



**REPUBLIC OF TRINIDAD AND TOBAGO
MINISTRY OF EDUCATION**

**SECONDARY EDUCATION MODERNIZATION
PROGRAMME**

DRAFT

SECONDARY SCHOOL CURRICULUM

Form Three

Mathematics

Curriculum Development Division

October 2003

TABLE OF CONTENTS

About this Draft	i
Foreword – A Note to Teachers	iii
Acknowledgements	v
PART ONE	
Introduction	1- 1
The Curriculum Underpinnings	1- 2
Philosophy of Education	1- 3
The Goals of Education	1- 5
The Essential Learning Outcomes	1- 6
The Curriculum Design and Development Process	1-11
PART TWO - CURRICULUM CONTENT	
Vision Statement	2- 2
Rationale for the Teaching and Learning of Mathematics	2- 3
Goals of the Mathematics Curriculum	2- 4
General Intended Outcomes For Forms I, II, and III.	2- 5
Connections to Other Core Curriculum Areas	2- 6
Framework for Mathematics for Forms I, II and III	2- 9
A General Curriculum Framework	2-11
Course Outline for Form III	2-12
PART THREE - STRATEGIES/METHODOLOGIES	
Teaching and Learning Strategies	3- 2
Suggested Activities	3- 6
Suggested Resources	3-15

PART FOUR - EVALUATION

Elaboration of Assessment and Evaluation 4- 2

Evaluation Tools and Strategies 4- 5

Cross-referencing to Teachers' Guide 4- 7

BIBLIOGRAPHY 4- 9

ABOUT THIS DRAFT

Under the umbrella of the Secondary Education Modernization Programme (SEMP), since the latter part of 1999, new secondary school curricula in eight (8) subjects – Language Arts (English), Science, Mathematics, Social Studies, Spanish, Physical Education, Visual and Performing Arts and Technology Education – have been in development. In this publication you will find the first drafts of the Form III curriculum guide produced for each of the above identified subject areas.

These Curriculum Guides represent ‘a work in progress’. They are not the finished product. They intended to serve the following purposes:

- (i) provide clear guidance to teachers for implementing effectively the instructional programme for a particular subject area at a particular class/form level.
- (ii) present a sufficiently detailed learning plan for the respective subject areas and for the entire secondary school curriculum that would enable teachers, school administrators and other major stakeholders to give meaningful, constructive feedback on the draft curricula for the various subjects – that is, for them to be actively involved in the development process.
- (iii) contribute to the further revision and refinement, through the feedback received at (ii) above, of this draft curriculum guide for Form III.

Teachers and other users of these Curriculum Guides should also carefully note the following:

- Teachers’ Guides, Performance Standards, Assessment Manuals, Integration Matrices (linking content and essential learning outcomes in the relevant subject areas) are being developed and are in various stages of completion as companion documents to these Curriculum Guides. Accordingly, teachers and other users of these Draft Curricula can be assured that only certain areas, which may be interpreted as showing a lack of clarity, detail and/or adequate treatment, will be adequately addressed in the forthcoming above-mentioned companion documents.
- A series of orientation meetings and training workshops related to the effective implementation of the curriculum is being planned. At these workshops/meetings the concerns of teachers will be addressed and guidance given with respect to the interpretation/clarification of certain aspects of these draft Guides.
- These first draft publications of the respective Curriculum Guides have been issued in ring binders. This mode of presentation will facilitate correction of existing typographical errors, standardization of font sizes, formatting, layout etc, as well as the revision/refinement of the subsequent drafts – which will inevitably ensue from feedback/comments on these draft documents.

Finally, we hold the view that teachers, in particular, but other stakeholders as well, are key players in the curriculum development process. Teachers are integral to the development of curricula that are relevant and appropriate. The curriculum is the major vehicle for providing quality education, which meets the needs of both the individual learner and the national development objectives of the Republic of Trinidad and Tobago. In this regard, we eagerly look forward to and indeed welcome the comments/suggestions of all stakeholders, especially teachers, which should be addressed to:

Director, Curriculum Development
Rudranath Capildeo Learning Resource Centre
Mc Bean, Couva

Tel/fax: 636-9296
e-mail: curriculum@tstt.net.tt

A Note to Teachers

The Ministry of Education through the Secondary Education Modernization Programme is seeking to reform the secondary education system. These draft National Curriculum Guides produced for eight subject areas are a key element in the current thrust to address the deficiencies identified in the system.

Draft curriculum guides have already been produced for years one and two of the secondary system. Implementation of the new curriculum began on a phased basis in September 2003. These draft guides for year three represent the conclusion of the first cycle of secondary school and together with those of years one and two prepare students for the National Certificate of Secondary Education, Part One.

The three sets of curriculum guides constitute the draft National Curriculum for the lower secondary school system. The National Curriculum is an important element of the School Curriculum which comprises all the learning and other experiences that each school plans for its pupils. It is expected that each school will undertake to develop the School Curriculum in alignment with the National Curriculum, fine tuning as necessary in response to the needs of their pupils and to the community.

Teachers too have curriculum functions to perform. Using the National Curriculum Guides they are expected to develop instructional programmes, determining the type and extent of curriculum integration and the teaching and assessment strategies to be employed to facilitate student success. They will also identify and develop appropriate learning materials and decide on how the curriculum will be individualized to suit students' capabilities, needs and interests.

The introduction of the new curriculum guides for forms one to three is being accompanied by several supporting initiatives. These include the

- phased technical upgrade of physical facilities
- provision of enhanced teaching and learning resources including textbooks
- increased use of educational technology
- introduction of a curriculum website at *www.curriculum.gov.tt*
- professional development opportunities for teachers, heads of departments, principals and vice-principals
- expanded schools transportation and meals programmes
- restructuring and decentralization of the education system.

As implementation proceeds, there will be careful monitoring to obtain feedback and to provide necessary support. Your comments and suggestions are most welcome and may be made on the website or in writing. Final revision of the draft guides is planned for the academic year 2005-2006.

We are confident that this new curriculum will significantly enhance teaching and learning experiences in our secondary schools and consequently the achievement of the national educational goals.

Sharon Mangroo

Director, Curriculum Development (Ag)

December, 2003

ACKNOWLEDGEMENTS

The Ministry of Education wishes to express its sincere appreciation to all those who contributed to the curriculum development process.

The Coordinating Unit of the Secondary Education Modernization Programme (SEMPCU) assisted in planning, facilitating, organizing and coordinating the various exercises in addition to providing technical assistance.

Special thanks to

- Mr. Maurice Chin Aleong, Programme Coordinator, Dr. Stephen Joseph, Assistant Programme Coordinator, Quality Improvement and Mrs. Patricia Sealy and Mrs. Renée Figuera, Education Specialists
- Mr. Lloyd Pujadas, Director, Curriculum Development and leader of the SEMP Curriculum Development sub-component who led the year three activities
- Dr. Robert Sargent, International Consultant of Mount St. Vincent University who guided the process
- The principals who generously released teachers to participate in the curriculum writing process
- The administrative staff of the Curriculum Development Division who typed and retyped the documents
- The Division of Educational Services which printed early drafts for circulation
- Mrs. Marie Abraham, Editor who contributed her time, energy and knowledge to the editing of these documents
- The Curriculum Officers and members of the Curriculum Writing Teams brought their knowledge, skills and practical experience of teaching and learning to the curriculum development process. Members of the writing team for this subject are listed below.

The Members of Curriculum Writing Team for this subject are:

NAME	SCHOOL/INSTITUTION
1. Karen M. Beekee	Siparia Senior Comprehensive
2. Shereen Khan	Curriculum Officer
3. Steven Khan	Presentation College, San Fernando

4.	Amanda Miller	Penal Junior Secondary
5.	Don Naranjit	Curriculum Officer
6.	Yvonne Ramsey	Curriculum Officer
7.	John Roopchan	Curriculum Officer
8.	Steve Warner	Waterloo High School

PART ONE

INTRODUCTION

In its commitment to a comprehensive reform and expansion of the secondary school system, the Government of the Republic of Trinidad and Tobago in 1996, adopted the report of the National Task Force on Education as educational policy. The specific recommendations for the improvement of secondary education led to discussions with the Inter American Development Bank (IADB) for loan funding arrangements for a programme to modernise secondary education in Trinidad and Tobago. This programme, the Secondary Education Modernization Programme (SEMP) was formalized and has been designed to:

- address deficiencies identified in the education system;
- establish a firm secondary education foundation that would catapult Trinidad and Tobago into the 21st century assured of its ability to participate advantageously in the global economic village, smoothly traverse the information super highway and utilize cutting edge technology for the competitive advantage it provides;
- allow for adaptation to future demands; and
- produce good citizens.

