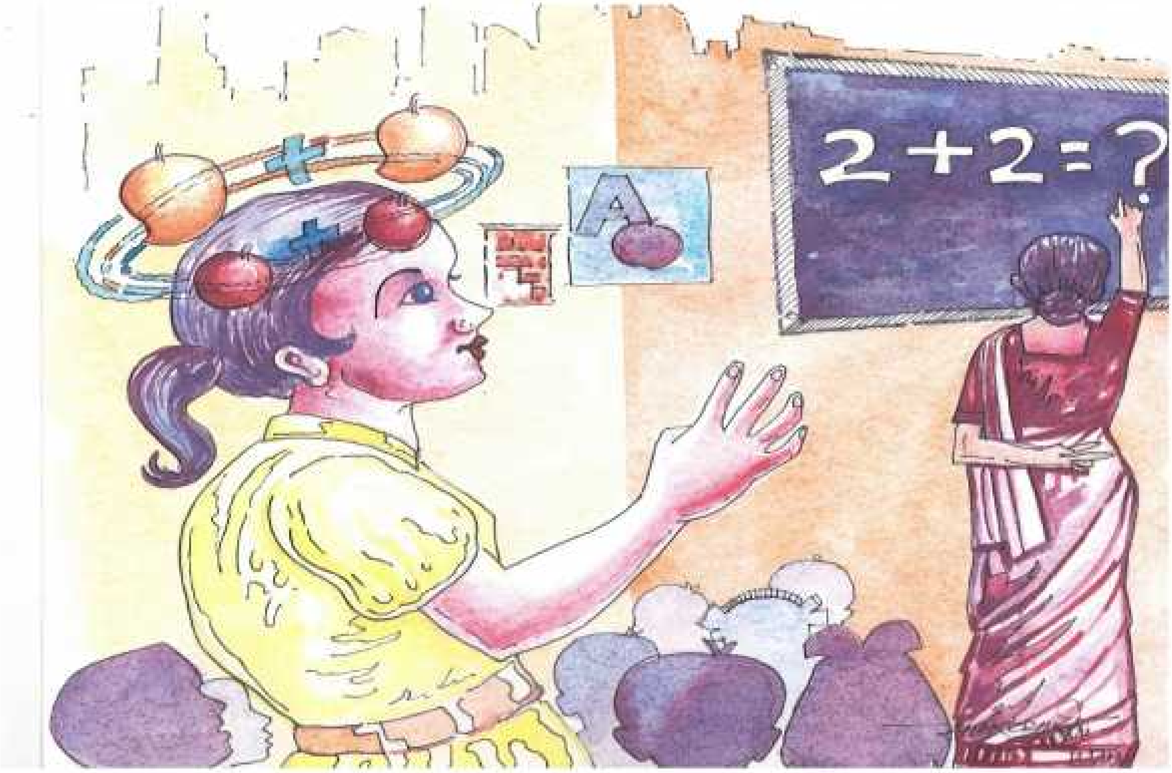
शिक्षा का अधिकार

सर्व शिक्षा अभियान

सब पढ़ें सब बढ़ें

GOVERNMENT OF GOA

GOA SARVA SHIKSHA ABHIYAN



SYLLABUS AND LEARNING INDICATORS MATHEMATICS VI, VII & VIII

APPROVED BY

STATE COUNCIL OF EDUCATIONAL RESEARCH AND TRAINING

GOVT OF GOA

शिक्षा का अधिकार

सर्व शिक्षा अभियान

सब पढ़ें सब बढ़ें

GOVERNMENT OF GOA

GOA SARVA SHIKSHA ABHIYAN

PORVORIM GOA

SYLLABUS
AND
LEARNING INDICATORS
IN
MATHEMATICS
FOR
CLASSES VI, VII & VIII

APPROVED BY
STATE COUNCIL OF EDUCATIONAL RESEARCH AND TRAINING
GOVT OF GOA

THE CONSTITUTION OF INDIA

PREAMBLE

WE, THE PEOPLE OF INDIA, having solemnly resolved to constitute India into a **SOVEREIGN SOCIALIST SECULAR DEMOCRATIC REPUBLIC** and to secure to all its citizens:

JUSTICE, social, economic and political;

LIBERTY of thought, expression, belief, faith and worship;

EQUALITY of status and of opportunity; and to promote among them all

FRATERNITY assuring the dignity of the individual and the unity and integrity of the Nation;

IN OUR CONSTITUENT ASSEMBLY this twenty-sixth day of November, 1949, do **HEREBY ADOPT, ENACT AND GIVE TO OURSELVES THIS CONSTITUTION.**

PART - I
SYLLABUS IN MATHEMATICS
FOR CLASSES VI - VIII

INDEX

PART - II
LEARNING INDICATORS

INDEX

PREFACE

Ministry of Human Resource and Development (MHRD) has approved the following quality improvement programmes for the State of Goa during the current academic year 2014-15:

1. Early Literacy programme for Std: I and II (Language and Mathematics)
2. EVS, English and Mathematics for Std: III, IV and V
3. Mathematics and Science for Std: VI, VII and VIII

NCERT has developed stage-wise learning indicators based on **The National Curriculum Framework (NCF-2005)** and the syllabi along with **stage-wise curricular expectations.**

The state's focussed programme for classes VI to VIII during the year 2014-15 aims to improve learning in Science and Mathematics. About 733 teachers at this stage will be trained for 3 days with a focus on teaching of Science. This training would include amongst others an understanding of learning indicators and assessment and evaluation practices based on learning indicators. Minimum one teacher is identified from each school for this programme during the year 2014-15. State has further committed to conduct studies to measure improvement in **learning levels** of the students (SLAS). With this Quality Improvement Programme, it is expected to show an increase of 10% over the State's own baseline SLAS survey conducted during the year 2013-14 for Class VII.

The learning outcomes/curricular expectations are generally treated as assessment standards. However, it is necessary to understand clearly that curricular expectations/learning outcomes needs to be achieved to the best possible level irrespective of the fact that these may or may not be used as testable construct.

The learning indicators given in Part II are based on the approved syllabus given in Part I of this handbook. The Learning Indicators have a broad range across the three classes and they aim at improving children's learning at different levels. Guidelines for teachers given at the end of each curricular area will further enhance quality in classroom transactions.

It is hoped that this handbook would provide meaningful insights into the progress and accomplishments of children's overall development from class to class and finally reach up to the expected learning level at each stage of Mathematics learning.

It is expected that Mathematics teachers would use this handbook as their personal copy; and also note their best practices, student's achievements, children's joyful and wholehearted participation in learning activity, their quality of learning, development of children's understanding etc in the space provided in this booklet. Sharing of this feedback among other teachers would certainly help create quality improvement. The material in this booklet is useful even to the parents in understanding 'growth' of children's understanding of Mathematics.

Goa Sarva Shiksha Abhiyan is grateful to Secretary Education, Shri D. P. Dwivedi, IAS, for his invaluable support and encouragement for the endeavours by GSSA.

We are thankful to the Director of Education Shri Gajanan Bhat and the Director of SCERT Shri Nagraj Honnekeri for their valuable guidance in implementing Learning Indicators in the schools at Elementary Stage in the State.

Place: Porvorim

Dated : 19-12-2014

Minanath T. Upadhye
State Project Director
Goa Sarva Shiksha Abhiyan

PREAMBLE

Why this document?

India's 12th Five Year Plan (2012-2017) notes that the four main priorities of education policies have been **Access, Equity, Quality and Governance**. The document also continues to prioritize these four areas, but places the greatest emphasis on **improving learning outcomes at all levels.** Various educational surveys, educational data over the years indicated that learning achievements of children in various subjects particularly in **Languages, Maths, EVS, Science and Social Sciences** are not satisfactory. The Joint Review Mission's reports of SSA of last few years also mentioned that the learning levels of children are not up to the desirable level in spite of all the efforts being made by the states such as timely availability of textbooks and other learning materials, training of teachers, regular monitoring, etc. It is a fact that many a times, **teachers complete the textbooks but they do not have clear idea what kind of learning they are expecting from children in respective subjects.** Generally teachers use textbooks that would only provide a broad idea as to how to transact the textual material inside and outside the classroom.

