies, the extent of learning)

- Note: Even though we planned for whole unit, we should carry out the strategies as suggested in the strategies of classroom.
- We can make use of mind mapping, brain storming and concept analysis in the process of understanding a concept.
- The exercises like “Do this”, “Try this” and “Think and discuss” should be solved in the presence of teacher in the classroom only.
- The additional information should be collected and utilised in the teaching learning process.
- Group activities, individual activities, whole class activities can be utilised as the strategies demanded.

It should be noted that above unit plan is tentative only. A teacher can prepare his own plan as flexible as he needed for the success of teaching learning process.

TEACHING NOTES: We should collect additional information from additional resources like reference books, internet and conferences. No information should be copied from the textbook. The information can be utilised at the time of teaching learning process. The professional development of a teacher can be judged on the basis of his teaching notes collected. Year plan and unit plan are needed to be written once only further teaching notes and reflections should be continuously written as the transactions in the classroom continued.

Teaching strategies in mathematics:

How to teach math?

Teaching learning process should be carried out strategically. The learning activities should be carried out as per the steps in strategies designed. Designing no. of periods and strategies to be adopted in each period are parts of a unit plan. Implementation of the strategies should follow a sequence of activities so that the objective set can be achieved. What activities should be carried out in stipulated 45 minutes and what should be practiced are as important as our planning in unit plan. All the children in a class room should participate in the teaching learning process and every student should be made to think. Whenever we adopt a suitable strategy to achieve competency in the classroom, it should be helpful to overcome the obstacles that come across in the classroom learning process. Let’s discuss the steps should be followed in a class room learning process.
I. Name of the lesson:

II. Period no: duration:

III. Concept to be taught:

IV. Academic standards to be achieved in this class:

Steps in the class room:

V. Introduction:
   i. Greetings and formal cordial chat:
   ii. Testing of previous knowledge: A teacher can make use of mind mapping or brain storming or puzzle or any activity to test as well as guide the classroom towards joyful learning.
   iii. Announcement of the topic:
   iv. Need and relevance of the topic: use of the learning concept should explained or any story related to the concept should be explained to students.

VI. PRESENTATION:
   i) Conceptual understanding:
      a) Reading the text: children should be asked to read the text in the textbook related to the concept to be taught and underline the new words/symbols/key words/sentences which are not understood. Teacher should write the words or symbols on the blackboard and should be discussed in the classroom.
      b) Activity for conceptual understanding: for the extensive learning of the concept, an activity should be provided to the students to understand the concept inductively or deductively.
   ii) Problem solving:
      a) Problem solving by the teacher on the board: main objective of this step is to understand the problem solving strategies.
      b) Model problem solving by the students: Each student in the class is encouraged to think and solve the problem individually. Some students commit some mistakes during substitution or calculation. Those should be rectified in the groups or whole class but inferiority in the students should be minimised as the class goes on.

VII. RECAPITULATION: A teacher can make use of mind mapping or brain storming or puzzle or any activity to recapitulate the learnt concepts in the class as well as guide the classroom towards joyful learning.

VIII. HOME WORK: Whatever the problems left in the exercises like “do this” or “try this” should be given as homework or problems prepared by the teacher on the learnt concept. The solved problems should be observed and corrected on the next day.
Note: All of these steps mentioned above should be directed towards the conceptual understanding in the child. Whatever the activity we provide in the class room, it should enhance the inductive or deductive logic in the student. The reasoning in mathematics would strengthen the student’s ability of problem solving in daily life. The role of the teacher not only confines to the class room only, his preparation for entering the classroom would enrich the teaching learning process.

**Period plan**

We have discussed the steps in the teaching learning process to be implemented in the class room. Besides this, the strategies in each step are important as well. Observing, analysing the contexts and generalising the concepts should be followed by the students only. But the role of the teacher is very important in this process. Sequence of the questions in the process of understanding and guiding it to generalisation of the concept helps the children to understand the concept. We have discussed the teaching steps and strategies till now.

Let’s look at a sample of period plan with the above teaching learning process.

Note: A regular teacher need not write this teaching learning process steps but it is suggested to be written by a student teacher while his/her teaching practice.

**Sample of a teaching learning process**

I. Class : 10
II. Unit : 7 (Coordinate geometry)
III. Period no : 1
IV. Time duration : 45mins
V. Concept to be taught : Introduction—the distance between the two points on line parallel to any one of the axes.

VI. Academic standards to be achieved :

a. Problem solving: the student can find the distance between the two given points on a line parallel to any one of the axes

b. Reasoning-proof: the student can generalise the condition to find the distance between the points and formulise the condition.

c. Communication: the student can name the coordinates in a point and communicate a point in the coordinate form. The student can express the distance formula for the distance between two points which lie on a line parallel to any one of the axes.

d. Connection: the student can utilise the learnt concept in other situations such as physics, chemistry, social, etc.

e. Representation-visualisation: the student can represent a point on a graph paper and distance between two points.

**VII. STEPS IN THE TEACHING LEARNING PROCESS**

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<table>
<thead>
<tr>
<th>STEP</th>
<th>STRATEGY</th>
<th>BB WORK</th>
<th>TLM/RESOURCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTRODUCTION</td>
<td>GREETINGS: Good morning children..! TESTING PREVIOUS KNOWLEDGE: (WHOLE CLASS ACTIVITY)</td>
<td></td>
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<tr>
<td></td>
<td>• You have learnt about coordinate axes in 9th class. Then try to draw rough model of the coordinate axes in your notebook. (After a minute)… Compare your models with your friends' models.</td>
<td></td>
<td>• Graph board</td>
</tr>
<tr>
<td></td>
<td>• What is horizontal line called? Try to name it on your paper.</td>
<td></td>
<td>• Graph chart</td>
</tr>
<tr>
<td></td>
<td>• What is vertical line called? Try to name it on your paper</td>
<td></td>
<td>• Colour chalks</td>
</tr>
<tr>
<td></td>
<td>• Then try to divide X-axis 10 equal parts with 5 parts on each part. And similarly try to divide Y-axis 10 equal parts with 5 parts on each part.</td>
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<tr>
<td></td>
<td>• What is intersection of the lines called?</td>
<td></td>
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<tr>
<td></td>
<td>• What is it called?</td>
<td></td>
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<tr>
<td></td>
<td>• Try to locate (2, 3) in the coordinate axes on which you have drawn.</td>
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<tr>
<td></td>
<td>• Compare it with your friends. (discussion about mistakes done by some students on coordinates of a point)</td>
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<tr>
<td></td>
<td>• Try to locate (2, 0). Where is it?</td>
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<tr>
<td></td>
<td>• How far is it from origin?</td>
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<tr>
<td></td>
<td>• How can you say the distance?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Declaration</td>
<td>Let us discuss today how to find the distance between two points on line which is parallel to any one of the axes?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>of the topic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relevance</td>
<td>Finding the distance between any two points is useful for us to</td>
<td></td>
<td></td>
</tr>
<tr>
<td>of the topic</td>
<td>• Analyse the graphs drawn on any data regarding business, measurements or technology etc.</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>• Analyse the motion of a body or graphs in electricity or heat in physics</td>
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</tr>
<tr>
<td>STEP</td>
<td>STRATEGY</td>
<td>BB WORK</td>
<td>TLM/RESOURCES</td>
</tr>
<tr>
<td>------</td>
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</tr>
<tr>
<td><strong>Presentation</strong>&lt;br&gt;a. Conceptual understanding</td>
<td><strong>Reading:</strong> Please open the page 159 and read the text from 159, 160, 161 and pages. (Individual activity)&lt;br&gt;Underline the new terms or the terms which can't understand/symbols/sentences&lt;br&gt;(teacher discusses in whole class the new terms or symbols in the conceptual understanding)&lt;br&gt;Activity for conceptual understanding:&lt;br&gt;Finding the distance between the two points on line parallel to any one of the axes.&lt;br&gt;&lt;b&gt;Activity 1 (individual activity):&lt;/b&gt;&lt;br&gt;  - Ask the students to locate A(2, 0), B(4, 0) and C(7, 0)&lt;br&gt;  - Find the distance between&lt;br&gt;    1) A(2, 0) and B(4, 0)&lt;br&gt;    2) B(4, 0) and C(7, 0)&lt;br&gt;Can you find the distance between&lt;br&gt;    3) D(5, 0) and E(8, 0)&lt;br&gt;    4) H(13, 0) and K(19, 0)&lt;br&gt;How can you say?&lt;br&gt;[Finally the teacher ends the discussion with the conclusion distance between ((x_1, 0)) and ((x_2, 0)) in the whole class]&lt;br&gt;The students will be provided another similar activity to generalise the distance between ((0, y_1)) and ((0, y_2)).&lt;br&gt;&lt;b&gt;Activity 2 (group activity):&lt;/b&gt;&lt;br&gt;  - Draw any line parallel to X-axis individually.&lt;br&gt;  - Mark any three points on it whose coordinates are integers.</td>
<td>Distance between the points ((x_1, 0)) and ((x_2, 0)) is (</td>
<td>x_2 - x_1</td>
</tr>
<tr>
<td>STEP</td>
<td>STRATEGY</td>
<td>BB WORK</td>
<td>TLM/RESOURCES</td>
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</tr>
</tbody>
</table>
| b. Problem solving | • Name them as P, Q and R  
• Then discuss in groups how you would find the distance between P,Q and P,R.  
(Discuss the dialogue in the group discussion in whole class and generalise the formula for the distance between two points on a line which is parallel to any one of the axes.) | Distance between the points \((x_1,k)\) and \((x_2,k)\) is \(|x_2-x_1|\)  
Distance between the points \((k,y_1)\) and \((k,y_2)\) is \(|y_2-y_1|\) | • Graph board  
• Graph chart  
• Colour chalks |
| Problem solving by the teacher: | Teacher writes the problem on the board: Find the distance between \(A(-4,-5)\) and \(B(2,-5)\) | Find the distance between \(A(-4,-5)\) and \(B(2,-5)\)  
Given \(A(-4,-5)\) and \(B(2,-5)\)  
Distance \(=|x_2-x_1|\)  
x_1 = -4 and x_2 = 2  
then distance \(=2-(-4)\)  
\(=2+4\)  
\(=6\) units | |
| Model problem solving by the student: | (Teacher gives a problem from Do this and asks the students to solve it individually.)  
Find the distance between the points P \((-4,-3)\) and Q \((-8,-3)\)  
(Then teacher discusses the mistakes committed by the students in calculations) | | |
| Recapitulation | The teacher discusses the summary of the classroom through mind mapping | | |
| Homework | Teacher gives the homework problems which are to be solved by the students | | |
TEACHER PREPARATION

INTRODUCTION:

We, the teachers have to shift our strategies from teaching a concept in the class to implementing teaching learning strategies in the class room as the new textbooks have been introduced on new syllabus prescribed by APSCF-2011. We have to realise the change of our role from teacher or preacher to facilitator of learning. A teacher need to have better understanding on syllabus, academic standards and modern techniques of evaluation to plan teaching learning strategies. A teacher should be vastly equipped for better achievement of academic standards. Let us discuss the areas in which we should have preparation for betterment of teaching learning strategies.

Teacher preparation

Preparation for teaching learning process
- Preparation for conceptual understanding
- Preparation for providing practice
- Deciding roles of various constituents in the process

preparation for evaluation
- Formative assessment-preparation
- Summative assessment-preparation
- Public exams-preparation
TEACHING LEARNING PROCESS -PREPARATION:

For achieving success in teaching learning processes, a teacher should have objective based preparation. Selecting the content from the textbook, concept involved in it, designing the strategies and activities for comprehension, achieving academic standards in mathematics are some of the main steps in the preparation of a teacher. These strategies should be prepared so as to encourage children to think while conceptual understanding or problem solving. Reading the whole chapter, preparing plans, gathering TLM, collecting additional information from various resources like reference books, internet, seminars, etc. would be the parts of our preparation before starting teaching of a lesson. Let us discuss how to prepare for conducting the teaching learning process.

CONCEPTUAL UNDERSTANDING -PREPARATION:

Teacher preparation is key factor in the process of teaching learning processes. Preparation of the teacher becomes base for implementing teaching learning processes and involving every child in them. The behavioural changes brought in teaching learning process will be useful for us to assess the children formatively and also for preparation.

The children have to participate in class room learning process as per their needs. There is a need to change our teaching process which does not consider the needs of a child. We should design class room learning processes as per the needs of a child by having a look at our present system of teaching. Since the new textbooks are introduced with new strategies in conceptual presentations, these textbooks won't support our old methods of teaching in the classroom. Let us discuss following points to know the needs of change.

- Are our teaching methods natural or artificial?
- Are we teaching according to the nature of the child and nature of mathematics?
- Are children collecting information from our teaching or constructing knowledge on their experiences in activities?
- Are students remembering the strategies to solve some particular problems or encouraged to solve the problems on their own?
- What are the behavioural changes brought in the students by mathematics teaching? Can they utilize these problem solving strategies in their real life?
- What may be the reason for the standards in mathematics learning are deteriorating day by day? Is it due to textbooks or teaching or standards of children?

Let us analyse the answers for the above questions and decide some factors of teacher preparation. Textbook is a fundamental tool for us to help in the teaching learning process in the classroom. We use textbook as a basic tool for implementation of classroom learning process. We should understand the connection between the concepts in the textbook. On the basis of understanding, we should prepare "concept mapping" in each unit of the textbook. We should then solve all the problems in the textbook.
We should also prepare strategies for learning of the problem solving skills. Let us observe the changes brought in the textbook.

- The notions (previous concepts) required to learn the new concepts are discussed in the beginning of every chapter. Problems regarding these concepts are also mentioned at various required places.
- Various contexts in the daily life, real life incidents, examples, patterns, activities are used to understand concepts in each chapter.
- Concepts have been divided into some sub-concepts for easy understanding of the concept and "do this" exercise is given subsequently.
- The concepts are given so as to understand them by discussions and by doing activities.
- "try this" exercise is given for developing critical and logical thinking, for extensive understanding of the conceptual understanding by logical usage of mathematical terminology, reasoning and connections in between concepts.
- "think, discuss and write" exercise is given for the child to think hypothetically and analyse the conceptual understanding and thus to develop logical thinking.
- Thus major exercises are given after every two or three concepts.

We have discussed the changes brought in new textbooks from old textbooks, haven't we? Our responsibility is to understand these parts of the textbooks along with the connection between the concepts. When we understand the given activities and their nature, formative exercises and major exercises and their purpose, we can decide roles of students, TLM and teachers. We can also design better classroom activities as group, individual and whole class activities. Thus, we can carry out successful teaching learning activities.

Based upon our above discussion, we can say that we should have better extensive understanding on each chapter in the textbook. We have to think as many as ways to understand a concept in which observation, identifying the general principle and generalising the concept or property plays a dominant role. The teacher has to become a facilitator during these activities are implemented. A teacher has to prepare in the following way for the successful implementation of the strategies.

- Firstly, a teacher should read the complete unit and identify the concepts to be taught and the content involved in it.
- Based upon the thorough understanding of the unit, we have to decide the academic standards.
- We have to prepare a unit plan in which required no. of periods, academic standards, strategies to be implemented in the classroom, TLM, etc. are mentioned.
- If we feel the activities or examples given in the textbook are not enough to carry out teaching learning process, we can design more activities or collect more examples. We should test them if we feel necessity of testing.
- We should collect or prepare required TLM or worksheets before carrying out teaching learning process.
- We can gather more information on the subject from reference books, internet, research papers, magazines, dailies, etc. for extensive understanding of the concept.
- We should write the gathered information on the subject in lesson plan.
- As it is mentioned earlier, we should read whole chapter thoroughly and understand logics should be developed by learning that concept. Besides this, we should solve every problem given in the exercises. We can clarify our doubts by discussing with our fellow teachers or subject experts.
- We should design group or individual or whole class activities based on the nature of the exercise and questions involved in it.
- We have to distribute time according to nature of the activity and conceptual understanding. We should plan each activity along with time period.
- We should have complete understanding on concepts and competencies to be developed in the students.
- Therefore, we should have holistic view on the chapter and good aptitude on it.

TEACHING LEARNING MATERIAL- READINESS:

We have observed the importance of planning teaching learning activities till now. We have to observe the activities, discussions, process of learning and their performance in the class room. All the students should be made sure to participate in learning activities so that every student can learn and enjoy mathematics. They should be made to observe, think, discuss and generalise while participating in the activities. But, success of every activity depends upon the resources or TLM used in that activity. The nature of TLM or resources which will be used in the activities should selected on the basis of availability, easy to handle, effect on learning, nativity, etc.

We use charts, sketch pens, graph sheets, newspapers as TLM commonly. But we can make use of commonly available resources such as school ground, class room, black board, sticks, etc. as resources in teaching learning process. We can also use mathematical instruments box, math kit, geo board, etc. as TLM in the teaching learning process. If we make use of effective TLM or resources, we can achieve objectives effectively.

EXAMPLES OF TLM

<table>
<thead>
<tr>
<th>CHARTS</th>
<th>GRID PAPER</th>
<th>TRACING PAPER</th>
<th>GEO BOARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEOMETRIC BOX</td>
<td>DICE</td>
<td>COLOUR PAPERS</td>
<td>MATH REFERENCES</td>
</tr>
<tr>
<td>ISOMETRIC SHEETS</td>
<td>COINS</td>
<td>SCISSORS</td>
<td>NCERT BOOKS</td>
</tr>
<tr>
<td>GRAPH PAPERS</td>
<td>PACK OF CARDS</td>
<td>3-D SHAPES</td>
<td>INTERNET PRINT OUTS,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>BOOKS OF OTHER STATES</td>
</tr>
</tbody>
</table>
We have seen some of the useful TLM and resources that can be useful in our teaching learning process. We should collect them after planning of the lesson the lesson and try them once before using them in the class room. When we collect them and test them we get enough confidence on the teaching learning process which we have designed. Thus we can be successful in achieving expected objectives in almost every child in the class room.

**ROLE OF THE TEACHER -READINESS :**

The teacher should prepare or design such activities so that

- The students should co-operate each other in learning and enhance their learning.
- The student should learn mathematics with joy.
- The students could achieve minimum of expected competencies on the concept in the stipulated time. Only then a teacher should go for the next concept.
- The students should be able to solve the problems on their own

Depending on our earlier discussion, a teacher should prepare himself for teaching. He should develop good attitude towards mathematics teaching so that the students construct their knowledge on their own. The student should be allowed to participate in the activities, to discuss, to think, to ask doubts freely, to enjoy math learning.

