NATIONAL STANDARDS CURRICULUM

MATHEMATICS

GRADES 7-8 APSEII

ACKNOWLEDGEMENT

- The curriculum formatter, Ms Janielle Flowers
- The various stakeholder groups, who provided valuable information on societal needs in relation to the curriculum
- All others whose names do not appear, but who contributed to the production of the NSC

T A B L E   O F   C O N T E N T S

The curriculum of any country informs all aspects of operations and helps to shape the intellectual, social, psychological and spiritual dimensions of our society. By its design, the National Standards Curriculum (NSC) clearly conveys the knowledge, skills and attitudes deemed by our society as critical to addressing Jamaica's current realities. It is expected that as teachers and students interact efficiently with the curriculum that a culture of communication, collaboration, creativity and thinking critically will be honed.

Through the implementation of the NSC, education in Jamaica is being reframed and re-positioned as customized, diverse, relevant, equitable, outcomes-based, and inclusive. Significantly, this approach will signal the introduction of the Alternative Pathways to Secondary Education (APSE), Spanish and Resource and Technology at the Primary level, the integration of the Science Technology Engineering and Mathematics (STEM) methodology and a greater utility of Information and Communication Technology (ICT) tools to facilitate improved outcomes. Since there is no one subject that can be relied on to meet all the needs of our children as each child differs in learning style preferences, abilities, background and so on, schools are expected to use the curriculum to schedule learning episodes that allow all children to creatively express themselves through the Creative Art Forms; think critically in the context of the Exploratory Core areas; practice behaviours that lead to spiritual, physical, emotional and social well-being through Enrichment activities and demonstrate productive capabilities by working collaboratively on projects in settings with a Problem Solving/Work-Based focus, using the standards and principles of Resource and Technology.

The Ministry of Education, Youth and Information will continue to support our schools in the implementation process through the provision of continued training opportunities for school leaders and teachers, improved physical infrastructure and the provision of the necessary teaching/ learning resources to support pedagogy. We look forward to the support of all our stakeholders- members of the community, members of school boards, principals and teachers in ensuring a successful implementation of the NSC.

The Honourable, Karl Samuda, CD, MP
Minister without Portfolio with responsibility for Education, Youth and Information

I fully endorse the National Standards Curriculum (NSC) as being pivotal to advancing the education of our Jamaican children. The broad focus on critical thinking, collaboration, creativity and communication is indeed very critical in equipping young Jamaicans with the requisite twenty- first century skills as we seek to advance the achievement of Jamaica's Sustainable Development Goals by 2030. There is no denying that quality education is one of the most powerful and proven tools for the sustainable development of any country, and that through the re- alignment and re-scoping of the national curriculum, Jamaica is well on its way to ensuring that our goals are not just symbolic but are a reality lived by all Jamaicans, particularly our youth.

The NSC is on the cutting edge of curriculum design and represents the shift from a content- based focus to a competency- based one where skills and attitudes are placed at the forefront. This approach should ensure that our youth are fully equipped with a combination of the essential knowledge, skills and attitudes to be successful in every aspect of their lives. Users of the curriculum will be pleased to find the utilization of a Pathway Approach to Education with an emphasis on the integration of the Science, Technology, Engineering and Mathematics (STEM) Methodology, Information and Communication Technology (ICT), the Creative Arts and the Technical and Vocational areas. The provision of alternative pathways for our learners, supported by learning coaches/ special needs educators is a significant achievement for the MoEYI and our ongoing support for this area concretizes our belief that every child can indeed learn.

The production of this curriculum document is not an indication that our journey has ended; rather it is a signal that we have advanced the very dynamic and obligatory process of the transformation of our education system. I anticipate the support of all our stakeholders in ensuring the curriculum implementation process is without major challenges.

The Honourable, Alando Terrelonge, MA, MP
State Minister in the Ministry of Education, Youth & Information

It was the mandate of the Curriculum Units of the Ministry of Education, Youth and Information to spearhead the crafting of a new curriculum for the nation, in keeping with international standards, global trends in the educational landscape and societal goals and aspirations. The mandate had several facets: to establish clear standards for each grade, thereby establishing a smooth line of progression between Grades from 1 to 9; to reduce the width, complexity and amount of content; to build in generic competencies such as critical thinking across the subjects; to ensure that the curriculum is rooted in Jamaica's heritage and culture; to make the primary curriculum more relevant and more focused on skills development, and to ensure articulation between primary and secondary curricula, especially between Grades 6 and 7. To achieve this, the MoEYI embarked on an extensive process of panel evaluations of the existing curricula, consultation with stakeholders, (re)writing where necessary and external reviews of the end products.

Today, we are indeed proud that, the curriculum development teams have succeeded in crafting a curriculum which has met these expectations. Under the National Standards Curriculum (NSC) focus will be given to project-based and problem-solving learning, with an integration of Science, Technology, Engineering and Mathematics/Science, Technology, Engineering, Arts and Mathematics (STEM/STEAM) methodologies across the system. Learners will benefit from more hands-on experiences which should enhance the overall learning experience and cater to the different kinds of learners in our classroom. In addition, they will be exposed to work-based learning opportunities that will help them become productive citizens of Jamaica and the world at large.

It is anticipated that as school administrators and teachers system-wide implement the National Standards Curriculum that improvements will be evident in the general academic performance, attitude and behaviour of our students.

We anticipate the participation of all our stakeholders in this process as we work together to improve the quality of life and prospects for all the children of Jamaica and to realize our mantra that *every child can, and must, learn.*

Dr. Grace McLean

Permanent Secretary , Ministry of Education, Youth & Information (Acting)
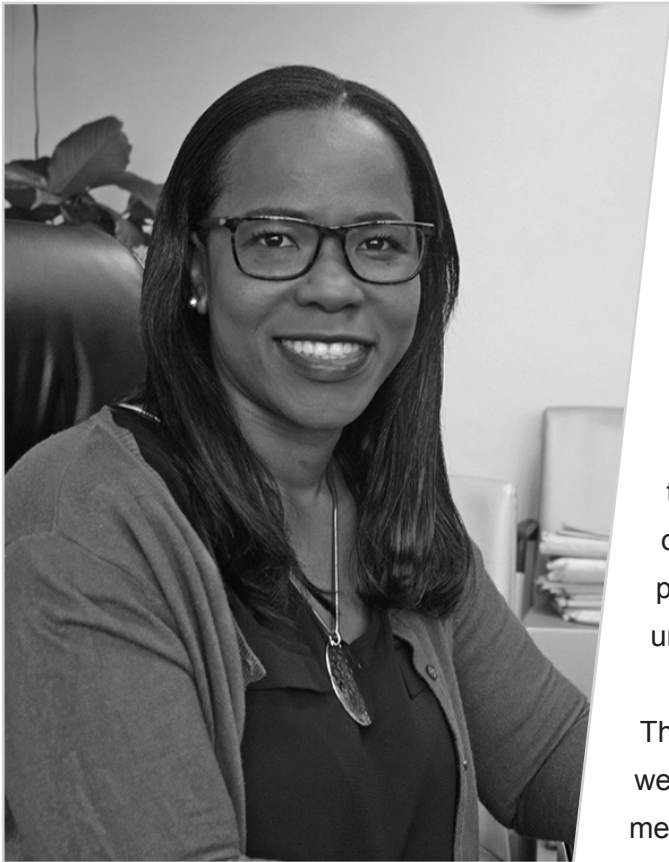
Education is the means by which the society can re-create itself in future generations. Cognizant of this fact, the Ministry of Education, Youth and Information (MoEYI) has positioned the National Standards Curriculum (NSC) as an important avenue through which the identity of future generations can be positively impacted. Given its very vibrant and broad-based nature the NSC targets the holistic development of learners with a view to develop successful lifelong learners and confident and productive individuals who are deeply rooted in their culture, identity and citizenship.

In preparing the education system for the implementation of the NSC the MoEYI continues to offer ongoing training/coaching support for all the relevant stakeholders involved in the implementation, including school administrators, teachers, parents and students. We are also committed to provisioning the system with the resources needed to ensure a successful implementation, particularly in the context of the inclusive and differentiated approaches endorsed by the NSC. We will continue to work with our partners in ensuring the resources available to schools are fully aligned to the content and philosophical underpinnings of the NSC.

This is an exciting time for education in Jamaica. As we advance the curriculum implementation process, we aim to provide all our learners with access to the best education possible. However, we recognize that meaningful and sustainable progress can only be realized from the collaborative effort of all our stakeholders. So as we forge ahead with implementation we invite all our stakeholders to keep focused on our shared vision: "Every Child Can Learn; Every Child Must Learn".

Capt. Kasan Troupe, Ed. D, JP
Chief Education Officer (Acting), Ministry of Education, Youth & Information

Fundamental to the Ministry of Education, Youth and Information's (MoEYI) core value is the belief that all learners deserve the opportunity to achieve their full potential in all facets of their lives (spiritual, moral, cultural, intellectual and physical). With its dynamic, inclusive approaches, the National Standards Curriculum (NSC) provides a clear and robust blueprint to provide our young Jamaicans with the opportunities, responsibilities and experiences to make this a reality.

The accomplishment of this curriculum cannot be attributed to the effort of one or two individuals. The MoEYI brought together a wide cross section of our stakeholders who contributed their diverse skills in creating curriculum documents that will facilitate high standards of learning and enhance the quality of instructional delivery. Our main mandates concerning the revision of the Curriculum included better alignment of the curriculum in the lower grades secondary grades with the Caribbean Secondary Examination Certificate (CSEC) examinations syllabus used in the upper secondary grades; developing progressive standards for all subject areas; prioritizing the 21st century skills of collaboration, critical thinking, communication and creativity; integrating STEM, the Creative Arts, the Enrichment Areas and ICT in the curriculum documents. It also promotes the use of learner-centred approaches across the various disciplines and creates a more inclusive learning environment by catering to diversity in our learners.

Additionally, Civics will return to be a discrete discipline, while Technical and Vocational Education and Training (TVET), and Spanish will be formally introduced at the Primary level. The Health and Family Life (HFLE) Curriculum has been reviewed and re-scoped to ensure alignment to the philosophy of the NSC and inclusion of all the relevant life skills needed by the 21st century learner.

It is with a deep sense of gratitude that I pay tribute to all the educators who have contributed to the timely development of this National Standards Curriculum which will invariably help all learners to maximize their potential.

Mrs Winnie Berry
Deputy Chief Education Officer,
Curriculum and Support Services, Ministry of Education, Youth & Information

The National Standards Curriculum (NSC) rests on the belief that all learners are endowed with the capabilities, gifts and talents to fulfil their divine purpose. These attributes are to be further enhanced or improved in a nurturing, inspiring and inclusive environment; one that caters to the whole person (soul, spirit and body - spiritual, emotional, social, physical and mental). As learners assume their roles and responsibilities individually and as communities of learning in such an environment, they become critical-reflexive thinkers, creative problem solvers, effective communicators and natural collaborators.

A curriculum design of this nature, calls for transformative change at the societal level (Elkind, 2004)[1] and not just at the school and classroom levels. This is a call for all stakeholders, as users of the curriculum, to adopt a critical -reflective and reflexive stance and join learners in the quest for meaning, purpose and stability as they help to shape the world. By integrating principles from various disciplines and their related methodologies, learners who interact with the curriculum are provided with enriching experiences, opportunities for creative expressions and authentic exploration of problems from a classical standpoint as well as in the context of workplace learning. This is due to the fact that the NSC recognizes the importance of each discipline in the problem solving process and in development.

Assessment as an element of the curriculum becomes primarily a learning process for charting progress through self-corrective measures that are informed by feedback from peers and teacher-facilitator. By providing assessment criteria statements in the curriculum, teachers are encouraged to facilitate learners functioning as self and peer assessors. This approach should see the learner developing self-direction with the support of mentors and coaches and forming an intrinsic desire to succeed. These attributes prepare them to face high stakes assessment as problems to be confronted with courage, a sense of readiness, insight and creative prowess.

These features of the NSC have the potential to influence learners' profile as Jamaicans who are gratified by an identity of cultural excellence that embodies moral obligations, intellectual rigour, innovativeness, environmental stewardship and productivity. The curriculum echoes the sentiments of our National Anthem, National Song and Pledge and serves as rich and credible source of the values and virtues that are woven together to convey the Jamaican identity. I wish for our school administrators, teachers, students and other stakeholders much success as they work with the document.

Dr Clover Hamilton Flowers

Assistant Chief Education Officer, Core Curriculum Unit, Ministry of Education, Youth & Information

[1] Elkind, D. (2004). The problem with constructivism. The Educational Forum, 68(4), 306–12.

TERMS	DEFINITIONS/MEANINGS
Range of Content	Provides an overview of the concepts, knowledge, skills and attitudes that will be developed in a unit of study.
About the Unit	Gives a brief overview of the content, skills that are covered in the unit and the methodologies that are used. As well as the attitudes to be developed.
Standards	Statements that explain what all students are expected to know and be able to do in different content areas by the end of a course of study e.g. by the end of period spanning grades 4 – 9
Attainment Targets	An attainment target is a desired or expected level of performance at the end of a course of work, within a given/specified teaching-learning period. Attainment targets identify the knowledge, skills and understanding which students of different abilities and maturities are expected to have by the end of each Grade. It is the standard that we expect the majority of children to achieve by the end of the grade.
Benchmarks	Behaviours students are expected to exhibit at different stages of development and age/grade levels.
Theme/Strands	Unifying idea that recurs throughout a course of study and around which content, concepts and skills are developed.
Prior Learning	It is what students are expected to already know through learning and experience about a topic or a kind of text
Specific Objectives	Specific objectives state what the student is expected to know or understand as a result of the learning experience. The specific objective is usually framed in the areas of the knowledge, skills and attitudes that the students are expected to achieve. Specific objectives tell us what the children will learn or will be taught.
Suggested Teaching/Learning Activities	A teaching/learning activity is an organised doing of things towards achieving the stated objectives. They are suggested activities that are crafted in a way to be an efficient vehicle which can move the student between what is to be learnt (objective) and what the student is to become (outcome).
Key Skills	Indicate the important skills that students should develop during the course of a unit. Key skills are aligned to the suggested teaching and learning activities in the unit which are intended to develop the skill to which it is aligned. Included in the key skills are the 21st century skills such as critical thinking and problem solving, collaboration, communication and ICT.

TERMS	DEFINITIONS/MEANINGS
Assessment	An assessment is a determination of whether intended results have been achieved. This section of the curriculum speaks to both the product that will be judged as well as the criteria against which it will be judged. It must be noted that this section does not introduce new activities. Instead, it speaks to the judging of the suggested teaching and learning activities
	Formal assessment may be conducted with the aid of instrument (e.g. via written test, portfolio) or by requiring students to complete assigned tasks (e.g. performance), and is usually recorded against a predetermined scale of grading. Informal assessment (e.g. via observation or spontaneous student expression) may also reveal important evidence of learning.
Points to Note	This section provides technical information that must be considered in delivering the unit. It may also include information that provides additional explanation of key concepts that may be unfamiliar to the teacher as well as suggestions for infusion within the unit.
Extended Learning	These are opportunities for students to utilise the knowledge and skills they would have acquired in the unit in authentic situations/experiences.
Learning Outcomes	A learning outcome is a demonstration/ behavioural evidence that an intended result has been achieved at the end of a course of study. The learning outcome tells us if pupils have understood and grasped what they have been learning.
Links to other Subjects	Suggests opportunities for integration and transfer of learning across and within different subject areas.
Key Vocabulary	This section consists of a number of words/phrases that addresses the skills, topics and content that must be covered in the unit.
Professional Portfolio	A professional portfolio is a structured and thoughtfully organized collection of artefacts which illustrates your skills and abilities, substantiated by samples of student work and realized through reflective writing, deliberation, and conversation with peers, teachers and faculty (Shulman, 1998).

Internet access has so changed the information landscape, and technological developments have so revolutionized the means available to either create or solve problems, that mathematical literacy is today as important as the ability to read text. All students must possess understanding of basic computation, statistics and geometry in order to make an informed response to the global environment of the twenty first century in which they live.

Mathematics contributes to the process of inquiry as a means of solving problems. It provides the opportunity for learners to be creative and inventive and in doing so, empowers them to construct their own mathematical knowledge to make sense of the physical, social, technological aspects of their environment.

The Mathematics Curriculum serves as a real life context for learners and teachers to engage in meaningful activities that are relevant to life, including their languages, cultures and everyday experiences beyond the walls of school. The Mathematics Curriculum from Grades 1-9 challenges and inspires learners to:

a) Use mathematical concepts and processes to interpret the world
b) Make connection between their previous mathematical knowledge to new situations
c) Communicate mathematical ideas and processes that have helped them to understand their experiences and refine their problem solving skills
d) Explore in a variety of ways, the application of mathematics to problems in their everyday life
e) Reflect on their experiences and decisions and make adjustments to their prior conceptions or meanings of situations
f) Develop attitudes such as perseverance, honesty and courage as they manipulate mathematical concepts and skills and engage in critical reflective thought

NSC
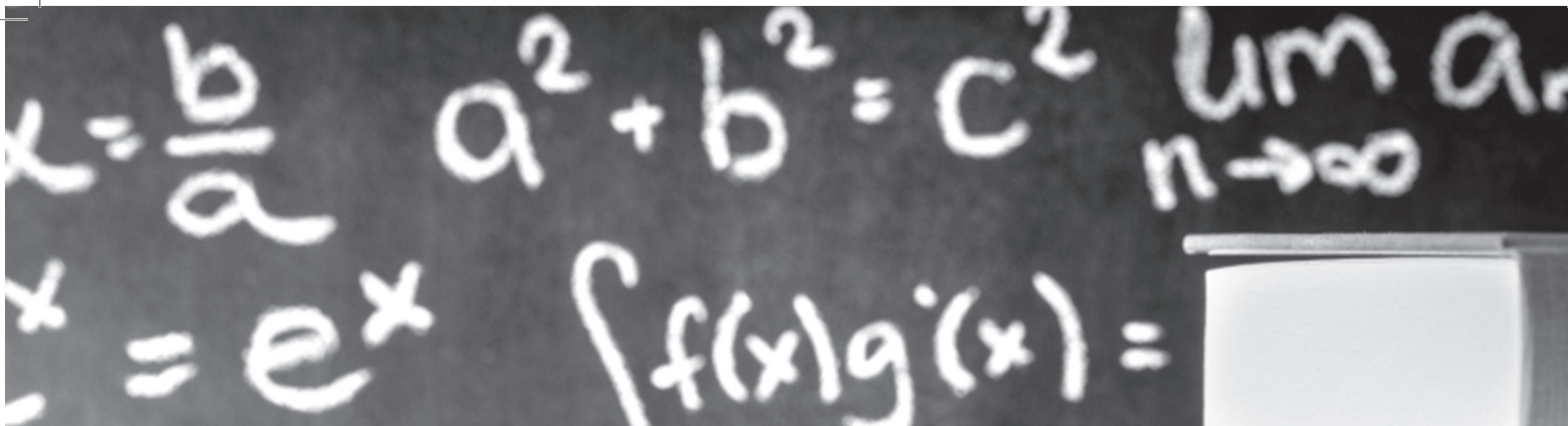
MATHEMATICS

GRADE 7 UNITS

APSE II | TERM 1

INTRODUCTION

This programme uses the National Curriculum Framework for Grades 1-8, and adapts this to the characteristics and level of students who are in the APSE SPII programme. Although the students may be reading well below their age/grade level, their mathematics skills will vary considerably, with estimated beginning mathematics skills between Grades 2 to 4. In addition these students are about ages 12 to 14, predominantly boys, and may have life experiences of using number and geometry, especially with money, consumer activities, and spatial awareness. The programme is written therefore to begin at about a Grade 2 mathematics level in Grade 7 (year 1) and move through to grade 6 level by Grade 9 (year 3).

GOALS

The goal of the SPII APSE mathematics programme is to provide opportunities for students to be competent in basic mathematics skills within three years depending on the students' initial knowledge, skills, strategies and basic understanding. It is possible that students could acquire skills on a competency basis within a year and not on a strict yearly basis, as students may move at different rates. The students who are moving well should be accommodated with more challenging strategies and activities.

ASSESSMENT

The approach to the details under the assessment column is to give examples of how (techniques, strategies, questions etc.) the objectives and learning outcomes should be assessed. We need to keep in mind that the purpose of assessment is to determine the extent to which students know, can do, and have achieved the target skills, and knowledge stated through the (instructional) objectives, and learning outcomes.

Prior Learning

Check that students:
• Know the various types pf numbers and identify number patterns.

OPERATIONS ON REAL NUMBERS

AT1

ATTAINMENT TARGET(S):
Know the value of numerals associate them with their names, numbers, ordinals and use concrete objects to model patterns , expressions and numbers .

KEY VOCABULARY:

Integers	Approximate	Natural number
Pattern	Odd	Counting number
Real numbers	Eratosthenes Sieve	Prime
Sequences	Even	Digit
Rational numbers	Irrational	Numeral
Composite	Whole	

OBJECTIVES
Students should be able to:
• Describe different types of numbers in the real number system (Natural, Whole, Integers Rational, Fractional)
• Compare and order a set of numbers
• Perform three(3) of the four(4) basic operations (addition subtraction and multiplication), including multiple operations
• Give reasonable estimates of the results of operations on numbers;
• By rounding off, approximate a given number to the nearest thousandths, hundredths, tenths, tens, hundreds, thousands, etc.)
• Identify without calculations, whole numbers divisible by 2,3,4,5,6 and 9
• Read and write Roman Numerals in Hindu-Arabic and Vice-versa
• Use Roman Numerals in problem solving

Students will:

Recall and define the key terms; whole, counting, even, odd, fractional , prime and composite numbers . Explore the time table of prime numbers and square numbers . Engage in a variety of activities to reinforce these numbers

In pairs or small groups use Sieve of Eratosthenes to identify prime and square numbers between (1- 100) (Easily downloaded from internet)

Begin by crossing out one as it is not a prime number. Then cross out all the multiples of two except two as two is the first prime number. Then all the multiples of three except three; itself. (Since all multiples of four are multiples of two they would already be crossed out). Continue this process until as many prime numbers have been discovered. Have students share prime numbers with each other

Use Sieve along with description of numbers given to compare and group numbers (odd, even, whole etc.)