The **NPE 1986 and POA 1992** emphasized that the essential levels of learning should be laid down and children's achievement should periodically be assessed so as to keep track of the progress towards the NPE goal of ensuring that all children achieve essential levels of learning. Steps were indeed initiated to put into practice the NPE formulation. **MLLs** were developed class-wise and subject-wise for primary stage in 1992 in the form of competencies. However, over time MLLs appear to have faded away from the educational discourse because the target of educational achievement became the MLLs and not the formation of experimental / critical minds. The development of **class-wise competencies** made this exercise more product and rubric-oriented, rather than focusing on overall development of children.

The National Curriculum Framework (NCF-2005) and the syllabi developed as a follow up for various curricular areas at each level (class) consciously do not provide class-wise learning outcomes/ curricular expectations but talk about **stage-wise curricular expectations.** The learning outcomes or curricular expectations are generally treated as assessment standards. It is therefore necessary to develop clarity that curricular expectations/learning outcomes are achieved to the best possible way whether these may or may not be used as testable construct.

Broadly, curricular expectations define what each child should to know, able to do and the disposition that should be acquired over a period of time. Curricular expectations are not to be measured class-wise but need to be achieved by the **end of a particular stage** as these are long term targets of the Curriculum i.e. abilities, attitudes, values, etc. **Learning Indicators along with the pedagogical processes will help achieve these curricular expectations.**

The **learning indicators** have been developed for each class i.e. at the end of each class from class I to class VIII. The 'learning indicators' need to lay down the **'essential levels of learning'** as postulated by the NPE;

The Learning Indicators help in a number of ways by:

- Understanding learning as a process
- Focusing and understanding children's learning on a continuum of learning
- Respond positively to diversity and helping all children to participate fully and achieve well.
- Providing a reference point for parents, children and others to understand the learning of every child in a simple way
- Providing a framework for monitoring, learning and reporting progress about the child

The present exercise is aimed to clarify some misconceptions or confusions related to these areas. With the implementation of CCE, teachers are using **CCE as a pedagogic tool.** They are expected to regularly assess children's progress as per their pace of learning and provide feedback. Research is consistent across countries, content area and age groups- show that using assessment for learning improves all student achievement more than external texts or educational reforms. **CCE also provides opportunities to teachers to use it as an assessment tool so that children's knowledge, understanding, various skills, attitudes, values, etc could be developed over a period of time.**

Children construct their knowledge and have different learning styles. Thus learning process needs to be seen as a continuum. As we all know in teaching-learning paradigm whatever we plan (inputs) for expected learning of a child, must be translated and reflected in the child's behaviour. However, the path Teaching learning strategies have to be planned according to the needs of the children. **For children with disabilities,** sign language, audible books, tactile maps and the likes are required. The teacher will have to determine the needs as she/ he interacts with the child, **while drawing her plan from curricular expectation to transaction and from transaction to attainment.** Without identifying learning indicators it is even more difficult for a teacher or a system to move further or improve learning levels. So there is a need to develop well defined learning indicators to meet the curricular expectations.

Teachers cannot think in isolation to achieve these curricular expectations. **Pedagogical interventions** that are required to achieve these expectations have also been given for each curricular area. These pedagogical processes provide examples which would help the teachers and other users to understand the extent and the nature of learning on the part of the children related to each curricular area.

The present exercise would also encourage the States to lay down learning indicators and learning outcomes through a joint effort of the Centre and States. The States have the full liberty to adopt/adapt these indicators/ outcomes as per their needs. This proposal is made in view of the fact that an important objective of planning in our country has been removal of disparities in achieving the objectives of educational and pedagogic planning.

All children up to the elementary stage irrespective of their abilities/disabilities, social-economic ethnic background or gender, have right to education. **Our school education needs to support our children to develop their knowledge, understanding, range of skills and dispositions to act in the future life as productive citizen.** Children have variations in their abilities, dispositions and personal social qualities. Some children have special needs i.e. physical, communication, sensory and/or emotional needs that affect their learning. Some disadvantages may influence their learning such as gender discrimination at home, development delay, limited experiences in early years. Providing appropriate and enriched experiences and modifying the teaching learning strategies help meet the identified learning needs of our children. **Inclusive approach** not only addresses the diverse needs of children but also provides opportunities to learn from each other. School programmes/activities should coordinate with the community services so as to meet the social, emotional, physical and learning needs of all children including those with special needs.

What does the document include?

NCERT has developed class-wise learning indicators. These have been developed in all the subject areas namely English, Hindi, Urdu, Mathematics, EVS, Science, Social Sciences and Arts Education. Children learn in a spiral way and not in a linear way; therefore the learning indicators have a broad range across the classes and stages and aim to include children learning at different levels. The document follows the nature and its approach to each curricular area as envisaged in NCF-2005. It also provides **guidelines for users** given at the end of each curricular area. Some of the guidelines are common but subject specific guidelines have also been provided. This document would provide useful and meaningful insights into the progress and accomplishments of children at various stages of their overall development and finally reach up to the expected learning level at each stage. This would serve as a useful document to parents and to the system at large about the quality of learning and development of children during the elementary stage of school education.

Part I

SYLLABUS

MATHEMATICS

FOR CLASSES VI, VII & VIII

Introduction:

The development of the upper primary syllabus has attempted to emphasise the **development of mathematical understanding and thinking** in the child. It emphasises the need to look at the upper primary stage as the stage of transition towards **greater abstraction**, where the child will move from using concrete materials and experiences to deal with abstract notions. It has been recognized as the stage wherein the child will learn to use and understand **mathematical language including symbols**. The syllabus aims to help the learner realise that mathematics as a discipline **relates to our experiences** and is used in daily life, and also has an abstract basis. All concrete devices that are used in the classroom are scaffolds and props which are an intermediate stage of learning. There is an emphasis in taking the child through the **process of learning to generalize**, and also checking the generalization. Helping the child to develop a **better understanding of logic** and appreciating the **notion of proof** is also stressed.

The syllabus emphasises the need to go from concrete to abstract, consolidating and expanding the experiences of the child, helping her generalise and learn to **identify patterns.** It would also make an effort to give the child many **problems** to solve, **puzzles** and **small challenges** that would help her engage with underlying concepts and ideas. The emphasis in the syllabus is not on teaching how to use known appropriate algorithms, but on helping the child develop an understanding of mathematics and appreciate the need for and develop different **strategies for solving and posing problems**. This is in addition to giving the child ample exposure to the standard procedures which are efficient. Children would also be expected to formulate problems and solve them with their own group and would try to make an effort to make mathematics a part of the outside classroom activity of the children. The effort is to take mathematics home as a hobby as well.

The syllabus believes that **language** is a very important part of developing mathematical understanding. It is expected that there would be an opportunity for the child to understand the language of mathematics and the structure of logic underlying a problem or a description. It is not sufficient for the ideas to be explained to the child, but the effort should be to help her **evolve**

her own understanding through engagement with the concepts. Children are expected to evolve their own definitions and measure them against newer data and information. This does not mean that no definitions or clear ideas will be presented to them, but it is to suggest that sufficient scope for their own thinking would be provided.

Thus, the course would de-emphasise algorithms and remembering of facts, and would emphasise the ability to follow logical steps, develop and understand arguments as well. Also, an overload of concepts and ideas is being avoided. We want to emphasise at this stage **fractions, negative numbers, spatial understanding, data handling and variables** as important corner stones that would formulate the ability of the child to understand abstract mathematics. There is also an emphasis on developing an understanding of spatial concepts. This portion would include symmetry as well as representations of 3-D in 2-D. The syllabus brings in data handling also, as an important component of mathematical learning. It also includes representations of data and its simple analysis along with the idea of chance and probability.

The underlying philosophy of the course is to develop the child as being confident and competent in doing mathematics, having the foundations to learn more and developing an interest in doing mathematics. The focus is not on giving complicated arithmetic and numerical calculations, but **to develop a sense of estimation and an understanding of mathematical ideas**.