The teacher should

- Go to the classroom at appropriate time as per time table. He should allot whole time for the learning of the students. After completing the activities, he should come out of the class room.
- Should carry out teaching learning process only after preparing year plan, lesson plan and designing class room strategies in a period.
- Write teacher’s reflection on the basis of implantation of strategies and achieving standards.
- If the expected standards are not achieved by strategies designed, we should design alternate learning strategies.
- In the process of learning some students achieve standards speedily. A teacher should prepare some extra creative activities for such students.
- A teacher has to prepare special strategies for slow learners in the class room.
- The teacher should identify the misconceptions in the children in the learning process or in solving problems and correct them.
- The teacher should discuss the progress of the students regularly and take some steps for more progress.
• The teacher should gather extra information from various resources as discussed earlier.
• The teacher should design appropriate, effective projects for extensive learning and evaluate it.
• The teacher should prepare himself so as to carry out strategies efficiently.

PREPARATION FOR EVALUATION:

We assess the progress of learning of a student formatively and summatively. Formative assessment is the assessment process which is conducted during teaching learning process. The achievement of academic standards in the students is not only assessed but also their process of learning is assessed. It also enhances the learning in the child. We assess the students by 1) generating new problems 2) written works 3) projects 4) slip tests in formative assessment. A should have comprehensive knowledge on these four tools of assessment for conducting formative assessment. He should prepare well for formative assessment.

PREPARATION FOR FORMATIVE ASSESSMENT:

Formative assessment is conducted to reduce stress and strain produced by exams in the students. Moreover this assessment also assesses the process of learning and the achievement of the students. To conduct formative assessment, a teacher should prepare like this.

• A teacher should know about every tool used in the formative assessment comprehensively.
• The teacher should understand the process of evaluation and allotment of grades.
• The teacher should prepare a register to note down the marks and grades. Tool wise recording and competency wise recording should be maintained in the register.
• A teacher should give place for formative assessment in the lesson plan wherever the projects and slip tests are conducted.
• The recording of the assessment should be impartial and should not deviate from evidences like project reports, slip test answers, written notebooks.
• These records should be kept always available for monitoring.
• Though we maintain evidences in the formative assessment, some important observation in the teaching learning process should be written in the lesson plan so that further learning is improved.
• Such activities should be designed for the teaching learning process which is very useful in assessing all the children easily and more accurately. Group, whole class and individual activities are designed so that they provide learning as well as assess the progress of the students learning.
20 marks are allotted for formative assessment in ninth and tenth classes. Performance of the students should be assessed for 5 marks for each tool and 4 x 5 = 20 marks in total should be assessed in the formative assessment. Every student should have comprehensive understanding on formative assessment so as to assess the students learning more accurately.

PREPARATION FOR SUMMATIVE ASSESSMENT:

Summative assessment is intended to assess the achievement of academic standards in students in the stipulated time.

Summative assessment is conducted in two papers namely PAPER-1 and PAPER-2. Each paper is conducted for 40 marks. And result is displayed along with formative assessment in which 80 marks for written papers and 20 marks for formative assessment. Each paper for written examination is conducted for 2 hrs and 45 mins in which 15 mins of the time is allotted for reading the paper and the remaining for writing answers in the examination. The teacher has to assess the academic standards achieved by the students by correcting answer scripts of the students. A teacher has to prepare the students and him in the following way.

- Two summative exams and a public exam is conducted for tenth class students in no questions are asked directly from textbook. A teacher should prepare such question papers in which no questions are asked directly from textbook for each paper for 40 marks each as mentioned earlier.
- 9th class examinations are useful for the students for the preparation of tenth class public examinations. They should be conducted as a practice of public examinations in tenth class.
- Conducting summative examinations in the ninth class and first two summative exams are the responsibility of the school.
- As the answer sheets are not given separately but a single booklet consisting 16 pages will be given to write the answers, the students should be trained to write in a single booklet.
- The students should be given comprehensive idea on paper-1 and paper-2.
- The teacher should explain a model paper so that they understand each section of the paper as per the marks.
- Before preparing a model question paper, the teacher should prepare a blueprint of the papers as per the weightages of types of questions and competencies.
- The teacher should prepare guidelines of correction of the papers.
- The questions in the question papers should allow the students to think and write the answers. Multiple choice questions should be asked to prepare the children for competitive exams.
- The teacher should understand the above discussed points and prepare the students and him as such.
PREPARATION FOR PUBLIC EXAMS:

The learning and public exams in tenth class are very much important for students for their higher studies. The students have to write these public exams and pass them. The public exams should not create stress and strain in the students and the exams should provide the opportunities for students to think and write their own understanding and views. For this, the students and teachers should prepare like this.

- The students or teachers should not depend on any types of guides or study materials which suppress the thinking processes. The students should be allowed to think on their own to solve problems. The children should be practiced problems solving strategies rather than problems from textbook. The students should enjoy solving problems but feel burden or stress in solving problems.

- Various types of problem solving strategies on various concepts should be practiced by the students but the teacher should not encourage the children to copy them from the black board or guide or any study material.

- Inductive and deductive logics should be developed in the students so that they can give reasons or prove generalisations. The students should be practiced to give reasons with appropriate logics or proving theorems with reason in each step.

- The students should be trained to use the mathematical language effectively and efficiently.

- Connecting various concepts is very important skill in mathematics which is useful in solving more complex problems. The students should be practiced to solve more complex problems in various chapters by connecting the various concepts.

- Representations skills should be developed in students for better performance on the public examinations.

- The children should be practiced to write the answer as per the nature of the problem or question.

- The students commit some minor mistakes while solving the problems. The teacher should identify them and correct their understanding in applying the logics or calculating.

- The students should be trained to write in a single booklet containing 16 pages because only 16 pages booklet is given to write the public examination.

- The students should be practiced to write the examination in the stipulated time.
EXAMINATIONS - REFORMS - NEED

How do the children participate in Teaching Learning Process? To what extent are they able to comprehend the concept? What is the process? How much have they learnt? Have teaching learning strategies succeeded in believing Academic standards?

We should know about the evaluation assessment processes to know about the above questions.

We have a misconception that evaluation is nothing but to conduction of paper pencil test. These written tests are being conducted in the form of unit test after completion of a chapter or every month or every two months periodically, terminal tests are being conducted after every three months in a year; and the progress of the children is being recorded. Thus teachers, parents and society also considering the achieved marks are benchmarks for children's progress and knowledge. By this process, "by heasting missing up of the content which is in teh: textbook and reproducing it in examinations has become a objective of teachin. Hence, the examinations which are conducting under evaluation process are become root causes for developing examination ________ insprite of developing positive attitude towards school, and learning process. By this, infi____ orthy complex is developed, and they are feeling that they are not capable to learning, these may be the causes for some unwanted incidents that the children comming often.

The process of measuring the progress of the children by marks and ranks, is root cause for stress among the children. By this, their physical, mental development constrained. The aims & objectives of teaching learning processes have become only achieving marks.
Evaluation - Present status

- No relation between the process of evaluation, questions asked in exams and educational objectives.
- Evaluating the learning of the child through only written exams. No place for oral and skills presentation and performance.
- Questions which can be answered by rote learning are asked in the examinations but they are not able to assess the thinking & analytical ability of the children.
- Learning has become textbook dependent. Transformation of information in the textbook and reproducing it in the examination has become main aim of the exams.
- Examination oriented teaching to carried out in the classroom. It is forcing the children towards rote learning. And the preparation of the children no well as teachers is targeting only exams.
- If a student studies 4 or 5 previous papers then he will be able achieve good marks as pass the exam.
- If a student studies a part of textbook or some chapters he may pass the examination or get good marks. There is no necessity to learn all the chapters and all concepts.
- Level of the child's learning is evaluated on the basis of memory but not encouraging the child to improve his skills.

Background

APSCF-2011 was constituted in accordance with the RTE-2009 and NCF-2005. The textbooks from Class I to X have been revised as per the guidelines and key principles of APSCF-2011. The new textbooks aim at achieving the class wise, subject wise, focussed on competencies or academic standards and developing multifaced personality and competencies such as thinking, self expression, analysis, logical representation etc.

Developed position papers and approaches to teaching and learning in all subjects focusing on the changes that are to be brought in the Department of School Education in the State. Similarly a position paper has also been developed on the reforms in examination and make examinations away from rote memory. CCE for Class I to VIII is being implemented in the state since April-2010 with a special focus on projects, self expressions, change in the nature of questions etc. A shift in the nature of Teaching Learning Process and engagement of the children in learning process with activities, dialogue and discussions, projects and experiments etc. By this knowledge construction process have been changed.

In view of changes as above in the school curriculum, textbooks, teaching learning process. It is necessary to change the way we assess the children i.e.: What to be assessed, how to be assessed and feedback procedures etc., it become necessary to bring reforms in Class IX and X examinations.
Need of Reforms in Examinations:

- The aspect that is to be worried about is mainly the key role played by school. The role of school is confined to prepare the children mechanically for their exams limiting their knowledge to textbooks only. Learning by rote memory and mechanical completion of syllabus do not prove to be beneficial for achieving the objectives of education. A school must enable the children to explore, search, discuss, read the reference books, discriminate and analyse. When these are kept in view, the present system of examination has to be changed.

- The Class-X is treated as the most important class and more focus on examination cut comes or results. Therefore, the syllabus of Class-X is being completed much earlier than decided months. The teaching is mostly aimed at examinations and school encouraging memorizing the answers with the help of guides, study materials etc. (It is should be eradicated) Most of the time the children are confined to reading and re-reading and memorizing the answers. There is no opportunity and pace for children to think on their own and construct answers applying their knowledge and experience.

- There is stress and anxiety in the entire preparation for Class-X on the post of children and teachers. The schools are confined as coaching centres without much focus on developing analytical and logical thinking on the part of the children and develop knowledge and wisdom.

- By practising rote memory and mechanical methods, the examination system is not focussing on testing the children's logical, analytical and communication abilities. Though the children are getting good marks, it does not reveal their abilities and competencies. There is high expectation on the part of X-Class children in terms of marks which leads to pressure / stress on the children and they report to varies types of incidents. Therefore it is required to take up appropriate reforms in exams (at IX & X), which actually reveals the original potentialities and abilities of children. The entire process of education should aim at developing, thinking, analytical and communication skills, problem solving skills, reasoning skills etc among the children in democratic way.

- The most important person in school education is teacher. Development of the students depends on the activities and programmes conducted by the teacher. Unfortunately all these activities are kept a side and giving out most importance to only information oriented examination. As a result of these teachers are not being trusted. If teachers are trusted and given responsibilities, fixing the targets we can achieve better results than now. Hence the evaluation methods need to be reformed in this angle. Instead of allotting the complete weightage to public exams, we should consider that some weightage must be given to internal assessment or formative assessment at school level during the course.

In this present situation. Children are under stress as evaluating them is just limited to exams. Under formative assessment, the alternate tools for assessment are included to avoid stress among children. Project works, experiments, children note books and children's responses and their participation must be made use of while evaluating their performance.
EXAMINATIONS - REFORMS CLASS IX AND X

G.O. Ms. No. 17, Dated: 14-05-2014

(Note: See GO Ms No. 2 for amendments of GO Ms No. 17)

A. Why reforms in class IX and X - Background

- APCSF-2011 was framed in accordance with RTE-2009 and NCF-2005. The textbooks from classes I to X are revised (modernized) on the basis of APCSF-2011.

- The new textbooks aim at achieving the class wise, subject wise, targeted competencies and developing multifaceted personality and competencies such as thinking, self expression, analysis, logical representation etc.

- Developed Position Papers and approaches to teaching in all the subjects focusing on the changes that are to brought in the Department of Education in the State. Similarly a Position Paper has also been developed on the reforms in examination and make examinations away from rote memory.

- CCE for classes I to VIII is being implemented in the State since April, 2010 with a focus on projects, self expression, change in the nature of questions etc.
A shift in the nature of teaching learning processes and engagement of the children in learning process with activities, dialogue and discussions, projects, experiments etc. The very process of experiencing and knowledge construction have been changed.

In view of changes as above in the school curriculum, textbooks, teaching learning process, it is necessary to change the way we assess the children i.e. what to be assessed, how to be assessed and feedback procedures etc. it become necessary to bring reforms in class IX and X examination.

B. NEED

- The aspect that is to be worried about is mainly the role played by 'school'. The role of school is reduced to prepare the children mechanically for their exams limiting their knowledge to textbooks. Learning by rote memory and mechanical completion of syllabus do not prove to be beneficial for achieving the objectives of education. A school must enable the children to explore, search, discuss, read the reference books, discriminate and analyze. When these are kept in view, the present system of examination has to be changed.

- The class X is treated as an important class and more focus on examination outcomes. Therefore, the syllabus of class X is being completed much earlier than decided months. The teaching is mostly aimed at examinations and school encouraging memorizing the answers with the help of guides, study materials etc. Most of the time the children are confined to reading and re-reading the texts and memorizing the answers. There is no opportunity and space for children to think on their own and construct answers applying their knowledge and experience. There is stress and anxiety in the entire preparation for class X on the part of the children and teachers. The schools are confined as coaching centres without much focus on developing analytical and logical thinking on the part of the children and develop knowledge and wisdom.

- The examination pattern and system is not focusing on testing the children's logical, analytical and communication abilities. Though the children are getting good marks, it do not reveal their abilities and competencies. There is high expectation on the part of the children at class X in terms of marks which leads to pressure on the children and they resort to various types of incidences. Therefore, it is required to take up appropriate reforms at class IX and X, which actually reveals the original potentialities and abilities of children. The entire process of education should aim at developing, thinking, analytical and communication skills among the children in a democratic climate.
- School should function for the all-round development of children. For their all-round development, children should participate in various activities and programmes to develop physically, mentally, socially, emotionally and morally. Presently, teaching is limited to languages, Science, Mathematics, Social Studies. Only these are being evaluated. Teaching must take place considering Health & Physical Education, Arts & Cultural Education, Work & Computer Education and Value Education & Life Skills as curricular areas. They should not be treated as co-curricular activities. Even these areas also be evaluated periodically.

- The most important person in school education is teacher. Development of the students depends on the activities and programmes conducted by the teacher. Unfortunately all these activities are kept a side and giving utmost importance to only information oriented examinations. As a result of these teachers are not being trusted. If teachers are believed and given responsibilities fixing the targets we can achieve better results than now. Hence, the evaluation methods need to be reformed in this angle. Instead of allotting the complete weightage to the public exams, we should consider teacher at school level and some weightage must be given to internal assessment or Formative Assessment.

- In this present situation, children are under stress as evaluating them is just limited to exams. Alternate aspects must be included to avoid pressure among children. Project works, experiments, assignments, children's notebooks and children's participation must be made use of while evaluating their performance.

C. Series of actions contemplated by SCERT for developing proposals on SSC Examination reforms

- Conducted a meeting with textbook writers and experts on the proposed SSC examination reforms during September, 2013 and discussed the issue.

- Based on the above discussions and the existing CBSE pattern, draft proposals have been formulated.

- A meeting was conducted with subject specific teachers, headmasters, Mandal Education Officers, academic officers of AP residential institutions, representatives from private school managements during March, 2014 and discussed the draft proposals and formulated the second draft.
The draft proposals have been sent to all the RJD SEs and DEOs in the State and requested them to discuss on the draft proposals and submit a report with suggestions and proposed changes. Accordingly, the DEOs conducted meetings with teachers and submitted their opinions and suggestion to the Director, SCERT.

A request was made to all the teacher organizations in the State duly furnishing the draft proposals with a request to discuss the same and attend a meeting to submit their opinions and suggestions. A meeting was convened with teacher organizations on 26th April, 2014 at SCERT where in the teacher organizations presented their opinions and suggestions.

A meeting was conducted by the Principal Secretary, School Education (PE & SSA) with Director SCERT, Addl. Directors of School Education, selective DEOs, Principal and staff members of CBSE schools, Professors of SCERT on 3rd May, 2014 at Conference Hall, J-Block, Secretariat, Hyderabad and discussed on the proposed class IX and X examination reforms. The members interacted presented their opinions and suggestions.

Based on the above meeting and discussions a penultimate draft on SSC examination reforms have been developed as given here under.

**PROPOSALS**

A) **Quantitative aspects**

1) **Number of papers for each subject**

- Presently there are two papers in class X for all subjects except second language (Telugu/ Hindi) which are of 2 ½ hours duration.

- **Language subjects** - Now, it is proposed single paper for languages i.e. Telugu, English, Hindi, Urdu etc. with 100 marks each.

- **Non language subjects** - Two papers for each non language subject i.e. Science, Social Studies and Mathematics.

- **Science subjects** - Two separate papers i.e. one for Biological Science and the other for Physical Science.

- **Social Studies subject** - Two papers i.e. one for Geography and Economics and the other for Civics and History.
- **Mathematics subject** - two papers i.e. the first paper in the areas of numbers, sets, algebra, progressions, coordinate geometry and the other paper for the remaining chapters of geometry, trigonometry, mensuration, statistics, probability etc.

- Each paper in non language subjects will be for 50 marks.

**2) Exams - Marks**

<table>
<thead>
<tr>
<th>Subject</th>
<th>Total Marks</th>
<th>Internal assessment marks [FA]</th>
<th>Marks for final public exam</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Language (Telugu/Hindi/Urdu etc.)</td>
<td>100 marks</td>
<td>80</td>
<td>20</td>
</tr>
<tr>
<td>Second Language (Telugu/Hindi)</td>
<td>100 marks</td>
<td>80</td>
<td>20</td>
</tr>
<tr>
<td>Third Language (English)</td>
<td>100 marks</td>
<td>80</td>
<td>20</td>
</tr>
<tr>
<td>Mathematics – Paper 1</td>
<td>50 marks</td>
<td>40</td>
<td>10</td>
</tr>
<tr>
<td>Mathematics – Paper 2</td>
<td>50 marks</td>
<td>40</td>
<td>10</td>
</tr>
<tr>
<td>Physical Science</td>
<td>50 marks</td>
<td>40</td>
<td>10</td>
</tr>
<tr>
<td>Biological Science</td>
<td>50 marks</td>
<td>40</td>
<td>10</td>
</tr>
<tr>
<td>Social Studies – Paper 1 (Geography &amp; Economics)</td>
<td>50 marks</td>
<td>40</td>
<td>10</td>
</tr>
<tr>
<td>Social Studies – Paper 1 (History &amp; Civics)</td>
<td>50 marks</td>
<td>40</td>
<td>10</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>600 marks</strong></td>
<td><strong>480</strong></td>
<td><strong>120</strong></td>
</tr>
</tbody>
</table>

3) **Marks - weightage and duration of examination**

- **Marks and duration of examination** - 100 marks per paper for each language paper and also 100 marks for non language subjects. However, in view of two papers in non language subjects each paper carries 50 marks.