The deficiencies identified include:

- an unacceptably low level of academic achievement;
- unsatisfactory personal and social development outcomes: and
- curricular arrangements whose major outcomes were linked to the attainment of a minimum of five General passes in the Caribbean Examinations Council (CXC) examination.

The Secondary Education Modernization Programme (SEMP) consists of four articulated components:

- (a) improved educational equity and quality
- (b) deshifting, rehabilitation, and upgrading of school infrastructure

- (c) institutional strengthening, and
- (d) studies and measures for improved sector performance.

This document is evidence of the effort to address component (a) under which curriculum development falls.

THE CURRICULUM UNDERPINNINGS

This curriculum has been informed by the wealth of available curriculum theories and processes. In the Final Report of the Curriculum Development Sub-Component submitted by J. Reece and K. Seepersad, the curriculum is defined, as a “plan for action” or a “written document that included strategies for achieving desired goals or ends.” This is the definition that is applied here. The curriculum is herein defined as the written document that is to be used by teachers to plan effective learning opportunities for students in secondary schools.

Macdonald (1976) declares,

‘Curriculum it would seem to me is the study of “what should constitute a world for learning and how to go about making this world”. As such it is a microcosm... the very questions that seem to me of foremost concern to all humanity, questions such as what is the good society, what is the good life and what is a good person are explicit in the curriculum question. Further, the moral question of how to relate to others or how best to live together is clearly a part of curriculum.’

In essence Macdonald’s statement establishes the basic forces that influence and shape the organization and content of the curriculum: the curriculum foundations. These are

- (a) The Philosophy and the Nature of Knowledge
- (b) Society and Culture
- (c) The Learner
- (d) Learning Theories

These foundations are at the heart or the centre of the dialogue essential to the development of a coherent, culturally focussed and dynamically evolving curriculum. Of course the prevailing philosophical concerns and educational goals provide the base.

PHILOSOPHY OF EDUCATION

The following philosophical statements are at the foundation of the curriculum and are stated in the Education Policy Paper 1993-2003 as follows:

WE BELIEVE

That every child has an inherent right to an education which will enhance the development of maximum capability regardless of gender, ethnic, economic, social or religious background.

That every child has the ability to learn, and that we must build on this positive assumption.

That every child has an inalienable right to an education which facilitates the achievement of personal goals and the fulfilment of obligations to society.

That education is fundamental to the overall development of Trinidad and Tobago.

That a system of 'heavily subsidised' and universal education up to age 16 is the greatest safeguard of the freedom of our people and is the best guarantee of their social, political, and economic well-being at this stage in our development.

That the educational system of Trinidad and Tobago must endeavour to develop a spiritually, morally, physically, intellectually and emotionally sound individual.

That ethical and moral concerns are central to human development and survival.

Fundamental constructs such as "decency," "justice," "respect," "kindness," "equality," "love," "honesty," and "sensitivity," are major determinants of the survival of our multi-cultural society.

That the parent and the home have a major responsibility for the welfare of the child and that the well-being of the child can best be served by a strong partnership between the community and the school.

That the educational system must provide curricular arrangements and choices that ensure that cultural, ethnic, class and gender needs are appropriately addressed.

That students vary in natural ability, and that schools therefore should provide, for all students, programmes which are adapted to varying abilities, and which provide opportunities to develop differing personal and socially useful talents.

That we must be alert to new research and development in all fields of human learning and to the implications of these developments for more effective teaching and school improvement.

That the educational system must be served by professionals who share and are guided in their operations by a set of systematic and incisive understandings, beliefs and values about education in general and its relationship to the development of the national community of Trinidad and Tobago.

That there is a need to create and sustain a humanised and democratised system of education for the survival of our democracy.

That the democratisation and humanisation of the educational system are largely contingent on the degree to which the system is professionalised. The nature of educational problems are [sic] such that the professional core must be engaged in decision-making with respect to the problems that affect their expert delivery of the services to the clientele and ultimately to Trinidad and Tobago. Professionals must come to experience a real sense of 'control and ownership' of matters educational.

That from a psychological perspective, education is a means of looking out beyond the boundaries of the immediate. It can be the viable means which creates individuals with the intellect and capacity to develop and lead societies, communities, villages, and/or neighbourhoods and families of the future. It should be responsive to and stimulate the searing human spirit and the emphatic quest for human communication, interaction, love and trust.

That learning is cumulative and that every stage in the educational process is as important and critical for the learner's development as what has gone before it and what is to come. As such we must view educational programming and development in the round, recognising the importance of every rung on the ladder of delivery by intensifying our efforts throughout the system.

THE GOALS OF EDUCATION

Coming out of the articulated philosophy, formal education in Trinidad and Tobago must aim to:

- provide opportunities for all students to develop spiritually, morally, emotionally, intellectually and physically;
- develop in all students attitudes of honesty, tolerance, integrity and efficiency;
- provide opportunities for self-directed and life-long learning;
- provide opportunities for all students to develop numeracy, literacy, scientific and technological skills;
- promote national development and economic sustainability;
- promote an understanding of the principles and practices of a democratic society;
- equip all students with basic life skills;
- promote the preservation and protection of the environment;
- develop in all students an understanding of the importance of a healthy lifestyle;

- help all students acquire the knowledge, skills and attitudes necessary to be intelligent consumers;
- provide opportunities for all students to develop an understanding and appreciation of the diversity of our culture; and
- provide opportunities for all students to develop an appreciation for beauty and human achievement in the visual and performing arts.

An analysis of the educational philosophy of the Ministry of Education's Policy Paper (1993 – 2003) and of the goals for education derived from it by the Curriculum Development Division (as outlined above), taken with the research conducted in developed nations, has led to the identification of six areas in which all secondary students must achieve. These are universally accepted goals that have been developed and underscored by other educational jurisdictions and have been described as essential learning outcomes. These outcomes help to define standards of attainment for all secondary school students.

THE ESSENTIAL LEARNING OUTCOMES

The six outcomes are in the areas of:

- Aesthetic Expression
- Citizenship
- Communication
- Personal Development
- Problem Solving
- Technological Competence

The achievement of these essential learning outcomes by all students is the goal that every core curriculum subject must facilitate. The core curriculum subjects, their content, and the teaching, learning and assessment strategies are the means to fulfil this end.

It is expected that by the end of the third year of secondary school students' achievement in all six areas will result in a solid foundation of knowledge, skills and attitudes which will constitute

the base for a platform for living in the Trinidad and Tobago society and for making informed choices for further secondary education.

The essential learning outcomes are described more fully below.

Aesthetic Expression

Students should recognise that the arts represent an important facet of their development, and that they should respond positively to its various forms. They should be able to demonstrate visual acuity and aesthetic sensibilities and sensitivities in expressing themselves through the arts.

Students should be able, for example, to

- use various art forms as a means of formulating and expressing ideas, perceptions and feelings;
- demonstrate understanding of the contribution of the arts to daily life, cultural identity and diversity;
- demonstrate an understanding of the economic role of the arts in the global village society;
- demonstrate understanding of the ideas, perceptions and feelings of others as expressed in various art forms;
- demonstrate understanding of the significance of cultural resources, such as museums, theatres, galleries, and other expressions of the multi-cultural reality of society.

Citizenship

Students should be able to situate themselves in a multicultural, multiethnic environment with a clear understanding of the contribution they must make to social, cultural, economic, and environmental development in the local and global context.