General Points in Designing Textbook for Upper Primary Stage Mathematics:

1. The emphasis in the designing of the material should be on **using a language that the child can and would be expected to understand herself** and would be required to work upon in a group. The teacher to only provide support and facilitation.

2. The entire material would have to be immersed in and emerge from **contexts of children**. There would be expectation that the children would verbalise their understanding, their generalizations, their formulations of concepts and propose and improve their definitions.

3. There needs to be space for children to reason and provide **logical arguments for different ideas**. They are also expected to follow logical

arguments and identify incorrect and unacceptable generalisations and logical formulations.

4. Children would be expected to observe patterns and **make generalisations**. Identify exceptions to generalisations and extend the patterns to new situations and check their validity.

5. Need to be aware of the fact that there are not only many ways to solve a problem and there may be many alternative algorithms but there may be many alternative strategies that may be used. **Some problems need to be included that have the scope for many different correct solutions**.

6. There should be a consciousness about the **difference between verification and proof**. Should be exposed to some simple proofs so that they can become aware of what proof means.

7. The book should not appear to be dry and should in various ways **be attractive to children**. The points that may influence this include; the language, the nature of descriptions and examples, inclusion or lack of illustrations, inclusion of comic strips or cartoons to illustrate a point, inclusion of stories and other interesting texts for children.

8. Mathematics should emerge as a **subject of exploration and creation** rather than finding known old answers to old, complicated and often convoluted problems requiring blind application of un-understood algorithms.

9. The purpose is not that the children would learn known definitions and therefore never should we begin by definitions and explanations. Concepts and ideas generally should be arrived at from observing patterns, exploring them and then trying to define them in their own words. **Definitions should evolve at the end of the discussion, as students develop the clear understanding of the concept.**

10. Children should be expected to **formulate and create problems** for their friends and colleagues as well as for themselves.

11. The textbook also must expect that the teachers would formulate many **contextual and contextually needed problems** matching the experience and needs of the children of her class.
12. There should be **continuity of the presentation within a chapter and across the chapters**. Opportunities should be taken to give students the feel for need of a topic, which may follow later.

CLASS-WISE COURSE STRUCTURE
IN MATHEMATICS
AT UPPER PRIMARY LEVEL

Class VI	Class VII	Class VIII
Number System (60 hrs) **(i). *Knowing our Numbers:*** • Consolidating the *sense* of numberness up to 5 digits, Size, estimation of numbers, identifying smaller, larger, etc. • Place value (recapitulation and extension) • Connectives: use of symbols =, <, > and use of brackets, word problems on number operations involving large numbers up to a maximum of 5 digits in the answer after all operations. This would include conversions of units of length & mass (from the larger to the smaller units), estimation of outcome of number operations.	**Number System (50 hrs)** **(i). *Knowing our Numbers: Integers:*** • Multiplication and division of integers (through patterns). Division by zero is meaningless • Properties of integers (including identities for addition & multiplication, *commutative*, *associative*, *distributive*) (through patterns). These would include examples from whole numbers as well. Involve expressing commutative and associative properties in a general *form*. Construction of counter examples, including some by children. Counter examples like subtraction is not commutative. • Word problems including integers (all operations)	**Number System (50 hrs)** **(i). *Rational Numbers:*** • Properties of rational numbers. (Including identities). Using general form of expression to describe properties • Consolidation of operations on rational numbers. • Representation of rational numbers on the number line • Between any two rational numbers there lies another rational number (Making children see that if we take two rational numbers then unlike for whole numbers, in this case you can keep finding more and more numbers that lie between them.)

Introduction to a sense of the largeness of, and initial familiarity with, large numbers up to 8 digits and approximation of large numbers)		• Word problem (higher logic, two operations, including ideas like area)
(ii). ***Playing with Numbers:*** • Simplification of brackets, Multiples and factors, divisibility rule of 2, 3, 4, 5, 6, 8, 9, 10, 11. (All these through observing patterns. Children would be helped in deducing some and then asked to derive some that are a combination of the basic patterns of divisibility.) Even/odd and prime/composite numbers, Co-prime numbers, prime factorisation, Every number can be written as products of prime factors. HCF and LCM, prime factorization and division method for HCF and LCM,	**(ii).** ***Fractions and rational numbers:*** • Multiplication of fractions • Fraction as an operator • Reciprocal of a fraction • Division of fractions • Word problems involving mixed fractions • Introduction to Rational Numbers (with representation on number line) • Operations on rational numbers (all operations) • Representation of rational number as a decimal. • Word problems on rational numbers (all operations) • Multiplication and division of decimal fractions • Conversion of units (length & mass)	**(ii).** ***Powers:*** • Integers as exponents. • Laws of exponents with integral powers

the property: LCM × HCF = product of two numbers. All this is to be embedded in contexts that bring out the significance and provide motivation to the child for learning these ideas.	• Word problems (including all operations)	
(iii) ***Whole numbers:*** • Natural numbers, whole numbers, properties of numbers (commutative, associative, distributive, additive identity, multiplicative identity), number line. Seeing patterns, identifying and formulating rules to be done by children. *(As familiarity with algebra grows, the child can express the generic pattern.)*	**(iii)** ***Powers:*** • Exponents only natural numbers. • Laws of exponents (through observing patterns to arrive at generalisation) (i) $a^m . a^n = a^{m+n}$ (ii) $(a^m)^n = a^{mn}$ (iii) $\frac{a^m}{a^n} = a^{m-n}$, where $m - n \in N$ (iv) $a^m . b^m (ab)^m$	**(iii)** ***Squares, Square roots,*** ***Cubes, Cube roots:*** • Square and Square roots • Square roots using factor method and division method for numbers containing: (a) no more than total 4 digits and (b) no more than 2 decimal places • Cubes and cubes roots (only factor method for numbers containing at most 3 digits) • Estimating square roots and cube roots. Learning the process of moving nearer to the required number.
(iv) ***Negative Numbers and***		**(iv)** ***Playing with***

Integers: • How negative numbers arise, Models of negative numbers, Connection to daily life, Ordering of negative numbers, Representation of negative numbers on number line. *Children to s*ee patterns, identify and formulate rules. What are integers, Identification of integers on the number line, Operation of addition and subtraction of integers, Showing the operations on the number line (addition of negative integer reduces the value of the number) Comparison of integers, Ordering of integers.		***numbers:*** • Writing and understanding a 2 and 3 digit number *in generalized form* ($100a + 10b + c$, where a, b, c can be only digit 0-9) and engaging with various puzzles concerning this. (Like finding the missing numerals represented by alphabets in sums involving any of the four operations.) Children to solve and create problems and puzzles. • Number puzzles and games • Deducing the divisibility test rules of 2, 3, 5, 9, 10 for a two or three-digit number expressed in the general form.

(v) *Fractions*: • Revision of what a fraction *is*, • Fraction as a part of whole, • Representation of fractions (pictorially and on number line), • Fraction as a division, • Proper, improper & mixed fractions, equivalent fractions, • Comparison of fractions, • Addition and subtraction of fractions (Avoid large and complicated unnecessary tasks). • (Moving towards abstraction in fractions) • Review of the idea of a decimal *fraction*, • Place value in the context of decimal *fraction*, • Inter conversion of fractions and decimal fractions (avoid recurring decimals at this stage),		

