SINGLE NATIONAL CURRICULUM

MATHEMATICS
GRADE I-V 2020

ONE NATION, ONE CURRICULUM

NATIONAL CURRICULUM COUNCIL,
MINISTRY OF FEDERAL EDUCATION AND PROFESSIONAL TRAINING, ISLAMABAD
GOVERNMENT OF PAKISTAN

بسم الله الرحمن الرحيم

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CHAPTER

01 INTRODUCTION

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01 INTRODUCTION

1.1 THE SINGLE NATIONAL CURRICULUM MATHEMATICS (I -V) 2020:

The Single National Mathematics Curriculum 2020 has been designed in the perspective of modern trends in Mathematics and emerging requirements of society in terms of National Integrity and Social Cohesion.

The main aim of the Single National Mathematics Curriculum 2020 is to develop mathematical literacy, induce logical thinking, reasoning and solve real life situations among students. Overall this curriculum provides a framework that encompasses expectations and provides guidance for meaningful learning of Mathematics at primary level. This document helps teachers to design, implement, and analyze instructions, and assessment methods in order to accomplish the overall goal of the curriculum. The entire curriculum is divided into four strands, Numbers and Operations, Algebra, Measurements and Geometry and Data Handling, all underpinned in Reasoning and Logical thinking which serves as a cross cutting strand. This Curriculum is based on standards, benchmarks and also features a progression grid to show the progression of Mathematical concepts across the grades. Students' learning outcomes are matched with the contents and are aligned with the benchmarks and the standards. The learning outcomes emphasize on the development of knowledge and conceptual understanding through application and reasoning skills. This curriculum also emphasizes on Values to promote student's spiritual, moral, social and cultural development through mathematics.

This curriculum (I-V) stimulates the logical cognition of students and encourages them to solve real life mathematical situations. In grades VI-VIII, students will be provided with the mathematical tools for justifying conclusions and to identify the relationship between different mathematical concepts in everyday situations. In grades IX-XII, students will additionally develop the ability to use Mathematics in other fields of study.

1.2 AIMS OF MATHEMATICS CURRICULUM

The basic aims of mathematics curriculum from grade I-V are as follow:

- Instill Mathematical skills for everyday use.
- Strengthen basic mathematical skills to set the foundation for higher level mathematics.
- Develop the ability to think in a logical manner to analyze diverse situations.
- Develop a sense of appreciation and enjoy learning mathematics.
- Develop a deep and sustainable understanding through Concrete, Pictorial and Abstract (CPA) approach.
- Engage in investigations and enquiries to develop skills in mathematical reasoning, processing information, making connections to real life situations and making judgments.

This curriculum document includes details of pedagogical approaches are designed to help mathematics teachers achieve the overall aims of this curriculum. For example, among others, Real Life Situations and Number Stories are two of the strategies to achieve the aims of this curriculum. These approaches engage students in analyzing situations and applying mathematical knowledge to solve related real-life situations. Moreover, students get opportunities construct similar situations and number stories and hence get intellectually inspired and engaged with mathematical content. Mental Mathematics and inquiry approach are equally important strategies especially for developing number sense, forming predictions, justifying arguments with evidence and drawing conclusions. Thus, this curriculum focuses on principles, patterns and systems so that students can apply their growing mathematical knowledge and develop a holistic understanding of the subject.

This document also includes assessment guidelines to ensure meaningful relationship and alignment between curriculum learning outcomes, instructional design and assessment methods. Specific formative assessment strategies are suggested that lead to improvement of students learning. An effective learning-outcomes-oriented quality assurance system, which is based on constant monitoring and effective feedback loop, is recommended.

Print materials, particularly the textbooks, have to play a key role towards providing quality education at all levels. Although there are many factors that contribute towards the overall learning of the child; yet, the importance of textbook as a reservoir of information/knowledge cannot be ignored. In addition to the textbook, teaching and learning resources include teacher's manual, workbook, and a range of web-based/electronic resources. Suggested activities, web links, and reference books are added to help the users of the Single National Curriculum for Mathematics (I-V) 2020.

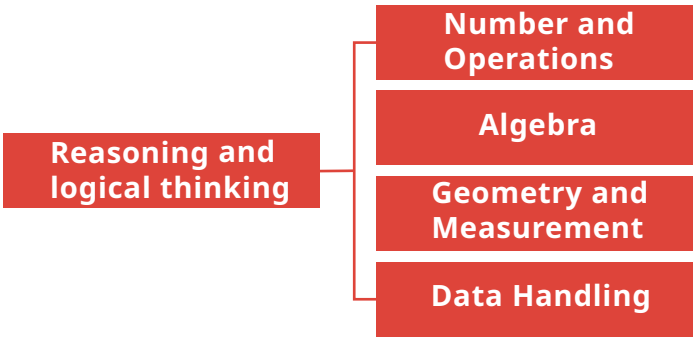
Mathematics teachers are therefore expected to:

- shift from dispensing information to plan investigative tasks.
- create cooperative and collaborative learning environment.
- design assessment tasks.
- draw valid inference about students.
- use this information to improve their own teaching practices.

1.3 MATHEMATICS CURRICULUM CONTENT STRANDS AND STANDARDS

The curriculum for Mathematics is comprised of the following four strands. The strands are intentionally kept broad to allow flexibility to the teachers to adapt their teaching styles in accordance with their students.

These strands include Numbers and Operations, Algebra, Geometry and Measurement and Data Handling. All of this content is underpinned by reasoning and logical thinking. All standards, benchmarks and students' learning outcomes are built around these strands.



Key Learning Strands	Standards
1. NUMBERS AND OPERATIONS	• Identify numbers, ways of representing numbers, comparing numbers and effects of number operations. • compute fluently with fractions, decimals and percentages • examine real life situations by identifying mathematically valid arguments and drawing conclusion to enhance their mathematical thinking
2. ALGEBRA	• analyze number patterns; • known facts, properties and relationships to analyze mathematical situations, • examine real life situations by identifying mathematically valid arguments and drawing conclusion to enhance their mathematical thinking
3. GEOMETRY AND MEASUREMENT	• identify measurable attributes of objects, construct angles and two-dimensional figures; • analyze characteristics and properties of geometric shapes and develop arguments about their geometric relationships • examine real life situations by identifying, mathematically valid arguments and drawing conclusion to enhance their mathematical thinking
4. DATA HANDLING	• collect, organize, analyze, display and interpret data/ information • examine real life situations by identifying mathematically valid arguments and drawing conclusion to enhance their mathematical thinking

1.4 THE MATHEMATICS CURRICULUM STANDARDS AND BENCHMARKS

The Standards for Mathematics are further sub-divided into the following Benchmarks for Grade Level-I-V:

Standards	Benchmarks Grade-(I-III)	Benchmarks Grade-(IV-V)
NUMBERS AND OPERATIONS • **Identify numbers, ways of representing numbers, comparing numbers and effects of operations in various situations.** • **compute fluently with fractions, decimals and percentages** • **examine real life situations by identifying mathematically valid arguments and drawing conclusion to enhance mathematical thinking**	The students will be able to: • identify, read and write whole numbers up to 10,000 • read and write Roman numbers up to 20 • identify and differentiate even and odd numbers up to 99 • arrange, compare numbers up to 3-digits using symbols (<,>or =) • identify and recognize place values up to 5-digit numbers • represent and identify the given number on number line • round off a number to the nearest 10 and 100 • add, subtract numbers up to 4-digits • develop multiplication tables up to 10 • multiply number up to 2-digits with 1-digit number • recognize and use of division symbol, divide up to 2-digit numbers by 1-digit number • solve real life situations involving addition, subtraction, multiplication and division • round off a number to the nearest 10 and 100 • recognize fractions and different forms of fractions with the help of objects and figures	The students will be able to: • read and write whole numbers up to 1,000,000 (1-million) in numerals and words • add and subtract numbers of different complexity and of arbitrary size • multiply and divide numbers, up to 6-digits, by 2- or 3-digit numbers and by 10,100 and 1000 • solve real life situations involving operations of addition, subtraction, multiplication and division • recognize and differentiate between factors and multiples of two or three 2-digit numbers • find highest common factor (HCF) and least common multiple (LCM) of two, three or four numbers, up to 2-digits • solve real life situations involving HCF and LCM • recognize and compare like and unlike fractions • arrange, convert and simplify fractions • add, subtract, multiply and divide fractions • solve real life situations involving addition, subtraction, multiplication and division of fractions

Standards	Benchmarks Grade-(I-III)	Benchmarks Grade-(IV-V)
	• express and match fractions in figures and compare fractions with same denominators using symbols <, > or = • identify and write equivalent fractions for a given fraction • add and subtract two fractions with same denominators	• apply unitary method for solving real life situations • identify and recognize decimal numbers • convert decimal numbers into fractions and vice versa • add and subtract numbers up to 3 decimal places • multiply and divide decimal numbers with whole numbers • round off decimal numbers up to specified number of decimal places • solve real life situations involving decimal numbers (up to 3-decimal places) • convert percentage to fraction and to decimal and vice versa
ALGEBRA • **analyze number patterns;** • **known facts, properties and relationships to analyze mathematical situations,** • **examine real life situations by identifying mathematically valid arguments and drawing conclusion to enhance mathematical thinking**	• develop the concept of equality using addition and subtraction of numbers • identify and complete geometrical patterns on square grid according to attributes like shape, size and orientation.	• develop the concept of equality using addition, subtraction, multiplication and division of numbers. • identify and describe repeating pattern using relationship between consecutive terms and generate number patterns

Standards	Benchmarks Grade-(I-III)	Benchmarks Grade-(IV-V)
GEOMETRY AND MEASUREMENT • **identify measurable attributes of objects, construct angles and two-dimensional figures;** • **analyze characteristics and properties of geometric shapes and develop arguments about their geometric relationships** • **examine real life situations by identifying, mathematically valid arguments and drawing conclusion to enhance mathematical thinking**	• use language to compare heights/ lengths, masses and capacity of different objects. • read, recognize and use units of length (kilometer, meter and centimeter), mass (kilogram and gram) and capacity (liter and milliliter) and time (minute and second). • add and subtract in units of length, mass, capacity and time for solving real life situations. • use solar and Islamic calendar to find a particular dates/ day. • recognize and identify two- and three-dimensional figures. • determine perimeter of square, rectangle and triangle. • identify and differentiate straight line and curved line. • identify and draw points, lines, line segments, and rays. • identify and describe symmetrical shapes.	• convert standard units of length, mass, capacity and time. • solve the real-life situations involving addition and subtraction of units of distance/ length, mass, capacity and time. • distinguish parallel and non-parallel lines. • identify, classify and construct different types of angles. • describe and classify 2-D figures and 3-D geometrical objects • determine perimeter and area of square and rectangle • describe and complete symmetric figures with respect to given line of symmetry and point of rotation.

Standards	Benchmarks Grade-(I-III)	Benchmarks Grade-(IV-V)
DATA HANDLING • **collect, organize, analyze, display and interpret data/ information** • **examine real life situations by identifying mathematically valid arguments and drawing conclusion to enhance mathematical thinking**	• read, interpret and represent data using Carroll diagram, picture graph and tally charts.	• read and interpret bar graphs, line graphs and pie charts. • represent real life situations using pie chart. • find an average of given quantities in the data. • draw and read simple bar graphs both in horizontal and vertical form. • solve real life situations using simple bar graphs.

CHAPTER

02 PROGRESSION GRID

CHAPTER

02 PROGRESSION GRID

The Progression grid serves as a guide indicating how competencies at a particular developmental level are to be attained in order to meet the standards. They provide indicators of expectations from students at completion of each grade (I-V). The progression grid lists all the SLOs in parallel and shows the gradual development of learning objectives from one grade to another to bridge the gaps between the grades.

Concept of Whole Numbers				
Grade I	**Grade II**	**Grade III**	**Grade IV**	**Grade V**
• identify numbers 1–9. • identify 0 as a number. • read numbers up to 9 in numerals and in words. • Write numbers up to 9 in numerals and in words. • Count objects up to 9 and represent in numbers. • Match the numbers 0–9 with objects. • Count backward from 9. • arrange numbers in ascending and descending order (up-to 9). • identify which number (up to 9) comes ➢ before and after a given number ➢ between two given numbers. • identify 10 as a 2-digit number. • Read numbers up to 99. • Write numbers up to 99. • count forward and backward up to 99	• write ordinal numbers from first to twentieth. • write numbers 1–100 in words. • read numbers up to 999. • write numbers up to 999 as numerals	• read roman numbers up to 20 • write roman numbers up to 20 • recognize even and odd numbers up to 99 within a given sequence • differentiate even and odd numbers within a given sequence • read and write given numbers up to 10,000 (ten thousand) in numerals and words	• read numbers up to 100,000 (one hundred thousand) • write numbers up to 100,000 (one hundred thousand) • write numbers in words up to 100,000 (one hundred thousand) • recognize prime and composite numbers up to 100	• read numbers up to 1,000,000 (one million) in numerals and words • write numbers up to 1,000,000 (one million) in numerals and words

Concept of Whole Numbers				
Grade I	**Grade II**	**Grade III**	**Grade IV**	**Grade V**
• recognize the place value of a specific digit in a 2- digit number (tens and ones) • identify the place value of the specific digit in a 2-digit number • decompose a number up to 99 to identify the value of a number in ten's and one's place. • compare one- and 2 - digit numbers • order the set of numbers from 0 to 99 in ascending and descending order. • identify which number (up to 99) comes ➢ before and after a given number ➢ between two given numbers • count in tens and recognize 100 as a three-digit number. • identify and write missing numbers in a sequence from 1 to 100 • count and write the number of objects in a given set. • identify the position of objects using ordinal numbers such as first, second... tenth, including representations 1^{st}, 2^{nd}... 10^{th} through pictures.	• write ordinal numbers from first to twentieth. • write numbers 1–100 in words. • read numbers up to 999. • write numbers up to 999 as numerals	• read roman numbers up to 20 • write roman numbers up to 20 • recognize even and odd numbers up to 99 within a given sequence • differentiate even and odd numbers within a given sequence • read and write given numbers up to 10,000 (ten thousand) in numerals and words	• read numbers up to 100,000 (one hundred thousand) • write numbers up to 100,000 (one hundred thousand) • write numbers in words up to 100,000 (one hundred thousand) • recognize prime and composite numbers up to 100	• read numbers up to 1,000,000(one million) in numerals and words • write numbers up to 1,000,000 (one million) in numerals and words

