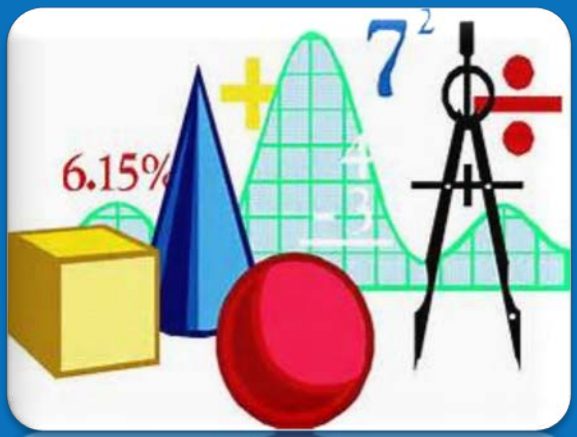
Mathematics



The Core concepts of Mathematics for Class VI are as follows:

Class VI

- Number System
- Ratio and Proportion
- Algebra
- Geometry
- Mensuration
- Data Handling

Theme 1: Number System

The idea about numbers that children built-up up to class V is of representing the number of items/objects in a collection. But in class VI children have to initiate the learning of numbers that are abstract which starts with negative numbers and extension of whole numbers to integers. This is the stage where the collection of integers is seen as a system that satisfy certain properties and have correlated structure.

A preparation of the extension of fractions and integers to rational numbers also takes place in this class. A gradual move helps children in developing these concepts. Let children observe various patterns while applying operations on integers and fractions (common and decimals). Generalization of these patterns will lead to many properties of integers and decimal fractions.

The multiples and factors of numbers can be obtained by just playing with numbers. Therefore, it is expected that children will learn about these concepts through a play way method. Children will be enabled to explore and develop their own rules for finding HCF and LCM of two or more numbers.

Learning Outcomes:

Children will be able to:

- create situations around them in which they find negative numbers;
  - through situations like money transactions, measuring of height budget etc. child uses larger numbers and thus appreciates their use;
  - reduces fractions involving larger numbers to simplest (lowest) forms;
- identify a situation for a given fraction (like proper, improper, equivalent, etc.);
- construct examples through which they demonstrate the addition and subtraction of integers;
- create daily life situations where opposites are involved and represent such quantities by positive and negative numbers;
- make their own strategies of ordering, adding and subtracting integers;
- use divisibility rules to find factors of a number;
- demonstrate ways of finding HCF and LCM of two numbers;
- devise strategies to identify appropriate situations to use the concepts of HCF and LCM.

Number System		
Key Concepts	**Suggested Transactional Processes**	**Suggested Learning Resources**
Numbers • Word problems on number operations involving large numbers This would include conversions of units of length & mass (from the larger to the smaller units).	• Revising previous concepts learnt by children. • Building on children's previous learning. • Extending number up to 8 digits through patterns that exist in numbers up to five digits and then citing/observing daily life situations e.g. cost of property, • Involving children in the activities that include classification of numbers on the basis of their properties like even, odd, multiples and factors. These properties can be used to classify numbers in to various categories.	• Number cards to create large numbers. • Number cards to demonstrate operations on numbers. • Maths Kit. • Multiplication table chart.
Natural numbers and Whole numbers. • Natural numbers. • Whole numbers. • Properties of numbers (commutative, associative, distributive, additive identity, multiplicative identity). • Number line.	• Provide opportunities to children to understand that whole numbers are extension of natural numbers with the number zero included in it. • Provide children opportunities to perform operations of natural numbers with zero and to form rules like when zero is added to any number or subtracted from any number the result is the same number.	• Maths Kit. • Geoboard with rubber band. • Videos/Life history of Mathematicians and their contributions.