- The duration of summative examination will be 3.00 hours for languages in addition to 15 minutes for reading the question paper. In case of non language subjects i.e. Maths, Science and Social Studies the examination duration will be 2½ hours in addition to 15 minutes for reading the question paper.

- The summative examinations which school based and also public exams at class X. Each subject will be conducted for 80% of marks. The remaining 20% of marks are through internal assessment i.e. Formative Assessment [FA].
- The average of four formative assessments conducted in an academic year will be accounted for 20% of marks i.e. the average of four formative assessments will be taken and accounted for 20% of marks in class X public examinations.

- Conduct one paper on each day except on general holidays.

**Summative Assessment:**

- Three summative tests must be conducted in each academic year for classes IX and X. In case of class X, public examination will be in place of third summative test to be conducted by the Board of Secondary Education.

- First and second Summative Assessments shall be conducted by schools itself through preparing question papers for 80% of marks. This ensures that the children are trained to write public exams. The remaining 20% of marks shall be awarded on the basis of the Formative Assessment.
  
  - First Summative Assessment – 80% marks.
  - Second Summative Assessment – 80% marks.

The questions must be developed based on the blueprint reflecting the academic standards.

**Formative Assessment:**

- There will be four formative tests in each academic year for classes IX and X. The items for formative assessment and marks are as given here under.

<table>
<thead>
<tr>
<th>S No.</th>
<th>Item for Formative Assessment</th>
<th>Marks</th>
<th>Operational strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><strong>Language subjects</strong> – Reading storybooks, children literature, newspapers etc.</td>
<td>5</td>
<td>Reading the books, newspapers, magazines by each individual student, comprehend and reflect in terms of writing in and presentation in classroom.</td>
</tr>
<tr>
<td></td>
<td><strong>Science</strong> – doing the experiments.</td>
<td>5</td>
<td>Conducting textbook experiments and writing in the records.</td>
</tr>
<tr>
<td></td>
<td><strong>Mathematics</strong> – Generating Mathematical problems under various concepts.</td>
<td>5</td>
<td>Writing the problems in the notebook for the given unit under various concepts and presentation/ sharing.</td>
</tr>
<tr>
<td></td>
<td><strong>Social Studies</strong> – Reading the text and interpretation and reflections on contemporary social issues.</td>
<td>5</td>
<td>Reading the social issues in the newspapers and in other books, observing the social issues in the community followed by oral and written and presentations.</td>
</tr>
<tr>
<td>S. No.</td>
<td>Item for Formative Assessment</td>
<td>Marks</td>
<td>Operational strategy</td>
</tr>
<tr>
<td>-------</td>
<td>-----------------------------------------------------------------------------------------------</td>
<td>-------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>2</td>
<td>Children's written work in their notebooks (self-expression to the questions/tasks given</td>
<td>5</td>
<td>After completion of every lesson/unit the children write answers to the questions given in the exercise part under each unit/lesson on their own in notebooks. The children shall not copy the answers from guides/study materials etc. They should think and write on their own.</td>
</tr>
<tr>
<td></td>
<td>(self-expression to the questions/tasks given in the exercise part under each unit).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Project works</td>
<td>5</td>
<td>Children write the project report in the notebooks and present/share in the classrooms.</td>
</tr>
<tr>
<td>4</td>
<td>Slip test</td>
<td>5</td>
<td>This is an informal test without any prior notice to the children. The teacher conducts the exam in the given period of 45 minutes in one or two completed units/lessons.</td>
</tr>
</tbody>
</table>

|       | **Total**                                                                                     | **20** |                                                                                                                                                       |

- A separate notebook for each subject for the formative assessment pertaining to three items of serial numbers 1, 3, 4 of the above table shall be maintained by each student. However, in case of serial number 2 i.e. a separate notebook may be maintained by each child. These notebooks reflecting children works must be preserved which will be the basis for awarding marks by the teacher and for the verification of officials whenever required.

- The same procedures of examination reforms now proposed for class X shall also applicable for class IX.

- Children must attend all the four formative assessments. In case any child is absent for any formative assessment, teachers should conduct the test whenever the child return to the school and accordingly award the marks.

**Verification of internal marks and submitting to O/o Director, Govt. Exams:**

- After completion of the 4th Formative Assessment in February, the headmaster should verify all the records for the above internal tests and keep ready for external moderation committee and submit the details of the marks to the SSC board in a fixed format through on-line. The programming part of this for submission of internal marks from schools will be done by Commissioner, Govt. Exams (CGE).
HM is responsible for proper conducting of internals through Formative Assessment. The District Educational Officer shall constitute the moderation committees @ 1 per 10 to 15 schools which will be generally for two or three Mandals. The moderation committee members monitor and verify the evidences in terms of records, children work etc. Experienced HMs of aided/ recognized schools can also be included in this committee along with HMs working under government management. The Dy.EO and staff members of teacher education institutions will take up a sample check of work of moderation committee and submit reports to CGE and a copy to DEO. The SCERT also undertakes sample check of work of moderation committees in the districts and submit report to CGE and a copy to the DEO and RJD SE.

Two or three Mandals shall be considered as a unit for monitoring and moderating. The moderation committee shall observe all the schools in the given Mandals both government and private.

4) Number of papers for each subject

- Even though 20% of marks are allotted to formative assessment, children must attend the public exam conducted for 80 marks and secure at least 28 marks in each subject i.e. 28 in single paper of language subjects and in case of non-languages where the paper is for public examination is for 40 marks each and one should secure 14 marks to pass in each of the two papers of non-language subjects and pass marks under internals are 3.5.

- In non-language subjects, the students must pass in each of the two papers separately.

- Children must score a minimum of 35% of marks in each subject which includes both internals and externals. Students must secure 28 marks in external public exam and 7 marks in internals. Students will be considered as failed if they score full marks in formative assessment and score below 28 in public exams. Therefore, students must quality in both internals and externals. In case of Science in view of separate books for Biological Science and Physical Sciences, the formative assessment is for 10 marks each for Biological and Physical Sciences.

Pass marks in Second Languages:

- The pass marks for second languages i.e. Hindi and Telugu will be 35% on par with other language subjects.
5) Grading

- The marks based grading for classes IX and X with following range is given here under.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Marks in Languages (100 M)</th>
<th>Marks in Non Languages (50 M)</th>
<th>Grade points</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>91 to 100 marks</td>
<td>46 to 50 marks</td>
<td>10</td>
</tr>
<tr>
<td>A2</td>
<td>81 to 90 marks</td>
<td>41 to 45 marks</td>
<td>9</td>
</tr>
<tr>
<td>B1</td>
<td>71 to 80 marks</td>
<td>36 to 40 marks</td>
<td>8</td>
</tr>
<tr>
<td>B2</td>
<td>61 to 70 marks</td>
<td>31 to 35 marks</td>
<td>7</td>
</tr>
<tr>
<td>C1</td>
<td>51 to 60 marks</td>
<td>26 to 30 marks</td>
<td>6</td>
</tr>
<tr>
<td>C2</td>
<td>41 to 50 marks</td>
<td>21 to 25 marks</td>
<td>5</td>
</tr>
<tr>
<td>D1</td>
<td>35 to 40 marks</td>
<td>18 to 20 marks</td>
<td>4</td>
</tr>
<tr>
<td>D2</td>
<td>0 to 34 marks</td>
<td>0 to 17 marks</td>
<td>3</td>
</tr>
</tbody>
</table>

Cumulative Grade Point Average (CGPA) will be calculated by taking the arithmetic average of grade points.

6) Other curricular subjects (Co-curricular areas) - Evaluation

- Co-curricular areas viz, Physical & Health Education, Arts & Cultural Education, Work & Computer Education, Value Education & Life Skills are the part of school curriculum. Periods have been allocated in the school timetable. These are the creative areas and develop skills, attitudes and improve the affective domain and character formation and help in the over-all development of children personality. Holistic development of students will be through inclusion of co-curricular areas as above in the areas of study.

Following are the actions to implement the co-curricular activities:

- Evaluation of co-curricular activities i.e. Physical & Health Education, Arts & Cultural Education, Work & Computer Education, Value Education & Life Skills are introduced in classes IX and X. Each area has 50 marks.

- Grade details of these subjects are to be recorded in the memorandum of marks of class IX and X.
• No public exam shall be conducted in these subjects. However, these areas will be evaluated for three times in an academic year i.e. quarterly, half yearly and annually. Teachers shall observe and award marks. The average will be taken into account and the details of grade must be submitted on-line by HM to CGE.

• HM should allot the responsibility of conducting these co-curricular activities followed by assessment to the teachers. Initially, choice may be given to the teachers to select the areas based on their interest. If it is not possible, the HM should allot co-curricular activities to the working teachers as suggested here under.

Ex:
- Value Education & Life Skills to language teachers/ Social Studies teachers.
- Art & Cultural Education to Social Studies teacher/ language teacher
- Work & Computer Education to Physical Science/ Biological Science teacher.
- Physical & Health Education will be conducted by Physical Director/ Physical Education Teacher. In case PD/ PET is not available other teachers like Bio sciences etc. may be considered.

However, the co-curricular areas shall be shown separately and will not be counted for grading the students in curricular areas.

B) Qualitative Aspects

1) Nature of the question papers

• The nature of questions must be open ending, descriptive, analytic which tests children abilities of thinking, critical analysis, judgments and leads to self expression and away from rote memory. Children must be trained to think critically and construct the answers on their own. No weightage will be given for the representation of text from the textbooks/ guides as such.

• The questions should make the children think and write. The questions should be analytical, application oriented and open ended.

• The questions once appeared in public exams should not be repeated.

• The questions given in the exercises of the textbook under each unit and lesson must not be given as such. They should prepare questions reflecting the academic standards.
2) Academic standards/competencies to be achieved

- The questions in the public exam should be in relevance to the laid down academic standards/competencies to be achieved in the subjects concerned.
- Weigh age for the competencies of the subjects shall be developed and blue print/weightage table prepared and accordingly questions shall be developed (by SCERT).

3) Types of test items

- Following are the nature of test items proposed as given here under.

   A) Non language subjects (Science, Mathematics and Social Studies)
   - Essay type questions.
   - Short answer questions.
   - Very short questions
   - Objective type questions - Multiple choice questions.

   B) Languages subjects - Telugu and other Indian languages
   - Reading comprehension
   - Writing
   - Creative expression
   - Vocabulary
   - Grammar

   C) Language - English
   - Reading comprehension
   - Vocabulary
   - Creative writing
   - Grammar

- Essay type questions: Answers to these must be written in 3 to 4 paragraphs or 12 to 15 sentences.
- Short answer questions: Answers to these must be written in 2 or 3 paragraph or 6 to 10 sentences.
- Very short answer questions: Answers to these must be written in two or three sentences.
- Objective type questions which are multiple choice in nature.

4) Questions - Choice

- Each question paper may contain internal choice for essay types of questions only.
5) Questions - Weightage

- Blue print will be developed reflecting weightage to the nature of questions and academic standards. No weightage to the lessons/units and questions may be given from any lesson/any part of the textbook.

- The weightage tables must be kept in view while preparing question papers. Type of questions (essay, short answer, very short answer and objective questions) and academic standard wise questions (how many marks and questions to each academic standard).

6) Single answer booklet and no additional papers

- It is proposed to give one answer booklet to the students to write the answers since suggestion given for the extent of answer in the form of paras/sentences/words. No additional answer papers will be entertained.

7) Correcting the answer scripts

- A teacher must correct 20 papers in the morning and 20 papers in the afternoon i.e. only 40 papers must be corrected per day.

- As the questions are thought provoking and open ended, correction must be done carefully. Appropriate guidelines will be given from SCERT to the teachers along with key for undertaking proper correction of answer scripts.

- Transparency in paper correction must be made by way of facilitating for re-counting of the answer scripts if students represent.

- Guidelines for correcting the papers will be framed from SCERT. Model answers to the questions will be framed to evaluate the answers to different questions i.e. essay, short answer, very short answer etc. The children self expression, power of analysis, self writing, application and explanation, argument and representation of their perspective etc. will form the basis for the correction instead of subject matter alone.

8) SSC Memorandum of Marks

- Following are the items represented in the class X public examination memorandum of marks.

  Part I:- General information about the student.

  Part II:- Grades for the curricular areas i.e. languages and non languages - both internals andexternals and over-all grade.

  Part III:- Grades for co-curricular activities with qualitative description.

  Information on the grades and grade point average may also be given on the other side of the memorandum of marks.
9) **Training Programme**

- The SCERT shall design the training programme for the teachers teaching classes IX and X along with supervisory staff. SCERT develop teacher handbooks on entire process of examination reforms and new textbooks and train the District Level Resource Persons in every subject area for the teachers teaching classes IX and X including supervisory staff in collaboration with RMSA. The RMSA shall meet the expenditure towards developing teacher handbook, conducting training to District Resource Persons and actual conduct of training to the teachers in the field.

- Training to the teachers and supervisory staff on the nature of questions and the process and criteria for assessment.

- The summative assessment for class IX and 1st and 2nd Summative Assessment in class X must be on the lines of public exams.

- Teachers and officials must be trained on nature of summative question papers for classes IX and X and the methods of evaluating those papers.

- Training must be given on conducting formative assessment, extracurricular activities and their evaluation, methods of submitting these details through online. All the officials and teachers must be given training in this regard.

- Teachers must be given training on 10th class textbooks, conducting exams, methods of evaluation, learning problems of children etc. through teleconference once a month. Their doubts in this regard must also be clarified and sharing of good questions.

10) **Responsibilities of D.C.E.B**

- D.C.E.B. shall take up the responsibility of preparing question papers for classes IX and X (except public exam paper) and also sending them to schools.

- One Headmaster with sound academic background and commitment must be made as in-charge of D.C.E.B. Subject wise district teams must be formed with expert teachers to prepare the question papers under D.C.E.B. The team members should include the textbooks writers from the district, SRG members, subject experts, teacher educators, experienced teachers.

- The subject groups of DCEB shall develop question papers and also examine the good questions furnished from schools and teachers. These teams must conduct subject wise trainings in the district and also monitor the practice of assessment in the schools. They may be considered as members in the moderation committee.
- SCERT should conduct orientations and trainings to the DCEB Secretaries and subject groups at regular intervals and build their capacity and also monitor the functional aspects of DCEBs.
- Action must be taken in the direction of interested teachers preparing summative question papers and submitting them to DCEB. Such question papers must be observed by the subject-wise teams, question papers must be prepared choosing.
- D.C.E.B. should conduct seminars and training programmes on awareness of correcting the answer scripts.

11) Others
- District Educational Officers, Regional Joint Directors must conduct education seminars and workshops to create awareness among teachers and parents about the reforms of class X exams to be conducted in March, 2015.
- Publicity must be given through media to make everyone aware of the reforms.
- The teacher education institutions like DIETs, CTEs and IASEs shall coordinate with DCEBs and provide necessary support with frequent field observations and studies.
- The SCERT shall develop a handbook on the processes and guidelines on the proposed examination reforms for class IX and X along with a booklet on the model papers and criteria for the corrections and feedback (key).
- The DRGs must be from the districts must be oriented at State and District Level. The DRGs are the subject-wise groups formulated for DCEB. The DRGs may be selected by the DIET/CTE/IASE in collaboration with DEO, DCEB Secretaries and Dy.EOs.

**ROLES AND RESPONSIBILITIES**

**SCERT:**
- The Director, SCERT develops and submit the proposals to government in consultation with Director, Government Exams.
- Develops guidelines on all aspects of examination reforms in the form of handbooks to the teachers and supervisory staff along with additional booklet on subject-wise model papers.
- Develops guidelines for the valuation of answer scripts as a part of teacher handbooks.
- Proposals to the government on the required facilities to the schools to implement the curriculum so as to meet the examination standards.
- Guidelines on the moderation for internals.
- Monitoring and studies on the implementation of SSC examination reforms at various levels and take up follow up action.

**Director, Government Exams:**

- Collaboration with SCERT in finalizing the proposals based on the feasibility and for submission to government for orders.
- Development of programme for the on-line submission of internals to the CGE and designing the memorandum of marks/certification.
- Monitoring the submission of internal marks and other nominal roles.
- Correction of answer scripts and declaring the results.
- Post examination work, revaluation etc.

**RMSA:**

- The RMSA shall support SCERT in developing teacher handbooks, material and conduct orientations to the teachers and supervisory staff.
- The RMSA shall support high schools with the required teaching learning material, resources to teach new textbooks, library and reference books based on the suggestive lists of resources, TLM and library books both for teachers and children.
- The RMSA shall take up printing of teacher handbooks on new textbooks, examination reforms, model papers, syllabus copies and material on co-curricular activities and provide to the schools.

**RJD SEs and District Educational Officer:**

- Conducting orientation to the teachers and supervisory staff on the new evaluation procedures. This also includes training to teachers and headmaster of private schools.

Restructuring and strengthening the DCEB with one in-charge i.e. Secretary and constitution of subject specific groups with expert teachers @10 to 15 teachers per subject.
Constitution of two member moderation committee for two or three Mandalas. Steps for the capacity building of these moderation committee members with the help of SCERT and DIETs/ CTEs/ IASEs.

Developing question papers printing and monitoring for the implementation for class IX and X except class X public examination.

Focus on thinking and self expression of answers from the children and do away the practice of memorizing answers from the guides and textbooks.

Gradual nurturing of self expression from class I onwards and focus on quality curriculum transaction and children learning outcomes rather than focus on class X alone.

Dy. Educational Officers:

- The Dy.EOs are responsible for 100% implementation of examination reforms of in their division and monitoring the internals. This is for both government and private schools.
- Identification of expert teachers in all the subjects and communicating list of such teachers to the DEO to consider for DCEB.
- Monitor the work of headmasters in monitoring the correct work of internals and implementation of curriculum and co-curricular activities.
- Record the nature of curriculum implementation and examination practices in the inspection book of every government and private school.
- The Dy.EO shall supervise the implementation of new textbooks, teaching learning process and implementation of formative and summative assessment procedures before moderation committee visits the schools.
- The Dy.EO is responsible for arranging training programmes and create awareness on curriculum transaction and examination reforms.
- Develop the knowledge on the basic aspects of curriculum, pedagogy, assessment duly reading and referring teacher handbooks, source books from SCERT and from other sources/ internet.