Concept of Whole Numbers				
Grade I	**Grade II**	**Grade III**	**Grade IV**	**Grade V**
• arrange numbers in ascending and descending order up to 9. • identify which number (up to 9) comes • before/after a given number, • between two given numbers. • compare and order the numbers 0-10. • compare one- and two-digit numbers. • order numbers from 0 to 99 in ascending and descending order. • identify which number (up to 99) comes • before/after a given number, • between two given numbers. • identify and write missing numbers in a sequence from 1 to 100. • compare two or more groups of objects in terms of numbers. • match objects having one to one correspondence • identify the number of objects in two groups to show 'more than' or 'less than'. • compare numbers from 1 to 20 to identify 'how much more' one is than the other number.	• compare 2 - digit numbers with 3 - digit numbers (hundreds, tens and ones). • compare 3 - digit numbers with 3 - digit numbers (hundreds, tens and ones). • count backward ten steps down from any given number. • arrange numbers up to 999, written in mixed form and in ascending or descending order. • count and write in 10s (e.g.10,20, 30,...). • count and write in 100s (e.g.100,200, 300,...) • identify the smallest/large st number in a given set of numbers	• compare two numbers up to 3 - digit numbers using symbols "<", ">", or "=" • write the given set of numbers in ascending and descending order (up to 3 - digit numbers)	• compare and order numbers up to 6 - digit	

Place Value of Numbers				
Grade I	**Grade II**	**Grade III**	**Grade IV**	**Grade V**
• identify 10 as a 2 - digit number. • recognize the place values of a 2 - digit number (tens and ones). • Identify the place value of the specific digit in 2 - digit numbers.	• recognize that 1,000 is one more than 999 and the first 4 - digit number. • recognize the place value of a 3 - digit numbers. • identify the place value of a specific digit in a 3 - digit numbers.	• identify the place values up to 5 - digit numbers • represent a given number on number line up to 2 - digit numbers. • identify the value of a number on number line up to 2 - digit numbers.	• identify place values up to 6 - digit numbers	

Addition of Numbers				
Grade I	**Grade II**	**Grade III**	**Grade IV**	**Grade V**
• recognize and use symbols of addition '+' and equality '='. • add two, 1 - digit numbers (sum up to 9). • add a 2 - digit numbers with 1 - digit number. • add a 2 - digit number to 10s. • add two, 2 - digit numbers. • recognize the use of symbol to represent an unknown such as □+ 4=7 (include questions that sum up to 20). • add mentally the numbers (up to 20) involving real life situations.	• add 1-digit numbers with 1 - digit numbers • add 1-digit numbers with 2 - digit numbers with carrying • add 2 - digit numbers with 2 - digit numbers with carrying • solve real life number stories involving addition of 2 - digit numbers with carrying • add 3 - digit numbers with 1 - digit numbers without carrying	• add numbers up to 4 - digit with and without carrying (vertically and horizontally) • add numbers up to 100 using mental calculation strategies • solve real life number stories involving addition	• add numbers up to 5 - digit numbers • solve real life number stories involving addition up to to 5 - digit numbers	• add numbers up to 6 - digit numbers • solve real life situations involving addition up to 6 - digit numbers

Addition of Numbers				
Grade I	**Grade II**	**Grade III**	**Grade IV**	**Grade V**
• construct addition equations from given pictures or number stories. • identify Pakistani currency coins (Rs 1, 2, 5 and 10) • identify Pakistani currency notes (Rs 10, 20, 50 and 100) • match a group of coins/notes to an equivalent group of different denominations • add and subtract money using the prices of objects (transactions for example toys) • recognize money change (up to Rs100) to its equivalent's denominations • determine if enough money is available to make a purchase up to Rs100 • add different combinations of coins/notes (to make sum up to Rs100)	• add 3-digit numbers with 2-digit numbers without carrying • add 3-digit numbers with 3-digit numbers without carrying • solve real life number stories involving addition of 3-digit numbers without carrying • add 3-digit numbers with1-digit numbers with carrying of tens and hundreds • add 3-digit numbers with 2-digit numbers with carrying of tens and hundreds • add 3-digit numbers with 3-digit numbers with carrying of tens and hundreds • solve real life number stories involving addition of 3-digit numbers with carrying of tens and hundreds			

Subtraction of Numbers				
Grade I	**Grade II**	**Grade III**	**Grade IV**	**Grade V**
• compare numbers from 1- 20 and find 'how many one is less than the other? • recognize subtraction as a difference and take away, (use the symbol '-'). • subtract 1 - digit numbers from 1 - digit numbers. (which results in positive). • subtract 1 - digit numbers from 2 - digit numbers. • subtract tens from 2 - digit numbers. • subtract 2 - digit numbers from 2 - digit numbers (which results in positive). • recognize the use of symbols to represent an unknown such as 9-□=7. • subtract mentally the numbers (up to 20) involving real life situations. • construct subtraction sentences from given pictures or number stories	• subtract 1 - digit numbers from 2 - digit numbers with borrowing • subtract 2 - digit numbers from 2 - digit numbers with borrowing • solve real life number stories of subtraction with borrowing • subtract 1 - digit numbers from 3 - digit numbers without borrowing • subtract 2 - digit numbers from 3 - digit number without borrowing • subtract 3 - digit numbers from 3 - digit numbers without borrowing • solve real life number stories of subtraction without borrowing • subtract 1 - digit numbers from 3 - digit numbers with borrowing. • subtract 2 - digit numbers from 3 - digit numbers with borrowing	• subtract up to 4 - digit numbers with and without borrowing • subtract numbers up to 100 using mental calculation strategies • solve real life number stories involving subtraction	• subtract up to 5 - digit numbers with and without borrowing • solve real life situations involving subtraction of up to 5 - digit numbers.	• subtract up to 6 - digit numbers. • solve real life situations involving subtraction of up to 6 - digit numbers.

Subtraction of Numbers				
Grade I	**Grade II**	**Grade III**	**Grade IV**	**Grade V**
	• subtract 3 - digit numbers from 3 - digit numbers with borrowing • solve real life number stories of subtraction up to 3 - digit numbers with borrowing • analyze simple real-life situations identifying correct operation of addition and subtraction with carrying/borrowing in mixed form.			

Multiplication of Numbers				
Grade I	**Grade II**	**Grade III**	**Grade IV**	**Grade V**
	• recognize multiplication as repeated addition (for example 2+2+2=6 is equivalent to 3 times 2 which is 3 x 2 = 6) and use multiplication symbol “×” • complete number sequences in steps of 2,3,4,5 and 10 (for example in steps of 2 the sequence is expressed as 2,4, 6...)	• develop multiplication tables for 6, 7, 8, and 9 • multiply 2 - digit numbers by 1 - digit numbers • multiply a number by 0 and 1 • apply mental mathematical strategies to multiply 1 - digit numbers to 1 - digit numbers • solve real life situations involving multiplication of 2 - digit numbers by 1 - digit numbers	• multiply up to 5 - digit numbers by up to 3 - digit numbers • solve real life situations involving multiplication of up to 5 - digit numbers by up to 3 - digit numbers.	• multiply up to 6 - digit numbers by 10, 100, and 1000. • multiply up to 6 - digit number, by a number up to 3 - digit • solve real life situations involving multiplication of up to 6 - digit numbers, by a up to 3 - digit numbers.

Multiplication of Numbers				
Grade I	**Grade II**	**Grade III**	**Grade IV**	**Grade V**
	• develop multiplication tables of 2,3,4, 5 and 10 till the multiplication of 10x10 • multiply numbers within multiplication table • write number sentence for multiplication from the pictures such as 2×[] =6 • solve number stories on multiplication up to 1-digit			

Division of Numbers				
Grade I	**Grade II**	**Grade III**	**Grade IV**	**Grade V**
	• recognize and use division symbol "÷" • recognize division as successive subtraction • divide numbers within the multiplication tables with remainder zero • solve number stories involving division up to 1 - digit numbers • solve real life situations (using Pakistani currency as well) involving addition, subtraction, multiplication, and division. • give reasons for choosing the correct operation	• divide 2 - digit numbers by a 1 - digit numbers (with zero remainder) • apply mental mathematical strategies to divide 1 - digit number by a 1 - digit number • solve real life situations involving division of 2 - digit numbers by a 1 - digit numbers	• divide numbers up to 4 - digit by numbers up to 2 - digit • solve real life situations involving division of numbers up to 4 - digit by numbers up to 2 - digit • solve real life situations using appropriate operations of addition, subtraction, multiplication and division of numbers up to 2 - digit • identify divisibility rules for 2, 3, 5, and 10 • use divisibility tests for 2, 3, 5 and 10 on numbers up to 5 - digit	• divide up to 5 - digit numbers by 10,100 and 1,000 • divide, up to 5 - digit numbers by up to 2 - digit numbers • solve real life situations involving division of numbers, up to 5 - digit by a number up to 2 - digit • find HCF of two or three numbers, up to 2 - digits, using prime factorization method and division method

Division of Numbers				
Grade I	**Grade II**	**Grade III**	**Grade IV**	**Grade V**
			• identify and differentiate 2 - digit prime and composite numbers • find factors of a number up to 50 • list the first ten multiples of a 1 - digit number • differentiate between factors and multiples • factorize a number by using prime factors • determine common factors of two or more 2 - digit numbers • determine common multiples of two or more 2 - digit numbers	• find LCM of two or three numbers, up to 2 - digit, using prime factorization method and division method • solve real life situations involving HCF and LCM

Fractions				
Grade I	**Grade II**	**Grade III**	**Grade IV**	**Grade V**
	• recognize fraction as equal parts of a whole • identify half, one-third and quarter with the help of objects and figures (without writing 1/2, 1/3, 1/4) • represent half (1/2), one third (1/3) and quarter (1/4) in numerical form • shade the equal parts of a given figure to match a given fraction • recognize and name unit fractions up to 1/10 • recognize fractions like two thirds (2/3), three fourth (3/4), four fifth (4/5), and so on up to nine tenths (9/10).	• express the fractions in figures and vice versa • match the fractions with related figures • recognize proper and improper fractions • differentiate between proper and improper fractions • identify equivalent fractions from the given figures • write three equivalent fractions for a given figure • write three equivalent fractions for a given fraction • compare fractions with same denominators using symbols “<”, “>” or “= “ • add two fractions with same denominators • represent addition of fractions through figures • subtract fractions with same denominators • represent subtraction of fractions through figures	• recognize like and unlike fractions • compare two unlike fractions by converting them to equivalent fractions with the same denominator • simplify fractions to the lowest form. • identify unit, proper, improper fractions and mixed numbers • convert improper fractions to mixed numbers and vice versa • arrange fractions in ascending and descending order • add fractions with like denominators • subtract fractions with like denominators • multiply fractions by whole numbers • multiply two or more fractions (proper, improper, and mixed numbers) • divide a fraction by a whole number • analyze real life situations involving fractions by identifying appropriate operations	• add and subtract two or more fractions with different denominators • multiply a fraction by a 1 - digit numbers and demonstrate with the help of diagrams • multiple two or more fractions involving proper, improper fractions and mixed numbers • solve real life situations involving multiplication of fractions • divide a fraction by a whole number • divide a fraction by another fraction involving proper, improper fractions, and mixed numbers • solve real life situations involving division of fractions • recognize percentage as a special kind of fraction. • convert percentage to fraction and to decimal number vice versa only for numbers without decimal part i.e. 35 %, 75% etc. • solve real life situations involving percentage

Decimal Numbers				
Grade I	**Grade II**	**Grade III**	**Grade IV**	**Grade V**
			• recognize a decimal number as an alternate way of writing a fraction • express decimal number as a fraction whose denominator is 10 or 100 or 1000 • identify and recognize the place value of a digit in decimals numbers up to 3 decimal places • convert a given fraction to a decimal number when denominator of the fraction is 10, 100 or 1000 • convert a given fraction to a decimal number when denominator of the fraction is not 10, 100 or 1000 but can be converted to 10, 100 or 1000 • convert decimals numbers (up to three decimal places) to fraction. • add and subtract 3 - digit numbers (up to 2 decimal places). • multiply a 2 - digit numbers (up to 1 decimal place) by 10, 100, and 1000.	• compare numbers up to 3 - digit with two decimal places • arrange numbers up to 3 - digit numbers with two decimal places in ascending and descending order • add and subtract 4 - digit numbers up to 3 - decimals places • multiply a 3 - digit numbers up to two decimal places by 10, 100, and 1000 • multiply a 3 - digtnumbers up to two decimal places by a whole number up to 2 - digit • multiply a 3 - digit number up to two decimal places by a 3 - digit numbers up to two decimal places • divide a 3 - digit numbers up to two decimal places by 10, 100, and 1000 • divide a 3 - digit numbers up to two decimal places by a whole number up to 2 - digit • divide a 3 - digit numbers up to two decimal places by a 2 - digit number up to one decimal place

Decimal Numbers				
Grade I	**Grade II**	**Grade III**	**Grade IV**	**Grade V**
			• multiply a 2 - digit numbers with one decimal place by a 1 - digit number. • divide a 2 - digit numbers with one decimal place by a 1 - digit number. • solve real life situations involving 2 - digit numbers with one decimal place using appropriate operation.	• convert fractions to decimals numbers using division. • solve real life situations involving division of 3-digit numbers up to two decimal places

Estimation				
Grade I	**Grade II**	**Grade III**	**Grade IV**	**Grade V**
		• round off a whole number to the nearest 10 and 100	• round off a whole number to the nearest 10, 100 and 1000 • round off decimal numbers (with one or two decimal places) to the nearest whole number.	• round off a 4 - digit numbers up to three decimal places to the nearest tenth or hundredth • estimate sum or difference of the numbers up to 4 - digit.

