

MATHEMATICS

Theme 1: Numbers

Children will be enabled to understand how the place value system works thereby helping them to think about the size of large numbers that they have not counted. Estimation is an essential skill that demonstrates number sense about base 10 system. Activities based on items such as beans or marbles help children develop strategies for estimating quantities. Numerals are written in both compact form and expanded form is used in algorithms. Rounding is a skill to estimation that requires understanding of a relationship between numbers. Opportunities will be provided to facilitate children's use of the place value frame and place value chart to represent large numbers. They will learn to express numbers in many ways like with words (number names), numerals and words, numerals only and finally develop scientific or exponential notations for large numbers in higher classes.

Learning Outcomes:

Children will be able to:

- ✎ read and write large numbers up to crores using the Indian numeration system;
- ✎ compare the Indian numeration system with the International system and read, write numbers using International numeration system;
- ✎ use place value to write a number in expanded form and vice versa;
- ✎ compare large numbers using place value;
- ✎ use place value to form greatest and smallest numbers from the given digits;
- ✎ round off numbers to nearest 10s, 100s or 1000th;
- ✎ represent numbers using roman symbols;
- ✎ acquire understanding about fractions;
- ✎ find the fractional part of a collection;
- ✎ identify and form equivalent fractions of a given fraction;
- ✎ express a given fraction $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{5}$ in decimal notation and vice-versa. For example, in using units of length and money - ₹ 5 is half of ₹ 10.

Numbers		
Key Concepts	Suggested Transactional Processes	Suggested Learning Resources
➤ Indian and International system of numbers- 9 digits numbers. ➤ Place value and face value. ➤ Expanded form. ➤ Comparison of the numbers. ➤ Ascending and descending order of numbers. ➤ Formation of greatest and smallest numbers from the given digits.	➤ Collecting and discussing various contexts in which large numbers are used like cost of properties, distance between planets etc. ➤ Involving children in collecting information from newspapers and magazines having large numbers should be encouraged to write the equivalent	➤ 9 Sets of number cards from 0-9 to create large numbers. ➤ New papers and magazine cutting having references of large numbers. ➤ Spike abacus with 9 spikes to represent numbers up to 9-digits.

Numbers

Key Concepts	Suggested Transactional Processes	Suggested Learning Resources
➤ Rounding off numbers- nearest 10, 100, 1000. ➤ Construction of Multiplication Tables - 2 to 20. ➤ Addition, Subtraction, Multiplication, Division by 2-digit division. ➤ Word problems. ➤ Roman numerals for large numbers.	- Indian/International number system. ➤ Practicing place value and its understanding through games/activities and concrete materials. ➤ Encouraging children to form rules for comparison of large number through exploration/patterns. ➤ Using newspapers and other reports to show how approximation of numbers is used in day to day life. Children should also be encouraged to discover rules of rounding off/approximation.	

Theme 2: Number Operations

The confidence gained in using standard algorithms for operations on whole numbers leads children to use them efficiently for problem solving and in addition, subtraction, multiplication and division of common fractions, decimal fractions and integers in later classes. Using manipulatives like place-value charts, unifix cubes and base ten blocks, 10X10 number grid and number line strengthens the understanding of standard algorithms. In using manipulatives in this context, children can be encouraged to work in pairs, one working with the models and the other recording the steps. It is important that children record the steps as they model them.

Learning Outcomes:

Children will be able to:

- ✎ apply the understanding of place value of numbers beyond 1000 in the four operations;
- ✎ divide a given number by another number (up to two digits);
- ✎ estimate sum, difference, product and quotient of numbers and verifies the same;
- ✎ use standard algorithms in addition subtraction and multiplication of numbers;
- ✎ divide a given number by another number (up to 2 digits) by using standard algorithm;
- ✎ solve problems involving four operations addition, subtraction, multiplication and division in different real life contexts;
- ✎ frame word problems based on mathematical statements involving number operations;
- ✎ explain the meaning of factors, multiples prime and composite numbers;
- ✎ find and displays multiples and factors of numbers using various techniques (e.g. factor tree);
- ✎ discover prime & composite number in the number sequence up to 100.

