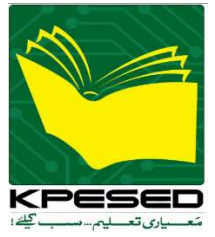




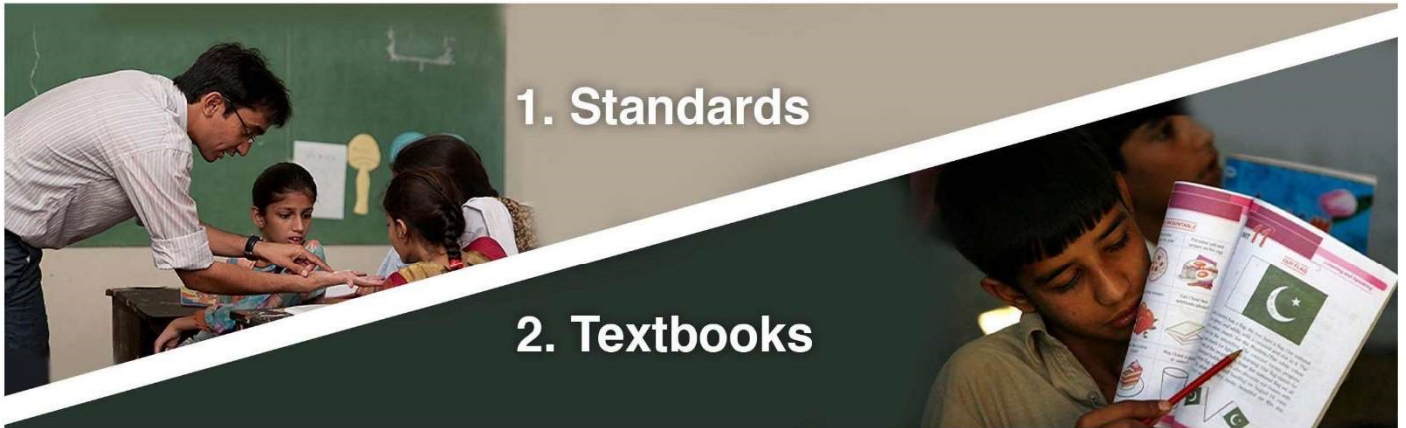
ایک قوم
ایک نصاب
ONE NATION, ONE CURRICULUM



MATHEMATICS (VI-VIII)

2022

FOUR PARTS OF A CURRICULUM:



DIRECTORATE OF CURRICULUM & TEACHER EDUCATION

KHYBER PAKHTUNKHWA ABBOTTABAD

بِسْمِ اللّٰهِ الرَّحْمٰنِ الرَّحِیْمِ

MATHEMATICS (VI-VIII)

2022



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KHYBER PAKHTUNKHWA ABBOTTABAD

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Mathematics 1-8

Introduction

OVERVIEW and INTRODUCTION:

Mathematics plays an essential role in every aspect of our daily life, in hidden ways and in everyday usage all around us: whether it is time tracking, driving, cooking, computers, airplanes, body scanners, software, coding or jobs such as accounting, finance, banking, engineering, and software. These functions require a strong mathematical background. It is excellent for our brains and develops neural pathways that not only deepens knowledge of the field but improves the brain power as well. While solving mathematical problems, data are collected, disassembled, and then interconnected to solve them. This develops analytical and problem solving skills for a child which he/she then transfers to resolve any issues in their daily lives.

Mathematics is the “universal language” as it is universally understood across cultures, countries and languages. The simple arithmetic equation of $2+2=4$ is understood all across the world and remains the same all around the world. It would not be incorrect to say that mathematics is the pillar of organised life for the present day. Without numbers and mathematical evidence, we cannot resolve any issues in our daily lives.

The Single National Mathematics Curriculum 2020 has been designed from the perspective of modern trends in Mathematics and emerging requirements of society in terms of National Integrity and Social Cohesion. The Single National Curriculum (SNC) of Mathematics for grade I-VIII aims to ensure that learners become proficient in doing Mathematics, develop mathematical literacy, induce logical thinking and are able to apply mathematical reasoning in real life and problem-solving.

This document helps teachers to design, implement, and analyze instructions, and assessment methods to accomplish the overall goal of the curriculum. The entire curriculum is divided into four strands, Numbers and Operations, Algebra, Geometry and Measurements and Statistics and Probability, all underpinned in Reasoning and Logical thinking which serves as a cross-cutting strand.

This Curriculum comprises standards, curriculum templates and a progression grid to show the progression of Mathematical concepts across the grades. The curriculum templates identify the student learning outcomes given in the progression grid into two essential aspects: knowledge and skill for the teacher. It also provides a sample of activities that match the Student learning outcomes and the content. Another essential feature of the curriculum template is the sample assessment questions and means for both formative and summative measures.

The learning outcomes emphasize the development of knowledge and conceptual understanding through application and reasoning skills. This curriculum emphasizes values to promote students' spiritual, moral, social, and cultural development through mathematics.

The learning approach that is encouraged for the teaching of mathematics throughout this curriculum is the Concrete-Pictorial- Abstract (i.e. CPA) approach. The Concrete-Pictorial-Abstract (CPA) approach is an approach in learning Mathematics which is done in stages. Each stage is built on the previous stage and

must therefore be taught sequentially. The CPA approach consists of three stages of learning namely learning through physical manipulation of concrete objects, followed by learning through pictorial representations of manipulation of concrete objects, and ends with solving problems using abstract notation (Witzell, 2005). Several research support the effectiveness of this approach, including enhancement of problem solving skills, analytical, reasoning skills, fewer procedural errors incur by students using this approach in algebraic variables compared to students learning through conventional learning. As students manipulate objects, visualize, create or design objects, and find solutions to a mathematical problem by imagining objects or their numbers proportionally, it develops their spatial sense abilities, problem solving abilities.

AIMS OF MATHEMATICS CURRICULUM

The basic aims of the 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 logically to analyze diverse situations.
- develop a sense of appreciation and enjoyment while learning mathematics.
- develop a deep and sustainable understanding through the Concrete, Pictorial and Abstract (CPA) approach by Jerome Bruner.
- Engage in investigations and inquiries to develop skills in mathematical reasoning, processing information, making connections to real-life situations and making judgments.

The SNC Mathematics is based on standards that provide a set of progressive and detailed learning outcomes for each topic and grade. The grade-wise learning development is shown through a progression grid/matrix.

The Student's Learning Outcomes (SLOs) for each grade are further categorized as knowledge and skill, which will help teachers to plan their lessons and administrators to monitor the effective learning process. This curriculum document includes details of pedagogical approaches designed to help mathematics teachers achieve the overall aims of this curriculum. For example, among others, real life situations are used to achieve this curriculum's aims. It helps engage students in analyzing situations and applying mathematical knowledge to solve related real-life situations. Moreover, students get opportunities to construct similar situations to engage intellectually with mathematical content.

Mental Mathematics and the inquiry approach, equally important strategies are also used 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 an effective feedback loop, is recommended.

Mathematics teachers are therefore expected to:

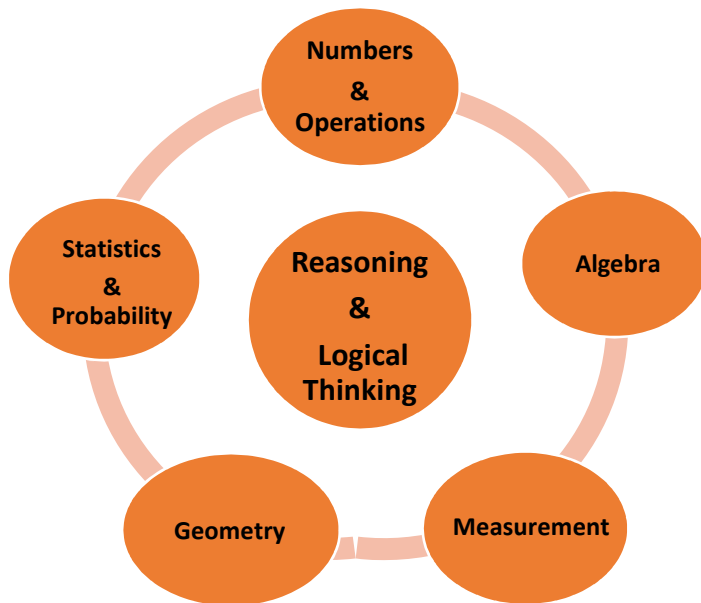
- Shift from dispensing information to plan investigative tasks.

- Encourage mastery of concepts instead of accelerating learning to complete syllabus.
- Encourage students to realise the inter concept and intra concept connections.
- Create a cooperative and collaborative learning environment.
- Design assessment tasks.
- Draw valid inferences about students.
- Use this information to improve their teaching practices

MATHEMATICS CURRICULUM CONTENT STRANDS AND STANDARDS

The curriculum for Mathematics is comprised of the following five strands. The strands are intentionally kept broad to allow flexibility to the teachers to adapt their teaching styles by their students. These strands include Numbers & Operations, Algebra, Measurement, Geometry and Statistics & Probability.

All of this content is underpinned by reasoning and logical thinking. All standards and students' learning outcomes are built around these strands.



ASSESSMENTS:

Assessment is a mandatory part of the teaching and learning process. It cannot be treated isolated from the teaching and learning process. It helps both teachers and learners to judge and evaluate their efforts and pace of learning.

In mathematics it becomes more essential, as mathematical concepts are linked with each other. Concepts grasped during one teaching session serve as a basis for the learning of upcoming concepts. Teachers use assessments for a number of purposes such as pre-assessing the learners' need, providing relevant instruction, assessing the intended learning outcomes, placement of the learners in different groups, diagnosis of weaknesses and strengths of the learners, adjustment of teaching strategies /

techniques and promotion of the learners to the next grade. Major functions of the assessment are instructional planning, feedback, making decision, and selection of appropriate resources and strategies to move forward.

In short the prime purpose of any assessment is to improve students' learning. Assessment, classified according to its **purpose**, and can be thought of as assessment *for, as, and of* learning.

The main forms are noted as:

- *Assessment for learning (known as Formative assessment),*
- *Assessment as learning (known as Formative assessment).*
- *Assessment of learning (known as Summative assessment).*

Formative Assessments:

Assessment for learning:

In this type of assessment, the teacher provides students with descriptive feedback and coaching for improvement. The purpose for **teachers** is to:

- gather evidence of student achievement consistently, fairly and conscientiously over short periods of learning time, optimally through informal methods;
- monitor students' progress towards the defined learning goals;
- provide descriptive, detailed, clear and specific feedback and coaching to students to improve their learning;
- define teaching adjustments and next steps for teaching to help students reach their potential.

Note: The teacher would not use this data as assessment data for the evaluation of student learning.

The most common forms of **assessment for learning (formative assessment)** are:

Checklists, anecdotal notes, field notes, rubrics, exemplars/benchmarks, continuums, portfolios/ reflective journals, learning stories, reading running records, observation diaries, inquiry charts, CATs, observations of students non-verbal feedback, homework exercises, questioning (open and closed), quiz, projects, selected responses (may include MCQs, true: false, matching short answers, fill-in-the-blanks, etc), open-ended tasks, reflections, KWL, KWHL, performance assessments, process-focused assessments, conferences between student and the instructor, answering specific questions, students reflections, students feedback collected periodically self-assessments, portfolio, etc.

Assessment as Learning

The main purpose of assessment as learning is to provide evidence to the students of their learning. The purpose for **students** is to:

- Develop their ability to continuously and consistently self-assess themselves and know where they are in their learning and what they can do.
- Become independent and autonomous learners who are able to:
 - set learning goals for themselves;
 - monitor their own progress towards these learning goals;
 - make adjustments in their learning approaches by determining and deciding next steps for developing their learning;
 - reflect on their thinking and learning;
 - guide and provide feedback to their peers to help improve their learning and achieve their learning goals.

Note: The teacher would not use this data as assessment data for the evaluation of student learning.

The most commonly used forms of **assessment as learning (formative assessment)** are:

In-class activities where students present their findings informally and provide feedback on peer assessments.

Summative Assessments

Assessment of Learning (Summative)

This assessment leads to the evaluation of student learning. It accurately summarizes and communicates to parents, individual students, teachers, other teachers, school leaders and policymakers what students know and can do concerning the overall curriculum expectations.

The teacher assesses a student's summative work at the end of a learning period, to determine to what degree (at what level) the student has achieved the learning goal.

The purpose for **teachers** is to:

- Provide evidence of students' achievement at strategic times during a specific class and often at the end of a learning unit.
- Summarize learning achieved by students at a given time, after a unit of learning;
- Provide assessment data for evaluation;
- Make judgments about the quality of students learning on the established curriculum expectations;
- Provide a value (pass/fail) to that quality of learning achieved by the students.
- Record and report student's achievements to all stakeholders including parents, teachers, school and senior management as well as students themselves.

Note: The teacher would use this data as assessment data for the evaluation of student learning.

Commonly forms of **assessment of learning (summative assessment)** are:

class tests, end of unit tests, mid-year examinations, monthly tests, progress tests, standardized tests, unseen test/examination in controlled conditions, MCQs in controlled conditions, open book or take-away exam, Essay or Report in controlled conditions, portfolio, presentations (peer - or tutor – assessed in controlled environments), performance (musical or dramatic), oral examination etc.

References:

Audsley, S.M. (2019) 6 reasons to study Mathematics. Retrieved from <https://www.phdstudies.com/article/6-reasons-to-study-mathematics/>

Growing Success- Assessment, Evaluation and Reporting in Ontario Schools (2013); and Assessment, Evaluation and Reporting Handbook (2013) retrieved from <http://www.edu.gov.on.ca/eng/policyfunding/success.html>

Putri, H.E.; Rahayu, P.; Muqadas, I. and Wahyudy, M. A. (2019). The Effect of Concrete-Pictorial-Abstract (CPA) Approach on Improving Elementary School Students' Spatial Sense Ability. Retrieved from: <https://files.eric.ed.gov/fulltext/EJ1264986.pdf>

Quddusi, M.A. (2018) Retrieved from: The Scientific World (2022) What is the importance of Mathematics in our daily lives. <https://www.scientificworldinfo.com/2018/11/what-is-importance-of-mathematics-in.html>

Math Progression Grid (1-8)

Note: *The progression grid identifies the core student learning outcomes. Please refer to the relevant ‘Curriculum Guidelines’ document to be informed of more directions for content and ideas for additional/advanced content.*

Domain A: Numbers and Operations

Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
<p>Benchmarks: Students will be able to demonstrate knowledge of place value (up to 4-digit numbers); represent whole numbers with words, diagrams, number lines, or symbols; order and compare numbers.</p> <p>They will add and subtract numbers up to 4-digit numbers; multiply (up to 3-digit numbers with 1-digit) and divide (3-digit by 1-digit number). Solve problems involving odd and even numbers, addition, subtraction, multiplication and division of numbers (involving missing numbers, money, quantities and measures), round numbers to nearest tens, hundreds and thousands and make estimates.</p> <p>Recognise fractions as parts of wholes or collections; represent fractions using words, numbers, equivalent</p>			<p>Benchmarks: Students will be able to demonstrate knowledge of place value (5-digit to 7-digit numbers); represent whole numbers with words, diagrams, number lines, or symbols; order and compare numbers.</p> <p>They will add and subtract numbers up to 6-digit numbers; multiply (up to 5-digit numbers with 3-digit) and divide (up to 5 digit up to 2 digit number) Solve problems involving odd and even numbers, addition, subtraction, multiplication and division of numbers (involving missing numbers, money, quantities and measures), round numbers to</p>		<p>Benchmarks: Students will be able use language, notation and Venn diagrams to describe sets and their elements, operate with real numbers, their properties and identify absolute value of real numbers, apply commutative ,associative and distributive laws on real numbers , compare, arrange and round off real numbers to required degree of accuracy, calculate factors, multiples, HCF and LCM, square roots and cube roots, ratio, rate, proportion, percentages, profit, loss, discount, Zakat, Ushr, commission, Taxes, insurance, partnership and Inheritance and apply all of these concepts in real life contexts.</p>		

<p>fractions in simplest form; compare and order simple fractions; add and subtract simple like and unlike fractions, including those set in problem situations. Demonstrate knowledge of decimal place value to the tenth.</p>	<p>nearest tens, hundreds and thousands and make estimates.</p> <p>Recognise fractions as parts of wholes or collections; represent fractions using words, numbers; compare and order simple fractions; add and subtract simple like, unlike fractions, including those set in problem situations.</p> <p>Demonstrate knowledge of decimal place value (up to three decimal place) compare, order, and round decimals (to the nearest whole number and up to two decimal place); add, subtract, multiply and divide decimals, including those set in real world problems (including money, quantities or measures).</p>	
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Student Learning Outcomes

<p><u>[SLO: M-01-A-01]</u> Count objects and numbers to and across 99 (2-digit numbers) forwards and</p>	<p><u>[SLO: M-02-A-01]</u> Count numbers up to and across 999 (3-digit numbers)</p>	<p><u>[SLO: M-03-A-01]</u> Count up to 9999 (4-digit numbers).</p>	<p><u>[SLO: M-04-A-01]</u> Count up to 99,999 (5-digit numbers).</p>	<p><u>[SLO: M-05-A-01]</u> Count up to 9,999,999 (7-digit numbers)</p>	<p align="center">---</p>	<p align="center">---</p>	<p align="center">---</p>
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backwards, beginning from zero one, or from any given number.	forwards and backwards, beginning from zero or one, or from any given number.						
<u>[SLO: M-01-A-02]</u> Read and write numbers up to 99 (2-digit numbers) in numerals and in words.	<u>[SLO: M-02-A-02]</u> Read and write numbers up to 999 in numerals and up to 99 in words.	<u>[SLO: M-03-A-02]</u> Read and write up to 999 in numerals and in words.	<u>[SLO: M-04-A-02]</u> Read and write up to 99,999 (5-digit numbers) in numerals and in words.	<u>[SLO: M-05-A-02]</u> Read and write up to 9,999,999 (6 and 7 digit numbers) in numerals and in words.	---	---	---
<u>[SLO: M-01-A-03]</u> Recognise the place value of each digit in 2-digit numbers (tens, ones/units).	<u>[SLO: M-02-A-03]</u> Recognise the place value of each digit in 3-digit numbers (hundreds, tens, ones/units).	<u>[SLO: M-03-A-03]</u> Recognise the place value of each digit in 4-digit numbers.	<u>[SLO: M-04-A-03]</u> Recognise the place value of each digit in 5-digit numbers.	<u>[SLO: M-05-A-03]</u> Recognise the place value of each digit in 6 and 7 digit numbers.	---	<u>[SLO: M-07-A-01]</u> With increasing degree of challenge, use the concept of place value for whole numbers, integers, rational numbers and decimal	---

						numbers.	
<p>[SLO: M-01-A-04] Compare and order numbers up to 99 using appropriate language (for instance: more and less, greater, smaller, equal to, same as, increasing, decreasing, smallest to largest and vice versa etc.)</p> <p>[SLO: M-01-A-05] Identify numbers before, after and between two numbers.</p>	<p>[SLO: M-02-A-04] Compare and order numbers up to 999 using appropriate language and $<$, $>$ and $=$ signs.</p>	<p>[SLO: M-03-A-04] Compare numbers using symbols and arrange numbers up to 9999 using appropriate language</p>	<p>[SLO: M-04-A-04] Compare numbers using symbols and arrange numbers up to 99,999</p>	---	---	---	---
---	<p>[SLO: M-02-A-05] Round numbers to the nearest tens using different concrete objects</p>	<p>[SLO: M-03-A-05] Round numbers to the nearest tens, hundreds and thousands using different concrete</p>	<p>[SLO: M-04-A-05] Reinforce/recall round off numbers to the nearest tens, hundreds,</p>	---	---	<p>[SLO: M-07-A-02] Round off whole numbers, integers, rational</p>	<p>[SLO: M-08-A-01] Round off numbers up to 5 significant figures.</p>

	and pictorial representations.	and pictorial representations.	thousands. [SLO: M-04-A-06] Round numbers to the nearest ten thousands.			numbers and decimal numbers to a required degree of accuracy, significance or decimal places (up to 3 decimal places).	
[SLO: M-01-A-06] Recognise the position of objects and write it using ordinal numbers up to 10.	[SLO: M-02-A-06] Recognise the position of objects and write it using ordinal numbers up to 20.	---	---	---	---	---	---
---	[SLO: M-02-A-07] Read and write Roman numbers up to 12.	[SLO: M-03-A-06] Read and write Roman numbers up to 20.	[SLO: M-04-A-07] Read and write Roman numbers up to 100.	---	---	---	---
[SLO: M-01-A-07] Find, recall and use addition and subtraction facts to 20.	[SLO: M-02-A-08] Find, recall and use addition and subtraction facts to 100.	---	---	---	---	---	---

<p>[SLO: M-01-A-08] Compare numbers to find how many more and how many less</p> <p>[SLO: M-01-A-09] Add and subtract numbers mentally and in written form including:</p> <ul style="list-style-type: none"> • up to three 1-digit numbers • 2-digit numbers and tens. <p>[SLO: M-01-A-10]</p> <p>Add and subtract numbers mentally and in written form including:</p> <ul style="list-style-type: none"> • 2-digit 	<p>[SLO: M-02-A-09] Add and subtract numbers mentally and in formal written form (with and without regrouping) including:</p> <ul style="list-style-type: none"> • 3-digit number and a 1-digit number. • 3-digit number and tens. • 3-digit number and a 2-digit number. • Two 3-digit numbers. 	<p>[SLO: M-03-A-07]</p> <p>Add and subtract numbers mentally and in written form (with and without regrouping) including:</p> <ul style="list-style-type: none"> • 4-digit numbers with 1-, 2-, 3- and 4-digit numbers. 	<p>[SLO: M-04-A-08]</p> <p>Add and subtract up to 5-digit numbers mentally and in written form (with and without regrouping) including:</p> <ul style="list-style-type: none"> • 5-digit numbers with 1-digit, 2-digit, 3-digit, 4-digit and 5-digit numbers. 	<p>[SLO: M-05-A-04] Add and subtract up to 6-digit numbers mentally and in written form (with and without regrouping) including:</p> <ul style="list-style-type: none"> • 6-digit numbers with 1-digit, 2-digit, 3-digit, 4-digit, 5-digit and 6-digit numbers. 	<p>---</p>	<p>---</p>	<p>---</p>
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<p>numbers and 1-digit numbers (without regrouping)</p> <ul style="list-style-type: none"> • Two 2-digit numbers (without regrouping) 							
<p><u>[SLO: M-01-A-11]</u> Solve real-world word problems with addition and subtraction using concrete objects and pictorial representations (involving missing numbers, money, quantities and measures)</p>	<p><u>[SLO: M-02-A-10]</u> Solve real-world word problems with addition and subtraction (involving missing numbers, money, quantities and measures)</p>	<p><u>[SLO: M-03-A-08]</u> Solve real-world word problems (including missing numbers and money) involving addition and subtraction.</p>	<p><u>[SLO: M-04-A-08]</u> Solve real-world word problems (including multi step) involving addition and subtraction.</p>	<p><u>[SLO: M-05-A-05]</u> Solve real-world word problems (including multi step) involving addition and subtraction.</p>	---	---	---

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---	<u>[SLO: M-02-A-12]</u> Recognise even and odd numbers.	<u>[SLO: M-03-A-10]</u> Recognise and differentiate between even and odd numbers.	---	---	---	---	---
<u>[SLO: M-01-A-12]</u> Identify Pakistani coins (Rs. 1, 2, 5 and 10) and notes (Rs. 10, 20, 50,	<u>[SLO: M-02-A-13]</u> Identify international currency and denominations (for instance	---	---	---	---	---	<u>[SLO: M-08-A-04]</u> Convert Pakistani currency

100, and 500	dollars.)							to well-known international currencies and vice versa.
<u>[SLO: M-01-A-13]</u> Solve money problems involving addition and subtraction of Pakistani money.	<u>[SLO: M-02-A-14]</u> Solve money problems involving addition and subtraction of Pakistani money and a few selected international currency notes. (for instance dollar)							
<u>[SLO: M-01-A-14]</u> Count and write in 2's, 5s and 10s using concrete objects (such as counters, pebbles, popsicle sticks etc) and pictorial representations (such as number line, hundred	<u>[SLO: M-02-A-15]</u> Count and write in 3s, 4s, 5s, 10s and 100s.	<u>[SLO: M-03-A-11]</u> Count and write in multiple steps. Develop times tables for 6, 7, 8, and 9 and write multiplication sentences using concrete and pictorial representations.	---	---	---	---	---	---

<p>square grid)</p> <p><u>[SLO: M-01-A-15]</u> Recognise counting in 2s, 5s and 10s as multiplication tables of two, five and ten.</p> <p><u>[SLO: M-01-A-16]</u> Recognise multiplication as repeated addition using concrete objects and pictorial representations (for instance materials, groups and arrays)</p>	<p><u>[SLO: M-02-A-16]</u> Recognise counting in 3s, 4s as multiplication tables of three and four.</p> <p><u>[SLO: M-02-A-17]</u> Recognise multiplication as repeated addition and develop multiplication tables (times tables) for 2, 3, 4, 5 and 10.</p> <p><u>[SLO: M-02-A-18]</u> Write multiplication statements (i.e., sentences) using concrete and</p>						
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	pictorial representations.						
<u>[SLO: M-01-A-17]</u> Recognise using concrete objects and pictorial representations that the multiplication of any two numbers can be done in any order.	<u>[SLO: M-02-A-19]</u> Recognise using concrete and pictorial representations that the multiplication of any two numbers can be done in any order.	<u>[SLO: M-03-A-12]</u> Reinforce through concrete and pictorial representations that the multiplication of any two numbers can be done in any order.	---	---	---	---	---
---	<u>[SLO: M-02-A-20]</u> Multiply mentally and in written form using the multiplication tables that they know: <ul style="list-style-type: none"> • 1 digit number by another 1 digit number. 	<u>[SLO: M-03-A-13]</u> Multiply mentally and in written form: <ul style="list-style-type: none"> • 2 digit numbers by 1 digit numbers. • 3 digit numbers by 1-digit numbers. 	<u>[SLO: M-04-A-10]</u> Multiply up to 4-digit numbers with 1-digit and 2-digit numbers mentally and in written form.	<u>[SLO: M-05-A-07]</u> Multiply upto 5-digit numbers with 1-digit, 2-digit and 3-digit numbers in written form.	---	---	---

	<p><u>[SLO: M-02-A-21]</u> Multiply mentally and in written form using the multiplication tables that they know:</p> <ul style="list-style-type: none"> • 2-digit number by a 1-digit number using a multiplication grid. <p><u>[SLO: M-02-A-22]</u> Multiply a number with 0 and 1.</p>						
---	<p><u>[SLO: M-02-A-23]</u> Solve real-world word problems involving multiplication.</p>	<p><u>[SLO: M-03-A-14]</u> Solve real-world word problems involving multiplication.</p>	<p><u>[SLO: M-04-A-11]</u> Solve real-world word problems involving multiplication.</p>	<p><u>[SLO: M-05-A-08]</u> Solve real-world word problems involving multiplication.</p>	---	---	---

<p>[SLO: M-01-A-18] Recognise division as repeated subtraction using concrete objects and pictorial representation. (groups, arrays and sharing)</p>	<p>[SLO: M-02-A-24] Recognise division as repeated subtraction through concrete and pictorial representation.</p> <p>[SLO: M-02-A-25] Write division statements (i.e., sentences) using concrete and pictorial representations.</p>	---	---	---	---	---	---
<p>[SLO: M-01-A-19] Recognise using concrete objects and pictorial representation that the division of one number by another number cannot be done in any order.</p>	<p>[SLO: M-02-A-26] Recognise using concrete and pictorial representation that the division of one number by another cannot be done in any order.</p>	<p>[SLO: M-03-A-15]</p> <p>Reinforce through concrete and pictorial representation that the division of any two numbers cannot be done in any order (Commutative).</p>	---	---	---	---	---

---	<p><u>[SLO: M-02-A-27]</u> Divide mentally and in written form:</p> <ul style="list-style-type: none"> • 1-digit number by another 1-digit number (without remainder) • 2-digit number by a 1-digit number (without remainder) 	<p><u>[SLO: M-03-A-16]</u></p> <p>Divide mentally and in written form:</p> <ul style="list-style-type: none"> • 2-digit numbers by 1 digit number (with and without remainder) • 3-digit numbers with 1-digit numbers (with and without remainder) <p><u>[SLO: M-03-A-17]</u></p> <p>Divide a number by 1 and itself.</p>	<p><u>[SLO: M-04-A-12]</u></p> <p>Divide up to 4-digit numbers by 1-digit and 2-digit numbers in written form.</p>	<p><u>[SLO: M-05-A-09]</u></p> <p>Divide up to 5-digit numbers by 1-digit and 2-digit numbers in written form.</p>	---	---	---
<p><u>[SLO: M-01-A-20]</u> Solve simple real world problems involving multiplication and division using any method (for</p>	<p><u>[SLO: M-02-A-28]</u> Solve real-world word problems involving multiplication and division using any method (for</p>	<p><u>[SLO: M-03-A-18]</u></p> <p>Solve real-world word problems involving division.</p>	<p><u>[SLO: M-04-A-13]</u></p> <p>Solve real-world word problems involving division.</p>	<p><u>[SLO: M-05-A-10]</u></p> <p>Solve real-world word problems involving division.</p>	---	---	---

instance materials, repeated addition, groups and arrays, mental methods, and known multiplication tables).	instance materials, repeated addition/subtraction, groups, arrays, mental and or written methods).						
---	[SLO: M-02-A-29] Solve real-world word problems (including Pakistani currency) involving addition, subtraction, multiplication and division.	[SLO: M-03-A-19] Solve real-world word problems involving addition, subtraction, multiplication and division.	[SLO: M-04-A-14] Use appropriate operations to solve real-world word problems involving addition, subtraction, multiplication and division.	[SLO: M-05-A-11] Use appropriate operations to solve real-world word problems involving addition, subtraction, multiplication and division.	---	----	---
---	---	---	[SLO: M-04-A-15] Identify divisibility rules for 2, 3, 5 and 10 and use them on up to 4-digit numbers.	[SLO: M-05-A-12] Identify divisibility rules for 7 and 11 and use them on up to 5-digit numbers.	---	---	---