Indicate on Place Value Chart the place and value of digits in numbers supplied by students. Round numbers supplied over thousand to the nearest thousand.

Extend Place Value Chart to show decimal numbers (tenth, hundredth, thousandth)

Introduce students to integers using number line.

Key Skills

• Recall key terms

• Identify types of numbers

• Classify

• Order

• Describe

• Calculate

• Compare

• Share findings

• Work in groups

• Investigate natural numbers

• Approximate number

• Show appreciation

• Explore rules of divisibility

Assessment Criteria

• Ability to work effectively in groups

• Satisfactory Ordering of real numbers

• Complete Sieve of Eratosthenes depicting classification of real numbers

• Complete patterns and sequences

Students will:
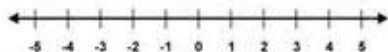
Relate integers on the number line to decimals on the place value chart (the further you go left of zero on the place value chart the smaller the value of the number . Likewise the further you go from zero on the number line the smaller the value of the number. Therefore -3 is greater than -8.)

View and interact with online presentation to reinforce integers. Then have students draw number lines as viewed then present situations (eg. the temperature in Canada during the winter reached -8°, while England reached -3° place these temperatures on the number line) and have them put in the temperatures on the number line.

In small groups be given numbers to test and develop rules of divisibility

Discuss the different number systems. Be guided in how to read and write Roman numeral in Hindu-Arabic numerals. Be presented with situations/problems to convert or write answers in Roman Numerals.

Compute addition and subtraction on numbers to include renaming. State whether answers are prime numbers, odd numbers or even numbers

Multiply using different methods (grid or lattice, traditional, repeated addition). Discuss rules for multiplying by zero and one. Have students multiply by powers of ten.

Review extended place value chart, then have them round decimal numbers to tenth, hundredth and thousandth. Have students write and convert decimals to fractions using powers of ten.

Key Skills

• Recall key terms

• Identify types of numbers

• Classify

• Order

• Describe

• Calculate

• Compare

• Share findings

• Work in groups

• Investigate natural numbers

• Approximate number

• Show appreciation

• Explore rules of divisibility

Assessment Criteria

• Ability to work effectively in groups

• Ordering of real numbers

• Complete Sieve of Eratosthenes depicting classification of real numbers

• Complete patterns and sequences

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Points to Note: •   Allow students to explore real-life situations where stated types of numbers are important.

Prior Learning

Check that students:

• Know the names and abbreviations of units; know the attributes of formal and informal ways to measure

MEASURING CONCEPTS

ATTAINMENT TARGET(S):

Use the correct units, tools and attributes to estimate, compare and carry out the process of measurement to given degrees of accuracy.

KEY VOCABULARY:

Measurement	AD (After Christ)	Mass
Decade	BC (Before Christ)	Capacity
Metric	Century	
Length	Intervals	

OBJECTIVES

Students should be able to:

• Explore standard and non-standard forms of measurement

• Investigate instruments and units of different measures

• Determine the decade/century in which an event took place given the year of the event

• Interpret and use the letters AD and BC after a year

• Calculate the time intervals between two events

• Measure length, mass, time, temperature, volume, capacity using appropriate instruments

• Perform conversions within units and across related unit of length (millimetre, centimetre, decimetre , metre, kilometre)

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria

Students will:

In groups, investigate the types of instruments used to measure length, mass, time, temperature, volume, capacity. Tabulate, share, and compare results with other groups. Also learn the units of measure for each measure.

Length	Mass	Time	Temperature	Volume	Capacity
ruler	balance	clock	thermometer	cubes	cups
		watch		containers	

Use information gathered to do research on non-standard forms of instruments used to measure length and time (sundial, hour glass, shadow stick, water clock, hand span, foot). In pairs, estimate and measure various objects (desk , notebooks, classrooms) using different instruments using non -standard measurement ; then measure using standard measurements. Compare findings establishing the need for standard forms of measurements.

Do research on the different time telling devices and state the effectiveness of their use/ relevance to their time

Calculate the length of time for break and lunch periods; hours in a school day; time from leaving home and arriving at school.

Use scales to check the mass of different objects (stones, beans, snack items textbooks etc. Use a thermometer to check the temperature of different items (cup of tea, ice cream, container with ice, body temperature); record findings.

Use the Jamaica Information Service (J.I.S.) Events calendar web page to research and make a historical time line of major events in the history of Jamaica and the world. Then identify the decade/centuries in which they occurred.

Key Skills

• Research dates of historical timelines

• Create and read timelines

• Calculate time

• Create schedule

• Solve problems

• Investigate

• Measure

• Observe

• Record information

• Make measuring instruments

• Work in groups

• Listen carefully

• Estimate

Assessment Criteria

• Correctly match instruments to attributes being measured

• Select appropriate units in measurement situations

• Accuracy displayed in timeline, times records,

• Time intervals calculated accurately

• Correctly construct and complete table

• Apply appropriate measurement idea to problem solving situations

• Use measurement concepts and skills to accurately solve problems

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: Timelines involving centuries may include Jamaica's Independence, emancipation, adult suffrage, Christopher Columbus' arrival in Jamaica, both World Wars Use timelines including decades, may include natural disasters (Sandy, Gilbert, Charlie, Ivan, Port Royal Earthquake, Japan Tsunami) Calculate the interval of time between any two of the events noted on the timelines Create various time schedules (homework, chores and then use them to solve problems involving the four operations. Use calendar as a point of reference to solve problems including time (how many years/weeks/months/days/hour/to a special event) Convert units of measure in length through millimetre, centimetre, decametre, metre, kilometre; stating which measurement is appropriate to measure different distances . (millimetre - pin; centimetre - desk , meter -distance around school field) Make and set up your own Sundial and record findings - Project Estimate then check with the Guiness Book of Records (a) How tall is the tallest man and the tallest woman? (b) How far can a flea jump? How fast does the cheetah travel?	• Research dates of historical timelines • Create and read timelines • Calculate time • Create schedule • Solve problems • Investigate • Measure • Observe • Record information • Make measuring instruments • Work in groups • Listen carefully • Estimate	• Correctly match instruments to attributes being measured • Select appropriate units in measurement situations • Accuracy displayed in timeline, times records, • Time intervals calculated accurately • Correctly construct and complete table • Apply appropriate measurement idea to problem solving situations • Use measurement concepts and skills to accurately solve problems

MEASURING CONCEPTS

ATTAINMENT TARGET(S):
Explore paths, geometric shapes and space and make generalization about geometric relationships within the environment.

KEY VOCABULARY:

Perpendicular	parallel lines	Obtuse
line segment	Acute	reflex
Intersecting	right	protractor
Parallelogram	Quadrilateral	Vertical
Triangles	Angels	Circular
Horizontal	Curve	

OBJECTIVES
Students should be able to:
• Students should be able to:
• Describe and draw parallel, perpendicular and intersecting line segments
• Differentiate between models of parallel and perpendicular line segments
• Draw angels of varying sizes using a protractor
• Define properties of acute, right, obtuse and reflex angles
• Explore properties of a triangle and quad lateral (square, rectangle, rhombus and parallelograms)
• Create geometric patterns with a combination of shapes

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: Discuss and define the terms parallel, perpendicular and intersect and use their bodies to represent the different lines; view presentation on lines and angles and have class discussions	• Writing definitions • Reporting findings • Forming conclusions • Solve problems • Browse and search • Draw	• Draw and label lines correctly • Accurately solve problems • Accurately draw and name angles • Estimate and measure angles
Glue fudge sticks or pieces of cord on paper to visually represent line segments. Make intellectual guesses as to whether these segments are parallel , perpendicular or intersecting and label accordingly. Contrast between parallel and non-parallel line segments		
Establish how angles are formed , used rulers to draw and label the angles . Know and use protractor efficiently . Define each angle highlighting distinguishing features of each (acute - less than 90°; obtuse –more than 90° but less than 180° etc.)		
Walk around the school yard to observe different angles and lines in the environment or have students view a projected picture of an amusement park and have them identify different angles . Do written report on places and uses of angles in the environment.		
Draw different types of angles , estimate their sizes then use protractor to obtain actual size of angles. Identify persons who are accurate or come closest to the actual measurement.		
Examine the angles for each seven (7) pieces of the Tangram and create own design.		

SAMPLING

ATTAINMENT TARGET(S):
Collect organize interpret and represent data and make inferences by applying knowledge of statistics and probability.

KEY VOCABULARY:

Pictograph	Double Bar graph	Population
Circle graph/Pie chart	Questionnaire	Data
Bar graph	Sample	

OBJECTIVES
Students should be able to:
- Discover that a sample may not be appropriate for a population
- Develop questionnaires and use them to collect data
- Discuss the appropriate uses of various tables and graphs
- Draw pictograph and bar graphs to show given data and interpret such graphs
- Represent data using bar graphs, double bargraphs, pictographs, piechart and line graphs
- Read and interpret tables and graphs

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria

Students will:

The school has decided to sell certain products in the tuck shop based on the responses given by students in Grade 7. Discuss the issue as it relates to the appropriateness of the sample selected in relation to the population of the school and hence the decision made.

Discuss other situations that would require the use of samples. Explain who they would ask to get the necessary information. Discuss why they would not ask every single individual in the population.

Develop simple questionnaires and use them to collect data from students in the class such as: types of families, favourite subject.

Discuss various types of graphs collected from newspapers and magazines. Have discussions on the types of graphs collected and the information being represented. Discuss the suitability of the graphs selected to represent the information.

Use masking tape on the board/door/wall to create axis for a bar chart. Give each student a rectangular strip of paper and have students place them in the category that best applies to them (birth month, favourite colour, pet, number of siblings).

Supply students with results from a survey.

Colour	Frequency
blue	3
red	8
yellow	4
green	1

Key Skills

• Listen scenario

• Discuss advantages/ disavantages of small/large samples

• Create scenarios and questionnaires

• Discuss types of graphs

• Collect data

• Report findings

• Analyse data

• Predict outcomes

• Forming conclusion

• Operate electronic devices

• Read and interpret legends/ keys

Assessment Criteria

• Products of various investigations.

• Correct use of sample and population

• Accurate representation of data

• Satisfactory predictions made from information on bar graphs

• Accurate creation of pie chart

• Discussion on type of graph to be used in various situation

• Answer questions based on graphs

| Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: Make pie chart by folding circular papers in halves, then fourths, then eights, then sixteenths. Colour the number of sectors for each colour. Write a legend/key for the chart drawn. Write and answer questions based on the pie chart created. Discuss the purpose of a pie chart as a diagram that is used to compare parts to the whole. Use what they know about angles to discuss and estimate the size of the angles at the centre for each sector in the pie chart and hence the total section for each colour Use computer software to create and compare different graphs from the same data. Plan and conduct a survey: enter, interrogate and interpret the information: construct and interpret the graph drawn - Share	• Manipulate pie charts •Discuss angles •Create and compare graphs •Conduct survey	• Pie charts accurately created according to the specified criteria •Size of angles satisfactorily estimated •Data collected in survey satisfactorily analyzed

NSC

MATHEMATICS

GRADE 7: **TERM 2**
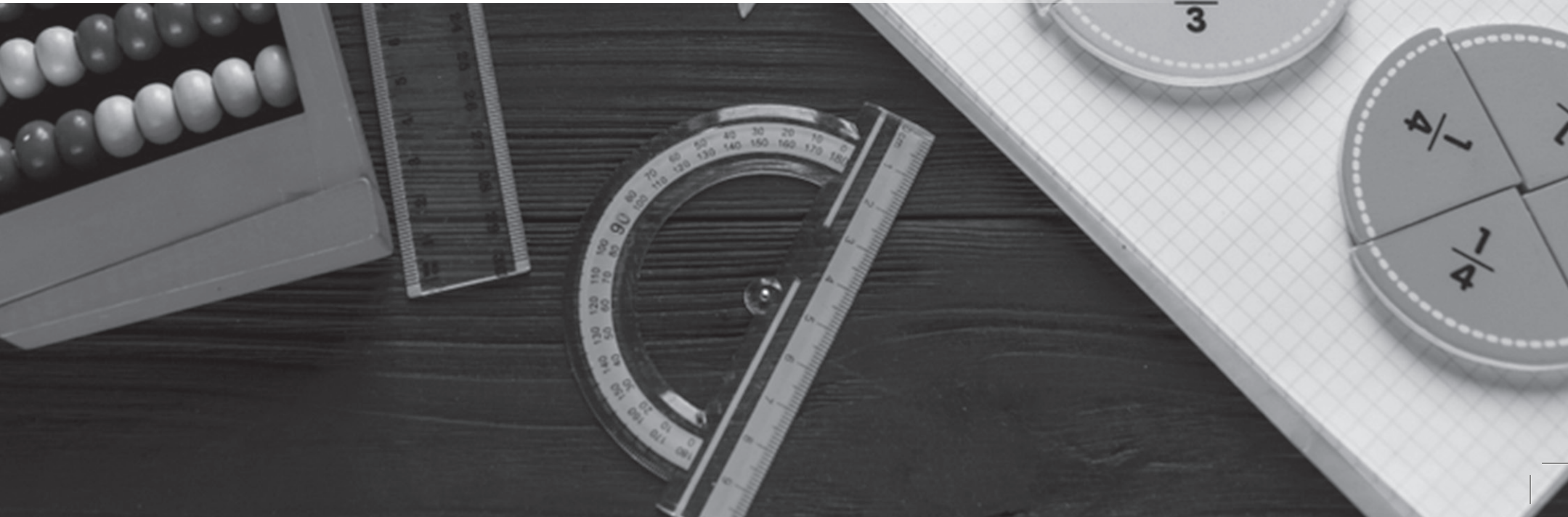
Prior Learning

Check that students:
 • Know and use the concept of a fraction family.
  • Represent fractions based on fraction models
  (Circular, rectangular)

PROPERTIES, FRACTIONS AND RATIOS

AT1

ATTAINMENT TARGET(S):

Know the value of numerals associate them with their names, numbers, ordinals and use concrete objects to model patterns, expressions and numbers

Use the basic operations, number, facts, calculators and dynamic software to compute and estimate in order to solve real world problems, involving fractions, percentages and decimals

OBJECTIVES

Students should be able to:

• Identify and use the following properties of arithmetic (Commutative, Associative and Distributive)
• Identify and use the following concepts (Identity and Inverse)
• Write a fraction as ratio and vice versa
• Divide a quantity in a given ratio
• Identify quantities and proportions
• Express fractional numbers in decimal forms with denominators 10, 100 and 1000
• Round a mixed number to the nearest whole number
• Solve problems which require operations on fractional numbers
• Divide three, four and five digit numbers by one, two and three digit numbers including instances where zero is a digit in the quotient
• Solve problems requiring division, writing the answer in mixed form where necessary (fraction or decimal)

KEY VOCABULARY:

Fraction	Divide	Commutative
Decimal	Quantity	Identity
Distributive	Ratio	Decimal
Inverse	Associative	Property
Bar line / vinculum	Decimal fraction	Reduced fraction
equivalent	Equivalent fraction	

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: In pairs, create questions focusing on addition. Use counters to model the addition facts to discover commutative property: 7 +5 = 5 +7. Repeat process showing multiplication: 4 x 6 = 6 x 4.	• Discuss • Draw conclusion • Investigate • Work in groups • Model addition/multiplication	•Arithmetic properties satisfactorily modelled • Ability to complete tables • Engagement in problem solving • Accurate comparison of quantities
In groups, investigate – using counters/cubes/blocks what combination of numbers is needed to arrive at a given number eg. (4 + 2) + 7 = 4 + (2 + 7). Repeat using multiplication (with blocks/cubes) eg. (6 x 8) x 2 = 6 x (8 x 2). Do other examples to arrive at the associative property.	• Identity property • Discover properties • Compare quantities	• Accurate computation of fractions and ratio • Numbers shown in various forms • Decimal fractions correctly identified
Use counters and set out a 2 by 5 array. How many different ways can you separate it into two parts? For each way complete a sentence, such as 2 x 5 = (2 x __) + (2 x ___) Distributive property	• Name/ write fractions with denominators 10, 100& 1000 • Tabulate information	• Statements accurately written • Prices correctly recorded in various ways • Accurate comparison between fractions and decimals
Engage in a class discussion on the term 'identity' (is there anything that can change someone's identity? This also happens with numbers.) What can be added to 200 to make it 200? That number is the additive Identity; what can we multiply 2437 by to get 2437? That number is the multiplicative identity	• Demonstrate types of fractions • Represent decimal fractions • Divide numbers • Solve real life problems • Browse and search	• Division on whole numbers correctly completed • Problems accurately solved
In pairs discuss what would happen if the number 5 is flipped. Then discuss what happens when the fraction 1/5 is flipped. Multiply the number 5 and its reciprocal and note what happens (5x 1/5=1)		
Discuss the following scenario: Paul collects shells, for every 3 shell Paul collects Steve collects 12; and develop a relationship between the number of shells collected by both boys - The ratio of Pauls' shells to Steve's - The ratio of Steve's shells to Paul's - Write the ratio in parts (i) and (ii) as fractions Share results with the whole class , find and discuss other examples with class.		

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria

Students will:
Explore the types of fractions :- proper , improper and mixed number . Sort and group a variety of fractions on a table . In pairs practise rounding off mixed numbers to the nearest whole number (2 1⁄4 is closer to 2 than 3)

In pairs draw 10 x 10 by grids. Shade various areas on the grid . Name fractional parts shaded with denominations of 10, 100 or 1000 . With teacher 's guidance write fractional numbers as decimals using place value chart. i.e. 1/10 = 10/100 =0.1.

In groups , use decimals squares (1 x10 and 10 x 10 grids) to show tenths and hundreds: colour some squares red on the 1 x 10 to show tenths and some squares green on the 10 x 10 grid to show hundredths . Select a red square grid then find a green square grid with the same amount shaded . Write a statement about the two numbers.

In groups read prices of various items with whole and decimal numbers from magazines , newspaper , brochures , price list etc . In tabular form , record prices in at least two ways . Discuss and share with class

In pairs revise division timetable with flash cards and multiplication tables eg.42÷ 6 =7 as 7 x 6 = 42. Repeat process increasing speed or manipulate interactive online multiplication games to reinforce the concept of multiplication.

Practise multiplication and division by converting mixed number to improper fraction and vice versa.

- **Convert 11/4 to a mixed number.**
- Divide:11 ÷ 4 = 2 with a remainder of 3
- Write down the 2 and then write down the remainder (3) above the denominator (4), like this:

$$2\frac{3}{4}$$

How many times can I get 4 out of 11 and what is the remainder. Write the remainder as a fraction.

Key Skills
- Discuss
- Draw conclusion
- Investigate
- Work in groups
- Model addition/multiplication
- Identity property
- Discover properties
- Compare quantities
- Name/ write fractions with denominators 10, 100& 1000
- Tabulate information
- Demonstrate types of fractions
- Represent decimal fractions
- Divide numbers
- Solve real life problems
- Browse and search

Assessment Criteria
- Models of arithmetic properties
- Ability to complete tables
- Engagement in problem solving
- Comparison of quantities
- Compute fractions and ratio
- Show numbers in various forms
- Identify decimal fractions
- Write statements
- Record prices in various ways
- Comparison between fractions and decimals
- Division on whole numbers
- Solve problems

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria

Students will:
• **Convert 3 2/5 to an improper fraction.**
• Multiply the whole number by the denominator: $3 \times 5 = 15$
• Add the numerator to that: $15 + 2 = 17$
• Then write that down above the denominator, like this:

$$\frac{17}{5}$$

Demonstrate how sets of objects are shared among group members. Discuss the shared amount (dividend), how much each member would have received (quotient), number of persons (divisor) and how much is left if any (remainder). Demonstrate the two ways that a remainder can be expressed in fraction and as a decimal.

In groups work with sets of 1-10 number cards . Form two and four digit numbers. Create division sentences, each student will take turn to give the quotient. Also write worded problems to be shared with class to solve orally and write remainders if any in fractions or decimals.

Play the games Fraction War and Decimal War.

Key Skills
• Discuss
• Draw conclusion
• Investigate
• Work in groups
• Model addition/multiplication
• Identity property
• Discover properties
• Compare quantities
• Name/ write fractions with denominators 10, 100 & 1000
• Tabulate information
• Demonstrate types of fractions
• Represent decimal fractions
• Divide numbers
• Solve real life problems
• Browse and search

Assessment Criteria
• Models of arithmetic properties
• Ability to complete tables
• Engagement in problem solving
• Comparison of quantities
• Compute fractions and ratio
• Show numbers in various forms
• Identify decimal fractions
• Write statements
• Record prices in various ways
• Comparison between fractions and decimals
• Division on whole numbers
• Solve problems

Points to Note: Explore real life situations involving ratio such as construction and home economics.