Number Operations		
Key Concepts	Suggested Transactional Processes	Suggested Learning Resources
➤ Standard algorithms for addition subtraction and multiplication of large numbers. ➤ Division of given number by another number (up to 2 digits). ➤ Framing and solving Problem from real life contexts involving number operations. ➤ Estimation of the sum, difference, product and quotient of two or more	➤ Exploring alternate algorithms for all four operations in addition to standard algorithms. ➤ Dividing numbers using different strategies like using standard algorithms or breaking a number and then using operation. (For example, to divide 9450 by 25, divide 9000 by 25, 400 by 25, and finally 50 by 25 to obtain the answer by adding all these quotients). ➤ Providing opportunities to explore the meaning of factors.	➤ Number cards and place value cards. (These will be used to demonstrate various algorithms for operations on numbers). ➤ Play money notes and coins (for representation of numbers according to place value).

Number Operations		
Key Concepts	Suggested Transactional Processes	Suggested Learning Resources
numbers.	➤ Creating contextual problems (within the child's daily life context) as word stories and exchange them with peers to solve. ➤ Providing opportunities for children to frame rules for estimation of the net result of four operations applied on numbers in daily life contexts.	

Life Skills: solving daily life problems

Theme 3: Fractions and Decimals

Children's comprehension of whole numbers and common fractions forms the basis for their understanding of decimal fractions. Real-world examples of things separated into tenths and hundredths are less common than are examples of common fractions. A better understanding will be developed through metric sub units like Deci (one-tenth), centi (one-hundredth), milli (one-thousandth) etc. An understanding of decimal fractions and their relationship with common fractions develops gradually, thus the focus will be on work with physical material, diagrams and real life situations.

Learning Outcomes:

Children will be able to:

- ✓ define proper, improper and mixed fractions;
- ✓ write equivalent fractions of given fraction by multiplying/dividing numerator and denominator;
- ✓ compare 3 or more fractions;
- ✓ add and subtract unlike fractions and mixed numbers;
- ✓ solve word problems on addition and subtraction of fractions;
- ✓ explain multiplication of fraction as 'of';
- ✓ multiply fractions- fraction by a whole number, fraction by fraction;
- ✓ relate fractions with denominator 10, 100, 1000 as decimal fraction;
- ✓ represent decimal fractions pictorially;
- ✓ find place value of decimal fractions as -tenths, hundredths, thousandths etc.;
- ✓ expand decimal fractions e.g. $234.67 = 200 + 30 + 4 + \frac{6}{10} + \frac{7}{100}$;
- ✓ classify decimal fractions as equivalent, like, and unlike;
- ✓ compare and order decimal fractions;
- ✓ add and subtract decimal fractions;
- ✓ solve word problems on addition and subtraction of decimal numbers;
- ✓ construct rules to multiply decimal fraction by 10, 100, 1000;
- ✓ multiply decimal number by whole number and decimal number by decimal number.