• Word problems involving addition and subtraction of decimals (two operations together on money, mass, length and temperature)		
Algebra (15 hrs) **INTRODUCTION TO ALGEBRA:** • Introduction to variable through patterns and through appropriate word problems and generalizations (example 5 × 1 = 5 etc.) • Generate such patterns with more examples. • Introduction to unknowns through examples with simple contexts (single operations)	**Algebra (20 hrs)** **ALGEBRAIC EXPRESSIONS:** • Generate algebraic expressions (simple) involving one or two variables • Identifying constants, coefficient, powers • Like and unlike terms, • Degree of expressions e.g., x2 y etc. (exponent ≤ 3, number of variables) • Addition, subtraction of algebraic expressions (coefficients should be integers). • Simple Linear Equations in one variable (in contextual problems) with two operations (avoid complicated coefficients)	**Algebra (20 hrs)** **ALGEBRAIC EXPRESSIONS:** • Multiplication and division of algebraic expressions • (Coefficient should be integers) • Some common errors (e.g. $2 + x \neq 2x$, $7x + y \neq 7xy$) • Identities $(a \pm b)2 = a2 \pm 2ab + b2$, $a2 - b2 = (a - b)$ (a + b). • Factorisation (simple cases only) as examples the following types: $a(x + y)$, $(x \pm y)2$, $a2 - b2$, $(x + a).(x + b)$ • Solving linear equations in one variable in contextual problems involving multiplication and division (word

		problems). (Avoid complex coefficient in the equations)
Ratio and Proportion: (15 hrs) • Concept of Ratio • Proportion as equality of two ratios • Unitary method (with only direct variation implied) • Word problems	**Ratio and Proportion: (20 hrs)** • Ratio and proportion (revision) • Unitary method continued, consolidation, general expression. • Percentage - an introduction. • Understanding percentage as a fraction with denominator 100. • Converting fractions and decimals into percentage and vice-versa. • Application to profit and loss (single transaction only). • Application to simple interest (time period in complete years).	**Ratio and Proportion: (25 hrs)** • Slightly advanced problems involving applications on percentages, profit & loss, Overhead Expenses, Discount, tax. • Difference between simple and compound interest (compounded yearly up to 3 years or half-yearly up to 3 steps only), Arriving at the formula for compound interest through patterns and using it for simple problems. • Direct variation – Simple and direct word problems. • Inverse variation – Simple and direct word problems. • Time & work problems– Simple and direct word problems.

Geometry: (65 hrs)	**Geometry: (60 hrs)**	**Geometry: (40 hrs)**
(i) *Basic geometrical ideas (2 -D)*: • Introduction to geometry. Its linkage with and reflection in everyday experience. • Line, line segment, ray. • Open and closed figures. • Interior and Exterior of *closed* figures. • Curvilinear and Linear *boundaries*. • Angle — Vertex, arm, interior and exterior. • Triangle — vertices, sides, angles, interior and exterior, altitude and median • Quadrilateral — Sides, vertices, angles, diagonals, adjacent sides and opposite sides (only convex quadrilateral are to be discussed), Interior and Exterior of a quadrilateral.	**(i) *Understanding shapes:*** • Pairs of angles: (linear, supplementary, complementary, adjacent, vertically opposite) (verification and simple proof of vertically opposite angles) • Properties of parallel lines with transversal (alternate, corresponding, interior, exterior angles)	**(i) *Understanding shapes:*** • Properties of quadrilaterals – Sum of angles of a quadrilateral is equal to 3600 (By verification) • Properties of parallelogram (By verification): i. Opposite sides of a parallelogram are equal, ii. Opposite angles of a parallelogram are equal, iii. Diagonals of a parallelogram bisect each other. [Why (iv), (v) and (vi) follow from (ii)] iv. Diagonals of a rectangle are equal and bisect each other. v. Diagonals of a rhombus bisect each other at right angles. vi. Diagonals of a square are equal and bisect each other at right angles.

• Circle — Centre, radius, diameter, arc, sector, chord, segment, semi-circle, circumference, interior and exterior.		
(ii) *Understanding Elementary Shapes* (*2-D and 3-D*): • Measure of Line segment • Measure of angles • Pair of lines – Intersecting and perpendicular lines – Parallel lines • Types of angles- acute, obtuse, right, straight, reflex, complete and zero angle • *Classification* of triangles (*on the basis of* sides, and of angles) • Types of quadrilaterals – Trapezium, parallelogram, rectangle, square, rhombus. • Simple polygons *(introduction)* (Upto octagons regulars as well as non regular).	**(ii) *Properties of triangles:*** • Angle sum property (with notions of proof & verification through paper folding, Proofs using property of parallel lines, difference between proof and verification.) • Exterior angle property. • Sum of two sides of, and its third side. • Pythagoras Theorem (Verification only)	

<table>
<tr>
<td>

Identification of 3-D shapes: Cubes, Cuboids, cylinder, sphere, cone, prism (triangular), pyramid (triangular and square).

Identification and locating in the surroundings.

Elements of 3-D figures. (Faces, Edges and vertices).
Nets for cube, cuboids, cylinders, cones and tetrahedrons.

</td>
<td></td>
<td></td>
</tr>
<tr>
<td>
(iii) Symmetry: (reflection):

Observation and identification of 2-D symmetrical objects for reflection symmetry.
Operation of reflection (taking mirror images) of simple 2-D objects.
Recognising reflection symmetry (identifying axes).

</td>
<td>
(iii) Symmetry:

Recalling reflection symmetry.
Idea of rotational symmetry, Observations of rotational symmetry of 2-D objects. (900, 1200, 1800)
Operation of rotation through 900 and 1800 of simple figures.
Examples of figures with both rotation and reflection symmetry (both operations)

</td>
<td></td>
</tr>
</table>

	Examples of figures that have reflection and rotation symmetry and vice-versa	
	(iv) *Representing 3-D in 2-D:* • Drawing 3-D figures in 2-D showing hidden faces. • Identification and counting of vertices, edges, faces, nets (for cubes cuboids, and cylinders, cones). • Matching pictures with objects (Identifying names) • Mapping the space around approximately through visual Estimation.	**(ii) *Representing 3-D in 2-D*** • Identify and Match pictures with objects [more complicated e.g. nested, joint 2-D and 3-D shapes (not more than 2)]. • Drawing 2-D representation of 3-D objects (Continued and extended) • Counting vertices, edges & faces & verifying Euler's relation for 3-D figures with flat faces (cubes, cuboids, tetrahedrons, prisms and pyramids).
	(v) Congruence: • Congruence through superposition examples blades, stamps, etc.) • Extend congruence to simple geometrical shapes e.g. triangles, circles.	

	• Criteria of congruence (by verification) SSS, SAS, ASA, RHS.	
(iv) Constructions: (using Straight edge Scale, protractor, compasses): • Drawing of a line segment. • Construction of circle. • Perpendicular bisector. • Construction of angles (using protractor). • Angle 60°, 120° (Using Compasses). • Angle bisector- making angles of 30°, 45°, 90° etc. (using compasses). • Angle equal to a given angle (using compass). • Drawing a line perpendicular to a given line from a point a) on the line b) outside the line.	**(vi) Construction (Using scale, protractor, compass):** • Construction of a line parallel to a given line from a point outside it. (Simple proof as remark with the reasoning of alternate angles). • Construction of simple triangles. Like - given three sides, given a side and two angles on it, given two sides and the angle between them.	**(iii)** ***Construction: Construction of Quadrilaterals:*** • Given four sides and one diagonal. • Three sides and two diagonals. • Three sides and two included angles. • Two adjacent sides and three angles.

Mensuration: (15 hrs)	**Mensuration: (15 hrs)**	**Mensuration: (15 hrs)**
CONCEPT OF PERIMETER AND INTRODUCTION TO AREA: • Introduction and general understanding *of perimeter* using many shapes. • Shapes of different kinds with the same perimeter. • Concept of area. Area of a rectangle and a square. *Counter examples to different mis-concepts related to perimeter and area.* • Perimeter of a rectangle – and its special case – a square. • Deducing the formula of the perimeter for a rectangle and then a square through pattern and generalisation.	**PERIMETER AND INTRODUCTION TO AREA:** • Revision of perimeter, • Idea of, Circumference of Circle. ***Area:*** • Concept of measurement using a basic unit area of a square, rectangle, triangle, parallelogram and circle, • Area between two rectangles and two concentric circles.	**AREA AND VOLUME:** (i) Area of a trapezium and a polygon. (ii) Concept of volume, measurement of volume using a basic unit, volume of a cube, cuboid and cylinder. (iii) Volume and capacity (measurement of capacity). (iv) Surface area of a cube, cuboid, cylinder.