Prior Learning
Check that students:
• Identify types of measurement units and devices
• Are aware of formal and informal ways to measure

CONVERSION, PERIMETER AND AREAS

AT1	**ATTAINMENT TARGET(S):** Use the correct units, tools and attributes to estimate, compare and carry out the process of measurement to given degrees of accuracy

OBJECTIVES

Students should be able to:

• Know and use the relationship between gram, kilogramme and tonne
• Choose and use the most appropriate metric units and their abbreviations in a given measurement situation
• Perform conversion of units and across related units
• Find the perimeter of plane and composite figures
• Find the area of plane and composite figures by counting square units / formulae

KEY VOCABULARY:

Metric	Surface	Fahrenheit
Kilogram	Distance	Litre
Tonne	Perimeter	Millilitre
Gram	Temperature	Capacity
Mass	Thermometer	Volume
Area	Celsius	Measurement

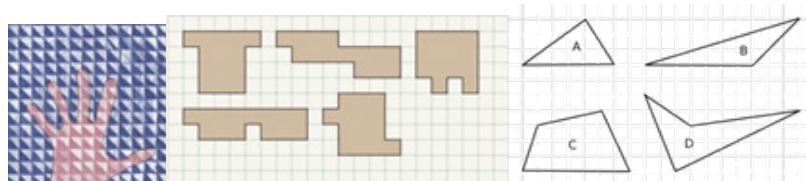| Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: In groups research the units of measure for mass, capacity and volume . Discuss the relationship among the three (3) concepts . Complete conversions between these units then share with whole class; setting problems for each other or creating scenarios where conversions is necessary. Explore °C and °F showing the relationship between both and conversion from one to the other (°F, Fahrenheit Scale used in the USA and °C, Celsius Scale is a part of the metric system used in most other countries) a. °F to °C Deduct 32, then multiply by 5, then divide by 9 b. °C to °F Multiply by 9, then divide by 5, then add 32 View scales on projector noting where zero on the Celsius scale matches to 32 on the Fahrenheit scale. View interactive website about perimeter and area. Use hand span to measure their desk, chairs and other plain surface in their classroom. Have students trace their hands and feet on squared centimetre paper (graph leave) then count squares to arrive at area of hands and feet.	• Convert measurements • Estimate and measure distances and perimeter • Calculate perimeter of regular and irregular polygons • Problem solving • Explore approximate and measure areas • Compare areas • Work in groups	• Complete conversions between units accurately • Accurately measure length, perimeter and distance • Calculate perimeter and areas of polygons accurately • Apply appropriate measurement concepts to problem solving situations • Accurately solve problems involving measurement • Find areas, perimeters and squares, rectangles and triangles accurately • Develop reasonable solutions to problems

Students will:
Explore the area of polygons (regular and irregular) by counting and using information in real world problems to obtain their perimeters and area

Discuss the formula for finding the area;
• quadrilateral (length x width) answer written in square units
• triangle ½ base x perpendicular height
• Volume length x width x depth or breath) with answer in cube units.

Solve real life problems created by teachers /classmates involving large or small areas and the three basic shapes; rectangle , squares and triangles . Use problem solving skills such as sketching, picking out relevant information and applying knowledge of patterns to find areas and perimeters.

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EXPLORING POLYGONS

ATTAINMENT TARGET(S):
Explore paths, geometric shapes and space and make generalization about geometric relationships within the environment

OBJECTIVES
Students should be able to:
• Model regular/irregular polygons with up to ten sides
• Draw polygons from description
• Identify conditions which make a triangle right, equilateral, isosceles or scalene
• Construct solids using their nets
• Calculate missing angles of polygons
• Construct tangrams

KEY VOCABULARY:

Right	Adjacent	Solids
triangle	opposite	polygons
Isosceles	Tangram	Regular
scalene	nets	irregular

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria

Students will:
Provide students with a set of assorted shapes, allow students to sort these shapes providing reason for sorting. Distinguish between shapes, which are polygons and non-polygons, regular and irregular. Record findings and description on a table.

Use geo board and elastic bands to form various examples of regular and irregular shapes . Identify examples of shapes within the environment or use online interactive geo board to create various shapes

Examine various polygons and record their properties in terms of
a. Sides- number, size , position
b. Angles- number and size
c. Diagonals- numbers and size

Explore the characteristics of the various types of triangles, using paper folding activities. Discuss each triangle formed. From discussion, group triangles according to their sides and angles.

Make a chart as shown, sketch a triangle in each cell and tell which of the nine cells are impossible to fill

	isosceles	equilateral	scalene
Right			
Acute			
obtuse			

Cut assorted shapes from print, using paper folding activities, determine the sides which are opposite and those which are adjacent. Name sides using letters and colour code the sides.

Key Skills
• Classify shapes
• Construct shapes
• Identify and compare shapes
• Draw polygons
• Tabulate ideas
• Calculate

Assessment Criteria
• Correctly identify properties of polygons
• Make different shapes using geo board
• Correctly draw and sort polygons
• Accurately calculate missing angles
• Correctly construct solid from net

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: Complete project on constructing solids using their net (obtain these from internet)	• Classify shapes • Construct shapes • Identify and compare shapes • Draw polygons • Tabulate ideas • Calculate	• Identify properties of polygons • Make different shapes using geo board • Draw and sort polygons • Calculate missing angles • Construct solid from net
Listen to detailed description of any polygon or solid and choose from a given selection the shape described.		
Use the tangram pieces to create different shapes.		
From information given about polygons have students calculate the missing angles of polygons (quadrilaterals - angles add up to 360°; triangles – angles add up to 180°.		
Explore four (4) right angled triangles. - Project Points to Note: Have Students explore through drawing polygon numbers : (a) triangle numbers and (b) square numbers.		

EXPLORING THE UNKNOWN

AT1

ATTAINMENT TARGET(S):
Employ algebraic reasoning through the use expressions, equations and formulae to interpret, model and solve problems involving unknown quantities

KEY VOCABULARY:

Algebra	Equation	Substitute
Constant	Terms	Simplify
Coefficient	Expression	N-sentence/statement
Variable	Operations	

OBJECTIVES
Students should be able to:
• Write algebraic expressions to represent given mathematical phrases.
• Investigate the order of operations when evaluating algebraic equations
• Use the symbols $<\ >\ =\ \neq$ in number sentences.
• Identify, add and subtract like and unlike terms
• Use symbols to represent quantities which vary
• Write equations to illustrate word problems
• Solve algebraic equations by substituting given numbers for unknown values.

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: Discuss the use of variables (letters) to represent unknown quantities. Recall terms such as sum, difference, product and quotient in order to know which operation to use when solving problems with unknown quantities. Discuss ways in which variables are written to form algebraic expression. Practise writing algebraic expressions by listening to scenarios presented by teacher. (Paul has some plums, he gave Mike 10; he later received 16 from Tom. (x-10+16) Have students examine mathematical problems with "solutions" and discuss ways in which one could arrive at each. E.g. 7+4-1x3+2-4= 28 7+4-1x3+2-4= 6, how do we know which solution is the correct solution? Reinforce order of operations using brackets. Use the symbols $<$ $>$ $=$ $\neq$ in number sentences i.e. (14 + n = 27) etc. and use algebraic sentences to solve worded problems. Engage students in a discussion of real life situations of substitution such as substituting an injured player on a football field/netball court or substituting butter for oil when frying an egg. Expand discussion to look at the substitution of numbers for variables in equations such as (x + y + z) =, when x=12; y=10 and z=14; therefore x + y + z is 12+ 10+ 14	• Solve number sentence • Investigate order of operations • Use algebraic sentences • Use variables • Use symbols • Form expressions • Work in groups • Operate electronic devices • Use substitution methods • Compare numbers	• Write algebraic expressions for given scenarios • Write number sentence for given scenarios • Solve algebraic equations • Rewrite phrases using mathematical symbols appropriately • Solve algebraic equations by substituting for unknown values **POINTS TO NOTE** Discuss the convention for letters in Algebra.

NSC

MATHEMATICS

GRADE 7: **TERM 3**

Prior Learning

Check that students:
• Understand and use the four (4) operations efficiently.
• Are able to identify and use basic language of buying and selling.

CONSUMER ARITHMETIC AND SETS

AT1

ATTAINMENT TARGET(S):

Know the value of numerals associate them with their names, numbers, ordinals and use concrete objects to model patterns , expressions and numbers

Use the basic operations, number, facts, calculators and dynamic software to compute and estimate in order to solve real world problems, involving fractions, percentages and decimals

KEY VOCABULARY:

Null	Profit	Loan
Empty	Loss	Commercial
Money	Unit price/unit cost	Financial Institution
Finite	Total cost	Currencies
Infinite	Trade	Conversion
Percentages	Savings	

OBJECTIVES

Students should be able to:
• Describe a set including the empty set
• Name any set using braces
• Use the language of sets (including disjoint, null, compliment and subsets
• Identify and give examples of well-defined sets
• Illustrate data using Venn Diagram (at most two intersecting sets within the universal set)
• Obtain and interpret information from Venn Diagrams
• Show knowledge of financial institutions and their function
• Calculate profit and loss in monetary and percentage terms
• Convert Jamaican dollars to other currencies and vice versa
• Compute the quantity given the total price and the unit price

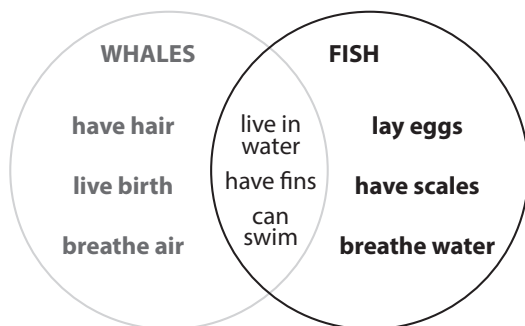| Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: Display an array of items found in the classroom. Select some of the objects then answer question students on the similarities of objects chosen . State the purpose or use of the things selected . Repeat the activity using other objects. In groups write an explanation on what was done in the activity above and share with class. Coin a definition for what they think a "set " is and share . Engage in a whole class discussion and produce one definition of what is a set. Collect group of items within the environment . Form their own sets based on objects assembled and describe each set found. Be engaged in presentation software on, "Types of sets' i.e. finite, infinite, jointed, disjointed, null/empty. Be grouped based on month in which they were born. Investigate and conduct interviews to decipher what else is common or uncommon among them . From their findings generate the types of sets observed finite, infinite, jointed, disjointed, null/empty, universal. Apply knowledge of types of sets to differentiate between types of numbers i.e. whole, odd, even, fractional, prime, counting and composite . Represent the data using Venn Diagrams. Analyse data from Venn Diagram. Write their own questions and have other groups answering.	• Work in groups • Investigate • Conduct interview • Collect data • Classify data • Define key terms • Draw Venn diagram • Participate in discussions • Tabulate data • Formulate questions • Create/display sets • Collect items • Apply types of sets to number types • Classify types of sets • List number types on Venn Diagram • Show set relationship • Examine • Use calculations • Observe • Convert currencies • Make presentations • Use the language of se	• Satisfactory participation in group discussion • Tables showing data collection and classification • Venn Diagrams depicting data collected • Satisfactory formulation of questions • Accurately display sets • Satisfactory classification of sets • Create realistic situations

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria

Students will:

WHALES — FISH

WHALES	(live in water, have fins, can swim)	FISH
have hair		lay eggs
live birth		have scales
breathe air		breathe water

Discuss the Venn diagram above. Identify name and describe each subset. Be guided by teacher in obtaining and analysing data from the diagram.

Be guided in presenting appropriate symbols representing each set from Venn diagram using only brackets/braces. Show set relationships using appropriate symbols of: not a member of, is a subset of, not a subset of) through discussion and visuals.

Engage in discussions on how they use money in real life situations (purchase items, save, invest). In pairs, discuss the following

• The difference between total price and unit/cost price
• Will quantity of an item determine the total price and unit price
• How is a profit made
• How is a loss made on an item
• The currencies used in their country

"BEST BUY"

Lunch list	Prices $
Patties	110
Pizza	140
Bun & cheese	150
Box lunch	350
Water	100
Potato chips	80
Soda	90
Fruit juice	120

Key Skills

• Work in groups
• Investigate
• Conduct interview
• Collect data
• Classify data
• Define key terms
• Draw Venn diagram
• Participate in discussions
• Tabulate data
• Formulate questions
• Create/display sets
• Collect items
• Apply types of sets to number types
• Classify types of sets
• List number types on Venn Diagram
• Show set relationship
• Use calculations
• Observe
• Convert currencies
• Make presentations

Assessment Criteria

• Participation in group discussion
• Tables showing data collection and classified
• Venn Diagrams depicting data collected
• Formulate questions
• Accurately display sets
• Classify sets
• Create realistic situations
• Convert currencies
• Complete computation involving profit, loss and percentage amounts
• Engage in group discussion

Students will:

In pairs, using the "Best Buy" list above, explain how they would determine the best buy in the scenario below:

Bill has $210.00 and would like to know how best to spend it making sure he has a drink and something to eat

John purchased 25 Mocho vanilla milkshake for $1 950. He then went to a meeting and sold them for $120.00 each.

- Calculate the cost price of each milkshake;
- Calculate the profit he made on selling the 25 cups of milkshake
- Calculate the percentage profit he made

Calculate problems with one and two steps involving all four operations relating to profit and loss, unit price, and sale price.

Examine magazines , newspapers and other articles on financial institutions . Describe ways in which money is being used e.g. loans and savings.

Discuss the various currencies which are traded in Jamaica. Examine the rates over a period of time and write your observation.

Be guided to perform conversion. Use the online converter to convert from any currency to the Jamaican one dollar and observe results. (Use the foreign exchange listing provided by a given bank on a given day).

Key Skills

Diagram
- Show set relationship
- Use calculations
- Observe
- Convert currencies
- Make presentations

Assessment Criteria

- Participation in group discussion
- Tables showing data collection and classified
- Venn Diagrams depicting data collected
- Formulate questions
- Accurately display sets
- Create realistic situations
- Convert currencies
- Complete computation involving profit, loss and percentage amounts

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CONSUMER ARITHMETIC AND SETS

AT3

ATTAINMENT TARGET(S):
Employ algebraic reasoning through the use of expressions , equations and formulae to interpret , model and solve problems involving unknown quantities

OBJECTIVES
Students should be able to:
- Represent a mapping by
  a. A mapping rule
  b. A mapping diagram
  c. As a set of ordered pair

- Recognize and give examples of each of the following type of mapping
  a. One to one
  b. One to many
  c. Many to one
  d. Many to many

KEY VOCABULARY:

Functions	Mappings	Many to one
Substitute	Ordered pairs	Many to many
Data	One to one	Patterns
Statistics	One to many	Relationship

Students will:

Be presented with the following scenario:

My phone keeps auto-correcting some words I type as shown in the table below.

Input	Output
Star	Stare
Rat	Rate
Dot	Dote

What is the pattern of my phone's auto-correct? How will my phone auto-correct Rag?

Play "Guess my Rule "- Think of a rule such as "n +3". Have students give different numbers and tell them the output for their numbers. Have students try to guess the rule used.

Create their own rules and have other students try to guess their rules.

Given the scenario of two vendors selling apples at different rates as follows:

Vendor A
2 apples	$ 5
3 apples	$ 7
5 apples	$10
7 apples	$13

Vendor B
1 apple	$2
2 apples	$4
3 apples	$6
4 apples	$8

Compare, contrast and make decisions on which is a better buy.

Be given different mapping diagrams to discuss in their groups which vendor it is best to buy from and why. Describe what is happening in each group.

Key Skills

- Reasoning through problem solving process
- Make generalizations
- Explore rules
- Think critically
- Describe pattern
- Engage in discussions
- Construct diagrams
- Make observations

Assessment Criteria

- Use a rule to describe an observed patterns
- Correctly construct Mapping Diagrams
- Correctly label types of mappings
- Correctly complete ordered pairs based on rules
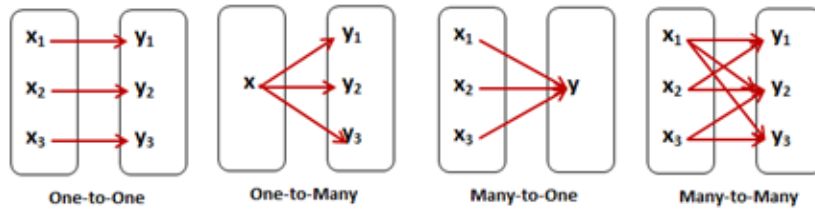- Correctly create mapping diagrams based on pairs.

Students will:

Discuss the mapping diagram as shown below and be guided in constructing mapping diagrams for the tables above (vendors)

Discuss the type of mapping in both cases (i.e. one to one, one to many etc.) Go through other types of mapping

One-to-One   One-to-Many   Many-to-One   Many-to-Many

Observe the relation between apples and prices for both vendors and decide on which is the best buy.

Create scenarios to generate the different types of mapping and discuss with class.

CONSUMER ARITHMETIC AND SETS

AT3

ATTAINMENT TARGET(S):
Collect organize interpret and represent data and make inferences by applying knowledge of statistics and probability

OBJECTIVES

Students should be able to:

• Calculate the mean or average of a given set of numbers
• Find the modal value of a set of data
• Find the median of a set of data
• Find the range of a set of values

KEY VOCABULARY:

Data	Average
range	ascending order
Mode	Descending order
median	

| Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: Complete the empty line plot below on the board. **Number of Siblings** 0 1 2 3 4 5 6 7 8 9 Use a tag (cut -out x or square) and place it in the position corresponding with the number of siblings they have. For example: **Number of Siblings** X X X X X X X X X X X X X X X X X X X X X X 0 1 2 3 4 5 6 7 8 9 Discuss the information represented on the line plot. Discuss the idea "of " range Begin a discussion about average (mode). For example, which single number best represents the number of siblings that most students have? Examine the following scenario: Bob has a mango tree. On Monday he picked 5 mangoes, on Tuesday he picked 3. On Wednesday he picked 5, Thursday 4 and Friday 6. On an average how many mangoes per day does he pick? Use cut - outs of mangoes / counters to model the problem situation . Discuss how they could find a single number that describes the number of mangoes Bob picks per day. Try to level off/ even out the mangoes across the days.	• Organize data examples • Estimate • Measure • Read • Interpret graphs • Compute averages	• Determine correctly when averages are used • Calculate range correctly • Calculate average accurately • Determine mean, mode and median correctly
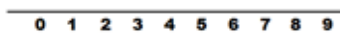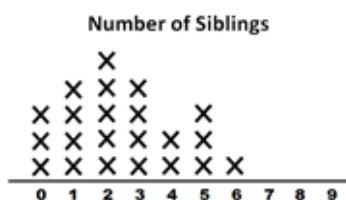
Students will:
Discuss when mean, mode and median are used and suggest one example of when to use each.

Find the average from a set of data provided by other students or online source . Also have them discuss the term range and how to calculate the same (highest score minus the lowest score) and its relevance.

Describe how arithmetic mean relates to the data it represent.

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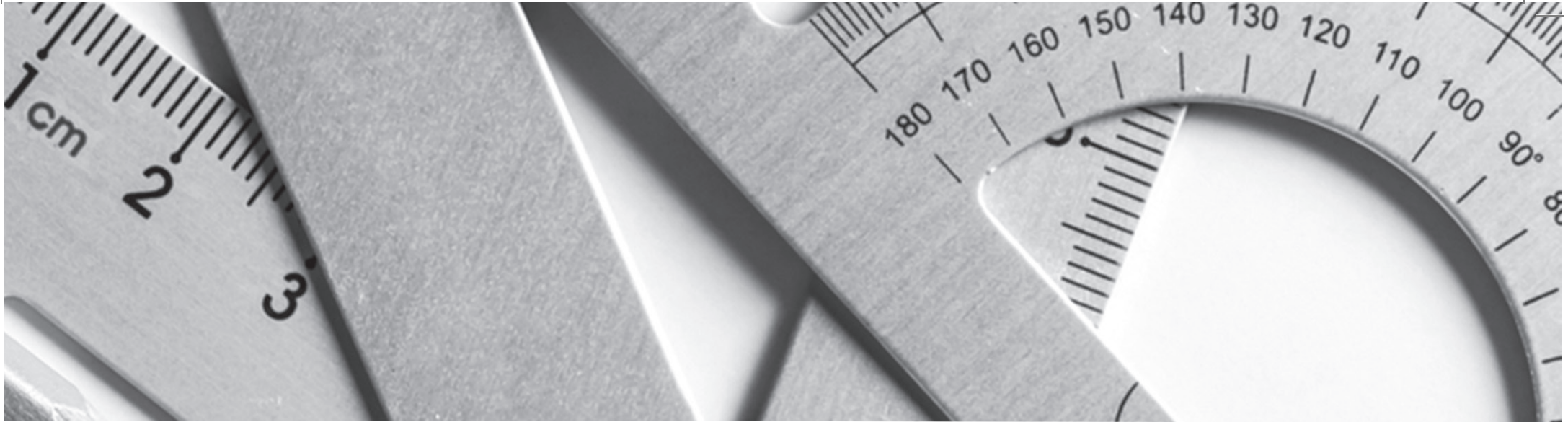
MATHEMATICS

GRADE 8: **TERM 1**

Prior Learning

Check that students:
- Perform the four basic operations on numbers
- Distinguish between the types of numbers

OPERATIONS WITH NUMBERS

AT3

ATTAINMENT TARGET(S):
Know the value of numerals, associate them with their names, numbers, ordinals and use concrete objects to model patterns, expressions and numbers.

KEY VOCABULARY:

Hindu- Arabic number system	Exponent Scientific	Base ten
	Symmetry property	Decimal places
Closure	Expanded form	Composite
Whole	Transitive property	product
Reflexive property	Standard form	

OBJECTIVES

Students should be able to:

- Round numbers to given number of decimal places
- Write a number to a given number of decimal places and significant figures
- Write numbers in exponential form
- Write number/integers in standard form
- Write a number greater than or equal to ten in standard form
- Read, write and use umbers, using the principle of place value, in the Hindu - Arabic system of numeration.
- Distinguish between the different types of numbers
- Identify and describe the different properties of numbers

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: Be given the decimal point demo card as well as several digit cards (e.g. 7, 0, 4, and decimal point.) Build a number to meet specific criteria. Rearrange themselves to build a number. Arrange digit cards to build a number to satisfy the conditions below: o Build the largest number you can. o Build the smallest number you can. o Build a number less than 70. o Build a number greater than 400. o Build a number that is less than 400. o Build a number less than 4. o Build a number that is between 40 and 70. o Build a number that is prime. Repeat with different digits and different directions.	• Form numerals • Rounding number to decimal places • Write numbers in standard form • Identify patterns • Compute • Investigate • Discover patterns • Research • Present • Discuss	• Formulation and use of function to represent multiplication of numbers of the same base. • Conclusions made and application of any number raised to the power of zero is one • Ability to represent number in different bases. • Confident articulation and contribution towards given activity. • Expressing of integer in standard form and vice versa.

