Learning Outcomes in Mathematics-Upper Primary Stage

Curricular Expectations

- Moves from concrete ideas of numbers to number sense.
- Sees relationships between numbers and looks for patterns in relationships.
- Understand and applies concept related to variables, expressions, equations, identities, etc.
- Uses arithmetic and algebra to solve real life problems and pose meaningful problems.
- Develops aesthetic sense by discovering symmetries in shapes like triangles, circles and quadrilaterals.
- Identifies space as region enclosed within boundaries of a shape.
- Develops spatial understandings in terms of perimeter, area and volume and uses them to solve day to-day life problems.
- Learns to provide reasoning and convincing arguments to justify her/his own conclusions in mathematical context.
- Collects, represents (graphically and in tables) and interprets data/information from her/his life experiences.

Class VI (Mathematics)

Suggested Pedagogical Processes	Learning Outcomes
 The learner may be provided opportunities in pairs/groups/ individually and encouraged to: ▷ encounter situations having numbers up to 8 digits. e.g. cost of property, total population of different towns, etc. ▷ compare numbers through situations like cost of two houses, number of spectators, money transactions, etc. 	 The learner: solves problems involving large numbers by applying appropriate operations (addition, subtraction, multiplication and division). recognises and appreciates (through patterns) the broad classification of numbers as even, odd, prime, co-prime, etc. applies HCF or LCM in a particular situation.
 classify numbers on the basis of their properties like even, odd, etc. observe patterns that lead to divisibility by 2,3,4,5,6,8,10 and 11. create number patterns through which HCF and LCM can be discussed. explore daily life situations to involve the use of HCF and LCM. 	 solves problem involving addition and subtraction of integers. uses fractions and decimals in different situations which involve money, length, temperature etc. For example, 7 ¹/₂ metres of cloth, distance between two places is 112.5 km etc. solves problems on daily life situations involving addition and

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>	create and discuss daily life situations involving the use of negative	subtraction of fractions / decimals.
٨	numbers. situations that require the representation by fractions and decimals can be created and presented pictorially.	 uses variable with different operations to generalise a given situation. For example, Perimeter of a rectangle with sides x units and 3 units is 2(x+3) units.
	use different contexts mathematic to appreciate the necessity of representing unknowns by variables (alphabet).	• compares quantities using ratios in different situations. For example the ratio of girls to boys in a particular class in 3:2.
≻	explore and generalise the need of using variables alphabets.	• uses unitary method in solving various word problems. For
۶	describe situations involving the need for comparing quantities by taking ratio.	example, if the cost of a dozen notebooks is given she finds the cost of 7 notebooks by first finding the cost of 1 notebook.
۶	discuss and solves word problems that use ratios and unitary method.	• describes geometrical ideas like line, line segment, open and closed figures angle triangle quadrilateral circle etc. with the
۶	explore various shapes through concrete models and pictures of different geometrical shapes like triangles and quadrilaterals, etc.	 help of examples in surroundings. demonstrates on understanding of angles by
٨	identifyvarious geometrical figures and observe their characteristics in and outside the classroom environment either individually or in groups.	 identifying examples of angles in the surroundings. classifying angles according to their measure. estimating the measure of angles using 45° 90° and 180° a
۶	make different shapes with the help of available materials like sticks, paper cutting, etc.	reference angles.
٨	observe various models and nets of 3-Dimensional (3-D) shapes like cuboid, cylinder, etc. and discuss about the elements of 3-D figures such as faces, edges and vertices.	 demonstrates an understanding of line symmetry by identifying symmetrical 2-Dimensional (2-D) shapes which are symmetrical along one or more lines creating symmetrical 2-D shapes
4	share the concept of angles through some examples like opening the door, opening the pencil box, etc. Students can be asked to give more such examples from the surroundings.	 classifies triangles into different groups/types on the basis o their angles and sides. For example- scalene, isosceles o agrilateral on the basis of sides attached
≻	classify angles based on the amount of rotation.	• aloggifieg quedrileterals into different _ groung/types or the loss
≻	discuss and draw 60° angle using compasses, the construction of	• classifies quadrilaterals into different groups/types on the basi