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---	---	---	---	---	<p><u>[SLO: M-06-A-02]</u> Identify base and exponent</p>	---	---

					and express numbers given in expanded form in index notation and vice versa.		
---	----	----	[SLO: M-04-A-18] Identify and differentiate between 2-digit prime and composite numbers up to 50.	[SLO: M-05-A-13] Identify and differentiate between 2-digit prime and composite numbers up to 100.	---	---	---
---	---	---	---	[SLO: M-05-A-14] Find H.C.F and L.C.M of two numbers (up to 2-digits) using various methods. (For instance prime factorization, division method etc.)	[SLO: M-06-A-03] Find H.C.F and L.C.M of two or three numbers (up to 3-digits) using various methods (for instance prime factorization and division	[SLO: M-07-A-04] Recall H.C.F and L.C.M.	---

					method).		
---	---	---	---	[SLO: M-05-A-15] Solve real-world word problems involving H.C.F and L.C.M.	[SLO: M-06-A-04] Solve real-world word problems involving H.C.F and L.C.M.	---	---
---	---	---	---	---	[SLO: M-06-A-05] Recognise, identify and represent integers (positive, negative and neutral integers) and their absolute or numerical value.	[SLO: M-07-A-05] Recall - Recognise, identify and represent integers (positive, negative and neutral integers) and their absolute or numerical value.	---
---	---	---	---	---	[SLO: M-06-A-06] Arrange a given list of	---	---

					integers and their absolute value in ascending and descending order.		
---	---	---	---	---	[SLO: M-06-A-07] Add and subtract upto-2-digit like and unlike integers and verify commutative and associative laws (where applicable).	---	---
---	---	---	---	---	[SLO: M-06-A-08] Multiply up to 2-digit like and unlike integers and verify commutative, associative and	---	---

					<p>distributive laws.</p> <p><u>[SLO: M-06-A-09]</u></p> <p>Divide like and unlike integers.</p>		
<p><u>[SLO: M-01-A-21]</u> Recognise, find, name and write fractions:</p> <ul style="list-style-type: none"> - half ($\frac{1}{2}$) - quarter ($\frac{1}{4}$) - two-quarters ($\frac{2}{4}$) - three-quarters ($\frac{3}{4}$) of a length, shape, set of objects or quantity using pictorial representations. 	<p><u>[SLO: M-02-A-30]</u> Identify, name and write;</p> <ul style="list-style-type: none"> -unit fractions -non-unit fractions -like fractions -unlike fractions of a discrete set of objects using pictorial representations. 	<p><u>[SLO: M-03-A-20]</u></p> <p>Recognise among:</p> <ul style="list-style-type: none"> -proper fractions -improper fractions. -mixed numbers 	<p><u>[SLO: M-04-A-19]</u></p> <p>Differentiate among:</p> <ul style="list-style-type: none"> -proper fractions -improper fractions -mixed numbers. 	---	---	<p><u>[SLO: M-07-A-06]</u></p> <p>Identify and represent (on a number line) rational numbers.</p> <p><u>[SLO: M-07-A-07]</u></p> <p>Represent whole numbers, integers and decimal numbers on a number line.</p>	<p><u>[SLO: M-08-A-05]</u></p> <p>Differentiate between rational and irrational numbers.</p> <p><u>[SLO: M-08-A-06]</u></p> <p>Represent real numbers on a number line and Recognise the absolute value of a real number.</p>

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---	<p><u>[SLO: M-02-A-31]</u> Compare and order unit fractions and like fractions (with denominators up to 10) using $<$, $>$ and $=$ sign.</p>	<p><u>[SLO: M-03-A-23]</u> Compare and order like fractions using symbols $<$, $>$ and $=$.</p>	<p><u>[SLO: M-04-A-21]</u> Compare and order unlike fractions.</p>	<p><u>[SLO: M-05-A-16]</u> Compare and order whole numbers, proper, improper fractions and mixed numbers in ascending and descending order.</p>	---	<p><u>[SLO: M-07-A-09]</u> Compare (using symbols $<$, $>$, $=$, \leq and \geq) and arrange (in ascending or descending order) whole</p>	<p><u>[SLO: M-08-A-07]</u> Demonstrate the ordering properties of real numbers.</p>

						numbers, integers, rational numbers and decimal numbers.	
---	[SLO: M-02-A-32] Add and subtract like fractions within one whole (e.g., $\frac{1}{4} + \frac{3}{4} = 4/4$).	[SLO: M-03-A-24] Add and subtract like and unlike fractions (with denominators that are multiples of the same number).	[SLO: M-04-A-22] Add and subtract like and unlike fractions (with denominators that are multiples of the same number) and write the answer in mixed numbers (if applicable).	[SLO: M-05-A-17] Add and subtract; two or three unlike fractions and mixed numbers.	---	[SLO: M-07-A-10] Verify associative and commutative properties of rational numbers.	---
---	---	---	[SLO: M-04-A-23] Multiply and divide proper, improper fractions and mixed numbers	[SLO: M-05-A-18] Multiply and divide proper, improper fractions and mixed numbers	---	[SLO: M-07-A-11] Verify associative, commutative and distributive	[SLO: M-08-A-08] Demonstrate the following properties:

			<p>by a whole number.</p> <p><u>[SLO: M-04-A-24]</u> Multiply two fractions and/or mixed numbers.</p>	<p>and express the answer in its simplest form (if applicable).</p>		<p>properties of rational numbers.</p>	<p>-closure property</p> <p>-associative property - existence of identity element - existence of inverses - commutative property - distributive property</p>
---	---	---	<p><u>[SLO: M-04-A-25]</u> Solve real-world word problems involving fractions by identifying appropriate operations.</p>	<p><u>[SLO: M-05-A-19]</u> Solve real-world word problems involving fractions.</p>	---	<p><u>[SLO: M-07-A-12]</u> Solve real-world word problems involving operations on rational numbers.</p>	<p><u>[SLO: M-08-A-09]</u> Solve real-world word problems involving calculation with decimals and fractions.</p>
---	<p><u>[SLO: M-02-A-33]</u> Know and recognise that tenths arise by dividing an object into ten</p>	<p><u>[SLO: M-03-A-25]</u> Know and recognise that hundredths arise by dividing an</p>	<p><u>[SLO: M-04-A-26]</u> Recognise, read, write decimal numbers and identify the place value of decimal</p>	---	---	---	<p><u>[SLO: M-08-A-10]</u> Identify and differentiate between</p>

	equal parts and in dividing single digit numbers and quantities by ten (using concrete and pictorial representations).	object, single digit numbers and quantities into hundred equal parts.	numbers with up to three decimal places.				decimal numbers as terminating (non-recurring) and non-terminating (recurring).
---	---	[SLO: M-03-A-26] Identify that tenths arise by dividing an object, single digit number and quantities into ten equal parts (e.g., $2/10 = 0.2$)	[SLO: M-04-A-27] Recognise the result of dividing 1 or 2-digit number by 10 and 100 and identifying the value of digits in the answer as ones, tenths and hundredths (e.g., $24/100 = 0.24$)	---	---	---	---
---	---	---	[SLO: M-04-A-28] Express -a decimal number (up to three decimal places) as a fraction whose denominator is 10, 100 and	[SLO: M-05-A-20] Convert fractions to decimals and vice versa.	---	---	---

			<p>1000.</p> <p>-a given fraction in its decimal equivalent (tenths, hundredths or thousandths) when the;</p> <p>(i) denominator of the fraction is 10, 100 or 1000.</p> <p>(ii) denominator of a fraction is not 10, 100, or 1000 but can be converted to 10, 100 or a 1000.</p> <p><u>[SLO: M-04-A-29]</u> Recognise and write a quarter, a half and three quarters (i.e., $\frac{1}{2}$, $\frac{1}{4}$, $\frac{3}{4}$. to its decimal equivalents.</p>				
---	---		<p><u>[SLO: M-04-A-30]</u> Compare and</p>	<p><u>[SLO: M-05-A-21]</u></p>	---	---	---

			order decimal numbers with up to two decimal places.	Compare and order numbers up to three decimal places using signs $>$, $<$ and $=$ sign and in ascending and descending order.			
---	---		[SLO: M-04-A-31] Round decimal numbers (with up to three decimal places) to the nearest whole number and to one and two decimal places.	[SLO: M-05-A-22] Reinforce rounding decimal numbers (with up to three decimal places) to the nearest whole number and to tenth and hundredth.	---	---	---
---	---	---	[SLO: M-04-A-32] Add and subtract 3-digit numbers with up to two decimal places.	[SLO: M-05-A-23] Add and subtract	---	---	---

				numbers up to three decimal places.			
---	---	---	<p><u>[SLO: M-04-A-33]</u> Multiply and divide a 2-digit number with one decimal place by:</p> <ul style="list-style-type: none"> • a 1-digit number. • a 2-digit number 	<p><u>[SLO: M-05-A-24]</u> Multiply numbers up to two decimal places by:</p> <ul style="list-style-type: none"> • up to 2-digit whole numbers • 3-digit numbers with up to two decimal places. <p><u>[SLO: M-05-A-25]</u> Divide numbers up to two decimal places by</p> <ul style="list-style-type: none"> • up to 2-digit whole numbers 	---	---	---

				<ul style="list-style-type: none"> • 2-digit numbers with one decimal place. 			
---	---	---	<p>[SLO: M-04-A-34] Multiply and divide a 2-digit number with one decimal place by 10 and 100.</p>	<p>[SLO: M-05-A-26] Multiply and divide a number up to two decimal places by 10, 100 and 1000.</p>	---	---	---
---	---	---	<p>[SLO: M-04-A-35] Use appropriate operations to solve real-world word problems including 2-digit numbers with one decimal place (including money, quantities and measures).</p>	<p>[SLO: M-05-A-27] Use appropriate operations to solve real-world word problems including numbers up to two decimal places (including money, quantities and measures).</p>	---	---	---

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---	---	---	[SLO: M-04-A-37] Recognise the percent symbol (%) and understand that percent is the 'number of parts per hundred'.		---	---	---
---	---	---	---	[SLO: M-05-A-29] Express percentages as a fraction with	[SLO: M-06-A-11] Express one quantity as a percentage of	---	---

				<p>denominator 100 and as a decimal number.</p> <p><u>[SLO: M-05-A-30]</u></p> <p>Use equivalences between simple fractions, decimals and percentages in real world contexts.</p>	<p>another, compare two quantities by percentage and increase or decrease a quantity by a given percentage.</p>		
---	---	---	---	<p><u>[SLO: M-05-A-31]</u></p> <p>Solve real-world word problems involving conversion of percentage, fraction and decimal numbers.</p>	<p><u>[SLO: M-06-A-12]</u></p> <p>Solve real- world word problems involving percentage.</p>	---	---

				<p><u>[SLO: M-05-A-32]</u></p> <p>Solve problems which require knowing percentage and decimal equivalents of $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{2}{5}$, $\frac{4}{5}$ and those fractions with a denominator of a multiple of ten or 25.</p>			
---	---	---	---	<p><u>[SLO: M-05-A-33]</u></p> <p>Use unitary method to calculate; the value of many objects of the same kind when the value of one is given, the value of one object when value of many is given and value of many objects when value of</p>	<p><u>[SLO: M-06-A-13]</u></p> <p>Explain rate as a comparison of two quantities where one quantity is 1.</p>	<p><u>[SLO: M-07-A-14]</u></p> <p>Calculate rate and average rate of quantities.</p>	---

				some is given (including related real-world problems).			
---	---	---	---	---	[SLO: M-06-A-14] Calculate ratio of two numbers (up to 3-digit) and simplify ratios.	[SLO: M-07-A-15] Calculate increase and decrease in a ratio based on change in quantities.	---
---	---	---	---	---	[SLO: M-06-A-15] Explain and calculate continued ratio.	---	---

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---	---	---	---	---	---	[SLO: M-07-A-16] Explain and calculate direct and inverse proportion and solve real-world word problems related to direct and inverse proportion.	[SLO: M-08-A-11] Calculate direct and inverse and compound proportion and solve real-world word problems related to direct, inverse and compound proportion. (using table, equation and graph)
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						<u>A-17]</u> Identify and differentiate between selling price, cost price, loss, discount, profit percentage and loss percentage.	<u>A-12]</u> Explain and calculate profit percentage, loss percentage and discount.
---	---	---	---	---	---	<u>[SLO: M-07-A-18]</u> Explain income tax, property tax, general sales tax, value-added tax, zakat and ushr.	<u>[SLO: M-08-A-13]</u> Explain and calculate profit/markup, principal amount and markup rate.
---	---	---	---	---	---	---	<u>[SLO: M-08-A-14]</u> Explain insurance, partnership and

							inheritance.
---	---	---	---	---	---	<u>[SLO: M-07-A-19]</u> Solve real world word problems involving profit, loss, discount, commission, tax, zakat and ushr.	<u>[SLO: M-08-A-15]</u> Solve real world word problems involving profit %, loss %, discount, profit, markup, insurance, partnership and inheritance.
---	---	---	---	<u>[SLO: M-05-A-34]</u> Recognise and use square numbers and cube numbers, and the notation for squared (²) and cubed (³)	<u>[SLO: M-06-A-17]</u> Recognise and calculate squares of up to 2-digit numbers.	<u>[SLO: M-07-A-20]</u> Recognise and calculate squares of numbers up to 3-digits.	---

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---	---	---	---	---	---	<p><u>[SLO: M-07-A-22]</u></p> <p>Solve real-world word problems involving squares and square roots.</p>	<p><u>[SLO: M-08-A-17]</u></p> <p>Solve real-world word problems involving squares and square roots.</p>
---	---	---	---	---	--	---	<p><u>[SLO: M-08-A-18]</u></p> <p>Recognise perfect cubes and find: -cubes of up to 2-digit</p>

							<p>numbers</p> <p>- cube roots of up to 5-digit numbers which are perfect cubes</p>
---	---	---	----	---	---	---	<p><u>[SLO: M-08-A-19]</u></p> <p>Solve real-world word problems involving cubes and cube roots.</p>
---	---	---	---	---	<p><u>[SLO: M-06-A-18]</u></p> <p>Use language, notation and Venn Diagrams to represent different types of sets and their elements.</p> <p>(finite, infinite,</p>	<p><u>[SLO: M-07-A-23]</u></p> <p>Use language, notation and Venn Diagrams to represent different sets and their elements.</p> <p>(natural numbers,</p>	<p><u>[SLO: M-08-A-20]</u></p> <p>Describe sets using language (tabular, descriptive and set-builder notation) and Venn diagrams</p>

					empty, singleton and universal set)	whole numbers, integers, even numbers, odd numbers, prime numbers)	
---	---	---	---	---	---	<p>[SLO: M-07-A-24]</p> <p>Identify and differentiate between:</p> <ul style="list-style-type: none"> ● subset and superset ● proper and improper ● equal and equivalent ● disjoint and overlapping. 	<p>[SLO: M-08-A-21]</p> <p>Find the power set (P) of set A where A has up to four elements.</p>

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							Verify De Morgan's laws and represent through Venn Diagram.
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Domain B: Algebra

Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
Benchmarks: Students will be able to analyse and complete geometrical and number patterns; find the missing number or operation in a number sentence.			Benchmarks: Students will be able to analyse and complete number patterns; find the missing number or operation in a number sentence.		Benchmarks: Students will be able to recognise and manipulate number patterns, use letters to represent numbers, expand, simplify, factorise, evaluate and manipulate algebraic expressions, use algebraic identities, interpret and plot graphs of linear equations, solve		

		linear and simultaneous linear equations and linear inequalities and apply all of these concepts in real life context.					
Student Learning Outcomes							
[SLO: M-01-B-01] Identify and extend the next shape in patterns with 2 or 3 orientations.	[SLO: M-02-B-01] Complete geometrical patterns (e.g., on a square grid) according to one or two of the following orientations: Shape, size or colour.	---	---	---	---	---	---
[SLO: M-01-B-02] Identify and extend patterns using 2-D and 3-D shapes as well as through pictorial illustrations.	[SLO: M-02-B-02] Explore patterns in a variety of ways using 2-D and 3-D shapes.	---	---	---	---	---	---

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---	---	---	<p><u>[SLO: M-04-B-02]</u></p> <p>Complete the given increasing and decreasing number patterns.</p>	<p><u>[SLO: M-05-B-02]</u></p> <p>Identify and apply the pattern rule of a given increasing and decreasing pattern to:</p> <ul style="list-style-type: none"> -extend the pattern for the next three terms -determine missing elements in a 	<p><u>[SLO: M-06-B-02]</u></p> <p>Continue a given number sequence and find:</p> <ul style="list-style-type: none"> -term to term rule -position to term rule 	<p><u>[SLO: M-07-B-02]</u></p> <p>Recall how to continue a given number sequence and find:</p> <ul style="list-style-type: none"> -term to term rule - position to term rule 	<p><u>[SLO: M-08-B-02]</u></p> <p>Find terms of an arithmetic sequence using:</p> <ul style="list-style-type: none"> -term to term rule -position to term rule

				given pattern.			
---	---	---	---	---	---	[SLO: M-07-B-03] Find terms of a sequence when the general term (nth term) is given.	[SLO: M-08-B-03] Construct the formula for the general term (nth term) of an arithmetic sequence.
---	---	---	---	---	[SLO: M-06-B-03] Solve real life problems involving number sequences and patterns.	[SLO: M-07-B-04] Solve real life problems involving number sequences and patterns.	[SLO: M-08-B-04] Solve real life problems involving number sequences and patterns.
---	---	[SLO: M-03-B-02] Find the missing number or operation in a number sentence (e.g., $20 + w = 100$).	[SLO: M-04-B-03] Identify and write expressions or number sentences to represent problems that	---	---	---	---

			may involve unknowns.				
---	---	---	[SLO: M-04-B-04] Identify and use relationships in a well-defined pattern (e.g., describe the relationship between adjacent terms and generate pairs of whole numbers given a rule).	---	---	---	---
---	---	---	---	---	[SLO: M-06-B-04] Explain the term algebra as an extension of arithmetic, where letters, numbers and symbols are used to construct algebraic	[SLO: M-07-B-05] Students will know Muhammad bin Musa Al-Khwarizmi as the founding father of Algebra.	[SLO: M-08-B-05] Recall the difference between: → open and close sentences → expression and equation

					expressions.	<p><u>[SLO: M-07-B-06]</u></p> <p>Recall variables as a quantity which can take various numerical values.</p> <p><u>[SLO: M-07-B-07]</u></p> <p>Recognise open and close sentences, like and unlike terms, variable, constant, expression, equation and inequality.</p> <p><u>[SLO: M-07-B-08]</u></p> <p>Recognise polynomials as algebraic expressions in which the</p>	→ equation and inequality
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						powers of variables are whole numbers.	
---	---	---	---	---	---	[SLO: M-07-B-09] Identify a monomial, a binomial and a trinomial as a polynomial.	---
---	---	---	---	---	[SLO: M-06-B-05] Evaluate algebraic expressions by substitution of variables with numerical values.	[SLO: M-07-B-10] Add and subtract two or more polynomials.	[SLO: M-08-B-06] Recall the addition and subtraction of polynomials.
---	---	---	---	---	[SLO: M-06-	[SLO: M-07-	[SLO: M-08-

					<u>B-06]</u> Manipulate simple algebraic expressions using addition and subtraction.	<u>B-11]</u> Find the product of: - monomial with monomial - monomial with binomial/trinomial - binomials with binomial/trinomial	<u>B-07]</u> Recall the multiplication of polynomials.
---	---	---	---	---	---	---	<u>[SLO: M-08-B-08]</u> Divide a polynomial of degree up to 3 by -a monomial -a binomial
---	---	---	---	---	<u>[SLO: M-06-</u>	<u>[SLO: M-07-</u>	<u>[SLO: M-08-</u>

					<u>B-07]</u> Simplify algebraic expressions.	<u>B-12]</u> Simplify algebraic expressions (by expanding products of algebraic expressions by a number, a variable or an algebraic expression) involving addition, subtraction, and multiplication division.	<u>B-09]</u> Simplify algebraic expressions involving addition, subtraction, multiplication and division.
---	---	---	---	---	---	<u>[SLO: M-07-B-13]</u> Explore the following algebraic identities and use them to expand expressions:	<u>[SLO: M-08-B-10]</u> Recognise the following algebraic identities and use them to expand expressions:

						$(a + b)^2 = a^2 + b^2 + 2ab$ $(a - b)^2 = a^2 + b^2 - 2ab$ $(a + b)(a - b) = a^2 - b^2$	$(a + b)^2 = a^2 + b^2 + 2ab$ $(a - b)^2 = a^2 + b^2 - 2ab$ $(a + b)(a - b) = a^2 - b^2.$
---	---	---	---	---	---	---	<u>[SLO: M-08-B-11]</u> Apply algebraic identities to solve problems like $(103)^2$, $(1.03)^2$, $(99)^2$, 101×99 .
---	---	---	---	---	---	<u>[SLO: M-07-B-14]</u> Factorize algebraic expressions	<u>[SLO: M-08-B-12]</u> Factorize the following types of

						<p>(by taking out common terms and by regrouping)</p> <p>[SLO: M-07-B-15]</p> <p>Factorize quadratic expressions (by middle term breaking method).</p>	<p>expressions:</p> <ul style="list-style-type: none"> ● $ka + kb + kc$ ● $ac + ad + bc + bd$ ● $a^2 \pm 2ab + b^2$ ● $a^2 - b^2$ ● $a^2 \pm 2ab + b^2 - c^2$
---	---	---	---	---	---	---	<p>[SLO: M-08-B-13]</p> <p>Manipulation of algebraic expressions</p> <p>$(a + b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$</p> <p>$(a - b)^3 = a^3 - 3a^2b + 3ab^2 - b^3$</p>

---	---	---	---	---	<p><u>[SLO: M-06-B-08]</u></p> <p>Recognise and construct linear equations in one variable.</p>	<p><u>[SLO: M-07-B-16]</u></p> <p>Construct linear equations in two variables such as; $ax + by = c$, where a and b are not zero.</p>	<p><u>[SLO: M-08-B-14]</u></p> <p>Construct simultaneous linear equations in two variables.</p>
---	---	---	---	---	<p><u>[SLO: M-06-B-09]</u></p> <p>Solve linear equations involving integers, fractions and decimal coefficients.</p>	<p><u>[SLO: M-07-B-17]</u></p> <p>Recall solving linear equations in one variable.</p>	<p><u>[SLO: M-08-B-15]</u></p> <p>Solve simultaneous linear equations in two variables using:</p> <ul style="list-style-type: none"> - elimination method - substitution method - graphical method

							division and factorisation method
---	---	---	---	---	[SLO: M-06-B-10] Solve real-world problems involving linear equations.		[SLO: M-08-B-16] Solve real-world word problems involving two simultaneous linear equations in two variables.
---	---	---	---	---	---	---	[SLO: M-08-B-17] Identify base, index/exponent and its value.
---	---	---	---	---	---	---	[SLO: M-08-B-18] Deduce and apply the following laws of

							<p>Exponents/ Indices:</p> <p>-Product Law</p> <p>-Quotient Law</p> <p>-Power Law</p>
---	---	---	---	---	---	---	<p>[SLO: M-08- B-19]</p> <p>Solve simple linear inequalities i.e.,</p> <p>$ax > b$ or $cx < d$</p> <p>$ax + b < c$</p> <p>$ax + b > c$</p> <p>[SLO: M-08- B-20]</p> <p>Represent the solution of linear inequality on the number</p>

							line.
---	---	---	---	---	---	<u>[SLO: M-07-B-18]</u> Introduction to Cartesian coordinate system.	---
---	---	---	---	---	---	<u>[SLO: M-07-B-19]</u> Plot the graph of the linear equation $ax + b = 0$ where $a \neq 0$ and of linear	---

						equations in two variables.	
---	---	---	---	---	---	<p><u>[SLO: M-07-B-20]</u></p> <p>Recognise and state the equation of a horizontal line and a vertical line.</p>	<p><u>[SLO: M-08-B-21]</u></p> <p>Recognise the gradient of a straight line.</p> <p>Recall the equation of horizontal and vertical lines i.e.,</p> <p>$y = c$ and $x = a$</p>
---	---	---	---	---	---	<p><u>[SLO: M-07-B-21]</u></p> <p>Find values of 'x' and 'y' from the</p>	<p><u>[SLO: M-08-B-22]</u></p> <p>Find the value of 'y' when 'x' is given from the equation</p>

						graph.	and vice versa.
---	---	---	---	---	---	---	<u>[SLO: M-08-B-23]</u> Plot graphs of linear equations in two variables i.e., $y = mx$ and $y = mx + c$
---	---	---	---	---	---	---	<u>[SLO: M-08-B-24]</u> Interpret the gradient/ slope of the straight line.
---	---	---	---	---	---	---	<u>[SLO: M-08-B-25]</u> Determine the y-intercept of a straight line.

Domain C: Measurement

Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
<p>Benchmarks: Students will be able to measure, compare and order lengths (Kilometres/metres/ centimetres), mass (kilograms/grams/milligrams), and capacity (litres/ millilitres); read, write and compare time (hours and minutes); measure area and perimeter using square grids.</p> <p>They would also solve problems involving mass, length, weight/mass, capacity, and time (including addition and subtraction).</p>			<p>Benchmarks: Students will be able to measure, compare and convert lengths, mass, capacity and time from one standard unit to another; read, write and convert time in 24 hour and 12 hour notation.</p> <p>They would also solve problems involving length, mass/weight, capacity and time; solve problems involving perimeter and area of parallelogram, triangle, square, rectangle and rectilinear shapes.</p>		<p>Benchmarks: Students will be able to convert between different units of measure, solve problems involving speed, distance, time, area and perimeter of 2D shapes, surface area and volume of 3D shapes and apply the Pythagorean Theorem.</p>		
Student Learning Outcomes							
[SLO: M-01-C-01]	[SLO: M-02-C-01] Compare the	---	---	---	---	---	---

<p>Use mathematical language to compare the height/length of two or more objects.</p> <p><u>[SLO: M-01-C-02]</u></p> <p>Measure and compare the length of objects using non-standard units.</p>	<p>lengths of different objects using standard units of length (metre and centimetre) using $<$, $>$, and $=$ signs.</p>						
---	<p><u>[SLO: M-02-C-02]</u></p> <p>Recognise and use the standard units of length (metre and centimetre) to measure and record the length of different objects.</p>	<p><u>[SLO: M-03-C-01]</u></p> <p>Recognise and use the standard units of length (kilometre, metre, centimetre and millimetre) to measure and record the length of different objects.</p>	---	---	---	---	---
---	---	---	<u>[SLO: M-04-C-</u>	<u>[SLO: M-05-C-</u>	---	<u>[SLO: M-07-C-</u>	---

			<u>01]</u> Convert units of length from larger to smaller units (Kilometre, metre, centimetre and millimetre).	<u>01]</u> Convert units of length from larger to smaller and vice versa.		<u>01]</u> Convert different units of distance.	
---	<u>[SLO: M-02-C-03]</u> Add and subtract lengths, given in the same units to solve real-world word problems.	<u>[SLO: M-03-C-02]</u> Add and subtract lengths, given in the same units to solve real-world word problems.	<u>[SLO: M-04-C-02]</u> Convert, add and subtract lengths, to solve real-world word problems.	<u>[SLO: M-05-C-02]</u> Convert, add and subtract lengths, to solve real-world word problems.	---	---	---
<u>[SLO: M-01-C-03]</u> Use mathematical language to compare the mass of two or more objects. <u>[SLO: M-01-C-04]</u>	<u>[SLO: M-02-C-04]</u> Compare the mass of different objects using standard units of mass (kilogram and gram) using <, >, and = signs.	---	---	---	---	---	---

Measure and compare the mass of objects using non-standard units.							
---	<u>[SLO: M-02-C-05]</u> Recognise and use the standard units of mass (Kilograms and grams) to measure and record the mass of different objects.	<u>[SLO: M-03-C-03]</u> Recognise and use the standard units of mass (Kilograms, grams and milligrams) to measure and record the mass of different objects.	---	---	---	---	---
---	---	---	<u>[SLO: M-04-C-03]</u> Convert units of mass from larger to smaller units (kilogram and gram).	<u>[SLO: M-05-C-03]</u> Convert units of mass from larger to smaller and vice versa.	---	---	---
---	<u>[SLO: M-02-C-06]</u> Add and subtract mass, given in the same units to solve real-world	<u>[SLO: M-03-C-04]</u> Add and subtract mass, given in the same units to solve real-world	<u>[SLO: M-04-C-04]</u> Convert, add and subtract mass to solve real-world	<u>[SLO: M-05-C-04]</u> Convert, add and subtract mass to solve	---	---	---

	word problems.	word problems.	word problems.	real-world word problems.			
<u>[SLO: M-01-C-05]</u> Use mathematical language to compare the capacity of two or more objects.	<u>[SLO: M-02-C-07]</u> Compare the capacity of different objects using standard units of capacity (litre and millilitre) using <, >, and = signs.	---	---	---	---	---	---
<u>[SLO: M-01-C-06]</u> Measure and compare the capacity of objects using non-standard units	<u>[SLO: M-02-C-08]</u> Recognise and use the standard units of capacity (litre and millilitre) to measure and record the capacity of different objects.	<u>[SLO: M-03-C-05]</u> Recognise and use the standard units of capacity (litre and millilitre) to measure and record the capacity of different objects.	<u>[SLO: M-04-C-05]</u> Convert units of capacity from larger to smaller units (litre and millilitre).	<u>[SLO: M-05-C-05]</u> Convert units of capacity from larger to smaller and vice versa.	---	---	---
<u>[SLO: M-01-C-07]</u> Read and write temperature to the nearest	<u>[SLO: M-02-C-09]</u> Read and write temperature to the nearest appropriate unit	<u>[SLO: M-03-C-06]</u> Read and write temperature to the nearest appropriate unit	<u>[SLO: M-04-C-06]</u> Recognise the other temperature measuring		---	---	---

appropriate unit i.e., (°C) using pictorial representations and relating temperature scale to number line.	i.e., (°C) using pictorial representations and relating temperature scale to number line. [SLO: M-02-C-10] Compare and order temperature using <, >, and = signs.	i.e., (°C) using pictorial representations and relating temperature scale to number line. [SLO: M-03-C-07] Compare and order temperature using <, >, and = signs.	scales; Kelvin, Celsius and Fahrenheit				
---	[SLO: M-02-C-11] Add and subtract capacities given in the same units to solve real-life word problems.	[SLO: M-03-C-08] Add and subtract capacities given in the same units to solve real-life word problems.	[SLO: M-04-C-07] Convert, add and subtract capacities to solve real-life word problems.	[SLO: M-05-C-06] Convert, add and subtract capacities to solve real-life word problems.	---	----	----
[SLO: M-01-C-08] Read and write time in hours (o'clock) from analogue clock and digital clock.	[SLO: M-02-C-12] Read and write time in hours and minutes (with five minute intervals, half past, quarter past and quarter to)	[SLO: M-03-C-09] Read and write time in hours and minutes from analogue and digital clocks.	[SLO: M-04-C-08] Read and write time from digital and analog clocks in 12-hour and 24-hour format.	---	---	---	---