Number System		
Key Concepts	**Suggested Transactional Processes**	**Suggested Learning Resources**
Negative Numbers and Integers • Need for negative numbers. • Connection of negative numbers in daily life. • Representation of negative numbers on number line. • Ordering of negative numbers, Integers. • Identification of integers on the number line, • Operation of addition and subtraction of integers, • Addition and subtraction of integers on the number line • Comparison of integers, ordering of integers.	• Conducting activities in the classes in groups of 4-5 children to represent opposite situations by numbers like moving up and down from a reference point, paying and getting some amount etc. • Asking children to extend the number line to represent negative numbers and zero along with natural numbers and let them realise that corresponding to every positive numbers there is a negative number and vice-versa.	• Maths Kit. • Geoboard with rubber band.
Fractions • Revision of Fractions, proper, improper and mixed fractions by activity only (no sums to be set from this topic) • Equivalent fractions. • Comparison of fractions, • Operations on fractions (Avoid large and complicated unnecessary tasks). (Moving towards abstraction in fractions). • Addition and Subtraction of like and unlike fractions, day to day application problems using fractions. • Word problems involving addition and subtraction of decimals (two operations together on money, mass, length and temperature).	• Encouraging children to demonstrate similar such products by paper folding and to generalise that product of two fractions can be obtained by multiplying the numerators to get numerator and denominator can be obtained by multiplying denominators.	• Maths Kit

Number System		
Key Concepts	**Suggested Transactional Processes**	**Suggested Learning Resources**
Playing with Numbers • Simplification of brackets. • Multiples and factors, (Revision of the prime factorisation by tree method and division method to be done in class but no problems to be set for evaluation from these.) • HCF and LCM, prime factorization and division method for HCF and LCM, the property LCM × HCF = product of two numbers. All the above concepts are to be embedded in children's contexts so that it brings out the significance and provide motivation to the child for learning these ideas.	• Encouraging children to create number patterns through which HCF and LCM can be discussed. • Conducting activities for number operations to be performed by children which through discussions could help them to know the different properties like closure, commutativity, associativity etc. • Creating situations in which numbers are required to be represented for opposite situations, like directions, give and take situations etc. And discuss with children about the ways to represent such situations by numbers. • Presenting daily life situations and pictures to introduce fractions and decimals like representing part of a whole as number, a dot mark placed to separate rupees and paisa, metre and centimetre, kilometre and metre, litre and millilitre etc. • Encouraging children to look at the pictures showing sum and difference of like fractions and to generalize. • Letting children work on their own to evolve and understand that to add or subtract two unlike fractions it is required to convert them into equivalent fractions of same denominators (like fractions).	• Maths Kit.

Life Skills: Solving daily life problems

Theme 2: Ratio and Proportion

There are many situations when two quantities are compared by using properties of division of numbers, like heights of two objects as one is half of other or double of other. Using such contexts the terminologies related to ratios need to be brought in home for children. The theme in this class mainly focuses on the basic idea of ratios and proportions which ultimately lead to the major applications of arithmetic in our daily life called commercial 'mathematics'. Percentage, unitary method, simple and compound interests, time and speed, work and time and profit and loss will be focused on in classes VII and VIII. Hence building a strong foundation in Class VI about ratio and proportion is very important.

Learning Outcomes:

Children will be able to:

- understand how the comparison of two quantities through ratio is different from comparisons done earlier;
- explain the meaning of proportion;
- try to construct examples that require the concept of ratio
- solve problems related to speed, distance and time.

Ratio and Proportion		
Key Concepts	**Suggested Transactional Processes**	**Suggested Learning Resources**
▸ Difference between fraction and ratio. ▸ Concept of Ratio. ▸ Proportion as equality of two ratios. ▸ Word problems on ratio and proportions. (Only simple daily life problems to be included) ▸ Idea of percent as fraction with 100 as denominator ▸ Idea of speed and simple daily life problems related to speed, time and distance.	▸ Revising previous concepts learnt by children. ▸ Building on children's previous learning. ▸ Presenting situations before the children that would prompt them to form patterns and feel the need for a symbol in place of number. ▸ Organising discussions in the class to show different methods of comparison of quantities are helpful in different situation(s). ▸ Encouraging children to create examples to show the difference between comparison of quantities done through operation of subtraction and that through division (ratio) ▸ Discussing examples to show the difference between ratio and proportion and to relate them.	▸ Maths Kit.