Headmaster:

- Headmaster is the first level supervisory officer to ensure proper implementation of curricular and co-curricular activities, teacher preparation, lesson plans, teaching learning process and conduct of exams properly by all the teachers.
• Identify and encourage teachers and children for their best efforts and talent and take it to the notice of higher officials and SCERT.

• Using of guides and study material by the children and memorizing the finished answers will damage the children's thinking capacities and self-expression. Therefore, guides and study material shall not be used. HM should ensure this.

• Allotment curricular and co-curricular subjects to the teachers available and see that all these areas must be transacted.

• Headmaster must check the evidences for internal exams i.e. proper conduct of formative and summative assessments at school level and offer suggestions on the records and registers prepared by teachers and children. He should verify all the children and teacher records on FA and SA and satisfy himself before placing it to the moderation committee.

• HM to furnish internal (FA) marks and grades on co-curricular activities to the Director, Govt. Exams through on-line as per the schedule from Director, Govt. Exams.

• The HM should follow the schedule for the conduct of internals and other exams and maintenance children cumulative records and communicating the progress to the parents at regular intervals.

• The HM must ensure for quality classroom transaction by utilizing available TLM, equipment and library books in the schools.

• The HM should conduct monthly review on the performance of the teachers and children and record in the minutes book along with suggestions for each teacher and review follow up action on the minutes of the earlier meeting.

• Arrangements for proper feedback to the children and their parents on children performance and school activities.

• The HM is the first teacher and must be sound in academic knowledge by way of reading teacher handbooks, new textbooks and other source books and conduct frequent sharing workshops within the school on teacher readings and other academic issues and concepts.

• The HM should observe the classroom transactions of each teacher and offer further suggestions and guidance for improvement.
Teachers:

- The teachers are responsible for the proper implementation of new textbooks i.e. activities, projects, experiments, field investigations, information tasks etc.

- The exercises given under each unit/lesson are analytical and thought provoking in nature and children should think and write on their own. There shall not copying of answers from the guides, study materials, copying from other children notebooks etc. This is one of the items under formative assessment with appropriate interest and care. Teachers should not encourage purchasing and using of guides, study materials etc.

- The questions in the box items are meant for discussions in the classrooms where children express and share their thinking and ideas. The box items are on the contemporary issues and situations where children are expected to reflect their experiences and prior ideas. This is helpful for application of textbook knowledge in their daily life situations.

- Prepare and implement curricular and co-curricular subjects assigned to them and transact in a qualitative way with a focus on interactive teaching, discussions with active participation of children. Read resource books and additional reference material to get more clarity on concepts and develop teaching notes on each lesson. Thus, add value to the textbooks. Teachers

- Conduct formative assessments (internals) and summative assessments and value the children notebooks and other records on regular basis. Give marks and grades based on children performance and maintain evidences of children performances in the form of children notebooks, records and keep ready for the observations of headmaster and moderation committee. The teachers shall take up remedial teaching and support children based on the gaps identified through formative and summative assessments.

- Keep and read the teacher handbook, modules provided during training programmes and take up follow up action. Teaching is a profession and teacher is a professional and constant updation of knowledge and skills is a must for any profession. Therefore, the teachers efforts for self development through reading resource books, magazines, journals, attending seminars/trainings, visiting subject specific websites, sharing in teacher meetings etc.

- Develop and use annual and lesson/unit plans and improve over time.

- Furnish children and teacher records pertaining to FA and SA to HM for his verification and for further guidance and suggestions.

- Encourage children for their initiatives and attempts to improve and support them.
FORMATIVE ASSESSMENT

We have to assess and note down the remarks observation in the process of learning by the students during teaching learning. Such activity to enhance the students learning is called formative assessment. This assessment is conducted in the fearless atmosphere in the classroom. It also helps the children to accelerate their learning. In this formative assessment the teacher observes and record the process of students learning regularly in various situations and he acts as facilitator by correcting the mistakes of the students. Hence, it is diagnostic and remedial tool in teaching learning process to encourage better performance of the child not merely depending up on the declaration of marks and grades.

Formative assessment is carried out the teaching learning process. Which means discussing the concepts, problems and exercises. This can be performed either in written form or oral which child’s reflections in understanding a concept, problem solving, proofs is assessed in the form of projects, slip tests, projects etc. The students are assessed not only in classroom but also outside the classroom or in leisure times. The process of learning, conceptual understanding and the extent of learning is assessed in formative assessment. In this assessment, there is no place for copying from guides or blackboard on fellow student's notebook. The student is given regular feedback by the teacher and given chance for self-learning while learning in the classroom misoptions are corrected during this assessment. The properties of formative assessment which is useful for self-learning are in the following way.

Salient features of Formative Assessment:

- It is a process of Observation how the child is learning and how child's progress is while teaching learning process going on.
- It is intended to diagnose the problems of a child while learning and to give remedial support.
- It provides absolute feedback of teaching-learning process at a particular stage.
- It gives reasons for why children are backward in learning a concept or unit. As per those reasons, we can change or choose alternative teaching learning strategies.
- It helps the children learn themselves and make them involve in the learning process.
- It is useful in children’s self evaluation, which helps the children to improve their learning capacity.
- It provides many opportunities for the child to adopt different learning styles / methods.
- It provides different assessment tools, not only paper pencil test, but also provides different tools like interactions, discussions sharing experiences.
- Children donot feel stress because it is conducted in natural learning environment.
- Teacher observes the progress of children while teaching learning process is going on and based on his observations, teacher may come to a conclusion regarding the learning of the child in formative assessment.

FORMATIVE ASSESSMENT - TOOLS:

As a part of teaching learning process, we provide different activities to the children for conceptual understanding. In mathematics children can generatize or draw some principles by solving example problem for proving theorem or statement. We provide different activities to children and we make the children to participate in these activities. We can estimate the progress of the children in this process. Without involvement or collaboration of children, there is no scope for comprehensive learning. Hence, teacher has to make the children to involve in the learning process continuously and estimate their progress.

Textbook is helping tool in this process. For conceptual understanding, teacher organizes som activities in the classroom. Before conducting an activity (which is in the text book) teacher asks the students to read the text related to the concept or activity and asks them to identify the new concepts, mathematical words or symbols. Then teacher discusses them in whole class and make students understand that new concepts etc.

Then the children has to participate in the particular activity. For observing the comprehension of the children, teacher provides more activities, like model problem solving. Which is useful for developing problem solving skills. While solving model problem teacher poses oral questions to the children and children gives answers. Some times children may asks questions for more comprehension. Then if we ask the children to solve the problems on black board, they come forward and solve the problem.

After understanding a particular concept by solving example problems, children can do problems in "do this" title. By discussing in groups and sharing their ideas, children can solve the problems of "Try this" and "Think and discuss": In these contexts children can solve similar problems given by the teacher from outside the textbook with the help of peer group.
Teacher has to discuss in the classroom with those children regarding how to solve the exercise problems. At this stage children has clear understanding on the concepts which are involved in the exercise. After the discussion children have to solve the exercise problem on their own. Moreover, students participation project works in groups and present reports. Thus teacher has to observe that how the children are comprehending the concept, how they are achieving such academic standards, how they are learning, how they are involving in the activity.

For this, teacher has to use some prescribed tools to assess the progress of the children, while teaching learning process is going on. Now, we observe the tools and allocation marks for each tool in Formative Assessment.

1. Creating or making new problems - 5 marks.
2. Children's written work - 5 marks.
3. Project work - 5 marks.

Thus, 20 marks are allotted for Formative Assessment in 10th class public examinations. This should be process implemented for Class 9 and 10 formative assessment.

Above tools are to be conducted as a part of teaching learning process. But they should not be conducted as unit test in a scheduled time or date. That means these must be conducted while teaching learning process is going on:

- Discussing with children.
- Conducting activities.
- Asking questions.
- Ask the children to solve the problems on black board.
- Giving home work on solving problems.
- Asking the children to create or generate new problems by innovations, discoveries, inventing new concepts.
- Ask the children to solve 2 or 3 problems instantaneously. Conducting small slip tests.
- Ask the children to write their opinions on a particular issue / concept.
- Data collection - analysis - writing reports.
- Conducting projects - writing reports etc.

Considering all the above activities, we have to assess the progress of the children.
Formative Assessment - Implementation:

Formative Assessment has been included in 10th Class public examinations. For Formative Assessment 20 marks are allocated. In these 20 marks, 5 marks for 'Creating new problems by children', 5 marks for 'Children's written work', 5 marks for 'slip tests' and 5 marks for 'Project work'. This method is going to be implemented for 9th & 10th Class from academic year (2014-15) onwards. Hence now we will know about the implementation and how to carry out each tool.

1) Creating or making new problems by Children:

Teacher has to make the children create new problems on a given concept on their own. In this context teacher has to assess in the created problem what the concepts are, what the logic is in that problem, what the complexity is, in how many steps that problems is solved, how many procedures are involves, whether they are related to daily life situations or not? and observe their progress. But merely changing names, numbers and signs in the textual problems should not be regarded as creating new problems. Keeping in view of all the above issues, the teacher ought to support the children in creating / making new problems on a given concept. The problems which are being created by children must be included challenge in the problem solving and should lead to creative thinking. After creating new problem, teacher ought to make the children to solve those problems on their own.

Implementation:

As a part of formative assessment, 5 marks are allotted to "Creating new problems". To implement this tool, teachers have to follow the following indicators:

- In a academic year, as a part of formative assessment, conduct it and record the marks 4 times (formative assessment wise).

- In every formative assessment, marks should be awarded for 10 marks and Note down for 5 marks in records. At year ending, we should count the total marks in 4-formative assessment, for 20 marks, then reduce the achieved marks for 5 marks.

Ex: A student got 16 marks out of 20 marks in four formative assessments, then reducing the achieved marks for 5 marks, that means the student got 4 marks out of 5 marks. (i.e. $\frac{16}{20} \times 5$)

- However for 9th & 10th classes, we have to record the marks & grades for reducing 5 marks only, inspite of calculation for 10 marks. This may be continued in four formative assessments.

- Make the children to create new problems on given concepts, for this one note is maintained by the children. Teacher has to award the marks for this as per the indicators.
In a period of formative assessment while awarding marks for this tool, consider completed lessons in a particular formative assessment period. Based on that chapters or concepts only, children have to prepare or create new problems.

That means, if a single chapter is completed, in a formative assessment period, then the children have to create at least 5 new problems based on the concepts in the chapter. If two chapters are completed, then children have to prepare total 10 problems at the rate of 5 problems for each chapter's concepts.

If children are not able to create new problems on given concepts, then teachers have to take initiation and discuss the daily life situations which may occur the concept. By whole class discussion, teachers have to make the children to create new problems.

According to the above indicators only marks should be awarded and recorded in a proper way.

In monitoring or inspections the school authority must show the records and notebooks.

2) **Children's written work:**

5 marks have been allotted in 10th class public examination for this tool. There marks also should be considered as children's progress. We have to observe that whether the children are writing the notes on their own or not. They should solve the problems on their own in the classroom activity or home work. That means, we have to make sure that they are solving the problems on their own under "do this", "try this" and "think and discuss". Students have to solve the exercise problems on their own which are discussed. But not copying form other sources. Some logical questions are asked here and there in the chapter the reflection of children on different on these questions in text book and beyond text book. The classwork or home work must be maintained in a note book. Thus note books, home work notes, filling some table in the textbook, assignments, portfolios etc are considered as written work of a child. Based on the child's written work, his/her progress should be assessed. We should follow the following indicators.

**Implementation:**

- Though 5 marks are allotted to this tool, we have to conduct this for 10 marks in each formative assessment.

- In four formative assessments the achieved marks out of 40 marks are to be reduced to 5 marks for recording.

- By implementing this method in 9th & 10th Classes, we can assess the progress of the children up to public examination. But, children's progress must be recorded formative assessment wise, out of 5 marks only.
• We have to observe that, whether the children are able to solve problems under "do this" activity - individually on their own.

• Similarly, we have to observe that how the children are solving the problems under 'try this', 'think and discuss and write'. And we have to observe whether they are doing homework on their own or not? How they writing in the note book?

• And we have to observe that, whether they are copying the procedures / solutions from others or guides etc. consider the problems which are solved by themselves only for assessment and treate them at correct.

• After confirming the children solved the problems on their own, we should award the marks / grades. Make sure that students are not copying down from other sources like guides, others note. If they copy from other sources, then award zero marks for that.

• Therefore, make the children to solve the problems on their own only, and by this way we have to assess their progress.

3) **Slip Test**:

Slip test may be conducted right then and there when the teacher wants there is no need of prior plan and prior information to be given to children. For conducting their slip test, This must be conducted in the instructional period only. Slip test may conducted to assess the children understanding of the what they have understood the one or two chapter, which are completed in a formative assessment period. And it may be conducted to test one or two / more concepts but with entirely new problems. This is meant for evaluating one or two competencies i.e. problem solving, Reasoning proof, etc.

5 marks are allotted to slip tests in 10th class public examinations. So, slip test must be conducted in each formative assessment period. It should be conducted in the class room within 45 min. only for this. Teacher has to write the questions / problems on the black board and instruct the children to write the answers. Thus teacher has to correct their answer scripts and assess their progress. Regarding slip test, we have to follow these indicators / suggestions.

**Implementation**:

• It is not a unit test as we conducted previously. Without giving prior notice, slip test should be conducted in a transactional period in a context of teaching learning process.

• Though 5 marks are allotted to slip test, in our regular class room, we have to conduct slip test for 20 marks in each formative assessment. The achieved marks are reduced for 5 marks for the record.

• After 4 formative assessments, average of 4 slip tests should be sent to public examinations board.

• This method must be implemented in 9th, 10th classes as a part of formative assessment. And in this way we assess their progress and record it. But we should dislapaly slip tests marks for 5 marks everytime in record.
4) Projects:

The cardinal principles of project work/method are: (i) learning by doing and (ii) learning by living, definition of the word project: The term project has been defined by a number of people. According to Parker - 'A project work is a unit of activity in which pupils are made responsible for planning and purposing'.

According to J.A. Stevenson, 'A project is a problematic act carried out for completion in its natural setting'.

According to W.H. Kilpatrick, 'A project is a whole-hearted purposeful activity proceeding in social environment'.

According to Ballard, - 'A project is a bit of real life that has imparted into school'.

Principles underlying the project method are:

(i) Principle of freedom 
(ii) Principle of reality

(iii) Principle of purpose 
(iv) Principle of experience

(v) Principle of sociability 
(vi) Principle of utility

(vii) Principle of co-ordination 
(viii) Principle of interest.

The main purpose of the project work is to incorporate or enhance the collaborative learning skills, leadership qualities, life skills. And make the learning joyful, by this evaluation of learning will be come as joyful activity.

By this project method, some process skills like, observation, hypothesizing, invention, discovery, experimentation etc. will be developed. Children may participate in teaching learning activity enthusiastic. In languages and non-languages children can construct knowledge or their own by this project method. On a given topic, student/students can discuss thoroughly, and analyze the problem in multiple angels, observe and supporting is main objective of this work. By this method, a self learning, drawing generalization from their experiences or what they learnt, collection of data regarding new topic preparing models, analysing the problems or data, sharing experiences with others, representation of graphs regarding data, etc., will be developed among the students.

As a part of formative assessment 5 marks are allotted for project work in SSC - Public examination. Therefore project work is considered as a part of teaching learning process and it should be conducted in every formative assessment period and the progress of the student must be assessed.
Steps in project work:

1) Providing a situation
2) Choosing and purposing
3) Executing
4) Evaluating
5) Recording.

Criteria for a good project:

1) It should be purposeful
2) It should impart gainful learning experiences
3) It should cater for the activities of pupils.
4) Project must be selected by the active participation of both pupils and the teacher
5) Students should get full freedom to work according to their own interests and abilities.
6) It must be economical in terms of time and money.
7) It should be challenging
8) It should be feasible
9) It should be time constraints controlled.

As we know project work is group of different tasks. Project work must be assigned as home work. Before assigning the project work as home work, teacher has to give proper instructions and suggestions regarding the project work, i.e. what is role of children, what they have to do? How to do?.

Project work may be given as group work or individual work, based on its nature. If it is a group task, then teacher has to allot the roles and responsibilities of group members. After completion of project work, students have to record it and present it among the classmates. If children face any problem during the project work or in separate writing or in presentation, then teacher has to give proper guidance and support to them. Teacher has to give proper guidance regarding steps in report writing.

For example:

Let us observe project work, in statistics chapter in 10th class mathematics text book. In this chapter the students who are able to find the Arithmetic Mean, they can solve the problem related to their daily life.

Hence we can assign a project to the students, how they are using this concept in this daily life situation.

Organization / Conducting - Project Work:

The following are suggestions for indications for organizing the project work:

- Consider that projects are for achieving specified objectives.
• Projects are assigned to students to complete them within a stipulated time period. So that project assessment skills are also very important.
• Consider that projects are not meant for enhancement of marks.
• Here, completion of project in any way is not important, but the process/method chosen by the student is very important.
• Project report - submission date must be informed prior.
• If the child doesn't complete the projects within the stipulated time, then teacher has to give suggestions/support or alternatives and make the child to complete the assigned project.
• Every child has to complete/do the assigned project work and submit the project report with his/her own handwriting in a given format.
• One project may be assigned to two or three groups.
• Though 5 marks allotted to project work in 10th class public examinations, as part of formative assessment we have to allot 10 marks for every project work.
• This method must be implemented for 9th & 10th classes. But while recording in register achieved marks/must be recorded for 5 marks only.

**Suggested Model of Project Report:**

1) Name of the Student:
2) Class: Medium:
3) Roll No:
4) Title of the Project
5) Introduction:
6) Objectives:
7) Hypothesis:
8) Method:
9) Data analysis - tables:
10) Interpretation/Problem solving:
11) Result:
12) Conclusions:
13) References:
Weightage of Marks:

While assessing the student’s project work, follow the weightage of marks allocation as shown in the below:

i) Preparation of objectives / procedures / recognizing the sources for data collection / data collection / data analysis / tabulation / Interpretation / recording results – 5 marks.

ii) Presentation of project report / Oral explanation / submission – 5 marks

Note: If a project work assigned to a group of students, then every student in the group has to write the project report (in his/ her own hand writing) and explain it individually. According to the explanation of the student marks must be allotted maximum 5 marks. But, if you want to assess the project for 5 marks (totally), then allot 2½ for each above step.