GEOMETRY AND MEASUREMENTS

Measurement of Length				
Grade I	**Grade II**	**Grade III**	**Grade IV**	**Grade V**
• compare the heights/lengths of two or more objects using following terms: ➢ long, longer, longest ➢ short, shorter, shortest, ➢ tall, taller, tallest ➢ high, higher, highest	• compare the length of different objects • recognize the units of length (meter and centimeter) • use standard metric units of length (meter and centimeter) and their abbreviations to measure and record lengths of verity of objects • use addition and subtraction within 100 to solve real life situations involving lengths in same units	• use standard metric units of length (kilometer, meter, and centimeter) including abbreviations. • add measures of length in same units with and without carrying • solve real life situations involving same units of length for addition without carrying • subtract measures of length in same units without borrowing • solve real life situations involving same units of length for subtraction without borrowing.	• use standard metric units to measure the length of different objects • convert larger to smaller metric units (2-digit numbers with one decimal place) kilometers into meters, meters into centimeters, centimeters into millimeters • add and subtract measures of length in same units • solve real life situations involving conversion, addition and subtraction of units of length	• convert measures given in kilometers to meters and vice versa, meters to centimeters and vice versa, centimeters to millimeters and vice versa. • solve real life situations involving conversion, addition and subtraction of units of distance

Measurement of Mass				
Grade I	**Grade II**	**Grade III**	**Grade IV**	**Grade V**
• compare the masses of two or more objects using the terms: ➢ Heavy, heavier, heaviest. ➢ Light, lighter, lightest.	• compare the mass of different objects • recognize the units of mass, (kilogram and gram) • use standard metric units of mass (kilogram, gram) and their abbreviations to measure and record mass of verity of objects	• use standard metric units of mass (kilogram and gram) including abbreviations • add measures of mass in same units without carrying • solve real life situations involving same units of mass for addition without carrying	• use standard metric units to measure the mass of different objects • convert larger to smaller metric units (2-digit numbers with one decimal place) kilograms into grams, grams into milligrams	• convert measures given in kilometers to meters and vice versa, meters to centimeters and vice versa, centimeters to millimeters and vice versa. • solve real life situations involving conversion, addition and subtraction of units of distance

Measurement of Mass				
Grade I	**Grade II**	**Grade III**	**Grade IV**	**Grade V**
	• use addition and subtraction within 100 to solve real life situations involving mass in same units	• subtract measures of mass in same units without borrowing • solve real life situations involving same units of mass for subtraction without borrowing	• add and subtract measures of mass in same units • solve real life situations involving conversion, addition and subtraction of units of mass	

Measurement of Capacity				
Grade I	**Grade II**	**Grade III**	**Grade IV**	**Grade V**
	• compare capacity of different objects using non-standard units (jug, glass, cup, etc.) • recognize and use the standard metric units of capacity, (liter and milliliters) • use addition and subtraction within 100 to solve real life situations involving capacity in same units	• use standard metric units of capacity (liter and milliliter) including abbreviations • add measures of capacity in same units without carrying • solve real life situations involving same units of capacity for addition without carrying • subtract measures of capacity in same units with and without borrowing • solve real life situations involving same units of capacity for subtraction without borrowing	• use standard metric units to measure the capacity of different containers • convert larger to smaller metric units (2-digit numbers with one decimal place) liters in to milliliters • add and subtract measures of capacity in same units • solve real life situations involving conversion, addition and subtraction of units of capacity	

Time				
Grade I	**Grade II**	**Grade III**	**Grade IV**	**Grade V**
• recognize the hour and minute hands of an analog clock. • read and tell time in hours from the analog clock for example 2 o'clock. • read and tell time in hours from the digital clock. • name and order days of the week. • identify which day comes after/before a particular day. • name (orally) the solar months of the year	• recognize the number of hours in a day and numbers of minutes in an hour • read and write the time from a clock in hours and minutes (with five-minute intervals) e.g. read 8:15 as eight fifteen and 8:50 as eight fifty • recognize a.m. and p.m. • draw hands of a clock to show time in hours and minutes (with five minutes intervals) • use Solar calendar to find a particular date/ day • use Islamic calendar to find a particular date/ day	• use a.m. and p.m. to record the time from 12-hour clock • read and write time from analog and digital clocks • read and write days and dates from the calendar • add units of time in hours • solve real life situations involving units of time for addition of hours • subtract units of time in hours • solve real life situations involving subtraction of units of time in hours	• read and write the time using digital and analogue clocks on 12-hours and 24-hours format • convert hours to minutes and minutes to seconds • convert years to months, months to days, and weeks to days • add and subtract units of time without carrying and borrowing • solve simple real-life situations involving conversion, addition and subtraction of units of time	• convert hours to minutes and vice versa, minutes to seconds and vice versa • convert years to months and vice versa, months to days and vice versa, weeks to days and vice versa • add and subtract interval of time in hours and minutes with carrying and borrowing • solve real life situations involving conversion, addition and subtraction of intervals of time.

Perimeter and Area				
Grade I	**Grade II**	**Grade III**	**Grade IV**	**Grade V**
		• calculate perimeter of square, rectangle, and triangle	• find perimeter of a simple figure on square grid • recognize that perimeter is measured in units of length • find area of a simple figure on square grid • recognize that area of a square is measured in m^2 and cm^2.	• differentiate between perimeter and area of a square and rectangular region • differentiate between perimeter and area of a region • identify the units for measurement of perimeter and area • find and apply formulas for perimeter and area of a square and rectangular region • solve real life situations involving perimeter and area of square and rectangular region.

Geometry				
Grade I	**Grade II**	**Grade III**	**Grade IV**	**Grade V**
• recognize and identify shapes of similar objects in daily life. • identify the following basic shapes ➢ rectangle ➢ square ➢ circle ➢ triangle • match similar basic shapes in daily life. • distinguish basic shapes by considering their attributes (sides). • classify 2-D shapes according to the number of sides and corners • identify whether an object is placed ➢ inside or outside ➢ above or below ➢ over or under ➢ far or near ➢ before or after of a given picture.	• identify the figures like square, rectangle, triangle, circle, semi-circle, and quarter-circle • identify vertices and sides of a triangle, rectangle and square • differentiate between a straight line and a curve • identify straight lines and curves from the given drawings	• recognize point, line, ray and line segment • classify figures according to number of sides as quadrilaterals (rectangles, squares) and triangles • identify circle, its center, radius and diameter	• recognize and identify horizontal and vertical, parallel and non-parallel lines • recognize an angle formed by intersection of rays and measure it in degrees • recognize right angle • identify center, radius, diameter and circumference of a circle	• identify different types of angle (acute, right, obtuse) • recognize straight and reflex angle • describe adjacent, complementary , and supplementary angles • identify and describe triangles with respect to their sides (equilateral, isosceles, and scalene triangles) • identify and describe triangles with respect to their angles (acute angled, obtuse angled, and right angles triangle) • recognize the kinds of quadrilateral (square, rectangle, parallelogram, rhombus, trapezium, and kite)

3-D SHAPES				
Grade I	**Grade II**	**Grade III**	**Grade IV**	**Grade V**
	• recognize and name 3-D objects (cubes, cuboids, cylinder, cone, sphere, pyramids)	• describe and differentiate 3-D objects (cubes, cuboids, pyramids) with respect to the number of edges and faces	• compare and sort 3-D objects (cubes, cuboids, pyramids, cylinder, cone, sphere)	• describe and make 3-D shapes (cubes, cuboids, cylinder, cone, sphere, pyramids) and their nets.

Practical Geometry				
Grade I	**Grade II**	**Grade III**	**Grade IV**	**Grade V**
	• use ruler to draw a straight line of given length (exclude fractional length)	• draw and measure lines to the nearest centimeters and millimeters	• measure and draw an angle and recognize the symbol (∠) to represent it • recognize and draw acute and obtuse angles with reference to a right angle	• use protractor and ruler to construct ➢ a right angle ➢ a straight angle ➢ reflex angles of different measures • use protractor and ruler to construct a triangle when two angles and their included side is given. • two sides and included angle is given. • use protractor and ruler to construct a square and rectangle when lengths of sides are given.

Symmetry				
Grade I	**Grade II**	**Grade III**	**Grade IV**	**Grade V**
		• identify reflective symmetry in simple two-dimensional (2-D) shapes • identify and draw lines of symmetry	• recognize lines of symmetry in two-dimensional (2-D) shapes • complete a symmetric figure with respect to a given line of symmetry on square grid/dot pattern	• recognize different types of symmetry (reflective and rotational). • identify lines of symmetry for given shapes • find point of rotation and order of rotational symmetry of given shapes

ALGEBRA

Patterns				
Grade I	**Grade II**	**Grade III**	**Grade IV**	**Grade V**
• identify the next shape in the patterns with 2 or 3 elements • extend a given pattern of 2 or 3 elements	• make/ complete geometrical patterns on square grid according to one or two of the following attributes ➢ shape ➢ size ➢ orientation		• recognize a given increasing and decreasing pattern by stating a pattern rule. • describe the pattern found in a given table or chart • complete the given increasing & decreasing number sequence	• identify and apply a pattern rule to determine missing elements for a given pattern • identify the pattern rule of a given increasing and decreasing pattern and extend the pattern for the next three terms • describe the pattern found in a given table or chart

DATA HANDLING

Data Handling				
Grade I	**Grade II**	**Grade III**	**Grade IV**	**Grade V**
		• representation of data by Carroll diagram and tally charts • read and interpret a Carroll diagram and tally charts • read and interpret a picture graph	• read simple bar graphs given in horizontal and vertical forms • interpret real life situations using data presented in bar graphs • read line graph. • interpret real life situations using data presented in line graphs. • read pie chart • interpret real life situations using data presented in pie chart	• find and describe average of given quantities in the data • solve real life situations involving average • organize the given data using bar graph • read and interpret a bar graph given in horizontal and vertical form • solve real life situations using data presented in bar graph

CHAPTER

03 CURRICULUM FOR MATHEMATICS GRADE I

CHAPTER

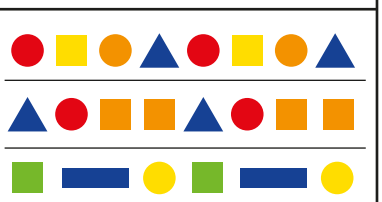
03 CURRICULUM FOR MATHEMATICS GRADE I

Unit	Contents and Scope	SLOs	Suggested Activities/ web links
Unit 1: Whole numbers	1.1 Numbers 0-9	i. Identify numbers 1-9.	Students should be motivated to count everything around them, like chairs, books, windows etc. Teacher should read aloud local stories and songs which involve numbers like پانچ چوہے گھر سے نکلے کرنے چلے شکار https://www.education.com/resources/two-digit-numbers/ Help students to establish one-to-one correspondence by moving, touching or pointing to objects as they say number words. Connect number names, numerals and quantities including zero, initially up to 10 and 100 using number stories
		ii. Identify 0 as a number.	
		iii. Read numbers up to 9 in numerals and in words.	
		iv. Write numbers up to 9 in numerals and in words.	
		v. Count objects up to 9 and represent in numbers.	
		vi. Match numbers 0-9 with objects.	
		vii. Count backwards from 9.	
		viii. Arrange numbers in ascending and descending order (up to 9).	
		ix. Identify which number (up to 9) comes • Before and after a given number • Between two given numbers.	
	1.2 Numbers up to 100	i. Identify 10 as a 2 - digit number.	
		ii. Compare and order the numbers 0-10.	
		iii. Read numbers up to 99	
		iv. Write numbers up to 99	
		v. Count forward and backward up to 99	
		vi. Recognize the place value of a specific digit in a 2 - digit numbers (tens and ones)	
		vii. Identify the place value of the specific digit in a 2 - digit number	
		viii. Decompose a number up to 99 to identify the value of a number in ten's and one's place.	
		ix. Compare 1 - digit and 2 - digit numbers	

Unit	Contents and Scope	SLOs	Suggested Activities/ web links
Unit 1: Whole numbers	1.2 Numbers up to 100	x. Order the set of numbers from 0 to 99 in ascending and descending order.	Activity 1: Decompose a number 49 in tens and ones. Activity 2: Are the number 19 and 91 the same or different? number stories in math http://www.mathcats.com/explore/numberstories.html Use base - 10 blocks or groups of ten beads as 10 and hundred beads as 100 to develop students' understanding of numbers. Children's currency can also be used for this purpose. Develop different representations of the same number by decomposing and composing, for example 25 as twenty-five ones; one ten and fifteen ones; and two tens and five ones. Teacher should help students to recognize 25 as 25 ones; one ten and fifteen ones; and two tens and five ones.
		xi. Identify which number (up to 99) comes • Before and after a given number • Between two given numbers	
		xii. Count in tens and recognize 100 as a 3 - digit numbers.	
		xiii. Identify and write missing numbers in a sequence from 1 to 100	
		xiv. Count and write numbers of objects in a given set	
		xv. Identify the position of objects using ordinal numbers such as first, second, ..., tenth, including representations 1^{st}, 2^{nd}, ...,10^{th} through pictures.	
	1.3 Comparing and ordering	i. Compare two or more groups of objects in terms of numbers.	
		ii. Match objects having one to one correspondence	
		iii. Identify the number of objects in two groups to show "more than" and "less than"	

Unit	Contents and Scope	SLOs	Suggested Activities/ web links
Unit 2: Number operations	2.1. Addition (without carrying)	i. Compare numbers from 1 to 20 to identify "how much more" one is from another.	Activity 1: Decompose a number 49 in tens and ones. Activity 2: Are the number 19 and 91 the same or different? number stories in math http://www.mathcats.com/explore/numberstories.html Use base-10 blocks or groups of ten beads as 10 and hundred beads as 100 to develop students' understanding of numbers. Children's currency can also be used for this purpose. Develop different representations of the same number by decomposing and composing, for example 25 as twenty-five ones; one ten and fifteen ones; and two tens and five ones. Teacher should help students to recognize 25 as 25 ones; one ten and fifteen ones; and two tens and five ones. Pegs and washing line could be a useful resource to teach addition or subtraction facts. It can also help students to translate their thinking from concrete operation to symbolic notations.https://earlyimpactlearning.com/washing-line-maths-activities/Activity: Complete the sentence such as 9-□= 7 Use beads, marbles, wooden blocks or any other suitable objects to convey the concept of addition and subtraction in real life. http://www.softschools.com/math/subtraction/picture_subtraction_worksheets/picture_subtraction_worksheets.html
		ii. Recognize and use symbols of addition "+" and equality" ="	
		iii. Add two 1 - digit numbers sum up to 9.	
		iv. Add a 2 - digit numbers to a 1 - digit number	
		v. Add a 2 - digit number to 10s	
		vi. Add two, 2 - digit numbers	
		vii. Recognize the use of symbol to represent an unknown such as □ + 4=7, 3+ 4=□, 4 + □ = 7 (include questions that sum up to 20)	
		viii. Add the numbers (up to 20) by using real life examples	
		ix. Construct addition sentence from given number stories	
	2.2. Subtraction (without borrowing)	i. Compare numbers from 1- 20 and find "how many less"	
		ii. Recognize subtraction as a difference and take away, and use the symbol "-"	
		iii. Subtract 1-digit number from 1 - digit number	
		iv. Subtract 1 - digit number from 2 - digit number	
		v. Subtract tens from 2 - digit number	
		vi. Subtract 2 - digit number from 2 - digit number (Which result in positive)	
		vii. Recognize the use of symbol to represent an unknown such as 9-□ =7, 9 – 7 =□	
		viii. Subtract the numbers (up to 20)	
		ix. Construct subtraction sentences from given number stories	