Data handling:(10 hrs)	**Data handling: (15 hrs)**	**Data handling: (15 hrs)**
(i) What is data? (ii) Choosing data to examine a hypothesis. (iii) Collection and organisation of data – Examples of organizing it in tally bars and a table. (iv) Pictograph - Need for scaling in pictographs, interpretation & construction. (v) Making bar graphs for given data interpreting bar graphs.	(i) Collection and organisation of data – Choosing the data to collect for a hypothesis testing. (ii) Mean Median and Mode of ungrouped data – Understanding what they represent. (iii) Constructing bar graphs. (iv) Feel of probability using data through experiments. Notion of chance in events like tossing coins, dice etc. Tabulating and counting occurrences of 1 through 6 in a number of throws. Comparing the observation with that for a coin. Observing strings of throws, notion of randomness.	(i) Reading bar-graphs, ungrouped data, arranging it into groups, (ii) Representation of grouped data through bar-graphs, constructing and interpreting bar-graphs. (iii) Simple Pie charts with reasonable data numbers. (iv) Consolidating and generalizing the notion of chance in events like tossing coins, dice etc. Relating it to chance in life events. Visual representation of frequency outcomes of repeated throws of the same kind of coins or dice. (v). Throwing a large number of identical dice/coins together and aggregating the result of the throws to get large number of individual events. (vi) Observing the aggregating numbers

		over a large number of repeated events. (vii) Comparing with the data for a coin. (viii) Observing strings of throws, notion of randomness
		INTRODUCTION TO GRAPHS: (15 hrs) **Preliminaries:** (i) Axes (Same units), Cartesian Plane. (ii) Plotting points for different kind of situations (perimeter vs length for squares, area as a function of side of a square, plotting of multiples of different numbers, simple interest vs number of years etc.) (iii) Reading off from the graphs. (iv) Reading of linear graphs. (v) Reading of distance vs time graph.

CLASS-WISE CONTENT-WISE ALLOCATION OF PERIODS (Prescribed)

SR. NO.	CONTENT	CLASS VI	CLASS VII	CLASS VIII
	1. Number System	60	50	50
	2. Algebra	15	20	20
	3. Ratio & Proportion	15	20	25
	4. Geometry	65	60	40
	5. Mensuration	15	15	15
	6. Data Handling	10	15	15
	7. Graphs	0	0	15
	TOTAL PERIODS:	**180**	**180**	**180**

CLASS-WISE CONTENT-WISE NUMBER OF PERIODS

(Teachers may write in the boxes below the actual number of periods utilised during the current academic year)

SR. NO.	CONTENT	CLASS VI	CLASS VII	CLASS VIII
	1. Number System			
	2. Algebra			
	3. Ratio & Proportion			
	4. Geometry			
	5. Mensuration			
	6. Data Handling			
	7. Graphs			
	TOTAL PERIODS:			

LEARNING INDICATORS IN MATHEMATICS
CLASSES VI, VII AND VIII

Curricular Expectations:

- Moves from number sense to number patterns.
- Sees relationships between numbers and looks for patterns in relationships.
- Gains proficiency in using newer language of mathematics like, variables, expressions, equations, identities etc.
- Uses arithmetic and algebra to solve real life problems and poses meaning to problems.
- Discover symmetries and acquire sense of aesthetics by looking around regular shapes like triangles, circles, quadrilaterals etc.
- Comprehend the idea of space as reason enclosed with in boundaries of a shape.
- Relate numbers with shapes in terms of perimeter, area and volume and uses them to solve every day life problems.
- Learn to provide reasoning and convincing arguments to justify their own conclusions particularly in mathematics.
- Collects, represents (graphically and in tables) and interprets data/information from her/his life experiences.

Conceptual Areas, Pedagogical Processes and Learning Indicators in Mathematics

CLASS VI

Conceptual Area	Pedagogical Processes	Learning Indicators
Numbers: • Consolidates the sense of numberness up to 5 digits in terms of its size of estimation. • Gets familiar with large numbers up to 8 digits. • Understands the importance of brackets and other symbols like, =, <, >. • formulates divisibility rules of 2, 3, 4, 5, 10and uses them as and when required. • Appreciates the classification of numbers as even, old, prime, co prime etc.	• Through various situations make children compare numbers up to 5 digits like cost of two houses, number of spectators present in two cricket matches etc. • Number patterns could be used to extend numbers up to 8 digits and then daily life situations involving 8 digit numbers could be discussed e.g. cost of property. • Involve children in classification of numbers on the basis of tier properties like even, odd, multiples and factors. These numbers can be used to classify numbers into various categories. • Divisibility rules can be introduced using patterns, and then different division problems could be discussed to show their	• Create situations around her in which she finds numbers. • Through situations like money transactions, measuring of height, budget etc. child uses larger numbers and thus appreciates their use. • Child reduces fractions involving larger numbers to simplest (lowest) forms. • Child attempts to construct examples through which she demonstrates the understanding of classification of numbers on the basis of tier properties like even, odd, multiples and factors.

	use. For example, let children form multiplication tables of different numbers like 2, 3, 4, etc and then from the multiplication facts ask them to identify the pattern like multiple of 3 has sum its digits divisible by 3, multiple of 5 has either 5 or zero in its ones place etc.	
• Understands the significance of HCF and LCM and finds them. • By observing patterns identifies and formulates rules for whole numbers. • Appreciates the need for negative numbers. • Through patterns formulates rules for ordering of integers, their representation on number line, addition and subtraction of integers etc. • Represents fractions and decimals pictorially and on number line. • Finds sum and difference of two fractions.	• Encourage children to create number patterns through which HCF and LCM can be discussed. • Different number operations could be performed by students which through discussions could help to know the different properties like closure, commutatively etc. • Situations could be created and discussed in which numbers are required to be represented for opposite situations, like directions, give and take situations etc. • Daily life situations and pictures could be presented to introduce fractions and decimals like representing part of a whole as number, a dot mark placed to separate rupees and paisa, meter	• Given a fraction child identifies a situation for 0 in the given fraction. • Uses divisibility rules to find factors of a number. • Demonstrates her ways of finding HCF and LCM of two numbers. • Devises her strategies to identify appropriate situations to use the concepts of HCF and LCM. • Creates daily life situations where opposites are involved and represents such quantities by positive and negative numbers. • Makes her own strategies of ordering, adding and subtracting integers.

	and centimeter, kilometer and meter, liter and milliliter etc. • Encourage children to look at the pictures showing sum and difference of like fractions and to generalize. • Let children evolve that to add or subtract two unlike fractions it is required to convert them into equivalent fractions of same denominators (like fractions)	
2. Algebra • Understands variables through patterns. • Classifies quantities as variable and constant. **Ratio and Proportion** • Understands how the comparison of two quantities through ratio is different from comparisons done earlier. • Understands the meaning of proportion. • Knows how ratio and proportion are related to unitary method.	• Situations may be presented before the children that would prompt them to form patterns and feel the need for a symbol in place of number. • Discussions may be held to show different methods of comparison of quantities are helpful in different situation. • Children may be encouraged to create examples to show the difference between comparison of quantities done through operation of subtraction and that	• Child tries to identify a pattern. • Child tries to formulate the pattern identified by her and tries to suggest a symbol for a general term of the pattern. • Child tries to construct examples that require the concept of ratio. • By constructing examples child tries to know how the concept of proportion is built upon that of ratio. • While solving problems

• Solves problems related to daily life using unitary method.	through ratio. • Examples could be discussed to show the difference between ratio and proportion and to relate them. • Daily life problems related to unitary method could be discussed that lie in child's everyday life like shopping, finding rate etc.	on unitary method child tries to understand unit of which quantity is to be found. • Finds rate and the total amount in related context using unitary methods.
3. Geometry: • Differentiates between different geometrical figures on the basis of their observable properties. • Classifies angle into different types on the basis of their measurement. • Understands the difference between different types of triangles and the basis on which they are classified. • Classifies Quadrilaterals as trapezium parallelogram, rectangle, square and rhombus. • Identifies 3-D shapes and their parts.	• Activities can be performed in which students can be shown concrete models and pictures of different geometrical shapes. • Students can be involved in activities related to identification of angles, triangles & quadrilaterals and nets. • A better way of connecting 2-D with 3-D is relating nets of various solids with their shapes. • Models and Nets of 3-D shapes can be made by students to get an idea of their edges, faces etc. • Discussion can be held after showing objects to the children.	• Classifies angles in different groups/types. • Child tries to draw different types of triangles and quadrilaterals. • Child attempts to prepare solids using their Nets. • Child observes the objects and tries to make strategies to decide about the symmetry of the object. • Child observes the reflection of objects in mirror and then tries to formulate rules about the symmetry of the object.