Fractions and Decimals

Key Concepts	Suggested Transactional Processes	Suggested Learning Resources
➤ Comparison of 3 or more fractions. ➤ Addition and subtraction of unlike fractions. ➤ Addition and subtraction of mixed numbers. ➤ Word problems on addition and subtraction of fractions. ➤ Multiplication of fractions- fraction by whole numbers and fraction and fraction. ➤ Division of fractions- whole number by a fraction, fraction by a fraction. ➤ Relationship between fractions and Decimals fraction. ➤ Pictorial representation of decimal fraction. ➤ Place value of decimal fraction- tenths, hundredths, thousandths. ➤ Expanded form: Decimal and fraction expansion ➤ Types of decimal fractions- equivalent, like, and unlike ➤ Comparing decimal fractions. ➤ Ordering of decimal fraction ➤ Addition and subtraction of decimal fraction. ➤ Word problems on addition and subtraction of decimal fraction. ➤ Multiplication of decimal fractions by 10, 100, 1000. ➤ Multiplication of decimal number by whole number and decimal number by decimal number.	➤ Using Paper folding to demonstrate like-unlike fractions, addition and subtraction of fractions and equivalent fractions. ➤ Encouraging children using origami paper for folding into equal number of parts to show fractions and their operations. ➤ Conducting activities for multiplication of fraction by another fraction as operation “of” through paper folding, coloring and forming rules. For example, $\frac{1}{2} \times \frac{1}{3}$ is half of one – third ➤ Associating the idea of division of fractions with division of whole numbers as number of times the divisor lies in the dividend. For example, $\frac{1}{2} \div \frac{1}{4}$ means number of $\frac{1}{4}$ in $\frac{1}{2}$ which is nothing but 2. ➤ Introducing through demonstration -decimal fractions as fraction with 10, 100, 1000 etc. as denominators and discussing the ways in which such numbers can be written using place value system. ➤ Involving children in framing rules to operate decimal fractions using the rules used for operating fractions. ➤ Measuring tape and scale can be used to demonstrate fractions, decimals and their relationship.	➤ Origami paper (<i>for showing fractions and their operations by folding in to equal number of parts</i>). ➤ Bending wire. ➤ Wooden sticks. ➤ Number cards. ➤ Measuring tape and scale.

Theme 4: Playing with Numbers (Factors and Multiples)

There are many relationships in the Numbers system which include even and odd numbers, prime and composite numbers. The classification of numbers into two groups is made on the basis of some properties of the numbers. Factors are one of such properties. Work with prime and composite numbers extends understanding of factors, divisors and multiples encountered in the study of multiplication and division. Children should learn that factors and division mean the same thing and that they can be used interchangeably. When two whole numbers are multiplied they should yield a product and can be called either factors or divisors of their product (exceptionally zero can be a factor but not a divisor). The product of two numbers also called multiple of the two numbers is another concept that is directly related with multiplication of numbers. The children then can adopt any of the two ways of finding factors of numbers; determining by examination and the second more systematic way is using factor trees. children must be advised to use the examination method to factor numbers and to name the greatest of them as HCF. Likewise they should adopt their own ways to find and name the smallest multiple of two or numbers as their LCM.

Learning Outcomes:

Children will be able to:

- ✎ write multiples of numbers;
- ✎ find factors of numbers;
- ✎ identify prime and composite numbers, twin primes and co-prime numbers;
- ✎ test divisibility of numbers by 2, 3, 4 and 5;
- ✎ find prime factors- by Factor Tree;
- ✎ find the Highest Common Factor (HCF)- Listing Method and Common Division;
- ✎ find the Lowest Common Multiples (LCM)- Listing Method and Common division;
- ✎ relate HCF and LCM and uses to find one when other is given.

Factors and Multiples

Key Concepts	Suggested Transactional Processes	Suggested Learning Resources
➤ Factors, common factors and Highest common factors of two numbers. ➤ Multiples, common multiples and Lowest Common multiples of two numbers. ➤ Prime and composite numbers, Twin primes and co-prime. ➤ Prime factors- Factor Tree Method. ➤ Highest Common Factor(HCF)- Listing Method	➤ Exploring counting numbers for multiples of numbers through various strategies like multiplication tables, number line, skipping the number etc. ➤ Using various strategies by children monitored by the teacher to find factors of a number. ➤ Involving children in finding and displaying	➤ Set of counters. (so that children can make equal groups to understand factors like, 24 counters can be grouped equally in to 24, 12, 8, 6, 4, 3, 2 and 1 groups) ➤ Wooden sticks of same and different sizes.

Factors and Multiples

Key Concepts	Suggested Transactional Processes	Suggested Learning Resources
and Common Division. ➤ Lowest Common Multiples(LCM)- Listing Method and Common Division. ➤ Relationship between HCF and LCM. ➤ Test for divisibility by 2, 3, 4, 5, 9 10, 11 (forming rules by observation).	multiples and factors of numbers using various techniques (e.g. <i>factor tree</i>, <i>multiplication tables</i>, <i>skip counting on a number line etc.</i>) ➤ Encouraging children to find prime numbers based on factors. Discussion may be held with them focusing on why prime numbers are important and useful. ➤ Involving children in discovering prime and composite numbers in the number sequence up to 100.	