Unit	Contents and Scope	SLOs	Suggested Activities/ web links
Unit 3: Measure-ment: Length and Mass	3.1. Comparison of objects	i. Compare the heights/lengths of two or more objects using the following terms • Long, longer, longest • Short, shorter, shortest • Tall, taller, tallest • High, higher, highest	Students should be given experiences of comparing the attributes of two objects by looking at, touching of directing aligning them side by side. They can use their hands and feet for comparison. Teacher should use language as large shoe, deep container etc.
		ii. Compare the masses of two or more objects using the terms: • Heavy, heavier, heaviest • Light, lighter, lightest	
Unit 4: Money	4.1. Pakistani currency	i. Identify Pakistani currency coins (Rs 1, 2, 5 and 10)	Engage students in dummy currency transactions.
		ii. Identify Pakistani currency notes (Rs 10, 20, 50 and 100)	
	4.2. Equivalent sets of money	i. Match a group of coins/notes to an equivalent group of different denominations	
		ii. Add and subtract money using the prices of objects (transactions) (e.g.toys)	
	4.3. Comparing money	i. Recognize money change (up to 100) to its equivalents/denominations	Teachers should encourage students to make their own notes and coins using card boards and do the transactions in the situations design by the teachers. For example, Teacher can ask students to pick four notes from a pile of mixed10, 20 and 50 rupees notes and ask to figure out what total money they could have.
		ii. Determine if enough money is available to make a purchase (up to 100)	
		iii. Add different combinations of coins/notes (to make sum up to 100)	
Unit 5: Time	5.1. Time	i. Recognize the hour and minute hands of an analog clock	
		ii. Read and tell time in hours from the analog clock for example 2 o'clock	
		iii. Read and tell time in hours from the digital clock	
	5.2. Date	i. Name in order days of the week	For teaching analog and digital clock, teachers should use clocks made up of card boards along with real clocks. Also, calendar could be used to teach number of days in a week and number of months in a year.
		ii. Identify which day comes after/before a particular day	
		iii. Name (orally) the Solar months of the year	
		iv. Name (orally) the Islamic months of the year	

Unit	Contents and Scope	SLOs	Suggested Activities/ web links
Unit 6: Geometry	6.1. Two Dimensional (2-D) Shapes	i. Recognize and identify shapes of similar objects in the daily life.	There could be a lot of activities, i.e. a clock is a circle, egg is an oval, pizza slice is a triangle, TV is a rectangle. Activities could include "eye spy" and outside/playground activity where students observe objects in nature that fit into the categories—tire of a car is a circle, signboards are square or rectangle, cricket grounds/tracks are circle etc. Make/complete patterns according to following attributes i. Shapes ii. Sizes iii. Colors Make models of given shapes using cardboard For example, a square is different from rectangle because although both have four sides but square has all four sides equal, while rectangle has opposite sides equal. https://www.education.com/worksheets/first-grade/identify-continue-shape-patterns/
		ii. Identify the following basic shapes • Rectangle • Square • Circle • Triangle	
		iii. Match similar basic shapes in daily life.	
		iv. Distinguish basic shapes by considering their attributes (sides).	
		v. Classify 2-D shapes according to number of sides and corners.	
	6.2. Patterns	i. Identify the next shape in the patterns with 2 or 3 elements	
		ii. Extend a given pattern of 2 or 3 elements	
	6.3. Position	i. Identify whether an object is placed • Inside or outside • Above or below • Over or under • Far or near • Before or after of a given object	Describe the relative location/position of the objects or people using positional language from the picture stories. Activity: use a map and describe points in relation to one another using the four-point compass). Activity: locate position on a grid with labelled rows and columns

CHAPTER

04 CURRICULUM FOR MATHEMATICS GRADE II

CHAPTER

04 CURRICULUM FOR MATHEMATICS GRADE II

Unit	Contents and Scope	SLOs	Suggested Activities/ web links
Unit 1: Whole numbers	1.1 Ordinal numbers	i. Write ordinal numbers from first to twentieth	Local stories and songs should be included to show different usage of numbers as cardinal and ordinal Number line with the pictures of jumping frog could be used for counting forward and backward. Base 10 blocks or any alternative model to illustrate base 10 counting system should be used.
		ii. Write numbers 1-100 in words	
	1.2 Numbers up to 100	i. Read numbers up to 999	
		ii. Write numbers up to 999 as numerals	
		iii. Recognize the place value of a 3 - digit number	
		iv. Identify the place value of a specific digit in a 3 - digit numbers	
		v. Compare 2 - digit numbers with 3 - digit numbers (hundreds, tens and ones)	
		vi. Compare 3 - digit numbers with 3 - digit numbers (hundreds, tens and ones)	
		vii. Count backward ten steps down from any given number	
		viii. Arrange numbers up to 999, written in mixed form, in increasing or decreasing order	
		ix. Count and write in 10s (e.g. 10, 20, 30, ...)	
		x. Count and write in 100s (e.g. 100, 200, 300, ...)	
		xi. Identify the smallest/largest number in a given set of numbers	
		xii. Recognize that 1000 is one more than 999 and the first 4-digit number	

Unit	Contents and Scope	SLOs	Suggested Activities/ web links
Unit 2: Number Operations	2.1. Addition of 2 - digit numbers (with carrying)	i. Add ones and ones	Number stories in math https://www.ixl.com/math/grade - 2
		ii. Add ones and 2 - digit numbers with carrying	
		iii. Add 2 - digit numbers and 2 - digit numbers with carrying	
		iv. Solve real life number stories, involving addition of 2 - digit numbers with carrying	
	2.2. Addition of 3 - digit numbers (without carrying)	i. Add 3 - digit number and ones without carrying	
		ii. Add 3 - digit number and 2 - digit number without carrying	
		iii. Add 3 - digit number and 3-digit number without carrying	
		iv. Solve real life number stories involving addition of 3 - digit numbers without carrying	
	2.3. Addition of 3 - digit numbers (with carrying)	i. Add 3 - digit number and 1 - digit number with carrying of tens and hundreds	
		ii. Add 3 - digit number and 2 - digit number with carrying of tens and hundreds	
		iii. Add 3 - digit numbers with 3 - digit numbers with carrying of tens and hundreds	
		iv. Solve real life number stories involving addition of 3 - digit numbers with carrying of tens and hundreds	
	2.4. Subtraction of 2 - digit numbers (with borrowing)	i. Subtract 1 - digit number from 2 - digit numbers with borrowing	Number stories in math https://www.ixl.com/math/grade-2
		ii. Subtract 2 - digit numbers from 2 - digit numbers with borrowing	
		iii. Solve real life number stories of subtraction of 2 - digit numbers with borrowing	

Unit	Contents and Scope	SLOs	Suggested Activities/ web links
Unit 2: Number Operations	2.5. Subtraction of 3 - digit numbers (without borrowing)	i. Subtract 1 - digit from 3 - digit number without borrowing	Number stories in math https://www.ixl.com/math/grade-2
		ii. Subtract 2 - digit number from 3 - digit number without borrowing	Think what to add to/take from 2 + □ = 10 ,10 – □ = 8 What make 10 and what make 8
		iii. Subtract 3 - digit numbers from 3 - digit numbers without borrowing	
		iv. Solve real life number stories of subtraction up to 3 - digit without borrowing	Add 54 and 45 on number line by making group of tens.
	2.6. Subtraction of 3-digit numbers (with borrowing)	i. Subtract 1 - digit number from 3 - digit number with borrowing	Subtract 34 from 81 on number line by making group of tens.
		ii. Subtract 2 - digit number from 3 - digit number with borrowing	
		iii. Subtract 3 - digit number from 3 - digit number with borrowing	
		iv. Solve real life number stories of subtraction up to 3 - digit with borrowing	
		v. Analyze simple situations identifying correct operation of addition and subtraction with carrying/borrowing in mixed form	
	2.7. Multiplication	i. Recognize multiplication as repeated addition (e.g. 2+2+2=6 is equivalent to 3 times 2 = 6 and 3 x 2 =6) and use multiplication symbol" x"	Multiplication http://www.tlsbooks.com/third-grade-multiplication-division.htm worksheets link on multiplication
		ii. Complete number sequences in steps of 2, 3, 4, 5 and 10 (e.g. in steps of 2 the sequence is expressed as 2, 4, 6...)	
		iii. Develop multiplication tables of 2, 3, 4, 5 and 10 till the multiplication of 10 x 10	http://www.tlsbooks.com/third-grade-multiplication-division.htm
		iv. Multiply numbers within multiplication table	
		v. Write number sentence for multiplication from the picture such as 2 x □ = 6	
		vi. Solve number stories on multiplication up to 1 - digit numbers.	https://www.tes.co.uk/teaching-resource/recognise-multiples-of-2-5-and-10-worksheet-6372812

Unit	Contents and Scope	SLOs	Suggested Activities/ web links
Unit 2: Number Operations	2.8. Division	i. Recognize and use division symbols ÷.	Make simple number stories using concrete objects like beads, blocks, toffees, sweets and decide what operation (addition, subtraction, multiplication, and division) are required to solve them
		ii. Recognize division as successive subtraction	
		iii. Divide numbers within the multiplication tables with remainder zero	
		iv. Solve number stories involving division up to 1 - digit numbers	
	2.9. Addition, Subtraction, Multiplication and Division	i. Solve real life situations (using Pakistani currency as well) involving addition, subtraction, multiplication, and division. Give reasons for choosing the correct operation	
Unit 3: Fractions	3.1 Fractions	i. Recognize fractions as equal parts of a whole	Fractions stories, paper folding, drawing and shading, using collection of objects to make equal parts of whole are useful strategies to start with fractions. Base - 10 blocks should be used to show how ten ones combine to make one ten. For example, if they add 7 and 8, they can do 'trade off', 15 ones with 1 ten and 5 ones. Instead of the language 'carrying' teacher should use language 'trading off' or 'exchanging' or 'joining'.
		ii. Identify half, one third and quarter with the help of objects and figures (without writing 1/2, 1/3, 1/4)	
		iii. Represent half, one third and quarter in numerical form (1/2, 1/3 and 1/4)	
		iv. Shade the equal parts of a given figure to match a given fraction	
		v. Recognize and name unit fractions up to 1/10.	
		vi. Recognize fractions like two thirds (2/3), three fourths (3/4), four fifths (4/5), up to nine tenths (9/10)	
Unit 4: Measure-ment: Length, Mass, and Capacity	4.1. Length	i. Compare the lengths of different objects.	Use a ruler or a measuring tape to find lengths and widths of different objects like book, table, chair etc. Find and compare heights of children in a class.
		ii. Recognize the units of length (meter and centimeter)	
		iii. Use standard metric units of length (meter and centimeter) and their abbreviation to measure and record lengths of variety of objects.	
		iv. Use addition and subtraction within 100 to solve real life situations involving lengths in same units	

Unit	Contents and Scope	SLOs	Suggested Activities/ web links
Unit 4: Measure-ment: Length, Mass, and Capacity	4.2. Mass	i. Compare the mass of different objects.	Feel the mass of different objects which weigh one kilogram and recognize that mass and size are not necessarily related. Identify objects around them which weigh less or more than one kilogram.
		ii. Recognize the units of mass, i.e. kilogram, gram	
		iii. Use standard metric units of mass (kilograms and grams) and their abbreviation to measure and record mass of variety of objects.	
		iv. Use addition and subtraction within 100 to solve real life situations involving mass in same units.	
	4.3. Capacity	i. Compare capacity of different objects using nonstandard units (jug, glass, cup, etc.)	Compare different-shaped containers which have the same capacity and discuss their observations. Find containers from real life which are less, more or equal to 1 liter. Estimate the capacity of various containers from real life, and then put them in order, from smallest to largest by referring to the printed capacity shown.
		ii. Recognize and use the standard metric units of capacity, i.e. liter and milliliter	
		iii. Use addition and subtraction within 100 to solve real life situations involving capacity in same units.	
Unit 5: Time	5.1. Time	i. Recognize the number of hours in a day and numbers of minutes in an hour	Draw the hands to show the time to the hour, half hour or quarter hour (using a ruler). Activity: use a calendar and talk about familiar events such as birthdays, Pakistan Day, etc.
		ii. Read and write the time from a clock in hours and minutes (with five-minute intervals) e.g. read 8:15 as eight fifteen and 8:50 as eight fifty	
		iii. Recognize a.m. and p.m.	
		iv. Draw hands of a clock to show time in hours and minutes (with five minutes intervals)	
		v. Use Solar calendar to find a particular date/day	
		vi. Use Islamic calendar to find a particular date/day	

Unit	Contents and Scope	SLOs	Suggested Activities/ web links
Unit 6: Geometry	6.1. Two dimensional (2-D) figures	i. Identify the figures like square, rectangle, triangle, circle, semi-circle, and quarter-circle	www.instantdisplay.co.uk Activity: Create 2-D shapes by using geoboards, match sticks, straws etc.
		ii. Identify vertices and sides of a triangle, rectangle and square	
	6.2. Straight lines and curves	i. Differentiate between a straight line and a curve	
		ii. Identify straight lines and curves from the given drawings	
		iii. Use ruler to draw a straight line of given length (exclude fractional length)	Identify objects around them which weigh less or more than one kilogram.
	6.3. Patterns	i. Make/ complete geometrical patterns on square grid according to one or two of the following attributes • Shape • Size • Orientation	Identify patterns in the environment such as on tiles, clothing, jewelry and patterns found in nature. Create patterns through practical activities using resources such as shapes, cubes, counters, paint, food items, coins, sequins stickers, threading beads or pasta shapes.
	6.4. Three dimensional (3-D) objects	i. Recognize and name 3-D Objects (cubes, cuboids, cylinder, cone, sphere)	Find common 2-D and 3-D shapes. Find corresponding shapes in the surrounding environments through activities. Compare and contrast 2-D and 3-D shapes by stating their properties.