Points to Note: As students develop proficiency with this activity, select a student to give directions for building each number to encourage the use of higher-order thinking skills.

Explore the Pascal's triangle chart generated from site: http:// www .easycalculation .com /pascal -triangle .php . Calculate and record the sum of each row/ Compare each sum and make inference(s) on the sequence that exist (if any). Observe that the next sum in the sequence is twice the sum before . Rewrite the sum in product form with a base of two i.e.:

1=1
2=2
4= 2x2 8= 2x2x2

Students will:

With guided research and questioning, find out how many times 2 was multiplied by itself to get ...4, 8, etc. Derive a simpler method of writing these products. Products can be written in the form a^m. Rewrite the sums in this form, i.e.

2^0, 2^1, 2^2, 2^3 etc

Explain what 'a' and 'm' represent in numbers written in the form a^m.

Be guided to discover that any non-zero number raised to power of zero (0) is one (1).

$2^5 = 32$,	$3^5 = 243$	$10^5 = 100,000$
$2^4 = 16$	$3^4 = 81$	$10^4 = 10,000$
$2^3 =$	$3^3 =$	$10^3 =$
$2^2 =$	$3^2 =$	$10^2 =$

÷ 2   ÷ 3   ÷ 4
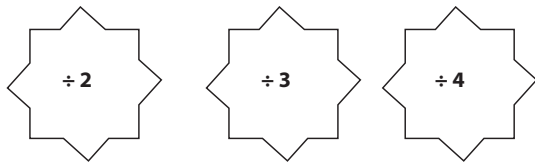
Express integers in the standard form.

Use the number line to round numbers (ensure that they are real numbers, for example 3.26543) to a given number of decimal places. Play games involving dollars and cents. Example: work with the scenario- As a shop owner, you do not have enough change to give to a customer, after his/her purchase. (Due, to this, rounding off is the best solution). Discuss the implication(s),(if any) to the customer and/or business.

In groups, using sets of 0-9 digit cards and a place value chart, shuffle cards and place the top card face up on the table. Write the digit in the column of their choice on their place value table. Take turns repeating for another six cards. **Note:** A player may not move a digit once they have written it down. When all the players have made a seven digit number, the player with the smallest [or largest, as the case may be] number wins.

Key Skills

• Conduct research

• Compute

• Investigate

• Manipulate number line

• Discuss

Assessment Criteria

•Correctly express integers in standard form
•Correctly manipulate the number line to solve problems

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: With teacher's guidance, draw a place value chart (7 columns, labelled 'Ones to Millions') on cartridge paper. Take turns writing their numbers from group activity above on chart displayed on the board (e.g. 8 904 762). Read each number aloud , then write number in words (i.e. Eight million , nine hundred four thousand, seven hundred and sixty two).	• Explore place values • Use expanded notation • Discuss and apply property of numbers	•Correctly assign place values to given numbers •Correctly write numbers using expanded notation Adequately discuss and apply the assigned property of numbers
Revise how to write a number using expanded notation e.g. 4 763 921 expands into 4 000 000 + 700 000 + 60 000 + 3000 + 900 +20 +1. Give practice in expanding numbers. Do the reverse: Give the expanded form of a number and have them write it in standard form.		
View video tutorial on Place Value up to millions then use spreadsheet software to practice to reinforce concept		
Research assigned property of numbers as a group. In groups discuss each of the following properties Closure ,Reflexive property, Symmetry property ,Transitive property and Trichotomy law and formulate real life analogies to demonstrate each property		
As whole class, discuss the term: **Reflexive property.** Look in a mirror- I am equal to myself, described mathematically as every number being equal to itself, therefore 2=2; 4+7 = 4+7		
Discuss the term **Symmetrical property:** If one value is equal to another value, then the second value is also equal to the first value. **E.g. If 10 + 14=24 then 24= 10+14**		
Discuss the term **Transitive property**. Now discuss the following situation: John's height= Mary's height and Mary's height=Peter's height, then John's =Peter's height. Described mathematically as: if one value (a) is equal to another value (b) which is also equal to a third value (c) therefore ; a=c and b=c, then a=c		

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria

Students will:
Discuss the term: Trichotomy Law
Be given an undisclosed sum of money in pairs . Discuss the proportion of each share Highlight that, one share can be more than the other or less than the other or the same as the other. Described mathematically as a>b, a=b or a< b **For any real number or amount the unknown can be less than, equal to or greater than the known amount**

Define the Closure property as follows:
Closure property of real number addition states that the sum of any two real numbers equals another real number. Closure property of real numbers, multiplication states that the product of any two real numbers equals another real number.For product and the sum of different types of numbers, use the table as shown below:

2, 5 are real numbers. 2 + 5 = 7, another real number.
4, 7 are real numbers.4 × 7 = 28, another real number.

Key Skills

• Explore place values

• Use expanded notation

• Discuss and apply
property of   numbers

Assessment Criteria

Adequately discuss and apply the assigned property of numbers

Learning Outcomes

Students will be able to:

✔ Define and apply the properties of closure, reflexive, symmetric, transitive properties and trichotomy as used and applied in the law of

mathematics

✔ Confidently articulate and contribute towards group discussion

✔ Express products using indices and vice versa

✔ Know the place values of bases other than that of base ten

✔ Write numbers/integers in standard form

Points to Note

- The use of real life examples is vital to building conceptual understanding of numbers
- Ensure that students correctly state the type of number they are dealing with than to just arbitrarily discuss numbers.

Extended Learning

- Research different number patterns within the Pascal triangle, eg. Fibonacci sequence, prime, numbers, even numbers
- Explore other number bases used in real life application
- Identify five extensions of the closure property of mathematics
- Find real life examples that may be linked with each property

RESOURCES

Base Ten Blocks, calculator, Pascal Triangle Chart, Place value Chart, worksheets, internet, computer, accessories

KEY VOCABULARY

Whole number, real number, expressions, equal, standard form, decimal places, rational, Trichonomy, distributive, commutative, associative, transitive identity, inverse, reflexive, properties

Prior Learning

Check that students:
• Know the relationship between units of measurement for length/ distance
• Understand the concepts of ratio fractions

SCALES AND TIME

AT3

ATTAINMENT TARGET(S):
Use the correct unit tools and attributes to estimate, compare and carry out the process of measurement to given degree of accuracy

KEY VOCABULARY:

Polygon	Clock	Regular
Measurement	Irregular	
Scale	Perimeter	

OBJECTIVES
Students should be able to:
• Interpret a simple scale drawing and the actual distance using the scale on a road map or floor plan
• Use the 24 hour clock in problem solving
• Calculate the perimeter of regular and irregular polygons
• Calculate the measurement of one side of a polygon given the perimeter and the length of the other sides

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: Engage students in discussions about scales on a map/scale drawing (how they are written, their importance in real life and how to interpret them)	• Measure scale drawing, cooperate with others • Problem solving • Identify situations • Compare times • Develop algorithm • Estimate • Measure • Experiment • calculate perimeter • work in groups	• Accurately calculate the distances, self-representation • Time conversion • Calculate perimeter • Calculation of the length of unknown sides of polygons • Estimation • Solve problems • Participate in groups
Work in pairs to measure their heights then use their own heights and a stick figure to represent themselves, where 1 cm on the stick represents 20 cm in actual height (1: 20)		
In groups calculate actual distances from scales on given maps or projected. 		
Investigate, discuss and explain the use of the 24 hour clock. Identify situations where this feature is used in the society. Make comparison with regular 12 hour clock as well as write times using the 24 hour clock.		
Write a list of time in 12 hour clock notation and convert to a 24 hour clock time. E.g. 1:00 p.m. =1300 hrs. (13:00 hrs.) Develop rules to convert p.m. time to 24 hour clock time		
In groups estimate the perimeter of a variety of polygons (regular and irregular) in the classroom e.g. books, tables, dsek etc.		
In pairs, measure the sides of polygons in the classroom and use the measurement to calculate the perimeter of those figures.		
Experiment in groups, to find the length of an unknown side in any polygon given the polygon drawn to scale, its perimeter and the length of other sides.		

Students will be able to:
- ✔ Develop, read and interpret scale drawings
- ✔ Express time in both 12-hr and 24-hr format
- ✔ Estimate and calculate the perimeter of regular and irregular polygons
- ✔ Problem solve in pairs to arrive at solutions for given tasks
- ✔ Calculate unknown dimensions of regular and irregular polygons given perimeter and the lengths of other sides
- ✔ Complete tasks cooperatively in groups
- ✔ Navigate digital maps to explore units of measurement

Points to Note

Extended Learning

Link scales drawing activities with Social Studies by allowing students to calculate the distance between parish capitals in Jamaica, from Jamaica and countries globally

- Research and write an essay providing details of three occupations that depend on the use of the 24-hr clock
- Make a model of a garden in any polygonal shape using a given perimeter

RESOURCES
Rulers, height chart, world map, map of Jamaica, regular and irregular polygons, internet, computer, multimedia projector/ other technology

KEY VOCABULARY
Ratio, scale drawing, regular polygons, irregular polygons, 24-hr clock, two dimensional

SOLIDS

AT3

ATTAINMENT TARGET(S):
Use the correct units, tools and attributes to estimate, compare and carry out the process of measurement to given degrees of accuracy.

KEY VOCABULARY:

Polygons	Edges	Faces
Prism	Rhombus	Vertex/vertices
Pyramids	Polyhedron/polyhedral	
Cubes/cuboid	Nets	

OBJECTIVES
Students should be able to:
• Recognize faces, edges, vertices of a solid and classify solids according to the number and shape of their faces.
• Describe, design or create three dimensional shapes
• Represent and solve problems using geometric models

Students will:

Have students collect three dimensional objects around their home or school environment; eg. juice boxes, carton boxes, medicine containers, Discuss the number and shapes of the faces, edges and the number of vertices. Tabulate findings
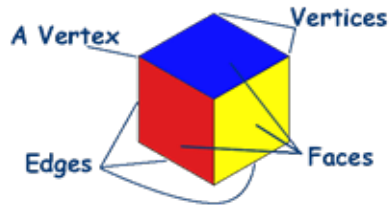
Construct a variety of polyhedrons either by sketching and assembling nets or use drawing tool in word processing software. Or, in word pad or any other software
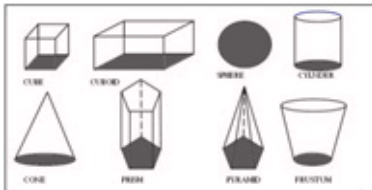
Types of polyhedrons

 Platonic Solids

Prisms

Pyramids

View other solids on internet counting faces, edges and vertices

Highlight the different faces by colouring and explaining how each polyhedron could be used in the real world.

Key Skills

- Discriminate and differentiate solids
- Tabulate properties of solids
- Construct solids
- Compare
- Discuss
- Work in groups
- Solve problems

Assessment Criteria

- Completion of table sowing faces, edges, and vertices
- Identification and description of polyhedrons in the environment
- Comparison
- Group participation
- Problem situation solved

Students will:

In groups be provided with a variety of two and three dimensional objects to compare and say what the differences between them are. Share findings with class

Use the cube to investigate how many squares are there on one face. Explain the strategy used to ascertain the number of squares on one face, and then determine the total number of squares on the cube.

In groups develop questions based on solids for their classmate to solve.

Key Skills

• Measure scale drawing

 • Cooperate with others

• Problem solving

• Identify situations

• Compare times

• Develop algorithm

• Estimate

• Measure

• Experiment

• Calculate perimeter

• Work in groups

Assessment Criteria

• Accurately calculate the distances, self-representation

• Accurately convert time

• Calculate perimeter correctly

• Accurately calculate the length of unknown sides of polygons

• Effectively estimate time

• Solve problems accurately

 • Participate in groups

Learning Outcomes

Students will be able to:

✔ Use plain shapes to create a solid
✔ Classify/group solids according to their properties from a given set
✔ List identify and compare aspects of geometric shapes in the environment
✔ Construct at least one polyhedron
✔ Investigate the relationship between the faces, edges and vertices of solids
✔ Design three dimensional solids using sticks, straws, strips of cardboard, ect.
✔ Identify the 'net' for a specific solid
✔ Engage in real life problem solving
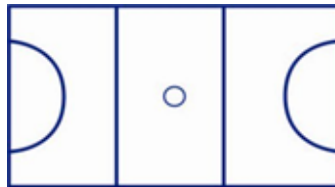✔ Work cooperatively in groups to complete given task

Most solids can be made three dimensional using their nets

There are various subject areas to which this concept is linked e.g. Art & Craft: students use shapes to create pattern; the shape of the food pyramid in Science depicts a pyramid
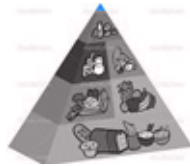
It also links with Physical Education where the shape of the netball court depicts a polygon
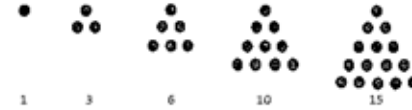
The number 1, 3, 6 and 10 are triangular numbers. Name the next three triangular numbers that extend the pattern.

Extension: the number 1, 4, 9 and 16 are square numbers. Name the next three square numbers using illustration

Figure 12

Encourage students to cut and paste pictures depicting various polyhedra as used in real life situations into scrapbooks

Explore the centered - pologon numbers and their growth for the triangle, the square and the hexagon

RESOURCES
Sticks, straws, nets of polyhedral, solid shapes, boxes, magazines, newspaper, tins, journals, scrapbook, internet, computer

KEY VOCABULARY
Polygons, lines of symmetry, rhombus, polyhedron, polyhedral, prism, pyramids, nets, sphere, vertex/vertices, edges, faces, cube, cuboid, quadrilateral, isosceles, scalene, parallelogram, cylinder, sphere

INEQUALITIES AND ORDERED PAIRS

AT3

ATTAINMENT TARGET(S):
Employ algebraic reasoning through the use expressions, equations and formulae to interpret, model and solve problems involving unknown quantities

KEY VOCABULARY:

Inequalities	Ordered pairs
Linear equation	Cartesian
Nnumber line	

OBJECTIVES
Students should be able to:
• Write inequalities to illustrate word problems
• Illustrate inequalities on a number line
• Solve simple linear equations and represent the solutions on a number line
• Add and subtract like and unlike terms
• Write coordinates of points as ordered pairs
• Plot ordered pairs of numbers on the Cartesian plain
• Read and identify points on the Cartesian plane

Students will:

Review writing negative and positive integers on the number line using interactive games and activities

Take part in whole group discussion to establish what are inequalities (**a relationship between two values when they are different**). View power point on inequalities to reinforce concept and practise writing and reading inequalities (x-5 > 3)

In small groups, practise writing and solving inequalities on the number line using the example below

Solve:x+3<7
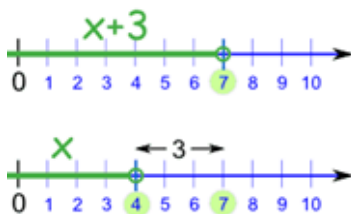If we subtract 3 from both sides, we get
X+3-3<7–3
X<4

Solution: x<4
In other words, x can be any value less than 4, because 4 is greater

In groups, solve worded problems involving inequalities.

Of 8 pups , there are more females than males . How many female pups could there be?
Assign letters **females f; males m**
We know that there are **8** pups; so **f + m = 8**, which can be rearranged to **m = 8 – f or f= 8- m**.
We also know there are more females than males, so: **f > m**
We are being asked for the number of girl pups **f**

- Analyse information
- Work in groups
- Plot points
- Locate points
- Plot lines
- Discuss key terms
- Identify coordinates
- Share and compare
- Solve problems

- Grid with points plotted correctly
- Cooperatively engage in group participation, discussions and activities
- List coordinates identified and written correctly
- Show willingness to get involved in real-life problem situations
- Share and compare results

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria

Students will:

Start with:

f +m= 8   and f >m

Then use the table below to record possible answers:

Female	Male
5	3
6	2
7	1
8	0

Key Skills

- Analyse information
- Work in groups
- Plot points
- Locate points
- Plot lines
- Discuss key terms
- Identify coordinates
- Share and compare
- Solve problems

Assessment Criteria

- Analyse information accurately
- Work in groups
- Plot points correctly
- Locate points correctly
- Discuss key terms adequately
- Identify coordinates correctly
- Solve problems correctly

In groups practise to solve equations with like and unlike terms. Write problems in their groups then move around to other groups solving the problems written . Then return to their groups to check solutions by classmates . Solutions will be discussed whether correct or incorrect

Examine a grid that is placed on the board with numbers placed vertically(y axis) and horizontally (x axis) equal distance apart. Treats (candy, gum, chocolate M&M etc.) will be placed at points where vertical and horizontal lines meet . Students will write down ordered pairs in groups. The group with all correct will claim the treats. **(Note: Points on x-axis is always written before the number on the y-axis)**
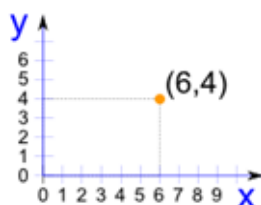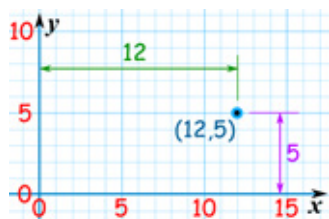
In groups investigate Cartesian Plain ; where they will plot ordered pairs . Read and write points on the Cartesian plane also ensuring they understand the order to read and write these pairs (x then y). Teacher can use scenario to reinforce the order **(a plane has to taxi down the runway before it can take off, showing movement from 'x' to 'y')**

Learning Outcomes

Students will be able to:
- ✔ Complete list of inequalities accurately
- ✔ Solve linear inequalities correctly
- ✔ Willingly complete teacher generated activity involving inequalities
- ✔ Write clear descriptions of patterns identified in relations
- ✔ Draw conclusion based on graphs showing relations
- ✔ Accurately locate coordinates on a plane
- ✔ Actively engage in group activity

Points to Note

Relation, Functions and Graphs can be linked to every subject

A Cartesian plane is made up of two number lines that meet at 90 degrees. The centre of the plane is called the origin

A relation is a set of inputs and outputs, often written as ordered pairs
Review how solving equations is related to change of subject of formula so that students can connect the skills needed for solving equations to this current topic

Extended Learning

- • Challenge students to create an activity of a relation associated with their daily life and create equations of their own.
- • Collect data on the ages of their peers. Show data collected in tabular form. Then plot appropriately the data on graph with correct coordinates
- • Allow students to make a collection of various types of graphs and add these to their Math kit
- • Research examples of inequalities in real life situations

RESOURCES
Internet, computer, sheets with number line, journals, cubes

KEY VOCABULARY
Algebra, inequalities, linear, formulae, solution, equation, ordered pair, Cartesian plane
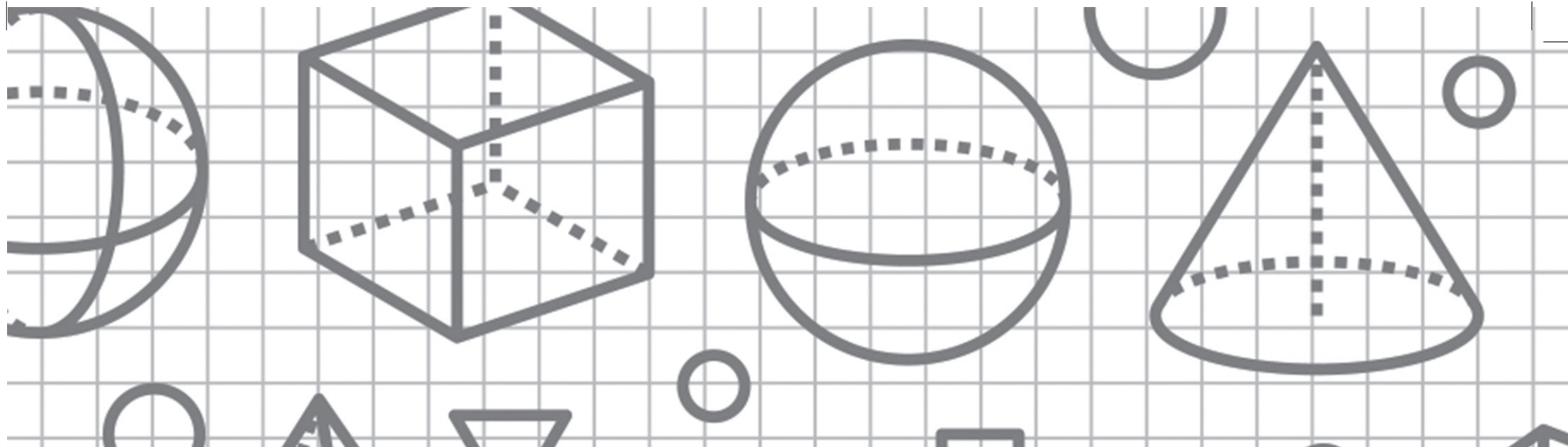
MATHEMATICS

GRADE 8: **TERM 2**

Prior Learning

Check that students:
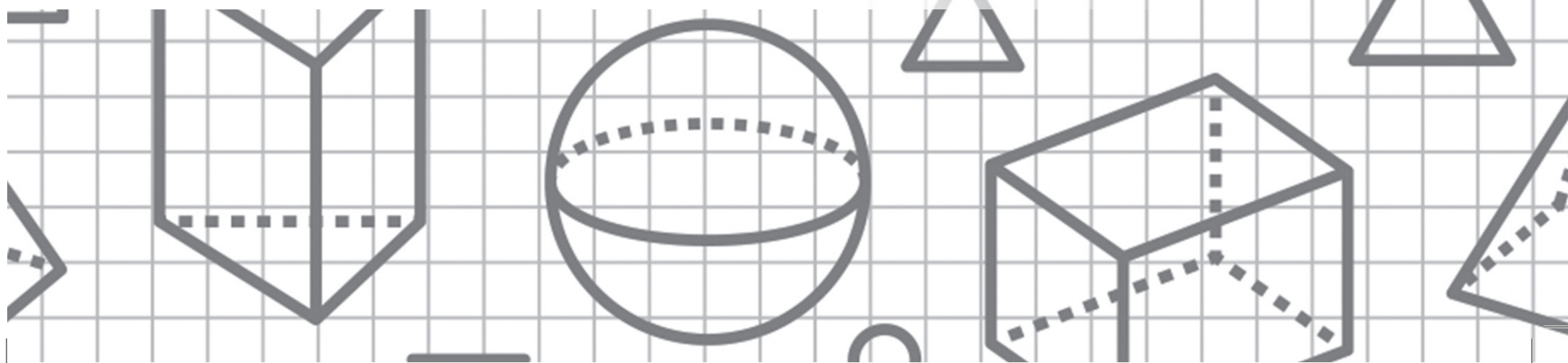- Perform the four basic operations on numbers
- Express fractions as ratio and vice versa
- Know types of numbers
- Identify the factors and multiples of a number
- Describe types of fractions
- Compute whole numbers

SELECTED TYPES OF NUMBERS

AT3

ATTAINMENT TARGET(S):

Know the value of numerals, associate them with their names, numbers, ordinals and use concrete objects to model patterns, expressions and numbers.