	Suggested Pedagogical Processes	Learning Outcomes
A A A A A A A A A A A A A A A A A A A	other angles like 30°, 120°, etc. can be discussed with the children. observe the reflection symmetry of a shape by using mirror or folding a paper cut out of a shape along specific lines. identify symmetrical shapes from surroundings like leaves, window, door, etc draw lines of symmetry when shapes are given. Group activity can be given, in which one group can draw half of the symmetrical shape and the other group can complete the shape. sort out the given set of triangles based on their angles and sides (group activity), discuss the basis of their classification. sort out the given set of quadrilaterals into different groups based on their shapes/size, etc. to explain the reason for the classification. differentiate 2-D and 3-D objects by differentiate the shape of the top of the pencil box and the entire pencil box, to add more examples of this type from the surroundings. discuss the various aspects of a 3-D object, like edges, vertices, and faces . introduce the concept of perimeter using different rectangular shapes from the classroom like blackboard, table top, books, etc, through the idea of boundary of these shapes . develop the concept of areas through measurement of region inside a shape by dividing it into square units. explain the importance of arranging information in daily life situations involving numbers such as cricket scores in different cricket matches, number of family members in different families. explore his/her own ways of organising data in pictorial form.	 of their sides/angles. identifies various (3-D) objects like sphere, cube, cuboic cylinder, cone from the surroundings with he help of example from surroundings. describes and provides examples of edges, vertices and faces of 3-D objects. finds out the perimeter and area of rectangular objects in the surroundings like floor of the class room, surfaces of a chalk boretc. arranges given/collected information such as expenditure of different items in a family in the last six months, in the form of table, pictograph and bar graph and interprets them.

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The learner may be provided opportunities in pairs/groups/	The learner:
 provide contexts for exploring the rules of multiplication and division of integers. This can be done through number line or number patterns. For example : 3×2=6 2×1-3 	 multiplies/divides two integers. interprets the division and multiplication of fractions. for example interprets ²/₃ × ⁴/₅ as ²/₃ of ⁴/₅. Also ¹/₂ ÷ ¹/₄ is interpreted as how many ¹/₄make ¹/₂? uses algorithms to multiply and divide fractions/decimals.
$3 \times (-3) = 0$ $3 \times (-1) = 0$ $3 \times (-2) = -6 \setminus 0$	 solves problems related to daily life situations involving rational numbers. uses exponential form of numbers to simplify problems involving multiplication and division of large numbers. represents daily life situations in the form of a simple
Same reduce by Numbers three numbers reduce by one numbers So $3 \times (-3) = -9$ means a positive integer multiplied by a negative integer given a negative integer *For example: (a) $\frac{1}{4} \times \frac{1}{2}$ is $\frac{1}{4}$ of $\frac{1}{2}$ is $\frac{1}{8}$ (b) $\frac{1}{2} \div \frac{1}{4}$ means number of $\frac{1}{4}$ in $\frac{1}{2}$ are two	 equation and solves it adds/subtracts algebraic expressions. distinguishes quantities that are in proportion. For example, tells that 15,45,40,120 are in proportion as 15/45 is the same as 40/120. solves problems related to conversion of percentage to fraction and decimal and vice versa. calculates profit/loss percent and rate percent in simple interest. classifies pairs of angles based on their properties as linear, supplementary, complementary, adjacent and vertically