CHAPTER

05

CURRICULUM FOR MATHEMATICS GRADE III

CHAPTER

05 CURRICULUM FOR MATHEMATICS GRADE III

Unit	Contents and Scope	SLOs	Suggested Activities/ web links
Unit 1: Whole numbers	1.1. Roman numbers	i. Read Roman numbers up to 20	http://www.amblesideprimary.com/ambleweb/mentalmaths/supersequencer.html http://www.ixl.com/math/grade-4/place-values http://www.whoinventedit.net/who-invented-numbers.html http://www.free-training-tutorial.com/place-value/collecttheships.html http://www.free-training-tutorial.com/place-value/airplanes.html http://www.free-training-tutorial.com/place-value/createnumber.html
		ii. Write Roman numbers up to 20	
	1.2. Even and odd numbers	i. Recognize even and odd numbers up to 99 within a given sequence	
		ii. Differentiate between even and odd numbers within a given sequence.	
	1.3. Place values	i. Identify the place values of numbers up to 5 - digit	
	1.4. Numbers up to 100,000	i. Read and write given numbers up to 10,000 (ten thousand) in numerals and words	
	1.5. Number Line	i. Represent a given number on number line up to 2 - digit numbers.	
		ii. Identify the value of a number from number line up to 2 - digit numbers.	
	1.6. Comparing and ordering numbers	i. Compare two numbers up to 3 - digits using symbols “<”, “>”, or “=”	
		ii. Write the given set of numbers in ascending and descending order (numbers up to 3 - digit)	
	1.7. Estimation	i. Round off a whole number to the nearest 10 and 100	

Unit	Contents and Scope	SLOs	Suggested Activities/ web links
Unit 2: Number Operations	2.1. Addition	i. Add numbers up to 4 - digit with and without carrying vertically and horizontally	Roll two dice twice a time, make 2 - digit numbers and then add on number line.
		ii. Add numbers up to 100 using mental calculation strategies	
		iii. Solve real life number stories up to 4 - digit with and without carrying involving addition	
	2.2. Subtraction	i. Subtract numbers up to 4 - digit with and without borrowing	Roll two dice twice a time, make 2 - digit numbers and then subtract on number line.
		ii. Subtract numbers up to 100 using mental calculation strategies	
		iii. Solve real life number stories up to 4 - digit with and without borrowing involving subtraction	
	2.3. Multiplication	i. Develop multiplication tables for 6, 7, 8, and 9	https://www.tes.co.uk/teaching-resource/recognise-multiples-of-2-5-and-10-worksheet-6372812 Ask students to explain the concept of multiplication with zero as zero group of 5 apples or 5 group of zero apples. https://www.homeschoolmath.net/teaching/md/zero_and_one.php
		ii. Multiply 2-digit number by 1 - digit number	
		iii. Multiply a number by 0 and 1	
		iv. Apply mental mathematical strategies to multiply 1 - digit numbers to 1 - digit numbers	
		v. Solve real life situations involving multiplication of 2 - digit numbers by 1 - digit numbers	
	2.4. Division	i. Divide 2 - digit number by a 1 - digit number (with zero remainder)	Describe a context in which a number of shares or a number of groups can be expressed as 56 ÷ 8.
		ii. Apply mental mathematical strategies to divide 1-digit number by a 1 - digit number	
		iii. Solve real life situations involving division of 2 - digit number by a 1 - digit number	

Unit	Contents and Scope	SLOs	Suggested Activities/ web links
Unit 3: Fractions	3.1. Common fractions	i. Express the fractions in figures and vice versa	Show fractions by using paper shapes and coloring. Show fractions of quantities using tangible objects.
		ii. Match the fractions with related figures	
	3.2. Proper and improper fractions	i. Recognize proper and improper fractions	
		ii. Differentiate between proper and improper fractions	
	3.3. Equivalent fractions	i. Identify equivalent fractions from the given figures	
		ii. Write three equivalent fractions for a given fraction	
	3.4. Comparing fractions	i. Compare fractions with same denominators using symbols "<", ">", or "="	
	3.5. Addition of fractions	i. Add two fractions with same denominators	
		ii. Represent addition of fractions through figures	
	3.6. Subtraction of fractions	i. Subtract fractions with same denominators	
		ii. Represent subtraction of fractions through figures	
Unit 4: Measure-ment: Length, Mass, and Capacity	4.1. Length	i. Use standard metric units of length (kilometer, meter, and centimeter) including abbreviations	https://www.homeschoolmath.net/worksheets/measuring-metric.php Teacher may ask students to find objects in the room that are as long as their foot or arm or palm.
		ii. Add measures of length in same units without carrying	
		iii. Solve real life situations involving same units of length for addition without carrying	
		iv. Subtract measures of length in same units without borrowing	
		v. Solve real life situations involving same units of length for subtraction without borrowing	

Unit	Contents and Scope	SLOs	Suggested Activities/ web links
Unit 4: Measure-ment: Length, Mass, and Capacity	4.2. Mass	i. Use standard metric units of mass (kilogram and gram) including abbreviations	Read the labels on products in your home which show their mass and compare the mass of various objects by putting them in order. Make two or three kilogram using various smaller masses. Create real life situations related to mass. In classroom add the capacities of various containers to the nearest liter and show the total capacity on a given scale.
		ii. Add measures of mass in same units without carrying	
		iii. Solve real life situations involving same units of mass for addition without carrying	
		iv. Subtract measures of mass in same units without borrowing	
		v. Solve real life situations involving same units of mass for subtraction without borrowing	
	4.3. Capacity	i. Use standard metric units of Capacity (liter and milliliter) including abbreviations	
		ii. Add measures of capacity in same units without carrying	
		iii. Solve real life situations involving same units of capacity for addition without carrying	
		iv. Subtract measures of capacity in same units without borrowing	
		v. Solve real life situations involving same units of capacity for subtraction without borrowing	
Unit 5: Measure-ment: Time	5.1. Time	i. Use a.m. and p.m. to record the time from 12-hour clock	Record the daily activities in terms of 'a.m.' and 'p.m.' • Activity: Ask students to record the daily activities of the morning, afternoon, evening and night using a.m. and p.m.
		ii. Read and write time from analog and digital clocks	
		iii. Read and write days and dates from the calendar	
		iv. Add measures of time in hours	
		v. Solve real life situations involving measures of time for addition of hours	

Unit	Contents and Scope	SLOs	Suggested Activities/ web links
Unit 5: Measure-ment: Time	5.1. Time	vi. Subtract measures of time in hours vii. Solve real life situations involving subtraction of measures of time in hours	• Discuss and record times of a variety of common events, school and home activities, television programs. • Provide a calendar of the year, and have the students figure out how many school days each month will have? On what days do the birthdays of friends and family fall? http://www.mathsisfun.com/geometry/symmetry-lineplane-shapes.html
Unit 6 Geometry	6.1. Geometrical shapes	i. Draw and measure line segments to the nearest centimeter and millimeter ii. Recognize point, line, ray and line segment iii. Classify figures according to number of sides as quadrilaterals (rectangles, squares and triangles) iv. Calculate perimeter of square, rectangle, and triangle v. Identify center, radius and diameter of a circle	Use paper folding and cutting to create equilateral and isosceles triangles. Draw a line of symmetry of different pictures or shapes using folding and mirrors.
	6.2. Symmetry	i. Identify reflective symmetry in two- dimensional (2-D) shapes ii. Identify and draw lines of symmetry	
	6.3. Three Dimensional (3-D) objects	i. Describe 3-D objects (cubes, cuboids, and pyramids) with respect to the number of edges and faces ii. Differentiate 3-D objects (cubes, cuboids, and pyramids) with respect to the number of edges and faces	Take pictures of various objects around them showing various 2-D (flat) and 3-D (solid) shapes
Unit 7: Data Handling	7.1. Data Representation	i. Representation of data by • Carroll diagram • Tally chart ii. Read and interpret a Carroll diagram and Tally chart iii. Read and interpret Picture Graph.	http://www.wmnet.org.uk/wmnet/custom/files_uploaded/uploaded_resources/850/carrollv4.swf Use Carroll diagrams to sort numbers or objects using one criterion, explain choices using appropriate languages.

CHAPTER

06 CURRICULUM FOR MATHEMATICS GRADE IV

CHAPTER

06 CURRICULUM FOR MATHEMATICS GRADE IV

Unit	Contents and Scope	SLOs	Suggested Activities/ web links
Unit 1: Whole numbers and Operations	1.1 Whole Numbers	i. Identify place values of digits up to one hundred thousand (100,000).	
		ii. Read numbers up to one hundred thousand (100,000).	
		iii. Write numbers up to one hundred thousand (100,000).	
		iv. Write numbers in words up to one hundred thousand (100,000).	
		v. Compare and order numbers up to 5 - digit.	
	1.2. Addition	i. Add numbers up to 5 - digit.	
		ii. Solve real life number stories involving addition of numbers up to 5 - digit.	http://www.k5learning.com/free-math-worksheets/fourth-grade-4/addition
	1.3. Subtraction	i. Subtract numbers up to 5 - digit.	
		ii. Solve real life situations involving subtraction of numbers up to 5- digit.	http://www.k5learning.com/free-math-worksheets/fourth-grade-4/subtraction Online resources / worksheets
	1.4. Multiplication	i. Multiply numbers up to 5 - digit by numbers up to 3 - digit.	http://www.k5learning.com/free-math-worksheets/fourth-grade-4/mental-multiplication
		ii. Solve real life situations involving multiplication of numbers up to 5 - digit by 3 - digit.	http://www.k5learning.com/free-math-worksheets/fourth-grade-4 http://www.k5learning.com/free-
	1.5. Division	i. Divide numbers up to 4 - digit by numbers up to 2 - digit.	Activity: Multiply a two-digit by a one number (using models and area rectangular methods).
		ii. Solve real life situations involving division of numbers up to 4 - digit by a number up to 2 - digit.	https:// www.splashlearn.com>area math-worksheets/fourth-grade-4/long-division
		iii. Solve real life situations using appropriate operations of addition, subtraction, multiplication and division of numbers up to 2 - digit.	

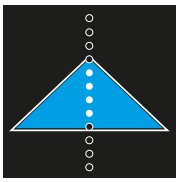
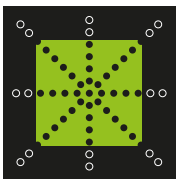
Unit	Contents and Scope	SLOs	Suggested Activities/ web links
Unit 1: Whole numbers and Operations	1.6. Number Patterns	i. Recognize a given increasing and decreasing pattern by stating a pattern rule.	Ask students to practice questions as below: For example, Pattern: 3, 8, 13, 18, 23, 28... (start with 3 and then add 5) The numbers alternately end with a 3 or 8 Activity: examine the patterns on Solar calendar and numbers chart.
		ii. Describe the pattern found in a given table or chart	
		iii. Complete the given increasing & decreasing number sequence	
Unit 2: Factors and Multiples	2.1. Divisibility Tests	i. Identify divisibility rules for 2, 3, 5, and 10.	
		ii. Use divisibility tests for 2, 3, 5 and 10 on numbers up to 5 digits.	
	2.2. Prime and composite numbers	i. Identify and differentiate 2 - digit prime and composite numbers	
	2.3. Factors and multiples	i. Find factors of a number up to 50.	
		ii. List the first ten multiples of a 1 - digit number.	
		iii. Differentiate between factors and multiples	
	2.4. Prime Factorization	i. Factorize a number by using prime factors.	Find all prime numbers less than 100.
		ii. Determine common factors of two or more 2 - digit numbers.	
		iii. Determine common multiples of two or more 2 - digit numbers.	
Unit 3: Fractions	3.1. Fractions	i. Recognize like and unlike fractions.	http://edhelper.com/Comparing_Fractions.htm https://www.superteacherworksheets.com/fractions-advanced.html Aamir ran 3/4 km before stopping for water, while Kaleem ran 2/3 km before stopping. Who ran the farthest before stopping? Draw a picture or write a sentence to support your answer.
		ii. Compare two unlike fractions by converting them to equivalent fractions with the same denominator.	
		iii. Simplify fractions to the lowest form	

Unit	Contents and Scope	SLOs	Suggested Activities/ web links
Unit 3: Fractions	3.2. Types of Fractions	i. Identify (unit, proper, improper) fractions and mixed numbers.	Explain how fractions are equivalent to each other using area and length models Students work in groups and solve the situations given below Ali plants carrots in 6/8 of his garden. If Mr. Noor has 4 regions and wants to plant carrots in the same sized space as Mr. Ali how many of the regions will he plant carrots in? Draw a picture and write a sentence to explain your answer. Arif ran 3/4 km before stopping for water, while Inham ran 2/3 km before stopping. Who ran the farthest before stopping? Draw a picture or write a sentence to support your answer. Express the fraction 3/6 as the product of a whole number and a unit fraction. Draw a model which supports your answer. Abdullah ran 1 and 2/3 km less than Akram. Abdullah ran 2 and 2/3 km. How far did Akram run? Draw a number line and an equation to support your answer.
		ii. Convert improper fractions to mixed numbers and vice versa	
		iii. Arrange fractions in ascending and descending order.	
	3.3. Addition and Subtraction of fractions	i. Add fractions with like denominators	
		ii. Subtract fractions with like denominators	
	3.4. Multiplication of fractions	i. Multiply a fraction (proper, Improper) and mixed number by a whole number	
		ii. Multiply two fractions (proper, Improper) and mixed numbers	
	3.5. Division of Fractions	i. Divide a fraction(proper, Improper) and mixed numbers by a whole number	
		ii. Analyze real life situations involving fractions by identifying appropriate number operations	

Unit	Contents and Scope	SLOs	Suggested Activities/ web links
Unit 4: Decimals	4.1. Decimals	i. Recognize a decimal number as an alternative way of writing a fraction.	
		ii. Express a decimal number as a fraction whose denominator is 10, 100 or 1000.	Write the place value of each digit of a decimal number '3.45' and also write in extended form.
		iii. Identify and recognize the place value of a digit in decimals (up to 3 - decimal places).	
	4.2. Conversion between fractions and decimal numbers	i. Convert a given fraction to a decimal if • Denominator of the fraction is 10, 100 or 1000. • Denominator of the fraction is not 10, 100 or 1000 but can be converted to 10,100 or 1000.	Use decimal notation and place value for tenths, hundredths and thousandths in context. For example, order amount of money, convert a sum of money such as Rs. 30.25 to paisa, or a length such as 130 cm to meters.
		ii. Convert a decimal (up to 3 - decimal places) to fraction.	
	4.3. Basic operations on decimals numbers	i. Add and subtract 3 - digit numbers (up to 2 - decimal places).	
		ii. Multiply a 2 - digit number (up to 1 decimal place) by 10, 100, and 1000.	
		iii. Multiply a 2 - digit number with 1decimal placeby a 1-digit number.	
		iv. Divide a 2 - digit number with 1 - decimal place by a 1 - digit number	
		v. Solve real life situations involving 2 - digit numbers with 1 - decimal place using appropriate operations.	
	4.4. Estimation	i. Round off a whole number to the nearest 10, 100, and 1000.	Estimate the sum and difference of two numbers up to 3 - digits with two decimal places using rounding off.
		ii. Round off decimal (with 1 or 2 decimal places) to the nearest whole number.	Estimate a quotient (2 or 3 - digit dividend by one- or two-digit divisor (e.g., 86 ÷ 4 as close to 80 ÷ 4 or close to 80 ÷ 5. Check the difference by using calculator and record the result)

Unit	Contents and Scope	SLOs	Suggested Activities/ web links
Unit 5: Measure-ments	5.1. Length	i. Use standard metric units to measure the length of different objects.	Rename units of length using decimal or fraction form (e.g., 25 cm can be converted into decimals and fractions as 25 cm = 0.25 m = 1/4 m Solve and complete practical tasks assigned by teacher involving addition, subtraction, multiplication and simple division of units of length (m, cm, and km)
		ii. Convert larger to smaller metric units (2 - digit numbers with one decimal place) • kilometers into meters • meters into centimeters • centimeters into millimeters	
		iii. Add and subtract measures of length in same units	
	5.2. Mass	i. Use standard metric units to measure the mass of different objects.	
		ii. Convert larger to smaller metric units (2 - digit numbers with one decimal place) • kilograms into grams • grams into milligrams	Rename units of mass using decimal or fraction form e.g., 250 g = 0.25 kg = 1/4 kg
		iii. Add and subtract measures of mass in same units	
	5.3. Capacity	i. Use standard metric units to measure the capacity of different containers.	Rename units of capacity using decimal and fraction form (e.g., 2 ℓ150 mℓ = 2150 mℓ = 2.15 ℓ
		ii. Convert larger to smaller metric units (2 - digit numbers with one decimal place) liters into milliliters	
		iii. Add and subtract measure of capacity in same units	
		iv. Solve real life situations involving conversion, addition and subtraction of measures of length, mass and capacity	