• Identifies 2-D symmetrical objects. • Understands reflection symmetry. • Constructs angles of different measures using compasses. • Draws perpendicular line segments.	• Activities can be performed using mirror and children may be made to observe the reflections. The observations can then be discussed. Folding a paper cutout of a shape along specific lines can also be used to show the reflection symmetry in case the two halves exactly cover each other. • After discussing the drawing of 60° angle using compasses, the construction of other angles like 30°, 120° etc. can be discussed with the children. Give then a feel of dividing a circle into equal segments that correspond to angle. For example a circle can be divided into six equal parts by the chords of length equal to radius of the circle and this actually forms $1/6^{th}$ of complete angle i.e 60^{o} at the centre. • Different geometrical figures may be given to draw that involves angles of various measures, line segments etc.	• Child tries to see the logic behind drawing an angle of certain measure using geometrical properties. • After learning to draw an angle of certain measure child tries to devise ways to draw related angles.
Mensuration: • Understands the concept of perimeter of a shape.	• Different shapes can be shown to the students and through the notion of boundary; the concept of perimeter can be	• Child tries to calculate the perimeter of different shapes given. • She tries to formulate

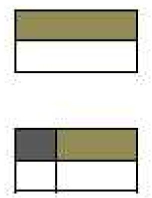
• Understands the concept of area of a shape.	discussed. • Discussion can be held about boundary and region, which can lead to concept of area.	the perimeter of shapes like rectangle, square etc. • Child tries to calculate the areas of rectangle and square by dividing them into appropriate smaller units. She tries to think of such small units.
Data Handling: • Understand the use of organizing data. • Represent data through pictograph, bar graph.	• Daily life situation involving quantitative information can be discussed with students. • Discussion can be held about why data should be organised. • Children can be motivated to use their own ways of organising data. • Children may be asked to explore their own ways of representing the data in picture and in table of numbers.	• Child tries to identify daily life situations in which the information is required to be properly arranged. • Child tries to explore different ways to organise and represent data.

Conceptual Areas, Pedagogical Processes and Learning Indicators in Mathematics

CLASS VII

Conceptual Area	Pedagogical Processes	Learning Indicators
Numbers: • Multiplication and division of integers. • Properties of integers. • Problem solving using operations on integers. • Multiplication and division of fractions. • Introduction to rational numbers. • Operations on rational numbers. • Decimal representation of rational numbers. • Multiplication and division of decimal fractions. • Problem solving using operations on rational numbers and decimal fractions. • Exponents.	• The rules for multiplication and division of whole numbers have already been studied by children. Involve children in discussion to find their ways of multiplying integers. • Use of patterns in multiplying a negative integer by another integer may be a new idea for children as up till now they have learnt that multiplication is repeated addition or an operator in case of fractions. • Give proper time to children to appreciate why product of two negative integers is positive. Similarly encourage children to explore, and using concept of dividing a natural number by another by simply finding the number which when multiplies the divisor	• Multiplies integers by using patterns and generalizes the rules to multiply a positive integer by a negative integer, a negative integer by a positive integer and two negative integers. • Divides two integers by using patterns and forms rules to perform division in integers. • Multiplies fractions by using patterns/paper folding/pictures and generalizes the rules. • Divides fractions by using patterns/visualization/picture and forms rules. • Forms rules to add, subtract, multiply and divide rational numbers by using the operations on fractions and integers. • Represents a rational number as decimal fraction and forms rules for operations on decimal fractions. • Uses exponential form and their rules to solve problems related to repeated

	gives the dividend as product. So to find -4 ÷ -2, we have to find the number which on multiplication with -2 gives the result -4. Many children will be able to infer that the required number must be +2. Many such examples will help the child to make their own rule like +ve ÷ -ve = -ve, -ve ÷ +ve = -ve and –ve ÷ -ve = +ve. • Involve children in classification of numbers on the basis of their properties like even, odd, multiples and factors. These numbers can be used to classify numbers into various categories. • Divisibility rules can be introduced using patterns, and then different division problems could be discussed to show their use. For example, let children form multiplication tables of different numbers like 2, 3, 4, etc and then from the	multiplication. • Observes patterns in multiplication tables and forms divisibility rules.

	multiplication facts ask them to identify the pattern like multiple of 3 has sum of its digits divisible by 3, multiple of 5 has either 5 or zero in its ones place etc. • Utilise children's knowledge about describing multiplication of fractions as operator 'of' and explain by paper folding, shading parts of whole etc. for example ⅓ x ½ is one-third of one-half which can be shown as  • The double shaded region is one-sixth of the whole which shows that. ⅓ x ½ = ⅙. • Let children do lot of such sums and observe the pattern that in all cases the product of fractions can be obtained by multiplying their numerators and their denominators.	– –

	Similarly_ ½ ÷ ¼ means the number of one fourths in one-half. Simple visualization is required to find that one-half contains two one-fourths. Let children observe pattern and find their own ways of dividing a fraction by another fraction. • Involve children in exploring their ways of writing repeated multiplication in short form as repeated addition is represented by multiplication. • With discussion let the children reach to the conclusion of writing repeated multiplication in exponent form.	
Algebra: **ALGEBRAIC EXPRESSIONS:** • Generate algebraic expressions. • Performs operations on algebraic expressions. • Simple linear equations in one variable (in contextual problems) with two operations.	• Use child's context and encourage them to generate algebraic expressions by proper choice of variable/unknown and operations. • Child's daily life experiences like adding/subtracting a group of 2 notebooks and 5 pencils to/from	• Forms, adds and subtracts algebraic expressions involving one or two variables/unknowns. • Expresses situations into simple linear equations and solves them.

	another group of 3 notebooks and 8 pencils etc. Let children form their own rule that like terms can only be added or subtracted. • Involve children in groups of three or four to explore situations which can be expressed by simple equations and solve them. Textbooks have many such examples.	
Ratio and Proportion: • Ratio and proportion and Unitary method continued. • Understanding percentage as a fraction with denominator 100. • Percentage and conversion of fractions and decimals into percentage and vice versa. • Application to profit and loss (single transaction only). • Application to simple interest (time period in complete years).	• Children know about many ways of comparing quantity. • Utilise their experiences to conclude that ratio is another way of comparing quantities. • Percentages and their applications are also in child's daily life experiences which can be used to form various formulae and solving problems using them.	• Describes ratios as percentage and forms formulae for profit/loss and simple interest using unitary method.

Geometry: **Understanding shapes:** • Pairs of angles (linear, supplementary, complementary, adjacent, vertically opposite) • Properties of parallel lines with transversal (alternate, corresponding, interior, exterior angles). •	• Diagrams and use of upper primary mathematics kit (developed by NCERT) help children in visualizing the relationship between various pairs of angles when a transversal cuts two lines (parallel and non parallel), angles of triangle and relationship among its sides.	• Identifies pairs of angles like linear, supplementary, complementary, adjacent and vertically opposite and finds the one when other is given. • Hypothesize the relationship between pairs of angles out of eight angles formed by a transversal with parallel lines.
Properties of triangles: • Angle sum property. • Exterior angle property. Pythagoras Theorem (Verification only)	• Involve children in experimentation with measurement of sides of right angled triangles and recognition of pattern to hypothesize the Pythagorean relation.	• Verifies angle sum and other properties of triangles and uses these properties to find unknown elements of a triangle.
Symmetry: o Recalling reflection symmetry o Idea of rotational symmetry, observations of rotational symmetry of 2-D objects. (90^o, 120^o, 180^o)	• Conduct activities with children given in textbooks (paper folding and observing diagrams) and encourage children to visualize symmetry and criterion for rotational symmetry of various shapes.	• Appreciates the rotational symmetry of various shapes and figures.
Representing 3-D in 2-		