Note to Teacher:

- Teacher has to preserve the project reports submitted by the students as a record of evidence. Keep this project reports available for visiting or inspecting teams at their visits. Based on this records only the visiting teams cross check their marks / grades.
- Teacher ought to help the students in preparation of questionnaire regarding data collection.
- Teacher has to assign the projects, which are having the scope for data collection / experimentation / discovery mode.
- Teacher ought to explain the mathematical concepts which are involved in the project work.
- An this way, according to the nature of the projects, teacher has to assess the work by examining the procedure of the project, and project report and by asking questions regarding the work.

OBSERVATION - INSPECTION:

Formative assessment is part of SSC - Public exams, the marks are consider as internal marks. So that implementation at school level is the responsibility of Head Master. And Divisional Level Dy.E.O. and District level D.E.O. and RTN's will observe. For this implementation moderation committees will be formed and they cross check the records of formative assessment. Hence keep availability of these records at school level.
Model Project - 1

Names of the students in the group.
1) B. Chandana  2) T. Karishma
3) U. Naseema  4) P. Susmitha
5) E. Meri  6) K. Usha

Class : 9
Medium : English
Title of the Project : Size of the footwear
Objectives : Finding the mode of the chappal size (footwear size) of 9 & 10 class students in the school.

Hypothesis : Size of the chappals of 9 & 10th class students is 7'.
Method : We T. Chandana, J. Karishma, K. Nasima, formed a group and Smitha, Meri, Usha formed a another group.

- The first group has collected data regarding size of the footwear of 9th class and the second group collected 10th class.

- With the permission of class teacher, we have made table as shown below, based on attendance reports. And sizes of the chappal was recorded against their names.

<table>
<thead>
<tr>
<th>Class: 9th</th>
<th>Class: 10th</th>
</tr>
</thead>
<tbody>
<tr>
<td>R.No.</td>
<td>Name</td>
</tr>
<tr>
<td>1.</td>
<td>A. Vani</td>
</tr>
<tr>
<td>2.</td>
<td>E. Sireesha</td>
</tr>
<tr>
<td>....</td>
<td>...............</td>
</tr>
<tr>
<td>....</td>
<td>...............</td>
</tr>
</tbody>
</table>

- By taking maximum and minimum values of sizes, frequency table have been prepared.
- Data was analyzed, the mode of the size was found, and bar graph was drawn for this data.
### Class: 9th

<table>
<thead>
<tr>
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<th>Name</th>
<th>Size</th>
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<tbody>
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<td>1</td>
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(ii) Frequency table

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<tr>
<td>Size</td>
<td>Tally marks</td>
<td>frequency</td>
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<td>III III III</td>
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(iii) Finding mode:

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</table>

<table>
<thead>
<tr>
<th>Size (x)</th>
<th>frequency (f)</th>
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<td>8</td>
<td>7</td>
</tr>
<tr>
<td>9</td>
<td>1</td>
</tr>
</tbody>
</table>
(iv) Bar Graphs:

Result: The size of the footwear of 9th & 10th class students is = 6.

Conclusion: ________________

Reference: 10th class maths text book (SCERT)

MODEL PROJECT – 2

I Preliminaries:

Names of the students : 1) K. Raju – Class: X, R.No.15
                        2) R. Akhila – Class: X, R.No.17
                        3) Sreedhar – Class: X, R.No.20
                        4) Veena – Class: X, R.No.25
                        5) Urmila – Class: X, R.No.30
Title of the project: Finding Heights – Distances:

Objectives: To find the height of a tree without climbing it

Hypothesis: Height of the tree ___ mtrs.

Required material: A hollow cylindrical long pipe, a plastic card board, sheet cut in semi-circle, thread and a weight.

Figure:

Method: This project is carried out based on practical/experimental method

Step-I (Construction of Instruments)

Take a cylindrical tube AB. Fig. 1 fix the semicircle shaped card board as shown. Fix one end of the thread at the midpoint ‘O’ and weight to the other end of the thread. Angles are marked on the semicircular card board from 0° – 90° on both sides as shown in the figure. Now, with this apparatus we can find the angle of elevation.

Step-II (Using the apparatus – and finding the angle of elevation practically)

First the distant object T is focused (i.e.: the top of the tree is focused) through the focus pipe. The thread shows an angle when we focus on the protractor. The values of this angle of elevation must be noted in a given proforma. Repeat this 2 or 3 times
Figure-2:

Table-1:

Showing the value of angles of elevation, perpendicular distance

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Angle of elevation (θ)</th>
<th>Perpendicular distance between observer and tree (m)</th>
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</thead>
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<td>2</td>
<td></td>
<td></td>
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<td>3</td>
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<td></td>
</tr>
</tbody>
</table>

Data Analysis:

By using the angle (θ), and distance (m) we can find the height of the tree, using trigonometric ratios as follows:

\[
\frac{PT}{AT} = \frac{\text{Height of the tree}}{\text{Perpendicular distance}}
\]

\[\therefore \text{Height of the tree} = \text{Distance} \times \tan \theta.\]

(we will find the height of the tree, by substituting the θ value from tangent values).
Table-2:

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Angle (θ)</th>
<th>Tan (θ) =</th>
<th>Perpendicular distance (d) m</th>
<th>Height of the tree = (d X Tan θ)</th>
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</thead>
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<td>3</td>
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</tr>
</tbody>
</table>

Observation : By observing the above values, the height of the tree = __________

Result : Height of the (target) tree = __________ m.

Conclusion : Thus, we can find the heights and distances by the help of such an apparatus called clinometers and using the trigonometric principles. If we know the height we can find the distance between target and observation point and vice versa. This method very useful in finding the width of rivers etc. And these applications are useful in Civil engineering, etc.

References :
1) Maths cas kit, NCERT
2) 10th class text book NCERT
3) Methods of Teaching mathematics - Telugu Academy

MODEL PROJECTS / SUGGESTED PROJECT PROBLEMS – 3

Chapter wise suggestive project problems are given below. These problems may be assigned under projects within the formative assessment period. In formative assessment, project from each chapter may be assigned to the groups.

- Teachers can identify new problems from each chapter based on the nature of concepts and assign project work to the children on their own. But at first teacher should have the concrete comprehension on the topic / project and then give proper guidance to the children. Make the each children should participate in it. For model project reporting two projects are discussed in this module.

Now, let us observe the topics / problems for project, chapter wise:
1. **Read Numbers**:
   - Collect the (H+) ions concentration of different solutions like: Citric acid, blood, water, CO (OH)₂, Soap etc. (using text book / logarithmic principle find the pH).
   - Collect the 5 models from grills preparing shop (welding point), in this context find the use of irrational numbers.
   - Find the 10 irrational numbers and ¾ - rational numbers in between √2 and √3 etc.

2. **Sets**:
   - Collect the data from your school mates, which game do they play. And explain it by a figure (we diagram)
   - Collect the data from your locality, that viewers of ¾ - T.V. channels.

3. **Polynomials**:
   - Representation different polynomials on graphs connecting with daily life situation.

4. **Pair of linear equations in two variables**:
   - Based on the problem in Ex.4.1, create a new problem connection real life situation and solve it.

5. **Quadratic Equations**:
   - Factorization of quadratic expressions - using geometrical concepts area of square of rectangle.

6. **Progressions**:
   - Find the number of bricks to build a pyramid.

7. **Co-ordinate geometry**:
   - Using co-ordinate geometry, prove the geometrical concepts like area of triangle, collinear point, etc.

8. **Similar Triangles**:
   - Testing the thermos practically.
   - Find the height of a tree / tangent, using the concept of similar triangles.
   - Prove the Pythagoras theory, using different methods / figures.
9. **Mensuration:**
   - Find the surface area and volume of different five 3D - objects in your locality (Ex: Shape of a building, expenditure estimation for white wash etc.)

10. **Trigonometry & (11) Applications of Trigonometry:**
   - Find the values of trigonometric ratios (for 0°, 30°, 45°, 60°, 90°) by using graph paper, scale, etc.
   - Find the height / distance of a given objects / targets, using clinometer.

11. **Probability:**
   - Find the difference between theoretical probability and experimental probability, with an experiment.
   - If you cut a wooden stick at two points, make it into 3 points, then what is the probability of making a triangle with that pieces.

12. **Statistics:**
   - Suggested projects in text book,
   - Collection data regarding literacy, in a locality / marks in SSC / results / and drawing frequency curve to that data, and interpretation.

**Formative Assessment - Recording Process:**

There is no need to conduct all the tools (i.e.: Slip test, written work, project work, creating new problems) at a time or on one day. By observing daily work and student’s responses we can assess the progress. We have to award marks and grades. Marks and grades are awarded to each tool in formative assessment. Observe the following table:

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of the student</th>
<th>Creating new mathematics problems</th>
<th>Written work</th>
<th>Project works</th>
<th>Slip test</th>
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</tbody>
</table>

Marks should be allotted to each tool as shown below.
Creating / making new problems:

- For creating / making new problems on different concepts in each unit (2 ½ marks)
- For presentation of such created problem in the classroom (2 ½ marks)
- These problems must be written (recorded) by the children in their F.A. Note Book

Written Works:

For solving the problems under different titles i.e.: do this, try this, think and discuss and exercise problems or any other problems posed by the teacher, students have to write (solve) in class work or home work note book. These class work and home work note books must be corrected by the teacher. And teacher has to observe that how the children are thinking and in what way they are solving the problems, based on that assess their progress and award (05) marks for it.

Project Work:

Project work (which is assigned by the teacher) report prepared by children, individually must be written in the F.A. Note Book. If children write the report perfectly, then award (2 ½) marks maximum.

For presentation of project work in the classroom by individual student, (based on their presentation process / skills) award 2 ½ marks maximum.

Slip Test:

Writing 3 or 4 problems on the black board, and let the children to solve such problems instantaneously in their F.A. note book. Based on their problem solving process, award maximum 5 marks only.

How many F.A.s? When?

In one academic year, we have to conduct four formative assessments for this observe the below table:

<table>
<thead>
<tr>
<th>F.A.</th>
<th>Month of conducting</th>
</tr>
</thead>
<tbody>
<tr>
<td>F.A.-1</td>
<td>July</td>
</tr>
<tr>
<td>F.A.-2</td>
<td>September</td>
</tr>
<tr>
<td>F.A.-3</td>
<td>November</td>
</tr>
<tr>
<td>F.A.-4</td>
<td>February</td>
</tr>
</tbody>
</table>
Summative Assessment

Formative assessment is carried out at the end of a course or over a period of learning to measure how far the students have achieved the competencies / academic standards in the concerned subjects. It, certifies the level of achievement by the children only at a given point time at the best. The dates with time of Summative assessment tests will be intimated to students priorly. Written test is conducted on the prescribed syllabus, which is to be completed in that period of time. It is paper pencil test, that means, in this students may write their opinions / answers to the given questions, then the teachers observes / evaluates them and assess their progress.

**Academic year – No. of Summative Assessments:**

In an academic year, 3 summative assessments are be conducted. Summative assessment will be conducted at school level, for 9th class 3 times and 2 times for 10th class, based on the question paper which is prepared by the teacher. In 10th class instead of 3rd Summative Assessment Public Exam is conducted by the Director of Govt. Examinations / Board. SA – 1, SA – 2 and SA – 3 in 9th class and SA – 1 and SA – 2 in 10th class are to be conducted as per SSC – Public examination pattern. By this children habituate and get exercises for SSC – Board exams from 9th class only. For this now we will observe the SSC – Public examination method – implementation.

**Number of Papers – Chapters:**

As a part of Summative Assessment, mathematics public examinations are conducted through two papers i.e. Paper-I and Paper-II.
Chapter for Paper-I and Paper-II:

In 10th class public examinations, for Paper-I, chapters related to the areas of Number system, Sets, Algebra, Progressions, Co-ordinate Geometry i.e.: (1) Real numbers, (2) Sets, (3) Polynomials, (4) Pairs of linear equations in two variables, (5) Quadratic Equations, (6) Progressions and (7) Co-ordinate geometry will be taken into consideration and questions are prepared based on these chapters only.

In Paper-II, chapters related to the areas of Geometry, Trigonometry, Mensuration, Statistics and Probability, i.e.: (1) Similar triangles, (2) Tangents and Secants to circles, (3) Mensuration, (4) Trigonometry, (5) Applications of trigonometry, (6) Probability, (7) Statistics will be taken into consideration and questions are prepared based on these chapters only.

Marks: Paper-I examination is conducted for 40 marks and Paper-II for 40 marks. Remaining 20 marks are allotted for formative assessment as internal marks. Thus, in this evaluation process 80% marks are allotted to Summative Assessment i.e. 10th class public examination and remaining 20% for formative assessment.

<table>
<thead>
<tr>
<th>Subject</th>
<th>Total marks</th>
<th>Public examination marks</th>
<th>Formative Assessment marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maths paper-I</td>
<td>50</td>
<td>40</td>
<td>10</td>
</tr>
<tr>
<td>Maths paper-II</td>
<td>50</td>
<td>40</td>
<td>10</td>
</tr>
</tbody>
</table>

Conducting process: At school level Paper-I examination (for 9th class SA-1, SA-2, SA-3 and 10th class SA-1, SA-2) is conducted in the morning session and Paper-II in the afternoon session on the same day. But in 10th class public examination, as SA-3 (i.e. public exams) paper-I on one day and paper-II on next day excluding the holidays, that means an examination per each day.

Time: In 10th class public examination, 15 minutes of times is given for reading the question paper and 2 1/2 hrs time for answering the question paper, that means totally 2 hr – 45 min. of time is given for each paper 80, answer booklet is supplied to the children after 15 minutes only, issuing of the questing paper. It means that 15 min. of time only meant for reading of question paper only. This process is continued for 9th and 10th classes in the exams of the Summative Assessments.
**Pass Marks:**

35% is the pass percentage for the students. Totally on formative and summative assessments. There is no need to pass separately in formative assessment and summative assessment and as well as separately in paper-I and paper-II also. (As per guidelines G.O.Ms.No.17 and its amendments).

**Grading system:**

Grades are to awarded based on the total achieved marks achieved in Paper-I, Paper-II and Internal marks regarding to them. This method / process is to be followed for 9th and 10th classes for 100 marks the grading system is like this

<table>
<thead>
<tr>
<th>Grade</th>
<th>Range of marks (100 marks)</th>
<th>Grade points</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>91-100</td>
<td>10</td>
</tr>
<tr>
<td>A2</td>
<td>81-90</td>
<td>9</td>
</tr>
<tr>
<td>B1</td>
<td>71-80</td>
<td>8</td>
</tr>
<tr>
<td>B2</td>
<td>61-70</td>
<td>7</td>
</tr>
<tr>
<td>C1</td>
<td>51-60</td>
<td>6</td>
</tr>
<tr>
<td>C2</td>
<td>41-50</td>
<td>5</td>
</tr>
<tr>
<td>D1</td>
<td>35-40</td>
<td>4</td>
</tr>
<tr>
<td>D2</td>
<td>0-34</td>
<td>3</td>
</tr>
</tbody>
</table>

The average of total grades is considered as cumulative Grade Point Average (GPA)

**Weightage for Internal & External Formative and Summative Assessment:**

- 80% marks allotted to public examinations, remaining 20% marks for formative assessment.
- 20% marks for formative assessment, will be taken as 'average marks achieved in four formative assessments. This average calculation must be as shown below, (criteria).
<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Tool in the Formative Assessment</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Creating new problems on given concepts</td>
<td>5</td>
</tr>
<tr>
<td>2.</td>
<td>Written work (class work, home work, written on their own)</td>
<td>5</td>
</tr>
<tr>
<td>3.</td>
<td>Project works</td>
<td>5</td>
</tr>
<tr>
<td>4.</td>
<td>Slip tests</td>
<td>5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>20</strong></td>
</tr>
</tbody>
</table>

- For FA – one note book is being maintained by every student. And make the students to write the above 1, 3, 4 items in that book, classwork / home work separately). Thus conduct the F.A., and keep these records available at the time of inspection of authorities.

- Students must and should attend all the formative assessments. If at any case, a child is absent in such formative assessment, teacher has to conduct F.A. for the student separately and assess his/her progress and record it. After conducting the 4th formative assessment, observing all the records; the head of the school has to send the details of F.A. in a prescribed proforma through online. Regarding this software and other things will be looked after by the commissioner for Govt. exams.

- To make the children to prepare for the public examinations – SA-A and SA-2 are conducted for 80% marks only and remaining 20% marks will be allocated based on the formative assessments conducted previously.

  SA-1 – as per above table 20% (FA1 + FA2) + 80% question papers.

  SA-2 – as per above table 20% (FA1 + FA2 + FA3) + 80% question papers.

  SA-3 (public examinations) – as per the above table 20% (FA1 + FA2 + FA3 + FA4) + 80% question papers.
• Conducting of Summative Assessment exams:

SA-1, SA-2, SA-3 are to conducted in the following months, as shown in the table.

<table>
<thead>
<tr>
<th>Summative Assessment</th>
<th>Month</th>
</tr>
</thead>
<tbody>
<tr>
<td>SA-1</td>
<td>Sept./Oct.</td>
</tr>
<tr>
<td>SA-2</td>
<td>Dec./Jan.</td>
</tr>
<tr>
<td>SA-3</td>
<td>Mar./Apr.</td>
</tr>
</tbody>
</table>

Quality Issues:

Generally questions are emphasized on content only. But in this present system, in every subject academic standards to be achieved in each class are identified. Teaching learning processes are intended to only to achieve that academic standards. So that, in evaluation process also, priority is given to assess the progress of the children based on these academic standards. For this question paper must be prepared based academic standards only.

a) Competencies – Academic Standards:

In mathematics, the following competencies / academic standards are identified.

1) Problem solving
2) Reasoning proof
3) Communication
4) Connections
5) Representation (visualization)

1) Problem Solving:

For problem solving, questions may be based on the following contexts / criteria.

• Word problems
• Pictorial problems
• Understanding of data – analysis problems
• Problems related to tables – graphs.

Problem solving is depended on number of steps, number processes, relavent data for the problem solving, method of solving and nature of the problem. Overall, the questions are framed based on the above parameters.
2) **Reasoning – Proof:**

The questions must be prepared on the following indicated, under this competency.

- Problems related to mathematical generalizations.
- Problems related to testing mathematical hypothesis.
- Problems – on giving reasons for particular steps – in problem solving.
- Problems on logical reasoning / testing the logic.
- Problem on testing the logic by inductive or deductive method.