Students should be able, for example, to

- demonstrate an understanding of sustainable development and its implications for the environment locally and globally;

- demonstrate an understanding of Trinidad and Tobago's political, social and economic systems in the global context;
- demonstrate understanding of the social, political and economic forces that have shaped the past and present, and apply those understandings to the process of planning for the future;
- examine issues of human rights and recognize and react against forms of discrimination, violence and anti-social behaviours;
- determine the principles and actions of a just, peaceful, pluralistic and democratic society, and act accordingly;
- demonstrate an understanding of their own cultural heritage, cultural identity and that of others and the contribution of multiculturalism to society.

Communication

Students should be able to, through the use of their bodies, language, tools, symbols and media, demonstrate their deeper understandings of synergies inherent in the exchange of ideas and information and thus communicate more effectively.

Students should be able, for example, to

- explore, reflect on, and express their own ideas, learning, perceptions and feelings;
- demonstrate understanding of facts and relationships presented through words, numbers symbols, graphs and charts;
- demonstrate sensitivity and empathy where necessary in communicating various kinds of emotions and information;
- present information and instructions clearly, logically, concisely and accurately for a variety of audiences;
- interpret and evaluate data, and express ideas in everyday language;
- critically reflect on and interpret ideas presented through a variety of media.

Personal Development

Students should be able to grow from inside out, continually enlarging their knowledge base, expanding their horizons and challenging themselves in the pursuit of a healthy and productive life.

Students should be able, for example, to:

- demonstrate preparedness for the transition to work and further learning;
- make appropriate decisions and take responsibility for those decisions;
- work and study purposefully both independently and in cooperative groups;
- demonstrate an understanding of the relationship between health and lifestyle;
- discriminate amongst a wide variety of career opportunities;
- demonstrate coping, management and interpersonal skills;
- display intellectual curiosity, an entrepreneurial spirit and initiative;
- reflect critically on ethical and other issues;
- deal effectively with change and become agents for positive, effective change.

Problem Solving

Students should know problem-solving strategies and be able to apply them to situations they encounter. They should develop critical thinking and inquiry skills with which they can process information to solve a wide variety of problems.

Students should be able, for example, to

- acquire, process and interpret information critically to make informed decisions;
- use a variety of strategies and perspectives with flexibility and creativity for solving problems;
- formulate tentative ideas, and question their own assumptions and those of others;

- solve problems individually and collaboratively;
- identify, describe, formulate and reformulate problems;
- frame and test hypotheses;
- ask questions, observe relationships, make inferences, and draw conclusions;
- identify, describe and interpret different points of view and distinguish fact from opinion.

Technological Competence

Students should be technologically literate, able to understand and use various technologies, and demonstrate an understanding of the role of technology in their lives, in society, and the world at large.

Students should be able, for example, to

- locate, evaluate, adapt, create, and share information using a variety of sources and technologies;
- demonstrate understanding of and use existing and developing technologies appropriately;
- demonstrate an understanding of the impact of technology on society;
- demonstrate an understanding of ethical issues related to the use of technology in a local and global context.

THE CURRICULUM DESIGN AND DEVELOPMENT PROCESS

In order to achieve the outcomes as defined by the underpinning philosophy and goals, the Curriculum Division of the Ministry of Education embarked on a design and development programme consonant with the current approaches to curriculum change and innovation

CURRICULUM DESIGN

George A. Beauchamp (1983) says, “curriculum planning is a process of selecting and organizing culture content for transmission to students by the school. The process is very complex, involving input from many sources, but the organized end result of the process is the design of the curriculum.”

The varied perspectives as to the nature of knowledge, the nature of the learner, what should be learnt and how, and to what end, have resulted in three (3) major classifications of curriculum designs. Zais (1976, p.376) lists them as: subject-centered, learner-centered, and problem-centered designs. Also bringing influences to bear on the design is what Eisner and Vallance (1974) call the “orientations to curriculum.” These orientations aid in the comprehension of what the curriculum is geared towards in terms of the development of the individual.

This curriculum displays a learner-centered design. It is based primarily on ‘man-centered’ philosophical assumptions employing constructivist theory. Its major orientation is to curriculum as self-actualization. It is student-centered, seeks to provide personally satisfying experiences for each student, and is growth oriented. As the student moves from one level to another, the activities expand to allow him/her new insights and approaches to dealing with and integrating new knowledge.

The curriculum design is defined by two structures, the substantive and the syntactic.

The substantive structure reflects the “range of subject matters with which it is concerned”; the syntactic structure describes the “procedures of inquiry and practice that it follows”.

The substantive structure begins with a vision statement, a rationale, lists the general and specific outcomes of the programme, and establishes the nature of the connections with the other core

subjects on the timetable. The syntactic structure is developed along a tabular format in which the intended outcomes are associated with activities making it easy to read and teacher friendly. The content finds coherence with Tyler's (1950) three criteria for the organization of learning activities: continuity, sequence and integration.

CURRICULUM DEVELOPMENT

The first stage of the curriculum development process consisted of stakeholder consultations held with a cross section of the community.

Consultations were held with primary and secondary school teachers, principals, members of denominational school boards, members of the business community, the executive of the TTUTA, representatives from the UWI, John S. Donaldson Technical Institute, San Fernando Technical Institute, Valsayn Teachers' College and Caribbean Union College, parents, librarians, guidance counsellors, students, curriculum officers and school supervisors. They were focused on the philosophy, goals and learning outcomes of education.

The results of these consultations were:

- agreement on the concept of a “core”, that is, essential learning outcomes consisting of skills, knowledge attitudes and values that students must acquire at the end of five years of secondary schooling;
- agreement on the eight subjects to form the core;
- agreement on the desirable outcomes of secondary school education in Trinidad and Tobago.

THE CORE CURRICULUM SUBJECTS

These are subjects that every student is required to take in forms one to three. Students will be allowed to choose from a list of subject offerings thereafter.

Minimum time allocation is recommended for each subject. The principal as instructional leader of the school will make the final decision according to the needs of the students and the resources available at any given time.

The subjects and the time allocations are as follows

Subject	No. of Periods	Subject	No. of Periods
English	Six	Mathematics	Five
Science	Four	Physical Education	Two
Spanish	Four	Technology Education	Four
Social Studies	Four	Visual and Performing Arts	Four

In Stage Two of the process the officers of the Curriculum Development Division studied the reports of the consultations, the Education Policy Paper, the reports of the Curriculum Task Force and of the Task Force for Removal of Common Entrance as well as newspaper articles and letters to the editor on education over the past five years.

The School Libraries Division and the Division of School Supervision assisted the Curriculum Development Division in this task. The result of the study was the identification and statement of a set of desirable outcomes and essential exit competencies to be had by all students on leaving school. All learning opportunities, all teaching and learning strategies, all instructional plans, are to contribute to the realization of these outcomes and competencies.

At Stage Three ten existing schools were identified to pilot the new curriculum. Teachers from eight subject areas were drawn from these schools to form Curriculum Writing Teams for each subject. Teachers with specific subject or curriculum development skills from other schools were also included in the teams. These teams met initially for three days then for one day per week during April to July 2000, to conduct the writing phase of the curriculum development. In this phase learning outcomes specific to each subject, which contribute to the fulfilment of the

national outcomes were identified. Subject content, teaching and learning and assessment strategies to support these outcomes were developed.

The process of curriculum development for years two and three continued in a similar fashion. Curriculum Officers were assisted by teachers who were released from their teaching duties for varying periods of time.

The following curriculum document is the result of their efforts.

The International Consultant, for Curriculum Development, Dr. Robert Sargeant, (Associate Professor - Mount St. Vincent University, Nova Scotia, Canada) guided the curriculum design and development process.

PART TWO
CURRICULUM CONTENT

VISION STATEMENT

The Trinidad and Tobago Mathematics curriculum will foster the growth and development of mathematically empowered students who can make an effective contribution to our society in an increasingly technological world.