D: o Identification and counting of vertices, edges, faces, nets (for cubes cuboids, and cylinders, cones). o Mapping the space around approximately through visual estimation.		• Reads simple maps and forms her own maps like home to school, map of her village, house etc.
Congruence: o Congruence through superposition. o Extend congruence to simple geometrical shapes e.g. triangles, circles. o Criteria of congruence.	• Children working in groups with traced copies of various shapes and superimposing one above the other help them in establishing congruence criterion.	• Establishes congruence criterion for triangles and circles.
Construction: o Construction of a line parallel to a given line from a point outside it. o Construction of simple triangles.		• Constructs simple triangles when three out of six elements are given (like three sides, two sides and included angle, a side and two angles etc.)
Mensuration: • Revision of perimeter and Idea of Circumference of Circle.	• Involve children in activities targeted to measurement of region enclosed by closed figures on a plan surface and	• Measures approximate area of simple regular and irregular closed shapes by using unit square grid sheet.

	encourage them to come to the conclusion that a unit is required.	
Area: • Concept of measurement using a basic unit area of a square, rectangle, triangle, parallelogram and circle.	• Conduct activities related to measuring units squares within a figure drawn on a square grid and to compare various regions.	• Forms formulae to find area of the region enclosed in a rectangle and a square as a better way of counting the number of units squares that fill them completely.
Data handling: • Collection and organisation of data – choosing the data to collect for a hypothesis testing. • Mean, median and mode of ungrouped data – understanding what they represent. • Constructing bar graphs. • Feel of probability using data.	• Utilize child's daily life experiences and contextual problems to test hypothesis by collection and organization of data. • Situations like finding a representative value to data help in understanding the idea of finding mean, median and mode of ungrouped data. • Staring with small sets of numbers will be easier to visualize and represent it by bar graphs. • Involve children in drawing inferences for future events from the existing data.	• Finds various representative values for simple data from her daily life. • Represents data by simple bar graphs and interprets them.

Conceptual Areas, Pedagogical Processes and Learning Indicators in Mathematics

CLASS VIII

Conceptual Area	Pedagogical Processes	Learning Indicators
Number System: **Rational Numbers***:* • Properties of rational numbers. (Including identities). Using general form of expression to describe properties. • Representation of rational numbers on the number line. • Between any two rational numbers there lies another rational number. • Word problem.	• Involve children in writing general form of rational numbers and to associate it with rules of algebra. The operations on algebraic expressions will help in describing properties of rational numbers. • Let children use the rules for comparison of integers and fractions to develop their own rules for comparison of rational numbers. • Encourage children to conclude that the half of the sum of two rational numbers lies between them and thus a rational number can be obtained between any two rational numbers. Provide hints to the children to reach to the conclusion that the process of finding a rational number between any two numbers never stops and thus there lies infinite many rational numbers between any two rational numbers. • Making children see that if we take two rational numbers then unlike for whole numbers, in this case you can keep finding more and more numbers that lie between	• Describes properties of rational numbers and expresses them in general form. • Performs operations on rational numbers. • Reach to the conclusion that between any two rational numbers there lies infinite many rational numbers.

	them. • Make children observe patterns in square numbers and to form their rules for perfect square numbers and square roots. • Likewise let children observe patterns in perfect cube numbers and form rule for cube root numbers.	
Powers • Laws of exponents with integral powers. • Square and Square roots using factor method and division method for numbers containing (a) no more than total 4 digits and (b) no more than 2 decimal places. • Cubes and cube roots (only factor method for numbers containing at most 3 digits).	• Allow children to play with numbers to find square roots and cube roots using prime factorization. • Let children practice the division method to find square roots of numbers. Utilising child's understanding about algebra introduces the generalised form of 2 and 3 digit numbers and to prove divisibility test of numbers.	• Finds square, square root, cube and cube root of numbers using different methods. Provide logic and valid reasoning for divisibility tests of 2, 3, 5, 9 and 10.
Playing with numbers • Writing and understanding a 2 and 3 digit number *in generalized form* (100*a* + 10*b* + *c*, where *a*, *b*, *c* can be only digit 0-9) and engaging with various puzzles Children to solve and create problems and puzzles. • Deducing the divisibility test rules of 2, 3, 5, 9, 10 for a two or three-digit number expressed in the general form.	• Make children observe patterns in square numbers and to form their rules for perfect square numbers and square roots. • Likewise let children observe patterns in perfect cube numbers and form rule for cube root numbers. • Allow children to play with numbers to find square roots and cube roots using prime factorization. • Let children practice the	• Finds square, square root, cube and cube root of numbers using different methods. Provide logic and valid reasoning for divisibility tests of 2, 3, 5, 9 and 10.

	division method to find square roots of numbers.	
Algebra **Algebraic Expressions** • Multiplication and division of algebraic expression (Coefficient should be integers). • Identities $(a \pm b)^2 = a^2 \pm 2ab + b^2$, $a^2 - b^2 = (a - b)$ (a + b) • Factorisation (simple cases only) as examples the following types $a(x + y)$, $(x \pm y)^2$, $a^2 - b^2$, $(x + a)(x + b)$ • Solving linear equations in one variable in contextual problems involving multiplication and division (word problems) (avoid complex coefficient in the equations). **Ratio and Proportion** • Slightly advanced problems involving applications on percentages, profit & loss, overhead expenses, Discount, tax. • Difference between simple and compound interest (compounded yearly up to 3 years or half-yearly up to 3 steps only • Direct and inverse variations – Simple and direct word problems • Time & work problems–	• The multiplication of algebraic expressions based upon the distributive property of multiplication over addition and subtraction of numbers. Moreover children already have the idea that same number multiplied repeatedly can be expressed in powers and the same is true for variables. Let children develop their own results for algebraic identities by using the multiplication of algebraic expressions. • Continuing the idea of numerical coefficient and factors of a term to evolve methods of writing an expression in terms of product of two or more expressions. This will lead to the factorisation of algebraic expressions. • Give special emphasis to the common errors that children commit while learning algebra like $2 + x = 2x$, $7x + y = 7xy$ *etc.)*, Arriving at the formula for compound interest through patterns and using it for simple problems.	• Multiplies two algebraic expressions and forms algebraic identities for square of binomials. • Factorizes an algebraic expression using identities. • Describes simple contextual situations into linear equations and solves them using different methods.

Simple and direct word problems		
Geometry **Understanding shapes:** • Properties of quadrilaterals – Angle Sum property. • Properties of parallelogram (By verification) (i) Opposite sides of a parallelogram are equal, (ii) Opposite angles of a parallelogram are equal, (iii) Diagonals of a parallelogram bisect each other. (iv) Diagonals of a rectangle are equal and bisect each other. (v) Diagonals of a rhombus bisect each other at right angles. (vi) Diagonals of a square are equal and bisect each other at right angles. **Representing 3-D in 2-D** • Identify and Match pictures with objects [more complicated e.g. nested, joint 2-D and 3-D shapes (not more than 2)]. • Drawing 2-D representation of 3-D objects (Continued and extended). • Counting vertices, edges & faces & verifying Euler's relation for 3-D figures with flat faces (cubes, cuboids, tetrahedrons, prisms and pyramids).	Involve children in activities of measuring angles and sides of shapes like quadrilaterals and parallelograms and to identify patterns in the relationship among them. Let them make their hypothesis on the basis of the generalisation of the patterns and later on to verify their assertions. Involve children in expressing/representing a 3-D shape into 2-D from their life like drawing a box on plane surface, showing bottles on paper etc. Let children make nets of various shapes like cuboids, cubes, pyramids, prisms etc. Again from nets let them make the shapes and to establish relationship among vertices, edges and surfaces. Through pattern let them reach to Euler's relation. Children enjoy constructing various figures by using compasses and a straight edge. But it is also important to involve children to argue why a particular step is required. For example, on drawing an arc using compasses we find all those points that are at the given distance from the point where the metal end of the compasses was placed.	• Generalizes sum of angles of quadrilateral and uses it in solving various problems related to finding angles of a quadrilateral. • Explains properties of parallelograms and tries to reason out how one property is related to other. • Represents 3-D shapes on a plane surface like paper, board, wall etc. • Makes nets of prisms and pyramids and forms the shapes from the nets. • Identifies relationship among number of edges, vertices and surfaces in various 3-D shapes and generalizes it.