NUMBER OPERATION: use the basic operations, number relationships, pattern, number facts, calculators and software to compute and estimate in order to solve real world problem involving fractions, percentages and decimals

KEY VOCABULARY:

Reciprocal	Prime factor	Percentage
Fractional number	Composite numbers	Decimal
Ratio	Number system	Withdrawal
Quantities	Compound interest	Deposit
Exponent	Simple interest	
Factor	Proportions	

OBJECTIVES

Students should be able to:
- List all the prime factors of a set of given numbers
- Write a composite number as a product of primes in exponential form
- Identify the reciprocal of a whole number or a fractional number
- Use the four basic operations to compute with fractional numbers
- Use ratio to compare quantities
- Write a ratio using the format 1:5, 1 to 5 or 1/5
- Solve problems which require the use of equivalent ratios
- Apply the concept of ratio to percentage forms and use the symbol % correctly
- Write a percentage as a fraction with denominator 100 or in its simplest form and/or as a decimal
- Calculate the percentage a given number is of another given number which is a factor of ten solve problems involving ratio and proportion
- Identify different types of bank accounts with their characteristic features
- Complete withdrawal and deposit forms/know how to write a cheque
- Use simple proportions of principal, rate and time to develop the Simple Interest
- Calculate Simple Interest and Compound Interest on loans and deposit using a calculator

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria

Students will:

Complete "Prime Number Sieve" using hundred boards: starting with the number four, colour all other numbers that are multiples of two. The uncoloured numbers are prime numbers.

Select the coloured number from the same hundred board and circle all the factors (excluding 1) for the number. Determine which of the circled number is not coloured. Determine two statements that can be made about these circled uncoloured numbers? **(These are the prime factors of the number chosen)**. Find prime factors for other numbers.

Use colour coded factor trees to write a composite number as a product of its prime. By using interactive online game **Factor and Multiplication Jeopardy**

Extend writing composite numbers as products of primes in exponential form: **2^2 x 3 x 7**

List multiples of given pairs of numbers, selecting factors that are common noting the one with the greatest value (H.C.F)

Use models (fraction blocks) to review addition and subtraction of fractional number. Extend to include multiplication and division; reinforcing reciprocals of whole numbers as a fractional number. (4 reciprocal ¼)

Use concrete/semi-concrete materials to model the concept of ratio (amount of lunch money, pencils and pens. Explore the format of representing ratios as **a:b; a to b & a/b**

Explore in groups the concept of percentage; the use of percentage in their own experiences; explore the use of percentage as fractions as well as decimals **48%=48/100=0.48.**

Key Skills

• Manipulate hundred board
• Work in groups
• Explore composite numbers
• Explore multiples
• Discuss key terms
• Manipulate fractions
• Solve problems with percentages

Assessment Criteria

• Prime numbers correctly identified
• Correctly write a composite number as a product of its prime
• Multiples of give numbers correctly identified
• Solve problems correctly

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria

Students will:

Use shading of parts of a 100 square grid to discuss and calculate percentages of sets, money and measure (using the correct symbols)

In groups using 4 by 10 rectangular grids, shade two rows (eight squares). Discuss that there are eight shaded squares and 32 un-shaded squares. Therefore the ratio of shaded to un-shaded squares is 8:32.

Illustrate how ratios can be written as fractions and percentages. Show how they can be simplified. For example 8 shaded squares out of a total of 40 squares:

As a ratio of shaded to un-shaded 8:32 or 4:16 or 1:4
As a fraction of the total 8/40 or 4/20 or 2/10 or 1/5
As a percentage of the total 8/40=20/100=20%.

In pairs, engage in solving real life ratio problems e.g. In a class, there are 25 grade 7 students and 15 Grade 8 students. Write in their simplest form, the ratios of: **Grade 7 students to Grade 8 students; Grade 8 students to Grade 7 students**

In pairs, using a set of 1-20 number cards, shuffle cards and deal two cards face-up on the table to form a ratio. Write the ratios in their books. Then write the ratios in their simplest form (if not already in this form) and list five equivalent ratios.

Solve worded problems which ask them to divide a certain quantity according to a given ratio. Use coloured beads or counters to model each ratio. Use receipts to examine ratio

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Practise matching simple fractions (e.g. ½, ¼, 1/5, 1/10 etc.) to percentage amounts using coloured pencils and decimal paper divided into hundredths.

In groups of four use 36 blank cards, write fractions in their lowest terms matching percentages cards i.e. 1/5= 20%, 27/100= 27%. Shuffle cards together and deal 6 cards to each player. Place remaining cards face down and play the Fraction War Game.

Key Skills
• List prime factors
• Write products of primes using exponents
• Compute with fractions
• Work in groups
• Use, model and write ratio
• Problem solving
• Write equivalent ratios
• Convert ratios to percentage and vice versa
• Use calculator
• Compute with money
• Compare and contract

Assessment Criteria
Find the HCF of a set of numbers

Find the product of prime numbers

Compare rational quantities

Model rational amounts

Problem solving

Correct completion of forms associated with banking

Making of wise financial decisions

Students will:

in a pile. Take turns to ;draw a card; play a set of three matching three cards if they have; discard a card face up.

Note: players may choose to draw a card from the top the top of the discard pile. The first player to make two sets of three cards wins the game.

Discuss and use many clippings from newspapers and magazines as possible involving discounts, sales, finding a percentage increase or decrease and finding the percentage of sales tax in a price.

With teacher's guidance explain what a discount or sale should do to the price of an item. Therefore if there is a 10% discount on an item, in order to find the new price, they have to find 10% of the price and subtract the answer from the original price or find 90% of the price. Explore other calculations using calculators to find sales tax, discounts, interest and hire purchase (compound interest) on items.

In groups, obtain information about types of accounts available and the interest rates available for each; explore similarities and differences of these accounts. Obtain different forms from these institutions (lodgement slips, withdrawal slips and sample cheque leaves) and practise completing these.

Compute and compare the interest on two types of accounts calculating the amount of money you would receive over a given period and say which account would be more beneficial and why.

Learning Outcomes

Students will be able to:
- ✔ Compare ratios
- ✔ Engage in problem solving situations
- ✔ Convert ratios to percentages and vice versa
- ✔ Convert percentages to fractions, decimals and vice versa
- ✔ Use ratio ideas to find unknown quantities
- ✔ Describe sharing proportionally using ratios
- ✔ Formulate and solve simple equations using ratios

Points to Note	**Extended Learning**
Ratios is another way of representing fraction	Encourage students to research ways in which aspects of ratios and proportions are used in real life situations
A ratio is a comparison of two numbers or quantities	Challenge students to use ratios between pairs of quantities to find one of the quantities when the other quantity is given
A percentage is out of 100	Allow students to write their own worded problems involving ratio
	In pairs make their own sets of percentage cards and models depicting equivalent ratios to add to their "Math Kit"

RESOURCES

Assortment of objects, worksheets, internet, computer, counting sticks/objects, set of 1- 20 number cards

Have students explore the concept of GCT and other forms of taxes.

Prior Learning

Check that students:
- Perform the four basic operations on numbers
- Express fractions as ratio and vice versa
- Know types of numbers
- Identify the factors and multiples of a number
- Describe types of fractions
- Compute whole numbers

AREAS AND VOLUMES

AT3

ATTAINMENT TARGET(S):
Use the correct unit tools and attributes to estimate, compare and carry out the process of measurement to given degree of accuracy.

KEY VOCABULARY:

Volume	Area	Vertex
Surface area	Hectares	Face
Perimeter	Dimensions	Formulae
Unit solid	2-dimensions	Parallelogram
Diagonal	3-dimensional	
Triangles	Edge	

OBJECTIVES

Students should be able to:
- Identify shapes that will cover a plane exactly and those that will not
- Differentiate between the size and use of the following units: square centimetres, square metres, hectares and square kilometre
- Solve problems involving area measurements
- Develop the idea of a 'unit solid'
- Build unit solids of volume 1 dm³,1cm³ and 1m
- Establish formulas and, estimate and calculate the volume and capacity of cubes, cuboids, prisms, cylinders, parallelograms and composite objects
- Calculate the volume of a rectangle prism given the number of unit solids in one layer and the number of layers
- Derive and use the formulae for the area of (a) parallelogram; (b) triangles (1/2 bh), (c) trapezia

Students will:

In pairs have students explore using one or more shapes to create patterns while exploring tiling of a plane

Watch video and tutorials on 'area and perimeter ' then come up with songs , games dramatization , mimes and dances to differentiate both concepts.

In groups estimate how many 1 square-centimetre (1cm2) or 1 square-metre (1m2) tiles can cover a given square, rectangular or triangular region for the flooring in and around the classroom or school.

Select and paste predesigned furniture (made in art class from cardboard, cartridge paper or any suitable material)on square paper. Students should then trace the outline of their rooms (bathroom, kitchen, bedroom, etc.), record their dimensions and the area of each room.

Work with a partner to calculate the area of shaded and un-shaded portions of polygonal shapes . Continue working in pairs to derive the formula of the area of a right -angled triangle by drawing a rectangle . Then construct a diagonal to create two right angled triangles

Derive the formula for a triangle using area of a rectangle.

Key Skills

- Draw diagrams
- Construct shapes
- Draw conclusion
- Desire formulae
- Divide shapes
- Work in groups
- Compare
- Contrast
- Estimate
- Create
- Compute
- Deductive reasoning

Assessment Criteria

- Tessellate shapes correctly to create patterns
- Give reasonable estimates of the areas of closed shapes by counting squares
- Apply appropriate formula to accurately calculate the areas, perimeters and volumes of shapes
- Work cooperatively
- Identifying the makeup of basic shapes in the nets of solids
- Correct use of formulae to compute total surface area of a given solids
- State correct definitions of Prisms
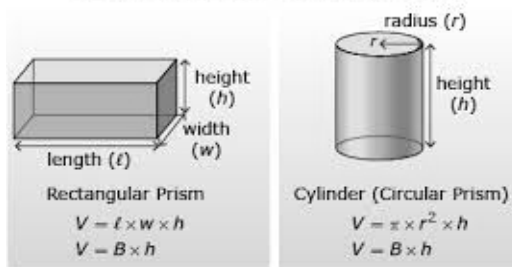- Correctly identify cubes, cuboids, cylinders and triangular prisms

Students will:

Area ABCD = b * h

B   C

h

A   b   D
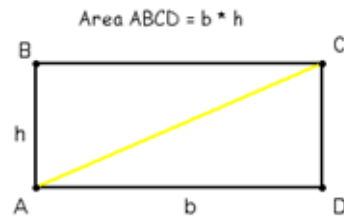
Since $\overline{AC}$ is a diagonal that cuts the rectangle in half, then $\triangle ACD$ is 1/2 Area ABCD or 1/2 b * h.

Interact with multimedia presentation to derive the area of other types of triangles as well as a Trapezoid

Use a combination of two dimensional shapes to form three dimensional objects and calculate the surface area of 3-D objects. Build unit solids from nets supplied by teacher or by collect different shapes, such as cylindrical containers, pasta boxes etc. Cut each of them along just a few edges so that they stay together but can be unfolded to show the different surfaces that make them up.

Look at various prisms to help them understand what volume actually means. Provide them with base ten centimetre cubes (1cm-1cm-1cm, or 1cm^3) and larger base ten decimetre cubes (10cm-10cm-10cm, or 1000cm^3) Verify these facts by using a ruler or metre stick to measure the dimensions of the cubes.

Volume of a Rectangular Prism and a Cylinder (Circular Prism)

radius (r)

height (h)

height (h)

width (w)

length (ℓ)

Rectangular Prism

$V = \ell \times w \times h$

$V = B \times h$

Cylinder (Circular Prism)

$V = \pi \times r^2 \times h$

$V = B \times h$

where B is the area of the base of the prism

Students will:

Explore how many base ten cubes would be needed to cover the base of the cubic metre models . Create one row of large base ten cubes along one side, and then consider how many rows would be needed to cover the base ten. Calculate how many layers would be needed to fill the cubic metre model . Use real life scenarios to practise converting between units..
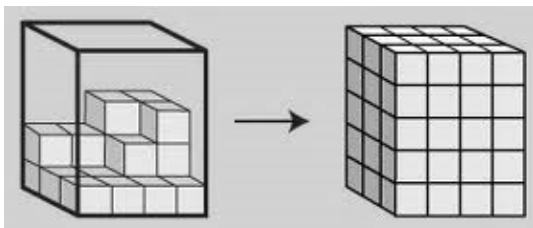
Use volumes and the dimensions of solid objects to generate formula for calculating the volume of such objects. Apply formula to find the volume of similar, solids of different dimensions.

Learning Outcomes

Students will be able to:
- ✔ Use shapes to create patterns
- ✔ Use appropriate units in measurement situations
- ✔ Derive formulae for calculating area of triangles, parallelogram and trapezia
- ✔ Differentiate between volume and surface area as well as capacity and volume
- ✔ Construct solids; convert between units of measure up to a cubic units
- ✔ Problem solve situations involving areas/ perimeter/polygons/solid shapes
- ✔ Use ICT tools to explore volumes of different solids

Points to Note

Other methods of deriving formulae are to be explored
Recap prior knowledge of converting between metric units up to square units

Extended Learning

Pupils may research information on Archimedes' principle
Allow students to make their own solid shapes using available materials
Encourage students to make journal entries on what they have learned from the activities above.

RESOURCES

Square paper, unit tiles, paint, nets of solid, cubes, boxes, rulers, cylinders with different bases, journals

KEY VOCABULARY

Volume, area, dimensions, 2&3 dimensional, edge, vertex, face, Tessellate, hectare, formulae, parallelograms, triangles, surface area, conversion, composite, capacity

Prior Learning
Check that students:
- Identify common shapes and objects
- Classify common shapes and objects by noting their properties, including their lines of symmetry
- Identify angles in a polygon
- Calculate angles in a polygon

SYMMETRY, CONGRUENCE, GEOMETRIC AND ANGLES

AT3

ATTAINMENT TARGET(S):
Explore paths, geometric shapes and space and make generalization about geometric relationships within the environment

KEY VOCABULARY:

Symmetry	Polygon	Congruence
Interior angles	Properties	Vertices

OBJECTIVES
Students should be able to:
- Identify and count the number of lines of symmetry in more compound plane figures
- Demonstrate a knowledge and understanding of congruence in two and three dimensions
- Determinate the properties of n-sided polygons
- Find the angle sum (sum of interior angles) of polygons with n interior angles

| Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria

Students will:

In groups, work with several plane shapes, use plain paper to cut- out shapes that are congruent to the ones given (remember they must be same size and same shape). Use 3-dimensional objects from measurement lesson to construct congruent ones.

Be given a number of shapes to identify those that are congruent/ not congruent.

Be presented with a variety of pictures and shapes divided exactly in two with lines. Have students fold pictures /shapes along the line; then discuss both sides.
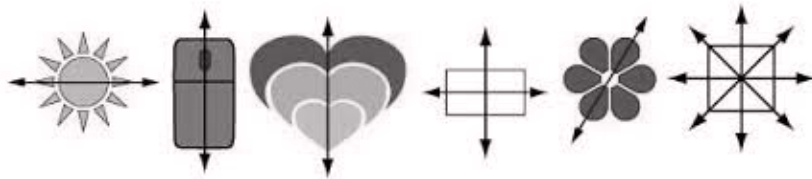
Establish line of symmetry and have students come up with definition **(imaginary line where you could fold the image/shape and have both halves match exactly)**. Also discuss that figures /shapes can have more than one line of symmetry.

Explore symmetry in more complex plane figures and use flags of the Caribbean to determine more lines of symmetry.

ICOSAHEDRAL SYMMETRY

5-FOLD   3-FOLD   2-FOLD

Key Skills

• Compare shapes

• Identify lines of symmetry

• Investigate congruency

• Discuss findings

• Classify

• Create patterns

• Solve problems

• Connect vertices

• Record

• Derive and use formula

• recall

Assessment Criteria

Determine congruency of plane shapes

Determine lines of symmetry on objects and plane shapes

Explain congruence

Group participation

Solve problems

Identify properties of n-sided polygon

Derive formula for sum of interior angles of an n-sided polygon

Use formula to calculate the sum of the interior angles of an n-sided polygon

es

Students will:

Draw and cut various polygons (ranging from 3 to 10 sides). Group all shapes together. In well-defined groups, select a particular set of polygons based on common properties.

Engage in discussions to identify properties used to identify group, record common response in a table.

Connect vertices within four of their grouped shape (without overlapping lines) to form triangles within them. Record the number of triangles contained in their shape in the table below:

Name of polygon	Number of sides	Number of angles	Number of triangles	Sum of angles based on number of triangles contained in polygons
Triangle	3	3	1	1 x 180 = 180
Quadrilateral		4	2	2 x 180 = 360
Pentagon				
Hexagon				
Octagon				
Nanogan				
decagon				

Recall that the sum of interior angles in a triangle is 180°.
Use this knowledge to determine the sum of the interior angles in each category of polygon and record for each in the table above

Derive a general formula to calculate the sum of interior angles in an n-sided polygon.

Use formula to calculate sum of interior angles in given polygons

Note: The general rule is sum of interior angles =(n-2) x180° Each Angle (of a Regular Polygon) = (n-2) x 180°/n

Learning Outcomes

Students will be able to:
- ✔ Derive formulae for the sum of interior angles of an n-sided polygon
- ✔ Use formulae to calculate the sum of the interior angles of an n-sided polygon
- ✔ Identify properties that makes shapes congruent
- ✔ Identify lines of symmetry in shapes and also recognize that diagonals lines are also lines of symmetry in some shapes
- ✔ Engage in real life problem solving situations
- ✔ Use word processing software to produce drawings 2-dimensional shapes

Points to Note

The line of symmetry in any plane shape, is the line that cuts/divides the shape in two equal parts when folded along that line

The line of symmetry in an object is that imaginary line where you could fold the image and have both halves matching exactly

Extended Learning

Use flags of the Caribbean and the world to identify and number lines of symmetry

Identify objects in the environment that have lines of symmetry

Explore other geometric shapes in the environment as well

Encourage students to investigate the sum of the interior angles of polygons of up to 20 sides

Allow students to research the various uses of angles in the construction industry. Create a class portfolio with data gathered

RESOURCES

Assortment of polygons, internet, computer, ruler, portfolio, geometric instruments,

paint, plain paper, solids, mirrors, graph sheets

KEY VOCABULARY

Polygons, angle, interior, properties, vertices, symmetry/symmetrical, congruent, identical, plane shapes

Prior Learning

Check that students:
- Understand the concepts of mean, mode and median.
- Identify mathematical patterns.
- Know how to make a prediction

DATA HANDLING, STATISTICS AND PROBABILITY

AT3

ATTAINMENT TARGET(S):
Collect organize, interpret and represent data and make inferences by applying knowledge of statistics and probability

OBJECTIVES
Students should be able to:
- Use the terms likely, unlikely, most likely, least likely, highly likely, even chance, highly unlikely, certain and impossible to describe the likelihood of an event occurring
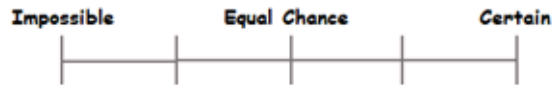- Calculate the probability of an event occurring

KEY VOCABULARY:

Probability	Possible	Certain
Chance	Impossible	Uncertain
Likelihood	Likely	Unlikely

Suggested Teaching and Learning Activities	**Key Skills**	**Assessment Criteria**

Students will:

1. Reproduce the following probability line on the board.

Pull and read aloud descriptions of an event from a bag . Ask students to place their events in the appropriate place on the probability line. Have students explain/justify their placement.

Also place the following on the probability line:

100%, 0%, 50%, 50-50,

2. Use a spinner, which is placed on the chalkboard to state on which colour the spinner is most likely to land.
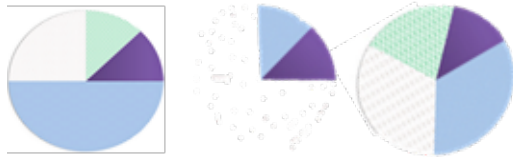
State a numerical value that would represent the chance of the spinner landing on each colour.

3. Place 3 blue balls and 3 red balls in a bag. Discuss how likely they think it would be to pull a blue ball. Assign a numerical value (50/50, 50% etc.)

    Now place 2 blue balls and 8 red balls in the bag and once again ask the likelihood of pulling a blue. Discuss if they now have a greater or smaller chance and why. Assign a numerical value.

4. Discuss the likelihood of rolling a "6" on a fair die. Be guided in determining the actual probability by discussing all possible outcomes. Discuss and calculate the probability of getting an even number.