RATIONALE FOR THE TEACHING AND LEARNING OF MATHEMATICS

The teaching and learning of mathematics has been under constant scrutiny over the last fifty years. Reports from external examination bodies, the Ministry of Education, employers and public and private agencies on mathematical achievement, have all concluded that the majority of our students at the primary and secondary levels lack basic skills in numeracy. The high percentage of students who are certified as being not proficient in mathematics is an indicator to the Ministry of Education that there is a problem. There are many factors that must be considered in improving this situation, but the most important will be the design of a mathematics curriculum that is relevant to the individual and to the needs of the society.

Mathematics is an activity that is intrinsic to the development of the mind, civilization and the daily lives of each individual. It is the study of the properties of number and its relation to measurement, space, shape, statistics and probability. Mathematics is essentially an abstract subject, and algebra is in essence the strand of mathematics that presents this in its purest form. The study of mathematics enables one to become a creative and critical thinker, it involves logical thinking, problem solving, and argumentative and investigative skills.

Mathematically empowered students adapt to accelerating changes in today's society because they would have acquired basic skills, self-confidence and self-reliance to be capable of making effective contributions to their society. Through practising and experiencing the mathematics processes of communication, reasoning, making connections, representations and the recognition of patterns and relationships, students would have achieved the essential learning outcomes and inevitably the goals of education. Students acquire mathematical power by constructing mathematical knowledge and understandings. The philosophy of education is underpinned by the belief that all children can learn, and that children learn in diverse ways. The delivery of the mathematics curriculum is informed by research on an on-going basis both with regards to the nature and purpose of mathematics, as well as the pedagogy, in order to ensure that all students become mathematically proficient.

Mathematics pervades our daily lives. Therefore the mathematics curriculum reflects the various ways in which students would encounter mathematics in their environment and in real life situations. It is instrumental in developing problem solving and organizational skills. Mathematics is essential to the study of all other subjects on the curriculum. It is a core and compulsory subject on both the primary and secondary schools' curriculum and this in itself underscores its value and the role that mathematics plays in our lives.

GOALS OF THE MATHEMATICS CURRICULUM

The goals of the Mathematics curriculum were arrived at by examining the philosophy, psychology, sociology, research findings, goals and essential learning outcomes defined for the education system in Trinidad and Tobago. The philosophy states that “ Education must foster moral, intellectual, spiritual, physical, social and emotional development of the child to enable him or her to live creative and productive lives” and that “ every child has a right to an education which would enhance his or her development regardless of background”. Part One of this document summarizes the above characteristics of the education system. Goals are desired expectations. They are statements of intent, that is, what one sets out to achieve. The goals of the Mathematics curriculum are:-

- To make mathematics relevant to the interests and experiences of the students and to prepare students for the use of mathematics in further studies;
- To cultivate creativity and critical thinking in applying mathematical knowledge and concepts to solve routine and non-routine problems;
- To develop skills in inquiry by the use of mathematics to explain phenomena, and by recognition of the influence of mathematics in the advancement of civilization;
- To develop self-reliance, honesty, open-mindedness, confidence and perseverance by cultivating a method of studying Mathematics that results in success;
- To promote appreciation of the role of mathematics in the aesthetics and to make mathematics fun;
- To enable students to communicate effectively, accurately and with clarity using mathematical language and representations orally, in writing and graphically;
- To encourage collaboration among students and to promote positive attitudes and values in students through the completion of mathematical tasks;
- To provide opportunities for students to experience the structure of mathematics and to appreciate the elegance and power of mathematics;
- To provide students with a range of knowledge, skills and techniques relating to number, geometry (space and shape), algebra, measurement, relations, functions, and statistics in a manner relevant to the technological advancements of the 21st century.

GENERAL INTENDED OUTCOMES FOR FORMS I, II AND III

Students, by the end of Form Three, will:

- use relevant mathematical programmes in accordance with their needs to prepare for the world of work, citizenship and further study
- solve routine and non-routine mathematical problems using a variety of strategies and demonstrating creative and critical thinking skills
- demonstrate skills in inquiry to investigate or examine the environment, other disciplines and the progress of mankind
- work independently and demonstrate competence in a variety of mathematical assessments
- enjoy doing mathematics and demonstrate an appreciation of the connection between mathematics, physical education and the visual and performing arts
- become effective communicators, presenting mathematical responses through discourse in writing and graphically, with the required degree of accuracy, logical sequencing and clarity
- display positive attitudes such as confidence, determination, thoroughness, respect for self and others, cooperation and teamwork
- cultivate an awareness of the nature and purpose of mathematics
- apply the mathematical knowledge and skills relating to all strands and use up-to-date technology to enhance learning.

CONNECTIONS TO OTHER CORE CURRICULUM AREAS

Mathematics is central to the secondary education core curriculum in all schools in Trinidad and Tobago. The teacher should integrate, where possible, Mathematics with other areas of the curriculum. In the process, the learner will observe how mathematics is used in daily life and be provided with opportunities to practice mathematical skills, while enhancing a better understanding of mathematical concepts. The concepts and skills developed in the mathematics classroom are applied in other disciplines.

The following briefly illustrates the nature of the connections and interdependent linkages between Mathematics and the other core areas.

LANGUAGE ARTS

- Interpreting diagrams, tables and charts
- Understanding terminology in mathematics by reading, engaging in oral discussion, debating, writing and listening
- Using the ideas of vocabulary, comprehension, analysis and inference to develop thinking skills
- Developing multiple literacy skills
- Using checklists to ensure that procedures are followed
- Formatting information for documentation

SOCIAL STUDIES

- Using statistics to analyze exponential growth of populations, rates of growth, distribution, basic demographics and traffic patterns
- Developing perceptions and skills in problem-solving and decision making in Social Studies which require a basic understanding of mathematical concepts and skills
- Using mathematical techniques for inquiry to foster understanding of the need for environmental protection, conservation and preservation
- Representing human settlements and other phenomena such as distribution, density and economic activities on diagrams, graphs, tables, charts and maps
- Recognizing that the functioning of social institutions, such as banks, insurance companies and credit unions is based on fundamental mathematics
- Influencing social interaction through an understanding of spatial arrangements

TECHNOLOGY EDUCATION

- Planning and designing in productions which require fundamental mathematics – consumer arithmetic, measurement, ratio and geometry
- Interpreting plans, drawings, blueprints, elevations, scales, and so on, which require basic geometrical and computational skills
- Programming and computer software applications for information technology, which require a knowledge of the binary base system and mathematical reasoning
- Infusing technology in the Mathematics curriculum to develop research, investigatory and reporting skills.

SPANISH

- Using numbers to record information such as age, date of birth and other personal data
- Developing vocabulary using terminology from the measurement strand in Mathematics
- Counting and recording quantities such as number of family members and population of countries.

SCIENCE

- Quantifying natural and artificial phenomena such as earthquakes, volcanic activity, temperature, speed, viscosity, spatial distribution, projectile motion, patterns, cell division and growth
- Investigating issues in science which require the use of basic mathematical principles and skills
- Collecting and representing scientific data which depend on skills in measurement, statistics, relations and functions

VISUAL AND PERFORMING ARTS

- Understanding timing and sound in music, which are based on basic mathematical concepts in number and trigonometry
- Observing the beauty in art and nature, which is based on the concept of symmetry in geometry
- Drawing, designing and dancing, which are dependent on acquiring skills in geometry and fundamental mathematics
- Producing art and craft which require the use of calculations, spatial sense and fundamental concepts in mathematics
- Sequencing of dance steps and patterns in dance, which are dependent on geometrical and number concepts and skills

HEALTH AND PHYSICAL EDUCATION

- Classifying foods into the six food groups and quantifying the number of calories or nutrients present in foods
- Comparing individuals' weight and height with the ideal weight and height dependent on age and physical stature
- Discussing obesity and malnutrition in the context of inequalities in mathematics
- Valuing water and air as important constituents of the body by quantifying the essential amounts required
- Counting to maintain rhythm in exercises, aerobics and gymnastics
- Designing and following a plan for aerobic exercises requiring a knowledge of spatial sense, shape and rhythm
- Using diagrams and graphs to display information
- Using problem-solving skills to cope with stress and acquire adequate rest and relaxation
- Playing games by following rules and coming up with appropriate strategies
- Appreciating exercise and its effect on the aesthetics of the body
- Appreciating sports and the wise use of leisure which can be displayed on a pie chart
- Monitoring energy levels, respiratory demand, blood pressure, elimination, musculature and mental health, using the appropriate instruments
- Using a statistical approach to test physical fitness