Unit	Contents and Scope	SLOs	Suggested Activities/ web links
Unit 5: Measure-ments	5.4. Time	i. Read and write the time using digital and analogue clocks on 12-hour and 24- hour format.	https://www.superteacherworksheets.com/time.html http://www.math-aids.com/Time/ Express the time orally and numerically from a 12-hour and 24-hour analog and digital click. Rename minutes as hours and hours as minutes. For example: a). 125 minutes. b). 1.15 hours Activity: Read and record calendar dates and days in a variety of formats (e.g., yyyy/mm/dd, dd/mm/yyyy)
		ii. Convert hours to minutes and minutes to seconds.	
		iii. Convert years to months, months to days, and weeks to days.	
		iv. Add and subtract measures of time without carrying and borrowing.	
		v. Solve simple real-life situations involving conversion, addition and subtraction of measures of time.	
Unit 6: Geometry	6.1. Lines	i. Recognize and identify parallel and non-parallel lines.	http://www.turtlediary.com/grade-3-games/math-games/lines.html Activity: Identify parallel and non-parallel lines in real life, e.g. on flags, furniture, doors and tiles www.instantdisplay.co.uk http://www.turtlediary.com/grade-3-games/math-games/angles.html http://www.bbc.co.uk/bitesize/ks2/maths/shape_space/ Form angles by opening books and doors, by rotating clock hands and geo strip arms, by physically turning (clockwise/anti-clockwise)
	6.2. Angle	i. Recognize an angle formed by intersection of two rays.	
		ii. Measure angles in degree (˚) by using protractor.	
		iii. Draw an angle of given measurement and use the symbol (∠) to represent it.	
		iv. Differentiate acute, obtuse and right angles.	
		v. Measure angles using protractor where • Upper scale of protractor reads the measure of angle from left to right. • Lower scale of protractor reads the measure of angle from right to left.	
		vi. Identify right angles in 2-D shapes	

Unit	Contents and Scope	SLOs	Suggested Activities/ web links
Unit 6: Geometry	6.3. Circle	i. Describe radius, diameter and circumference of a circle.	Draw a circle of given radius using compass and straightedge/ruler.
	6.4. Perimeter and Area	i. Find perimeter of a 2-D figures ona square grid. ii. Recognize that perimeter is measured in units of length. iii. Find area of 2-D figures on a square grid. iv. Recognize that area of a square is measured in meter square (m^2)and centimeter square (cm^2)	Find the area of rectangular shapes drawn on a square grid by counting squares. Calculate the perimeter and area of simple compound shapes that can be split into rectangles and squares. Draw more than one shape (rectangles and squares) for the same given perimeter.
	6.5. Symmetry	i. Recognize lines of symmetry in two-dimensional (2-D) shapes. ii. Complete a symmetrical figure with respect to a given line of symmetry on square grid/dot pattern.	Find objects in nature having symmetry in their design. i.e. butterflies, spider webs, flowers, apple, rainbow, animals, humans, etc. Identify the line of symmetry of the given shapes  
	6.6 Three Dimensional (3-D) objects	i. Compare and sort 3-D objects (cubes, cuboids, pyramids, cylinder, cone, sphere)	
Unit 7: Data Handling	7.1. Bar Graph	i. Read simple bar graphs given in horizontal and vertical form. ii. Interpret real life situations using data presented in bar graphs.	http://www.bbc.co.uk/bitesize/ks2/maths/data/frequency_diagrams/play/
	7.2. Line Graph	i. Read line graph. ii. Interpret real life situations using data presented in line graphs.	https://www.tes.co.uk/teaching-resource/carroll-diagrams-worksheets-6181717.
	7.3. Pie Chart	i. Read Pie Chart. ii. Interpret real life situations using data presented in Pie Chart.	http://www.math-aids.com/Graph/

CHAPTER

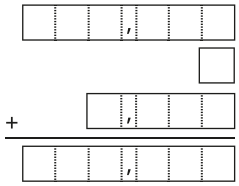
07 CURRICULUM FOR MATHEMATICS GRADE V

CHAPTER

07 CURRICULUM FOR MATHEMATICS GRADE V

Unit	Contents and Scope	SLOs	Suggested Activities/ web links
Unit 1: Whole numbers and Operations	1.1. Numbers up to one million	i. Read numbers up to 1,000,000 (one million) in numerals and words.	Ask students to create 7 - digit numbers by rolling a number cube 7 times and order the numbers.
		ii. Write numbers up to 1,000,000 (one million) in numerals and words.	Use the box method to find 764 x 404
	1.2. Addition and Subtraction	i. Add numbers up to 6 - digit numbers	Calculate the sums on the right. Add these sums to find 764 x 404 = ???, ???
		ii. Subtract numbers up to 6 - digit numbers	
	1.3. Multiplication and Division	i. Multiply numbers, up to 5 - digit, by 10, 100, and 1000	
		ii. Multiply numbers, up to 5 - digit, by a number up to 3 - digit numbers.	
		iii. Divide a number up to 5 - digit numbers by 10,100 and 1000	
		iv. Divide numbers up to 5 - digit numbers by a number up to 2 - digit numbers.	
		v. Solve real life situations involving operations of addition, subtraction, multiplication, and division.	Activity: There are 1,716 students participating in Defense Day ceremony. They are put into teams of 16 for the competition. How many teams get created? If you have left over students, what do you do with them?
	1.4. Number Patterns	i. Identify and apply a pattern rule to determine missing elements for a given pattern	Activity: Complete the pattern:
		ii. Identify the pattern rule of a given increasing and decreasing pattern and extend the pattern for the next three terms	
		iii. Describe the pattern found in a given table or chart	Activity: Complete the pattern:

	700	+ 60	+ 4
400	280,000	24,000	1,600
+ 0	0	0	0
+ 4	2,800	240	16



□ x 4 = 32

□ x 40 = 320

8 x 400 = □

8 x □ = 32,000

□ x 40,000 = 320,000

□ x 400,000 = 3,200,000

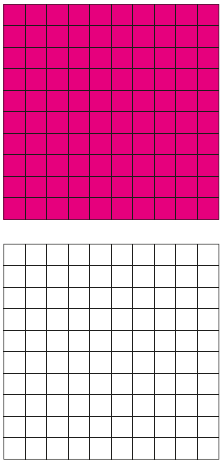
□ x 4,000,000 = 32,000,000

□ ÷ 7 = 3

2,100 ÷ □ = 300

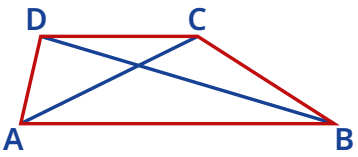
2,1000 ÷ 7 □ = 300

Unit	Contents and Scope	SLOs	Suggested Activities/ web links
Unit 2: Highest Common Factor (HCF) and Least Common Multiple (LCM)	2.1. HCF	i. Find HCF of • two numbers up to 2 - digit numbers • three numbers up to 2 - digit numbers using prime factorization method and division method	Use factor tree method to introduce Prime Factorization.
	2.2. LCM	i. Find LCM of • two numbers up to 2 - digit numbers • three numbers up to 2 - digit numbers using prime factorization method and division method	
		ii. Solve real life situations involving HCF and LCM.	
Unit 3: Fractions	3.1. Addition and Subtraction of Fractions	i. Add and subtract two or three fractions with different denominators.	Create a diagram to show why 4/8 = 1/2 are equivalent. Place the set of fractions 1/8, 2/8, 3/8...8/8 on a number line. Activity: Decompose a fraction 3/8 in to sum of different ways and Justify decompositions, e.g., by using a visual fraction model. Activity: There is some juice in a jug. Ali used 7/8 ℓ and his sister used 3/4 ℓ. 2 ½ℓ left behind, how much juice was in the jug?
	3.2. Multiplication of Fractions	i. Multiply a fraction by a 1 - digit numbers and demonstrate with the help of diagram	
		ii. Multiply two or three fractions involving proper, improper fractions, and mixed numbers.	
		iii. Solve real life situations involving multiplication of fractions.	
	3.3. Division of Fractions	i. Divide a fraction by another fraction involving proper, improper fraction, and mixed numbers.	
		ii. Solve real life situations involving division of fractions.	

Unit	Contents and Scope	SLOs	Suggested Activities/ web links
Unit 4: Decimal numbers and Percent-ages	4.1. Decimal numbers	i. Compare numbers up to 3 - digit with 2 decimal places using signs <, > or =.	Activity: Write 1.66 as a mixed number whose fractional part has a denominator of 100 1.66 = □ $\frac{\square}{100}$ Show 1.66 by shading the model. (One whole is already shaded.) 
		ii. Arrange numbers up to 3 - digit numbers with 2 decimal places in ascending and descending order.	
		iii. Add and subtract 4 - digit numbers up to 3 - decimal places	
		iv. Multiply a 3 - digit number up to 2 decimal places by 10, 100, and 1000	
		v. Multiply a 3 - digit number up to 2 decimal places by a whole number up to 2 - digit	
		vi. Multiply a 3 - digit number up to 2 decimal places by a 3 - digit number up to 2 decimal places.	
		vii. Divide a 3 - digit number up to 2 decimal places by 10, 100, and 1000	
		viii. Divide a 3 - digit numbers up to 2 decimal places by a whole number up to 2 - digit.	
		ix. Divide a 3 - digit number up to 2 decimal places by a 2 - digit number up to 1 decimal place	
		x. Convert fractions to decimals using division.	
		xi. Solve real life situations involving division of 3 - digit numbers up to 2 decimal places	
	4.2. Estimation	i. Round off a 4 - digit number up to 3 - decimal places to the nearest tenth or hundredth.	
		ii. Estimate sum or difference of the numbers (up to 4 - digit).	

Unit	Contents and Scope	SLOs	Suggested Activities/ web links
Unit 4: Decimal numbers and Percent-ages	4.3. Percentages	i. Recognize percentage as a special kind of fraction ii. Convert percentage to fraction and to decimal number and vice versa (only for numbers without decimal part i.e. 35%, 75% etc.) iii. Solve real life situations involving percentages	Understand Percentage as the number of parts in every 100 and find simple percentages of quantities. Express half, tenths, hundredths as percentages. Ask students to visit market to find items with discount percentage prices.
Unit 5: Distance and Time	5.1. Distance	i. Convert measures given in • kilometers to meters and vice versa • meters to centimeters and vice versa • Centimeters to millimeters and vice versa. ii. Solve real life situations involving conversion, addition and subtraction of measures of distance	Engage students in taking decisions when to use which unit of measurement and why? Make number stories for calculation by using meter rod, measuring tape or ruler in the context of addition, subtraction, and conversions of unit for distance
	5.2. Time	i. Convert • hours to minutes and vice versa • minutes to seconds and vice versa ii. Convert • years to months and vice versa • months to days and vice versa • weeks to days and vice versa iii. Add and subtract intervals of time in hours and minutes with carrying and borrowing. iv. Solve real life situations involving conversion, addition and subtraction of intervals of time.	Make a number story for the calculation by using calendar, stopwatch or clock, in the context of addition, subtraction and conversion of units for time. Make a number story and use a calendar to calculate time intervals in days and weeks (using knowledge of days in calendar months)

Unit	Contents and Scope	SLOs	Suggested Activities/ web links
Unit 6: Unitary Method	6.1. Unitary Method	i. Calculate the value of many objects of the same kind when the value of one of these objects is given	
		ii. Calculate the value of one object of the same kind when value of many of these objects are given	
		iii. Calculate the value of many objects of the same kind when the value of some of these is given	
Unit 7: Geometry	7.1. Angles	i. Recognize straight and reflex angle	Identify right angles in 2-D (flat) shapes. Identify right angles in the environment. Compare angles with a right angle in shapes and environment.
		ii. Recognize the standard units for measuring angles is 1°, which is defined as 1/360 of a complete revolution.	
		iii. Identify, describe and estimate the size of angles	
		iv. Classify angles as acute, right or obtuse.	
		v. Compare angles with right angles and recognize that a straight line is equivalent to two right angles	
		vi. Use protractor and ruler to construct • A right angle • A straight angle • Reflex angles of different measures	
		vii. Describe adjacent, complementary and supplementary angles	
	7.2. Triangles	i. Identify and describe triangles with respect to their sides. (isosceles, equilateral, and scalene)	http://www.mathworksheets4kids.com/triangles.html https://www.ixl.com/math/grade-5/types-of-triangles http://www.mathsisfun.com/geometry/triangles-interactive.html http://www.bbc.co.uk/schools/teachers/ks2_activities/maths/angles.shtm
		ii. Identify and describe triangles with respect to their angles. (Acute angled triangle, Obtuse angled triangle and right-angled triangles)	

Unit	Contents and Scope	SLOs	Suggested Activities/ web links
		iii. Use protractor and ruler to construct a triangle when • two angles and their included side is given. • two sides and included angle is given.	Estimate, measure and draw angles (acute and obtuse) in degrees using a protractor.
		iv. Measure the lengths of the remaining sides and angles of the triangle.	
	7.3. Quadrilaterals	i. Recognize the kinds of quadrilateral (square, rectangle, parallelogram, rhombus, trapezium, and kite).	Use the following example and ask students to solve similar situations. ABCD is a given quadrilateral with four sides. Identify its sides, vertices and angles. 
		ii. Identify and describe properties of quadrilaterals including square, rectangle, parallelogram, rhombus, trapezium, and kite, and classify those using parallel sides, equal sides and equal angles.	
		iii. Use protractor and ruler to construct square and rectangle when lengths of sides are given.	
	7.4. Symmetry	i. Recognize different types of symmetry (Reflective and Rotational) in 2-D figures.	http://www.icteachers.co.uk/children/sats/symmetry.htm Create symmetrical designs and pictures using concrete materials i.e. pattern blocks, connecting cubes, paper folding Identify and sketch lines of symmetry in 2-D shapes and patterns
		ii. Identify lines of symmetry for given 2-D figures	
		iii. Find point of rotation and order of rotational symmetry of given 2-D figures	
	7.5. Three dimensional (3-D) Objects	i. Identify cubes, cuboids and pyramids from their nets.	
		ii. Describe and make 3-D objects (cubes, cuboids, cylinder, cone, sphere, pyramids)	

Unit	Contents and Scope	SLOs	Suggested Activities/ web links
Unit 8: Perimeter and Area	8.1. Perimeter and area	i. Differentiate between perimeter and area of a square and rectangular region.	Aslam and Umar determined that the dimensions of their school flag needed to be 60cm by 50cm. What will be the area of the school flag?
		ii. Identify the units for measurement of perimeter and area.	
		iii. Find and apply formulas to find perimeter and area of a square and rectangular region	
		iv. Solve real life situations involving perimeter and area of square and rectangular regions.	
Unit 9: Data Handling	9.1. Average	i. Find and describe average of given quantities in the data	Students should collect some kind of data related to them (heights, age, marks in a test, favorite game or food, interests, hair color, etc.). After organizing such data, they should draw conclusions and respond to any further inquiry about the collected data. They may use the data to create bar or pie graph.
		ii. Solve real life situations involving average	
	9.2. Bar Graphs	i. Organize the given data using bar graph	http://academic.sun.ac.za/mathed/malati/3PrimDat.pdf http://www.learnhive.net/learn/icse-grade-5/mathematics/data-handling
		ii. Read and interpret a bar graph given in horizontal and vertical form	
		iii. Draw horizontal and vertical bar graphs for given data	
		iv. Solve real life situations using data presented in bar graphs.	