<p><u>[SLO: M-01-C-09]</u></p> <p>Show time in an hour on an analogue clock.</p>	<p>from analogue and digital clocks.</p> <p><u>[SLO: M-02-C-13]</u></p> <p>Show time in hours and minutes on an analogue clock.</p>						
<p>---</p>	<p>---</p>	<p><u>[SLO: M-03-C-10]</u></p> <p>Recognise and use a.m. and p.m.</p>	<p>---</p>	<p>---</p>	<p>---</p>	<p>---</p>	<p>---</p>
<p>---</p>	<p><u>[SLO: M-02-C-14]</u></p> <p>Recognise intervals of time (for instance · to estimate/give a rough calculation of the time taken by particular events or tasks)</p>	<p>---</p>	<p><u>[SLO: M-04-C-09]</u></p> <p>Convert larger units to smaller units of time (hours, minutes, seconds, years, months, weeks and days).</p> <p><u>[SLO: M-04-C-10]</u></p> <p>Calculate duration of</p>	<p><u>[SLO: M-05-C-06]</u></p> <p>Convert larger units to smaller units of time and vice versa.</p>	<p>---</p>	<p><u>[SLO: M-07-C-02]</u></p> <p>Convert 12 hour clock to 24 hour clock and vice versa.</p> <p><u>[SLO: M-07-C-03]</u></p> <p>Convert between different units</p>	<p>----</p>

			different events using start time and end time.			of time and speed.	
---	---	[SLO: M-03-C-11] Add and subtract measures of time given in the same units to solve real-life word problems.	[SLO: M-04-C-11] Add, subtract and convert measures of time to solve real-life word problems.	[SLO: M-05-C-07] Add, subtract and convert measures and intervals of time to solve real-life word problems.	---	[SLO: M-07-C-04] Calculate arrival time, departure time and journey time in a given situation (on the previous day and the next day).	---
---	---	---	---	---	---	[SLO: M-07-C-05] Solve real-world word	---

						<p>problems involving distance, time and average speed.</p> <p><u>[SLO: M-07-C-06]</u></p> <p>Differentiate between uniform and average speeds.</p>	
<p><u>[SLO: M-01-C-10]</u></p> <p>Name days of the week and months of the Solar and Islamic year.</p>	<p><u>[SLO: M-02-C-15]</u></p> <p>Use Solar and Islamic Calendar to find a particular day/date in real-life situations.</p>	<p><u>[SLO: M-03-C-12]</u></p> <p>Read and write days and dates from the Solar Calendar.</p>	---	---	---	---	---

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---	---	---	---	---	<p><u>[SLO: M-06-C-03]</u></p> <p>Calculate the surface area and volume of cube and cuboids.</p>	<p><u>[SLO: M-07-C-09]</u></p> <p>Calculate the surface area and volume of any simple 3-D shape including right prisms and cylinders.</p>	<p><u>[SLO: M-08-C-04]</u></p> <p>Calculate the surface area and volume of the pyramid, sphere, hemisphere and cone.</p>

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---	---	---	---	---	<p><u>[SLO: M-06-C-04]</u></p> <p>Solve real life word problems involving the surface area and volume of cubes and cuboids.</p>	<p><u>[SLO: M-07-C-11]</u></p> <p>Solve real life word problems involving the surface area and volume of right prisms and cylinders.</p>	<p><u>[SLO: M-08-C-05]</u></p> <p>Solve real life word problems involving the surface area and volume pyramid, sphere, hemisphere and cone.</p>

Domain D: Geometry

Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
<p>Benchmarks: Students will be able to use properties to describe and compare three-dimensional shapes (cube, cuboid, cone, cylinder, sphere, prism and pyramids) and relate those with two dimensional shapes; differentiate and classify polygons.</p> <p>Identify parallel and perpendicular lines; reflective symmetry, right angles and angles smaller and larger than a right angle; positions, directions and movements, centre, radius, and diameter of a circle.</p>			<p>Benchmarks: Students will be able to use properties to describe and compare quadrilaterals; identify three dimensional shapes and relate three dimensional shapes with their two dimensional representations.</p> <p>They will also identify and draw types of angles up to 180 degrees and lines of symmetry in 2-D shapes; compare and order angles by size; identify circumference of a circle.</p>		<p>Benchmarks: Students will be able to construct lines, angles of different measure, bisectors of angles, line segments, triangles and quadrilaterals ,use the properties of triangles ,quadrilaterals, polygons and circles to calculate unknown angles and lengths, apply facts of congruence and similarity and analyse and apply concepts of symmetry and transformations from two and three-dimensional perspectives.</p>		
Student Learning Outcomes							
<p>[SLO: M-01-D-01]</p> <p>Recognise and identify 2-D shapes (Rectangle, square, circle and triangle)</p>	<p>[SLO: M-02-D-01]</p> <p>Recognise, identify and draw 2-D shapes (Rectangle, square, circle, triangle, semi-</p>	<p>[SLO: M-03-D-01]</p> <p>Differentiate and classify polygons with respect to their attributes (pentagon, hexagon, octagon and decagon).</p>	---	<p>[SLO: M-05-D-01]</p> <p>Recognise, compare and classify types of quadrilaterals and their characteristics (parallel sides,</p>	---	<p>[SLO: M-07-D-01]</p> <p>Recognise quadrilaterals and their characteristics (parallel sides, equal</p>	---

with respect to their characteristics (i.e., sides and corners).	circle and quarter-circle) with respect to their characteristics. [SLO: M-02-D-02] Identify pairs of perpendicular and parallel lines.			equal sides, equal angles, right angles, lines of symmetry etc). (Square, rectangle, parallelogram, rhombus, trapezium and kite).		sides, equal angles, right angles, lines of symmetry etc). (Square, rectangle, parallelogram, rhombus, trapezium and kite) [SLO: M-07-D-02] Differentiate between convex and concave polygons.	
[SLO: M-01-D-02] Recognise and identify 3-D Shapes (cube, cuboid, cone, cylinder and sphere) with respect to their	[SLO: M-02-D-03] Recognise, identify 3-D shapes in different orientations. [SLO: M-02-D-	[SLO: M-03-D-02] Identify and differentiate between prisms and pyramids with respect to their attributes.	---	[SLO: M-05-D-02] Recognise and draw nets of prisms and pyramids.	[SLO: M-06-D-01] Recognise and identify 3-D shapes (i.e., cube, cuboid, cone, cylinder, sphere,	---	---

characteristics.	<u>04]</u> Make 3-D Shapes using varied modelling materials (cube, cuboid, cone, cylinder, sphere,) with respect to their characteristics.				hemisphere and cone) with respect to their characteristics		
<u>[SLO: M-01-D-03]</u> Describe the position, movement and direction of an object including moving in a straight line using positional language (for instance: inside, outside, above, below, over, under, far, near, before, after, straight, backward, right and left).	<u>[SLO: M-02-D-05]</u> Describe the position, direction and movement of an object including moving clockwise, anti-clockwise, quarter, half and three quarters turns using appropriate positional language (for instance: inside, outside, above, below, over, under, far, near,	<u>[SLO: M-03-D-03]</u> Describe the movement of objects (i.e., slide and rotation).	---	---	<u>[SLO: M-06-D-02]</u> Reflect an object using grid paper and compass and find the line of reflection by construction.	<u>[SLO: M-07-D-03]</u> Translate an object and give precise description of transformation	<u>[SLO: M-08-D-01]</u> Rotate an object and find the centre of rotation by construction. <u>[SLO: M-08-D-02]</u> Enlarge a figure (with the given scale factor) and find the centre and scale

	<p>before, after, beside, between, left, right and in front of, quarter turn, half turn, three quarter turns, clockwise, anti-clockwise, behind etc).</p> <p><u>[SLO: M-02-D-06]</u></p> <p>Recognise turn as a rotation.</p>						factor of enlargement.
---	<p><u>[SLO: M-02-D-07]</u></p> <p>Identify and differentiate between a straight and curved line.</p> <p><u>[SLO: M-02-D-08]</u></p> <p>Identify horizontal and</p>	<p><u>[SLO: M-03-D-04]</u></p> <p>Recognise point, line, ray and line segment; and draw and measure line segments.</p>	<p><u>[SLO: M-04-D-01]</u></p> <p>Recognise and identify parallel and non-parallel lines.</p>	---	<p><u>[SLO: M-06-D-03]</u></p> <p>Identify and differentiate between parallel lines, perpendicular lines and transversal.</p>	<p><u>[SLO: M-07-D-04]</u></p> <p>Know that the perpendicular distance from a point to a line is the shortest distance to the line.</p>	---

	vertical lines.						
---	---	[SLO: M-03-D-05] Identify the centre, radius and diameter of a circle.	[SLO: M-04-D-02] Describe the radius, diameter and circumference of a circle.	---	---	[SLO: M-07-D-05] Describe the properties of a circle; centre, radius, diameter, chord, arcs, major and minor arc, semi-circle and segment of a circle.	[SLO: M-08-D-03] Describe chord, arcs, major and minor arc, semi-circle, segment of a circle, sector, central angle, secant, tangent and concentric circles.
---	[SLO: M-02-D-09] Identify quarter turns.	[SLO: M-03-D-06] Recognise and Identify quarter turns and identify quarter turns as right angles (and vice versa).	[SLO: M-04-D-03] Recognise and identify acute, right and obtuse angles.	[SLO: M-05-D-03] Identify - angles at a point on a straight line and half a turn (180 degrees).	[SLO: M-06-D-04] Identify adjacent angles and find unknown angles related to parallel	[SLO: M-07-D-06] Calculate unknown angles in quadrilaterals using the properties of	---

		<p><u>[SLO: M-03-D-07]</u></p> <p>Identify half and 3-quarter turns (clockwise and anti-clockwise) as two and three right angles respectively.</p>	<p><u>[SLO: M-04-D-04]</u></p> <p>Compare and order angles up to 180 degrees by size.</p> <p><u>[SLO: M-04-D-05]</u></p> <p>Measure and draw angles (using a protractor) within 180 degrees.</p>	<p>- angles at a point and 1 whole turn (360 degrees).</p> <p><u>[SLO: M-05-D-04]</u></p> <p>Describe and calculate complementary and supplementary angles.</p>	<p>lines and transversals.</p> <p>(corresponding, alternate and vertically opposite angles)</p>	<p>quadrilaterals.</p> <p>(square, rectangle, parallelogram, rhombus, trapezium and kite).</p>	
---	---	---	---	---	---	<p><u>[SLO: M-07-D-07]</u></p> <p>Understand the relationship between interior and exterior angles of polygons and between opposite interior and exterior</p>	---

						<p>angles in a triangle.</p> <p><u>[SLO: M-07-D-08]</u></p> <p>Calculate the interior and exterior angles of a polygon and the sum of interior angles of a polygon.</p>	
---	---	<p><u>[SLO: M-03-D-08]</u></p> <p>Identify reflective symmetry in 2-D shapes.</p>	<p><u>[SLO: M-04-D-06]</u></p> <p>Recognise and draw lines of symmetry in 2-D shapes and complete symmetrical figures with respect to a given line of symmetry.</p>	<p><u>[SLO: M-05-D-05]</u></p> <p>Explore, identify and draw lines of symmetry in 2-D shapes and complete symmetrical figures with respect to a given line of symmetry.</p>	<p><u>[SLO: M-06-D-05]</u></p> <p>Recognise rotational symmetry, find the point of rotation and order of rotational symmetry.</p>	<p><u>[SLO: M-07-D-09]</u></p> <p>Recognise identity and draw lines of symmetry in 2-D shapes and rotate objects using rotational symmetry; and find the</p>	---

						order of rotational symmetry.	
---	---	---	---	<p><u>[SLO: M-05-D-06]</u></p> <p>Identify and describe different types of triangles; with respect to sides and angles.</p> <p>Calculate and measure unknown angles in a triangle.</p>	---	<p><u>[SLO: M-07-D-10]</u></p> <p>Calculate unknown angles in a triangle.</p>	---
---	---	---	---	---	<p><u>[SLO: M-06-D-06]</u></p> <p>Construct angles of specific measures (30, 45, 60, 75, 90, 105 and 120) and bisect angles using a compass.</p> <p><u>[SLO: M-06-D-</u></p>	<p><u>[SLO: M-07-D-11]</u></p> <p>Construct different types of triangles. (equilateral, isosceles, scalene, acute-angled, right-angled and obtuse-angled)</p>	<p><u>[SLO: M-08-D-04]</u></p> <p>Construct a triangle when: - three sides (SSS) -two sides and included angle (SAS) -two angles and</p>

					<p><u>07]</u></p> <p>Construct a perpendicular (from a point on the line and outside the line) and a perpendicular bisector.</p>	<p>included side</p> <p>- a right-angled triangle when hypotenuse and one side (HS) are given.</p> <p><u>[SLO: M-08-D-05]</u></p> <p>Construct different types of quadrilaterals (square, rectangle, parallelogram, trapezium, rhombus and kite).</p> <p><u>[SLO: M-08-D-06]</u></p> <p>Draw angle and</p>
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							line bisectors to divide angles and sides of triangles and quadrilaterals.
---	---	---	---	---	---	---	<p>[SLO: M-08-D-07]</p> <p>Identify congruent and similar figures (in your surroundings), apply properties of two figures to be congruent or similar and apply postulates for congruence between triangles.</p>

Domain E: Statistics and Probability

Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
<p>Benchmarks:</p> <p>Read and interpret data from pictographs, bar graphs, tally charts, block graphs and Carroll diagrams.</p> <p>Organise and represent data using pictographs, bar graphs, tally charts, block graphs and Carroll diagrams to answer questions.</p> <p>Describe the probability of an event.</p>			<p>Benchmarks:</p> <p>Read and interpret data from tables, pictographs, bar graphs, tally charts, block graphs, line graphs, pie charts and Carroll diagrams.</p> <p>Organise and represent data using tables, pictographs, bar graphs, tally charts, block graphs, line graphs, pie charts and Carroll diagrams to answer questions.</p> <p>Solve problems in context in relation to averages of quantities, measures and numbers.</p> <p>Describe the probability of an event; represent the probability of an event including real world problems.</p>		<p>Benchmarks:</p> <p>Students will be able to collect, classify and tabulate statistical data, interpret, construct and use statistical graphs, calculate and interpret measures of central tendency and solve problems using various concepts pertaining to Experimental and Theoretical Probability.</p>		
<p>Student Learning Outcomes</p>							

<p><u>[SLO: M-01-E-01]</u></p> <p>Read and interpret data using pictographs, block graphs and tally charts.</p> <p>(including real-world problems)</p>	<p><u>[SLO: M-02-E-01]</u></p> <p>Read and interpret data using pictographs, bar graphs and tally charts and; represent data using tally charts.</p> <p>(including real-world problems)</p>	<p><u>[SLO: M-03-E-01]</u></p> <p>Represent data; read and interpret data using Carroll Diagrams.</p> <p>(including real-world problems)</p>	<p><u>[SLO: M-04-E-01]</u></p> <p>Draw, read and interpret horizontal and vertical single and double bar graphs.</p> <p>(including real-world problems)</p>	<p><u>[SLO: M-05-E-01]</u></p> <p>Draw, read and interpret bar and line graphs.</p> <p>Interpret pie charts.</p> <p>(including real-world problems)</p>	<p><u>[SLO: M-06-E-01]</u></p> <p>Draw, read and interpret horizontal and vertical multiple bar graphs and pie charts.</p> <p>(including real-world problems)</p>	<p><u>[SLO: M-07-E-01]</u></p> <p>-Recognise drawing and interpreting of bar graphs, line graphs and pie charts.</p> <p>- Differentiate between a histogram and a bar graph.</p> <p>-Construct and compare histograms for both discrete and continuous data with equal interval range.</p> <p>-Select and justify the most appropriate graph(s) for</p>	<p><u>[SLO: M-08-E-01]</u></p> <p>Select and justify the most appropriate graph(s) for a given data set and draw simple conclusions based on the shape of the graph.</p>
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						a given data set and draw simple conclusions based on the shape of the graph.	
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---	---	---	---	<u>[SLO: M-05-E-02]</u> Find the average of given quantities, measures and numbers in a data. <u>[SLO: M-05-E-03]</u> Solve real world word problems related to averages involving quantities, measures and numbers.	<u>[SLO: M-06-E-03]</u> Calculate the mean, median and mode for ungrouped data and solve related real-world problems.	<u>[SLO: M-07-E-03]</u> Calculate the mean, median and mode for ungrouped data and the mean for grouped data and solve related real-world problems; Compare, choose and justify the appropriate	<u>[SLO: M-08-E-03]</u> Calculate range, variance and standard deviation for ungrouped data and solve related real-world problems.

						measures of central tendency for a given set of data.	
---	---	---	---	---	---	<u>[SLO: M-07-E-04]</u> Construct frequency distribution tables for given data (i.e., frequency, lower class limit, upper class limit, class interval and mid-point) and solve related real-world problems.	<u>[SLO: M-08-E-04]</u> Construct frequency distribution tables, histograms (of equal widths) and frequency polygons and solve related real-world problems.
<u>[SLO: M-01-E-02]</u> Describe the likelihood that everyday events	<u>[SLO: M-02-E-02]</u> Describe the likelihood that everyday events	<u>[SLO: M-03-E-02]</u> Describe the likelihood that everyday events will occur, using	<u>M-04-E-02]</u> Describe the outcome of a simple probability	<u>[SLO: M-05-E-04]</u> Explain experiments and outcomes; and represent the	<u>[SLO: M-06-E-04]</u> Explain experiments, outcomes,	<u>[SLO: M-07-E-05]</u> \Explain and compute the probability	<u>[SLO: M-08-E-05]</u> Explain and compute

will occur, using mathematical language (i.e., impossible, less likely and more likely).	will occur, using mathematical language (i.e., impossible, less likely, more likely, unlikely and certain).	mathematical language (i.e., impossible, possible, less likely, more likely, equally likely, unlikely and certain).	experiment (spinner and dice), using mathematical language (i.e., impossible, less likely, more likely, equally likely, unlikely and certain).	probability (using a fraction) that an event will occur, in simple games and probability experiments (including real-world word problems).	sample space, events, equally likely events and probability of a single event. Differentiate the outcomes that are equally likely and not equally likely to occur. (including real-world word problems).	of; certain events, impossible events and complement of an event. (including real-world word problems).	the probability of; mutually exclusive, independent, simple combined and equally likely events. (including real-world word problems). <u>[SLO: M-08-E-06]</u> Perform probability experiments (for example tossing a coin, rolling a die, spinning a spinner
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							<p>etc. for certain number of times) to estimate probability of a simple event</p> <p><u>[SLO: M-08-E-07]</u></p> <p>Compare experimental and theoretical probability in simple events.</p>
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DRAFT

Mathematics - Class 6

Suggested Guidelines

DOMAIN: Numbers and Operations

Sub-Domain: Multiples and Factors

STEP 1

Standard : Students will be able to recognize factors, multiples, HCF and LCM

Student Learning Outcomes: Students will be able to

- Recognize factors of numbers up to 3-digit
- Multiples of numbers up 2-digit.
- HCF and LCM.

Knowledge:

Students will be able to know:

- Factors of numbers up to 3-digit
- Multiples of numbers up to 2-digit
- Highest Common Factor (HCF)
- Least Common Multiple (LCM)

Skills:

Students will

- Find factors of up to 3-digit numbers
- Find multiples of up to 2-digit numbers
- Find prime factors of a given number up to 4-digit express its factors in the index notation (base and exponent)
- Find HCF of three numbers upto3-digits by
 - prime factorization
 - division method
- Find LCM of up to three numbers of 3-digits by
 - prime factorization
 - division method
- Apply HCF and LCM in real life situations
- Recognize and calculate squares of up to 2-digit numbers.

Additional/Advanced:

Students will be able to:

- Find relation between HCF and LCM

STEP 2**Assessments:****Formative Assessments:**

Some of the types of formative assessment teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc),
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on.

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized tests.
- External Exams

Some of the sample questions that can be used as part of formative assessment are:

1. Write any 3-digit number and do prime factorization. Peer checking can be done for this task.
2. Write first five multiples of numbers 10– 15 in 2 minutes.

3. Find the lowest number which is exactly divisible by 18 and 24.
4. Find the greatest number that divides 90 and 126 exactly.

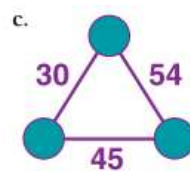
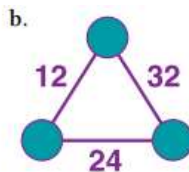
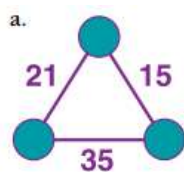
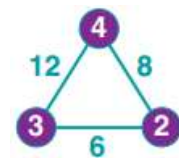
Some of the sample questions that can be used as part of summative assessments are:

5. Write the multiples of 6 which are greater than 20 and less than 50.
6. Write all the prime numbers between 1 and 15.
7. Write all the composite numbers between 1 and 30.
8. Write all the prime numbers between the following:
 31 and 50 50 and 90 61 and 80
9. Write all the composite numbers between the following:
 40 and 50 75 and 90 25 and 35
10. Find the highest common factor of the given numbers by long division method.
 18 and 30 75 and 180
11. Two ropes are 64 cm and 80 cm long. What maximum length of pieces can be cut equally from the given ropes?
12. A shopkeeper sells candles in packets of 12 and candle stands in packet of 8. What is the least number of candles and candle stands Nida should buy so that there will be one candle for each candle stand.
13. A florist wants to arrange 24 bouquets of flowers in different rows. Find out in how many ways he can arrange the bouquets with same number in each row.

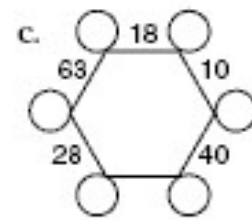
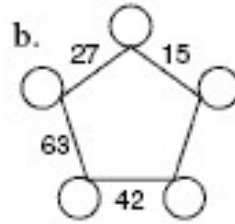
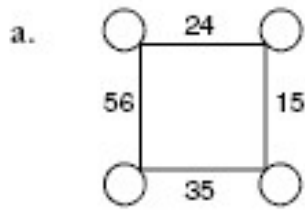
STEP 3

Learning Activities

1. Teacher can explain the concept of factors by making a combination table.
2. Teachers can also use a puzzle of different polygons to make learning fun. For example in the following polygon, the number beside each line segment is the product of the factors in the circles at each end of the line segment.



3. Teachers can ask students to make different polygons and exchange with other classmates as a challenge.



4. Teachers can play a bingo game with 2 dice and provide students with a number grid. 1-dice will be used with original numbers i.e. 1-6 and others will be used as 4-9. This game will be played in pairs:

- Take turns to roll the dice.
- On your turn, multiply the two numbers showing on the dice and mark square on the board that shows the product.
- The first player to cover three squares in a row (vertically, horizontally, or diagonally) wins.
- If neither player ends up with three counters next to each other, the game is a draw.

36	45	54	63	72	81
35	40	42	48	56	20
24	28	32	16	63	30
40	48	25	28	45	36
54	72	35	42	56	24
32	64	49	20	30	72

5. Teachers can use an interesting activity for introducing factorization by continuing the roots to their prime factors. On a sheet of brown construction paper, have students draw a tree trunk. On the trunk write the number 24. Below the trunk, have students draw roots with all the possible factors of 24: 1, 2, 3, 4, 6, 8, 12 and 24. Have students complete this activity with other numbers.
6. Teachers can play Two –Minute Multiple games with students by asking students to write numbers 2 - 10 in a column on their mini white boards. Teacher will set the timer of 2 minutes and will read aloud the first 10 multiples of 2 - 10. Students will be required to write the multiple corresponding to the correct number. When time is up, each player counts the multiples written next to the numbers. The player with the most correct multiples wins!
7. Teacher can use following activity to do practice of prime factorization:
- Ask students to stand in an open space at least an arms-length away from each other.
 - Tell them that you will be calling out numbers (such as 13, 21 or 101) and they will need to decide if the number is prime or composite.
 - If prime, they should sit down. If composite, they should stand up.
 - After calling out a composite number, choose a standing student to give the prime factorization of the number
8. Teacher can share following online game with students to practice prime factorization
<https://www.mathplayground.com/factortrees.html>

9. Teachers can make cards to play treasure hunt with students. Each card will contain the answer of any other card and a question. Students will solve the questions to solve the treasure hunt.

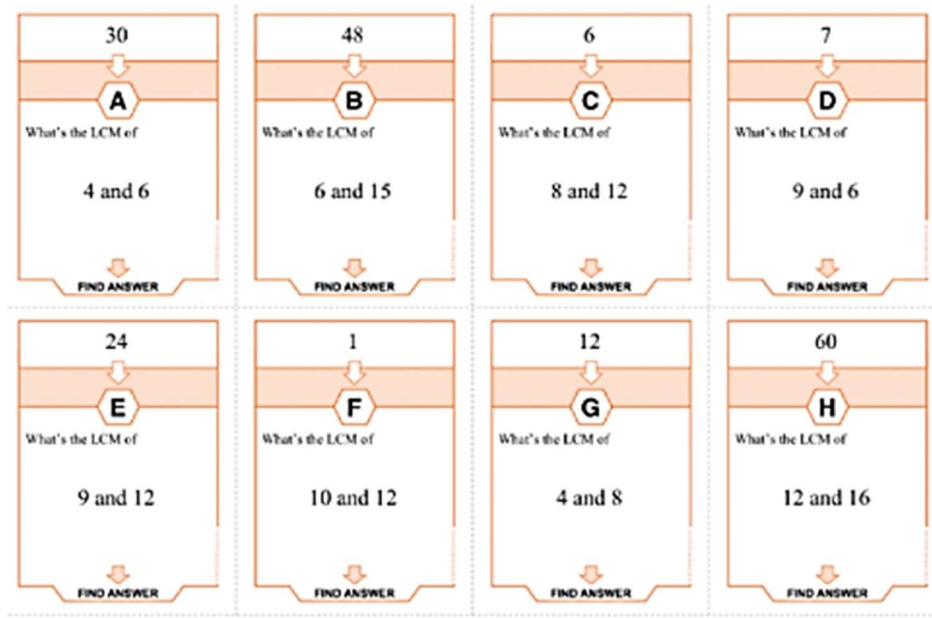


Figure 1 [Treasure Hunt Cards] [tes]

10. Teacher can share following online game with students to practice Highest Common Factor (HCF) and Least Common Multiple (LCM)
- https://www.transum.org/software/SW/Starter_of_the_day/Students/HCF_LCM.asp
- https://www.transum.org/software/SW/Starter_of_the_day/Students/HCF_LCM.asp?Level=2
11. Following coloring activity sheet can be provided to students to match the square numbers by coloring the block with same color.

Match up the square numbers				
4^2	225	25	8^2	49
100	3^2	7^2	169	15^2
12^2	81	5^2	16	144
64	13^2	9	10^2	9^2

Figure 2 [Square Numbers] [tes]

12. Following type of maze game can be used as a fun learning activity by teachers to practice square numbers.

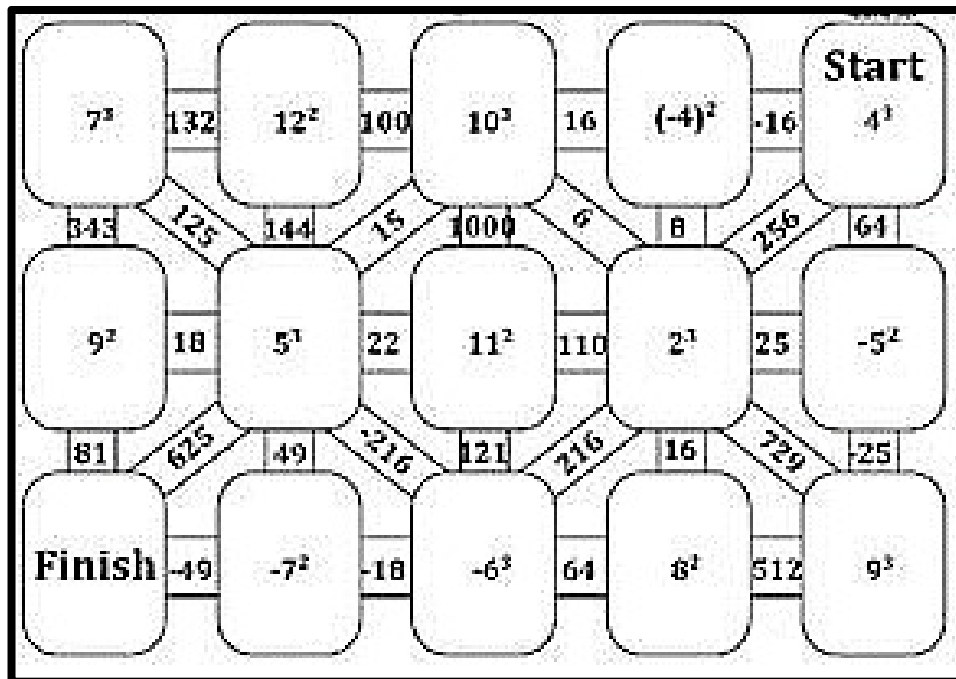


Figure 3 [Square Numbers] [tes]

Reference:

TES (2021) Retrieved from: <https://www.tes.com/teaching-resource/lcm-and-hcf-treasure-hunt-11743277>

TES (2021) Retrieved from:

<https://www.tes.com/teaching-resource/square-numbers-matchup-game-11059444>

Teachers Pay Teachers (2021) Retrieved from: <https://www.teacherspayteachers.com/Product/Squared-and-Cubed-Numbers-Maze-4790446>

Domain: Number and Operations

Sub-Domain: Integers

STEP 1

Standard: Students will be to recognize and identify integers, their absolute values and compare and arrange in different order.