VALUES EDUCATION

- Infusing values into the Mathematics curriculum by encouraging a display of positive values such as collaboration, teamwork, respect for others, determination, thoroughness and confidence
- Fostering sharing and caring for others and unequal sharing of quantities into the topic "Ratio and Proportion"
- Teaching different types of relationships of social interaction and the impact of these on life through infusion into the topic "Relation and Functions"
- Teaching budgeting, consumerism and fair business practices through the topic of "Consumer Arithmetic"
- Using Venn diagrams in the topic "Sets" to represent religions, ethnic groupings and interests, to develop an understanding of the diversity of the society
- Fostering various types of social interaction by using different seating arrangements

FRAMEWORK FOR MATHEMATICS FOR FORMS I, II AND III

The content of the syllabus for Mathematics is organized in strands which are sequenced as follows:

- Number Operations and Number Theory
- Sets, Relations and Functions
- Measurement
- Algebra
- Geometry
- Statistics and Probability

NUMBER OPERATIONS AND NUMBER THEORY

An understanding of numbers is central to the development of numeracy. Number sense, number operations, laws, principles and structures of numbers are the essential learnings required by students to be applied in their daily lives and in their future careers.

MEASUREMENT

This strand is divided into two units. Measurement I is essential in developing students' skill in the use of measuring instruments, and in reading and interpreting scales, and calculating attributes of objects. The integration between the measurement and geometry strands is essential in developing the concepts and skills that students require in measurement.

Measurement II is essential in developing students' consumer skills and involves decision making in the use of money in trading situations and investment.

Measurement has many practical applications that can assist students to understand the use of mathematics in everyday life. It links Mathematics with other subject areas such as Science, Physical Education and Language Arts.

ALGEBRA

Algebra is the essence of mathematics. It requires students to examine patterns, sequences and relations in mathematics and to form generalizations. This strand is divided into two sub-units. Algebra I provides an introduction to the basics of algebraic variables, terms, expressions (both linear and quadratic), and the processes of simplification, substitution and factorization. Algebra II provides a model in the form of equations which can be used as a powerful problem-solving strategy in mathematics.

GEOMETRY

Geometry is the branch of mathematics which deals with the study of shapes, their properties, the relationships which exist among them and the ways in which they can be moved or transformed. Through the study of geometry, students are able to represent and describe the world in which they live with greater accuracy. Students develop spatial sense, dynamic imagery, logical thinking, and reasoning skills as they engage in geometric activities.

SETS, RELATIONS AND FUNCTIONS

This strand is divided into two units – Sets and Relations and Functions. It provides a visual representation of mathematics which can be used as a strategy for solving problems. The content used in developing these concepts is taken from the other strands in Mathematics and from real life situations.

Sets introduce students to its language and notation which are used widely in mathematical discourse, especially in algebra. It is suggested that Sets be taught early in the programme.

Relations and functions deal with rules which define a correspondence between two sets. These rules are expressed using an algebraic expression or an equation. This unit should be taught later in the program, since its purpose is to provide a variety of representations for mathematical relations identified in all other strands in Mathematics.

STATISTICS AND PROBABILITY

In everyday life, students will repeatedly encounter data and information from which intelligent political and economic decisions will be made. Statistics often engender reactions of emotion or intuition. As probability and statistics become more a part of the mathematics classroom, students must be taught not only the rules and formulae, but also the necessary unbiased selection of samples and the statistical analysis process that must be carried out before inferences and decisions are made. Statistics must therefore be infused with values education. Students must understand that although intuition is a powerful tool in mathematics, it cannot be relied on exclusively.

Probability is dependent on the collection of unbiased information, which is analyzed and interpreted to prove whether a hypothesis is true, or not. This is called experimental probability. Theoretical probability is represented by a fraction formed by the ratio of the number of times an event is possible to the number of total possibilities. The purpose of the strand is to provide an objective process for arriving at conclusions. This strand can be taught independently of all the other strands.

A GENERAL CURRICULUM FRAMEWORK

	TERM ONE	TERM TWO	TERM THREE
FORM ONE	<ul style="list-style-type: none"> ▪ Exploring whole numbers (Number Operations and Number Theory) ▪ Applying measurement in 2-D (Measurement I) ▪ Introducing Algebra (Algebra I) 	<ul style="list-style-type: none"> ▪ Using equations to model mathematics (Algebra II) ▪ Consumer Arithmetic: Daily living (Measurement II) ▪ Basic Geometry (Geometry) 	<ul style="list-style-type: none"> ▪ Relations and relationships (Relations and Functions) ▪ Discrete representation of data (Statistics and Probability) ▪ Collecting and organizing statistical data (ungrouped) (Statistics and Probability)
FORM TWO	<ul style="list-style-type: none"> ▪ Exploring integers (Number Operations and Number Theory) ▪ Extending the application of measurements in 2-D (Measurement I) ▪ Basic Algebra (Algebra I) 	<ul style="list-style-type: none"> ▪ Using equations to model Mathematics (Algebra II) ▪ Consumer Arithmetic: Family life (Measurement II) ▪ Basic Geometry (Geometry) 	<ul style="list-style-type: none"> ▪ Graphical representation of linear relations and functions (Relations and Functions) ▪ Statistical data displays (Statistics and Probability) ▪ Probability and decision making (Statistics and Probability)
FORM THREE	<ul style="list-style-type: none"> ▪ Exploring real numbers ▪ Applying measurement in 2-D and 3-D ▪ Taking basic Algebra further 	<ul style="list-style-type: none"> ▪ Using equations to model Mathematics ▪ Consumer Arithmetic: Business/ financial institutions ▪ Making connections in Basic Geometry 	<ul style="list-style-type: none"> ▪ Inequalities ▪ Graphical solutions of inequalities and linear equations with two unknowns ▪ Statistical analysis of data: discrete and continuous

COURSE OUTLINE FOR FORM THREE

Strand: NUMBER OPERATIONS AND NUMBER THEORY

LEARNING OUTCOME	INSTRUCTIONAL FOCUS	SUGGESTED TEACHING/LEARNING STRATEGIES	INTEGRATED CURRICULUM ACTIVITIES	SUGGESTED ASSESSMENT STRATEGIES
TOPIC: REAL NUMBERS				
<p>Students will be able to:</p> <ul style="list-style-type: none"> ▪ explain what are rational numbers, their use in real life situations and their relationship to whole numbers and integers 	<ul style="list-style-type: none"> ▪ Valuing fractions ▪ Representing numerals as fractions in the form $\left[\frac{a}{b} \right]$ ▪ Representing fractions as decimals ▪ Terminating and non-terminating decimals 	<ul style="list-style-type: none"> ▪ Working cooperatively students identify real life situations where solutions to problems are fractions ▪ Guided instruction to examine the structure of a numeral written as a fraction ▪ Use of worksheet to connect the decimal fraction to the decimal notation ▪ Students derive a procedure for the conversion of fractions to decimals and the reverse 	<ul style="list-style-type: none"> ▪ Social Studies: Identifying consumer-related activities, e.g., purchasing materials, sharing. ▪ Physical Education: Timing events in sports. ▪ Music: Timing in music. ▪ Technology Education: Researching the development of fractions and decimals using the internet and other resources 	<ul style="list-style-type: none"> ▪ Observation of students' work. ▪ Mental quiz ▪ Students compile a portfolio to include the definition and historical development of rational numbers ▪ Worksheet