Life skill: solving daily life problems

Theme 3: Algebra

Children have idea of using symbols/letters for numbers from very early classes. Even in class I children use to solve problem like 5+ □ = 7, □ + □ = 9 etc. and in class V they learnt that perimeter of a square is 4 x where x is it's side. Thus the introduction of this topic should be made through these examples which children are already acquainted with and avoid directly bring the abstract idea of variable, unknowns and constants. The aim of this theme in this class is that children will be enabled to understand algebra as generalization patterns on numbers in term of using a letter of any number. Ultimately children learn that algebra is generalization of arithmetic and hence we use all rules as we have in number operations.

Learning Outcomes:

Children will be able to:

- describe variable and unknown through patterns and through appropriate word problems and generalise (example $5 \times 1 = 5$, etc.);
- understand unknowns through examples with simple contexts (single operations as per the examples given);
- define terminology associated with algebra like literal numbers, terms, expressions, factor, coefficient, polynomials, degree, like and unlike terms;
- frame algebraic expressions (No operations on algebraic expressions);
- evaluate value of algebraic expressions by substituting a number for the variable.

Algebra		
Key Concepts	**Suggested Transactional Processes**	**Suggested Learning Resources**
▸ Introduction to constants, variable and unknown through patterns and through appropriate word problems and generalisations (For example $1+3=2^2$, $1+3+5=3^2$, $1+3+5+7=4^2$, sum of first n odd numbers = n^2.). (This is only for introduction to the theme. Detailed discussion and numerical problems not required). ▸ Introduction to unknowns through examples with simple contexts (single operations) ▸ Terminology associated with algebra- like literal numbers,	▸ Revising previous concepts learnt by children. ▸ Building on children's previous learning. ▸ Providing situations which can be mathematically expressed by using numbers and letters in place of numbers like any even number is double of a natural number can be expressed as: Even number= $2n$, where n is a natural number.	▸ Maths Kit

Algebra		
Key Concepts	**Suggested Transactional Processes**	**Suggested Learning Resources**
terms, expressions, factor, coefficient, polynomials, degree, like and unlike terms. ➢ Framing algebraic expressions. ➢ Evaluation of algebraic expressions by substituting a value for the variable. (Operations on algebraic expressions not required) ➢ Introduction to linear equation in one variable. (Only one operation at a time *e.g.*, : x+6 = 10, x-4 = 5, 2x = 8, x/2 =5).		

Skills: Developing efficient strategies for numerical calculation, describing relationships and applying algebraic techniques

Theme 4: Geometry

Children in this class should be now in Van Heile's level 2 of geometry learning i.e. Properties are perceived at Level 2, but they are isolated and unrelated. At Level 2 children would say "I know it's a rectangle because it is closed; it has 4 sides and 4 right angles; opposite sides are parallel; opposite sides are congruent; diagonals bisect each other; adjacent sides are perpendicular; etc...." All the properties known are listed since the student doesn't perceive any relationship between the properties, e.g., one implies the other. There is no knowledge of necessary and sufficient conditions. Like wise children develop their understanding about properties of other shapes and figure in this class.

Learning Outcomes:

Children will be able to:

- differentiate between different geometrical figures on the basis of their observable properties;
- classify angle into different types on the basis of their measurement;
- understand the difference between different types of triangles and the basis on which they are classified;
- classify quadrilaterals as rectangle and square;
- classify angles in different groups/types;
- attempt to prepare solids using their nets;
- try to see the logic behind drawing an angle of certain measure using geometrical properties;
- identify 3-d shapes and their parts;
- identify 2-d symmetrical objects;
- construct angles of different measures using compasses.