Student Learning Outcomes: Students will be able to

- Recognize and identify integers (positive integers, negative integers and neutral integers).
- Calculate absolute or numerical value of an integer.
- Using a number line, compare and arrange a given list of integers and their absolute values in ascending and descending order

Knowledge:

Students will be able to know:

- Integers
- Negative integers
- Positive integers
- Zero (0) as a neutral integer
- Absolute or numerical value of an integer
- Integers on number line
- Identify integers on number line as:
 - a. positive integer
 - b. negative integer
 - c. neutral integer

Skills:

Students will

- Represent integers on number line
- Arrange a given list of integers in ascending and descending order
- Arrange the absolute or numerical values of the given integers in ascending and descending order
- Apply integers to solve real life situations

STEP 2

Assessments:

Formative Assessments.

Some of the types of formative assessment teacher may use are:

- Question & Answer (open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc),

- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on.

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized tests.
- External Exams

Some of the sample questions that can be used as part of the formative assessment are:

Ask students the following type of questions:

1. Note down temperatures of their five favorite countries and represent them on the number line.
2. Write any five negative numbers and any 5 positive numbers and find their absolute values.
3. Students can be asked a riddle: A special integer exists in mathematics that shows a special property. If you subtract any number from that integer, the result will always be divisible by the successor of that number completely.

Some of the sample questions that can be used as part of the summative assessments are:

Ask students the following type of questions:

1. In each case, arrange the given integers in ascending order:
 - 8, 0, -5, 5, 4, -1
 - 3, -3, 4, -7, 0, -6, 2
 - 1, -7, 8, -3, 0, 3, 17
2. In each case, arrange the given integers in descending order:
 - 5, -3, 8, 15, 0, -2
 - 12, 23, -11, 0, 7, 6
 - 1, -21, -31, 12, 5, 11

3. Evaluate the following:
 $|14 - 6| = |8| = 8$ $-|-10| = -10$ $15 - |-6| = 15 - 6 = 9$
 $7 + |-7| = 7 + 7 = 14$
4. When Steve woke up. His temperature was 102° F. Two hours later it was 3° lower. What was his temperature then?
5. An elevator is on the twentieth floor. It goes down 11 floors and then up 5 floors. What floor is the elevator on now?
6. Josie has \$47 left on her checking account. If she writes a check for \$55, what will Josie's balance be?
7. It will be -12° C tonight. The weatherman predicts it will be 25° C warmer by noon tomorrow. What will the temperature be by noon tomorrow?
8. The elevation of Mt. Everest is 29,028 feet. The elevation of the Dead Sea is -485 feet. What is the difference in the elevation between Mt. Everest and the Dead Sea?

STEP 3

Learning Activities

1. Teacher will ask students to give real life scenarios where they have seen negative numbers.
2. Teacher can show the following video to discuss real life examples of integers.
<https://www.youtube.com/watch?v=9w7gwFA1HNI>
3. Number cards will be made by teacher and students will be asked to add negative or positive signs and then arrange them in ascending or descending order.
4. Different temperature cards will be displayed to students and they will be asked to arrange them in order from coldest to warmest.
5. Number line will be displayed on board and students will be asked to point out the position of different integers on number line.
6. Teacher can prepare a short worksheet of filling the missing spaces on number line.
7. Students can play a game with dice in pairs to compare integers.
 - Teacher will provide a handout with some blank spaces for 2-digit or 3-digit numbers with positive and negative signs and an empty box in between number blanks for comparison of integers.
 - Player 1 will role dice and fill one blank of question and then player 2 will role dice and fill the other blank then according to positive and negative signs, players will determine which sign goes between numbers($<$, $>$ or $=$).
 - The player with greater number gets 1 point.
8. Following Online game link can be shared with students for practice of arranging integers.
https://www.mathplayground.com/mobile/numberballs_fullscreen.htm
9. Teacher can show the following video to explain concept of absolute value. Video can be paused at several intervals to ask questions from students.

<https://www.youtube.com/watch?v=zxaT8ArCKjQ>

10. Following Online game link can be shared with students for practice of finding absolute value of integer.

https://www.math-play.com/Millionaire-Game-Absolute-Value/Millionaire-Game-Absolute-Value_html5.html

Domain: Number and Operations

Sub-Domain: Laws of Integers

STEP 1

Standard: Students will be able to apply four operations (+, -, x, ÷ BODMAS), commutative, associative and distributive laws on integers.

Student Learning Outcomes: Students will be able to

- Add upto-2-digit like and unlike integers.
- Verify commutative and associative laws.
- Subtract up to 2-digit like and unlike integers.
- Multiply up to 2-digit like and unlike integers.
- Verify commutative, associative and distributive laws.
- Divide like and unlike integers up to 2-digit.

Knowledge:

Students will be able to know:

- Commutative, associative and distributive laws.
- "0" as an additive identity
- Additive inverse of an integer
- "1" as a multiplicative identity
- Order of mathematical operations by applying the BODMAS rule.

Skills:

Students will

- Add two integers up to 2-digit with the same and opposite signs and represent it on a number line
- Verify commutative and associative law of addition for integers up to 2-digit numbers
- Subtract two integers up to 2-digit with same and opposite signs.
- Multiply two integers up to 2-digit with the same and opposite signs
- Verify commutative and associative law of multiplication for integers up to 2-digit numbers
- Verify Distributive law of multiplication over addition up to 2-digit integers
- Verify Distributive law of multiplication over subtraction up to 2-digit integers
- Divide Two Integers with Same And Opposite Signs.

- Explain the order of mathematical operations by applying the BODMAS rule.
- Simplify Mathematical Expressions Involving integers, fractions and decimals.

STEP 2

Assessments:

Some of the types of formative assessment teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc),
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on.

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized tests.
- External Exams

Some of the sample questions that can be used as part of formative assessments are:

Ask students the following type of questions:

1. Make a poster of Addition and subtraction rules of integers with examples.
2. Make mathematical expressions and exchange it with other students to take it as a challenging question.
3. Maze hand out can be given to students to assess mathematical expressions.

Some of the sample assessments that can be used as part of the summative assessments are:

Ask students the following type of questions:

1. Simplify :

$$12 - [20 \div \{8 - 2(9 - 5 - 2)\}]$$

$$25 - [4 + \{16 - (12 - 2)\}]$$

$$36 - [18 - \{14 - (15 - 4 \div 2 \times 2)\}]$$

$$13 - [20 \div \{8 - 2(9 - 5 - 2)\}]$$

2. Challenge Activity for students

Use each of the digits 1, 2, 3 and 4. Place appropriate operation symbol and brackets to derive the given answer.

Example: $(4 + 3 - 1) \times 2 = 12$

	= 11
$(4 + 3 - 1) \times 2$	= 12
	= 13
	= 14
	= 15
	= 16
	= 17
	= 18
	= 19
	= 20

Figure 4 [Challenge Activity] [liveworksheets]

STEP 3

Learning Activities

1. Teachers can use the following links to explain the concept of adding and subtracting integers.
<https://www.youtube.com/watch?v=CfkaifC7tGY>
<https://www.youtube.com/watch?v=1DKWG5CBeek>
2. Teachers can use playing cards to practice adding, subtracting and multiplying integers.
 - Red cards are negative and black cards are positive

- Deck will be placed in the center of the table upside down and each student will be asked to take out 2 cards.
 - Students will be asked to add, subtract or multiply the value of their card
 - To get a 2-digit number students will take out 2 cards to create 1 value.
 - On giving each right answer, Students will get 1 point.
3. Following Online game link can be shared with students for practice of adding integers.
https://www.mathplayground.com/ASB_SpiderMatchIntegers.html
4. Teachers can explain the commutative property by following activity.
- Write this problem on the board. For example, $9 + 2 = \underline{\quad}$
 - Have nine children stand to the left of the board and two children to the right. Have the children count all the students for the answer of 11.
 - Shift, write $2 + 9 =$ on the board and discuss that it doesn't matter in addition, the ORDER of the problem, just the total amount of items, the sum.
 - KEEP the same students in the two groups but have them shift to the left or right so the nine students are now on the right and the SAME two students are on the left.
 - Discuss how the total number of students have not changed, and that we call this the Commutative Property of Addition.
5. Teachers can use 3 dice to practice associative property. Teacher will provide a handout of associative property with blanks. Students will roll all 3 dice at once and will write the numbers in the same sequence on both sides and then they will solve both sides to find out both sides give the same answer.
6. Teachers can explain the concept of distributive property by using a real-life scenario. For example,
- Imagine one student and her two friends each have seven strawberries and four apples. How many pieces of fruit do all three students have in total?
 - In their lunch bags — or, the parentheses — they each have 7 strawberries and 4 apples. To know the total number of pieces of fruit, they need to multiply the whole thing by 3.
 - When you break it down, you're multiplying 7 strawberries and 4 apples by 3 students. So, you end up with 21 strawberries and 12 apples, for a total of 33 pieces of fruit.
7. Following Online game links can be shared with students for practice of Commutative, Associative and Distributive property.
- <https://www.mathgames.com/skill/3.37-properties-of-addition>
- <https://www.mathgames.com/skill/3.38-solve-using-properties-of-addition>
- <https://www.mathgames.com/skill/7.96-properties-of-addition-and-multiplication>

8. Teacher can make a concept map of BODMAS on board to explain the order of operations.

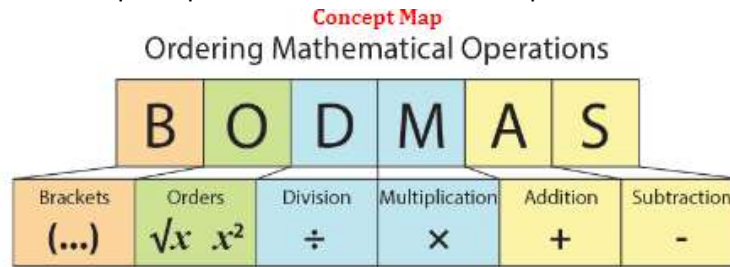


Figure 5 [BODMAS CONCEPT RULE] [liveworksheets]

9. Teachers can take a box in class containing mathematical expressions written on folded paper chits. Students will be asked to take out one paper chit and solve it. First student solving the mathematical expression correctly will be announced “Math Genius” of class.

Reference:

Liveworkseets (2021) Retrieved from:

<https://www.liveworksheets.com/bp935523uz>

Domain: Number and Operations

Sub-Domain: Rate, Ratio and Percentage

STEP 1

Standard: Students will be able to define and calculate ratio, rate, and percentage and apply these in real life context.

Student Learning Outcomes: Students will be able to

- Define and calculate ratio, equivalent ratio, rate and percentage.
- Solve real life problems involving ratio, rate and percentage.

Knowledge:

Students will be able to know:

- Ratio, equivalent ratio, rate.
- Difference between ratio and rate.
- Ratio has no unit but the rate has a unit.
- Meaning of percentage.
- The amount, the base, and the percent in a percent problem.

Skills:

Students will

- Express ratio as comparison of two quantities that are measured in same units
- Calculate ratio of two numbers/ quantities up to 3-digit
- Simplify given ratio into lowest (equivalent) form
- Explain the relationship between ratio and fraction
- Explain continued ratio.
- Explain rate as comparison of two quantities that are measured in different units.
- Express one quantity as percentage of another
- Compare two quantities by percentage
- Increase or decrease a quantity by a given percentage
- Solve Real Life Situations involving percentage
- Solve Real Life Situations Involving Ratio, Rate and Percentage.

Additional:

Students will be able to know relation between distance, time and speed

Additional:

Students will be able to:

- convert 12-hr clock time to 24-hr clock time (calculating journey time)
- solve real-life problems involving distance, time and speed

STEP 2**Assessments:**

Some of the types of formative assessment teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc),
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on.

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized tests.
- External Exams

Some sample questions that can be used as part of formative assessments are:

Ask students the following type of questions:

1. Use their favorite recipe and find out the quantity of each ingredient to make 15 servings.
2. Make a discount poster of their favorite clothing shop. And make a list of 5 articles with original price and 25% discounted price.

Some sample questions that can be used as part of summative assessments are:

Ask students the following type of questions:

1. The length of the ribbon was originally 30 cm. It was reduced in the ratio 5: 3. What is its length now?
2. Mother divided the money among Ron, Sam and Maria in the ratio 2: 3: 5. If Maria got \$150, find the total amount and the money received by Ron and Sam.
3. The ratio of the number of boys and girls is 4:3. If there are 18 girls in a class, find the number of boys in the class and the total number of students in the class.
4. Jason is driving across the country. For the first 3 hours, he travels 60 mph. For the next 2 hours he travels 72 mph. Assuming that he has not stopped, what is his average traveling speed in miles per hour?
5. Tom runs a 100m race in a certain amount of time. If John runs the same race, he takes 2 seconds longer. If John ran at 8m/s, approximately how fast did Tom run?
6. In an election, candidate A got 75% of the total valid votes. If 15% of the total votes were declared invalid and the total number of votes is 560000, find the number of valid votes polled in favor of the candidate.
4. A shopkeeper bought 600 oranges and 400 bananas. He found 15% of oranges and 8% of bananas were rotten. Find the percentage of fruits in good condition.
5. Aaron had \$ 2100 left after spending 30 % of the money he took for shopping. How much money did he take along with him?

STEP 3

Learning Activities

1. Teachers can demonstrate the concept of ratio by M&M Activity. Each student will get a pack of M&Ms of assorted colors. Teacher will lead students through how they will fill out the activity sheet. Students will count the total M&Ms and will calculate the ratio of each color to total M&Ms.

	Red	Orange	Yellow	Green	Blue	Brown
Total of each color						
Ratio of color to total M&Ms						

2. Teacher can explain the concept of equivalent ratios by using kid's favourite recipe to make several servings.
3. Following Online game links can be shared with students for practice of unit rate:
https://www.brainpop.com/games/unitrates/?topic_id=
4. Teacher can Challenge students to use their knowledge about percentages in this fun game. Just roll the dice and race to calculate the percentage. Whoever gives the correct answer first earns a point and the first person to reach 15 points wins!!
 - In order to determine the percentage, students will pick a card from the deck and whatever number they'll draw they will have to add zero at its end. For example, if student draws an 8 the percentage need to calculate will be 80
 - 2 dice will be rolled to get a number of which percentage has to be calculated.
 - The first player should turn over a card and roll the dice.
 - Players race to see who can get the correct percentage of the number rolled on the dice. For example, if the total of the 2 dice was 11 and the percent was 20%, players try to determine what 20% of 11 is. 4. The first player to get the correct answer wins that round and gets a point. Play continues until one player reaches 15 points.
5. Following Online game links can be shared with students for practice of percentage increase or decrease.
<https://www.quia.com/rr/230204.html>

Domain: Number and Operation

Sub-Domain: Sets

STEP 1

Standard: Students will be able to use language notation and Venn diagrams to represent sets.

Student Learning Outcomes: Students will be able to

- Use language, notation and Venn diagrams to represent different types of sets and their elements (empty, singleton , subsets , proper, improper subsets and universal set , finite and infinite sets).

Knowledge:

Students will be able to know:

- Set, an element of a set, empty set.
- Singleton set and universal set.
- Types of sets.
- Sets using Venn diagrams.

Additional:

Students will be able to know about subsets of a given set

Skills:

Students will be able to

- Name the sets using capital letters A, B, C etc. And use symbol for empty set (Φ).
- Differentiate between elements of a set, finite & infinite sets and universal sets.
- Identify and find the subsets (proper and improper) of a set, finite and infinite sets.
- represent sets using Venn diagrams

STEP 2

Assessments:

Some of the types of formative assessment teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc),
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what

they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on.

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized tests.
- External Exams

Some of the sample questions that can be used as part of formative assessments are:

Ask students the following type of questions:

1. Make sets of first ten multiples of 6 and 8 and find union and intersection of sets using Venn diagram.
2. Students can be asked to do a short activity in pairs. In each pair, students will make a set of his/her favorite food items, after making a set, each pair of students will find the union and intersection of their favorite colors.

Summative Assessments

Ask students the following type of questions:

1. If $A = \{1, 3, 7, 9, 10\}$, $B = \{2, 5, 7, 8, 9, 10\}$, $C = \{0, 1, 3, 10\}$, $D = \{2, 4, 6, 8, 10\}$, $E = \{\text{set of natural numbers}\}$ and $F = \{0\}$
Find:
(i) $A \cup B$ (ii) $E \cup D$ (iii) $C \cup F$ (iv) $C \cup D$ (v) $B \cup F$ (vi) $A \cap B$
(vii) $C \cap D$ (viii) $E \cap D$
2. If $P = \{\text{multiples of 3 between 1 and 20}\}$ and $Q = \{\text{even natural numbers upto 15}\}$. Find the intersection of the two given sets P and set Q.

STEP 3

Learning Activities:

1. Teachers can use the following online game link for practice of symbols used in set.
https://www.transum.org/software/SW/Starter_of_the_day/Students/Set_Notation/Default.asp
2. Teachers can use the following online video link to explain types of sets.

<https://www.youtube.com/watch?v=8dup8yGwBhM>

3. Teacher can explain the concept of representing sets using the Venn diagram by the following activity: Teacher will make three sets of hobbies. Sports, Reading and Computer games.
 - Set A is for pupils who like sport.
 - Set B is the pupils who like reading.
 - Set C is for pupils who like computer games.
 - Teacher will write the names of students in each set. And then construct the Venn diagram on board.
4. Teacher can use following online video link to explain union and intersection of two set
<https://www.youtube.com/watch?v=YEsBbAGqkZw>
5. Teacher can use following activity to do practice of set:
 - These activities will require students to be grouped prior to the beginning of the activity.
 - Divide students into groups of 5-7
 - Give one set of numbers to each group
 - Teacher will write a few sets on the b board. A - D
 - Call out a problem such as "The union of A and E".
 - The first group to raise the correct number cards reflecting the answer to your question gets a point.
 - Continue for as long as desired. The team with the most points at the end of the game wins
6. Teachers can use the following online puzzle link for practice of Venn diagram used in set.
<https://www.univie.ac.at/future.media/moe/tests/mengen/duv.html>

DOMAIN: Algebra

Sub-Domain: Algebraic Expression

STEP 1

Standard: Students will be able to recognize simple number patterns, use letters to represent numbers, evaluate, add, subtract and simplify linear expressions.

Student Learning Outcomes: Students will be able to

- Recognize simple patterns from various number sequences.
- Use letters to represent numbers, express basic arithmetical processes algebraically.
- Evaluate algebraic expressions, add and subtract linear expressions.
- Simplify linear expressions.

Knowledge:

Students will be able to know:

- Simple patterns from various number sequences.
- Term Algebra as an extension of arithmetic, where letters, numbers and symbols are used for construction of algebraic expressions
- Basic arithmetic operation using Algebra
- Algebraic sentence as combination of algebraic expressions using symbols =, ≠.

Skills:

Students will

- Continue a given number sequence and find a term to term rule.
- Solve real life problems involving number sequences and patterns
- Evaluate an algebraic expression or algebraic formula
- Differentiate a statement as open, true and false
- Manipulate simple algebraic expressions using addition and subtraction
- Simplify Algebraic Expressions

STEP 2

Assessments:

Some of the types of formative assessment teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc),
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on.

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized tests.
- External Exams

Some of the sample questions that can be used as part of formative assessments are:

Ask students the following type of questions:

1. Write a sequence of even numbers between 60 and 90.
2. Make a poster of polygons in sequence according to the number of sides.
3. Teacher can also ask tricky riddle to students:

Riddle: What do u think are the last two numbers in this sequence: 8, 5, 4, 9, 1, 7, _?

(Hint: use numbers less than 10)

Answer: 6, 3. the number names in words are in Alphabetical order. (eight, five, four etc.)

Some of the sample questions that can be used as part of the summative assessments are:

Ask students the following type of questions:

1. Determine the n th term of the sequence (Give questions involving simple numbers, fraction numbers ranging from simple to more complex):
2. Find the terms a_2 , a_5 and a_7 of the arithmetic sequence if you know :
 - a) $a_1 = 4, d = 3$
 - b) $a_1 = -5, d = -2$
 - c) $a_1 = 0, d = -1$.

Learning Activities

1. Teacher can use manipulatives like math manipulatives, decimal manipulatives, or place value manipulatives to create activities: For example, dominoes come with dotted patterns, Teacher can ask students to arrange in an increasing or decreasing order to give practice on sequences. Teachers can also use any type of snacks or cereal to make a sequence of any pattern.
2. Teachers can use a classic deck, which can also offer a very entertaining way of learning number sequences. There is a game called Parliament, the game goes something like this:
 - The equal number of cards are dealt to each player.
 - Teachers can decide a middle number to start the game, say 7.
 - All the players carrying number seven keep it on the table
 - The other players start making a series in increasing and decreasing order, which means the left side of number 7 is expanded by placing numbers 6, 5, 4 and so on. Similarly, on the right side, the players have to put the numbers 8,9,10 till King
3. Teachers can provide a hundred square grid (by browsing on net for a copy of it) or can display it on board to ask students to color squares to explore different number patterns like odd numbers, even numbers, counting in multiples from times tables and ten more and ten less.
4. Teachers can use the following online game link for practice of sequence.
<https://mathsframe.co.uk/en/resources/resource/42/sequences>
5. Teacher can use following online game link for practice of sequence.
<https://www.topmarks.co.uk/ordering-and-sequencing/chinese-dragon-ordering>
6. Teachers can take a simple example like $2x + 4y - 9$ to explain coefficients, variables and constants. He/She can begin by asking students to identify the terms in the expression and then use the expression to draw attention to coefficients, variables and constants.
7. Teacher can share following online game links to identify term, coefficient and constant in algebraic expressions
<https://www.mathgames.com/skill/6.6-identify-terms-coefficients-and-monomials>

8. Teachers can use hexagon calculation games to do practice of algebraic expressions. Hexagon puzzle is an algebra challenge that can be played by multiple players. It involves rolling a dice to work out the value of an algebraic expression. Students take turns rolling the dice and the number rolled becomes the value of 'n'. The player then gets one chance to choose a hexagon and solve the equation using the assigned value of 'n'. At the end of the game, the student with the most number of solved hexagons wins.

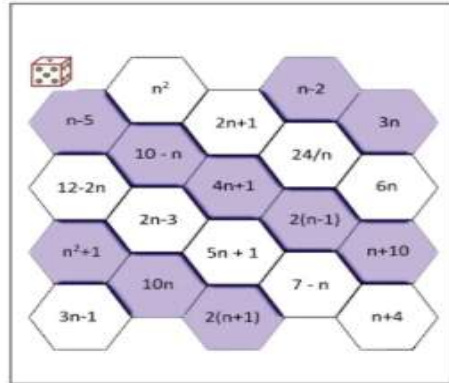


Figure SEQ Figure * ARABIC 7[Hexagon Calculation Game] [prodigygame]

Figure 7 [Hexagon Calculation Game] [prodigygame]

9. Teacher can share following online game links to practice algebraic expressions
<https://www.mathgames.com/skill/4.94-write-variable-expressions>
<https://www.mathgames.com/skill/6.9-evaluate-multi-variable-expressions>

Reference:

Help Teachers (2021) Retrieved from: <https://www.helpsteaching.com/questions/157258/expand-96x7>

Prodigy Game (2021) Retrieved from:

https://prodigy-website.cdn.prismic.io/prodigy-website/eb0ad3f4-7f29-4860-84dc-57932df3f9a6_hexagon.pdf

Domain: Algebra

Sub-Domain: Linear Expressions & Equations

STEP 1

Standard: Students will be able to identify and differentiate between linear expressions and linear equations, solve linear equations and apply them in real life context.

Student Learning Outcomes: Students will be able to

- Recognize algebraic equations.
- Differentiate between linear algebraic equations and linear algebraic expressions in one variable,
- Solve linear equations and apply them in real life situations.

Knowledge:

Students will be able to know:

- Concept of equations.
- Linear equations in one variable.

Skills:

Students will

- Construct linear equations in one variable
- Solve simple linear equations involving integers, fractions and decimal coefficients.
- Solve linear equations of the type:
 $ax + b = c, a \neq 0$
- Solve real life situations involving linear equations

STEP 2

Assessments:

Formative Assessments:

Some of the types of formative assessment teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks

- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc.)
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized tests.
- External Exams

Some of the sample questions that can be used as part of formative assessments are:

Ask students the following type of questions:

1. Convert word statements to algebraic equations. For example: Sum of price of 3 shirts and 2 pants is Rs. 13,000
2. Develop an equation with one variable and exchange it with the student sitting beside and solve it as a challenge.

Some of the sample questions that can be used as part of summative assessments are:

Ask students the following type of questions:

1. Solve simple linear equations (give questions involving simple linear equations, linear equations in fractions etc)
2. Translate the sentence into an algebraic equation and solve
3. Twice the difference of x and 3 gives 18.
4. 4 times the difference of x and 8 gives 22
5. Seven more than x is equal to 21
6. Product of 4 and y is equal to the sum of $2y$ and 8.

Learning Activities

- Teachers can use the following activity to explain the concept of balancing equations.



Figure 8 [Balancing Equation] [mathisfun]

- Teachers can use Balance Math activity to do practice of algebraic equations. Students need to find out the missing number to balance the pan. When both sides weigh the same, the pan stays balanced. Working on these pan balance problems is a great way to improve logical reasoning skills.

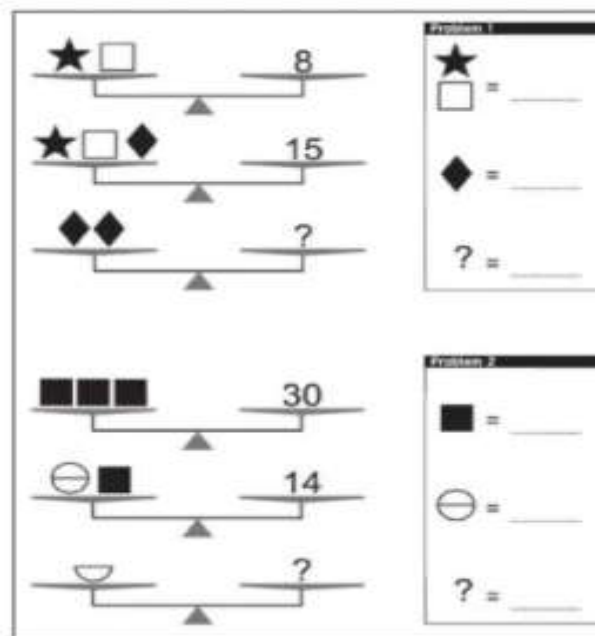


Figure 9 [Balancing Activity] [prodigygame]

- Teachers can use riddle activity to do practice of linear equations. 'Riddle Me' is a fun classroom activity for students. The game can be made easy or hard depending on the equations but essentially the motive is to solve the value of each algebraic equation and find the answer to the

riddle. The student who manages to solve all the equations and find the answer to the riddle wins the game!

Solve for 'x'. Write the corresponding letter in the space below that matches your answer.

1. $8+x=16$	A	2. $2x-8=6$	N
3. $x-10=0$	B	4. $4+3x=7$	P
5. $2x+5=9$	C	6. $4x-4=16$	R
7. $9+2x=17$	E	8. $6+2x=24$	S
9. $3x-6=3$	H	10. $3x+5=23$	Y

What do witches put on their hair?

<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>		
9	2	8	5	4	9	1	5	8	6

Figure 10 [Riddle Me This] [prodigygame]

4. Teachers can share the following online game links to practice algebraic equations.

<https://www.mathgames.com/skill/3.75-solve-for-the-variable-with-addition-and-subtraction>

<https://www.mathgames.com/skill/3.76-solve-for-the-variable-with-multiplication-and-division>

References:

Prodigy Game (2021) Retrieved from:

https://prodigy-website.cdn.prismic.io/prodigy-website/eb0ad3f4-7f29-4860-84dc-57932df3f9a6_hexagon.pdf

Maths is Fun (2021) Retrieved from:

<https://www.mathsisfun.com/algebra/add-subtract-balance.html>

Prodigy Game (2021) Retrieved from:

https://prodigy-website.cdn.prismic.io/prodigy-website/5cfc7227-ab10-448c-a1ce-583d70366ddb_balance.pdf

DOMAIN: Measurements

Sub-Domain: Surface Area and Volume

STEP 1

Standard: Students will be able to calculate area and perimeter, surface area, volume of different 2D and 3D shapes by applying suitable formulae and units.

Student Learning Outcomes: Students will be able to

- State and differentiate between area and perimeter and their units.
- Recognize the formulae to calculate the area and perimeter, surface area, volume of different 2D and 3D shapes.

Knowledge:

Students will be able to know:

- Difference between area and perimeter.
- Formulae to calculate the area and perimeter of different shapes.

Skills:

Students will

- Calculate the area and perimeter of a rectangle, square, parallelogram, triangle and trapezium.
- Calculate the surface area and volume of cube and cuboids.
- Solve real life word problems involving perimeter, area, the surface area and volume of cubes and cuboids.