• Calculating probability
• Identifying possible outcomes

Correctly list activities that are certain, uncertain, possible, impossible

State correct real life activities involving chance Correctly list all possible outcomes

Accurately calculate the possibility of an event occurring in a given scenario

Learning Outcomes

Students will be able to:
- ✔ Use appropriate terminology to describe the likelihood of an event occurring
- ✔ Calculate the probability of an event occurring
- ✔ Conduct simple experiments to explore probability

Points to Note

Students' understanding about probability/likelihood/chance will develop from experience. They may initially confuse chance with luck for example or, believe that a 6 is "harder to roll" than say a 4. Facilitate discussions about the likelihood of events and allow students to justify their positions without trying to force a definition. Over time, students will begin to develop their own understanding.

It is important that students understand that the chance of an event occurring is unaffected by previous trials in a simple experiment. For example, each time you flip a coin the chance of getting a head is 0.5, regardless of whether or not you flipped six heads in a row previously.

Extended Learning

Develop a list of goofy personal insurance plans such:
Bitten by Shark Insurance, Struck by lightning Insurance, Falling through a manhole Insurance, Death by Spider Insurance, Getting Splashed by a car Insurance

Discuss with students, which, if any, they would invest in. Have students research online the probability of some of the more unlikely events occurring

Have students research (online/interviews/phone calls) various insurance premiums (life/health/vehicle). Have them discuss what factors affect the cost of insurance and present different case subjects and discuss who would receive more expensive premiums and why.

RESOURCES
Spinners, cards, dice, balls

KEY VOCABULARY
Chance, likelihood, unlikely, certain, uncertain, possible, impossible, probability

NSC
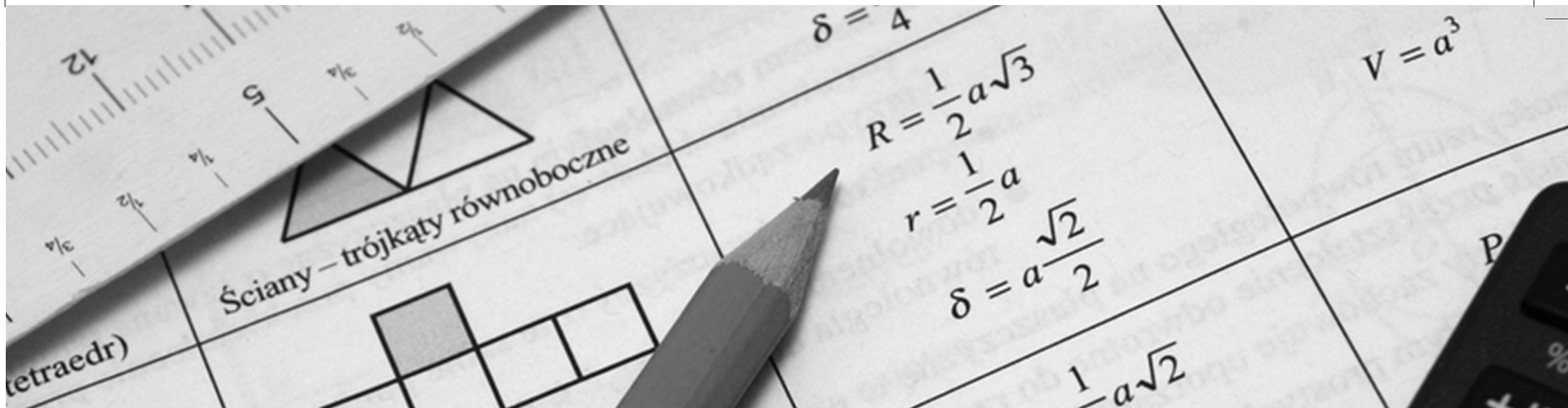
MATHEMATICS

GRADE 8: **TERM 3**

Prior Learning

Check that students:
- Describe a set including the empty set
- Differentiate between sets of counting, whole, odd, even, prime, composite, and fractional numbers
- Name any set using braces

SETS

AT3

ATTAINMENT TARGET(S):

Know the value of numerals associate them with their names, numbers, ordinals and use concrete objects to model patterns , expressions and numbers

Use the basic operations, number, facts, calculators and dynamic software to compute and estimate in order to solve real world problems, involving fractions, percentages and decimals

OBJECTIVES

Students should be able to:
- Describe a set including the empty set
- Name any set using braces
- Use the language of sets (including disjoint, null, compliment and subsets
- Identify and give examples of well-defined sets
- Illustrate data using Venn Diagram (at most two intersecting sets within the universal set)
- Obtain and interpret information from Venn Diagrams
- Show knowledge of financial institutions and their function
- Describe terms used in profit and loss

KEY VOCABULARY:

Symbols	Universal sets	Equivalent set
Sets	Finite	Union
Null/empty	Complimentary	Equal set
Subsets	Infinite set	
Venn Diagram	Intersection	

| Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria

Students will:

Allow students to use two (or three) rings to encompass objects such as 'things from plastic', circular objects, sweets, etc. With teacher sort objects using just one circle (inside or outside) then two circles to discover the need to overlap them then finally three circles to discover the general 3-set picture. (Allow students to critically analyse each stage.)
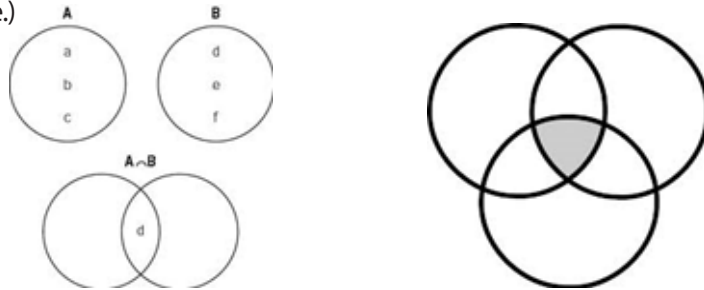
List the members and count the number of members in various subsets of an assortment of Venn Diagram. Describe these subsets in words and in terms of set algebra e.g. A B or AUB

Work in groups with a set of fruits each containing different number and types e.g. one group receiving one fruit, another two fruit, explore and record the number of possible choices they have in selecting fruit or combination of fruits from their assigned set. Discuss their findings. From discussion, create mathematical relationships between the number of fruits and the number of subsets. Generate a formula for the total number of subsets of a given set.
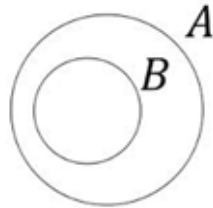
Arrange themselves in groups according to their likes or dislikes of two given subsets e.g. favourite sports, subjects, food etc. Extract, analyze and discuss the information from the Venn Diagram. List the set of names of students who like neither. Identify the number of students who like both.

Key Skills

• Construct sets
• Draw Venn diagrams
• Deduce where members of a set belong
• Interpret Venn diagram
• Record
• Arrange
• Select
• Simulate
• Analyse
• Observe
• Categorize
• Solve problems
• Work in groups

Assessment Criteria

Represent sets in circles

Sort objects

Descriptions and listings of subsets

Problem solved

Writing set notation

Create equivalent sets, finite set and infinite set card

Work in groups

List of subsets of a given set and formulation and use of function that defines the total subsets within a set

Representation of the universal set and its subsets using a

Venn Diagram

Accurate analyses of the information illustrated in Venn

Diagrams

Students will:

In pairs create cards of infinite and finite sets e.g. counting numbers, factors of 12, and letters in words including empty set. Exchange cards with other groups. Sort the cards into two groups; finite sets and infinite sets. Record information in tabular forms and then share with entire class.

In groups represent the letters in the following words SET, JOINT, and MAY using a Venn diagram. Find a word that would be a subset of any of the words e.g. "IN" is a subset of "JOINT". Repeat process using type of numbers, food items, geometric shapes etc.

In groups formulate questions based on these Venn Diagrams for whole class to answer

Learning Outcomes

Students will be able to:
- ✔ Place objects on a Venn Diagram correctly
- ✔ Describe subsets in words and symbols, list and number their elements
- ✔ Solve problems associated with sets
- ✔ Distinguish between finite , infinite, disjointed, intersecting and null/empty sets
- ✔ Participate in group discussions

Points to Note

Sets can be linked to Science with the classification of living and non-living things

In Mathematics with the classification of numbers

Extended Learning

- Investigate where in real life set is used. For example a shopping list

- Challenge students to list all the subsets of the days of the school week

- Allow students to work in pairs. One will device a single Venn diagram showing interesting sets, subsets and disjoint sets and write questions about the Venn diagram. The other students will answer the question

RESOURCES
Attribute pieces, worksheet, strings, equivalent, set cards, computers, internet

KEY VOCABULARY
Finite, infinite, set, intersection, equivalent set, union, equal set, disjoint sets, subsets, Venn Diagram, symbol

Prior Learning

Check that students:
• Know the basic parts of a circle
• Are able to use a compass and protractor

CIRCLE

AT3

ATTAINMENT TARGET(S):

Use the correct unit tools and attributes to estimate, compare and carry out the process of measurement to given degree of accuracy.

OBJECTIVES

Students should be able to:

• Investigate the relationship between parts of a circle; circumference, radius and diameter in terms of measurement

• Use the compass to draw circles to create designs.

KEY VOCABULARY:

|		
Radius	Protractor	Quadrant
Circumference	Compass	Chord
Polygons	Segment	Arc
Diameter	Circle	Sector
PI (π)	Centre	

Students will:

View presentation on circle. Discuss the attributes of the different parts of the circle (radius, chord, segments, sector etc.) in their own words through observation

O - Center of the circle
OA - Radius of the circle
BC - Diameter of the circle
DE - Chord of the circle
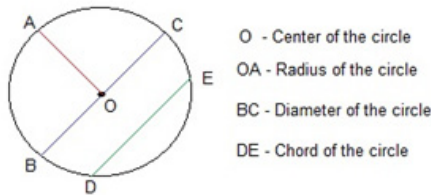
In pairs use rulers to measure the lengths of diameters and radii in five circles of different sizes. Record the measurements then compare to establish the relationship between the diameter of a circle and its radius. Calculate the measurement of radius or diameter of different circles using established relationship.
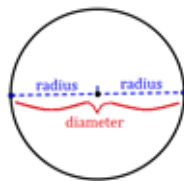
Mark off the length of the diameter of four different sized circles and experiment to find the relationship between the circumference and the diameter of each using string, flexible ruler, etc. Use derived relationship to calculate the circumference of given circles (group activity). N.B. Teacher should explain to students that the relationship established gives the value pi (π =22/7).
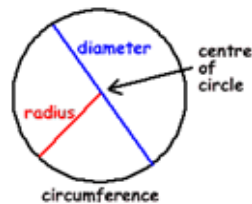
In groups, use their compass to draw circles of specified radius on square paper or grid sheet. Create colourful abstract art pieces using arcs, sectors, circles, etc.

In groups calculate the values of missing angles in circles.

Key Skills

• Discuss

• Investigate the parts of a circle

• Compute circumference, radius & diameter

• Solve problems

• Construct circles and other angles

• Calculate vale of unknown angles in circles

• Work in groups

Assessment Criteria

Accurately establish relationship between the radius and diameter of a circle

Given the circumference, accurately calculate the radius and diameter of a circle

Given the radius/diameter, accurately calculate the circumference of a circle

Correctly identify a radius, diameter, chord, segment, arc and sector on a given circle.

Group participation

Accurately solve problems involving the calculations of the circumference of the circle

Accurately construct circles using a compass.

Learning Outcomes

Students will be able to:
- ✔ Identify and describe the different parts of a circle
- ✔ Calculate the value of the diameter given the radius and vice versa
- ✔ Compute the circumference of a circle given the radius or diameter
- ✔ Calculate the size of unknown angles in a circle
- ✔ Engage in problem solving situations
- ✔ Complete activities cooperatively in groups
- ✔ Plan and conduct research on the parts of a circle

Points to Note

Make link with circle and aspects of planets i.e. spherical, Lines of Latitude/longitude, Equator, Prime Meridian

Link with Religious Education e.g. Circle of Life, AUM ect,

Pupils may use hairpins to fit circles of the same size together to create a sphere

Extended Learning

Write arguments for and against the moot "A circle is not a polygon"

Encourage students, in groups, to cut and paste pictures depicting the use of circles in real life situations in their scrapbook

Allow students to use circles to design table mats. Then add completely mats to their "Math Kit"

Encourage students to make entries in their journals on the experience gained from the activities above

RESOURCES
Circles, strings, flexible ruler, square paper, compass, grid sheet, plain paper, magazine/newspaper, projector, computer, crayons

KEY VOCABULARY
Radius, diameter, chord, sector, segment, circumference, quadrant, arc, PI, protractor, compass, circle, polygons

Prior Learning

Check that students:
- Construct using appropriate geometric instruments, a circle of a given radius
- Construct, using ruler and compass only: a) line segment; b) perpendicular and parallel lines; c) line bisector

CONSTRUCTIONS

AT3

ATTAINMENT TARGET(S):
Use the correct unit tools and attributes to estimate, compare and carry out the process of measurement to given degree of accuracy.

OBJECTIVES
Students should be able to:
- Construct using appropriate geometric instruments; angle bisectors; angles of 90°. 45°. 60°. 30°; triangles
- Construct these angles using a protractor.

KEY VOCABULARY:

Angles	Construct	Triangle
Bisector	Degrees	

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria

Students will:

In pairs use protractor and ruler to construct an angle by:

i.   Draw a line segment

ii.   Indicate with a dot, along the line segment the point at which the angle must be drawn

iii.   Place the centre of the protractor at the dot with baseline along the line segment

iv.   Find the requirement angle on the scale, counting from zero on the baseline and then mark a small dot at the edge of the protractor

v.   Join the dots with a ruler to form the requirement required angle

vi.   Label the angles with capital letters

Draw and measure other angles e.g. 90°, 135°, 75°, 56°, 98°

Teach students to construct these angles using ruler and angle bisectors

Draw a given angle

Scribe an arc of any length from the vertex of the angle, to intersect both sides of the angle. Label these intersection points P and Q

Scribe an arc from any two points, P or Q of any length radius. Scribe a second arc from the next point (p or Q) with same radius as first arc. Label the point of intersection of the two arcs. Bisect 60° angle to construct 30° angle.

Key Skills

• Construct circles and other angles

• Work in groups

• Scribe arcs

• Label points

Assessment Criteria

Group participation

Construct circles

Construct 90°, 60°, 45°. & 30° angles

Accurate use of angle bisector

Students will:

Step 2.
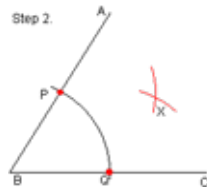
Draw a line from the vertex through the intersection of the arcs

Step 3.

Measure, record and compare the size of the newly formed angles.

Construct similar angles in the same way or watch video on "**Angle Bisector Construction-Math is Fun**" to view construction of other angles.

Key Skills

- Construct circles and other angles
- Work in groups
- Scribe arcs
- Label points

Assessment Criteria

Group participation

Construct circles

Construct 90°, 60°, 45°. & 30° angles

Accurate use of angle bisector

Learning Outcomes

Students will be able to:
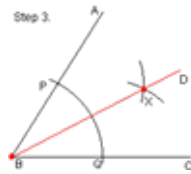- ✔ Construct angles accurately
- ✔ Use appropriate geometric instruments during various constructions
- ✔ Use bisectors correctly to divide angles evenly

Points to Note

Geometric construction should be linked to Visual Art, Resource & Technology

"Construction" in Geometry means to draw shapes, angles or lines accurately

These constructions use only compass, straight edge (ruler) and a pencil

This is the "pure" form of geometric construction no numbers involved

Extended Learning

Encourage students to research on career areas in which constructions of angles and polygons are applied

Allow students to use match/fudge sticks to design the constructions of angles and triangles in their scrapbook

RESOURCES

Geometric instruments, ruler, compass, internet, computer, accessories, journals, scrapbook, fudge/match sticks, markers

KEY VOCABULARY

Angles, construct, triangle, bisector, degrees

Prior Learning

Check that students:
- Write coordinate of points in ordered pairs
- Plot ordered pairs of numbers on the Cartesian plane
- Read and identify points on the Cartesian plane
- Connect points on the Cartesian plane to form patterns
- Represent a mapping by (a) a mapping rule; (b) a mapping diagram; (c) as a set of ordered pair

FUNCTION, RELATIONS AND GRAPHS

AT3

ATTAINMENT TARGET(S):
Employ algebraic reasoning through the use expressions, equations and formulae to interpret, model and solve problems involving unknown quantities

KEY VOCABULARY:

Coordinates	Relation	Gradient
Rate of change	Equation	Hypotenuse
Points	Function	Intercept/y-intercept
Quantity	Axes(x- and y-)	

OBJECTIVES
Students should be able to:
- Plot ordered pairs of a mapping as a graph
- Draw straight line graph of the form y=mx + c by
  (a) plotting points, (b) using the gradient and intercept
- Determine gradients and intercepts of straight line graphs
- Relate gradient of a graph to the rate of change of quantities
- Find the equation of a straight line graph
- Graph linear equations on the coordinate plane and identify regions on the graph
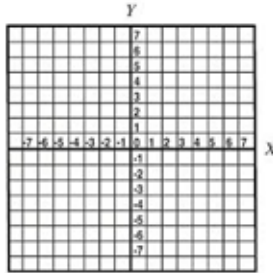
Students will:

Using the classroom as a grid, use themselves as markers to locate various points. Then with teacher's guidance, discuss the term coordinates with given examples


In pairs, using grid/graph sheet, plot the points named below on the grid provided above: A (3,6); B (-2, 8); C (-5,-4); D (7,-7); E (1,0); F(0, -6); G (0, 0). Share and compare completed grids with other pairs, and then as a whole class

As a whole class discuss the term gradient and how it is found on a straight line. In pairs, using grid/graph sheet, work out the gradient of a line showing the relation between the Jamaican dollar and the US dollar

$$\text{Gradient} = \frac{\text{Change in Y}}{\text{Change in X}}$$
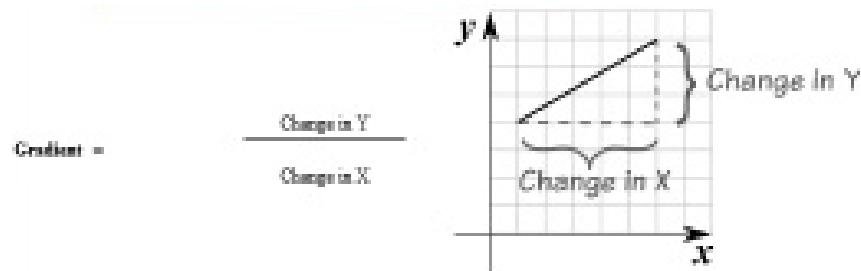
Choose any two points on the line. Draw a right angled triangle with the line as hypotenuse. Use the scale on each axis to find the triangles vertical and horizontal lengths. Work out the **vertical length ÷ horizontal length**. Thus the result is the gradient of the line.
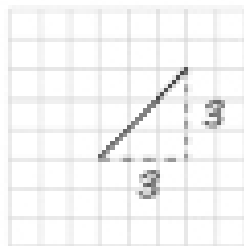
The Gradient of this line = $\frac{3}{3}$ = 1

So the Gradient is equal to 1

Key Skills

- Plot points
- Locate points
- Plot lines
- Discuss key terms
- Identify coordinates
- Work in groups
- Share and compare
- Solve problems
- Identify gradients
- Determine gradient of a line
- Calculate the gradient of a line
- Identify y-intercept

Assessment Criteria

Grid with points plotted

Cooperatively engage in group participation, discussions and activities

Plot lines on grid

List coordinates identified and written

Show willingness to get involved in real-life problem situations

Share and compare results

Calculate gradients accurately

Identify y-intercepts correctly

Represent equations on graph

Students will:

As a whole class with teacher's guidance, discuss the term: y- intercept with given examples **(y- intercepts is where the graph of an equation crosses the y-axis)**
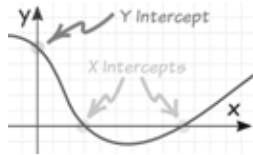
Discuss the general formula y=mx + c, where m is the gradient and c is the y- intercept

Y – how far up
X = how far along
M = slope or Gradient (how steep the line is)
C = the Y- Intercept (where the line crosses the Y axis)

How do we find "m" and "c"; 'm' is calculated as shown above and 'c' is where the line crosses the Y axis. This information can now be used to calculate the equation of a straight line.

$$m = \frac{2}{1} = 2$$

C = 1 (where the line crosses the Y- Axis)
y = mx + c
So: y = 2x + 1

Students will:

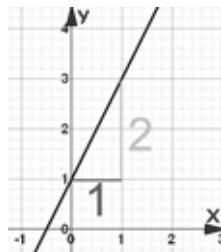With that equation you can now choose any value for 'x' and find the matching value for 'y'.

Example: when 'x' is 1;

Y = 2 x 1 + 1 = 3; check values on graph that **X = 1 and Y = 3.** Calculate using other values for 'x' and find corresponding values of 'y'.

View powerpoint presentation/ youtube lesson on using ordered pairs to find Y- intercepts.