Geometry		
Key Concepts	**Suggested Transactional Processes**	**Suggested Learning Resources**
Basic geometrical ideas (2-D): Introduction to geometry. Its linkage with and reflection in everyday experiences. ☛ 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	Revising previous concepts learnt by children. Building on children's previous learning. Performing activities in which students can be shown concrete models and pictures of different geometrical shapes. Involving children in activities to identify, angles, triangles & quadrilaterals and their nets. Asking children to make models and Nets of 3-D shapes to get an idea of their number of edges, faces and corners (vertices) etc. Conduct discussion on number and type of corners, edges and	Maths Kit. Cardboard, Hardboard, cutter, pencil, adhesive, scale. Geometry Boxes. Geoboard with rubber band.

Geometry		
Key Concepts	**Suggested Transactional Processes**	**Suggested Learning Resources**
exterior, altitude and median. ☛ Quadrilateral — Sides, vertices, angles, diagonals, adjacent sides and opposite sides (only convex quadrilaterals are to be discussed), NOTE: Only the property: the sum of interior angles of a quadrilateral is 360 degree to be done. Different types of quadrilaterals are not to be done in detail, only the properties to be stated and the child can be asked to identify or recognise the figure without using any property conditions, only through observation. ☛ Circle — Centre, radius, diameter, arc, sector, chord, segment, semicircle, circumference, interior and exterior. Only the basic terms to be taught ➢ **Understanding Elementary Shapes (2-D and 3-D):** ☛ Measure of Line segment. ☛ Measure of angles. ☛ Pair of lines – Intersecting and perpendicular lines, Parallel lines. NOTE: Only the concept of perpendicular and parallel lines to be covered. Angles formed by two lines and their transversal not be done (e.g. corresponding, alternate angles etc)	faces after showing solid objects to the children like models of cubes and cuboids. ➢ Activity to identify various shapes of quadrilaterals by the children based on observation ➢ Performing activities with mirrors in which children are asked to observe the reflections of one part of a shape with its image and image with the other part. This will be followed by discussion. ➢ Using the activity of folding of a paper cut out of a shape along specific lines to show the reflection symmetry in case the two halves exactly cover each other. ➢ Providing children opportunities to draw an angle measuring 60° using compass. On the basis of this construction let them construct other angles that measure 120° and 90°. ➢ Providing opportunities to children to draw different geometrical figures that involve angles of various measures, line segments etc. ➢ Encouraging children to construct perpendicular bisector of line segment using compass and angles of measure 30^0, 15^0, 45^0, etc. using protractor.	

Geometry		
Key Concepts	**Suggested Transactional Processes**	**Suggested Learning Resources**
☛ 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 – rectangle and square ☛ Identification of 3-D shapes: Cubes and Cuboids, Identification and locating in the surroundings. NOTE: Project work on 'Identification and locating in the surroundings' to be included. ☛ Elements of 3-D figures. (Faces, Edges and vertices). Only cubes and cuboids ☛ Nets for cube and cuboids NOTE: Collaborate with the art class to cover this part **Constructions (using Straight edge Scale, protractor, compasses)** ☛ Drawing of a line segment. ☛ Perpendicular bisector. ☛ Construction of angles (using protractor). NOTE: Use of a protractor to be taught only ☛ Angle 60°, 120° (Using Compasses) ☛ Construction of a circle.		

Integration: Arts Education

Skills: to identify, visualise and quantify measures, relating abstract information to real life situations

Theme 5: Mensuration

In the previous three classes children were learning the measurement of various quantities like length, mass, temperature and time. Mathematically proficient students communicate precisely by engaging in discussion about their reasoning using appropriate mathematical language. The terms students should learn to use with increasing precision are area, surface area, volume, decomposing, edges, dimensions, net, vertices, face, base, height and diagonal. Children continue to strengthen their understanding that area is the number of squares needed to cover a plane figure. Thy will also know the formulas for rectangles. "Knowing the formula" does not mean memorization of the formula but to have an understanding of why the formula works and how the formula relates to the measure (area) and the figure. All children should be enabled to develop this understanding.