3) **Communication:**

Under the ‘Communication’ competency, problems / questions may be prepared based on the following indicators / contexts / topics, etc.

- Creating new problems on given mathematical concept / mathematical sentence.
- Converting the word problems into mathematical statements.
- Preparing tables from given data (Making grouped data).
- Problems on mathematical communication.
- Problems on explaining the mathematical thoughts in own words, as well as explaining the terms / symbols in a formula, etc.

4) **Connections:**

- Under the connection competency, problem / questions must be prepared based on the following indicators.
- Problems on connecting one area to another area in the mathematics with other subjects.
- Problems on connecting various concepts, methods to solve one problems.
5) **Representation – Visualization:**

Under this competency, the questions are prepared based on the following indicators/contexts:

- Constructions
- Problems on data from tables, graphs
- Showing numbers on number line
- Problems on reading data from pictorial graph, bar graph, 2D-ictures, 3D-pictures
- Problems related to drawing pictures (2D/3D)
- Problems related to drawing graphs (pictorial graphs, bar graphs, cumulative curves, phi graphs, etc.)

**Note:-**

- Preparing frequency table from raw data in statistics comes under ‘communication’ competency.
- Preparing frequency table from raw data, and finding mean, median, mode for that data – comes under ‘problem solving’.
- Drawing graphs or cumulative curves for given frequency table – comes under representation and representation.
- Draw graph for the problem? Comes under – representation & visualization.
- Draw graph and draw conclusion / find the particular – comes under problem solving.

b) **Nature of Questions:**

- Questions should not be based memory / recall and remembering.
- Questions must be "thought provoking" to write the answer. Questions must be analytical, connecting various concepts to solve, multiple answer – questions.
- No repetition of questions in public examinations
- Problems should not be given as it is, as they are in the exercise. But prepare same types new question as in the exercise and give them in public examination.
Types of questions – weightage:

In 10th class public examinations, regarding mathematics, Paper-I, Paper-II, types questions will be prepared as shown below. Weightage table given for types of questions. As per the weightage table, number of questions are limited in this process, summative assessment (exams) are to be conducted for 9th and 10th.

Types of question – weightage table:

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Type of question</th>
<th>Marks for each question</th>
<th>No. of questions</th>
<th>Total marks</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Essay type</td>
<td>4</td>
<td>4</td>
<td>16</td>
<td>Internal choice</td>
</tr>
<tr>
<td>2.</td>
<td>Short answer</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>No choice</td>
</tr>
<tr>
<td>3.</td>
<td>Very short answer</td>
<td>1</td>
<td>7</td>
<td>7</td>
<td>No choice</td>
</tr>
<tr>
<td>4.</td>
<td>Multiple choice ques-</td>
<td>½</td>
<td>10</td>
<td>5</td>
<td>No choice</td>
</tr>
<tr>
<td></td>
<td>tions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Short answer</td>
<td></td>
<td>27</td>
<td>40</td>
<td></td>
</tr>
</tbody>
</table>

Weightage to Academic standards:

Thus, weightage to academic standards is also an important in preparing the question paper. In our mathematics 60% weightage has given to problem solving and remaining 40% has given to rest of academic standards. This weightage also to be followed for 9th & 10th classes in Summative Assessment, 80 teachers has to prepare the question paper as per the weightage table of academic standards.

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Academic Standards</th>
<th>% of weightage</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Problem solving</td>
<td>40%</td>
<td>16</td>
</tr>
<tr>
<td>2.</td>
<td>Reasoning – proof</td>
<td>20%</td>
<td>8</td>
</tr>
<tr>
<td>3.</td>
<td>Communication</td>
<td>10%</td>
<td>4</td>
</tr>
<tr>
<td>4.</td>
<td>Connection</td>
<td>15%</td>
<td>6</td>
</tr>
<tr>
<td>5.</td>
<td>Representation – visualization</td>
<td>15%</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>100%</td>
<td>40</td>
</tr>
</tbody>
</table>
Keeping in view of the above weightage tables, and considering the following indicators, question paper is to be prepared.

1. As per Table-I (types of questions – weightage table), internal choice is given for essay type answer questions. (4 marks for each question) 80 that student has to attempt first question or second question within the internal choice.

2. As per Table-I, there is no choice for short answer questions, very short answer questions, and multiple choice questions. So that student has to attempt all these questions.

3. As per Table-2 (academic standards – weightage) weightage given to 1st and 2nd Academic standards – should not be change at any circumstances But, based on the length of topics, concepts, weightage may be changed @ 5% for rest of 3 academic standards. This flexibility only limited SA1, SA2 in the 10th class. Any how this weightage must be 100%, for maximum 40 marks only 80, in 9th class SA3 examinations, question paper is to be prepared as per the above weightages in the table.

4. There is no chapter wise weightage. Questions may be prepared based on academic standards choosing any chapter from text book.

5. While asking questions from different chapters, any type of question may asked from any chapter. ‘4 marks questions may come from particular chapter, and 2 marks question may come from concerned chapters; this wrong concepts on should not be created. As per the context or situation any type of question may be selected / asked.

6. While preparing the question paper, we should follow the above two weightage tables.

7. Enclose the evaluation indicators along with the question paper.

8. The following abstract weightage table is enclosed with the question paper. But in the below weightage table, only weight is given to academic standards. Based on these weightage tables, we should prepare blue print for which type of questions? and how many are given? in each question paper. This blue print is not same for each question paper. Why because, considering concepts / topics from each chapter, according to the vision or thinking of the classroom teacher may prepare the different types of questions based on academic standards only. But every teacher keep in mind that equal priority given to all chapters, and ask / prepare the questions covering all the chapters. Any one chapter should not be given top priority, give equal priority all chapters. 80, make the children to learn all the chapters, which creates interest in learning mathematics, and make them to accelerate their progress.
<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Academic Standards</th>
<th>weightage %</th>
<th>Marks</th>
<th>VSA questions</th>
<th>SAQ</th>
<th>Essay questions</th>
<th>MCQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Problem solving</td>
<td>40%</td>
<td>16</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Reasoning proof</td>
<td>20%</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Communications</td>
<td>10%</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Connection</td>
<td>15%</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Representation – visualization</td>
<td>15%</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>100%</td>
<td>40</td>
<td>7</td>
<td>6</td>
<td>4</td>
<td>10</td>
</tr>
</tbody>
</table>

**Single Answer Booklet:**

In our SSC – public examinations at present, along with the main answer sheet, additional sheets are being supplied, sometimes, there is scope for misuse of these additional sheets. To avoid all these, single answer booklet, having sufficient pages is supplied in new examination system. So, children have to write all the answers in that single answer booklet only. No additional sheet is supplied. So, don’t waste the pages, while writing the answers. Based on the size of the answers to the questions, required pages in each answer booklet is estimated, and number of pages are calculated for the answer booklet. We should intimate to the children that they have to write all the answers in that answer booklet only, and make them understand how to write the answers properly, utilizing the space in the answer booklet.
Competency wise model questions:

Problem solving:

1. What is the sum of the numbers which are divisible by 3 and in between 1 and 150.
2. Sum of two numbers is 1296. If a number is 16 times of another number, then find the numbers.
3. Find the remainder when $x^4 - 3x^2 + 4$ is divisible by $x - 2$.
4. Find arithmetic mean and median for the following data.

<table>
<thead>
<tr>
<th>Class interval</th>
<th>51-60</th>
<th>61-70</th>
<th>71-80</th>
<th>81-90</th>
<th>91-100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>5</td>
<td>12</td>
<td>16</td>
<td>14</td>
<td>9</td>
</tr>
</tbody>
</table>

5. Ajay bought a TV for ₹14100/- and sold it for ₹15000/-. Find the loss percentage.
6. Solve $\frac{x-3}{8} - \frac{x+1}{6} + \frac{x-1}{4} = 1$
7. The marked price of a cell phone is ₹6000/- and its selling price is ₹5200/-. Find its discount percentage.
8. Find the square root and cube root of 15625.
9. Two year ago, the average age of 40 persons is 11 years. A person has dropped himself from that group now and average age of the remaining group has become 12 years. What is the age of the person who dropped himself from the group?
10. The circumference of a circle is 22cm. Find the area of semicircle of the circle.
11. Two vertices of a triangle are (3,-5) and (-7,4) and centroid of the triangle is (2,-1). Find the third side of the triangle.

Reasoning and proof:

1. Whether √11 is rational or irrational? Explain with reasons
2. Whether (3, 4, 5) are Pythagoras triplets or not? Explain with reasons
3. \(n(n+1)(n+2)\) is always divisible by 6 for all \(n \in \mathbb{N}\). Why? Explain with reasons.

4. Can we construct a triangle with length of the sides 5cm, 3cm and 10cm? Explain with reasons.

5. Area of the following triangle in Raghu’s opinion is \(\frac{1}{2} \times 7 \times 5\) and in Mary’s opinion is \(x \times 8 \times 5\). Who is right and why?

6. Choose some triplets of consecutive odd numbers and find the product of the numbers in each triplet. Have you observe any pattern? And what can you generalise from that pattern?

Communication:

1. Express the following in standard form:
   a. 0.000000000175 
   b. 201405170678

2. Explain every variable in volume of a cylinder \(V = \pi r^2 h\).

3. Express the following in exponential form:
   a. 243 
   b. 10000 
   c. 1024

4. Express 0.7 in fractional form.

5. The cost of a fountain pen is ₹5 less than that of a ball pen. Express this information using \(x, y\) as variables.

6. What is right triangle? Explain.

7. What does “r” represent in \(V = \frac{4}{3}\pi r^3\)?
Connections:

1. Find the area of the circle which is inscribed in a square with side 28cm.

2. A ball is vertically thrown upwards with initial velocity 80 m/sec from a building of 96 m height. The ball is at the distance $S = 96 + 80t - 16t^2$ away from ground after $t$ seconds. After how much time it will reach the ground?

3. Area of a rectangle is represented by $6x^2 - 11x - 10$. Represent the length and breadth of the rectangle by possible binomials.

4. There is a cone having equal height and equal radius of base with those of a cylinder. Show that ratio of their volumes is 3:1.

5. A sphere with 4.2 cm radius is moulded into a cylinder having 6cm radius of base. Then what is the height of the cylinder?

Representation - Visualisation:

1. Represent $\sqrt{5}$ on number line.

2. The ratio of milk and water in a liquid of 35 litres is 5:2. Represent this information in a linear equation and thus on a graph.

3. Represent the following points on a graph and join each pair.
   a. $(1, 0)$ $(0, 8)$
   b. $(2, 0)$ $(0, 7)$
   c. $(3, 0)$ $(0, 6)$
   d. $(4, 0)$ $(0, 5)$
   e. $(5, 0)$ $(0, 4)$
   f. $(6, 0)$ $(0, 3)$
   g. $(7, 0)$ $(0, 2)$
   h. $(8, 0)$ $(0, 1)$

4. Construct a triangle ABC with $\angle B = 45^\circ$, $\angle C = 60^\circ$ and $AB + BC + CA = 12cm$. 

5. The yielding of a crop per hectare of 50 farmers in a village is given in the following table.

<table>
<thead>
<tr>
<th>Yielding (in quintals)</th>
<th>50-55</th>
<th>55-60</th>
<th>60-65</th>
<th>65-70</th>
<th>70-75</th>
<th>75-80</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of farmers</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>12</td>
<td>18</td>
<td>8</td>
</tr>
</tbody>
</table>

Draw an ogive curve for the above data.

6. Prepare a frequency table for the following histogram.

```
<table>
<thead>
<tr>
<th></th>
<th>Bikes</th>
<th>Autos</th>
<th>Cars</th>
<th>bicycles</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>60</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
```

**Preparation of questions under different competencies/academic standards with a single data.**

1. Data: $\sqrt{2}$
   a. Problem solving: Find the value of $\sqrt{2}$ for three decimals
   b. Reasoning-proof: Whether $\sqrt{2}$ is rational or irrational?
   c. Representation-visualisation: represent $\sqrt{2}$ on number line.

2. Data: In a triangle ABC, AB=8cm, BC=6cm and AC=10cm.
   a. Problem solving: Find the possible ratios in between any two sides of a triangle ABC with sides AB=8cm, BC=6cm and AC=10cm.
b. Reasoning-proof: It is given for a triangle ABC, AB=8cm, BC=6cm and AC=10cm and BC:AC=5:3. Verify whether the given information is correct or not?

c. Communication: It is given that the sides of a triangle are 3, 4 and 5 times of a number. Then express this in the form a ratio.

d. Connections: If the sides of a triangle are in the ratio 3:4:5 and its perimeter is 24cm, then find its sides.

e. Representation –visualisation: construct a triangle with sides AB=8cm, BC=6cm and AC=10cm.

Question Papers - Preparation Indicators:

- Questions in the question paper should not be based on memorization.
- Questions must be thought provoking. Questions must be analytical, and connecting different concepts to solve the problem, multi answers questions also be included.
- Once a question asked in the public examination, it should not be separated as it is in future public examinations. This type of new questions are to be given.
- In essay types answer questions, under single academic standards only internal choice (two) questions are given.
- According weightage to types of questions and weightage to academic standards tables, questions are to be prepared.
- While giving essay type questions, mainly word problems, problems have more logics, problems having 2 or 3 processes, more thought provoking, constructions, solving questions, graph type questions may be given.
- Under short answer type questions, questions having 1 or 2 processes, direct answerable, with in ¾ - steps answerable, having small explanations - type questions may be given.
- Short problems, orally calculated problem, definitions, principles or symbols - based questions etc., are given under very short answer type questions.
- Multiple choice questions must be less time taken, oral thinking and calculated type are given 4 answers of a each MC question, lead the child that each question may be suitable for the given question.
- In case, in any chapter, if we don't find essay type answerable question, two short-answer questions together asked under essay typed question.

- Before preparing the question paper, blue print must be prepared. The question paper is to be prepared, based on that blue print only. Blue print is not same for every question paper. Model blue print given separately for paper-I and Paper-II, for understanding the preparation of question paper. Model question paper also given. So observe them for understanding.

### Maths – Paper – I, - Blue Print

<table>
<thead>
<tr>
<th>Competency</th>
<th>Weightage %</th>
<th>Essay questions (4)</th>
<th>Short answer questions (2)</th>
<th>Very short answer questions (1)</th>
<th>Multiple choice questions (½)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problemsolving</td>
<td>40%</td>
<td>2(8)</td>
<td>2(4)</td>
<td>3(3)</td>
<td>2(1)</td>
</tr>
<tr>
<td>Reasons - proof</td>
<td>20%</td>
<td>-</td>
<td>2(4)</td>
<td>2(2)</td>
<td>4(2)</td>
</tr>
<tr>
<td>Communications</td>
<td>10%</td>
<td>-</td>
<td>-</td>
<td>2(2)</td>
<td>4(2)</td>
</tr>
<tr>
<td>Connection</td>
<td>15%</td>
<td>1(4)</td>
<td>1(2)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Representation in visualization</td>
<td>15%</td>
<td>1(4)</td>
<td>1(2)</td>
<td>-</td>
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</tbody>
</table>

### Maths - Paper - II, - Blue Print

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<th>Competency</th>
<th>Weightage %</th>
<th>Essay questions (4)</th>
<th>Short answer questions (2)</th>
<th>Very short answer questions (1)</th>
<th>Multiple choice questions (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problemsolving</td>
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<td>2(8)</td>
<td>2(4)</td>
<td>3(3)</td>
<td>2(1)</td>
</tr>
<tr>
<td>Reasons - proof</td>
<td>20%</td>
<td>-</td>
<td>2(4)</td>
<td>2(2)</td>
<td>4(2)</td>
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<tr>
<td>Communications</td>
<td>10%</td>
<td>-</td>
<td>-</td>
<td>1(1)</td>
<td>2(1)</td>
</tr>
<tr>
<td>Connection</td>
<td>15%</td>
<td>1(4)</td>
<td>1(2)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Representation in visualization</td>
<td>15%</td>
<td>1(4)</td>
<td>1(2)</td>
<td>1(1)</td>
<td>1(1)</td>
</tr>
</tbody>
</table>
Summative Assessment III - Model Paper
Mathematics
(English Version)
(Real numbers, Sets, Polynomials, Pair of linear equations in two variables, Quadratic equations, Progressions, Coordinate geometry)

Time : 2 Hours 45 Minutes  

Instructions : 1. Read the following question paper and understand every question thoroughly without writing anything. 15 minutes time is allotted for this.
2. Answer all the questions from the given four sections.
3. Write answers to the objective type questions (Section-IV) on answer sheet, but at the same place.
4. In Section-III, every question has internal choice. Answer to anyone alternative.

Section-I

Answer every question. Each question carries one mark. 7x1=7

1. How do you find the distance between two points on the line parallel to x-axis. Explain.

2. If the slope of line segment joining P(-2, 3), Q(x, 6) is -1, then find x. (P.S.)


4. Find cubic polynomial with the zero values -7, 1, 2.

5. Can x+2, x+4 and x+9 be in A.P. Justify your answer.

6. Difference between a two digit number and the number formed by interchanging its digits is 36. Express this data as an algebraic equation.

7. Explain the characteristic of a line passing through points (-5, 2), (0, 2), (3, 2), (5, 2).

Section-II

Answer every question. Each question carries 2 marks. 6x2=12

8. If A = {1, 3, 6, 9}, B = {1, 2, 3, 4, 5, 6} then show A ∪ B and A - B as Venn diagrams.

9. Are sets of multiples of 3 and multiples of 2 disjoint sets. Justify your answer?
10. Find the ratio in which y-axis divides the line segments joining the points A(3, 2), B(-1, 2).

11. Find the area of a rectangle whose length and breadth are the roots of the quadratic equation \( x^2 - 6x + 8 = 0 \).

12. If \((3\times4\times5\times7) + (19\times21\times23)\) a composite number. Justify your answer.

13. If 6th term of a G.P. is 46875 and its 4th term is 375. Find its 9th term.

**Section-III**

Answer every question. Each question carries 4 mark. \(4\times4=16\)

14(A) The length and breadth of a rectangular metal sheet are in the ratio 7 : 5. Four \(3\text{cm} \times 3\text{cm}\) squares have been separated from the corners of that rectangle and it has been moulded into a cuboid of \(96\text{ cm}^3\) of volume. Find the area of the rectangular metal sheet taken in the beginning.

(OR)

(B) A stone is thrown vertically upwards from a building of 96 ft height with an initial velocity of 116 ft/sec. If the acceleration due to gravity is 32 ft/sec\(^2\), then after how many seconds the stone will reach the ground.