Theme 5: Introduction to Negative Numbers

The concept of a number having a value of less than zero and number indicating a direction are not easily understandable through words alone. In this theme children through situations will be exposed to involving negative and positive number (integers). This will enable children to visualize and understand them better. Number line helps children understand moving up and down the number sequence, magnitude of numbers and the concepts of more than and less than. When used to compare numbers, children see that any number is greater than any other number to its left. The same property holds for negative numbers too. When integers are ordered on a number line, as negatives number get larger their value get smaller and smaller.

Learning Outcomes:

Children will be able to:

- ✎ represent whole numbers through number line;
- ✎ develop idea of integers as counting number, zero and negatives of counting numbers;
- ✎ compare integers through number line;
- ✎ arrange integers in ascending and descending order;
- ✎ add and subtract integers.

Introduction to negative numbers

Key Concepts	Suggested Transactional Processes	Suggested Learning Resources
➤ Introduction to negative numbers through number line. ➤ Idea of integers as counting number, zero and negatives of counting numbers. ➤ Comparison of integers through number line. ➤ Ascending and Descending order of integer. ➤ Rules for addition, subtraction of integers.	➤ Involving children in discussion to have necessity of numbers less than zero like having measurement in opposite directions with reference to a point (<i>above and below sea level, temperature above and below zero etc.</i>) ➤ Encouraging children to use number line for representation of negative numbers. ➤ Letting children explore the ways to name negative and positive numbers together along with zero. ➤ Using number line to show that negative numbers are mirror image points corresponding to counting numbers (<i>natural numbers</i>) ➤ Number line may be used to represent integers and their ascending and descending orders.	➤ Number line. ➤ Counters of two colours where the colours represent opposite numbers.

Theme 6: Geometry

The levels described by the Van Hiele are sequential, and success at one level depends on the development of geometric thinking at the preceding level. Typically, children at the primary level demonstrate characteristics of level 0 and are moving toward level 1 of the Van Hiele's levels of geometric thought. Children entering the class V are most likely functioning in the visualization and analysis levels (0 and 1) of geometric thought. The goal of teaching geometry at this stage is to provide instructional activities that will encourage children to develop thinking and reasoning skills needed to move towards level 2 of the hierarchy, informal deduction (at upper primary stage). Building on children's experiences with non-standard to standard measures they are ready to begin work with acquiring a confidence in using standard units and relate bigger to smaller and vice-versa.

Learning Outcomes:

Children will be able to:

-  explore idea of angles and shapes;
-  classify angles into right angle, acute angle, obtuse angle and represents the same by drawing and tracing;
-  identify 2D shapes from the immediate environment that have rotation and reflection symmetry like alphabet and shapes;
-  identify angles in the environment through observation and paper folding;
-  identify rights angles in the objects and in the environment;
-  classify angles into right, acute, obtuse angles based on their visible attributes;
-  represent different angles (like acute, obtuse, right angles) by drawing and tracing on the paper;
-  explore symmetry in familiar 3D shapes;
-  explore reflection symmetry and rotational symmetry w.r.t. to familiar 2D- geometrical shapes;
-  construct the shapes of cubes, cuboids, cylinders and cones from the given nets (designed for this purpose).

Geometry		
Key Concepts	Suggested Transactional Processes	Suggested Learning Resources
➤ Angle and its measures. ➤ Classification of angles into right, acute, obtuse angles. ➤ Identification and representation of acute, obtuse and right angles. ➤ Symmetry in familiar 3D	➤ Using paper folding activities (fold art angle) right angles can be identified in the vicinity and in objects. ➤ Buildings, class room door windows etc. can provide excellent concrete support to the concept of an angle.	➤ Coloured papers, cardboards, scissors, etc. ➤ Small pieces of mirrors with rounded edge. ➤ Empty card board boxes. ➤ Thick card board sheets, pencils, markers and cutters.