Strand: NUMBER OPERATIONS AND NUMBER THEORY

LEARNING OUTCOME	INSTRUCTIONAL FOCUS	SUGGESTED TEACHING/LEARNING STRATEGIES	INTEGRATED CURRICULUM ACTIVITIES	SUGGESTED ASSESSMENT STRATEGIES
<ul style="list-style-type: none"> ▪ add, subtract, multiply and divide rational numbers using concrete materials, visuals and patterns. 	<ul style="list-style-type: none"> ▪ Developing the rules for addition, subtraction, multiplication and division of fractions. ▪ Developing the rules for addition and subtraction of decimals 	<ul style="list-style-type: none"> ▪ Students display concretely, visually and in symbols, the use of equivalent fractions, add and subtract fractions with: <ul style="list-style-type: none"> - same denominator - related denominators - different denominators ▪ Students use visuals and patterns to develop the rules for multiplication and division of fractions written in the form $\frac{a}{b}$ ▪ Teacher demonstrates the extension of the value system for whole numbers in developing the rules for adding and subtracting decimals 	<ul style="list-style-type: none"> ▪ Science: Students compile problems involving the four operations on rational numbers ▪ Mathematics: Consumer Arithmetic: Students compile and simulate problems involving ready reckoners ▪ Technology Education: Design of activities involving measurement and money 	<ul style="list-style-type: none"> ▪ Observation of concrete solutions presented by students ▪ Worksheet displaying visual solutions, patterns and rules ▪ Students verbalise rule, solve problems mentally and also using paper and pencil for computations

Strand: NUMBER OPERATIONS AND NUMBER THEORY

LEARNING OUTCOME	INSTRUCTIONAL FOCUS	SUGGESTED TEACHING/LEARNING STRATEGIES	INTEGRATED CURRICULUM ACTIVITIES	SUGGESTED ASSESSMENT STRATEGIES
<ul style="list-style-type: none"> ▪ add, subtract, multiply and divide rational numbers using concrete materials, visuals and patterns (continued) ▪ create and solve everyday problems involving rational numbers using a variety of strategies. 	<ul style="list-style-type: none"> ▪ Developing the rules for multiplication and division of decimals ▪ Translating problems: one-step, multi-step, into mathematical sentences ▪ Solving problems and determining reasonableness of answers 	<p>Group work</p> <ul style="list-style-type: none"> ▪ Students represent decimals as decimal fractions and derive the rules for multiplication and division by searching for a pattern - group work ▪ Guided instructions to write mathematical sentences given number stories ▪ Group work <ul style="list-style-type: none"> - to create number stories given a theme or mathematical sentence 	<ul style="list-style-type: none"> ▪ Social Studies: Developing rules and laws in society as coming from accepted patterns and norms ▪ Language Arts: Translating from one language to another e.g., English language to mathematical symbols ▪ Values Education: Using themes related to Values Education to create number stories 	<ul style="list-style-type: none"> ▪ Group presentations to report on the rules derived for multiplication and division of decimals, with illustrations. ▪ Group presentations of number stories with peer evaluation. ▪ Students compile a journal of stories ▪ Group presentation of strategies justifying the selection chosen

Strand: NUMBER OPERATIONS AND NUMBER THEORY

LEARNING OUTCOME	INSTRUCTIONAL FOCUS	SUGGESTED TEACHING/LEARNING STRATEGIES	INTEGRATED CURRICULUM ACTIVITIES	SUGGESTED ASSESSMENT STRATEGIES
<ul style="list-style-type: none"> ▪ explain irrational numbers using manipulatives, drawings and symbols. 	<ul style="list-style-type: none"> ▪ The concept of an irrational number ▪ Properties of irrational numbers 	<ul style="list-style-type: none"> ▪ Using concrete material, students examine the property of square numbers and extend to the concept of square-root ▪ Students calculate the square root of numbers 1 to 100 ▪ Students relate the square-root of a number to the length of the side of a square, written as a decimal, using drawings to illustrate ▪ Investigation of the square-root of the number '2' written as a decimal. Extension of investigation to identify the properties of an irrational number. 	<ul style="list-style-type: none"> ▪ Mathematics strands: Students make connection within the mathematical strands of number, geometry and measurement ▪ Technology Education Research the origin of the irrational number <i>pi</i> 	<ul style="list-style-type: none"> ▪ Students identify irrational numbers and state their properties ▪ Students present the researched information on <i>pi</i> in the most appropriate format ▪ Students record the procedure used for the investigation and the results in a note book

Strand: NUMBER OPERATIONS AND NUMBER THEORY

LEARNING OUTCOME	INSTRUCTIONAL FOCUS	SUGGESTED TEACHING/LEARNING STRATEGIES	INTEGRATED CURRICULUM ACTIVITIES	SUGGESTED ASSESSMENT STRATEGIES
<ul style="list-style-type: none"> ▪ add, subtract and multiply irrational numbers using a variety of contexts. 	<ul style="list-style-type: none"> ▪ Simplifying expressions containing irrational numbers 	<ul style="list-style-type: none"> ▪ Use of guided instruction to teach problem solving related to algebra, geometry and measurement ▪ Teacher demonstrates that the product of two irrational numbers results in a rational number 	<ul style="list-style-type: none"> ▪ Language Arts: students discuss the use of words in mathematics that convey a different meaning to that used in everyday life ▪ Visual and Performing Arts: Students present a mathematical concept using aesthetic expression 	<ul style="list-style-type: none"> ▪ Worksheet with problems using irrational numbers in a variety of contexts.
<ul style="list-style-type: none"> ▪ display in a variety of ways the relationship among the subsets of real numbers. 	<ul style="list-style-type: none"> ▪ Identifying the subsets of real numbers: <ul style="list-style-type: none"> - Natural (N) - Whole (W) - Integers (Z) - Rationals (Q) - Irrationals (Q*) - Real (R) 	<ul style="list-style-type: none"> ▪ Students use an activity to categorize numbers into subsets according to common properties and name each subset 	<ul style="list-style-type: none"> ▪ Mathematics: Sets: Grouping sets of numbers according to common properties. 	<ul style="list-style-type: none"> ▪ Students make a journal listing mathematical terminology and explain the meanings of terms. ▪ Notebook entries of activities and summary statements

Strand: NUMBER OPERATIONS AND NUMBER THEORY

LEARNING OUTCOME	INSTRUCTIONAL FOCUS	SUGGESTED TEACHING/LEARNING STRATEGIES	INTEGRATED CURRICULUM ACTIVITIES	SUGGESTED ASSESSMENT STRATEGIES
<ul style="list-style-type: none"> ▪ display in a variety of ways the relationship among the subsets of real numbers (continued) ▪ apply the laws and properties of numbers to the real number system using cooperative strategies. 	<ul style="list-style-type: none"> ▪ Representing the relationship among these subsets on <ul style="list-style-type: none"> - number tree - Venn diagram ▪ Applying <ul style="list-style-type: none"> - commutative law - associative law - distributive law to the real number system 	<ul style="list-style-type: none"> ▪ Group activity - construction of a visual representation of the relationships among subsets ▪ Group work to verify the laws by examining simple computational problems involving real numbers ▪ State the laws for the real numbers using algebraic notation ▪ Independent practice to solve simple problems using the laws 	<ul style="list-style-type: none"> ▪ Mathematics: <ul style="list-style-type: none"> Sets: Drawing Venn diagrams to represent the relationships between different sets of numbers. ▪ Values Education: <ul style="list-style-type: none"> Students discuss the relationships among groups in the society and compare the relationship among numbers with the relationship among different groups in society ▪ Social Studies: <ul style="list-style-type: none"> Relating laws to order in society, and the consequences of not following the law 	<ul style="list-style-type: none"> ▪ Oral questioning with verbal responses on the relationship of groups in society ▪ Rubric to evaluate debating skills, thinking skills and value system ▪ Worksheet with computational problems