15(A) Rama has arranged 256 dots to draw a rangoli in the following ways. In how many rows has she arrange the dots.

```
. . . . .
 . . . .
  . . .
   . .
    .
```

(OR)

(B) In a nuclear fusion reaction a \(\text{U}^{235}\) nucleus will split two lighter nuclear creates 3 neutrons and 200 MeV of energy. These three neutrons will again split three \(\text{U}^{235}\) nucleus. Find the energy released if this process continuous for 10 stages.

16(A) Draw the graph of \(p(x) = x^2 - 12x + 35\) and find the zeroes of the polynomial of it.

(OR)

(B) The product of two consecutive multiples of 3 is 81. Form a quadratic equation and by using this information draw its graph.
17(A) Find the sum of all the multiples of 2 or 3 between 100 and 200 (100 and 200 are not included).

(OR)

(B) 5 women and 3 men having same capacity can complete a work in 6 days. And 3 men, 3 women of same capacity together complete the same work in 9 days, then in how many days a women or a man can complete the work.

Section-IV

Choose the wright answer A, B, C, D and write the correct answer. 10×\(\frac{1}{2}\)=5

18. A = {1, 2, 3, 4, 5, 6}, B = {2, 4, 6} then
   A) B \subseteq A    B) A \subseteq B    C) B \subset A    D) A \subset B

19. If there is no x term in a cubic polynomial then
   A) \(\alpha+\beta+\gamma=0\)    B) \(\alpha\beta+\beta\gamma+\alpha\gamma=0\)    C) \(\alpha+\beta+\gamma=0\)    D) Not possible

20. The product of two consecutive numbers is 56. Then quadratic equation formed by this is
   A) \(x^2 + x - 56 = 0\)    B) \(x^2 - x + 56 = 0\)
   C) \(x^2 + x + 56 = 0\)    D) \(x^2 - x - 56 = 0\)

21. If x-coordinates of two points are zero. Then slope of the line segment joined by these two points is
   A) 0    B) 1    C) -1    D) not defined

22. 1, -2, 4, -8, .......... is
   A) AP    B) GP    C) Both    D) None of these

23. A = \{x : x \in N; x \leq 0\} then
   A) A = \{0\}    B) A = 0    C) A = \{\phi\}    D) A = \phi

24. In the rational form of a terminating decimal number prime factor of the denominator is
   A) 5 only    B) 2 only    C) 2 or 5 only    D) Any prime

25. Shaded Region represented by the venn diagram
   A) P \cup Q    B) P \cap Q    C) P-Q    D) Q-P

26. Common difference of an AP is 3. If 2 is added to every term of the progression, then the common difference new AP
   A) 5    B) 6    C) 3    D) 2

27. If slopes of line segments AB and BC are equal then the area of \(\Delta\)ABC is
   A) Positive    B) Zero    C) Negative    D) Imaginary
**Summative Assessment III - Model Paper**

**Mathematics**

*(English Version)*

*(Similar triangles, Tangents and secants to a circle, Mensuration, Trigonometry, Applications of trigonometry, Probability, Statistics)*

**Time : 2 Hours 45 Minutes**

**Paper-II**

**Max. Marks : 40**

---

**Instructions :**

1. Read the following question paper and understand every question thoroughly without writing anything. 15 minutes time is allotted for this.

2. Answer all the questions from the given four sections.

3. Write answers to the objective type questions (Section-IV) on answer sheet, but at the same place.

4. In Section-III, every question has internal choice. Answer to anyone alternative.

---

**Section-I**

**Answer every question. Each question carries one mark.**

7x1=7

1. The information related to the health tests conducted for students of a class are as follows:

<table>
<thead>
<tr>
<th>Blood Group</th>
<th>A</th>
<th>AB</th>
<th>B</th>
<th>O</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Students</td>
<td>10</td>
<td>13</td>
<td>12</td>
<td>5</td>
</tr>
</tbody>
</table>

If a student is selected at random from this class, then find the probability for the blood group of that selected boy to be 'B'.

2. If a cone, hemisphere, cylinder are on the same base and having the same height, then what is the ratio of their volumes. Justify your answer.

3. Write trigonometric identity in Tan \( \theta \) and Sec \( \theta \).

4. If the length of shadow of a tower is \( \sqrt{3} \) times its height, then the angle with which a person standing at the end of the shadow will see the top of the tower.

5. For a circle with centre 'O', 'P' is an external point. If PS and PT are tangents drawn to the circle, then find \( |POS| \).
6. Which has greater value among Cos 6° or Cos 60°? Why?
7. Explain the procedure to find median of ungrouped data.

Section-II

Answer all questions. Each question carries 2 marks.  

6×2 = 12

8. Prepare ascending cumulative frequency table for given below.
   In a company the salaries of employees and their number like this.

<table>
<thead>
<tr>
<th>Employees salary</th>
<th>5-10</th>
<th>10-15</th>
<th>15-20</th>
<th>20-25</th>
<th>25-30</th>
<th>30-35</th>
<th>35-40</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of employees</td>
<td>4</td>
<td>45</td>
<td>20</td>
<td>13</td>
<td>9</td>
<td>7</td>
<td>2</td>
</tr>
</tbody>
</table>

9. If tan θ + sin θ = m, tan θ - sin θ = n, then express the value of m² - n² in terms of m and n.

10. In a leap year find the probability of getting 53 Sundays. Similarly find the probability of getting 54 Sundays. Justify your answer.

11. A square of side 25 cm is divided into n² equal small squares. If circles are drawn in each of these small squares touching all the sides, then find the area of the given square not covered by these circles.

12. If there spheres of radius 3 cm, 4 cm and 5 cm are melted and cast into a large sphere, then find the radius of the large sphere so formed.

13. Triangle ABC is an isosceles triangle in which AB = AC. Point D is mid point of AC. If a circle is drawm passing through B, intersecting AB at P and 'D' as point of contact so that AC is a tangent to the circle at D, then prove that AP = 1/4 AB.

Section-III

Every question is provided with internal choice. Each question carries 4 marks.

14(A) From any point in the interior of the triangle, lines are drawn parallel to the sides of it. If the areas of the three small triangles thus formed are 4, 9 and 16 square units then find the area of the given larger triangle.

(OR)
(B) For a circle with centre 'O', point 'T' is an external point. TA and TB are tangents drawn to the circle from T. Chord AB intersects \( \overline{AO} \) at C. If \( \frac{1}{OA^2} + \frac{1}{TA^2} = \frac{1}{36} \) then find the value of AB.

15(A) The crop yielding for a hectar of 100 farmers of a village is given as follows:

<table>
<thead>
<tr>
<th>Crop yielding (in quintols)</th>
<th>30–35</th>
<th>35–40</th>
<th>40–45</th>
<th>45–50</th>
<th>50–55</th>
<th>55–60</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of farmers</td>
<td>4</td>
<td>6</td>
<td>12</td>
<td>24</td>
<td>32</td>
<td>22</td>
</tr>
</tbody>
</table>

Represented the above data in the form of a less than cumulative frequency curve.

(OR)

(B) Draw a line segment AB of length 10 cm. With 'A' as centre and 5 cm radius draw a circle. With 'B' as centre and 3 cm radius draw another circle. Draw tangents from centre of each circle to the other circle.

16(A) The perpendicular sides of a right triangle are 6 cm and 8 cm. If it is rotated about its hypotenuse, then find the volume of the double cone so formed.

(OR)

(B) A rectangle ABCD is inscribed in a circle of radius 6 cm. Diagonals of that rectangle intersect at 'O' and one of the angles thus formed is 90° then find the area of the rectangle ABCD in terms of 90°.

17(A) A tree was broken by a wind and top of the tree is touching the ground making an angle of 30°. If the point where top touches the ground to the bottom of the tree is 20 m, then find the height of the tree before it was broken.

(OR)

(B) Find Arithmetic mean for the following data.

<table>
<thead>
<tr>
<th>Marks</th>
<th>0–9</th>
<th>10–19</th>
<th>20–29</th>
<th>30–39</th>
<th>40–49</th>
<th>50–59</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of students</td>
<td>3</td>
<td>8</td>
<td>14</td>
<td>21</td>
<td>9</td>
<td>5</td>
</tr>
</tbody>
</table>
Section-IV

Answer all questions. Each question carries \( \frac{1}{2} \) mark. \( 10 \times \frac{1}{2} = 5 \)

18. In \( \triangle AABP \), if 'c' is a point on BP such that \( \frac{PA}{AC} = \frac{AB}{BC} \), then PC PB is equal to

A) \( AP^2 \)  
B) \( AC^2 \)  
C) \( AB^2 \)  
D) \( BC^2 \)

19. The average of 13 scores is 8. If one of the scores 20 is deleted from them, then the average of the remaining scores is

A) 7  
B) 5  
C) 21  
D) 12

20. Which one of the following is equal to \( \sin x \) is

A) \( \frac{\sqrt{1 - \cos^2 x}}{\cos x} \)  
B) \( \frac{\tan x}{\sqrt{1 - \tan^2 x}} \)  
C) \( \frac{\sin x}{\sqrt{1 - \sin^2 x}} \)  
D) \( \frac{\sqrt{1 + \cos^2 x}}{\cos x} \)

21. Which one of the following is true

A) When two coins are tossed there are three possible outcomes, two heads, two tails, one head and one tail so probability of getting two heads is \( \frac{1}{4} \)

B) When a dice is rolled the possible outcome is an even number or odd number so probability of getting odd number is \( \frac{1}{2} \)

C) A deck of 52 cards contains 4 suits. So the probability of a selected card to become ace is \( \frac{1}{13} \)

D) Out of three students, the probability for two students to have the same date of birth in a year is 3.65

22. \( \triangle ABCD \) is a quadrilateral and a circle touches the sides of it at points P, Q, R and S respectively then which one of the following is true.

A) \( AB + CD = BC + DA \)  
B) \( AB + AD = BC + CD \)

C) \( AD + DC = AD + BC \)  
D) \( AB + BC + CD < AD \)
23. In $\triangle PQR$, E and F are points on sides PQ and PR respectively. In which of the following situations we set $EF \parallel QR$

A) $\frac{PQ}{PE} = \frac{PF}{PR}$

B) $\frac{PE}{EQ} = \frac{EF}{QR}$

C) $\frac{PE}{EQ} = \frac{PF}{FR}$

D) $\frac{PE}{EF} = \frac{QE}{QR}$

24. In the formula of mode

$\text{mode} = l = \left[ \frac{f_1 - f_0}{2f - f_0 - f_2} \right] \times h$, $f_o$ represents

A) frequency of preceding model class

B) frequency of succeeding model class

C) frequency of model class

D) frequency of zero model class.

15. p : Every angle in an equilateral triangle in 60°

q : Every angle in an equilateral triangle is not 60° then

A) q $\equiv$ p

B) p $\equiv$ ~(~q)

C) ~p $\equiv$ q

D) p = q

26. In a $\triangle ABC$ are D, E and F are mid points of AB, BC and CA respectively. If $\triangle ABC = 16 \text{ cm}^2$ then are $\triangle DEF$ = .............. then

A) 4 $\text{ cm}^2$  B) 16 $\text{ cm}^2$  C) 64 $\text{ cm}^2$  D) 32 $\text{ cm}^2$

27. For an acute angle A, $\sin A = \cos A$ then

A) $\angle A = 30^\circ$  B) $\angle A = 45^\circ$

C) $\angle A = 60^\circ$  D) $\angle A = 75^\circ$
In any successful teaching learning process, different resources place vital role. Here is a wrong conception that resources means, the material which is used at the time of teaching learning process only. To make the children comprehend the mathematical concepts, teacher as to prepare himself before the teaching learning process. In teaching or learning beyond the text book, different resources are needed. So, teacher has to search for new resources, and access to children, and make the children use in their learning process, which can give support their learning.

Teacher should not limit to teach what is in the text book. For more comprehension, extensive learning we need different resources like Maths kit, digital resources, internet, websites, different institutions / organizations, reference books etc.

Teacher can use them in their classes if they fit into their lesson: plan the following list gives a rough idea of the range of different resources available in internet.

The resources have been grouped into a few (loose) categories for facilitate easy navigation.

Websites

General

The mathforum@Drexel University (http://www.mathforum.org)
The Centre for Innovation in Mathematics Teaching (CIMT) (http://www.cimt.plymlec.ac.uk)
Math cats - Fun math for kids (http://www.mathcats.com), count on (http://www.counton.org)
1. Illuminations - Resources for teaching maths (http://illuminations.nctm.org) Interactive (http://www.shodor.org/interactivate)

Gadsen Mathematics Initiative (http://www2.gisd.k12.nm.us/GMIWebsite/MathResources.html)

2. Mathematical Interactivities - Puzzles, games and other online educational resources (http://mathematics.helam.net)


4. Mathnet - Interactive mathematics in education (http://www.mathsnet.net)

NewZealands maths (http://www.nzmaths.co.nz)

The Mactutor History of Mathematics archive (http://www-history.mcs.st-and.ac.uk/history)

Math cartoons (http://www.trottermath.net/humor/cartoons.html)

Math Com is (http://home.adelphi.edu/~stemkoski/mathmatrix1com Home.html)

Mathematical quotation server (http://math.furman.edu/~mwoodard/mQs/mQuots.html)

Wolfram Mathworld - The web’s most extensive mathematical resource (http://mathworld.wolfram.com)

Optical illusions and visual phenomena (http://www.michaeltach.ce/ot)

Optical illusions gallery (http://www.unoriginal.co.uk/optical5.html)

Teachers resources online (http://www.cleavebooks.co.uk/trol/index.html)

Interactive: Activities (http://www.shodor.org/interactive/activities/#fun)

Maths articles (http://www.matharticles.com/articles)

Math words and some other words of interest (http://www.pbellweb.net/etvindex.html)

Portraits of scientists and mathematicians (http://www.sil.si.edu/digitalcollections/hst/scientific-identity/CF/display results.cfm?alpha sort=R)

Let epsilon < 0 (http://epison.complexifx.com)

Grand illusion (http://www.grand-illusions.com)


Maths teaching ideas (http://www.teachingideas.co.uk/maths/contents.html)

E-books

Illustrated maths formulas - salim (http://www.arvindguptatoys.com/arvindgupt almathformulas.pdf)

Ramanujan - the man behind the mathematician Sundaresan and Padmavijayam (http://gyanpedia.in/tfi/Resources/books/ramanujan.doc)
A mathematician’s apology - G.H. Hardy
Puzzle maths - G. Gamov and stem
1000 uses of a hundred square - Leah Mildred Beardsley
Geometry comic book - Jean Pierre Petit
Elements - Euclid
How children learn mathematics
Suggested experiments in school mathematics - J.N. Kapur
Primary resources - Maths
Proteacher: Maths lesson plans for elementary school teaches
Maths activities
Maths powerpoints
Maths is fun - maths resources
Middle school portal for maths and science teachers
Maths games, maths puzzles and maths lessons designed for kids and fun
Numbers
Magic, squares, magic stars & other patterns
Number recreations
Broken calculator - Maths investigation
Calculator chaos
Primary school numeracy
Quarks to Quasars, powers of 10
Algebra
Algebra puzzle
Algebra tiles
Geometry
The Fractory: An interactive tool for creating and exploring fractals (http://library.thinkquest.org/3288/fractals.html)
Tessellate (http://www.shodor.org/interactivate/activities/Tessellate)
MathSphere-Free graph paper (http://www.mathsphere.co.uk/resources MathSphereFreeGraphPaper.html)
Paper models of polyhedral (http://www.korthalsaltes.com)

Problem solving
Mathpuzzle (http://www.mathpuzzle.com)
Puzzling world of polyhedral dissections (http://www.iohnrausch.com/PuzzlingWorld?contents.html)
Interactive mathematics miscellany and Puzzles (http://www.cut-the-knot.org)
Puzzles and projects (http://www.delphiforfun.org/Programs/Indices/projectsIndex.html)
10ticks daily puzzle page (http://www.10ticks.co.uk/sdailyPuzzle.aspx)
Gymnasium for Brain (http://www.gymnasiumforbrain.com)
Puzzles and games (www.thinks.com)

Miscellaneous
Mathematical imagery (http://www.ioslevs.com)

మాధ్యమ సామర్థము:

1. Introduction to Geometric Constructions (by Ramesh Krishnamurthi)
2. 59 mathematical ideas (by Tony Willy)
3. Sacred Geometry (by Thames & Hudson)
4. Mathematics for all (by UNESCO)
5. 536 Puzzles & curious problems (by Henry Ernest Dudemy)
6. A problem solving approach through generalising a specializing (by Rina Zazkis, Simon Fraser University)
7. Challenging problems in Geometry (by Alfred Posamentier, Charles T. Salkind)
8. Sources of mathematical discovery
9. Hindu Geometry (by Bibhutibhusan Datta and Avadhesh Narayan Singh)
10. An introduction to contemporary mathematics (by John Hutchinson)
11. Graphs and their uses (by Oystein Ore, Yale University)
12. A passion for mathematics (by Clifford A. Pickover)
13. Algebra with Arithmetic and Mensuration (From the SANSKRIT) (or Brahmegupta and Bhascara) (translated by Henry Thomas Colebrooke)
14. The Aryabhattiya of Aryabhata (translated by Walter Eugene Clark)
15. Euclid's Elements of Geometry (translation by Richard Fitzpatrick)
16. Geometry and the imagination (by D. Hilbert, Schon - Vossen)
17. Patterns of plausible inference (by G. Polya)
18. A History of Mathematical Notations (by Florian Cajori, California)
19. Integrated Algebra-1 (by Annxavier Gartett)
20. The Fundamental theorem of Arithmetic (by Mir Publishers, Moscow)
21. Mathematical reasoning writing and proof (by Ted Sundstrom)
22. Mathematical problems and puzzles (by S. Straszewicz)
23. Dictionary of Mathematics (Oxford)
24. How to solve it ? (by G. Polya)
25. Q.E.D. (Beauty in Mathematical proof by Polstar)
26. Mysteries of the equilateral triangle (by Brian J. Mc Cartin)
27. The contest problem book VIII (by J. Douglas Faires and David Wells)
28. Introduction to the Foundations of Mathematics (by Raymond L. Wilden)
29. The Universal Book of Mathematics (by David Darling)
30. The Nothing that is (A natural history of zero) (by Rober: Kaptan)
31. Magazines related to Mathematics
33. Short stories about numbers - Rajneesh Kumar
34. A premier on number sequences - Shilesh Sherali
35. Maths Charmers - Alfred S. Pemantier
36. Mathematics Maxwells First Steps in number theory a primer on divisibility - Shilesh Shirali
37. Thematics Puzzles - 359 Mathematical Recreations - Boris A. Kordemsky
38. A biography of the world's most mysterious number - Alfred S. Posamentier
## Erata