CHAPTER

03 TEACHING STRATEGIES

CHAPTER

08 TEACHING STRATEGIES

8.1 TEACHING STRATEGIES

Mathematics is a science of numbers and space. It has its own language in term of signs, symbols, terms and operations. It requires intuition, logic, reasoning and integrating various ideas and themes. Mathematical skills are used to solve many real-life situations throughout life. While mathematics may be abstract in nature, it does not have to be boring, uninteresting, un-enjoyable or difficult. The way mathematics is taught plays a major role in preconceived notions of the subject. There are many interventions, which can make mathematics more interesting and easier to understand. One of them is by connecting the subject with nature so students can relate to mathematics and understand it better and recognize its aesthetic value and help students admire the beauty of mathematics through nature.

The primary grades are the most important years of the child's school career. In grade I-V students acquire content knowledge that they use as the foundation for the rest of their education. Students have different learning styles. Not all students will optimally absorb concepts by simply listening to their teachers. Keeping this in mind, it is important for teachers to design lesson plans that include hands-on activities such as games, quizzes, and puzzles.

The major strategies recommended for teaching Mathematics are as follow:

i. Demonstration approach

Demonstration approach is a strategy in which the teacher engages "in a learning task other than just talking about it". A teacher's role is to demonstrate mathematical concepts practically and invite questions, while the learners are encouraged to observe, reflect and draw relevant inferences about the mathematical concept. Learners are also encouraged to demonstrate their understanding of mathematical concepts.

ii. Inquiry based learning

In inquiry-based learning, teachers use questions, problems and scenarios to help students learn through individual or group thought and investigation. Instead of simply presenting facts, the teacher encourages students to talk about a problem and draw on their intuition to understand it.

iii. Brain storming

Brain storming is a strategy for stimulating creativity among learners. Both the teacher and the learners play an active role in brainstorming. It includes the following phases:

- Identification of a situations
- Generation of an idea
- Evaluation of an idea
- Solution implementation and evaluation

The teacher should act as a facilitator in the idea-generation and should record all responses. S/he should also encourage everyone to participate and should also accept all suggestions regardless of how strange they may seem.

iv. Math-Lab approach

It is a method of teaching whereby children in small groups work through an assignment/task, learn and discover mathematics for themselves. The children work in an informal manner, move around, discuss and choose their materials and method of tackling a situation, assignment or task.

v. Discovery approach

This is an effective approach for helping learners to understand concepts and generalizations and for developing their higher-order thinking skills. This approach refers to an "Inductive Method" of guiding learners to discuss and use ideas already acquired as a means of discovering new ideas. The ultimate goal of this approach is to engage learner construct new knowledge on the basis of their previous knowledge.

vi. Practical work approach

In this approach, learners manipulate concrete objects and/or perform activities to arrive at a conceptual understanding of phenomena, situation, or concept. Activities can be done in the garden, in the yard, in the field, in the school grounds, or anywhere as long as the safety of the learners is assured.

vii. Problem solving approach

In this approach, students are not told the solution of the situations but they are asked to solve and overcome various situations themselves. The major steps in problem solving are:

- Defining the situations
- Collecting and organizing data
- Formulation of tentative solution
- Testing of tentative solution
- Conclusion

viii. Co-operative learning

It encourages learners to work in small groups to achieve the common goals. The group learns a particular content/concept and every member is expected to participate actively in the discussion, with the fast learners helping the slower ones learn the lesson. This builds positive relationships among classmates and creates a learning environment that values diversity. This also further develops both good learning and social skills. Its tangible benefits are learning to share, taking turns, higher self-esteem, more positive relationships and a wider circle of friends, and cooperation.

8.2 ROLE OF A TEACHER

Teachers are role-model for the students. Their actions convey more than their words. Students learn values from how their teachers act rather than from what they say. Teacher makes a maximum impact on the personality of a student in the formative years. Teachers must have healthy attitude and should possess rich values. A teacher is not only a source of information but is also a mentor and guardian. A teacher can maintain and impart values in students by giving them instructions.

Teaching in a Mathematics classroom requires listening to the students, understanding their level of thinking, setting and analyzing the task. The teachers' role shifts from dispensing information to planning investigative tasks, managing a cooperative learning environment and supporting students' creativity in developing rational understanding of the concepts. This improved teaching practice could include the following aspects of a teacher' s role:

i Create an effective class opener.

In the first five minutes of the class period set the tone for the entire lesson. Teachers can share the learning objective or pose essential questions to the class so that students know the purpose and, at the end of the lesson, can self-assess whether the objective has been met for them. It might include one or more warm-up situations as a way to review and assess students' prior knowledge in preparation for exposure to the new material.

ii Introduce topics using multiple representations.

The multiple representations include using manipulatives, showing a picture, drawing out the real-life situation, and offering a symbolic representation (applicable to everyday). Students who are exposed to, and can recognize the same relationship posed in the different representational modes are more likely to have conceptual understanding of the relationship and perform better on assessments.

iii. Solve real life situations in different ways.

In the best classroom environment, the teacher is able to show different ways to solve the same situation and encourage the students to come up with their own creative ways to solve them.

iv. Involve students in group/pair work.

After exposition of concepts, involve students in an individual, pair, or small group work/activity, encourage them to look for and share alternate ways to come up with the correct solution. Facilitating students in developing their own methods and then sharing the correct steps with the class is a very powerful learning experience.

v. Conceptualize the real-life application.

Teachers should always be able to demonstrate how every concept can be applied to the real world. If a concept cannot be applied in that manner, still share how it might be applied within mathematics or another subject area. Another option is showing how the concept was developed through the history of math. Consider taking a minute out of each lesson to show where or how the math can be seen or used in life, outside the classroom.

vi. Enable students to communicate their reasoning.

Students need to explain their reasoning when solving real life situations. In order to determine if every student truly understands the concept, it's necessary for each student to communicate both orally and in writing.

vii. Conclude class with a summary.

The last five minutes might be used to accomplish three very important things:

- A quick formative assessment to determine how much was learned, such as students self-rating their understanding of the concept on a 1-5 scale.
- Reviewing the objective of the lesson, and a brief discussion on what the lesson will entail or lead to, in the next class
- Previewing the homework together to avoid any confusion.

These are just some of the relevant strategies which can be used to conclude the lessons along with a number of others that can be employed by the teacher.

Thus a teacher's primary responsibilities are to assist learners' cognitive reconstruction and conceptual organization through providing them the opportunities for interaction in mathematical tasks that encourage discussion and negotiation of ideas to help them to develop conceptual understanding.

8.3 CLASSROOM PLANNING FOR MATHEMATICS

i. Classroom management

The classroom is the work-place of both teachers and children, and a well-managed work-place increases job satisfaction and enhances the learning process. Planning facilitates co-operation and the best use of resources and space. This is particularly relevant when mathematics is being integrated with other subjects. Integration with geography may require the use of maps or globes. Science equipment may be required for work on capacity. Integrating mathematics with other areas of the curriculum enables children to use mathematics in a meaningful way.

ii. The mathematics area

Ideally the mathematics area should be a free-standing workshop where children experiment and display their results. In addition, it is necessary to have wall space for displaying charts, flashcards and the results of the children's work. The worktop space could be a cupboard or shelving which can then be used to store equipment not in use. Mathematical displays and apparatus should be changed to suit the strand being worked on if they are to be seen to be effective and genuine aids.

iii. Effective use of equipment

Children who are actively involved in a structured task will be more likely to exhibit positive classroom behavior, and the teacher will be free to work with another child or group of children. It is important that the children share responsibility for the appropriate use and storage of the apparatus, as this will develop their independence. Charts showing labelled equipment and the terminology in use should be visible to those working in the area. These give the child the freedom and independence to work on tasks uninterrupted.

If possible there could be a recording area nearby, or children could use clipboards for on-the-spot recording. Color-coded or number-coded pockets of worksheets could also be provided so that the children can work independently.

CHAPTER

09 ASSESSMENT IN MATHEMATICS

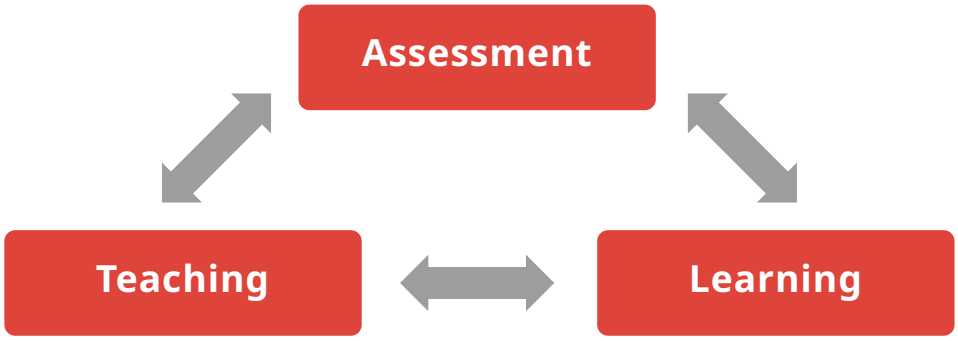
CHAPTER

09 ASSESSMENT IN MATHEMATICS

9.1 ASSESSMENT IN MATHEMATICS

Assessment plays a vital role in interactive teaching and learning. It is the process of gathering information using a variety of tools and techniques that reflect how well a student is achieving the curriculum expectations in a subject. As part of assessment teachers provide students with descriptive feedback that guides their efforts towards improvement. The quality of assessment largely determines the quality of evaluation. Evaluation refers to the process of judgments and decisions based on the interpretation of evidence gathered through assessment.

Assessment and evaluation should be based on curriculum expectations and the achievement levels outlined in the Single National Curriculum.



Assessment can be classified as:

- Formative assessment (Assessment for Learning or Diagnostic assessment)
- Summative assessment (Assessment of Learning)

Formative assessment (Assessment for Learning or Diagnostic assessment)

The formative assessment involves both students and teachers in a recursive process. It starts with the teacher, who models the process for the students. The teacher describes, explains, or demonstrates the concepts or skills to be taught, or assigns student investigations—reading assigned material, locating and reading materials to answer questions, doing activities or experiments—to put content into students' hands.

Gradually, students internalize the learning goals and become able to see the target themselves. They begin to be able to decide how close they are to it.

Formative assessment refers to the ongoing process students and teachers engage in when they

i. Focus on learning goals.
ii. Take stock of where current work is in relation to the goal.
iii. Take action to move closer to the goal.

Formative assessment includes

- Class Tests
- Worksheets
- Quizzes
- Class Activities/ projects
- Homework

Summative assessment (Assessment of Learning)

Summative assessment is based on the information collected through tests made by a teacher which are used to measure what students have learned at the end of particular instructional period. Students are assigned scores or grades on the basis of assessment results in the form of a report.

The purpose of summative assessment is to assess the students against some standards or benchmarks or learning outcomes. To assess students, the standardized test is associated for summative assessment. It provides information about the mastery of the child's particular concepts and skills. It is important to mention that students should be assessed on basis of students learning outcomes instead of assessing them against text book questions or material.

It includes:

- Term wise Examination
- Final Examination

9.2 MATHEMATICS CURRICULUM GRADE WISE TABLES;

Following tables explain weightings of specified topics with respect to different grade levels in accordance with the curriculum.

UNIT WISE WEIGHTAGES — GRADE - I

Unit	Title	Weightage
1.	Whole Numbers	39%
2.	Number Operations	25%
3.	Measurement: Length and Mass	06%
4.	Money	08%
5.	Time	10%
6.	Geometry	12%
Total Weightage		100%

UNIT WISE WEIGHTAGES — GRADE - II

Unit	Title	Weightage
1.	Whole Numbers	18%
2.	Number Operations	44%
3.	Fractions	07%
4.	Measurement: Length, Mass and Capacity	14%
5.	Time	08%
6.	Geometry	09%
Total Weightage		100%

UNIT WISE WEIGHTAGES — GRADE - III

Unit	Title	Weightage
1.	Whole Numbers	16%
2.	Number Operations	20%
3.	Fractions	16%
4.	Measurement: Length, Mass and Capacity	21%
5.	Time	10%
6.	Geometry	13%
7.	Data Handling	04%
Total Weightage		100%

UNIT WISE WEIGHTAGES — GRADE - IV

Unit	Title	Weightage
1.	Whole Numbers and Operations	17%
2.	Factors and Multiples	11%
3.	Fractions	15%
4.	Decimals	15%
5.	Measurement: Length, Mass and Capacity	19%
6.	Geometry	16%
7.	Data Handling	07%
Total Weightage		100%

UNIT WISE WEIGHTAGES — GRADE - V

Unit	Title	Weightage
1.	Whole Numbers and Operations	14%
2.	HCF and LCM	05%
3.	Fractions	08%
4.	Decimals and Percentages	25%
5.	Distance and Time	09%
6.	Unitary Method	04%
7.	Geometry	20%
8.	Perimeter and Area	06%
9.	Data Handling	09%
Total Weightage		100%

9.3. COGNITIVE DOMAINS / SKILLS

The Single National Curriculum for Mathematics (I-V) 2020, includes cognitive domain aligned with TIMSS a project of International Association for Evaluation of Educational Achievement.

- **Knowing:** Knowledge
- **Applying:** Understanding and Application
- **Reasoning:** Analysis, Synthesis and Evaluation

i) Knowing

In this domain, students are expected to have knowledge of words/ symbols and understand the basic ideas behind them. It covers the careful application of the concepts, definitions, relations or representation of either.

ii) Applying

In this domain, students should be able to select and apply appropriate mathematical concepts and procedure while solving real life situations. It covers pure mathematical questions for example numeric or algebraic expressions, equations, geometric figures and statistical data sets.

iii) Reasoning

In this domain, students are required to use their prior knowledge of mathematics in new situations. It recognizes and formulates a situation by analyzing, synthesizing and evaluating to solve real life situations considering whether there is sufficient and consistent data.