Geometry		
Key Concepts	Suggested Transactional Processes	Suggested Learning Resources
shapes like Cube, human body, buildings etc. ➤ Reflection and rotational symmetry in familiar 2D-geometrical shapes like circle, rectangle, square, triangle and circles. ➤ Nets of cubes, cuboids, cylinders and cones.	➤ Classification of angles may be encouraged by finding obtuse and acute angles in surroundings and in the objects around us. ➤ Discovering symmetry in the objects/environment may be encouraged. ➤ Using concrete materials to explore reflective as well as rotational symmetry. Card board cut out shapes, may be rotated from different points to find out their rotational symmetry. Paper folding, making shapes/designs using carbon papers etc. may be used for developing a deeper understanding of concept of the symmetry. ➤ Encouraging children to bring empty boxes, open them up and trace their nets. Also using the nets so traced are able to create boxes.	

Integration: Science (Solids, Liquids and Gases)

Theme 7: Measurement

The early learning of measurement is largely inventive and investigative by nature. Children up to primary grades begin with activities to establish the everyday contexts for measurement and to introduce measurement with nonstandard units. This theme will enable children to begin to conserve length and area and understand that these concepts do not change, even when an object's position or appearance is altered. Children will also learn to use standard units by providing them frequent opportunities to measure objects so that they construct their understanding of units and of the measurement process.

Learning Outcomes:

Children will be able to:

- ✎ relate different commonly used larger and smaller units of length, weight, time and money and convert larger units to smaller units and vice versa;
- ✎ estimate the volume of a solid body in known units like volume of a bucket in about 20 times that of a mug;
- ✎ apply the four operations in solving problems involving money, length, mass, capacity and time intervals;
- ✎ explain the terms area and perimeter of simple geometrical shapes;
- ✎ compute area and perimeter of simple geometrical shapes.

Measurement		
Key Concepts	Suggested Transactional Processes	Suggested Learning Resources
➤ Area and perimeter of simple geometrical shapes; ideas and their measurement. ➤ Daily life problems involving length, weight, time, money & volume: Use of four number operations. ➤ Idea of larger and smaller units of length, weight, time, money & volume and conversion .	➤ Developing and using Square grids, dot grid to facilitate the understanding of concepts related to area and perimeter. ➤ Conducting exploration activities with groups of children to infer that area and perimeter are not co-related i.e. figures having same area may have different perimeters. ➤ Creating and solving contextual problems regarding calculations of length, weight, volume etc. ➤ Providing practice questions for inter conversion of bigger units into smaller units and vice versa in various interesting ways.	➤ Squared grid papers, dot grid printed papers. ➤ Coloured markers, scissors etc. ➤ Daily life objects such as match boxes, sugar cubes, paper weight, etc. (<i>for demonstration of length, area, volume and weight</i>).

Integration: Science

Life Skills: solving daily life problems

Theme 8: Introduction to Percentage

This theme will focus on children becoming aware and understanding the importance use and different applications of percentage in a variety of ways in many daily life aspects. Percent expresses a relationship between some number and 100. The symbol % and word percent means per hundred or out of hundred. The children at this stage will be provided opportunities to understand the meaning of percent through their experiences. As percent is common fraction with 100 as denominator, so it is also a decimal fraction representing hundredths. A conscious attempt will be made to extensively build on children's understanding about these earlier learnt concepts to further build their understanding about percent.

Learning Outcomes:

Children will be able to:

-  define percentages as fraction with 100 as denominator;
-  establish relationship between fractions, decimal fractions and percentages;
-  pictorially represent percentage;
-  convert fractions to percentages and vice-versa;
-  convert decimals to percentages and vice-versa;
-  solve simple word problem on percentage.