STEP 2

Assessments:

Some of the types of formative assessment teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc.)

- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe are the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized tests.
- External Exams

Some of the sample questions that can be used as part of formative assessments are:

Ask students the following type of questions:

1. Find the area and perimeter of their lunch boxes.
2. Make the layout of their house on a grid sheet and find Area and perimeter of each room.
3. Count the tiles of the room and estimate the area and perimeter of the classroom.

Some of the sample questions that can be used as part of summative assessments are:

Ask students the following type of questions:

- 1. Adeel ran 5 rounds of a square ground of side 70 m. Find the total distance he ran.**
2. Mrs. Rao gives one rectangular card of sides 18 cm by 14 cm to each of her 7 pupils. She wants her pupils to glue a ribbon around the border of their own card. Find the length of the ribbon they will need altogether.
3. Mrs. Basit cuts a 25 cm by 6 cm cloth into 5 equal pieces. What is the area of each piece?
4. Yasir purchases a new house, but the main gate of the house looks ugly because of color. He measures the gate 8 feet by 10 feet. He wants to paint the main gate with white color at a cost of \$20 per square foot. How much will it cost for Yasir to add color to his main gate?
5. What is the height of a rectangular stone with a perimeter of 260.2 mm and a base length of 75.4 mm?
6. Lubna has a keyboard. The length of the keyboard is 18 inches and the width is 10 inches. Find the area of the keyboard.
6. A rectangular park is 54 yards wide and 110 yards long. What is its perimeter?

7. Alisha wanted to paint her ugly brown flower box red. Using the given dimensions, how many square inches will she have to paint?
8. Dawood and Kiran are building a tree house in the shape of a rectangular prism for their daughter. If the tree house is going to be 5 feet tall, 8 feet wide, and 7.5 feet long how much space will there be inside? How much space will they have to paint on the outside?

STEP 3

Learning Activities

1. Teachers can start the concept by asking students to make an anchor chart. This smart option lays out the differences and similarities between area and perimeter measurements.

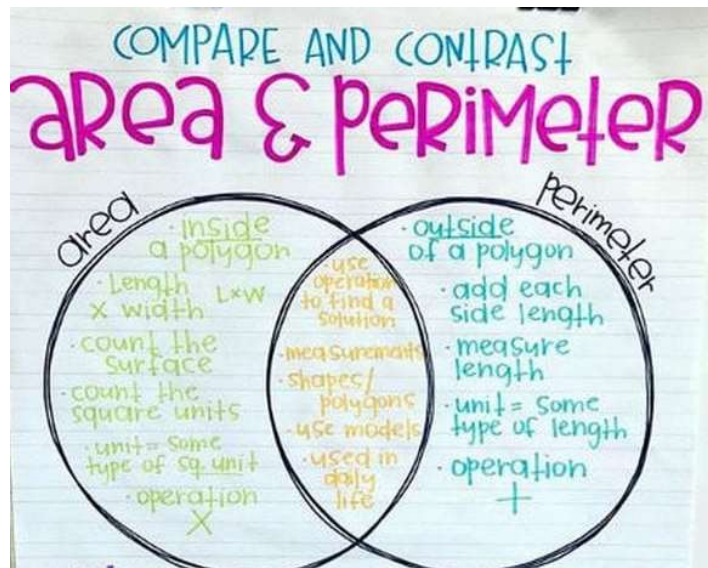


Figure 11 [Area & Perimeter] [weareteachers]

2. Students can be provided a grid sheet and asked to draw themselves and find area and perimeter.

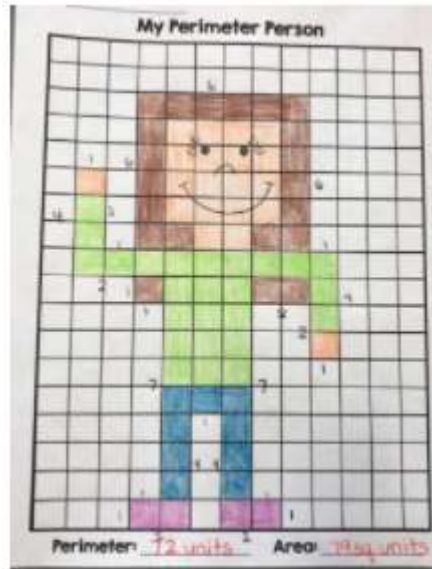


Figure 12 [Perimeter Person] [qwordfromthird]

3. Teachers can also do a pair activity and can use square floor tiles to make different shapes by painter's blue tape and can ask students to find area and perimeter.
4. Teachers can share the following online game links to practice areas and perimeter.
<https://www.splashlearn.com/s/math-games/find-the-perimeter-of-the-shapes-using-grids>
<https://www.splashlearn.com/s/math-games/find-the-perimeter-of-polygons>
<https://www.splashlearn.com/s/math-games/find-the-area-by-multiplying-the-side-lengths>
5. Teachers can ask students one day before to bring empty boxes of cube or cuboid shape in class then next day students will find the volume of those boxes.
6. Teachers can share the following online game links to practice volume of cube and cuboid.
<https://www.splashlearn.com/s/math-games/find-volume-using-the-formula>
<https://www.splashlearn.com/s/math-games/solve-the-word-problems-related-to-volume>

References:

Prodigy Game (2021) Retrieved from:

https://prodigy-website.cdn.prismic.io/prodigy-website/c1c3b0cf-b7f0-4161-814a-0e9783d55f9c_riddle.pdf

DOMAIN: Geometry

Sub-Domain: Symmetry

STEP 1

Standard: Students will be able to identify 2D, 3D shapes, parallel lines and related angles and rotational symmetry.

Student Learning Outcomes: Students will be able to

- Identify 2-D, 3-D shapes with respect to their characteristics.
- Differentiate between parallel and intersecting lines.
- Identify transversal angles related to them and recognize rotational symmetry.

Knowledge:

Students will be able to know:

- 3-D shapes (cube, cuboid, cone, cylinder, sphere, hemisphere and cone) with respect to their characteristics.
- Difference between parallel lines, perpendicular lines and transversal.
- Adjacent angles and unknown angles related to parallel lines and transversals. (corresponding, alternate and vertically opposite angles)
- Rotational symmetry.

Skills:

Students will

- Reflect an object using grid paper and compass and find the line of reflection by construction.
- Solve problems involving angles formed by two parallel lines and a transversal (corresponding, alternate, vertically opposite angles).
- Find the point of rotation and order of rotational symmetry.

Additional:

- Calculate unknown angle using the concept of angles at a point.

STEP 2

Assessments:

Formative Assessments

Some of the types of formative assessment teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc.)
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe are the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized tests.
- External Exams

Some of the sample questions that can be used as part of formative assessments are:

Ask students the following type of questions:

1. Make an assignment of animal pictures with a line of reflection.
2. Write their name in all capital letters and draw line of symmetry on each letter.
3. Find order of rotational symmetry of 5 objects.

Summative Assessments

Ask students the following type of questions:

1. Draw all the lines of symmetry in the shapes below (give different objects pictures which can have line of symmetry):
2. Fill in the blanks:
 - A square has lines of symmetry.
 - An equilateral triangle has lines of symmetry.
 - A line of symmetry divides an image into equal halves.
 - A scalene triangle has lines of symmetry.
 - A circle has lines of symmetry.
 - Letter H has lines of symmetry.
3. Give questions that asks for drawing lines of symmetry such as:
 7. Draw a shape with exactly 2 lines of symmetry. Include the lines of symmetry on your drawing.
 8. Draw a shape with exactly 5 lines of symmetry. Include the lines of symmetry on your drawing.
 9. Draw a shape with exactly 3 orders of rotation.
 10. Draw a shape with exactly 6 orders of rotation.
4. Give questions that asks for order of rotational symmetry such as:
 11. What is the order of rotational symmetry of an equilateral triangle?
 12. What is the order of rotational symmetry of a regular pentagon?
 13. What is the order of rotational symmetry of a parallelogram?
 14. What is the order of rotational symmetry of a kite?
5. Find the order of rotational symmetry of following shapes

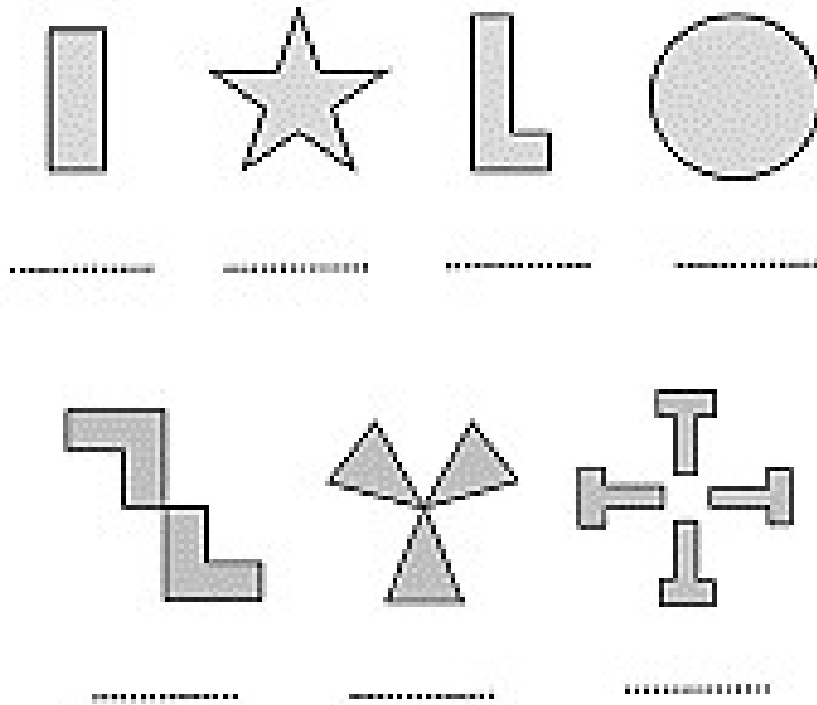


Figure 13 [Rotational Symmetry] [studylib]

STEP 3

Learning Activities

1. Students can be given a short activity to take color paper and fold it in half and cut any shape on its edge and observe symmetry by unfolding paper.
2. Teachers can assign students to write A to Z in Capital letters and find lines of reflection in each alphabet.
3. Teachers can make a worksheet with the following type of questions.

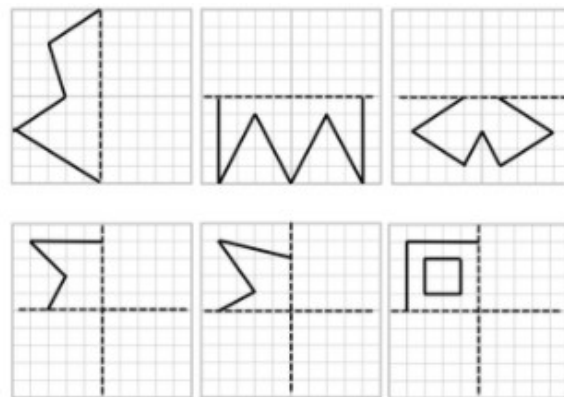


Figure 14 [line of Symmetry] [fiveways]

4. Teachers can share the following online game links to practice algebraic equations.
<https://www.topmarks.co.uk/symmetry/symmetry-matching>
<https://www.mathgames.com/skill/8.73-reflections-graph-the-image>
5. Teacher can use following method to explain the concept of rotational symmetry
 - Students will be asked to each pick a couple of different cut out shapes and trace them on a piece of paper.
 - After tracing the shapes, the students will be asked to use their pen or pencil to hold down the center of the shape and rotate the shapes and count how many times the cut out shape lined up perfectly with the traced shape (until they got to a full turn around).
 - The number of times cut out will be lined to sketch in one complete rotation will be the rotational symmetry order.
6. Teacher can use following link to explain the concept of rotational symmetry and point of rotation
<https://www.mathsisfun.com/geometry/symmetry-rotational.html>
7. Teacher can share following link with students to solve a quick quiz
https://www.mathopolis.com/questions/q.html?id=849&t=mif&q=849_850_2137_2138_3360_3361_3362_3363_5033_5034&site=1&ref=2f67656f6d657472792f73796d6d657472792d726f746174696f6e616c2e68746d6c&title=526f746174696f6e616c2053796d6d65747279#
8. Teachers can ask students to write down everything they know about lines and angles. Allow a few volunteers to write one piece of information each on the board.
9. Teachers can do a poster activity in which students will make columns with all the types of angles along with sketches.

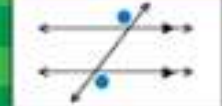


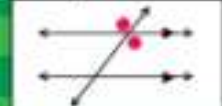

FIGURE	ANGLE TYPE	RELATIONSHIP
		
		congruent
		
		

Figure 16 [Types of Angle][mrblairmaths]

10. Teachers can share the following online game links to practice of angles formed by two parallel lines and a transversal.

<https://www.mathgames.com/skill/8.46-transversal-of-parallel-lines>

https://www.transum.org/software/SW/Starter_of_the_day/Students/AngleParallel.asp

References:

Five Ways (2021) Retrieved from:

<https://www.fiveways-primary-school.org.uk/admin/ckfinder/userfiles/files/Symmetry%202.pdf>

Pinterest (2021) Retrieved from:

<https://www.pinterest.com/pin/283375001524974344/>

Mr. Blair's Maths (2021) Retrieved from:

<https://sites.google.com/a/vusd.us/mr-blair-s-math-class/home/integrated-math-2/unit-2---lines-and-angles>

DOMAIN: Geometry

Sub-Domain: Geometrical Constructions

STEP 1

Standard: Students will be able to construct angles of different measure (with compass), bisectors of angles and bisector and perpendicular bisectors of line segments.

Student Learning Outcomes: Students will be able to

- Construct angles of different measures.
- Define bisectors of an angle, bisector and perpendicular bisector of a line segment.

Knowledge:

Students will be able to know:

- Difference between line and line segment.
- Bisector of an angle, perpendicular bisector of a line segment.
- Difference between bisector and perpendicular bisector of a line segment.

Skills:

Students will

- Construct angles of specific measures (30, 45, 60, 75, 90, 105 and 120) and bisect angles using a compass.
- Construct a perpendicular (from a point on the line and outside the line) and a perpendicular bisector.

Additional:

- find unknown angles (straight line and at a point)
- find unknown angles in a triangle (interior and exterior angles)

STEP 2

Assessments:

Formative Assessments

Some of the types of formative assessment teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,

- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc.)
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe are the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized tests.
- External Exams

Some of the sample questions that can be used as part of formative assessments are:

Ask students the following type of questions:

1. Make an acute angle, an obtuse angle and a right angle and draw their angle bisectors.
2. Draw 5 line segments of any measurements and draw a perpendicular bisector on each.

Some of the sample questions that can be used as part of summative assessments are:

Ask students the following type of questions:

1. Find the size of each missing angle.(give images of different angles drawn on 180 or 360 degrees)
2. Use your protractor to draw these angles:
40° 125° 25° 268°
3. Identify which of the following pairs of angles are complementary or supplementary?
(i) 70°, 20° (ii) 20°, 170° (iii) 50°, 145° (iv) 125°, 55° (v) 105°, 75°
4. Construct angle bisector of following angles. (provide images of different angles)
5. Construct line bisector of following line segments:
67.8 cm 45 cm 122 cm

STEP 3

Learning Activities

1. Teacher can explain the concept of angle bisector by using the following activity.
 - Divide the class into small groups, and provide each group with a large piece of paper, a protractor, a ruler, a pencil, and some art supplies.
 - Instruct each group to make a large X on the paper by connecting the corners of the paper using two diagonal lines.
 - Point out the four angles that have formed, and tell students to find and draw the angle bisector of each angle.
 - Tell students that this will form additional angles, which will have their own bisectors, and so on.
 - Students should continue finding bisectors until they have a given number of sections. They can then use the art supplies to color in each section for a piece of “angle bisector artwork” that looks a bit like an explosion.
2. Teachers can use the following web link to show construction of angle and line bisection.
<https://www.mathspad.co.uk/i2/construct.php>
3. Teachers can explain the concept of perpendicular bisectors by asking students to stand and make T using their arms. Teacher will explain how the body is acting as a perpendicular to their arms and the distance from their nose to tip of the finger on each side is equal.
4. Teachers can share the following online quiz link of line and angle bisector.
<https://www.mathgames.com/skill/8.111-measures-of-bisected-lines-and-angles>

DOMAIN: Statistics and Probability

Sub-Domain: Data Management

STEP 1

Standard: Students will be able to recognize graphs, grouped, ungrouped data continuous and discrete variables. Calculate mean, median and mode.

Student Learning Outcomes: Students will be able to

- Recognize different types of graphs.
- Differentiate between grouped and ungrouped data, continuous and discrete variables.
- Calculate mean median and mode.

Knowledge:

Students will be able to know:

- Types of graphs.
- Difference between grouped and ungrouped data, continuous and discrete variables.
- Types of formulae to calculate means.

Skills:

Students will

- Draw, read and interpret horizontal and vertical multiple bar graphs and pie charts.(including real-world problems)
- Organize different types of data (i.e. discrete, continuous, grouped and ungrouped).
- Calculate the mean, median and mode for ungrouped data and solve related real-world problems.

STEP 2

Assessments:

Formative Assessments

Some of the types of formative assessment teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc.)

- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe are the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized tests.
- External Exams

Some of the sample questions that can be used as part of formative assessments are:

Ask students the following type of questions:

1. Make a pie chart of time they spend out of 24 hours in following activities: Studying, Playing, Eating, Sleeping and Other Activities.
2. Collect data of ages of 10 people and find the mean of that data.
3. Find the median of the first 12 prime numbers.

Some of the sample questions that can be used as part of summative assessments are:

Ask students the following type of questions:

1. Find the mean of the following data.
 - (a) 9, 7, 11, 13, 2, 4, 5, 5
 - (b) 16, 18, 19, 21, 23, 23, 27, 29, 29, 35
 - (c) 2.2, 10.2, 14.7, 5.9, 4.9, 11.1, 10.5 (d) $11/4$, $21/2$, $51/2$, $31/4$, $21/2$
2. Find the mean of the first ten whole numbers.
3. Find the mean of the first 5 prime numbers.
4. The mean of 8, 11, 6, 14, x and 13 is 66. Find the value of the observation x.
5. The weights in kg of 10 students are given below:
39, 43, 36, 38, 46, 51, 33, 44, 44, 43

Find the mode of this data. Is there more than 1 mode? If yes, why?

6. Find the median of the following data.

27, 39, 49, 20, 21, 28, 38

10, 19, 54, 80, 15, 16

47, 41, 52, 43, 56, 35, 49, 55, 42

12, 17, 3, 14, 5, 8, 7, 15

7. The number of bed-sheets manufactured by a factory during five consecutive weeks is given below. Represent the data using the bar graph. (provide a table with weeks and number of bedsheets provided in it)
8. The number of students in 7 different classes is given below. Represent this data on the bar graph. (provide a data in a table with class and number of students given in it)
9. The population of a particular state in different years is given below. Represent this data on the bar graph. (Provide a data in a table with years and population figures provided in it)
10. The following table shows the mode of transport used by 400 students of a school. Represent the following information on the pie chart. (Provide a data in a table with mode of transport and number of students mentioned in it)
11. The percentage of expenditure of a company under different heads is as follows. Represent the following information on the pie chart. (Provide a data with heads of expenditure being salary, electricity, conveyance and machines and percentages given as 45%, 20%, 10% and 25% respectively)

STEP 3

Learning Activities

1. Teachers can use skittles to explain the concept of bar graph in the following way. Teachers can ask several questions through which students will learn the interpretation of bar graphs. For example: which color skittle do you have the most? Which color skittles do you have in the same number? Etc.
2. Teachers can share the following online game link of interpreting and constructing bar graphs.
 - <https://www.splashlearn.com/s/math-games/answer-how-many-more-or-less-using-bar-graphs>
 - <https://www.splashlearn.com/s/math-games/create-bar-graphs>
 - <https://www.splashlearn.com/s/math-games/analyze-and-represent-data-using-bar-graph>
3. Teachers can explain the method of constructing a pie chart by gathering data from students. Data can be gathered by asking students how many students like to read Comic books, Poem books, Story books and Puzzle books.

4. Teachers can assign students to make a pie chart of the favourite flavors of ice-cream for the children in a locality. Draw the pie chart to represent the given information. (Provide a data in a table with ice cream flavours and percentages of students who like them mentioned in it.)
5. Teacher can share following online game link of interpreting and constructing pie chart
https://www.transum.org/software/SW/Starter_of_the_day/Students/Pie_Charts.asp
6. Teacher can ask students to find mean and median of following data sets:
 - First 10 even numbers
 - Odd numbers between 50 and 70
 - Multiples of 15 below 100.
7. Teachers can share the following online quiz link of finding mean, median and mode.
<https://www.mathgames.com/skill/7.90-interpret-charts-to-find-mean-median-mode-and-range>

References:

Pinterest (2021) Retrieved from:

<https://www.pinterest.com/pin/124763852166566344/>

Domain: Statistics and Probability

Sub-Domain: Probability

STEP 1

Standard: Students will be able to understand the concepts relating to probability.

Student Learning Outcomes: Students will be able to

- Explain experiments, outcomes, sample space, events, equally likely events and probability of a single event.
- Differentiate the outcomes that are equally likely and not equally likely to occur.(including real-world word problems).

Knowledge:

Students will be able to know:

- Experiments, outcomes, sample space, events, equally likely events and probability of a single event.
- Difference between the outcomes that are equally likely and not equally likely to occur.

Skills:

Students will

- Explain experiments, outcomes, sample space, events, equally likely events and probability of a single event.
- Differentiate the outcomes that are equally likely and not equally likely to occur.
- Apply the probability concepts to real life situations.

STEP 2

Assessments:

Formative Assessments

Some of the types of formative assessment teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc.)

- Observation diaries
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Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized tests.
- External Exams

Some of the sample questions that can be a part of formative assessments are:

Ask students the following type of questions:

1. Write five things which they are likely to do in a day and 5 things they are unlikely to do in their complete day.
2. Write 7 events which will have zero chances to happen.

Some of the sample questions that can be used as part of summative assessments are:

Ask students the following type of questions:

1. If the spinner is spun once, determine whether it is certain, likely, unlikely, or impossible that the pointer stops on a number that is a multiple of 3.
 - Which outcome is least likely when spinning the arrow on this spinner?
2. A spinner is divided into 10 equal sectors numbered 1 through 10. If the spinner is spun, is it certain, likely, unlikely, or impossible that it lands on a number less than 4?
3. What is the probability of rolling a number which is greater than 6 on a fair die?
4. There are 15 letter tiles in a bag: six tiles are labeled S, eight tiles are labeled R, and one is labeled M. Which of the following describes how likely it is to choose the letter M?

STEP 3

Learning Activities

1. Teachers can give the concept of probability by making a concept map and by using real life events.

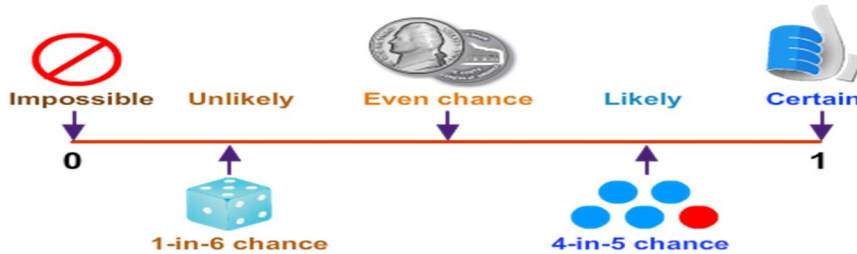


Figure 18 [Probability Line] [mathsisfun]

2. Teachers can make a maze handout of probability for students to practice probability. Teachers can share the following online quiz link of probability.

<https://www.ixl.com/math/grade-3/certain-probable-unlikely-and-impossible>
<https://www.scottle.edu.au/ec/viewing/L118/index.html#>

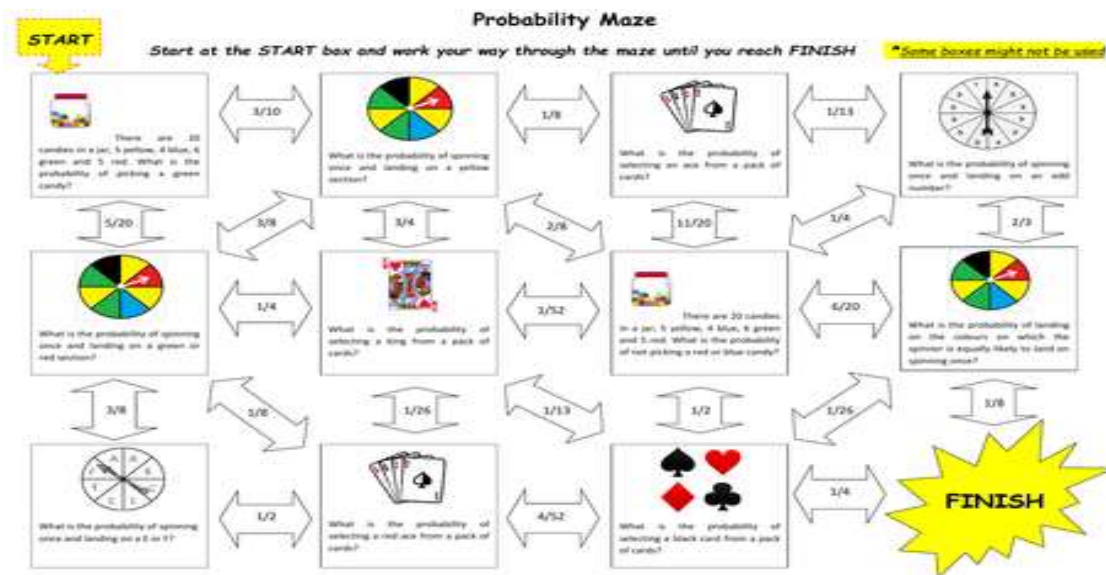


Figure SEQ Figure * ARABIC 19 [Probability Maze] [tes]

References:

Math is Fun (2021) Retrieved from:

<https://www.mathsisfun.com/data/probability.html>

TES (2020) Retrieved from:

<https://www.tes.com/teaching-resource/probability-maze-activity-11787241>

DRAFT

Mathematics - Class 7 Suggested Guidelines

Note:

Key for Core and Advanced/Additional SLOs

- Normal font = Core
- Italics = Advanced/Additional Concepts

Domain: Numbers and Operations

Sub-Domain: Rational Numbers

STEP 1

Standard: Identify, recognize, compare, arrange and round Integers, whole numbers, rational numbers and decimal numbers

- **Student Learning Outcomes:** Identify, arrange and round integers, whole numbers, rational numbers and decimal numbers. Represent these using a number line. Develop an understanding of place-value for these different types of numbers, and the concept of significant figures

Knowledge:

Students will be able to know: :

- rational number as a number that can be expressed in the form of $\frac{p}{q}$, where p and q are integers and $q \neq 0$

Students will know:

- Different types of sets (including natural, whole, integers and rational number sets)

Skills:

Students will be able to:

- Represent rational numbers and decimal numbers on a number line
- Use symbols $<$, $>$, $=$, \leq and \geq to compare rational numbers and decimal numbers
- use the concept of place value for rational numbers and decimal numbers of any size
- Arrange whole numbers, integers, rational numbers and decimal numbers in ascending or descending order

- Round any whole numbers, integers, rational numbers and decimal numbers to a required degree of accuracy, significance or decimal places (up to 3 decimal places)

STEP 2

Assessments

Formative Assessments

- Basketball approach (Through a question about numbers and sort them) to encourage silent learners in discussion.
- In-class presentations on rules of significant figures.
- Cut & Paste – Mixed Numbers Practice Page (Can be used for number line)
- Exit Ticket

Summative Assessments

Tests at the end of each unit, Monthly tests, Mid-year exams, End-of-Year exams.

STEP 3

Learning Activities

- Generate a discussion with students on: why and how man first felt the need to have numbers in his life and what type of numbers do they see around them, and the numbers they see in Mathematics that they cannot see in real life (e.g. negative numbers), and to be able to categorize different kinds of numbers.
- Comparing Numbers: Number Whisper – Have partners think of a secret number. They write it down (keeping it hidden). Then, give clues. For example, mine is greater than one, but less than 10. They keep giving clues until the number is guessed correctly. Students then switch roles.
- Group discussion on the pros and cons of rounding off money amounts. For instance, while shopping, to figure out if they have enough money to buy something or when trying to divide a large amount of items among a few people. These mental math problems usually start with rounding, and you can practice this at home. Some other good places to practice rounding numbers is the grocery store, restaurants, or shopping mall or planning a party.
- Use number line for ordering and comparing different types of numbers

Domain: Number and Operations

Sub-Domain: Laws of Operation (rethink)

STEP 1	
Standard: Use vocabulary and symbols related to addition, subtraction, multiplication and division for integers, whole numbers, rational numbers and decimal numbers.	
<ul style="list-style-type: none">● Student Learning Outcomes: Perform mental calculations on increasingly large numbers. Use Commutative, Associative and Distributive Laws, and the concept of Order of Operations to solve problems involving addition, subtraction, multiplication and division	
Knowledge: Students will understand: <ul style="list-style-type: none">● Associative property of whole numbers, integers and rational numbers● Commutative property of whole numbers, integers and rational numbers● Distributive property of rational numbers with respect to multiplication over addition and subtraction Students will know: <ul style="list-style-type: none">● “0” as additive identity● “1” as multiplicative identity	Skills: Students will be able to: <ul style="list-style-type: none">● Identify additive inverse of a rational number● Identify the multiplicative inverse of a non-zero rational number● Perform mental calculations, including mixed operations on large numbers <100● Use commutative, associative and distributive laws of the four operations (addition, subtraction, multiplication and division) in whole numbers● Use the concept of Order of Operations to solve numerical expressions involving integers, whole numbers, rational numbers and decimal numbers● Solve word problems that involve addition, subtraction, multiplication and/or division of integers, whole numbers, rational numbers and decimal numbers in real-life contexts● Use knowledge of rounding to give an estimate to a calculation - to check the reasonableness of the solution.
STEP 2	

Assessments

Formative Assessments:

- Think-pair-share activity (related to the concept of Order of Operations)
- Online math games on integer and decimal addition, subtraction, multiplication and division
- Ask the students to create addition, subtraction, multiplication and division word problems, each with an answer of 5.7
- Two stars and a wish (Break the class into pairs and have them review each other's work - application of number properties)

Summative Assessments

Tests at the end of each unit, Monthly tests, Mid-year exams, End-of-Year exams.