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<tr>
<td>1.</td>
<td>Instructions to student</td>
<td>Cover page backside</td>
<td>4th point</td>
<td>with out</td>
<td>without (No space)</td>
</tr>
<tr>
<td>2.</td>
<td>Instructions to student</td>
<td>Cover page backside</td>
<td>6th point</td>
<td>&quot;Think discuss and write&quot;</td>
<td>&quot;Think, discuss and write&quot; (, after Think)</td>
</tr>
<tr>
<td>3.</td>
<td>Instructions to student</td>
<td>Cover page backside</td>
<td>7th point</td>
<td>Sub topics argrelated</td>
<td>Sub-topics are related (&quot;.&quot; and &quot;space&quot;)</td>
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<tr>
<td>4.</td>
<td>Instructions to student</td>
<td>Cover page backside</td>
<td>8th point</td>
<td>(1) given in the (2) you can do this in</td>
<td>(1) given in the (2) you can do these (&quot;in&quot; single time only)</td>
</tr>
<tr>
<td>5.</td>
<td>Instructions to student</td>
<td>Cover page backside</td>
<td>9th point</td>
<td>Provided in tables, try these exercises</td>
<td>tables. Try to solve these exercises</td>
</tr>
<tr>
<td>6.</td>
<td>Instructions to student</td>
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<td>10th point</td>
<td>Donot post phone</td>
<td>Don't postpone (No space)</td>
</tr>
<tr>
<td>7.</td>
<td>Instructions to student</td>
<td>Cover page backside</td>
<td>12th point</td>
<td>For recreation collect some more</td>
<td>Collect some more for recreation</td>
</tr>
<tr>
<td>8.</td>
<td>Instructions to student</td>
<td>Cover page backside</td>
<td>17th point</td>
<td>Stock market etc, you</td>
<td>etc. you</td>
</tr>
<tr>
<td>9.</td>
<td>Preface</td>
<td>(v) initial page</td>
<td>1</td>
<td>Completed the three years of</td>
<td>Completed three years of</td>
</tr>
<tr>
<td>10.</td>
<td>Preface</td>
<td>(v) initial page</td>
<td>1</td>
<td>elimentary</td>
<td>elementary</td>
</tr>
<tr>
<td>11.</td>
<td>Real Numbers</td>
<td>1</td>
<td>2</td>
<td>bigger collection than integers</td>
<td>bigger collection than that of integers</td>
</tr>
<tr>
<td>12.</td>
<td>Real Numbers</td>
<td>4</td>
<td></td>
<td>TRY This</td>
<td>Do This</td>
</tr>
<tr>
<td>13.</td>
<td>Real Numbers</td>
<td>6</td>
<td>last line of page</td>
<td>Now (i) ( \frac{3}{2^3} = \frac{3}{8} ) ( \left( \frac{3}{8} \right) ) delete</td>
<td></td>
</tr>
<tr>
<td>14.</td>
<td>Real Numbers</td>
<td>7</td>
<td>(ii)</td>
<td>1.04 = ( \frac{26}{25} = \frac{26}{25} ) ( \left( \frac{26}{25} \right) ) delete</td>
<td></td>
</tr>
<tr>
<td>15.</td>
<td>Real Numbers</td>
<td>7</td>
<td>(v)</td>
<td>0.00025 = ( \frac{1}{4000} ) ( \left( \frac{1}{4000} \right) ) delete</td>
<td></td>
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<tr>
<td>17.</td>
<td>Real Numbers</td>
<td>7</td>
<td>3</td>
<td>Let us conclude: ... you see that any <strong>rational number</strong> which has........</td>
<td>real number</td>
</tr>
<tr>
<td>18.</td>
<td>Real Numbers</td>
<td>15</td>
<td>TRY</td>
<td>...., use your <strong>new knowledge</strong></td>
<td>&quot;new&quot; delete (...use your knowledge)</td>
</tr>
<tr>
<td>19.</td>
<td>Real Numbers</td>
<td>15</td>
<td>1.5 last para</td>
<td>...we are going to learn <strong>about logarithms</strong>....</td>
<td>&quot;about&quot; delete ...... learn logarithms</td>
</tr>
<tr>
<td>20.</td>
<td>Real Numbers</td>
<td>16</td>
<td>TRY THIS</td>
<td>(i) Find $16 \times 64$ .......... (ii) Find $25 \times 25$ ......</td>
<td>(i) Find $16 \times 24$ (ii)/full $25 \times 25$ (multiplication sign)</td>
</tr>
<tr>
<td>21.</td>
<td>Sets</td>
<td>25</td>
<td>2.1</td>
<td>Observe the examples given below</td>
<td>Observe the following.</td>
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<td>22.</td>
<td>Sets</td>
<td>25</td>
<td>2.1 (1)</td>
<td>Euclid.... Aryabhata, Bhaskar</td>
<td>Euclid.... Aryabhata, Bhaskaracharya</td>
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<tr>
<td>23.</td>
<td>Sets</td>
<td>25</td>
<td>2.1 (3)</td>
<td>Happy... joyful, confused</td>
<td>(confused) delete</td>
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<tr>
<td>25.</td>
<td>Sets</td>
<td>25</td>
<td>Para 2</td>
<td>... It was developed by George conor ......., we will &quot;learn sets&quot; (&quot;about&quot; delete)</td>
<td>&quot;George conor&quot;...., we will &quot;learn sets&quot; (&quot;about&quot; delete)</td>
</tr>
<tr>
<td>26.</td>
<td>Sets</td>
<td>26</td>
<td>DO THIS</td>
<td>(ii) Red, blue, green, <strong>yellow, black</strong></td>
<td>(ii) Red, blue, green (&quot;yellow&quot;, &quot;black&quot; delete)</td>
</tr>
<tr>
<td>27.</td>
<td>Sets</td>
<td>26</td>
<td>TRY THIS</td>
<td>(iii) ...... integers $1, 3, 5, ...$</td>
<td>(iii) .......... integers. (1, 3, 5, ......) delete</td>
</tr>
<tr>
<td>28.</td>
<td>Sets</td>
<td>27</td>
<td>under para (1)</td>
<td>(ii) $B = {\text{Square, .... parallelogram}}$</td>
<td>The elements of $B$ are square, rectangle, rhombus, parallelogram etc.</td>
</tr>
<tr>
<td>29.</td>
<td>Sets</td>
<td>27</td>
<td>4</td>
<td>....'belongs to', So $1 \in \mathbb{N}$ means that .......$0 \notin \mathbb{N}$ means that ......</td>
<td>So $1 \in \mathbb{N}$ read as that ...... $0 \notin \mathbb{N}$ read as that ....</td>
</tr>
<tr>
<td>30.</td>
<td>Sets</td>
<td>27</td>
<td>5</td>
<td>....... we have the set of all vowel letters in the English ....</td>
<td>.... Vowels in the English ....</td>
</tr>
<tr>
<td>31.</td>
<td>Sets</td>
<td>27</td>
<td>under 5 (ii)</td>
<td>$V = {x : x \text{ is a Vowel letter in English...}}$</td>
<td>$V = {x : x \text{ is a vowel in the English alphabet}}$</td>
</tr>
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<tr>
<td>32.</td>
<td>Sets</td>
<td>29</td>
<td>Exercise 2.1</td>
<td>3 (iii) .... Natural numbers N</td>
<td>...... natural numbers N</td>
</tr>
<tr>
<td>33.</td>
<td>Progressions</td>
<td>127</td>
<td>5 History</td>
<td>Among the Indian mathematician Aryabhata (470 AD)</td>
<td>Aryabhata</td>
</tr>
<tr>
<td>34.</td>
<td>Progressions</td>
<td>128</td>
<td>8</td>
<td>In all the lists... terms are ... preceding terms</td>
<td>.................. term .................. term................ (s) delete</td>
</tr>
<tr>
<td>35.</td>
<td>Progressions</td>
<td>128</td>
<td>6.2.1</td>
<td>This fixed ...................... negative (or zero)</td>
<td>(or zero) delete</td>
</tr>
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<td>36.</td>
<td>Progressions</td>
<td>131</td>
<td>Do this</td>
<td>(4) Multiply and divide</td>
<td>multiply and also divide</td>
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<td>37.</td>
<td>Progressions</td>
<td>156</td>
<td>Optional exercise (2)</td>
<td>The sum of ...................... is 8 find the ..... ................ AP ?</td>
<td>If the sum ............... is 8 then find the ............ A.P.</td>
</tr>
<tr>
<td>38.</td>
<td>Progressions</td>
<td>156</td>
<td>Optional exercise (4)</td>
<td>The houses...... sum of the numbers of the houses preceding the house......</td>
<td>preceding</td>
</tr>
<tr>
<td>39.</td>
<td>Progressions</td>
<td>157</td>
<td>6</td>
<td>150 workers were engaged .................. which the was and completed</td>
<td>....were.............. which the work was completed.</td>
</tr>
<tr>
<td>40.</td>
<td>Coordinate geometry</td>
<td>160</td>
<td>Do this</td>
<td>(i) ........ (-4, 0), (2, 0) ; (6, 0) (-8, 0)</td>
<td>........ (-4, 0), (2, 0), (6, 0) and (-8, 0)</td>
</tr>
<tr>
<td>41.</td>
<td>Coordinate geometry</td>
<td>161</td>
<td>Try this</td>
<td>(i) where....... (0, -3), (0, -8), (0, 6), (0, 4)</td>
<td>1. Where....... (0, -3), (-0, -8), (0, 6) and (0, 4)</td>
</tr>
<tr>
<td>42.</td>
<td>Coordinate geometry</td>
<td>164</td>
<td>Do this</td>
<td>Find the ........ pairs of points</td>
<td>....... pair of points</td>
</tr>
<tr>
<td>43.</td>
<td>Coordinate geometry</td>
<td>164</td>
<td>Try this</td>
<td>Find ........ rounded to are decimal</td>
<td>rounded to two decimal.</td>
</tr>
<tr>
<td>44.</td>
<td>Coordinate geometry</td>
<td>173</td>
<td>Try this</td>
<td>The points (2, 3), (x, y), (3, -2) ........ is again find (x, y)</td>
<td>The points (2, 3), (x, y) (3, -2) are...... is again then find (x, y)</td>
</tr>
<tr>
<td>45.</td>
<td>Coordinate geometry</td>
<td>177</td>
<td>Exercise 7.2</td>
<td>Find the co-ordinates............. ................ which divides the join - (-1, 7) ................. ...................... 2 : 3.</td>
<td>........ which divides the line segment joining the points</td>
</tr>
<tr>
<td>46.</td>
<td>Coordinate geometry</td>
<td>181</td>
<td>Try This</td>
<td>Find ........ taken in order are as vertices</td>
<td>...... taken in order as vertices. (are delete)</td>
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<tr>
<td>47.</td>
<td>Coordinate geometry</td>
<td>184</td>
<td>Last</td>
<td>Meena : I have done case like this case</td>
<td>(case) delete</td>
</tr>
<tr>
<td>48.</td>
<td>Coordinate geometry</td>
<td>188</td>
<td>Ex: 22</td>
<td>....... a line are ....... line</td>
<td>line segment</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>......................................... line</td>
<td></td>
</tr>
<tr>
<td>49.</td>
<td>Coordinate geometry</td>
<td>189</td>
<td>Ex: 22</td>
<td>slope ........................ line is 1</td>
<td>line segment</td>
</tr>
<tr>
<td>50.</td>
<td>Mathematical modeling</td>
<td>353</td>
<td>Last</td>
<td>Mathematical....................... paint is need to whitewash a room..............</td>
<td>Mathematical .......... paint is needed to painting a room.....</td>
</tr>
<tr>
<td>51.</td>
<td>Mathematical modeling</td>
<td>354</td>
<td></td>
<td>(i) speed(s)=\frac{Distance (d)}{time (i)}</td>
<td>(i) Speed (s)=\frac{distance (d)}{time (t)}</td>
</tr>
<tr>
<td>52.</td>
<td>Mathematical modeling</td>
<td>354</td>
<td></td>
<td>(ii) Where P = Principle</td>
<td>P = Principal</td>
</tr>
<tr>
<td>53.</td>
<td>Mathematical modeling</td>
<td>355</td>
<td></td>
<td>\begin{align*} I &amp; = \frac{PTR}{100} \quad \text{(Model)} \ \text{where } P &amp; = \text{Principal} \end{align*}</td>
<td>P = Principal</td>
</tr>
<tr>
<td>54.</td>
<td>Trigonometry</td>
<td>275</td>
<td>Try This</td>
<td>What will be the ratios of sides .................................</td>
<td>ratio</td>
</tr>
<tr>
<td>55.</td>
<td>Trigonometry</td>
<td>281</td>
<td>Try This</td>
<td>Find the ratios for \tan 90^{\circ}, \cosec 90^{\circ}, \sec 90^{\circ}, \sec 90^{\circ} \text{ and cot } 90^{\circ}</td>
<td>Find the values for \tan 90^{\circ} .......</td>
</tr>
<tr>
<td>56.</td>
<td>Application of Trigonometry</td>
<td>303</td>
<td>Ex: 12.2</td>
<td>Problem (10)</td>
<td>interchange (replaced) by problem(2) from optional exercise.</td>
</tr>
<tr>
<td>57.</td>
<td>Application of Trigonometry</td>
<td>303</td>
<td>Ex: 12.2</td>
<td>Problem (10)</td>
<td><strong>Correction:</strong> Chinky observes a town PO of height 'h' from a point A on the ground. She moves a distance 'd' towards the foot of the tower and finds the angle of elevation doubled with the initial angle. When she moved farther a distance of (\frac{3d}{4}) the angle of elevation trippled. Then prove that (36h^2 = 35d^2)</td>
</tr>
<tr>
<td>58.</td>
<td>Trigonometry</td>
<td>277</td>
<td>Ex: 11.0</td>
<td>(2) problem Tan Q - Tan R</td>
<td>Tan P - Tan R</td>
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<tr>
<td>1.</td>
<td>8</td>
<td>191</td>
<td>1</td>
<td>ask</td>
<td>asks</td>
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<tr>
<td>2.</td>
<td></td>
<td></td>
<td>2</td>
<td>the same shape but their.............</td>
<td>the same shape, their...............</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(delete 'but')</td>
<td></td>
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<tr>
<td>3.</td>
<td></td>
<td></td>
<td>3</td>
<td>distances of far-away, objects ..........</td>
<td>far-away objects (delete ,)</td>
</tr>
<tr>
<td>4.</td>
<td></td>
<td>192</td>
<td>1</td>
<td>No, they have same shape, yet they ..........</td>
<td>No, though they have same shape, they do ..........</td>
</tr>
<tr>
<td>5.</td>
<td></td>
<td></td>
<td>2</td>
<td>think what ......................... film (negative)?</td>
<td>what does a photographer do when .......... film (negative)?</td>
</tr>
<tr>
<td>6.</td>
<td></td>
<td></td>
<td>3</td>
<td>two polygons of ...................... are similar.</td>
<td>two polygons with the same number of sides are said to be similar.</td>
</tr>
<tr>
<td>7.</td>
<td></td>
<td></td>
<td>6</td>
<td>But ......................... similar.</td>
<td>But all the circles are similar as they have same shape</td>
</tr>
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<td>8.</td>
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<td>4</td>
<td>symbolically</td>
<td>symbolically</td>
</tr>
<tr>
<td>9.</td>
<td>8</td>
<td>193</td>
<td>5</td>
<td>For similarity of polygons only .................</td>
<td>For the two polygons to be similar, only,.................</td>
</tr>
<tr>
<td>10.</td>
<td></td>
<td>194</td>
<td>1 (.2)</td>
<td>Write the true .....................</td>
<td>Write true.....................</td>
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<td>11.</td>
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<td>194</td>
<td>8.3</td>
<td>In the example ...................... similarity.</td>
<td>Given below are the two triangles which show the property of similarity.</td>
</tr>
<tr>
<td>12.</td>
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<td>3</td>
<td>Take any ruled..................... on that ............. with base .....................lines.</td>
<td>Take ............. on it with one of the lines as the base.</td>
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<td>13.</td>
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<td>205</td>
<td>8.4</td>
<td>If in two ............. the sides .....................</td>
<td>In two triangles, if the sides .....................</td>
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<td>14.</td>
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<td>207</td>
<td>1</td>
<td>relation is symbolic             in symbolic form.</td>
<td></td>
</tr>
<tr>
<td>15.</td>
<td>8</td>
<td>209</td>
<td></td>
<td>Eg : 7 Gopal ...................... living room from ...... top floor window.</td>
<td>Gopal ........ living room through the window from .... top floor.</td>
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<td>16.</td>
<td>8</td>
<td>211</td>
<td>8.5</td>
<td>ratio (spelling)                ratios</td>
<td></td>
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<tr>
<td>17.</td>
<td>8</td>
<td>214</td>
<td>8.6</td>
<td>You are ........ theoren, you had .............</td>
<td>..........theoren, as you.............</td>
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<td>18.</td>
<td>8</td>
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<td>8.9</td>
<td>Pythagores (spelling)                Pythagoras</td>
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<td>19.</td>
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<td>Eg : 11 Pythagorous                Pythagoras</td>
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<td>20.</td>
<td>Eg : 12</td>
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<td>Pythagoras</td>
<td>Pythogoras</td>
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<td>occur</td>
<td>occurs</td>
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<td>222</td>
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<td>wrong assumption</td>
<td>assumption that the negation of the statement as true.</td>
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<td>Pt 5</td>
<td>Leaves</td>
<td>leaves</td>
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<td>224</td>
<td>Pt 5</td>
<td>Flies due north</td>
<td>Flies towards north</td>
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<td>9.2 Acti</td>
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<td>rotate</td>
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<td>9.2.1</td>
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<td>....what we just</td>
<td>found i.e the ......</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>found the tangent</td>
<td></td>
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<td>233</td>
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<td>such that</td>
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<tr>
<td>15</td>
<td>Mathematical modeling</td>
<td>-</td>
<td>February</td>
</tr>
</tbody>
</table>

**Note:** As per examination reforms, the syllabus has been divided into Paper-I and Paper-II. Hence, teachers should note these changes and follow accordingly in their teaching.