Strand: NUMBER OPERATIONS AND NUMBER THEORY

LEARNING OUTCOME	INSTRUCTIONAL FOCUS	SUGGESTED TEACHING/LEARNING STRATEGIES	INTEGRATED CURRICULUM ACTIVITIES	SUGGESTED ASSESSMENT STRATEGIES
<ul style="list-style-type: none"> ▪ apply the laws and properties of numbers to the real number system using cooperative strategies.(continued) 	<ul style="list-style-type: none"> ▪ Identifying the <ul style="list-style-type: none"> - identity element - inverse element with respect to addition and multiplication ▪ Developing thinking skills ▪ Examining the concept of closure for the real number system and comparing it with its sub-systems 	<ul style="list-style-type: none"> ▪ Review of the concept of an identity element and determination of whether it holds for the real numbers through discussion ▪ Review of the concept of an inverse element and determine the inverse of fractions, decimals and irrational numbers through discussion ▪ Students investigate the inverse of the number zero ▪ Review and extension of the laws of closure of real numbers through discussion and demonstration 	<ul style="list-style-type: none"> ▪ Social Studies/ Values Education: Discuss identity as it relates to self and what contributes to an individual's identity. ▪ Language Arts: Use of debate to present arguments to investigate the meaning of $\frac{0}{0}$ and to respect different points of view that arise ▪ Social Studies: Customs/traditions/practices of different groups in society 	<ul style="list-style-type: none"> ▪ Open questioning . ▪ Class Quiz ▪ Project report on investigation of $\frac{0}{0}$ and the law of closure

Strand: NUMBER OPERATIONS AND NUMBER THEORY

LEARNING OUTCOME	INSTRUCTIONAL FOCUS	SUGGESTED TEACHING/LEARNING STRATEGIES	INTEGRATED CURRICULUM ACTIVITIES	SUGGESTED ASSESSMENT STRATEGIES
TOPIC: REPRESENTATION OF NUMBERS				
Students will be able to: <ul style="list-style-type: none"> ▪ multiply and divide numbers written in index form. 	<ul style="list-style-type: none"> ▪ Concept of a number written in index form ▪ Derivation of the rules for simplification: <ul style="list-style-type: none"> - multiplication - division - zero index - negative index - exponent 	<ul style="list-style-type: none"> ▪ Students' activity to represent numbers as products of prime factors <ul style="list-style-type: none"> -recognizing numbers with repeated factors -writing numbers in index form ▪ Guided discovery using examples to generate rules stated algebraically: $a^n \times a^m = a^{m+n}$ $a^n \div a^m = a^{n-m}$ $a^0 = 1$ $a^{-n} = \frac{1}{a^n}$ $(a^n)^m = a^{n \cdot m}$ 	<ul style="list-style-type: none"> ▪ Technology Education: Exploring the use of indices in technology education – e.g., <ul style="list-style-type: none"> - Storing information in compact form requires the use of the index form - Making connections with algebra, square roots, volume and area ▪ Social Studies: The development of and the role of rules in society. 	<ul style="list-style-type: none"> ▪ Using a game to evaluate the acquisition of the concept ▪ Worksheet with a variety of problems

Strand: NUMBER OPERATIONS AND NUMBER THEORY

LEARNING OUTCOME	INSTRUCTIONAL FOCUS	SUGGESTED TEACHING/LEARNING STRATEGIES	INTEGRATED CURRICULUM ACTIVITIES	SUGGESTED ASSESSMENT STRATEGIES
<ul style="list-style-type: none"> ▪ represent large and small numbers in scientific notation. 	<ul style="list-style-type: none"> ▪ Concept of scientific notation/standard form ▪ Writing numbers in standard form ▪ Simplifying computational tasks using standard form 	<ul style="list-style-type: none"> ▪ Discussion on the need for standard form/scientific notation ▪ Guided instruction to review rules for writing numbers in index form and to define standard form ▪ Writing large numbers in the form $A \times 10^n$ where $1 \leq A < 10$, $n \in \mathbb{Z}$ ▪ Writing small numbers in standard form ▪ Demonstration and independent practice 	<ul style="list-style-type: none"> ▪ Science: Students collect examples of numbers represented in scientific notation from different disciplines, the news and other real life situations 	<ul style="list-style-type: none"> ▪ Students make journal entries of examples of numbers represented in scientific notation ▪ Worksheet for practice ▪ Paper-pencil test

Strand: NUMBER OPERATIONS AND NUMBER THEORY

LEARNING OUTCOME	INSTRUCTIONAL FOCUS	SUGGESTED TEACHING/LEARNING STRATEGIES	INTEGRATED CURRICULUM ACTIVITIES	SUGGESTED ASSESSMENT STRATEGIES
<ul style="list-style-type: none"> ▪ approximate numbers to a given number of significant figures. 	<ul style="list-style-type: none"> ▪ Meaning of significant figures ▪ Rule for approximation ▪ Zero involvement <ul style="list-style-type: none"> - at beginning - between two digits - at end of number ▪ Relating significant figures to standard form 	<ul style="list-style-type: none"> ▪ Students' activity to recognize that the place value of the first digit of value in a number determines the first significant figure ▪ Teacher demonstrates the use of a number line to review the rule for approximation, and to identify the digit to which the rule must apply in interpreting the number of significant figures ▪ Working examples with zero in different positions ▪ Independent practice converting numbers to standard form to a specified number of significant figures 	<ul style="list-style-type: none"> ▪ Science: Students collect examples from science and other disciplines 	<ul style="list-style-type: none"> ▪ Verbal explanation of process involved in writing numbers to the required number of significant figures ▪ Oral questioning ▪ Paper-pencil test

Strand: NUMBER OPERATIONS AND NUMBER THEORY

LEARNING OUTCOME	INSTRUCTIONAL FOCUS	SUGGESTED TEACHING/LEARNING STRATEGIES	INTEGRATED CURRICULUM ACTIVITIES	SUGGESTED ASSESSMENT STRATEGIES
<ul style="list-style-type: none"> ▪ apply approximation techniques to perform computational estimation in relevant problem situation. 	<ul style="list-style-type: none"> ▪ Reviewing: <ul style="list-style-type: none"> - rounding - decimal places - scientific notation - significant figures - combinations of the above 	<ul style="list-style-type: none"> ▪ Simulating situations <ul style="list-style-type: none"> - purchasing groceries - counting very large quantities - representing very large and very small quantities ▪ Discussing ‘accuracy versus estimations’ as it relates to the above situations to determine the choice of approximation 	<ul style="list-style-type: none"> ▪ Technology Education: <ul style="list-style-type: none"> Selection of examples from science, consumer arithmetic, economics, sports, assembles (social & national), social studies. ▪ Values Education: <ul style="list-style-type: none"> Discussion of values and their relationship to choice of approximations in the above situations 	<ul style="list-style-type: none"> ▪ Performance tasks ▪ Oral questioning

COURSE OUTLINE FOR FORM THREE

Strand: MEASUREMENT I

LEARNING OUTCOME	INSTRUCTIONAL FOCUS	SUGGESTED TEACHING/LEARNING STRATEGIES	INTEGRATED CURRICULUM ACTIVITIES	SUGGESTED ASSESSMENT STRATEGIES
TOPIC: MEASUREMENTS INVOLVING CIRCLES				
Students will be able to: <ul style="list-style-type: none"> ▪ develop and use the formula for the length of an arc in a given circle. 	<ul style="list-style-type: none"> ▪ Developing the idea of the formation of a circle as a complete turn (360°) ▪ Developing the idea that an arc is a fraction of the circle ▪ Using the formula for circumference, derivation of the general formula for calculating length of arc 	<ul style="list-style-type: none"> ▪ Teacher guides students to recognize that the circumference of a circle can be divided into 360 sub units ▪ Use of instructional materials to review the formula for the circumference of circle ▪ Through guided discussion students are allowed to calculate the arc lengths for different situations. 	<ul style="list-style-type: none"> ▪ Physical Education: <ul style="list-style-type: none"> - Designing and Measuring distances along athletic tracks, basketball courts etc. ▪ Technology Education: <ul style="list-style-type: none"> - House plans - Fencing of land ▪ Visual Arts: <ul style="list-style-type: none"> - Estimating material for wire bending in carnival costume designing/decorating 	<ul style="list-style-type: none"> ▪ Observation of class work and note books to assess the level of understanding of concepts and the representation of ideas ▪ Oral questioning and observation of class work and note books