STEP 3

Learning Activities

- Pick up any object on your desk. It could be a pen, a cup, a computer mouse, or anything else. By holding what you picked up in your hand, you can tell it has certain properties, like size, shape, and weight. Similarly, the numbers we use in math problems also have properties of their own.
- Here, we are going to go over number properties: the commutative property, the associative property, distributive property, multiplicative inverse and additive inverse. These properties show us how the numbers in math problems can be rearranged or tackled in different orders without changing the final answer. This is important because sometimes a problem is easier to solve if it can be written in a different order. We use these properties when working out both basic math and algebra problems.
- Quick mental tests on mixed operation (e.g. $22 \div 11 \times 10$, $50 + 60 \times 5$, $50 \div 5 + 4 \times 3$ etc.)
- Provide students with a variety of division questions that result in a remainder and have them investigate and discuss the meaning of the remainders
- A way to remember the order of the operations is PEMDAS or BODMAS, where in each letter stands for a mathematical operation.
- The PEMDAS rule that state the order in which the operations in an expression should be solved, is:
 1. Parentheses - They take precedence over all other operators. The first step is to solve all the operations within the parentheses. Work out all groupings from inside to out. (Whatever is in parentheses is a grouping)

2. **Exponents** - Work out all the exponential expressions.
3. **Multiplication and Division** - Next, moving from left to right, multiply and/or divide whichever comes first.
4. **Addition and Subtraction** - Lastly, moving from left to right, add and/or subtract whichever comes first.

Domain: Number and Operations

Sub-Domain: Square and Square Root

STEP 1	
Standard: Use prime factorization to calculate square root of perfect square numbers.	
<ul style="list-style-type: none">● Student Learning Outcomes: Recognize prime and composite numbers less than 500. Calculate square and square root of different types of numbers. Recall the concepts of HCF and LCM and use them to solve word problems	
<p>Knowledge:</p> <p>Students will Know :</p> <ul style="list-style-type: none">● the following properties of perfect square of a number:<ul style="list-style-type: none">○ the square of a proper fraction is less than itself○ the square of a decimal less than 1, is less than itself● Square root is the inverse process of squaring a number <p>Students will know:</p> <ul style="list-style-type: none">● Square of a number as multiplication of a number with itself	<p>Skills:</p> <p>Students will be able to:</p> <ul style="list-style-type: none">● Recognize prime and composite numbers <500● Calculate square of an integer, whole number, rational number or decimal number (up to 3-digits)● Calculate square roots of perfect squares using prime factorization of:<ul style="list-style-type: none">○ Integers (up to 3 digits)○ Fractions○ Decimal numbers (up to 2 decimal places)● Solve word problems with real-life context involving squares and square roots● <p>Advanced/Additional:</p> <p>Students will be able to:</p> <ul style="list-style-type: none">● Use approximation to the nearest perfect square numbers to find square roots of non-square numbers (e.g. $\sqrt{1000}$)

STEP 2

Assessments

Formative Assessments

- White Board technique (Every student will need a small whiteboard at their desk - they will do prime factorization on their white-board and show it to the class)
- Basketball technique (To recognize composite and prime numbers)
- Think-pair-share (Students will find out square roots)

Summative Assessments

Tests at the end of each unit, Monthly tests, Mid-year exams, End-of-Year exams

STEP 3

Learning Activities

- Ask students to use factor trees to identify prime and composite numbers.
- Ask students to square various numbers including integers, decimals and fractions.
- Online games on square and square roots.
- Use LCM and HCF in real life application problems.
- *Use estimation for finding square roots of non-square numbers by recalling all square numbers from 1 to 20 by group activity.*

Domain: Number and Operations

Sub-Domain: Rate, Ratio and Percentage

STEP 1

Standard: Perform appropriate operations on fractions and percentages in various problem-solving contexts.

- **Student Learning Outcomes:** Identify and convert between different types of fractions, percentages and decimals. Calculate simple percentage, percentage increase and percentage decrease. Solve word problems with real-life contexts involving Zakat, Ushr, Inheritance, Commission and Taxes

Knowledge:

Students will understand:

- The concept of income tax, property tax, general sales taxes and value-added tax

Students will know:

- The method of calculating Zakat, Inheritance and Ushr in different circumstances (in accordance with Islamic principles)

Skills:

Students will be able to:

- Identify and convert between various types of fractions
- Express one quantity as the percentage of another quantity
- Increase and decrease quantities by a given percentage
- Differentiate between:
 - selling price and cost price
 - profit, loss and discount
 - profit percentage and loss percentage
- Solve word problems related to real-life situations involving profit, loss and discount
- Calculate Zakat, Inheritance and Ushr
- Solve word problems related to real-life situations involving Zakat, Inheritance, Ushr, Commission, Income tax, Property tax, general sales tax (GST) and value-added tax (VAT)
- Convert and use equivalences between simple fractions, decimals, ratios and percentages in various contexts
- Solve problems involving fractions - expressing the answers in simplest form

STEP 2**Assessments****Formative Assessments**

- Think-pair-share (for the concept of Types of fractions)
- Presentations: Word problems on Zakat, Ushr, Inheritance, profit, loss and discount will be solved/discussed by group presentations.

Summative Assessments

Tests at the end of each unit, Monthly tests, Mid-year exams, End-of-Year exams.

STEP 3

Learning Activities

- Concept of Zakat will be explained (Zakat is one of the five pillars of Islam. It is the amount, which wealthy Muslims (Sahib-e-Nisaab) pay to needy Muslims. The rate of Zakat is 2.5% of the total value of the Gold & Silver & cash amount.
- Know the rate of Ushr levied on land-owner in respect of produce of the land
- Know the ratio of shares among legal inheritors of a property (in accordance with Islamic principles).
- Calculate amount of share of each legal inheritor of a property (in accordance with Islamic principles).
- Discuss real world applications with students in which a percentage greater than 100% is used.
- Online games on percentage increase and decrease, discount, VAT and GST.

Domain: Number and Operations

Sub-Domain: Financial Mathematics

STEP 1

Standard: Use the concept of rate, ratio and proportion in various problem-solving contexts.

- **Student Learning Outcomes:** Calculate increase and decrease in ratios, rates, average rates, direct and inverse proportion. Solve word problems pertaining to all of these concepts

Knowledge:

Students will understand:

- Proportion as equality of two ratios

Students will know:

- Common units of rate

Skills:

Students will be able to:

- Calculate Increase and decrease in a ratio based on change in quantities and vice versa
- Calculate rate and average rate of quantities
- Calculate direct proportion
- Calculate inverse proportion
- Solve word problems related to real-life situations involving direct and inverse proportions, rates and ratios

STEP 2**Assessments****Formative Assessments**

- Basketball activity (for increase and decrease in ratios)
- Four corners of room technique (Students can go in four corners of the room according to their understanding, for example if a student doesn't get the concept he can go to that corner where all students are standing who are confused about concept, and so on.)
- White board technique (can be used for direct and inverse proportion questions given by teacher)
- Assessment Reflection

Summative Assessments

Tests at the end of each unit, Monthly tests, Mid-year exams, End-of-Year exams

STEP 3**Learning Activities**

- Give students examples from daily life on increase and decrease in ratios (e.g. the total number of teachers in school has increased from 50 to 60, hence the ratio of new vs old number of teachers is 6:5)
- Explain to the students how they can figure out based on the given ratio whether they have to calculate the increase or decrease in a quantity.
- Give students examples from daily life to understand how different quantities can be used together to form a rate (e.g. 100 km/h, 70 beats/min, \$1.69/100 g, \$9.50/kg)

- Sometimes a change in the proportions of one quantity means a change in the proportions of the other! For example, when you buy more apples, you will have to pay more money. Similarly, if we increase the speed of a vehicle, the time that it takes to cover some distance goes down.

Domain: Number and Operations

Sub-Domain: Sets

STEP 1	
<p>Standard: Use language, notation (tabular and descriptive form) and Venn diagrams to describe sets and their elements, and solve word problems.</p>	
<ul style="list-style-type: none"> • Student Learning Outcomes: Describe and differentiate different types of sets. Show different set operations using Venn diagrams 	
<p>Knowledge:</p> <p>Students will understand:</p> <ul style="list-style-type: none"> • Commutative and associative properties of union and intersection on two sets • Operations on sets: <ul style="list-style-type: none"> ○ union of two sets ○ intersection of two sets ○ difference of two sets ○ Complement of a set <p>Students will know:</p> <ul style="list-style-type: none"> • The meaning of and enumerate complement, union, intersection and difference of two sets mathematically 	<p>Skills:</p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Describe and list down the elements of a descriptive set in numerical form and vice versa • Describe the following sets: <ul style="list-style-type: none"> ○ natural numbers (N) ○ whole numbers (W) ○ even numbers (E) ○ odd numbers (O) ○ prime numbers (P) ○ integers (Z) • Differentiate the following: <ul style="list-style-type: none"> ○ subsets and supersets ○ proper and improper subsets ○ <i>equal and equivalent sets</i> ○ disjoint and overlapping sets • Show complements, union and intersection and difference of two sets by shading in Venn diagram using one universal sets and two subsets

- Identify and describe mathematically different sets shaded in the Venn diagram using one universal set with two subsets
- Solve simple word problems involving set theory

Advanced/Additional:

Students will be able to:

- Differentiate the following:
 - *equal and equivalent sets*
- *Verify the following:*
 - $A \cap A^c = \emptyset$.
 - $A \cup A^c = U$
 - $(A \cup B)^c = A^c \cap B^c$
 - $(A \cap B)^c = A^c \cup B^c$

STEP 2

Assessments

Formative Assessments

- Entrance Tickets (Students' prior knowledge will be checked related to different sets and notations)
- The white board technique - can be used to solve union, intersection and complements of sets.
- Venn Diagram - classroom group activities.
- 3-2-1 strategy – students are asked to mention 3 takeaways, 2 questions and 1 thing they enjoyed about a particular topic. This provides an easy way for teachers to check student understanding and to gauge student interest in a particular topic

Summative Assessments

Tests at the end of each unit, Monthly tests, Mid-year exams, End-of-Year exams

STEP 3

Learning Activities

- Sets can be found all around us. People like to group things according to common properties because it makes it easier to find things and easier to use. Use the example of collective nouns

(e.g. a flock of birds, a fish of school, a pack of wolves, a hive of bees) to develop the basic understanding of a set (i.e. it is a collection/group of like items)

- Use 4 different colored counters (red, blue, green and yellow) and three baskets to explain union, intersection and difference of two sets. Basket A contains (red, blue and yellow counters) and basket B contains (red, blue and green counters). Use basket C to explain concepts of union, intersection and difference between two sets. Let students explore the ideas on their own in groups.
- Standard symbols and particular writing forms are used in sets to help save time and writing space.
- Explain to students about the complement of sets. The complement of a set is the set that includes all the elements of the universal set that are not present in the given set. Let us say A is a set of all coins which is a subset of a universal set that contains all coins and notes, so the complement of set A is a set of notes, which does not include coins.
- Teach students to choose a random universal set and two subsets and find intersections and complements, to be able to identify the area to be shaded in Venn diagram in general cases
- Online games on set theory and Venn diagram
- Following link can be used to put numbers in correct sets:
https://www.transum.org/Maths/Activity/Number_systems/
- Numbers can be arranged in Even, prime and square numbers by using following link:
https://www.transum.org/software/SW/Starter_of_the_day/Students/Venn_Diagram.asp
- https://www.transum.org/software/SW/Starter_of_the_day/Students/Venn_Diagram_Matching.asp - Match the sets statement with the equivalent Venn diagram.

Domain: Algebra

Sub-Domain: Algebraic Expressions

STEP 1

Standard: Manipulate algebraic expressions

- **Student Learning Outcomes:** Recognize Muhammad bin Musa Al-Khwarizmi as the father of Algebra. Develop an understanding of algebraic terms, monomial, trinomial and polynomial. Add, subtract, multiply, simplify and factorize algebraic expressions

Knowledge:

Students will understand:

- The algebraic terms including; open and close sentences, like and unlike terms, variable, constant, expression, equation and inequality
- Variable as a quantity which can take various numerical values

Students will know:

- Muhammad bin Musa Al-Khwarizmi as the founding father of Algebra

Skills:

Students will be able to:

- Recognize polynomial as an algebraic expression in which the powers of variable are whole numbers
- Identify a monomial, a binomial and a trinomial as a polynomial
- Add two or more polynomials
- Subtract a polynomial from another polynomial
- Multiply:
 - monomial with monomial
 - monomial with binomial/trinomial
 - binomial with binomial/trinomial
- 3 basic identities $(a+b)^2$, $(a-b)^2$, $a^2 - b^2$
- Simplify algebraic expressions involving addition, subtraction and multiplication
- Simplify by expanding products of algebraic expressions (by a number, a variable or an algebraic expression)
- Factorize algebraic expressions (by taking out common terms and by regrouping)
- Factorize quadratic expressions (by middle term breaking method)

Advanced/Additional:

Students will be able to:

- *Multiply and divide algebraic fractions and express the answers in the simplest form.*

STEP 2

Assessments

Formative Assessments

1. Play Math Baseball

Divide your class into two teams to play math baseball - an activity that gives full control to the teacher of the questions students answer. Firstly, a teacher will compile the questions related to a distinct skill and assign them equal marks. One team will start 'at bat', scoring runs by giving correct answers. Jot down the marks of team on board. After 5 questions, switch the team.

2. Peer checking

Assign some questions to the students by writing them on board or write them on chart paper and paste it on the board. Mention 10-15 minutes time for students to solve the questions. After the time finishes, ask the students to exchange their notebooks. Teacher will explain the checking criteria - write down the correct answers on the board and it will help the students to identify the mistakes.

3. Factoring Comic activity

Students love comics and graphic novels, this activity brings this interest into conversation with Math. To start with, assign each student a polynomial. Ask them to imagine that each variable within the polynomial is a character. Their task is to create a comic strip that shows how they would factor the polynomial. They can create images personifying their factors.

When a teacher will put their comics together, he will have an illustrated guide to factorize polynomials.

Summative Assessments

Tests at the end of each unit, Monthly tests, Mid-year exams, End-of-Year exams

STEP 3

Learning Activities

- Give an introduction of Muhammad Ibn Musa Al Khwarizmi as he was the first person to treat Algebra as an independent discipline and introduced the methods of reduction and balancing the equation. The term algebra itself comes from the title of his book; he has been described as the "father of algebra".
- Explain the new vocabulary terms monomial, binomial and trinomial to the students and let them write it in their notebooks. A **monomial** is the product of non-negative powers of variables. A monomial has no variables in its denominator and will have only one term. A **binomial** is the sum

of two monomials and thus will have two unlike terms. A **trinomial** is the sum of three monomials meaning it will be the sum of three unlike terms.

- Recall the concept of factors of a numeral to make students understand the concept of factorization in linear algebra.
- Also, take factorization as the inverse process of multiplication of an algebraic expression with a number or a variable or both.
- Introduce the general form of quadratic expression as $ax^2 + bx + c$, where a, b, c are constants.
- Use algebra tiles to explain the concept of factorization in quadratic expressions.
- Online games on algebraic expressions and factorization

Suggested Online Resources:

<https://www.khanacademy.org/math/algebra-basics/alg-basics-algebraic-expressions?t=practice>

(Factorization of algebraic expressions)

<https://www.theproblemsite.com/games/quadratic-rush>

(Online game for quadratic expressions)

Domain: Algebra

Sub-Domain: Algebraic Equations and Inequalities

STEP 1	
Standard: Manipulate Algebraic Equations and Inequalities.	
<ul style="list-style-type: none">● Student Learning Outcomes: Solve linear equations and basic linear inequalities. Plot graphs for linear equations in two variables. Solve basic simultaneous equations and inequalities. Recognize the pattern in number sequences and determine the nth term	
<p>Knowledge:</p> <p>Students will understand:</p> <ul style="list-style-type: none">● The use of number lines to represent intervals/inequalities <p>Students will know:</p> <ul style="list-style-type: none">● Explanation of the solution of linear equations in one variable	<p>Skills:</p> <p>Students will be able to:</p> <ul style="list-style-type: none">● Solve linear equations (including those involving algebraic fractions) in mathematical and practical situations● With increasing level of challenge, change the subject of a formula and use substitution method to calculate values of unknown variables● Construct linear equation in two variables such as; $ax + by = c$, where a and b are not zero● Solve basic simultaneous linear equations in two variables using elimination, substitution and graphical methods.● Solve basic single and simultaneous linear inequalities in one variable and use number line to illustrate the answers● Recognize the pattern in number sequences and find out the missing next terms (including the nth term) <p>Advanced/Additional: <i>Students will be able to:</i></p>

- Show, by shading the region on the graph, the solution to Inequalities in one variable.

STEP 2

Assessments

Formative Assessments

1. Think-Pair- Share exercises

Pair the students together to think individually about a specific question, discuss their results and findings. Finally have each pair share their ideas with the rest of the class and open the floor for further discussion. It allows our students to process content individually, in a small group and in a large group.

2. Gallery walk [for simultaneous equations]

Depending on the strength of a class, divide the students in 4-6 groups. Each group of students will select one group leader who will write down the steps of working. Provide them a flip chart/A4 paper for the solution. Assign them a question to be solved within the given period. They will paste it on the wall of the classroom. All of the groups will take a round of the class and observe the strategies used by other groups.

3. Task cards for writing, solving and Graphing Inequalities

A teacher will combine all 3 skills into one activity by writing tasks from each skill on the cards.

Step 1: On the 1st 4 cards, students have to answer yes or no.

Step 2: The next 4 cards have students answer yes or no to 4 different options in an inequality. Students then have to graph an inequality on the following 4 cards.

Step 3: Another 4 cards have scenarios written where students have to write an inequality based on the situation. The last 4 cards require students to solve an inequality and then graph it on a number line.

Summative Assessments

Tests at the end of each unit, Monthly tests, Mid-year exams, End-of-Year exams

STEP 3

Learning Activities

- Starter activity for Equations

'Riddle me this' is a fun classroom activity for students. The game can be made easy or hard depending on the equations you select but essentially the motive is to solve the value of each algebraic equation and find the answer to the riddle. The student who manages to solve all the equations and find the answer to the riddle wins the game!

- **Starter activity for Inequalities**

For making our students master of one-step inequalities, challenge them with a maze that requires them to pick an inequality based on a sentence. Students will read a sentence and pick the correct inequality and continue this process until they get to the end of the maze. Use it for group work.

- Have students understand that two variables in an equation will require two equations for solution
 - Ask students to solve linear equations using substitution or elimination methods, plot their graphs, compare them and share their observations.
 - Generate a discussion on the drawbacks of the graphical method with the students.
 - Have students check their answers by substituting in the given equations
 - Use the knowledge of number lines to represent intervals/inequalities.
 - Show, by shading the region on the graph, the solution to Inequalities in one variable.
 - Related Inequalities in real life problem solving skills such as speed limit on the highway, minimum payments on the credit card bills, number of text messages you can send each month from your cell phone and the amount of time it will take to get from home to school. All of these can be represented as mathematical inequalities.
 - Ask students to share patterns they have seen, or present them with samples of patterns. Ask them to describe the patterns. Ask whether there are other ways to represent the same pattern. Review pattern-related vocabulary as opportunity arises during the discussion.
 - Give students different number sequences (increasing and decreasing), pictorial patterns and tables and generate a discussion on the possible nth term
 - Ask students to make their own number sequences and derive their nth terms and vice versa
-
- **Suggested Online resources:**
 - www.mathgames.com/skill/8.67-solve-a-system (substitution method)
 - <http://www.onlinemathlearning.com/algebra-math-games.html> (Basic algebra)
 - http://www.transum.org/Software/SW/Starter_of_the_day/Similar.asp?ID_Topic=36 (Sequences)

Domain: Algebra

Sub-Domain: Coordinate Geometry

STEP 1

Standard: Use the concept of Linear functions to solve problems pertaining to Coordinate Geometry.

- **Student Learning Outcomes:** Develop an understanding of the Cartesian coordinate system. Plot graphs of linear equations – Find values of x and y , gradient and y -intercept from straight line equations
- Solve basic simultaneous linear equations in two variables using graphical methods.

Knowledge:

Students will understand:

- the meaning and effect of negative, positive and zero gradients of straight lines on the graph

Students will know:

- Cartesian coordinate system
- The equation of horizontal and vertical lines
- Relationships between gradients of parallel and perpendicular lines

Skills:

Students will be able to:

- Plot graphs of linear equations in two variables
- Calculate gradients and y -intercepts from a given straight line equation of the form $y = mx + c$, as well as from the graph
- Find the values of x and y from the graph

STEP 2

Assessments

Formative Assessments

1. Play Math Baseball (Finding the values of x and y from the graph)

Divide your class into two teams to play math baseball- an activity that gives full control to the teacher of the questions students answer. First, a teacher will compile the questions related to a distinct skill and assign them equal marks. One team will start 'at bat', scoring runs by giving correct answers. Jot down the marks of the team on board. After 5 questions, switch the team.

2. Peer checking (Finding the gradient and y-intercept from a set of given linear equations)

Assign some questions to the students by writing them on board or write them on chart paper and paste it on board. Mention 10-15minutes time also. After the time finishes, ask the students to exchange their notebooks. Teacher will explain the checking criteria - write down the correct answers on the board and it will help the students to identify the mistakes.

3. Presentations (Students will complete the table of coordinates and will represent them on graph and will find the gradient and y-intercept)

4. Think-pair-share

5. Visualization

Summative Assessments

Tests at the end of each unit, Monthly tests, Mid-year exams, End-of-Year exams.

STEP 3

Learning Activities

- Provide students with graphs of discrete data arranged horizontally and vertically. Students should create a table of values from the graph, write an equation by recognizing the pattern in the data and be able to describe a situation to represent each graph.
- Have students write equations from pre-drawn graphs of straight lines
- Provide students with various graphs and linear relations and ask them to match the graph with the equation based on their knowledge of gradient and y-intercept. Students could also be asked to describe the pattern within the graphs.
- Have students calculate the gradients of parallel and perpendicular lines and share their observations about them.
- Use online resources to draw lines and describe their gradients.

<https://www.youtube.com/watch?v=rgvysb9emcQ>

Domain: Geometry

Sub-Domain: Quadrilaterals

STEP 1	
Standard: Develop an understanding of the properties of Quadrilaterals, polygons and circles.	
<ul style="list-style-type: none">● Student Learning Outcomes: Develop an understanding of properties of circles and quadrilaterals. Calculate interior and exterior angles of a polygon	
<p>Knowledge:</p> <p>Students will understand:</p> <ul style="list-style-type: none">● <i>The meaning of concentric and eccentric circles</i> <p>Students will know:</p> <ul style="list-style-type: none">● Properties of quadrilaterals (square, rectangle, parallelogram, rhombus, trapezium and kite)● A circle; its center, radius, diameter, chord, arc, major and minor arcs, semicircle and segment of the circle.	<p>Skills:</p> <p>Students will be able to:</p> <ul style="list-style-type: none">● Calculate the interior and exterior angles of a polygon● Calculate the sum of interior angles of a polygon● Differentiate between Convex and Concave polygons <p>Advanced/Additional</p> <ul style="list-style-type: none">● <i>Identify and differentiate between similar and congruent 2D shapes and 3D objects – recognition only</i>
STEP 2	
Assessments	
Formative Assessments	
<p>1. Think-pair-share (Calculate the interior and exterior angles of a polygon)</p> <p>2. Play Math Baseball (Calculate the sum of interior angles of a polygon)</p> <p>Divide your class into two teams to play math baseball- an activity that gives full control to the teacher of the questions students answer. First a teacher will compile the questions related to a distinct skill and assign them equal marks. One team will start 'at bat', scoring runs by giving correct answers. Jot down the marks of the team on board. After 5 questions, switch the team.</p>	

3. Peer checking

Assign some questions to the students by writing them on board or write them on chart paper and paste it on board. Mention 10-15 minutes time also. After the time finishes, ask the students to exchange their notebooks. Teacher will explain the checking criteria - write down the correct answers on the board and it will help the students to identify the mistakes.

Summative Assessments

- Tests at the end of each unit, Monthly tests, Mid-year exams, End-of-Year exams.

STEP 3

Learning Activities

- Draw a rectangle and find its area. Divide it into two equal triangles and find their areas. Now add these areas and share your results with the whole class.
- Have students construct area formulas of parallelogram and trapezium by applying their knowledge of the area of rectangles. Have them cut a right-angled triangle from one end of a rectangle and join it on the other end to have a parallelogram. Have them investigate and explore that the area remains the same when shapes are re-arranged to make new shapes.
- Give your students different pairs of parallelograms and equilateral triangles of equal heights and join them to form a trapezium. Have them investigate and explore and derive area formula of a trapezium. Use the same strategy to explore perimeter of these shapes.
- Have students join different 3D objects to explore volume and surface areas of compound objects.
- Use online games on calculation of perimeters, areas and volumes.
- Apply angle properties of triangles and quadrilaterals to find missing angle(s) in triangles and quadrilaterals
- **Online videos**
<https://www.youtube.com/watch?v=5CeBlu260Rw>
<https://www.youtube.com/watch?v=NIHqdwTtcCY>

Domain: Geometry

Sub-Domain: Polygons

STEP 1	
Standard: Construct lines, angles and various polygons	
<ul style="list-style-type: none">● Student Learning Outcomes: Recognize the way to name polygons and angles. Construct angles, triangles, quadrilaterals, angle bisectors and line bisectors	
Knowledge: Students will understand: <ul style="list-style-type: none">● The relationship between interior and exterior angles of polygons, and understand the relationship between opposite interior and exterior angles in a triangle Students will know: <ul style="list-style-type: none">● The way to name polygons and their angles mathematically (e.g. using different notations such as $\square ABC$ or $\square A$ etc.)● The perpendicular distance from a point to a line is the shortest distance to the line.	Skills: Students will be able to: <ul style="list-style-type: none">● Recognize and construct acute, obtuse and reflex angles using a protractor● Construct equilateral, isosceles and scalene triangles● Construct acute angled, obtuse angled and right-angled triangles
STEP 2	
Assessments	
Formative Assessments	
1. Think-pair-share	
<ul style="list-style-type: none">● Construct acute angled, obtuse angled and right-angled triangles● Draw angle and line bisectors to divide angles and sides of triangles and quadrilateral. Pair the students together to think individually about a specific question, discuss their results and findings. Finally have each pair share their ideas with the rest of the class and open the floor for further discussion. It allows our students to process content individually, in a small group	

and in a large group.

2. Using worksheets

To assess them on; how to construct angles, triangles, quadrilaterals, angle bisectors and line bisectors. Let them solve independently. Check it later and identify the weak areas of students.

3. Gallery walk

Depending on the strength of a class, divide the students in 4-6 groups. Each group of students will select one group leader who will write down the steps of working. Provide them a flip chart/A4 paper for the solution. Assign them a question to be solved within the given time period. They will paste it on the wall of the classroom. All of the groups will take a round of the class and observe the strategies used by other groups.

Summative Assessments

Tests at the end of each unit, Monthly tests, Mid-year exams, End-of-Year exams

STEP 3

Learning Activities

- Have students identify angles in a variety of real life contexts (e.g., angles formed by the two hands of a clock, by the intersection of two roads, and by the blades of scissors or hedge clippers etc.)
- Have students arrange two straws, or two toothpicks:
 - parallel to one another;
 - intersecting;
 - perpendicular at an end point of one straw;
 - perpendicular at endpoints of each straw;
 - one straw perpendicular to the other straw and bisecting;
 - one straw perpendicular to the other straw, but not at its end points and not bisecting;
 - one straw bisecting the other straw but not perpendicular;
 - each straw bisecting the other straw but not perpendicular;
 - one straw bisected by the other straw and perpendicular;
 - Each straw bisecting the other straw and perpendicular.
- Draw angle and line bisectors to divide angles and sides of triangles and quadrilaterals.
- **Online videos**
 - <https://www.youtube.com/watch?v=IlwvSzfUkOY>
 - <https://www.youtube.com/watch?v=5bvjnleMn5A>
 - <https://www.youtube.com/watch?v=XBgwGROzzzk>

Domain: Geometry

Sub-Domain: Properties of lines, angles and polygons.

STEP 1	
Standard: Solve various problems related to properties of lines, angles and polygons.	
<ul style="list-style-type: none">● Student Learning Outcomes: Identify and manipulate 2D shapes with respect to symmetry and translation. Calculate unknown angles and lines using properties of triangles and quadrilaterals	
Knowledge: Students will understand: <ul style="list-style-type: none">● Symmetry and translation. Students will know: <ul style="list-style-type: none">● Angle properties:<ul style="list-style-type: none">○ adjacent angles on a line○ vertically opposite angles○ angles on a point○ alternate angles○ corresponding angles and interior angles between parallel lines○ sum of complementary angles○ sum of supplementary angles	Skills: Students will be able to: <ul style="list-style-type: none">● Identify and illustrate all lines of symmetry in a wide range of 2D shapes● Rotate objects using rotational symmetry and describe the order of rotational symmetry for a wide range of 2D shapes● Translate an object● Calculate unknown angles in triangles and quadrilaterals, using the properties of angles in triangles and quadrilaterals (square, rectangle, parallelogram, rhombus, trapezium, and kite) Advanced/Additional: Students will be able to: <ul style="list-style-type: none">● <i>Identify and give precise description of transformation connecting given figures.</i>
STEP 2	
Assessments	
Formative Assessments	
1. Think-pair-share	
2. White Board technique	

3. Worksheets

4. To assess them on how to solve various problems related to properties of lines, angles and polygons, provide them worksheets. Let them solve independently. Check it later and identify the weak areas of students.