Learning Outcomes:

Children will be able to:

- demonstrate the idea of area and volume of shapes;
- calculate the perimeter of different shapes given, she tries to formulate the perimeter of shapes like rectangle, square;
- calculate the areas of rectangle and square by dividing them into appropriate smaller units. she tries to think of such small units;
- use conversion of units of mass, money, time and capacity in different daily life situations.

Mensuration		
Key Concepts	**Suggested Transactional Processes**	**Suggested Learning Resources**
▸ Concept of perimeter and introduction to area ▸ Concept of area, Area of a rectangle and a square ▸ Conversion of units (Mass, time, money, and capacity) from smaller to larger and vice-versa. (Only relevant conversions e.g., milli, centi, m/l/g, kilo to be included) ▸ Counter examples to different misconceptions related to perimeter and area (Only discussion in class, no problems or assessments to be done) ▸ 3 D Figures- Cubes and cuboids	▸ Revising previous concepts learnt by children. ▸ Building on children's previous learning. ▸ Organising discussion in the classroom on the measurement of boundary of a closed shape (2-D) and naming this measure as perimeter. ▸ Forming small groups of 3-4 children to evolve ways to find the measure of a region enclosed by a closed shape on a plane surface. This discussion will lead to understanding the concept of area. ▸ Encouraging children through small hints to drive the rule/formula to find the area of a rectangle when the two adjacent sides are known. ▸ Providing opportunities to solve simple daily life problems involving	▸ Maths Kit. ▸ Use of visuals available in classroom and in surroundings.

Mensuration		
Key Concepts	**Suggested Transactional Processes**	**Suggested Learning Resources**
➢ Introduction of Volume	perimeter and area of rectangular regions. ➢ Encouraging crafts teachers to teach making of cubes and cuboids using nets. Discussing parts of a 3-D shape (faces, edges, vertices) in class using the shapes created by students.	

Skills: solving daily life problems

Theme 6: Data Handling

This theme focusses on building on and reinforcing children's understanding of numbers, they begin to develop their ability to think statistically. Children recognize that a data distribution may not have a definite centre and that different ways to measure centre yield different values. The mean measures centre in the sense that it is the value that each data point would take on if the total of the data values were redistributed equally, and also in the sense that it is a balance point.

Learning Outcomes:

Children will be able to:

- understand the use of organizing data;
- represent data through bar graph;
- identify patterns in numbers and shapes;
- identify daily life situations in which the information is required to be properly arranged;
- explore different ways to organise and represent data;
- appreciate the need for finding a representative value for given data;
- find mean of data having not more than ten observations.

Data Handling		
Key Concepts	**Suggested Transactional Processes**	**Suggested Learning Resources**
▸ Collection of data to examine a hypothesis ▸ Collection and organisation of data - examples of organising it in tally bars and a table. ▸ Construction of bar graphs for given data interpreting bar graphs. ▸ Mean of data not having more than ten observations	▸ Revising previous concepts learnt by children. ▸ Building on children's previous learning. ▸ Encouraging children through discussion (whole class/in small groups) to reason out why data should be organised. Children can be motivated to use their own ways in organizing data. ▸ Asking children to explore their own ways of representing the data in the form of diagrams/ pictures (Bar Graph) and in tables of numbers. ▸ Providing children various situations for interpreting data given in tabular or pictorial form like newspaper cuttings, TV programmes etc.	▸ Maths Kit ▸ Newspapers. ▸ TV Programmes.

Integration: Arts Education

Life Skills: Understanding and interpreting data, drawing inferences