Cognitive domains play vital role in the development of assessment. In order to assess the student's in primary grades the following cognitive domains are used:

9.1 Table of Cognitive Domains

Cognitive Domains/Skills	Percentage weightage	Action Verbs	Examples
Knowing	**40%**	Recall	Recall definition, terminology, unit of measurement, geometric shapes and notations
		Recognize	Recognize numbers, expressions, quantity, shapes
		Classify/order	Classify numbers, expressions, quantities and shapes by common properties
		Compute	Carry out algorithmic procedure for +, - , x,÷ or combination of theses with numbers, fractions, decimal and carry out straight forward algebraic expressions

Cognitive Domains/Skills	Percentage weightage	Action Verbs	Examples
Applying	**40%**	Determine	Determine appropriate operations, strategies and tools for solving situations for which there are commonly used methods of solution
		Represent/ Model	Display data in tables or graphs; create equations, inequalities, geometric figures or diagrams that model situations
		Apply	Apply strategies and operations to solve situations involving mathematical concepts and procedures
Reasoning	**20%**	Analyze	Determine, describe or use relationships among numbers, expressions, quantities and shapes
		Synthesize/ Integrate	Link different elements of knowledge, related representations and procedures to solve situations
		Evaluate	Evaluate alternative problem-solving strategies and solutions
		Generalize	Make statements that represent relationships in more general and more widely applicable terms
		Justify	Provide mathematical arguments to support a strategy or solution

In order to develop/construct an assessment tool, a two-dimensional table known as Table of Specification is used to align objectives, instructions and assessment.

Following is a table of specification for grade 4 as an example.

9.2 TABLE OF SPECIFICATION FOR GRADE – IV

Content Strands / Cognitive Domains	Whole Number & Operations (50%)	Measurements (15%)	Geometry (25%)	Data Handling (10%)	Total (100%)
Knowing (40%)	20	6	10	4	40
Applying (40%)	20	6	10	4	40
Reasoning (20%)	10	3	5	2	20
Total (100%)	50	15	25	10	100

Number & Operations is further divided into sub topics. Unit wise distribution of 50 items is given below.

NUMBER AND OPERATIONS DISTRIBUTION UNIT WISE IN GRADE – IV

Number and Operations / Cognitive Domains	Whole Number & Operations (15%)	Factors and Multiple (10%)	Fractions (15%)	Decimal and Fractions (10%)	Total 50%
Knowing (40%)	6	4	6	4	20
Applying (40%)	6	4	6	4	20
Reasoning (20%)	3	2	3	2	10
Total (100%)	15	10	15	10	50

For each Grade, table of specification can be developed for summative assessment (annual examination paper of mathematics).

PAPER PATTERN FOR ASSESSMENT:

Cognitive Domains/Skills	Percentage weightage	Section
Knowing	**40%**	**Section A** • Multiple Choice Questions (MCQs), • Fill in the blanks • Match the column • Short questions (simple computations)
Applying	**40%**	**Section B** • Constructed response questions • Problem Solving
Reasoning	**20%**	**Section C** • Constructed response question. • Short questions (simple computations)

Note:

- For all sections, questions will be selected from all competencies.

CHAPTER

10 TEACHING AND LEARNING RESOURCES

CHAPTER

10 TEACHING AND LEARNING RESOURCES

It is observed that the textbooks have been considered as the only teaching and learning resource in most of the institutions. Although many other resources are available, including teacher's manual, workbook and electronic resources, teachers rarely use them to support learning. This curriculum document expects the teachers to use multiple resources to enrich learning. Examples include:

10.1 THE TEXTBOOK

Print materials, particularly the textbooks, play a key role in providing quality education at all levels. Although there are many resources that contribute towards the overall learning of the child yet the importance of textbook as a reservoir of information/ knowledge cannot be ignored.

Textbook writers have a vital role to play in influencing and motivating the students through their writing. A quality textbook is

- thoughtfully planned both for content and presentation,
- written by qualified and competent subject expert(s),
- attractive and engaging, to stimulate the interest of teacher and the taught

10.2 GUIDELINES FOR TEXTBOOK AUTHORS

Textbooks aimed at younger students of primary grades tend to include more teaching and learning features than those at higher level. Therefore, while developing textbooks the following aspects should be taken into consideration;

- The textbook should be in line with the objectives of curriculum.
- The author should continuously focus on standards and learning outcomes.
- The text/content should be age appropriate and according to the mental level of students.
- The volume of the textbook should be manageable for the academic year.
- The textbooks should be reader friendly. Use headings and subheadings and other design elements to make the books reader friendly. Avoid too much cramped text on one page.
- All content and information should be accurate and up-to-date
- The material should be arranged in a logical manner; simple to complex, familiar to unfamiliar and concrete to abstract.
- The material/content must be free from ambiguities and errors (both mathematical and typographical).
- The content provided in the textbook should not develop wrong concepts.
- The text should be clear and concise. It should not give any other meaning than the one intended.

- The text should be free from any kind of biases. Equal representation should be given to male and female characters in word problems. Real life examples and questions should not show any segment of society in a negative light.
- Special attention should be paid to geometrical portions. Every table, line drawing and graph should be labeled appropriately.
- Footnotes and side notes may be inserted wherever necessary.

10.3 TEXTBOOK STYLE AND STRUCTURE

To make a textbook an effective teaching and learning tool its style and structure should be given due importance. The material needs to be structured in a coherent and logical way, and that writing style should be reader friendly.

Unit Opening	
Unit Outline	Include heading of the unit.
Student Learning Outcomes (SLOs)	Include all SLOs of the respective unit.
Real Life Relevance	Illustrate the real-life relevance of the unit.
Short Introduction	Explain what this unit covers and why.

Unit Body	
Key Terms	Use italics for emphasis and bold for key terms. Define key terms when first introduced and collate them with their definitions for the glossary.
Running Glossary	Key terms and definitions may be pulled out from the main body of text so that students spot them easily in the unit body (e.g. in the margins).
Feature Boxes	Regular feature boxes may include various contents such as a mathematical formula, a working rule or a statement of theorem, application to real world and/or further discovery activity recommendations which may/may not include web resources.
Illustrative Examples	Include illustrative examples to develop conceptual understanding of the topic.
Problem Sets	Special attention should be paid on preparation of Problem Sets. Correlate Mathematics with real life situations and includes sufficient exercises on real life problems almost in every problem set, if appropriate. The questions on the application of Mathematics in other fields of study are also very useful.
Learning Review Points Tips or Hints	Include bulleted questions for students to check their understanding at regular intervals. Possible labels include 'self-test point' or 'checkpoint'.
Visuals	Separated from the main body of text, they allow the author to speak directly to the student, offering useful advice or flagging important points. Tables, graphs, line drawings and lists may be used to break up the text.

Unit Ending	
Problem Set (Review)	Include multiple-choice questions, interpretive exercises and fill-in items. Students may also be asked to label diagrams or write a one word answer to short question.
Summary	Include a review of the main concepts. This can relate to the SLOs by covering each in turn (bullet points work well). The summary should not include any new information.

End of Textbook	
Glossary	Include only the key terms in the glossary.
Answers to Problems	Include answers to the problem sets unit wise.
Appendices	Include extra information the student needs such as list of mathematical formulas, log tables and relevant websites.
Bibliography	Include bibliography and list of books for suggested reading where appropriate.
Index	Include index for the key terms used in the book.

10.4 THE TEACHER'S MANUAL

Ideally the teacher's manual should come with the textbook. The manual is aimed at informing teachers how the textbook is written and how best to use it to facilitate student learning. It can be seen as a means of helping teachers develop professionally. It provides detailed explanation of key concepts and the way to teach a particular topic. Its basic features are as below.

The teacher's manual should

- facilitate lesson planning by providing a structured step by step guide
- be easy to understand and use
- list all the SLOs to be achieved through the lesson plan
- provide background knowledge that helps in building the teachers capacities on the topic
- include a list teaching learning resources required for the activities
- include activities that serve as interesting lesson openers
- include easy to follow hands on activities that help in teaching and learning the new concepts
- give sequenced instructions for each activity
- recommend a question bank (having questions different from text) and suggest interactive quizzes corresponding to each unit
- include recommendations for concluding the lessons
- identify strategies for assessment of learning

10.5 THE WORKBOOK

Workbooks play an important role in enrichment of learning. They contain writing activities and exercises that reinforce and build upon each unit in the textbook. Workbook exercises help to develop students' conceptual understanding of the topics dealt with in the text. They assist students in developing skills by applying knowledge to new situations. A workbook has the following basic features.

A workbook should

- be easy for students to understand and follow
- involve clear and explicit instructions
- be stimulating, challenging and innovative
- correspond to knowledge and skill developed in the textbook
- consists of many exercises and activities for each unit, topic and subtopic
- be non-repetitive in style and structure
- avoid using too many activities for one topic or skill
- include exercises and activities which are different from those in textbook or teacher's manual
- suggest accessible and affordable materials/resources for the proposed activities

10.6 MATHEMATICS LABORATORY

Mathematics laboratory is a place where students can learn and explore mathematical concepts and verify mathematics facts and concepts through a variety of activities using different materials. Activities in math labs are carried out by the teachers and students to explore, learn and stimulate interest and develop favorable attitude towards mathematics.

Following are a few examples of easily accessible and affordable materials which can be suggested for the activities corresponding to basic concepts of Mathematics.

Name	Purpose
Area Model	Base ten blocks are used to represent the parts of each number that is being multiplied. To find the product, students can add various parts of the model. This model can also be used for fraction multiplication.
Arrays and Open Arrays	Arrays and Open Arrays are helpful in developing understanding of multiplication facts. Grids can also be used to model arrays. Open arrays allow students to think in amounts that are comfortable for them and do not lock them into thinking using a specific amount. These arrays help visualize repeated addition and partitioning and ultimately using the distributive property.
Balance (pan or beam) Scales	Pan balances have a pan or platform on each side to compare two unknown amounts or represent equality. Measuring materials (masses) can be used on one side to measure in standard units.
Base Ten Blocks	Base ten blocks include unit cubes, rods, flats, and large cubes used to find the place value of a number, addition and subtraction of whole numbers.
Carroll Diagram	Use for classification of different attributes. The table shows the four possible combinations for the two attributes.
Cubes (Linking)	Use for counting to 100 by ones and tens, grouping, and one-to-one correspondence, exploring patterns.

Name	Purpose
Cuisenaire Rods	Cuisenaire rods are mathematics learning aids for students that provide an interactive, hands-on way to explore mathematics and learn mathematical concepts, such as the four basic arithmetical operations, working with fractions and finding divisors. Each color represents a different length and can represent different number values or units of measurement.
Dice (Number Cubes)	Standard type is a cube with numbers or dots from 1 to 6 (number cubes). Use Learn important concepts and tricks to solve questions based on dice reasoning. Most dice are cube shaped, with the numbers 1 to 6 on the different faces.
Dominoes	Dominoes are rectangular tiles divided in two-halves. Theseare a family of tile-basedgames played with rectangular "domino" tiles. Each domino is a rectangular tile with a line dividing its face into two square ends.
Fraction Blocks	Fraction blocks also known as Fraction Pattern blocks. Fraction tower Cubes are great math manipulative for the classroom. It helps students better understanding the concept of fractions. Use with basic pattern blocks to help study a wider range of denominators and fraction computation.
Fraction Circles	Sets of fractional Circles include fraction pieces: 1,1/2,1/31/4....1/Fraction Circles. Fraction Circles enable students to explore fractions, fractional equivalences, add and subtract.
Fraction Pieces	These are rectangular pieces that can be used to represent fractions to learn about fractions and their meaning at your own pace. ... However, both circles represent the fraction two-thirds.
Frames	Use with any type of counter to fill in the frame as needed.
Geo boards	A geo board is a mathematical manipulative used to explore basic concepts in plane geometry such as perimeter, area and the characteristics of triangles and other polygons.
Geometric Solids	Geometric solids include a variety of prisms, pyramids, cones, cylinders, and spheres. Geometric solid materials - a basket large enough to contain ten geometric wooden solids: a triangular prism; a rectangular prism; a cube; a cylinder.
Geo-strips	Plastic strips that can be fastened together with brass fasteners to form a variety of angles and geometric shapes. Strips come in 5 different lengths. Each length is a different color.
Hundred Chart	The hundred charts are useful when students are learning to count to 100. It provides a visual aid and helps students learn how to skip count
Hundredths Circle	Circle divided into tenths and hundredths. Also known as “percent circles”.

Name	Purpose
Pattern Blocks	Standard set includes: Yellow hexagons, red trapezoids, blue parallelograms, green triangles, orange squares, beige parallelograms.
Pantomimes	Pantomimes are shapes that use five square blocks joined edge to edge to form various combinations. There are twelve possible shapes in a set.
Polydrons	Geometric pieces snap together to build various geometric solids as well as their nets. Pieces are available in a variety of shapes, colors, and sizes: Equilateral triangles, isosceles triangles, right-angle triangles, squares, rectangles, pentagons, Hexagons
Power Polygons	Power polygons can be used for classification, sorting, perimeters, areas and fractions amongst other topics: 2-D shapes; Ideal introduction to geometry; features 15 different shapes; includes useful storage tub; includes Teacher's Guide.
Counting Frame	Counting frame that has 10 beads on each bar: 5 white and 5 red. Available with different number of bars (1, 2, or 10).
Trundle Wheel	Trundle Wheel is a tool to measuring longer distances. Each revolution equals 1 meter usually noted with a click.

10.7 THE WEB-BASED RESOURCES

The use of World Wide Web (www) is growing very fast to access an immense volume of rapidly evolving information. It is acting as a driving force since its ease of use makes the internet trivially accessible to the students even with a little knowledge of computer. Through web-based links as mentioned along with the learning outcomes will provide

- access to various sites of Mathematics around the world,
- view of three-dimensional figures, graphics, lesson plans, activities and various books of interest

10.8 THE REFERENCE BOOK RESOURCES

The reference book resources can help authors, teachers and students to get guidance for developing the mathematical concepts according to new emerging trends. A list of reference books has been provided for guidance.

Book Title	Authors	Publishers
Macmillan Mathematics	Paul Broadbent & Mary Ruddle	Macmillan
Abacus Evolve framework Edition	Ruth Merttens and David Kirkby	Ginn
Onward Maths	Dr Evelyn Tan, Neo Seow Ling	Alston Publishers
NHM Series New Heinemann Maths	Heinemann	Paramount

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Mr. Muhammad Rafique Tahir Joint Educational Advisor, National Curriculum Council, Ministry of Federal Education and Professional Training Islamabad		
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11	Dr. Khalid Saifullah Syed	Professor, Department of Mathematics, Baha ud Din Zikrya University, Multan
12	Mr. Bilal Ahmed	Assistant Prof. Maths, FC College University, Lahore
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