With teacher's guidance observe then discuss a pair of simultaneous equations using a graph as shown on a chart or projected onto a white board. In pairs, using graph sheet draw the lines of the equations. Share and compare their lines/equations with other pairs, then as a whole class. Engage in a whole class discussion on; that the points where the lines cross is the solution e.g. Solve these simultaneous equations by drawing graphs

2x + 3y = 6
4x – 6y = -4
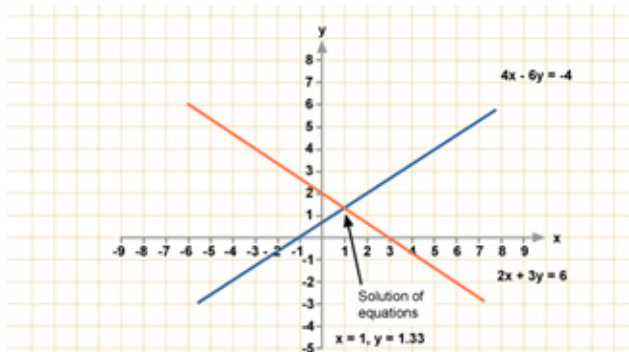
Learning Outcomes

Students will be able to:
- ✔ Complete grid with points plotted accurately
- ✔ Plot lines neatly and correctly on grid while identifying and listing coordinates correctly
- ✔ Accurately calculate gradients of given lines and identify 'y' intercept
- ✔ Accurately represent linear equations on graph paper
- ✔ Cooperatively engage in group participation, discussion and activities
- ✔ Show openness to share and compare results with others

Points to Note

Relations, functions, graph and Cartesian coordinates ought to be linked to other areas of Mathematics

Aspects of relations should be linked to Geography

A relation can also be represented as a graph, function or pattern

Cartesian coordinates can be used to pinpoint where you are on a map or graph

The Gradient (slope) of a straight line shows how steep a straight line is. This can either be positive or negative

Extended Learning

Challenge students to make a floor map of their bedroom on grid paper or graph sheet. Include the axis and plot the coordinates to indicate the location of important parts of the room

Encourage students to research the many ways in which coordinates on a grid are used in real life situations

Encourage students to research on how the concept of gradient and slope is used in real life

Challenge students to investigate the importance of the "z axis"

RESOURCES
Grid/graph, classroom floor, ruler, internet, computer, accessories, scrapbook, journals, teacher generated tables

KEY VOCABULARY
Coordinates, points, relation, function, graph, axis i.e. "x and y"; gradient, hypotenuse, intercept/y-intercept, rate of change, quantity, equation

APPENDICES

TERMS	DEFINITIONS/MEANINGS

SUBJECT GLOSSARY

TERMS	DEFINITIONS/MEANINGS

Below are tips you may find usefulwhen teaching students with special needs:

- Get to know your students and their individual needs.
- Ensure that classroom procedures and routines are flexible enough to accommodate individual differences
- Use positive non-discriminatory language
- Be deliberate in including students with special needs in all activities
- Communicate high expectations
- Model and reinforce appropriate social skills
- Use assessment data to plan instructions
- Teach to students' strengths and learning styles
- Students with special needs respond well to direct instructions or guided discovery
- Use multisensory teaching approaches that engage two or more learning modalities simultaneously
- Break content into small steps and teach each step to mastery
- Differentiate objectives based on students' functioning levels
- Make ample use of mnemonics and other memory aids
- Pair students with special needs with learning partners/buddies
- Provide appropriate accommodations as needed during instruction and assessment:
  - a. Extra time
  - b. Reduced work load
  - c. Material in alternative formats
  - d. Visual cues
  - e. Technological aids
  - f. Alternate activities

The 21st century is a time of rapid technological growth and social change. The school curriculum must, therefore, ensure that young people are well prepared for the challenges and opportunities that they will meet as adults in this century. The MoEYI is making every effort to provide for the multiple intelligences of our children and cater to their diverse needs in order to fully maximize their capabilities. Hence, the MoEYI has created alternative pathways to receiving an education at the secondary level.

Providing alternative pathways will be far-reaching in carrying out the Ministry's mantra, "Every child can learn....every child must learn". Learning pathways will allow for an inclusive approach in which instruction is based on tailored curricula, enabling each learner to perform to his/her fullest potential based on aptitude, interest and ability. Alternative Pathways represent a new approach to secondary education. Secondary education in Jamaica is being reframed and re-positioned as customised, diverse, relevant, equitable, outcomes-based, and inclusive; and significantly, this approach will signal the introduction of a seven year (Grades 7-13) period of instruction for students on all secondary pathways.

Goals of the APSE

• Design the school system to offer differentiated instructional programmes, informed by the National Standards Curriculum (NSC).

• Develop individualized intervention/learning plans based on students' performance profile.

• Provide special educators as Pathway Coaches to support subject teachers of students on Secondary Pathways II and III in the delivery of instruction.

• Facilitate a functional academic approach at the secondary level characterised by response to intervention (RtI) methodology, interactive, learner-centred, project-based and problem- based learning, reflection and alternative forms of assessment.

• Foster a system for ALL students to exit the secondary level with the knowledge, skills, competences and attitudes which will have them ready for the world of work or to access tertiary level education.

Secondary Pathways I, II & III (SP I, II & III)

All students will access secondary education via the prevailing Grade Six examination. The exit examination will provide individual profiles to inform decisions for pathway access and standards for differentiation.

SPI is a 7-year programme with a curriculum based on the constructivist approach. At Grades 7-9 students will access the National Standards Curriculum (NSC), and at Grades 10, 11, 12 & 13, they will access the curricula/syllabi of the examining body.

SP II is a 2-year transitional programme with a curriculum based on the constructivist approach. Special educators/pathway coaches will work with teachers and students on this pathway. Students will be provided the required intervention and support to allow for transition. At the end of Grade 8 students will be re-evaluated through psycho-educational evaluation to determine their readiness for crossing over into either SP I or SP III.

SP III is a 7-year programme with a curriculum based on the constructivist approach. At Grades 7-9 students will access the National Standards Curriculum (NSC), and at Grades 10 & 11, they will access the curricula/syllabi of the examining body. At the end of Grade 11 SP III students will transition into the Career Advancement Programme.

At Grades 7-9 the NSC, will be modified to meet the needs of the SP III students. Students in SP III will be instructed through a functional academics curriculum in the core subjects- Mathematics, English Language, Communication, Social Studies and Science. Their instruction will be further enriched with Personal Empowerment, Technical and Vocational instruction, as well as the performing and creative arts. Pathway Coaches will collaborate with subject teachers to prepare content, ensuring differentiation in instruction for students on SP II and III. These students will also be supported through use of the Response to Intervention (RtI) methodology.

PERSPECTIVES OF SCIENCE, TECHNOLOGY, ENGINEERING, MATHEMATICS & THE AESTHETICS (STEM/STEAM) IN RELATION TO THE NATIONAL STANDARD CURRICULUM (NSC)

INTRODUCTION & BACKGROUND

The integration of theoretical principles that relate to STEM/STEAM Education in the NSC began in June 2014. This move was influenced by recommendations of the STEM Steering Committee that emphasized the need to develop learners who are not just productive, but who would also be innovative Jamaicans. STEM integration was also regarded as one of the strategic long term means of addressing the economic challenges being faced by Jamaica using education as a primary vehicle for the implied transformational change to happen, beginning from short term efforts.

Initial discussions and deliberations promoted an emphasis on STEM rather than STEAM Education. However, critical analysis of the conversations conveyed the perspective of STEM as a collection of related disciplines that all learners should have the opportunity of pursuing, to develop the competencies they offer and as a consequence be able to gain employment or become employers in STEM related areas. As stakeholders from different backgrounds processed their understanding of STEM, new meanings of the concept emerged from the discussions. One was the perspective of STEM as a methodology. There was, however, concern about the exclusion of "A" in STEM. This "A" component however, brought to the discussion, multiple meanings. In some Aesthetics as a field and was considered an important component to be included if educators are serious about issues of discrimination, holistic learning and current research on the iterative function of the brain that warrants attention to brain based learning and the role of the Arts in promoting knowledge integration to cater to multiple domains of learning. There was also discontent about neglecting the Performing Arts when related creative industries contribute significantly to economic development. The concern was that the role of the Arts to economic development was being trivialized.

The call for the integration of the Aesthetics or Art forms became more pronounced as STEM took on more national significance. This was supported by research that indicates the importance of the Aesthetics in developing values and attitudes, in promoting holistic learning and in serving as drivers of innovations. By integrating principles from STEM with those from the Arts/Aesthetics, the approach to problem solving would encourage greater appreciation for and reliance on the interdependent nature of knowledge when science and arts intersect. Additionally, STEAM as a methodology encourages the harmonizing of the cognitive and the emotional domains in the problem-solving process.

The concept of STEAM was adopted in 2015, as an integrative approach to education and a methodology that pays attention to the benefits to be derived from the inclusion of the Arts or Aesthetics with STEM related principles. These collective benefits are supported by Jolly (2014), Sousa and Pilecki (2013) and include divergent thinking; differentiated learning; Arts integration; focus on intrinsic motivation and informed decision-making.

PERSPECTIVES OF STEM/STEAM IN THE CONTEXT OF THE NSC

In the context of the NSC, STEM/STEAM is used in a number of ways. These include:

STEM/STEAM as an integrative learning approach and methodology in facilitating learning. This perspective places emphasis on STEM/STEAM as a means of helping learners become creative or innovative problem solvers and lifelong learners who rely on scientific principles (laws and theories) to address issues/concerns or to deal with observed phenomenon that are puzzling for them or that inspire interest. As an approach, the focus is on solving problems based on principles. As methodology, the focus is on the system of practical procedures to be used to translate principles into the problem - solving processes or to choose from available problem- solving models.

STEM/STEAM as an Experiential-Vocational Learning Framework that is based on problem solving through the project-based approach. Emphasis is placed on solving real life problems in a context that requires learners and their facilitators to observe work-based principles. The primary purpose for this focus is for learners to: (i) become employable (ii) prepare for further education and/or for occupational or work readiness.

STEM as types of institutions in which learning is organized as a meta-discipline as described by Morrison and Bartlet (2009). Based on this perspective, STEM facilitates the demonstration of knowledge in a manner that removes the boundaries of each discipline for application to problem as would be practised in the real world.

IMPLICATIONS OF PERSPECTIVES OF STEM/STEAM IN LIGHT OF THE NSC

Since the NSC is based on Constructivism principles, STEM/STEAM as an approach and methodology, has to be established on post-positivistic thinking. From this position, STEM/STEAM influences the kind of practice that promotes collaboration, negotiation of meaning and openness to scrutiny.

The NSC developers selected a Constructivist approach that included the deliberation, designing and development stages of the curriculum process. Evidence of the influence of Constructivism can be seen the NSC Framework Document that conveys the following emphasis:

(i) **The element of objectives** is presented in two forms; firstly as **Learning Objective**s to focus attention on process and experience rather than product. Secondly as Learning Outcomes that serve as some of the outputs of the process. They include the basic understandings, skills and dispositions anticipated from learners' engagement in the planned experiences.

(ii) **The element of content** is treated as contexts for learners to think critically, solve problems creatively while developing their identity as Jamaicans. Content is not expected to be treated as disciplines to be mastered but as areas that contribute knowledge, skill sets and attitudes that form the composite of competencies to be acquired from their integration in the learning situations.

(iii) **The element of learning experiences (method)** is presented as a set of learning activities that serves as a source of problems to be addressed as a part of the learning process. These real-life activities provide the scope of knowledge, skills and required dispositions or character traits for learners to make sense of that aspect of life or the world that they represent. They are the threads that connect all the other elements of the curriculum and allow for the integration of STEM/STEAM in the following ways:

- Identification of activities that are presented as problems to be solved using the STEM/STEAM approach based on contextual factors that include the profile of the learner, the learning conditions and the anticipated impact.

- Integrating activities to form a real problem to be solved as a short, medium or long term project to which the project based learning would be applied.

- The examination of learning activities by learners and teachers as co-learners through multiplelenses using content of science, technology, mathematics and the humanities that they have already explored to engage in the problem identification and definition processes.

- Extending learning in the formal setting to the informal by connecting co-curricular initiatives that are STEM/STEAM based that learners are undertaking at the institutional level through clubs and societies, as whole school projects or in partner ship with external stakeholders.

- Using the learning activities to review STEM/STEAM initiatives that form a part of the informal curriculum to and for reflection on action.

- Using activities as springboards for reflecting on career or occupational interest in STEM/STEAM related areas.

(iv) The element of evaluation is communicated in two major ways; firstly as prior learning which serves diagnostic purpose and secondly as an on-going developmental process. This formative focus is indicated by the inclusion of explicitly stated assessment criteria that are to be used alongside the learning activities. The use of assessment criteria as counterparts of the learning activities also indicates that assessment is learner centred since it is serving developmental rather than promotional purpose and as a consequence, allows learners to self-correct as they use feedback to develop feed-forward capabilities. Evidence of learning, based on the learning outcomes, can be collected from various types of assessment methods that emphasize the learner centred constructivist orientation. This brings to the fore the need for serious consideration to be given to differentiation in assessment for fairness and credibility of claims about learners' capabilities and to inform decisions that will impact their educational journey.

In general, this integrated approach, which is the context of STEAM, is aimed at improving the quality of the educational experience for learners while influencing the achievement of the aims of education that relate to productivity and creativity as part of the profile of the Jamaican learner.

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The 5Es Overview: "The 5E Learning Cycle"

What is a 5E Learning Cycle?

This model describes an approach for facilitating learning that can be used for entire programmes, specific units and individual lessons. The NSC supports the 5E constructivist learning cycle, as it places emphasis on the processes that may be used to help students to be personally involved in the learning situation as they are guided to build their own understandings from experiences and new ideas.
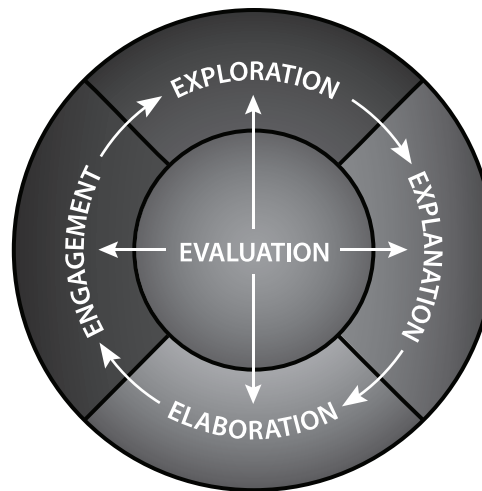
5E Instructional Model

Figure 1. Illustrating one version of the 5E model that conveys the role of valuation as an interconnecting process that is at the core of the learning experience.

Figure 2, illustrating a cyclical perspective of the model with each process being given similar emphasis in contributing to the learning experience on a whole.

EXPLANATION OF THE INSTRUCTIONAL MODEL

What are the 5Es?
The 5Es represent five key interrelated processes that provide the kind of learning experiences for learners to experience the curriculum or planned learning episodes: Engage, Explore, Explain, Extend (or Elaborate), and **Evaluate**.

ENGAGE: The purpose of the ENGAGEMENT dimension is to help students to be ready intellectually, socially, emotionally etc. for the session. Attention is given to the students' interests and to getting them personally involved in the lesson, while pre-assessing prior understandings, attitudes and/or skills. During the experience, students first encounter and identify the instructional task and their roles and responsibilities. During the ENGAGEMENT activity, students make connections between past and present learning experiences, setting the organizational groundwork for upcoming activities. The engagement activity may be used to (a) help student unearth prior knowledge (b) arouse their curiosity (c) encourage students to ask questions as a sign that they have wonderments or are puzzled.

EXPLORE: The purpose of the EXPLORATION dimension is to get students involved in solving a real problem that is based on a selected context. EXPLORATION provides them with a chance to build their own understanding of the phenomenon being investigated and the attitude and skills involved for arriving at a workable solution. In exploring the students have the opportunity to get directly involved with the phenomenon and materials. As they work together in learning teams or independently, the need to share and communicate becomes necessary from the experiences. The teacher functions as a facilitator, providing materials, guarding against obstacles to learning and guiding the students to operate based on agreements. The students become inquirers and co-owners of the learning process. In exploring, they also ask questions, formulate hypothesis, search for answers or information/ data, reflect with others, test their own predictions and draw conclusions.

EXPLAIN: The purpose of the EXPLANATORY dimension is to provide students with an opportunity to assess their thinking and to use intellectual standards as critical thinkers to communicate their perspectives and/or the meaning of the experiences. They rely on communication tools and their skills as Language users to: (a) organize their thoughts so that they are clear, relevant, significant, fair, accurate etc. (b) validate or affirm others (c) self-motivate. Reflection also occurs during the process and may cause students to adjust their perspective or justify their claims and summarise the lessons being learned. Providing explanations contributes to vocabulary building and self-corrective actions to deal with misconceptions that they become aware of from feedback of their peers and/or their facilitator.

EXTEND: The purpose of this dimension is to allow students to use their new knowledge and continue to explore its significance and implications. Students work independently or with others to expand on the concepts and principles they have learned, make connections to other related concepts and principles within and/or across disciplines, and apply their understandings in new ways to unfamiliar situations.

EVALUATE: The purpose of the EVALUATION dimension is for both students and facilitator to determine progress being made or the extent to which learning has taken place based on the stated objectives or emergent objectives. EVALUATION is treated primarily as an on-going diagnostic and developmental process that allows the learner to become aware of gaps to be treated and progress made from their efforts to acquire the competencies that were the focus of the session. Examples of competencies include understanding of concepts, principles and processes and demonstrating various skills. Evaluation and assessment can occur at different points during the learning episode. Some of the tools that assist in this diagnostic and formative process include rubrics, teacher observation log, self-inventories, peer critique, student interviews, reflective presentations, displays/expositions,

portfolios, performances, project and problem-based learning products. Analysis of reflections, video recordings are useful in helping students to determine the depth of their thinking and understanding and the objectives they have or have not achieved.

Who developed the 5E model?

The Biological Science Curriculum Study (BSCS), a team led by Principal Investigator Roger Bybee, developed the instructional model for constructivism, called the "Five Es".

The Link between the 5E model and Types of Learning Activities

The five (5) types of Learning Activities purported by Yelon (1996) can be integrated with the 5E's so as to enrich the teaching and learning process. He noted that every instructional plan should include the following learning activities

1. Motivation Activities: Intended to help learners to be ready for the session

2. Orientation Activities: Inform students of their roles and responsibilities based the purpose or objectives of a learning episode.

3. Information Activities: Allow students to manipulate current knowledge, access/retrieve and generate new ideas

4. Application Activities: Allow for the use of knowledge and skills in novel situations

5. Evaluation Activities: Allow for reflection, corrective actions and sourcing of evidence to confirm/refute claims about learning.

These activities can be planned to serve one of the purposes of each dimension of the 5E model. For example, ENGAGEMENT may be comprised a Motivation Activity and an Orientation Activity. EXPLORATION and EXPLANATION require an Information Activity, while EXTEND requires an Application Activity. EVALUATION requires the kind of activity that will contribute to the collection of data for assessing and arriving at a conclusion about performance based on stated or expected purpose for which learning is being facilitated.
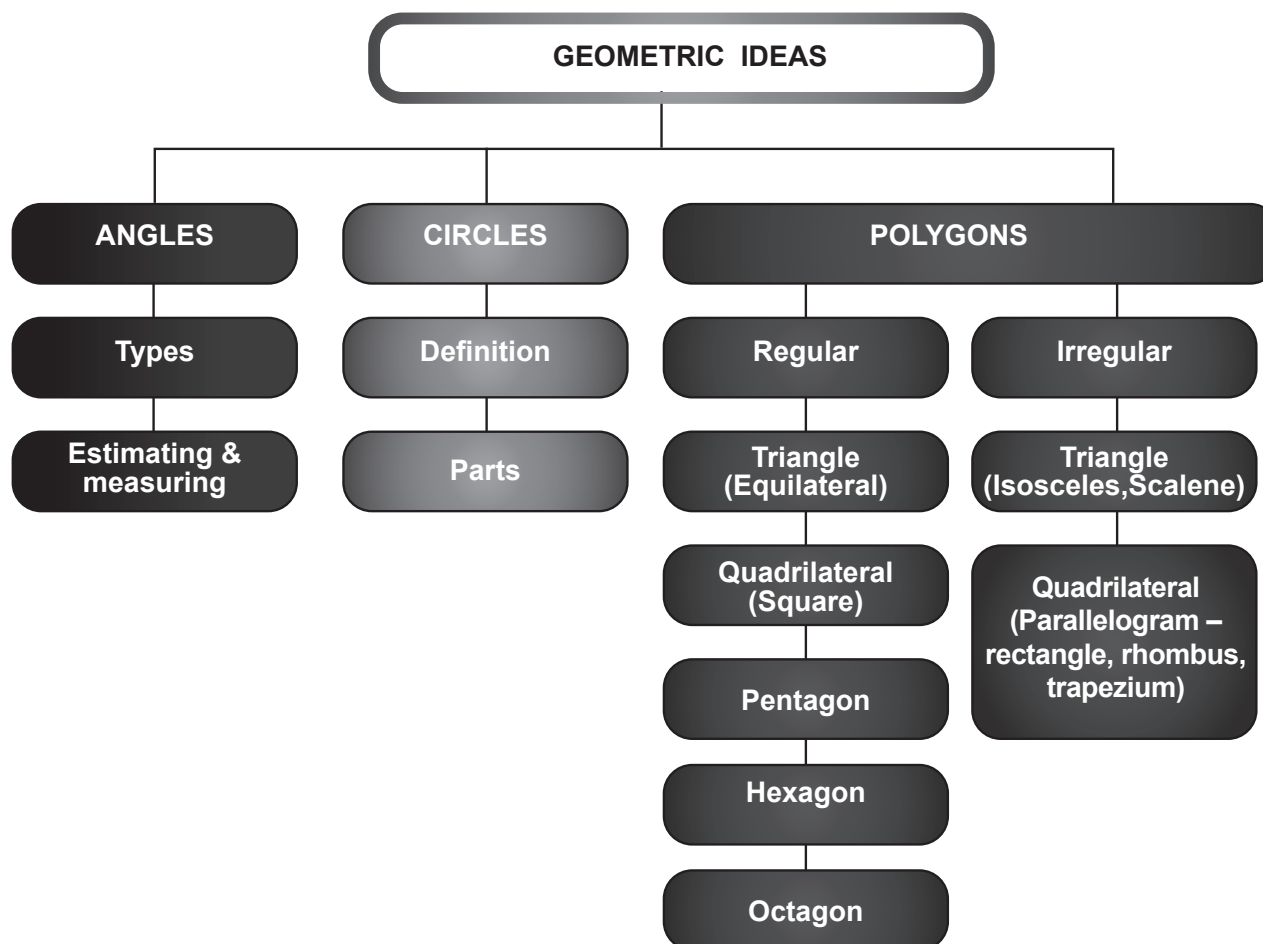
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LESSON PLAN OVERVIEW

As the demand for competence in Mathematics continues to increase, new and novel ways are used to ensure that much learning is taking place. This unit is designed to help pupils in Grade 7 to have a deeper understanding and appreciation of Geometry. They will be given the opportunity to learn about angles, circles and polygons. They will see how these shapes are used in everyday life and will be given the chance to create and know the salient properties of these shapes.