Introduction to Percentage		
Key Concepts	Suggested Transactional Processes	Suggested Learning Resources
➤ Introduction of percentages. ➤ Relationship between fractions, decimals and percentage. ➤ Pictorial representation of percentage. ➤ Conversion of fractions to percentages and percentages to Fractions. ➤ Conversion of decimals to percentages and percentages to decimals. ➤ Simple word problems on percentage.	➤ Introducing percentage as fraction with denominator as 100 and relating it with decimal representation. ➤ Letting children form the rules for percentage and conversion using the known rules of fractional and decimals. ➤ Encouraging children to relate their marks obtained in different subject with percentage. ➤ Measuring tapes, scales may be used to explain fractions and decimals.	➤ Measuring tape. ➤ Scale. ➤ Number sticks. ➤ Paper magazine cuttings.

Life Skills: solving daily life problems

Theme 9: Data Handling

Various graphs like pie charts, line graphs and bar graphs relate to children's daily life experiences like newspapers and sports transmission shown on TV. Children will be encouraged to devise their own ways of reading and interpreting these pictographs. At this stage children are skilled to attempt the drawing of bar graphs for the data either collected by them or obtained from other sources. The data related to issues related to environment, classroom activities etc. will help children in connecting the skill of data handling with their daily activities.

Learning Outcomes:

Children will be able to:

- collect data related to various daily life situations, represents it in tabular form and by bar graphs and interpret a given bar graph.
- interpret pie charts and line graphs generally found in newspapers and magazines.

Data Handling		
Key Concepts	Suggested Transactional Processes	Suggested Learning Resources
- Pictorial representation of the raw data. - Interpretation of Bar graph, line graph and pie chart.	- Conducting group activities on data collection, tabulation (in graphic form) and interpretation within and outside classrooms. - Advising children to make presentation as groups on their whole activity as a project. This should have tabular and graphical representations as used in newspaper/magazines - Providing opportunities to interpret pie charts and line graphs given in textbooks, newspaper and magazine cuttings.	- Coloured papers, stickers of different objects, glue sticks. - Newspaper and magazines cuttings having bar graphs, pie charts and line graphs.

Integration: Arts Education

Life Skills: analysis and interpretation

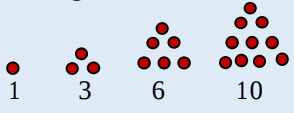
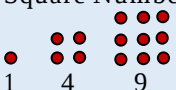
Theme 10: Patterns

Children are now confident at this stage with observing and generalizing patterns in numbers and shapes. This will help them in other themes of mathematics like applying operations on numbers (whole numbers, common and decimal fractions), properties of various 2-D shapes and 3-D figures and measurements. They should explore additional properties of whole numbers like triangular and square numbers through patterns.

Learning Outcomes:

Children will be able to:

-  observe and identify patterns with a unit of repeat and extend it;
-  observe and generalize a rule to extend a progressive pattern;
-  create a pattern with more than one characteristic;
-  observe and generalize patterns of triangular and square numbers.

Patterns		
Key Concepts	Suggested Transactional Processes	Suggested Learning Resources
➤ Patterns with a unit of repeat and their extension. ➤ Progressive patterns. ➤ Extension of progressive patterns. ➤ Patterns with more than one characteristic. ➤ Triangular and square numbers.	➤ Providing a lot of patterns that are in the near vicinity of children and have a unit of repeat. Let them identify this unit and extend the pattern. ➤ Dividing children in to group of two-three each. Let one group form a pattern with repeat and other extend it. ➤ Giving exposure to progressive patterns which are commonly found in numbers and shapes. For example: ➤ 2, 4, 6,; 5, 10, 15, 20, ➤  ➤ Providing opportunities for finding a rule for extension of the pattern of numbers that can be placed as triangle and square. Let children find further few terms on the basis of the rule and without finding all previous terms. ➤ Triangular numbers  1 3 6 10 Square Numbers  1 4 9	➤ Number sticks. ➤ Triangular, square, rectangular shapes made from thick paper cutter. ➤ Use of charts showing patterns with numbers, and different shapes.

Integration: Arts Education

Life Skill: Logical thinking, reasoning