Suggested Pedagogical Processes	Learning Outcomes
 Suggested Pedagogical Processes Suggested Pedagogical Processes explore the multiplication/ division of fractions/decimals through pictures/paper folding activities /daily life examples. discuss the situations that require the use of fractional numbers in opposite direction, such as moving 10¹/₂ m to the right of a tree and 15²/₃m to its left etc. involve children in exploring how repeated multiplication of numbers can be expressed in short form. For example 2×2×2×2×2= can be expressed as 2⁶. explore the possible combinations of variables and constants using different exerctions to form alreptotic expressions in variables. 	 Learning Outcomes verifies the properties of various pairs of angles formed when a transversal cuts two lines. finds unknown angle of a triangle when its two angles are known. explains congruency of triangles on the basis of the information given about them like (SSS, SAS, ASA, RHS) using ruler and a pair of compasses constructs, a line parallel to a given line from a point outside it and triangles. finds out approximate area of closed shapes by using unit square grid/ graph sheet. calculates areas of the regions enclosed in a rectangle and a square. finds various representative values for simple data from her/his daily life contexts like mean, median and mode. recognises variability in real life situation such as, variations in the height of twderte in her sheared uncertainty in pairs.
 contexts. provide situations from daily life that lead to setting up of equations and choosing the appreciate value of the variable that equate both sides. 	 interprets data using bar graph such as consumption of electricity is more in winters than summer, runs scored by a team in first 10 overs etc.
 conduct activity of adding /subtracting number of objects of same category from daily life. For example number of notebooks obtained when 3 notebooks are added to a group of 5 notebooks. discussion can be held to evolve the understanding of the concepts of ratios and percentage (equality of ratio.) 	

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provide daily life situations based on profit/loss and simple interest that show the use of percentage.	
explore different examples from daily life in which pair of angles are involved with a common vertex.(Scissors, Road Junction, Letter X, T, etc).	
verify the properties of various pairs of angles by drawing diagram (One group can give measure of one angle, the other group needs to give the measure of other angle.)	
visualise 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 through diagrams and upper primary mathematics kit (developed by NCERT).	
draw different types of triangles, ask them to measure angles of all triangles, and verify.	
> explore exterior angle property of triangles; and Pythagoras theorem.	
identify symmetrical figures from their environment and which shows rotational symmetry.	
visualise the symmetry through paper folding activities .	
establishing congruence criterion and later on verify the property with the help of by superimposing one above the other.	
demonstrate the construction of a line parallel to the given line from a point outside it through students active participation.	
construct the simple triangle by using ruler and compasses.	

Suggested Pedagogical Processes	Learning Outcomes
Trace the figures in the given graph sheets.	
> count the exact number of square units occupied by the traced	
figure (Complete, Half, etc). and find out the approximate area of	
these figures.	
through discussion motivate them to arrive at the formula for area	
of a rectangle/square.	
> find a representative value of data i.e. mean , mode or median of	
ungrouped data. Encourage them to arrange it in a tabular form and	
represent it by bar graphs.	
draw inferences for future events from the existing data.	
Advances the situations where the term 'abanas' can be used for	
Inscuss the situations where the term chance can be used, for evenuels what are the sharess of minute day or sharess of acting	
example, what are the chances of rainy today as chances of getting	
& while rolling a dice.	

Suggested Pedagogical Processes	Learning Outcomes
 Suggested Pedagogical Processes he learner may be provided opportunities in pairs/groups/ 1 dividually and encouraged to: explore examples of rational numbers with all the operations and explore patterns in these operations. use generalised form of numbers upto 3 digits and uses her understanding of algebra to derive the divisibility rules for 2, 3, 4 done earlier by observing patterns on them. explore patterns in square numbers, square roots, cubes and cube roots of numbers and form rules for exponents as integer. provide situations that lead to simple equations and encourage them to solve using suitable processes. experiences of multiplying two algebraic expressions and different polynomials may be provided based on their previous knowledge of distributive property of numbers and generalise various algebric identities using concrete examples. based on their previous knowledge of factorising two numbers introduce the factorisation of algebraic expressions using relevant activities. situation may be provided that involve the use of percentages in contexts like discount, profit & loss, VAT, simple and compound interest, etc. 	 Learning Outcomes The learner: generalises properties of addition, subtraction, multiplication and division of rational numbers through patterns finds out as many rational numbers as possible between two given rational numbers. proves divisibility rules of 2, 3,4, 5, 6, 9 and 11 finds squares, cubes and square roots and cube roots of numbers using different methods. solves problems with integral exponents. solves puzzles and daily life problems using variables. multiplies algebraic expressions. e.g expands (2x-5)(3x²+7). uses various algebric identities in solving problems of daily life applies the concept of per cent in profit and loss situation in finding discount, VAT and compound interest. e.g calculates discount per cent when marked price and actual discount are given or finds profit per cent when cost price and profit in a transaction are given.
 provide various situations to generalise the formula of compound interests through repeated use of simple interest. a number of situations may be given where one quantity depends on 	 Solves problems cased on ancer and inverse proportions Solves problems related to angles of a quadrilateral using angle sum property

the quantities increase together or in which while one increases the other decreases. For example, as the **speed** of a vehicle **increases** the **time taken** by it to cover the distance **decreases**.