Construction of Quadrilaterals: • Given four sides and one diagonal. • Three sides and two diagonals. • Three sides and two included angles. • Two adjacent sides and three angles.		Constructs quadrilaterals using compasses and straight edge given • Four sides and one diagonal • Three sides and two diagonals • Three sides and two included angles • Two adjacent sides and three angles
Mensuration • Area of a trapezium and a polygon. • Surface area of a cube, cuboid, cylinder. • Concept of volume, measurement of volume using a basic unit, volume of a cube, cuboid and cylinder. • Volume and capacity (measurement of capacity).	• Children already know the method of finding area of a rectangle. Let children discuss in groups to convert trapezium and parallelograms into rectangles of equal area. This will help them in formation of formulae to find these areas. • In finding surface areas of cube and cuboid involve children in opening such boxes and realize that all these surfaces are made up of rectangles and squares only. The rest of the job of finding total surface area will only be to add these areas. Children already have vocabulary related to measurement of volume and capacity through their daily life experiences. Involve them in activities to get a feel of filling a given space and to measure it by just counting the unit items that fill it completely. This will also	• Finds area of trapezium and polygons by using square grid and also by using formulae. • Forms formula to find volume of a cuboid by observing and generalizing patterns of counting units cubes that completely fill the cuboids. • Finds surface area of cuboid and cube through their nets and later on by using formulae.

	help them in deciding why a cube is taken as a unit of measuring volume.	
Data handling • Arranging ungrouped data into groups, representation of grouped data through bar graphs, constructing and interpreting bar graphs. • Simple Pie charts with reasonable data numbers. • Consolidating and generalising the notion of chance in events like tossing coins, dice etc. Relating it to chance in life events.	Conduct activities related to throwing a large number of identical dice/coins together and aggregating the result of the throws to get large number of individual events. Involve children in making their assumption for the future events on the basis of the above data. Observing the aggregating numbers over a large number of repeated events also help in forecasting the chances of future events comparing with the data for a coin. Observing strings of throws will help children in developing notion of randomness.	Makes hypothesis on chances of coming events on the basis of its earlier occurrences like after repeated throws of dice and coins.
Introduction to graphs • Axes (Same units), Cartesian Plane. • Plotting points for different kind of situations (perimeter vs length for squares, area as a function of side of a square, plotting of multiples of different numbers, simple interest vs number of years etc.) • Reading off from the graphs o Reading of linear graphs o Reading of distance vs time Graph	Involve children in representing the rectangular arrangement of children in a class by using numbers and encourage them to come to the conclusion of using two axes and a unit. By this way they will appreciate that each child can be identified by a pair of numbers. Making such drawings will help in categorizing the set of points as in a line or on a curve or randomly placed	Draws and reads points plotted on Cartesian plane.

Guidelines for Users

i. The columns in the Table-1 reflect curricular expectations and pedagogical processes.

The first column, curricular expectations provide learning goals as the child moves from class VI to class VIII through content and themes mentioned in this column are perceived as a vehicle to achieve the goals of Mathematics curriculum at upper primary stage. The teaching-learning process or pedagogical processes are built along the Mathematics content keeping in the mind the cognitive reach of a child. It imbibes active participation of learner and provides opportunity to construct knowledge utilising multiple resources. The major focus of the process is to create learning environment.

ii. The columns in Table-2 highlight learning indicators class wise which reflects the progress of learning. These are suggestive and may be adopted or adapted as per the need and context.

These pedagogical processes and learning indicators would help in implementation of CCE effectively.

Children with special needs require to be taken along with class and it is desired to design alternate activities keeping in view the learning objectives similar to those to the others. The teacher should take into account the specific problem of the child and plan alternate strategies for teaching learning process. A healthy inclusive classroom environment provides equal opportunity to all the students, those with and those without learning difficulties can learn together. The measures to be adopted may include:

- Develop process skills through group activities and use of ICT for simulation, repeated practices and evaluation.
- Assess learning progress through different modes taking cognizance of the learner's response.
- Observation of the child's engagement in multiple activities, through varied ways and levels of involvement.

- Use of adapted equipments/devices (for e.g. Visual output devices should have aural output and vice versa)

- Use of embossed diagram in the pedagogical process and learning progress.

- Use of adapted equipments in observation and exploration.

- Use of multiple choice questions to get responses from children who find difficult to write or explain verbally.

SOFTWARE

Following Software in Excel Formal is produced by Goa Sarva Shiksha Abhiyan for automation.

Software at Sr. No (1) and (2) below are supplied to all Schools in the State and all Computer Teachers are trained to use them in their schools for automated generation of school results.

Software at Sr. NO. (4) to (9) are supplied to all CRPs and BRPs to facilitate generation of QMT Reports.

(1) Automated generation of Students' Performance in Grades as prescribed under CCE by SCERT in all Formative and Summative Tests/Examinations, Scholastic and Co-scholastic Achievement, subject wise and test wise, Permanent School Record of students' Performance etc. (For Upper Primary Classes) in English.
(2) Automated generation of Students' Performance in Grades as prescribed under CCE by SCERT in all Formative and Summative Test/Examination, Scholastic and Co-scholastic Achievement, subject wise and test wise, Permanent School Record of students' Performance etc. (For Primary Classes) in English.
(3) Automated generation of Students' Performance in Grades as prescribed under CCE by SCERT in all Formative and Summative Tests/Examinations, Scholastic and Co-scholastic Achievement, subject wise and test wise, Permanent School Record of students' Performance etc. (For Primary Classes in Marathi).
(4) Automated Generation of Learner's Assessment for Primary Classes for each quarter. (For Clusters, Blocks, Districts and State)
(5) Automated Generation of Learner's Assessment for Upper Primary Classes for each Quarter. (For Clusters, Blocks, Districts and States)
(6) Automated Generation of Enrolment and Attendance for each Quarter. (For Clusters, Blocks, Districts and States)
(7) Automated calculation of Average Daily Attendance for the previous Month, for clusters, Blocks, Districts and State (For Boys)
(8) Automated calculation of Average Daily Attendance for the previous Month, for Clusters, Blocks, districts and State (For Girls)
(9) Automated calculation of Average Daily Attendance for the previous Month, for Clusters, Blocks, Districts and State (For all Student).

Narendra J. Kamat
State Quality Co-ordinator
Goa Sarva Shiksha Abhiyan, Porvorim.

(Instruction to Printer – Please insert the following matter on first and last inside cover pages)

This Handbook is the Personal Copy of Shri/Smt. … Mathematics teacher of ………………………………. …..… School … … … … … …

My special efforts towards enhancing Quality of Mathematics Education in my school are as under:

A.	**Five best Activity Based Worksheets prepared by me for pupils' understanding of Concepts in Mathematics syllabus. (Write titles)**
1	
2	
3	
4	
5	
B	**Five pedagogic initiatives/ strategies/best practices adopted by me for improving teaching-learning process in my Mathematics class.**
1	
2	
3	
4	
5	
C	**Five good practices adopted by me for monitoring the progress of pupils' learning in my Mathematics class.**
1	
2	
3	
4	
5	

D	**Five prominent examples in which training inputs are being used by me in my day-to-day interactions with my students for quality improvement in my Mathematics class.**
1	
2	
3	
4	
5	
E	**Five examples of professional support I provide to my fellow teachers teaching Mathematics.**
1	
2	
3	
4	
5	

(Note to Printer: This is the last outside cover page. Please insert a border to this cover page with background colour).

Arise, awake, sleep no more; within each of you there is the power to remove all wants and all miseries. Believe this, and that power will be manifested.

- Swami Vivekananda

Real learning comes about when the competitive spirit has ceased.

- J. Krishnamurti

Strength does not come from physical capacity. It comes from an indomitable will.

- Mahatma Gandhi

The highest education is that which does not merely give us information but makes our life in harmony with all existence.

- Ravindranath Tagore

All the creatures are pleased by loving words; and therefore we should address words that are pleasing to all, for there is no lack of sweet words.

- Chanakya