Summative Assessments

Tests at the end of each unit, Monthly tests, Mid-year exams, End-of-Year exams.

STEP 3

Learning Activities

- Provide students with or have them bring in a multitude of 2-D shapes and classify them according to the number of lines of symmetry, and rotational symmetry with the angle and order of rotation.
- Develop the concept of equal corresponding angles and sides in case of congruent and equal corresponding angles and proportional corresponding sides in case of similar shapes
- Apply angle properties of triangles and quadrilaterals to find missing angle(s) in triangles and quadrilaterals
- **Online Videos:**
https://www.youtube.com/watch?v=qTD_z47egHs
<https://www.youtube.com/watch?v=EZ6dOIRQDBo>

Domain: Measurement

Sub-Domain: Surface Area and Volume

STEP 1

Standard: Use the concepts of Perimeter, Circumference, Area, Volume and Surface Area in problem solving

- **Student Learning Outcomes:** Using appropriate formulae, calculate the circumference and area of circles, area and perimeter of 2D shapes and volume and surface area of 3D shapes. Convert between standard units of mass, length, area and volume

Knowledge:

Students will understand:

- Standard units of length, mass and capacity for estimation and calculation

Students will know:

- Chord, arc and sector in a circle
- Formulae for the following:
 - Circumference of a circle
 - Area of a circle
 - Areas of various quadrilaterals
 - Area of triangle
 - Surface areas of right prism and cylinders
 - Areas of right prism and cylinders

Skills:

Students will be able to:

- Calculate the circumference of a circle
- Calculate the area of a circular region
- Calculate the area and perimeter of composite shapes (shaded and unshaded regions)
- Calculate the surface area and volume of right prisms
- Calculate the surface area and volume of a cylinder
- Calculate the surface area and volume of any simple and compound 3D objects (including right prisms and pipes)
- Calculate the missing dimension from the given area/perimeter/surface area/volume of all 2D shapes, right prisms and cylinders
- Solve word problem with real-life contexts, involving circles, quadrilaterals, right prisms and cylinders
- Convert between standard units of area (converting between m^2 , cm^2 , mm^2 and vice versa) and volumes (converting between m^3 , cm^3 and mm^3 and vice versa)

STEP 2**Assessments****Formative Assessments**

At the beginning, make sure that all students must bring the cut outs of different basic shapes [triangle, circle, rectangle and square] with measurements written on it. Any medium can be used [colored sheets, chart papers, foamy sheets]. It will help them in better understanding of the area and perimeter of basic shapes.

Model presentations [Assessing the calculation of volume]

Divide the students in groups of 3-4 students each. Ask them to bring different 3D shapes which are used in daily life. Next, they will calculate the volume of that object. Once all the groups have completed this task, they will present their object and its parameters to the rest of the class. Teacher will evaluate their calculations.

Assessing the skills of units of measurement and its conversion

For this research-based project, guide them to search world's famous buildings, places and monuments [either using the internet or books available in the library]. The students are to note down its dimensions in the notebook along with the picture of that place as well.

Once this task is checked by the teacher, ask the students to convert the mentioned units of measurements as well. e.g If a student has researched the area of Badshahi Masjid in hectares, ask him/her to convert it into square kilometers as well.

Summative Assessments

Tests at the end of each unit, Monthly tests, Mid-year exams, End-of-Year exams

STEP 3

Learning Activities

- Preparing a resource sheet of formulae of all 2D and 3D shapes

Right from the beginning of this topic; guide the students to prepare colored sheets to note down all the formulae of the shapes under study. At the end of topic, paste these resource sheets in their notebook.

- Celebrate Pi(π) day on 14th March

Have fun filled events on this day to mark the celebrations. Every year on 14 March, the world celebrates Pi day to recognize the mathematical constant Pi. It defines as the ratio of a circle's circumference to its diameter and its value is **22/7**. The numbers in the date [3/14] match the first three digits of the mathematical constant pi.

- Provide pictures of many regular triangles, squares and rectangles, with the measure of one side provided for each. Have students explore to find the most efficient method for finding the perimeters of each. Lead students to discover that "side + side + side + side..." is inefficient when multiplication can be used instead. Repeat the activity with rectangles and squares.

- Use exploratory activities to find the value of perimeter of a circle. Give students circles of different sizes and thread/string to calculate the perimeter. Compare the answer with the answers calculated by the formula and discuss the error in the answer
- Provide paper copies of nets for students who are having difficulty visualizing the parts of a 3-D object, for them to cut and fold.
- Use a variety of different shapes of boxes and containers for cutting and calculating surface area.
- Generate discussions on volume, using informal measurement methods, such as linking cubes. Show and discuss the centimeter cube. Explain that just as square units are used to measure area and surface area, cubic units are used to measure volume. Have students bring in small boxes of various shapes and sizes and use centimeter cubes to determine the volume of each box and provide students with relevant contexts for determining volume
- Provide students with or have them bring in a multitude of 2-D shapes and classify them

- **Suggested online resources:**

<https://www.studyladder.com/games/activity/converting-between-units-of-mass-grams-and-kilograms-27995> (Problems & Activities)

<http://www.onlinemathlearning.com/parts-of-circle.html> (Parts of a circle)

<http://www.hoodamath.com/mobile/games/tronix.html> (Online Games & Activities)

<https://www.ixl.com/math/grade-7/compare-and-convert-metric-units> (Converting units)

http://nlvm.usu.edu/en/nav/frames_asid_284_g_3_t_4.html?open=activities&from=topic_t_4.html (Virtual manipulatives – requires Java Player)

<http://www.onlinemathlearning.com/measurement-games.html> (Different measurements)

Domain: Measurement

STEP 1	
Standard: Solve problems pertaining to Distance, Time and Speed.	
Student Learning Outcomes: Convert between different units of time, distance and speed. Calculate the arrival, departure and journey times in real-life contexts. Recognize the relationship between speed, distance and time, and solve the associated word problems	
Knowledge: Students will understand: <ul style="list-style-type: none">● Relationship between speed, distance and time Students will know: <ul style="list-style-type: none">● Difference between uniform and average speeds	Skills: Students will be able to: <ul style="list-style-type: none">● Convert between 12 hour clock and 24 hour clock and vice versa● Calculate the difference between two times, and find start or end times for a given time interval (on the previous day and the next day)● Calculate arrival time, departure time and journey time in a given situation (on the previous day and the next day)● Convert between different units of speed, time and distance● Solve word problems with real-life contexts, involving, distance, time and average speed. Advanced/Additional: Students will be able to: <ul style="list-style-type: none">● <i>Draw and interpret simple distance – time and Speed-time graphs (Travel Graphs) in real life contexts.</i>

STEP 2

Assessments

Formative Assessments

Design a worksheet for the students comprising the questions of basic time calculations of 12 hour and 24-hour clock notation. It will help the teacher to assess their prior knowledge and then designing the next steps to approach.

Assessing time calculation

Guide the students to search the timetable of a specific bus company/freight train/airplane moving from one destination to another. Once the students have the timetable, guide them to find the time differences between different destinations.

Assessing the skills of calculating speed and its conversion

For this research-based project, guide them to search the speed of different models of vehicles, animals, means of transportation, world's fastest athlete, fastest animal, fastest car etc. [either using internet or books available in library]. Note down its speed along with the given units in the notebook (along with the picture of that object as well).

Once the task is checked by the teacher, tell them to convert the mentioned units of speed as well. e.g. if a student has researched the speed of a tiger in km/hr, tell him to convert it in meters/seconds and vice versa.

Worksheets

Use worksheets for illustrations of travel graphs, finding the missing distance and time conversions especially for time from hours in hours and minutes.

Drawing travel graphs

Let the students observe their daily life routine and draw travel graph accordingly. E.g., ask the students to observe their daily routine of coming to school from home, note down the arrival time, departure time, and number of times they stop during the journey. After recording all of these values, draw its travel graph.

Different students can observe different journeys to draw their travel graphs.

Summative Assessments

Tests at the end of each unit, Monthly tests, Mid-year exams, End-of-Year exams .

STEP 3

Learning Activities

- Provide the students with geared clocks or tell them to make it for themselves to help them work out the differences between time manually with a visual and tactile aid
- Using knowledge of calculating time intervals to read or understand train or bus timetables.
- Activity for the relation between speed and time
- The purpose of this activity is for students to recognize that speeds can be ranked by comparing time, if the distance travelled is the same. Students will appreciate the fact that the shortest time means the greatest average speed.

Material required:

A simple race track-curtain trail or the space between 2 meter rods, table tennis balls, straws, meter rod and stopwatch

Steps:

Students blow the ball along the race track as quickly as possible; they will compete in groups of 4. 1 student should blow the marble while the others record the time taken to complete a 200 cm course and then calculate the speed. The ball with the greatest average speed wins. The winner from each group enters the final stages of the competition.

- Use real life situations to calculate arrival time, journey time and departure time and plot graphs from that data

- **Suggested Online Resources:**

http://nlvm.usu.edu/en/nav/frames_asid_272_g_4_t_4.html?open=instructions&from=topic_t_4.html (Converting units - Requires Java)

<https://www.ixl.com/math/grade-7/compare-and-convert-metric-units> (Converting units)

<http://www.onlinemathlearning.com/average-speed-problems.html> (average speed word problems)

Domain: Statistics and Probability

STEP 1

Standard: Use the concepts of Data Handling, Frequency Distribution and Statistical graphs in problem solving

Student Learning Outcomes: Recognize and differentiate between discrete and continuous data. Construct and interpret frequency tables, histograms, bar charts, pie charts and line graphs

Knowledge:

Students will understand:

- The Difference between a histogram and a bar chart

Students will know:

- The following concepts:
 - Frequency
 - Tally marks
 - Range
 - Lower class limit
 - Upper class limit
 - Class interval
 - Mid-point

Skills:

Students will be able to:

- Differentiate between discrete and continuous data
- Construct and interpret grouped frequency tables for discrete data and continuous data choosing appropriate intervals over a sensible range
- Recall the construction and interpretation of different types of bar graphs, line graphs, pictograms and pie charts
- Interpret a pie chart and derive original frequencies from the sector angles of given pie chart
- Construct and compare histograms for both discrete and continuous data with equal interval range

Advanced/Additional:

- *Select and justify most appropriate graph(s) for a given data set and draw simple conclusions based on the shape of graphs.*

STEP 2

Assessments

Formative Assessments

- Entrance Tickets (To check students' prior knowledge about discrete and Continuous data)
- White board strategy can be used to write examples of discrete and continuous data (Students concepts will be assessed by examples written on their respective boards)
- Class presentations/projects in groups to draw line graphs, pictograms and pie charts
- Think-pair-share activity can be used to compare histograms for both continuous and discrete data
- 3-2-1 strategy to check students' understanding in construction and interpretation of charts.

Summative Assessments

Tests at the end of each unit, Monthly tests, Mid-year exams, End-of-Year exams .

STEP 3

Learning Activities

- Have a class discussion about Primary and secondary data, the differences between continuous and discrete data and which type is appropriate in different situations.
- Generate a discussion on the advantages and disadvantages of different graphs, including pie charts, line graphs, bar graphs, double bar graphs, pictograms and histograms, in representing a specific given set of data.
- Set up groups that collect, arrange and display different kinds of data through different methods including questionnaires, experiments, databases and electronic media. Ask students to construct frequency tables from that data and choose the most appropriate graph to represent it. The groups may give a presentation at the end of their data collection.
- Link the concept of percentages, fraction and ratio with the calculation of area of sectors for a pie charts and vice versa

Domain: Statistics and Probability

STEP 1

Standard: Calculate and interpret Measures of Central tendency in various problem-solving contexts

Student Learning Outcomes: Recognize the difference between grouped and un-grouped data. Calculate mean, median and mode for ungrouped data. Compare and justify the appropriate measure of central tendency for a given data-set

Knowledge:

Students will understand:

- The difference between grouped and ungrouped data

Students will know:

- The formulae for the following:
 - Mean of ungrouped data
 - Mean of grouped data
 - Interquartile range

Skills:

Students will be able to:

- Calculate the mean, median and mode for ungrouped data
- Solve problems with real life contexts, involving mean, median and mode
- Compare, choose and justify the appropriate measures of central tendency (mean, mode, median) for a given set of data

Advanced/Additional:

Students will be able to:

- *Calculate the mean, median and mode for grouped data*
- *Calculate the three quartiles and Interquartile range for ungrouped data.*

STEP 2

Assessments

Formative Assessments

- Think-pair-share: Ungrouped data will be given and students will find mean, median, mode and range of the data in groups. Each group will then share their work with other groups. They can compare and justify the most suitable measure of central tendency.
- Classroom presentations on real life applications of measures of central tendency.
- Exit ticket

Summative Assessments

Tests at the end of each unit, Monthly tests, Mid-year exams, End-of-Year exams .

STEP 3

Learning Activities

- Generate a discussion on Data, the word data is used to refer to any kind of information that you collect and record. It can include words, numbers, measurements, and more. Suppose you decided to record the temperature outside your house every day for a month. Is this data? What if you asked each of your friends what their favorite ice cream flavor was and then wrote down their answers? Would that information be data? Both of these would give you data.
- Generate a discussion on grouped and ungrouped data - grouped data is the type of data which is classified into groups after collection. The raw data is categorized into various groups and a table is created. When a test is done, the result is data this can be grouped in many ways like the number of students that scored above and less average.
- Generate a discussion on situations where mean, median or mode is most appropriate choice of average
- For quantitative data collected in the previous unit, ask students to choose and calculate appropriate measures of central tendency and explain why it is the most suitable average for the given data.
- Ask students to find the range and interquartile range (for ungrouped data) of the above data and discuss with the whole class the spread of the values and its effect on mean and median

Domain: Statistics and Probability

STEP 1

Standard: Solve problems using various concepts pertaining to Probability.

Student Learning Outcomes: Develop an understanding of terms related to probability. Differentiate between mutually exclusive and equally likely events. Determine the complement of an event and probabilities of events involving less than, greater than, at most, at least a particular number

Knowledge:

Students will understand:

- The meaning of the terms experiment, outcome, event, sample space, mutually exclusive events, equally likely events, possible outcomes, favorable outcomes

Students will know:

- The probability of a certain event and of an impossible event
- The formula for finding the probability of the complement of an event

Skills:

Students will be able to:

- Determine the complement of an event by examining the sample space for that event
- Differentiate between mutually exclusive and equally likely events
- Find the probabilities of events involving less than, greater than, at most, at least a particular number - for single event experiments only
- Use the knowledge of probability for solving simple problem (with real-life contexts)

Advanced/Additional:

Students will be able to:

- *List elements of sample space and its subsets for simple and combined events experiments (2 dice, 2 coins, 1 coin and a dice) using possibility diagrams and tree diagrams*

STEP 2**Assessments****Formative Assessments**

- White board technique: (Used to find the probabilities of events involving less than, greater than, at most, at least a particular number - for single event experiments only). This technique is very useful to assess student's individual learning.
- Think-pair-share (for tree diagrams of various single and combined events)

Summative Assessments

Tests at the end of each unit, Monthly tests, Mid-year exams, End-of-Year exams

Learning Activities

- Ask students to use their prior knowledge and list down all possible outcomes of sample space set for rolling a dice and tossing a coin
- Generate a discussion on mutually exclusive and equally likely events by giving examples. For example, the event of a person being an adult. The person is either an adult or not an adult, not in between. Therefore, these two events are mutually exclusive. Getting an even number on the toss of a dice and getting an odd number on the toss of a dice are equally likely events, since the probabilities of each event are equal.
- Generate a discussion to clear the concepts of events such as less than, greater than, at most and at least of a number for single events.
- Give examples to explain complements of events such as mutually exclusive pair of events are complements to each other. For example, if the desired outcome is heads on a flipped coin, the complement is tails. The Complement Rule states that the sum of the probabilities of an event and its complement must equal 1
- Use table and probability tree/possibility tree methods to list down elements of sample space for single and combined events experiments (2 coins, 2 dice, one coin and a dice)
- Give students the opportunity to explore decision-making based on probability. They should use a sample to determine the probability of an event, use the results and subjective judgment to make predictions and explain the reasonableness of the predictions, based on any assumptions that they made.

DRAFT

Mathematics - Class 8

Suggested Guidelines

DOMAIN: Numbers and Operations

Sub-Domain: Real Numbers

STEP 1

Standard: Students will be able to demonstrate understanding of real numbers, operate with real numbers (with and without number line) and identify the absolute value of real numbers.

Student Learning Outcomes: Students will be able to

- demonstrate decimal fractions as terminating, non-terminating, recurring and non-recurring
- Differentiate rational and irrational numbers.
- Recognize real numbers as a union of rational and irrational numbers.
- Recognize the absolute value of a real number.
- Demonstrate the properties of real numbers and their subsets with respect to addition and multiplication.

Knowledge:

Students will be able to know about :

- calculation with decimals and fractions in real-life situations/word problems
- terminating, non-terminating and recurring and non-recurring
- rational and irrational numbers
- real numbers on a number line
- the absolute value of a real number
- the properties of real numbers

Skills:

Students will be able to

- solve real-life situations/word problems involving calculation with decimals and fractions
- demonstrate decimal fractions as terminating, non-terminating and recurring and non-recurring
- differentiate rational and irrational numbers
- represent real numbers on a number line
- identify the absolute value of a real number

- demonstrate the properties of real numbers and their subsets with respect to addition and multiplication:
 - closure property
 - associative property
 - existence of identity element
 - existence of inverses
 - commutative property
 - distributive property of multiplication over addition/ subtraction

STEP 2

Assessments:

Formative Assessments

Some of the types of formative assessment teachers may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the-blanks, etc),
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments

Some of the forms of summative assessment are:

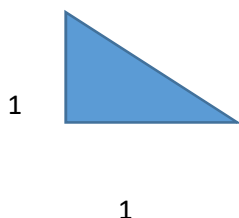
- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized tests
- External Exams

Learning Activities

1. Ask the students to construct circles (with different radii) and measure the circumference of each by using thread.

Find the ratio of circumference to its radius, of each circle up to 5-decimal places and approximate it to the nearest tenths. What have they observed?

- The exact ratio of circumference of a circle to its diameter is the irrational number π (pi), which is 3.1416 rounded to 4-decimal places.
- Numbers that are not rational can be discovered by using a right-angled triangle whose two sides each of length 1 units as shown in the figure:



- The length of hypotenuse $\sqrt{2}$ is an irrational number.
- The square root of a prime number is always an irrational number.

2. Number Sorting

This game is perhaps the most straightforward. Have students sort through a set of numbers, and separate them into two groups: rational and irrational numbers. You can structure this in many different ways. You can create a set of index cards with various numbers written on them, and have students sort them in pairs or groups.

However perhaps a more fun approach is to have students grab a card from a box on one side of the classroom, and run to the whiteboard at the opposite side to place it in the correct group. You can draw two large circles on the whiteboard, one labeled rational numbers and the other labeled irrational numbers. Then, provide students with tack that they can use to stick each card to the board in the correct place. This makes the sorting process a game where students compete to complete as many numbers as possible. For every correctly placed number, award a point to that group. For every incorrectly placed number, subtract a point. The group with the most points wins.

3. Rational & Irrational Rules Posters

Since there are lots of rules for students to know about what makes a number rational or irrational, we need to find ways to make it easier for students to remember them. One possible way to do this is to have students work in groups to create a poster summarizing those rules in an understandable and clear way. Students should be encouraged to be as

creative as possible in designing their posters, making them attractive, and easy to understand.

- By having students think carefully about the best way to present the rules, they'll be reinforcing them in their own minds at the same time. You can even use one of their posters to introduce the topic to next year's students.

DOMAIN: Numbers and Operations

Sub-Domain: Estimation and Approximation

STEP 1	
Standard: Students will be able to round numbers and measures to an appropriate/required degree of accuracy and use approximation through rounding to estimate answers.	
Student Learning Outcomes: Students will be able to: <ul style="list-style-type: none"> ● round off and estimate numbers and quantities ● approximate numbers and quantities to a specified number of decimal places and significant figures. 	
Knowledge: Students will be able to know about : <ul style="list-style-type: none"> ● mathematical vocabulary related to estimation and approximation ● rounding off up to the specified number of decimal places ● significant figures ● rounding off up the to specified number of significant figures 	Skills: Students will be able to: <ul style="list-style-type: none"> ● round off whole numbers, integers, rational numbers and decimal numbers to a required degree of accuracy, significance (up to 5 significant figures) or decimal places (up to 3 decimal places). ● analyze approximation error when numbers or quantities are rounded off ● Solve real-life situations involving approximation
STEP 2	
Assessments:	
Formative Assessments	
Some of the types of formative assessment teachers may use are: <ul style="list-style-type: none"> ● Question & Answer(open and closed) ● Quick Quiz 	

- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the-blanks, etc),
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized tests
- External Exams

STEP 3

Learning Activities

1. Use fraction and decimal data from real-life situations, for example, areas of cities, distances between towns, atomic masses of elements, metric units, areas, volumes, and surface areas of objects, to round off to a given number of decimal places
2. Give the approximate height of the school building, walls of the classrooms, the height of the flag pole, the distance between your home and school
3. The teacher will request learners to share a 5- digit number for rounding off. Ask learners to round off the number to the nearest 10 individually on the book. Ask learners to explain the procedure. Now round off the number to the nearest 100 and 1000
4. Ask students to form any four 7-digit numbers using their date of birth. For example, if my date of birth is 04/09/1996, I can form any four 7-digit numbers using the numbers in it. For example:
4,009,961; 1,996,094; 6,090,914; 4,916,900
5. Then, ask the students to round off any to the various number of significant figures. Work in pairs. Write down a 6-digit or a 7-digit number. Give clues for your partner to guess your number. (For example, if you wrote down 347100, you could say: My number has six digits. The digit 4 is next to the digit 3. The number is rounded off to the nearest 100s. The number is divisible by 3. The digit 7 is in the thousands' place. The value of the digit in the

hundreds place is 100. There are two zeros in my number. What is my number) Take turns to guess each other's numbers.

DOMAIN: Numbers and Operations

Sub-Domain: Factors and Multiples

STEP 1	
Standard: Students will be able to evaluate square roots and cube roots and solve problems involving square roots and cube roots.	
Student Learning Outcomes: Students will be able to: <ul style="list-style-type: none"> ● calculate square root and cube roots of perfect squares and perfect cubes given as a whole number, fraction and decimal by prime factorization and division method. 	
<p>Knowledge:</p> <p>Students will be able to know about :</p> <ul style="list-style-type: none"> ● perfect squares ● perfect cubes ● the square root of a natural number, a common fraction and a decimal ● cubes of natural numbers up to 2- digit ● cube roots of numbers up to 5-digit which are perfect cubes <p>Advanced/Additional</p> <p>Students will be able to know about:</p> <ul style="list-style-type: none"> ● calculating square root of natural number by division method up to 5- digit 	<p>Skills:</p> <p>Students will be able to:</p> <ul style="list-style-type: none"> ● Recall squares and cubes of natural numbers up to 3- digit. <p>Square Roots</p> <ul style="list-style-type: none"> ● compute square root of: <ul style="list-style-type: none"> ▪ a natural number ▪ a common fraction ▪ a decimal, given in perfect square form by prime factorization method up to 5- digit ● calculate square root of a number up to 4-digit with maximum 2-decimal places which is not a perfect square ● apply squares and square roots in real life situations <p>Cubes and Cube roots</p> <ul style="list-style-type: none"> ● calculate cube roots of a number up to 5-digit which are perfect cubes by prime factorization method

- apply cubes & cube roots in real life situations/word problems

Advanced/Additional

Students will be able to:

- *compute square root of:*
 - *a natural number*
 - *a common fraction*
 - *a decimal,*
given in perfect square form by division method up to 5- digit.

STEP 2

Assessments:

Formative Assessments

Some of the types of formative assessment teachers may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the-blanks, etc),
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized tests
- External Exams

STEP 3

Learning Activities

1. Learners investigate and describe patterns in multiples of
 - 3, 6 and 9
 - 2, 4 and 8e.g., multiples of 3 have digits that add up to a multiple of 3; all multiples of 6 are also multiples of 3. all multiples of 4 are even numbers
2. Learners can be asked to share a 3-digit number and explore that which numbers is it divisible by? Ask learners to the class to justify their answers
3. LCM is used for adding and subtracting fractions with different denominators.
4. LCM and HCF can be used to:
 - divide group of objects into smaller groups
 - distribute equally any number of sets of objects
 - arrange objects into rows and columns.

DOMAIN: Numbers and Operations

Sub-Domain: Ratio, Rate and Proportion

STEP 1

Standard.: Students will be able to extend and formalize their knowledge of ratio and proportion in working word problems, and in expressing proportional relations algebraically

Student Learning Outcomes: Students will be able to :

- differentiate between direct and inverse proportion
- solve problems involving direct, inverse and compound proportions.

Knowledge:

Students will be able to know about :

- relationship between ratio and fraction
- relationship between ratio and proportion
- difference between direct and inverse proportions
- expressing direct and inverse proportion in algebraic terms

Skills:

Students will be able to

- recall the difference between direct and inverse proportion
- solve problems involving direct proportion of two quantities using:
 - table
 - equation
 - graph

- finding the unknown quantities in direct and inverse proportions
- difference between graphs of direct and inverse proportional quantities
- compound proportion

- solve problems involving inverse proportion of two quantities using:
 - table
 - equation
- solve real life situations/word problems involving compound proportion

Advanced/Additional

Students will be able to:

- *solve problems involving inverse proportion of two quantities using:*
 - *graph*

STEP 2

Assessments:

Formative Assessments

Some of the types of formative assessment teachers may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the-blanks, etc),
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized tests
- External Exams

STEP 3**Learning Activities**

1. Explain that a ratio is a relationship between two numbers of the same kind
2. Set up real situations i.e., the ratio of boys to girls in a class, the ratio of teachers to students, the ratio of blue counters to yellow counters in a jar and seek the solution
3. Ask learners to bring one of their utility bills (Electricity, Telephone, Sui Gas etc.) and find out the following:
 - the rate of one unit of quantity,
 - how many units the household consumed in a particular month,
 - has the bill issuing authority calculated the due amount correctly?

DOMAIN: Numbers and Operations**Sub-Domain: Percentage and Financial Arithmetic****STEP 1**

Standard: Students will be able to deal with currency conversion and solve problems involving profit, loss, discount, Insurance, Partnership and Inheritance

Student Learning Outcomes: Students will be able to :

- convert currencies
- calculate profit percentage, loss percentage, percentage discount, profit/ markup, the principal amount, the profit/ markup rate and time period
- solve problems containing real life situations involving insurance, partnership and inheritance

Knowledge:

Students will be able to know about :

- currency conversion
- difference between profit percentage and loss percentage
- percentage discount
- insurance
- partnership
- inheritance

Skills:

Students will be able to

Currency Conversion

- convert Pakistani currency to well-known international currencies and vice versa

Profit, Loss and Discount

- calculate profit percentage and loss percentage
- calculate percentage discount
- solve problems from real life situations involving successive transactions

Profit and Markup

- differentiate profit and markup
- calculate:
 - the profit/ markup
 - the principal amount
 - the profit/ markup rate, time period
- solve problems from real life situations involving profit/ markup

Insurance

- solve real life situations involving:
 - Insurance
 - Partnership
 - Inheritance (according to Islamic Principles)

STEP 2

Assessments:

Formative Assessments

Some of the types of formative assessment teachers may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the-blanks, etc),
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments

Some of the forms of summative assessment are:

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- Class Test
- Periodic/Monthly Tests

- Mid-year Exam
- End of Year Exam
- Standardized tests
- External Exams

STEP 3

Learning Activities

1. Write 30% on the board. What is the equivalent decimal? (0.3) Ask: What is the equivalent fraction? ($30/100 = 3/10$). Ask learners to write down other facts that they can deduce using these facts, e.g., $15\% = 0.15 = 15/100 = 3/20$
2. Each learner will be given a set of cards with equivalent fractions, decimals or percentages e.g., $3/4$ could be on one card and 75% on another). Learners take turns to put a card down on the table, and if two successive cards have the same value the learner will say 'snap' and will be the winner.
3. Learners can be asked to identify the larger quantity and give the reason too.
75% of PKR 200 or 5% of PKR 2000?

DOMAIN: Numbers and Operations

Sub-Domain: Sets

STEP 1

Standard: Students will be able use language, notation and Venn diagrams to describe sets and their elements, and solve word problems

Student Learning Outcomes: Students will be able to:

- describe sets in nature and numbers using language (tabular, descriptive and set-builder notation) and Venn diagrams
- find power set (i.e. $P(A)$ of a set A , where A has up to four elements
- verify commutative, associative and distributive laws with respect to union and intersection,
- Use Venn diagram to demonstrate union and intersection of two sets (Subsets, overlapping sets and disjoint sets)

Knowledge:

Students will be able to know about :

- sets in nature and numbers.
- set notations
- use of mathematical vocabulary i.e. set, element, equal sets, empty set, universal set, subsets, equivalent, equal sets, universal set, complement of a set, subset, proper subset, intersection of sets, union of sets, power set
- operations on sets
- Venn diagram
- properties of sets

Advanced/Additional

Students will be able to know about:

- *Venn diagram*
- *properties of sets*
- *De Morgan's Laws*

Skills:

Students will be able to:

- discover sets in nature and numbers
- express sets using tabular, descriptive, and set-builder notations
- differentiate equivalent, and equal sets
- write subsets
- write power set $P(A)$ of a set A , where A has up to four elements
- describe operations on sets Tabular form:
 - union of two sets
 - intersection of two sets
 - difference of two sets
 - complement of a set
- apply sets in real life situations

Advanced/Additional

Students will be able to:

- *use Venn diagram to demonstrate union and intersection of two sets (Subsets, overlapping sets and disjoint sets)*
- *describe operations on sets by using Venn diagram:*
 - *union of two sets*
 - *intersection of two sets*
 - *difference of two sets*
 - *complement of a set*
- *use Venn diagram to demonstrate union and intersection of two sets (Subsets, overlapping sets and disjoint sets)*
- *discover properties of sets*
- *verify De Morgan's Laws.*

Assessments:

Formative Assessments

Some of the types of formative assessment teachers may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the-blanks, etc),
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
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- Mid-year Exam
- End of Year Exam
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- External Exams

STEP 3

Learning Activities

1. Use concrete, pictorial, and verbal representations to develop an understanding of sets from everyday life. For example, sort and classify data on the basis of different attributes such as a collection of books of grade VIII syllabus, kitchen utensils, geometrical instruments, etc.
2. Categorize elements as metals and non-metals on the basis of physical properties with the help of Venn diagrams
3. Ask students to take any two rational numbers (decimals, fractions) and find rational numbers between them, and observe that there are infinite rational numbers between them.
4. Draw a number line and mark the location of each pair of rational numbers, then find another rational number between them

5. Prepare Index cards with one set notation symbol on each. You will need one card per student so replicas will be necessary, however, try to keep the numbers of each symbol equal. Write the six sets above on the board. Hand out one card to each student. Stand at the board and ask students to stand in a line against the opposite wall of the room.