They will also engage in activities that will make learning more enjoyable, permanent and memorable. The strategies, structures and techniques used throughout the lessons will only seek to enrich their learning. Webb's Depth of Knowledge , Gardener's learning styles as well as questioning will be used to stimulate critical thinking among these learners.

ADVANCE ORGANIZER

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                          GEOMETRIC  IDEAS
   ┌──────────────┬──────────────┬──────────────────────────┐
 ANGLES          CIRCLES                POLYGONS
   │                │          ┌──────────────┬──────────────┐
 Types          Definition    Regular        Irregular
   │                │             │              │
Estimating &      Parts       Triangle       Triangle
measuring                    (Equilateral)  (Isosceles,Scalene)
                                 │              │
                             Quadrilateral   Quadrilateral
                             (Square)        (Parallelogram –
                                 │            rectangle, rhombus,
                             Pentagon         trapezium)
                                 │
                             Hexagon
                                 │
                             Octagon
```

LESSON PLAN

The following levels of practice (strategies, structures and techniques) are used throughout the unit to get responses from students.

Structures:

Random call	Voting
Turn –to-your-neighbour and share	Corners
K-W-L	Continuum
Ranking	Either/or
Three minute pause	Question and answer pairs
Writing pair	Think- pair -share
Think-pair-square	Think-square-share
Rally table	Roundtable
T-chart	Mix-n-match
Round robin	Numbered heads
Fold-the -line	People hunt
Team building	Venn diagram
To-tell-the-truth	Discussion pairs

Strategies:

Jigsaw	Cooperative learning
Group jigsaw	Discovery/Active learning
Mnemonic device	Nonlinguistic representation

Techniques

Getting students' attention	Greeting students
Introducing rules	Taking role quickly
Praise the deed	Encouraging students
Forming groups	Introducing social skills
Setting basic routines	Posting assignment
Teambuilding task	Class building task

ASSESSMENT PLAN

This unit is based on students' learning and mastering basic geometric ideas. Students will learn through the three levels of practice:

a) Strategies

b) Structures

c) Techniques

Grading in this class is based on mastery. This means that the students are able to complete assignments as time permits. They should meet required expectations. All assignments must be done. No points will be given for incomplete assignments, or for assignments that are poorly done. The following grading system will be applied:

95—100%	A	75—79%	B-
90—94%	A-	70—74%	C+
85—89%	B+	65—69%	C
80—84%	B	60—64%	C-

Below 60%-- not passing

Points will be given for the following areas:
    Punctuality ……….10

Assignments………20
Participation………10
Quest………………20
Final exam (portfolio)…40

Lessons	Content	Structures	Strategies	Techniques	DOK	Multiple intelligences
1	Introduction	• Team building • Think- pair= share • Turn -to -your neighbour • T-chart	Mnemonics (keyword)	• Greet students • Praise the deed • Introduce rules • Get students' attention	Levels 1,2	• Verbal/linguistic • Interpersonal • Intra
2	Angles	• Question and answer pair • Think-square- share • Three minute pause	Discovery/active learning	• Post assignment	Levels 1,2	• Mathematical • Kinaesthetic • Interpersonal • Intrapersonal • Verbal/linguistic
3	Circles	• Mix-n-match • Think-pair-share • Roundtable • Turn-to-your-neighbour • Class building • People Hunt • Note taking • Think-pair-square-share	Discovery/Active learning Mnemonics		Levels 1,2,3	• Spatial • Mathematical • Verbal/linguistic
4	Polygons	• Either/or • Turn-to-your-neighbour • Rally table • K-W-L • Think-square-share • Sequencing • Round robin • Question and answer pair	Group jigsaw	• Pictorial representation	Levels 3,4	• Verbal/linguistic • Spatial • Interpersonal • Intrapersonal • Mathematical
5	Polygons	• T-chart • Ranking corners • Continuum • Think aloud • Three minute pause • Voting • Venn diagram • Numbered heads • Bar graph		• Shaping • Internalising	Levels 2,3	• Interpersonal • Intrapersonal • Spatial • Mathematical

PREREQUISITES

All students should have mastered the following objectives before starting this unit.

1)   Differentiate between the concepts of point, space, curved/horizontal/vertical/oblique

lines or line segments.

2)   Differentiate between models of parallel and perpendicular line segments when drawn or seen in the environment.

The teacher may administer a diagnostic test to see if the students attained these objectives.

LESSON 1

GOALS

- To provide students with an environment which is conducive to learn.
- To create a culture that supports and encourages collaboration.

OBJECTIVES

- Discuss class rules and assign responsibility.
- Form cooperative learning groups.
- Identify and practice social skills
- Discuss the importance of equal participation.
- Discuss the learning outcomes.

(STEP BY STEP)

1. Welcome students to the class.

2. Have devotion. Sing the song "I love the thrill that we feel when we get together with God's wonderful people."

Offer a word of prayer,

3. Introduce rules:

a) When I raise my hand, this signifies that I need your attention. You too need to raise your hand to indicate that you notice me.

b) All students must participate in the lesson.

c) Listen to what others have to say.

d) Respect others and their ideas.

e) Take your responsibility seriously.

f) Stick to the task at hand.

g) Use **jargon card** when you need an explanation for a term/concept

h) Use **question card** when you have a question

3. Group students in cooperating groups of four/five and assign responsibility.
Roles may change daily, weekly or monthly.

> **Roles**
> - Facilitator
> - Recorder
> - Manager
> - Clerk

5. **Team building** activity

- Choose a name for your team
- Choose a team address
- Create a logo for your team
- Devise a way for greeting and farewell
- Select/create a team song
- Choose individual names

6. Discuss the social skills needed for cooperative groups to function effectively. (Use think-pair- share, Random card)

7. Students examine the following quotation:

"One man can be a crucial ingredient on a team, but one man cannot make a team."

Individuals think about it, select a keyword, then use turn –to –your –neighbour and share their word and give reasons for selection.

8. Students discuss in their groups what participation looks like and sounds like. Use the T- Chart to display the responses. (Random call, praise the deed)

9. Students peruse the assignment sheet and the assessment criteria. Use jigsaw-
- Divide the material into equal parts.
- Distribute the information. In each separate group; each individual assigns one part of the information. (Use clerk to distribute the material)
- Individual student work

a) Each student reads his or her information.

b) The student decides on the 3-5 most important details to learn from his material: and

c) The individual student decides the best way to teach this information to the cooperate groups.

d) Students teach. Each student has an assigned amount of time to present the information.

e) The assessment — teacher uses questioning and random card call to assess the learning

10. Individual students will **journal**.
- What went well?
- What could be improved?
- Write question or comment you may have.

LESSON 2

GOALS
- Identify formation of angles.
- Estimate and measure various angles.
- Participate in selected teaching structures and strategies.

OBJECTIVES
- Formulate a definition for an angle
- Name the various parts of an angle
- Classify angles as right, acute, obtuse or reflex
- Manipulate angle marker transparency
- Estimate the size of given angles
- Use protractors to measure angles
- Participate in a number of teaching structures and strategies.
- Discuss the learning outcomes.

1,) Teacher welcomes students to the class.

2.) The teacher reminds students of the rules.

    a) When I raise my hand, this signifies that I need your attention. You too need to raise your hand to indicate that you notice me.

    b) All students must participate in the lesson.

    c) Listen to what others have to say.

    d) Respect others and their ideas.

    e) Take your responsibility seriously.

    f) Stick to the task at hand.

    g) Use jargon card when you need an explanation to a term/concept

    h) Use question card when you have a question

3.) We will be looking at angles today. Examine the diagrams given (see Figure 1 in the appendix). Answer the question: What is an angle? (Use question and answer pair—

    Step1. Ask the question.

    Step2. Each member of the pair develops an answer individually.

    Step 3. Both discuss answers by taking turns.

    Step 4. Each listens to partner, comparing answers.

    Step 5. Pair synthesizes by preparing a composite response that utilizes ideas from both answers.

    Step 6. Share responses (use random call cards)

4.) Teacher will use discovery method for students to explore the parts of an angle. Students will use a mnemonic device (association) to assist them in learning the parts of the angle. (Use think-square-share.) The parts of the angle are the sides (the rays) and the vertex (common endpoint).

5.) The teacher presents the poem " Angles", teacher asks the students to read the poem and identify interesting and important aspects of the poem. The teacher pauses instruction. Students pair and follow the instruction. The teacher uses random call cards to solicit answers from two or more students. Teacher resumes the instruction by asking students to identify confusions and try to clear them up. (Three minutes pause)

6.) Students use transparent angle marker to show angles specified by teacher. Individuals think about their answers. In pairs, students discuss their ideas with a partner of their team. Pairs alternatively report to each other. (Rally table) Students share with the whole class. (Use random call card)

7.) Students are given individual worksheet with various size angles. They are to name the angles, estimate the measure and then use a protractor to measure them. (Use think –square-share)

8.) Post assignment: Paste pictures depicting angle in the environment in your portfolio. Describe the angles and explain how to estimate and measure these angles,

9.) Journal

- What went well?
- What could be improved?

Write question or comment you may have.

LESSON 3

GOALS

- Make students aware of the various parts of a circle.
- Participate in selected teaching structures and strategies.

OBJECTIVES

- Create a definition of the circle.
- Identify parts of the circle.
- Describe the various parts of the circle.
- Distinguish between the diameter and the chord..
- Create a mnemonic device to remember the parts of the circle.
- Use circles to create a design.
- Participate in a number of teaching structures and strategies.
- Assess the content and process of the lesson.

STEP-BY STEP

1. Welcome students to class.
2. The teacher reminds students of the rules.
   a) When I raise my hand, this signifies that I need your attention. You too need to raise your hand to indicate that you notice me.
   b) All students must participate in the lesson.

      c) Listen to what others have to say.

      d) Respect others and their ideas.

      e) Take your responsibility seriously.

      f) Stick to the task at hand.

      g) Use jargon card when you need an explanation for a term/concept

      h) Use question card when you have a question.

3. Today our first activity will be a Mix & match.

4. Students choose a strip of paper with a quotation about parts of a circle.

The nature of God is a circle of/ which the centre is everywhere/ and the circumference is nowhere (Empedocles)

5. Do a Mix & match.

6. Select a keyword and make a connection from the quote. Use think- pair –share.

7. Use roundtable to answer the question "What is a circle?"

   • The teacher poses the question.

   • The first student in each group writes a response and passes the paper to the second student.

   • The second student writes a response on the same paper and passes it to the next student.

   • The process continues around the table.

   • All this is done without students talking to each other. (the teacher uses random call cards to solicit students' answers)

8. Given a circle each, teacher demonstrates selected parts of the circle through paper folding. Students practice the skills for self. (Direct instruction with mastery learning)

9. In pairs students participate in note taking. One pair taking their own notes whiles the other fill in the blanks as the teacher and students read the passage. Use jargon /question cards when needed

10. Turn to your neighbour and discuss the differences between the chord and the diameter. (Round robin)

11. Use mnemonic devices to develop a way to remember the parts of the circle discussed. Use Think –pair-square-share for this activity.

12. The group makes the presentation. Everyone must participate.

13. Class building activity-People Hunt-Questions are based on the angles and the circle. (Assessment)

14. Draw or take photographs of hubcap designs that can be found on cars and trucks. Paste the drawings/ photographs in their portfolio. Identify the geometric shapes they see. Create own hubcap designs. Use colours of their choice in the designs. (Assignment.)

15. Journal

16. Closure – Watch the video "10 Amazing Crop Circles that have left authorities stunned".

GOALS

1. Make participants aware of polygons
2. Participate in selected teaching structures and strategies.

OBJECTIVES

1. Identify polygons.
2. Determine if a figure is a polygon.
3. Formulate a definition for polygons
4. Investigate the properties of a selected polygon
5. Discuss how polygons are used in everyday situations.
6. Participate in a number of teaching structures and strategies.
7. Assess the content and process of the lesson

STEP-BY STEP

1. Welcome students to class.

2. Remind students of the classroom rules.

    a) When I raise my hand, this signifies that I need your attention. You too need to raise your hand to indicate that you notice me.

    b) All students must participate in the lesson.

    c) Listen to what others have to say.

    d) Respect others and their ideas.

    e) Take your responsibility seriously.

    f) Stick to the task at hand.

    g) Use jargon card when you need an explanation to a term/concept

    h) Use question card when you have a question.

3.This afternoon our first activity will be an either/or

Which shape reminds you of your relationship with God, a triangle or a square?

(Turn –to –your neighbour; rally table)

4. We are going to use the K-W-L structure to find out what you know about polygons, what you want to know and at the end of the lesson what you have learnt

5. Today we will be looking at a special set of shapes called polygons. Examine the set on your desk to answer the question, "What are polygons?" (Literal) (Use think- square- share)

6. We will use the jigsaw structure to learn about the characteristics of polygons. Each person will learn the material well so as to teach the others who have not read the material. Use   sequencing to present your report to the class.

7. Have discussion on how polygons are used in art. (Creative)(Round robin

8. Answer the following questions (use question and answer pair)
   - What characteristics do the polygons share? (Analysis)
   - How do the polygons differ from the figures that are not? (Analysis)
   - Why are some polygons more popular than others? (Evaluation)
   - What solutions would you suggest for building durable bridges in Jamaica (synthesis)

9. Use three (3) polygons of your choice to create a picture to remind you of what polygons are. (Pictorial representation)
10. Complete the K-W-L chart. (Random call).
11. Sketch the shape of different kinds of dwellings (tents, tepees, hogans, igloos, etc.). List the names of the geometric shapes in each. (Assessment)
12. Journal
13. Closure

GOALS

- Make participants aware of the various types of polygons
- Participate in selected teaching structures and strategies.

OBJECTIVES

- Identify triangles, quadrilaterals, pentagons, hexagons and octagons.
- Classify each figure as a triangle, quadrilateral, pentagon, hexagon or an octagon.
- Cut up polygonals into triangles
- Construct a rocket using rectangles and triangles.
- Discuss how triangles are used in every life.
- Participate in a number of teaching structures and strategies.
- Assess the content and process of the lesson

STEP-BY STEP

1. Welcome each student.

2. Remind students of the classroom rules.

3. Students use a pie chart to show the contribution of each team member.

4. Use T-chart to discuss what collaboration looks like/sounds like. Use random card call to let students put the information on the chart.

5. Examine yourself. How do you view your relationship with your best friend?

     -----As a square

     -----As a rectangle

     -----As a triangle

     -----As a pentagon

      (Ranking and corners)

6. Poly means many. How do you view true friendship?

     o One person staying by himself or herself.

     o Two or three persons coming together.

     o Many people coming together. (Continuum).

7. Examine various geometric shapes to see the number of triangles can be found within its plane

8. Cut squares into smaller pieces and then arranges them to make a rocket. (Think-aloud –

9. constructing model, shaping –point out common errors, internalising-speed variation).

10. We will use the three-minute pause to learn more about types of polygons.
    o Students listen to the story "The Bermuda Triangle".
    o In pairs write three interesting/important points about the Bermuda Triangle.
    o Share what they have written (random card call)

11. Students respond to the following statement:
    All parallelograms are quadrilaterals (use voting)

12. Use the Venn diagram to examine the relationship between a bicycle frame and geometric shapes.
(Circles, line segments, angles) Random call.

13. Answer the following questions

a) Name the polygon that has 5 sides.

b) True or false. All squares are rectangles. (Numbered heads)

14. Find out the favourite shape of each student in the class. Use bar graph to show your findings.

Group jigsaw
    o Divide the information to be presented in the number of organized cooperative groups
    o Assign each cooperative group one part of the information
    o Each cooperative group reads their information and decide on the 3-5 most important details to learn.
    o Decide on the best way to share the information with the class.
    o All group members present the information.

15. Play tournament.

16. (Assignment). Explore traffic signs. Draw at least two examples of signs with the following polygonal shapes

1. Triangle   2.quadrilateral   3. pentagon   4. Octagon   5.hexagon

ANGLES

THESE ARE:

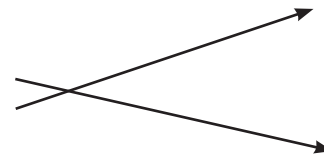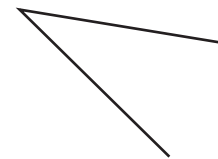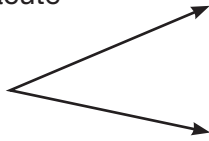**ANGLES**   **NOT ANGLES**

ANGLES
(UNKNOWN)

Angles are made,
When two lines meet,
Their size depends on direction…
They have different values,
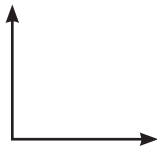Read in degrees, but all angles have a degree of perfection.
This angle's acute

I'm acute

This one is obtuse,

I'm obtuse

And this one is 90 degrees,

I'm Mr. Right

While the acute one's so small,

The obtuse one will fall,

He bends back like trees in a breeze….

And then you will find,

 Old Mr. Right,

Its' 90 degrees- let's swim!!!

He stands up so straight,

Where his lines intersect,

Like tennis court lines at the gym.

Well angles can't angle,

Which means they can't fish,

And an angle can't grant you a wish…

And angles aren't ANGELS,

Or witches or ghosts,

And they can't be served as a dish…

Yet, there are all sorts of angle

For all sorts of needs,

Like there are all sorts of dogs, of all sorts of breeds…

We're surrounded by angles'

And I think it'd be found, that without all these angles

Life would feel really round…

WORKSHEET #2

Use a protractor to measure the angles below.

Classify each angle. Choose right, acute, obtuse, or reflex angle.

a)

b)

c)

d)

e)
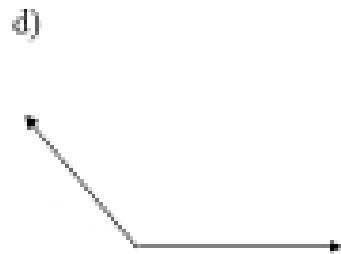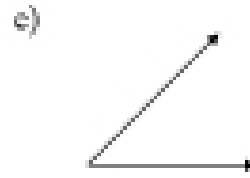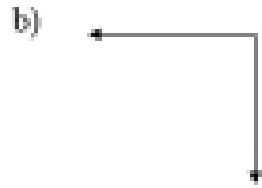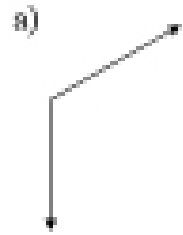
PEOPLE HUNT

A Class Building Activity

Find someone who…	Name
1.Keeps a journal	
2.Loves to read	
3.Can list the parts of the circle	
4. Can name the shape of the stop sign	
5.Knows how many degrees in a right angle	
6. Can describes an angle	
7. Can name the instrument used to measure angles	
8. Can name the angle that measures less than 90 degrees	
9.Can name a quadrilateral that has no right angl	
10.Can give the plural of	

ROCKET DISCOVERY

Students learn how to cut a square into smaller pieces and rearrange the pieces to make a rocket.
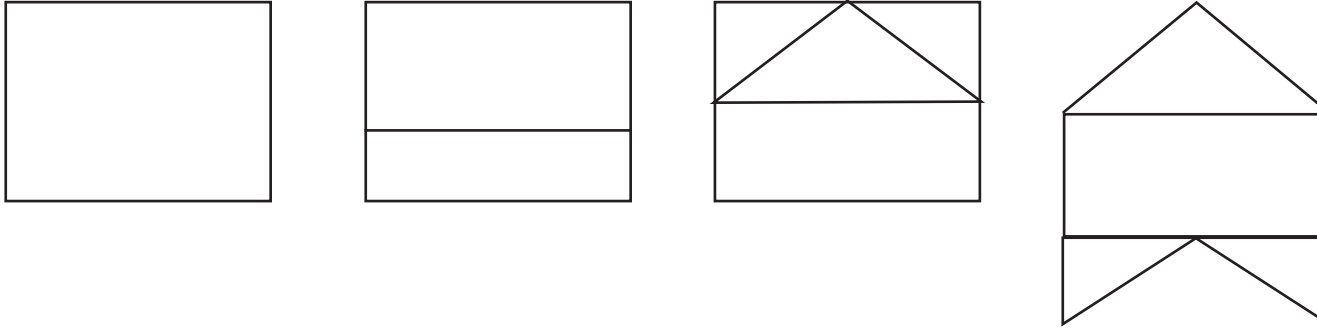
BERMUDA TRIANGLE FACTS

1. A triangular region
2. Located in the North Atlantic Ocean
3. Bounded by Miami, Bermuda and Puerto Rico
4. Known for its paranormal activities… disappearance of aeroplanes and ships
5. Also known as "the Devil's triangle"
6. A similar area known as 'The Devil's Sea, located in the Pacific Ocean
7. The lost city….Atlantis is also linked to the Bermuda triangle.

Portfolio

Name_____

Date_____

	Required	Included	Comments
Table of content			
Letter from student • Explanation of the content • Reason for selection			
Excerpt from journal			
Angles in the environment			
Draw or take photographs of hubcap designs			
Sketch the shape of different kinds of dwellings			
Explore traffic signs			
Display of some arrangements of four different coloured right –angled isosceles triangles Subject-area connection			
Corrected or revised homework, quiz, or class work			
Favourite geometry problem			
An essay/song/poem/jingle on geometry			
Use tangrams to create fun shapes…people, animals, buildings			