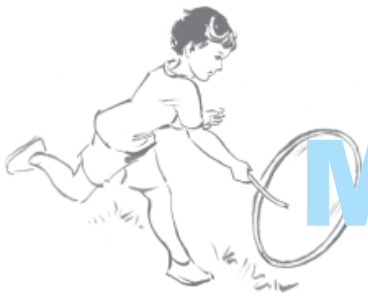

MATHEMATICS

MATHEMATICS
CLASSES VIII

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 recognised 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 maybe many alternative strategies that maybe 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 VIII

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.)
- Word problem (higher logic, two operations, including ideas like area)

(ii) ***Powers***

- Integers as exponents.
- Laws of exponents with integral powers

(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

Class VIII

- 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) ***Playing with 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.

Class VIII

Algebra **(20 hrs)**

(i) ***Algebraic Expressions***

- Multiplication and division of algebraic exp.(Coefficient should be integers)
- Some common errors (e.g. $2 + x \neq 2x$, $7x + y \neq 7xy$)
- 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 (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 (40 hrs)

(i) ***Understanding shapes:***

- Properties of quadrilaterals – Sum of angles of a quadrilateral is equal to 360^0 (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.

(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)

(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

Class VIII

Mensuration **(15 hrs)**

(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 **(15 hrs)**

(i) Reading bar-graphs, ungrouped data, arranging it into groups, representation of grouped data through bar-graphs, constructing and interpreting bar-graphs.

(ii) Simple Pie charts with reasonable data numbers

(iii) Consolidating and generalising 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.

Throwing a large number of identical dice/coins together and aggregating the

result of the throws to get large number of individual events. Observing the aggregating numbers over a large number of repeated events. Comparing with the data for a coin. 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

- Reading of linear graphs
- Reading of distance vs time graph