Call out instructions for students to move toward you based on their card identification. For example:

"Move one step forward if your card means to create a new set out of all the numbers in two other sets."

"Hop forward twice if your card would result in the set {4}."

For clues that could have more than one response (like subset or intersection), ask students to explain why they have moved forward.

The first student to reach you takes your place while the other students return to the starting place.

Play as long as time allows swapping leaders each time a student reaches the leader.

6. Write the above six sets on the board. Give each student one card. Ask students to write a set of numbers based on a set notation operation (like subset, intersection, or union) stemming from any combination of the original six sets. After everyone has finished creating a new set, instruct them to mingle around the room and group themselves by the operation used to create their sets.

For example, all students who used unions should join together and all students who wrote subsets should join. Do not allow students to talk during this time! They must arrange themselves by group simply based on similarities between the resulting sets.

7. Sets of number cards showing numbers 0, 1, 2, 3, 4, 5, and 6 (one set per group). Write the six sets on the board. Divide students into groups of 5-7. Give one set of numbers to each group. Referring to the sets on the board, call out a problem such as "The union of A and E". The first group to raise the correct number cards reflecting the answer to your question gets a point. Continue for as long as desired. The team with the most points at the end of the game wins. Instead of calling out the problem in words, write the problem on the board in set notation, like 'A U B'. This will require students to practice recognizing the symbols used in set notation.

DOMAIN: Algebra

Sub-Domain: Number Sequence and Pattern

STEP 1	
Standard: Students will be able to solve problems involving numbers sequences and patterns.	
Student Learning Outcomes: Students will be able to: <ul style="list-style-type: none">● identify pattern from various number sequences● differentiate arithmetic sequence and geometric sequence● discover terms of an arithmetic sequence using term to term and position to term rules● construct the general term● solve problems from real life situations involving numbers sequence and pattern	
Knowledge: Students will be able to know about : <ul style="list-style-type: none">● identify simple pattern from various number sequences● difference between arithmetic sequence and geometric sequence● continuing a given number sequence● finding term to term rule● finding position to term rule● find terms of a sequence when general term (nth term) is given● constructing the formula for general term	Skills: Students will be able to: <ul style="list-style-type: none">● differentiate arithmetic sequence and geometric sequence● discover terms of an arithmetic sequence using:<ul style="list-style-type: none">▪ term to term rule▪ position to term rule● construct the formula for general term (nth term) of an arithmetic sequence● solve problems from real life situations involving numbers sequence and pattern
Advanced/Additional <i>Students will be able to know about:</i> <ul style="list-style-type: none">● <i>terms of a geometric sequence</i>● <i>formulating general term (nth term) of geometric sequence</i>	Advanced/Additional <i>Students will be able to:</i> <ul style="list-style-type: none">● <i>discover terms of a geometric sequence</i>● <i>construct the formula for general term (nth term) of geometric sequence</i>

STEP 2

Assessments:

Formative Assessments

Some of the types of formative assessment teachers may use are:

- Question & Answer (open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the-blanks, etc),
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments

Some of the forms of summative assessment are:

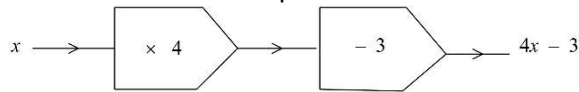
- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized tests
- External Exams

STEP 3

Learning Activities

1. Ask learners to think of a number and write it down. They:
 - add 10
 - double the answer
 - subtract 6
 - halve the answer
 - take away the original numberWhat do learners notice about their final answers? (Everyone gets 7.)

2. Use algebraic disc for activities
3. Provide learners with real life problems to write as a simple algebraic expression
4. Calculate the number of electrons in a given orbit using the $2n^2$ formula
5. Ask Learners to develop function machines and write their output as a formula.



What sequence does the machine output produce? Generalize it and discover the formula.

6. Describe, extend, and make penalizations about geometric and numeric patterns
7. Make a set of cards as shown

+ 10	- 10	+ 100
+ 10	- 100	+ 100
+ 10	- 1000	+ 100
+ 1000	+ 1000	+ 1000

Each player will start with the number 10 000 written on their paper

The cards will be piled as face down

Players will be instructed to take turns and turn over a card and add or subtract from their starting number as the card shown

Students will keep track of their numbers using their pen and paper

The player with the highest number once all the cards has been turned over will be the winner

DOMAIN: Algebra

Sub-Domain: Expansion and Factorisation

STEP 1

Standard: Students will be able to simplify and factorise algebraic expressions and apply algebraic identities to solve problems.

Student Learning Outcomes: Students will be able to:

- differentiate expression and equation
- use algebraic identities to expand and factorise algebraic expressions
- change the subject of the formula to calculate the unknowns by substituting

Knowledge:

Students will be able to know about :

- the difference between
 - open and close sentences
 - expression and equation
 - equation and inequality
- addition, subtraction, multiplication and division of polynomials
- algebraic identities and their application
- expand algebraic expressions
- factorise algebraic expressions

Advanced/Additional

Students will be able to know about:

- *base, index/ exponent and its value*
- *scientific notation/standard form*
- *use of positive, negative, fractional and zero indices*
- *application of the laws of exponents/ indices*

Skills:

Students will be able to

- recall the difference between
- open and close sentences
- expression and equation
- equation and inequality
- recall addition, subtraction and multiplication of polynomials

Division of Algebraic Expressions

- divide a polynomial of degree up to 3 by
- a monomial
- a binomial
- simplify algebraic expressions involving addition, subtraction, multiplication and division

Basic Algebraic Identities

- recognize algebraic identities to expand expressions
- $(a + b)^2 = a^2 + b^2 + 2ab$
- $(a - b)^2 = a^2 + b^2 - 2ab$
- $(a + b)(a - b) = a^2 - b^2$
- apply algebraic identities to solve problems like $(103)^2$, $(99)^2$, 101×99

Factorization

- factorize the following types of expressions:
- $ka + kb + kc$
- $ac + ad + bc + bd$
- $a^2 - b^2$
- $a^2 \pm 2ab + b^2$

- $a^2 \pm 2ab + b^2 - c^2$
- $a x^2 + bxy + cy^2$ (By midterm break)

Manipulation of algebraic expressions:

- $(a + b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$
- $(a - b)^3 = a^3 - 3a^2b + 3ab^2 - b^3$

Advanced/Additional

Students will be able to:

- *identify base, index/ exponent and its value*
- *use scientific notation/standard form to express very large and very small numbers*
- *use positive, negative, fractional and zero indices*
- *apply the laws of exponents/ indices*

STEP 2

Assessments:

Formative Assessments

Some of the types of formative assessment teachers may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the-blanks, etc),
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test

- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized tests
- External Exams

STEP 3

Learning Activities

1. Ask learners to explain method of simplification of expression by collecting like terms?
 $4x + 7 + 3x - 3 - x$.
2. Explore the n -degree polynomial in one variable as an algebraic expression of the form
 $a_0 + a_1x + a_2x^2 + \dots + a_nx^n$.
3. Use algebra tiles to explain learners the concept of factorization in quadratic expressions
4. Recognize and generate equivalent form of simple algebraic expressions and solve linear equations
5. Use algebra to explore relationships between symbolic expressions and graphs with emphasis on the meaning of intercept and slope
6. Use algebra to represent real life situations and to solve problems especially those involving linear relationships
7. Use GeoGebra software to plot the graph of the form:
 $y = c$, and $x = a$, $y = mx$, and $y = mx + c$.

DOMAIN: Algebra

Sub-Domain: Linear Equations and Inequalities

STEP 1	
Standard: Students will be able to interpret and plot graphs of linear equations, solve linear and simultaneous linear equations and linear inequalities.	
Student Learning Outcomes: Students will be able to: <ul style="list-style-type: none">● plot graphs of linear equations in two variables● interpret the gradient/ slope and determine the y-intercept of the straight line from the graph● recall gradient of a straight line, the equation of horizontal and vertical lines● construct and solve linear and simultaneous linear equations in two variables● solve simple linear inequalities● represent the solution of linear inequality on the number line.	
Knowledge: Students will be able to know about: <ul style="list-style-type: none">● Cartesian plane● extracting gradient of a straight line from the equation● extracting intercept of a straight line from the equation● changing the subject of the formula● finding the unknown by substitution● simultaneous linear equations● solving simultaneous linear equations● the difference between equation and inequality● solving simple linear inequalities Advanced/Additional <i>Students will be able to know about:</i> <ul style="list-style-type: none">● <i>representing the solution of linear inequality on the number line</i>	Skills: Students will be able to Graphs of Linear Equations <ul style="list-style-type: none">● recognize gradient of a straight line● Recognize the equation of horizontal and vertical lines i.e $y = c$ and $x = a$ <ul style="list-style-type: none">● find the value of 'y' when 'x' is given from the equation and vice versa● plot graphs of linear equations in two variables i.e., $y = mx$ and $y = mx + c$● interpret the gradient/ slope of the straight line● determine the y-intercept of a straight line Linear Equations

- change the subject of the formula
- calculate the value of unknown in a given formula by substituting the values of suitable unknown

Simultaneous Linear Equations

- construct simultaneous linear equations in two variables
- solve simultaneous linear equations in two variables using
 - elimination method
 - substitution method
 - graphical method
- solve problems from real life situations involving two simultaneous linear equations in two variables

Linear Inequalities

- solve simple linear inequalities i.e.,
 - $ax > b$ or $cx < d$
 - $ax + b < c$
 - $ax + b > c$

Advanced/Additional

Students will be able to:

- *represent the solution of linear inequality on the number line*

STEP 2

Assessments:

Formative Assessments

Some of the types of formative assessment teachers may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,

- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the-blanks, etc),
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
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- End of Year Exam
- Standardized tests
- External Exams

STEP 3

Learning Activities

1. Re-enforce the idea of an unknown by providing learners with sample equations to solve, for example,

$$2 + \blacksquare = 8$$

$$6 - \blacksquare = 8.$$
2. Establish that some equations can be solved by simple thinking about the answer, e.g., for $x - 3 = 5$, think “what number when you subtract ‘3’ gives ‘5’.
3. Use short, relatively simple words problems to give students practice in translating problem situation in to mathematical sentences. Write equations for each problem and then find the solution
4. Describe and name the location of the points with simple relations in coordinates system such as maps
5. Describe, name, and interpret relative position in plane
6. Find and name the locations of point in coordinates system, such as maps
7. For graphical method, the teacher may use GeoGebra as teaching tool to improve students’ conceptual understanding of linear equations in one or two variables.
8. Design a real-life story involving two linear equations in two variables and ask students to:
9. Understand the problem and the words used in stating the problem. Devise the plan for the

solution by translating the situation to an algebraic equation clearly stating what the variables represent. Carry out the plan and solve the problem

DOMAIN: Measurement

Sub-Domain: Mensuration

STEP 1	
Standard: Students will be able to recognize various parts of a circle, solve problems involving surface area and volume of 3D shapes and apply the Pythagorean theorem.	
Student Learning Outcomes: Students will be able to: <ul style="list-style-type: none">● recognize various parts of a circle● calculate the surface area and volume of pyramid, sphere, hemisphere and cone● apply the Pythagorean theorem.	
Knowledge: Students will be able to know about : <ul style="list-style-type: none">● area and perimeter of 2D shapes● difference between area and perimeter● volume and surface area of cube, cuboid prisms and● calculating the surface area and volume of pyramid● calculating the surface area and volume of sphere and hemisphere● calculating the surface area and volume of cone● calculating unknown angles using the properties of quadrilaterals● polygons e.g. Pentagons, Hexagons etc● calculating the interior, exterior angles and the sum of interior angles of polygons● Pythagorean theorem and its application Advanced/Additional Students will be able to know about: <ul style="list-style-type: none">● calculating arc length of the circle● calculating area of the sector of a circle	Skills: Students will be able to Surface Area and Volume of pyramid, Sphere and Cone <ul style="list-style-type: none">● calculate the surface area and volume of pyramid● calculate the surface area and volume of a sphere and hemi-sphere● calculate the surface area and volume of a cone● solve problems from real life situations involving surface area and volume of pyramid, sphere, hemi-sphere and cone Pythagorean Theorem <ul style="list-style-type: none">● state the Pythagoras theorem and give its informal proof● solve right angled triangles using Pythagoras theorem● solve problems from real life situation using Pythagoras theorem

Advanced/Additional

Students will be able to:

- *calculate the arc length of the circle by expressing the arc length as a fraction of circumference of the circle.*
- *calculate the area of the sector of a circle by expressing sector area as a fraction of the area of the circle*
- *calculate the surface area and volume of composite shapes including pyramid, sphere, hemi-sphere and cone.*

STEP 2

Assessments:

Formative Assessments

Some of the types of formative assessment teachers may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the-blanks, etc),
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments

Some of the forms of summative assessment are:

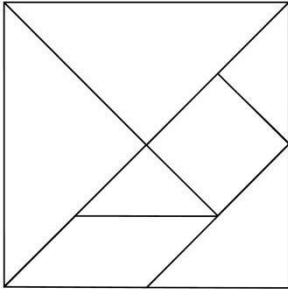
- End of Unit Test
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- Mid-year Exam
- End of Year Exam
- Standardized tests

- External Exams

STEP 3

Learning Activities

1. Learners make compound shapes with tangram pieces but do not use all pieces. They calculate the area of piece and then the compound shape. How would they *check the area of all pieces*?



2. Provide the learners with unit cubes and encourage them to find how many cubes will fit into boxes of various sizes. Learners will discover how many cubes will fill the box. The number of cubes that fill the box is the volume of the box.
3. Explore geometrical ideas and their relationships with arts, science, and everyday life
4. Ask learners to make a poster showing the parts of a circle with their definitions, including 'radius', 'diameter', 'circumference'
5. Ask learners to measure the length of the circumference of a range of circles given the diameter using a thread. They calculate the ratio of circumference and diameter. Look at the pattern. What can you tell?
6. GeoGebra software can be used to explain the concepts of surface areas and volumes of solid objects
7. Ask students to calculate volume of classroom, whiteboard, and books
8. Provide learners with a set of pictures of objects (or real objects) and ask them how they would measure the area. Ask them how many ways they could measure them.

DOMAIN: Geometry

Sub-Domain: Congruency & Similarity, Construction of Triangles, quadrilaterals, circles with its parts and Transformations

STEP 1	
<p>Standard: Students will be to apply facts of congruency and similarity, construct triangles, quadrilaterals, circle with its parts and understand transformations from a two-dimensional perspective.</p>	
<p>Student Learning Outcomes: Students will be able to:</p> <ul style="list-style-type: none">● differentiate congruent and similar figures● apply the properties of congruency and similarity● construct triangles, quadrilaterals , circles and its parts● rotate an object and locate the center of rotation and enlarge a figure with the given scale factor.	
<p>Knowledge:</p> <p>Core</p> <p>Students will be able to know about :</p> <ul style="list-style-type: none">● various types of triangle i.e. equilateral, isosceles and scalene triangles, acute-angled, obtuse-angled and right-angled triangles● different types of symmetry (reflective and rotational)● difference between congruent and similar figures● congruent Triangles● construction of a triangle w.r.t SSS, SAS, ASA, HS● circle and its parts i.e. center, radius, diameter, circumference, chord, arc, major and minor arcs, sector, semicircle, secant, tangent, concentric circles and segment of the circle● Reflection of an object through a line.● Translation of an object and give precise description of transformation	<p>Skills:</p> <p>Students will be able to</p> <p>Congruent and Similar Figures</p> <ul style="list-style-type: none">● explore congruent and similar figures from surroundings● apply the properties of congruency and similarity for two figures <p>Congruent Triangles</p> <ul style="list-style-type: none">● apply following postulates for congruency between triangles:<ul style="list-style-type: none">▪ $SAS \cong SAS$▪ $SSS \cong SSS$,▪ $ASA \cong ASA$▪ $HS \cong HS$ <p>Construction of Triangles</p> <ul style="list-style-type: none">● construct a triangle when three sides (SSS) are given (where possible)● construct a triangle when two sides and included angle (SAS) are given

Advanced/Additional

Students will be able to know about:

- *the enlargement of a figure with the given scale factor (positive or negative)*
- *locating the center and scale factor of enlargement given the original figure and its enlargement*

- construct a triangle when two angles and included side (ASA) are given
- construct a right-angled triangle when hypotenuse and one side (HS) are given

Construction of quadrilaterals

- Square
- Rectangle
- Parallelogram
- Trapezium
- Rhombus
- Kite
- Draw angle and line bisectors to divide angles and sides of triangles and quadrilaterals.

Circle

- explain the terms related to the circle:
 - arc (major and minor arcs)
 - sector
 - chord
 - semi-circle
 - central angle
 - secant
 - tangent
 - concentric circles

TRANSFORMATIONS

Rotation

- rotate an object and find the center of rotation by construction

Advanced/Additional

Students will be able to:

Enlargement

- enlarge a figure with the given scale factor (positive or negative)
- locate the center and calculate the scale factor of enlargement given the original figure and its enlargement.

STEP 2

Assessments:

Formative Assessments

Some of the types of formative assessment teachers may use are:

- Question & Answer (open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the-blanks, etc),
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
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- End of Year Exam
- Standardized tests
- External Exams

STEP 3

Learning Activities

1. Congruent shapes:

Two geometrical shapes which are identical in shape and size are said to be congruent. Congruent figures can be obtained by reflection, rotation, and translation original figure. We use the symbol ' \cong ' to denote congruence. For example:

- Two circles of the same radii.
- Two line segments of the same length.

2. Similar shapes:

Geometrical figures which have the same shapes but different size is called similar shape or figure. Similar figures can be obtained by enlargement and reduction of the original figure. We use the symbol '~' to denote similarly. For example:

- Two circles of different radii
 - Two line segments of different measure
3. Ask Learners to sort quadrilaterals into groups with similar properties, e.g., those that have right angles, parallel sides, diagonal properties
 4. GeoGebra software can be used to explain the concepts of quadrilaterals, polygons, and circles
 5. Teachers can use the website Math open reference for the construction of quadrilateral and triangles: www.mathopenref.com
 6. Translate polygons on the coordinate grid
 7. When a polygon is translated, each vertex of the polygon moves the same distance in the same direction. The size and shape of the image after translation is the same as original polygon.

DOMAIN: Statistics and Probability

Sub-Domain: Information Handling

STEP 1

Standard: Students will be able to collect, classify and tabulate statistical data, represent data graphically, construct and use cumulative frequency diagrams and calculate and interpret measures of central tendency in various problem solving contexts.

Student Learning Outcomes: Students will be able to:

- differentiate between discrete and continuous data and grouped and ungrouped data
- reinforce representing the discrete data using suitable graphs such as Line graph, bar graph, multiple bar graph and pie chart, construct cumulative frequency distribution, histogram and frequency polygon
- solve problems involving mean of grouped and ungrouped data.

Knowledge:

Students will be able to know about :

- frequency table and tally chart
- collecting and organizing data using frequency distribution
- difference between discrete and continuous data
- difference between grouped and ungrouped data
- representing the discrete data using suitable graph such as:
 - line graph
 - bar graph
 - multiple bar graph
 - pie chart
- averages
- calculating mean , median mode and range of ungrouped data

Advanced/Additional

Students will be able to know about:

- *calculating the median and mode for ungrouped data*
- *solving problems from real life situations involving median and mode of grouped data.*

Skills:

Students will be able to

- recognize the difference between discrete and continuous data and grouped and ungrouped data
- reinforce representing the discrete data using suitable graph such as
 - line graph
 - bar graph
 - multiple bar graph
 - pie chart

Frequency Distribution

- construct cumulative frequency distribution
- represent frequency distribution by constructing:
 - Histogram
 - frequency polygon
- Select and justify the most appropriate graph(s) for a given data set and draw simple conclusion based on the shape of the graph

Measure of Central Tendency

- solve real life situations involving mean of grouped and ungrouped data

Advanced/Additional

Students will be able to:

- *calculate the median and mode for ungrouped data*
- *solve problems from real life situations involving median and mode of grouped data.*

STEP 2

Assessments:

Formative Assessments

Some of the types of formative assessment teachers may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the-blanks, etc),
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized tests
- External Exams

STEP 3

Learning Activities

1. Design investigation to collect data using observation, surveys, and experiments
 - Construct the frequency table to record the shoes size of everyone in the group/ class.
 - Measure the length of everyone feet and construct a frequency table, deciding on class interval
 - Discuss and understand the correspondence between data set and their graphical representation specially histograms
 - Interpret pH of different acids/ basis/ salts form the given histogram
2. Select the appropriate measure of central tendency using above collected data
3. Use measures of central tendency, focusing on mean, median, and mode and understand how

will each representation shows important aspects of data

4. In groups of four, each learner calculates the range, mean, median and mode / modal class of a set of data. Make sure to include examples of discrete and continuous data, and grouped data. Learners then discuss what each statistic shows in the context of the data (e.g., the modal shoe size shows which shoe size is most common for your age group)

DOMAIN: Statistics and Probability

Sub-Domain: Probability

STEP 1	
Standard: Students will be to solve problems pertaining to Experimental and Theoretical Probability.	
Student Learning Outcomes: Students will be able to: <ul style="list-style-type: none"> ● find all possible outcomes of a probability experiment such as tossing a coin, rolling a die and spinning a spinner. ● performing probability experiments ● comparing experimental and theoretical probability in simple events ● predicting the outcomes of simple combined events ● calculate the probability of simple combined events. 	
<p>Knowledge:</p> <p>Students will be able to know about :</p> <ul style="list-style-type: none"> ● finding all possible outcomes of a probability experiment such as <ul style="list-style-type: none"> ▪ tossing a coin ▪ rolling a die ▪ spinning a spinner ● probability experiment, outcomes, sample space, events, equally likely events ● computing the probability of equally likely events ● expressing the probability of an event of a probability experiment as ratio, fraction and percent through probability scale ● the probability of an event occurring is P and an event 'not occurring' is 1–P 	<p>Skills:</p> <p>Students will be able to :</p> <ul style="list-style-type: none"> ● determine that the probability of an event occurring is P and an event 'not occurring' is 1–P <p>Experimental and Theoretical Probability</p> <ul style="list-style-type: none"> ● perform probability experiments (for example tossing a coin, rolling a die, spinning a spinner etc. for certain number of times) to estimate probability of a simple event ● compare experimental and theoretical probability in simple events <p>Probability of a Simple Combined Events</p>

- the difference between experimental and theoretical probability

Advanced/Additional

Students will be able to know about:

- *combining probabilities with “AND” and “OR”*

- predict the outcomes of simple combined events with the help of:
 - sample space
 - tree diagram
- calculate probability of simple combined events
- apply the probability concepts to real life situations

Advanced/Additional

Students will be able to:

- *calculate combining probabilities with “AND” and “OR”*

STEP 2

Assessments:

Formative Assessments

Some of the types of formative assessment teachers may use are:

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- Quick Quiz
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- Standardized tests
- External Exams

STEP 3

Learning Activities

1. Display three large sheets of paper labelled 'Impossible' 'Uncertain' 'Certain'. In pairs, learners think of at least two events that they could put into each category. Take feedback and list all the events on the sheets of paper
2. Use bags of sweets/ beads with different color and find out the probability of picking a red sweet.
3. Carry out this activity 20 times. Record the results and calculate their experimental probability of picking of red sweet.

Guidelines for Textbook Authors

GUIDELINES FOR THE TEXTBOOK AUTHORS

A textbook is an important teaching and learning tool and a standard source of information for the formal study of a subject. Writing a textbook is an extremely important and technical task in the sense that it requires the translation of curriculum learning outcomes at the proper cognitive level of the learners. The textbook authors are required to understand the curriculum in letter and spirit. In this regard, the following key points are of fundamental importance:

- Complete understanding of the content of the curriculum
- Background knowledge of the development of the Single National Curriculum (SNC)
- Understanding of the CPA (Concrete-Pictorial-Abstract) approach
- Realization of the thoughts of the ones who developed the curriculum
- Realization of the responsibility of a National Textbook Author

Keeping the above key points in mind, the textbook authors are recommended to follow the following, but not limited to these, guidelines:

- The first and foremost responsibility of a textbook author is to translate the spirit of the curriculum into content and activities/exercises of the textbook. Therefore, the textbook author needs to go through the curriculum by time and again in order to have an in-depth understanding.
- Prepare a mind map of themes and learning outcomes, that is, chapter-wise distribution/presentation of the scheme of the SLOs.
- It is necessary for the authors to remember, all the time, that the learning approach adopted in the development of this curriculum is the CPA approach. Therefore, it is required for the authors to introduce each and every concept following the CPA approach. Ignorance in this regard might result in a great deviation from our goals.
- The textbook should be written in such a manner that it should carry a thorough continuation among the contents presented in a different chapter.
- Retain and limit the textual material to the learning outcomes details. Consider the time allocated to the subject in the scheme of studies. This will help to decide the length, width, and depth of chapters/topics and concepts.
- Select accurate, authentic, and up-to-date text, and real-life examples.
- Make the mathematical concepts interesting and easy to understand for the children through relevant activities, information boxes, and pictures etc.
- The material must help to enhance the knowledge of learners, develop inquiry skills, and engage them in higher-order thinking.
- The content should be interactive and appealing for further learning of the learners.
- The content should help the child make connections between the different concepts.

- The material should help learners to understand the world in which they live and grow as lifelong learners.
- The material must be relevant and error-free.
- The material must be free from gender, ethnic, regional, and all sorts of biasedness.
- Use attractive and engaging text, tables, graphs etc. along with clear and appropriate illustrations which must be properly labeled and captioned.
- The textbook should have a variety of practical and thought-provoking activities to develop long-lasting learning of the learners.
- Exercises should include clues to encourage learners to think, develop skills, and use the information for a variety of purposes.
- If a particular topic involves various types of problems or techniques, each type should be given importance individually. Accordingly, the exercises should also include the questions of every type in the order they are introduced in the text.
- Authors should consider introducing structural questions (involving a gradually increasing level of difficulty i.e., from low to moderate, and then to higher-order)
- The textbook must contain a Table of Contents, a list of Mathematical symbols, and a Glossary.
- The textbook must be contextually relevant and applicable in the normal classroom environment.
- The figures, illustrations, and pictures should be from the local/Pakistani environment.
- Include an appropriately developed assessment after a few concepts/themes, topics/subtopics in each chapter.
- Last but not the least, the textbook should contain material that could make the learners to think beyond the textbook.

Guidelines for Writing a Chapter

In order to make the learning interesting and exciting and to provide a strong foundation for higher-order learning, each chapter in the mathematics textbooks must have the following, but not limited to these, features:

- A chapter should start as a continuation of the previous chapter or even a previous section. It is necessary for the authors to start with the facts (either from the existing knowledge of the learners or from daily-life situations) that highlight the need for the contents of that chapter.
- ***Chapter opener to introduce the chapter with title, full page-colored photographs, and Specific Learning Outcomes (SLOs).***
- ***SLOs*** at the beginning of each chapter clearly describes the objectives and the tasks that are to be achieved in the chapter.

- Keywords, terms and definitions **to be highlighted in the text.**
- **Headings and subheadings with specific colors to show different levels of activities.**
- **Math tidbits** to provide snippets of interesting and useful knowledge.
- Attractive and colorful illustrations to **captivate learners.**
- Questions like **“Do You Know?”** to recall, think, and apply what they have learned as well as to reinforce the learning of key concepts and principles.
- **Relevant everyday experiences and contexts are used.**
- **Hands-on activities to encourage the learners to make their own inquiries.**
- **Skills and processes to infuse values, ethics and attitude.**
- **Mini-exercise** to provide questions involving scientific investigations and relating mathematics contents with the technology, society, and environment.
- Authors are encouraged to introduce the activities/exercises to be done in groups to make the students interact and share their mathematical concepts with each other. This will indirectly refine their mathematical concepts and will contribute to leading them towards collaborative studies.
- **Awareness beyond the classroom** to widen the horizon of the learners by providing interesting information and introducing, more advanced relevant concepts according to grade level in an understandable way.
- **Key Points** to provide a summary of the concepts and principles studied in a chapter should be included at the end of that chapter.
- **Review Questions** at the end of each chapter to:
 - recall and integrate previous learning
 - engage and develop their creativity
 - move from lower higher-order thinking
 - develop process skills
 - develop multiple intelligences
- **Think-Tank/Investigate** to include open-ended questions to provoke learners' thinking, creativity and investigation skills.
- **Addresses of relevant websites and online learning centers/resources** should be mentioned at the end of each chapter so that the learners and teachers can get up-to-date information about the concepts. The material should reflect the role of technology to promote learning with understanding. Beware that the referred websites or centers should not include material contrary to our religious, moral, ethical, cultural, and social values.
- Teacher Guide should include tips to teachers at relevant places in chapters to explain different concepts and to use a variety of tools/materials, and activities.

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