- measure the angles and sides of different quadrilaterals and let them identify patterns in the relationship among them. Let them make their hypothesis on the basis of the generalisation of the patterns and later on verify through examples.
- verify the properties of parallelograms and apply reasoning by doing activities such as constructing parallelograms, drawing their diagonals and measuring their sides and angles.
- express/represent a 3-D shape into its 2-D form from their daily life like, drawing a box on a plane surface, showing bottles on paper, board or wall etc.
- make nets of various shapes like cuboids, cubes, pyramids, prisms, etc. From nets let them make the shapes and establish relationship among vertices, edges and surfaces.
- demonstrate the construction of various quadrilaterals using geometric kit.
- sketch the figure of trapezium and other polygons in the given graph paper and asked student to estimate their areas using counting of unit square.
- derive the formula for calculating area of trapezium using the areas of triangle and rectangle (square).
- identify that surfaces of various 3-D objects like cubes, cuboids and cylinder.
- derive formulae for surface area of cubes and cuboids using the formulae for areas of rectangles, squares and circles.

relationship between them through reasoning.

- represents 3D shapes on a plane surface such as sheet of paper, black board etc.
- verifies Euler's relation through pattern
- constructs different quadrilaterals using compasses and straight edge.
- estimates the area of shapes like trapezium and other polygons by using square grid/graph sheet and verifies using formulas.
- finds the area of a polygon.
- finds surface area and volume of cuboidal and cylindrical object.
- draws and interprets bar charts and pie charts.
- makes hypotheses on chances of future events on the basis of its earlier occurrences or available data like , after repeated throws of dice and coins.

≻	demonstrate to find volume of a given cube and cubiod using unit
	cubes.
≻	collect data, organise it into groups and represent it into bar graphs/
	pie chart.
\succ	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 and make 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.

For Children with Special Needs (Mathematics)

To overcome difficulties for access with respect to learning mathematics, some pupils may require tactile, and others to specialist, equipment for work related to shape, geometry, calculations, etc. Some may require simpler language or more pictures. Others may need help in interpreting the data in graphs, tables, or bar charts. There may be children who may need help in interpreting oral directions or while making mental calculations. Use of ICT may be required to overcome difficulties in quantitative and abstract thinking.

Some specific needs of children with different disabilities are given below which may be taken care of to help them learn with their peers and accomplish the desired learning outcomes.

For Visually Impaired Children

- Development of spatial concepts (concepts related to space) and understanding the relationships between spatial concepts;
- Understanding three-dimensional objects transformed into two-dimensional forms¹;
- Understanding special characters (symbols) used in Mathematics;
- Difficulty in audio recording of mathematical text, for example, equations etc.;

- Difficulty in transcribing and reading mathematical text in Braille because of spatial arrangement and colour codes;
- Learning of Nemeth or any other Mathematical Braille Code².

For Hearing Impaired children

- Delay in linguistic growth, leading to lack of general vocabulary and technicalvocabulary of Mathematics (words like reciprocal, linear etc.).
- Understanding the wordiness (use of a number of words to explain meaning or making a point) of mathematical problems.
- Distinguishing words with multiple meanings like interest³, table, credit, angle, rate, volume, power, point.
- Distinguishing mathematical words while student is lip/speech reading (tens and tenths, sixty and sixteen).
- Limited use of cognitive strategies to select the relevant information and approaches necessary for solving problems.

For Children with Cognitive Impairments, Intellectual Disability

- Sequencing, step wise problem solving and difficulty in place value.
- Mathematical calculations (computations), number reversals, copying problems etc Confusion in operational symbols, such as + for x, and difficulty in recalling sequence of operations.
- Identifying different shapes in geometry and directionality.
- Abstract concepts like in Algebra and integers, etc.
- Comprehension of word problems.