Strand: MEASUREMENT I

LEARNING OUTCOME	INSTRUCTIONAL FOCUS	SUGGESTED TEACHING/LEARNING STRATEGIES	INTEGRATED CURRICULUM ACTIVITIES	SUGGESTED ASSESSMENT STRATEGIES
<ul style="list-style-type: none"> ▪ determine the perimeter of compound shapes involving circles 	<ul style="list-style-type: none"> ▪ Identifying simple plane shapes that make up a compound shape ▪ Identifying the lines from each plane shape which contribute towards the perimeter of a compound shape ▪ Summing the lengths of lines identified to determine perimeter 	<ul style="list-style-type: none"> ▪ Students deduce the formula for the length of an arc examining tabulated results ▪ Teacher presents 2-D drawings of compound shapes from the real world and have the students divide the shapes into the least number of known simple shapes. ▪ Students are asked to deduce the strategy for finding the perimeter and present their solutions to the class 	<ul style="list-style-type: none"> ▪ Problem Solving: <ul style="list-style-type: none"> - Seemingly complex situations can be seen as a combination of smaller and simpler situations 	<ul style="list-style-type: none"> ▪ Authentic task to determine the amount of material needed to make a frame ▪ Individual or group presentations

Strand: MEASUREMENT I

LEARNING OUTCOME	INSTRUCTIONAL FOCUS	SUGGESTED TEACHING/LEARNING STRATEGIES	INTEGRATED CURRICULUM ACTIVITIES	SUGGESTED ASSESSMENT STRATEGIES
<ul style="list-style-type: none"> ▪ determine the perimeter of compound shapes involving circles (continued) 	<ul style="list-style-type: none"> ▪ Identifying the appropriate formulae to be used in given situations. ▪ Solving problems involving length of arc 	<ul style="list-style-type: none"> ▪ Using the appropriate formulae, the perimeter of simple shapes are determined by students. ▪ After demonstration of how to solve problems, students are presented with a variety of problems on a worksheet 	<ul style="list-style-type: none"> ▪ Physical Education: <ul style="list-style-type: none"> - Marking of play fields and athletic tracks 	<ul style="list-style-type: none"> ▪ Observation of notebooks and classwork ▪ Work sheet assessment ▪ Paper-pencil test

Strand: MEASUREMENT I

LEARNING OUTCOME	INSTRUCTIONAL FOCUS	SUGGESTED TEACHING/LEARNING STRATEGIES	INTEGRATED CURRICULUM ACTIVITIES	SUGGESTED ASSESSMENT STRATEGIES
<ul style="list-style-type: none"> ▪ Develop and use the formula for the area of a sector in a given circle 	<ul style="list-style-type: none"> ▪ Recognizing that a sector is a fraction of the area of a circle ▪ Using the formula for area of circle, derivation of the general formula for calculating the area of a sector 	<ul style="list-style-type: none"> ▪ Teacher guides students to recognize that the area of a circle can be divided into 360 sub units ▪ Students are allowed to create sectors of different sizes (from cut-outs and drawings) and label appropriately 	<ul style="list-style-type: none"> ▪ Physical Education: <ul style="list-style-type: none"> - Designing and measuring areas on various game courts/fields, e.g., for basketball, volleyball, netball, shot put, discus, hammer throw 	<ul style="list-style-type: none"> ▪ Observation of class work and notebooks
<ul style="list-style-type: none"> ▪ Calculate the area of compound shapes involving circles. 	<ul style="list-style-type: none"> ▪ Identifying simple plane shapes that make up a compound shape 	<ul style="list-style-type: none"> ▪ Teacher uses the compound shapes identified earlier and the procedures for sub-divisions to generate “area” problems 	<ul style="list-style-type: none"> ▪ Technology Education: <ul style="list-style-type: none"> - House plans - Gardening - Tiling, painting 	<ul style="list-style-type: none"> ▪ Observation of class work and marking solutions to problems generated.

Strand: MEASUREMENT I

LEARNING OUTCOME	INSTRUCTIONAL FOCUS	SUGGESTED TEACHING/LEARNING STRATEGIES	INTEGRATED CURRICULUM ACTIVITIES	SUGGESTED ASSESSMENT STRATEGIES
<ul style="list-style-type: none"> ▪ calculate the area of compound shapes involving circles 	<ul style="list-style-type: none"> ▪ Summing the areas of the known plane shapes to obtain the area of a compound shape ▪ Solving problems involving areas of sector 	<ul style="list-style-type: none"> ▪ Students calculate the area of the plane shapes which contribute towards the compound shape and sum them up to obtain the area of a compound shape ▪ Through demonstration using a sample problem on areas, students are guided to solve similar problems and there are presented with a work sheet to complete independently. 	<ul style="list-style-type: none"> ▪ Visual Arts: <ul style="list-style-type: none"> - Estimating material for carnival costume designing/ decorating - Craft ▪ Problem Solving: <ul style="list-style-type: none"> - Seemingly complex situations can be seen as a combination of smaller and simpler situations 	<ul style="list-style-type: none"> ▪ Authentic task to determine the amount of material needed to make a product in two dimensions ▪ Enrichment (Spatial visualization) – making and solving tangrams ▪ Work sheet assessment ▪ Paper-pencil test

Strand: MEASUREMENT I

LEARNING OUTCOME	INSTRUCTIONAL FOCUS	SUGGESTED TEACHING/LEARNING STRATEGIES	INTEGRATED CURRICULUM ACTIVITIES	SUGGESTED ASSESSMENT STRATEGIES
<p>TOPIC: Prisms</p> <p>Students will be able to:</p> <ul style="list-style-type: none"> ▪ calculate surface area of a prism (cube, cuboid, cylinder and triangular prism). 	<ul style="list-style-type: none"> ▪ Identifying properties of prisms ▪ Identifying the plane faces: <ul style="list-style-type: none"> - number - shape of faces ▪ Recognizing the surface area as being the sum of the areas of the individual faces 	<ul style="list-style-type: none"> ▪ Review of the properties of prisms through guided discussion ▪ Students classify prisms according to shape and faces ▪ Students calculate the areas of each face and sum them up to obtain the total surface area 	<ul style="list-style-type: none"> ▪ Technology Education: <ul style="list-style-type: none"> - Designing and using prisms in different situations. ▪ Visual Arts: <ul style="list-style-type: none"> - Estimating material for craft involving prisms 	<ul style="list-style-type: none"> ▪ Oral questioning or Quizzes ▪ Observation using a check list ▪ Paper-pencil test

Strand: MEASUREMENT I

LEARNING OUTCOME	INSTRUCTIONAL FOCUS	SUGGESTED TEACHING/LEARNING STRATEGIES	INTEGRATED CURRICULUM ACTIVITIES	SUGGESTED ASSESSMENT STRATEGIES
<ul style="list-style-type: none"> ▪ calculate surface area of a prism using the corresponding net. ▪ calculate volume of prism (cube, cuboid, cylinder and triangular prism) 	<ul style="list-style-type: none"> ▪ Relating surface area of prism to the area of a corresponding net ▪ Conceptualizing volume as a measure of 3-D region or space ▪ Differentiating between volume and capacity 	<ul style="list-style-type: none"> ▪ Students cut along the edges of prismic shapes so that the corresponding nets are obtained ▪ Through guided discussion, explore the relationship between the surface area of the prism and the area of its corresponding net ▪ Use interactive demonstration in which students will select items from a display of hollow containers and solids, based on guidelines presented ▪ Through guided discussion, items are classified and concepts of volume and capacity are clarified 	<ul style="list-style-type: none"> ▪ Communication/Business Studies/Technology Education: <ul style="list-style-type: none"> - making labels for food packages - purchasing materials for covering cushions or other surfaces - Metalwork ▪ Science: <ul style="list-style-type: none"> - Volume of solids by displacement - Conservation of volume 	<ul style="list-style-type: none"> ▪ Observation of classwork ▪ Oral questioning ▪ Paper-pencil test ▪ Oral questioning ▪ Observation of notebooks and classwork

Strand: MEASUREMENT I

LEARNING OUTCOME	INSTRUCTIONAL FOCUS	SUGGESTED TEACHING/LEARNING STRATEGIES	INTEGRATED CURRICULUM ACTIVITIES	SUGGESTED ASSESSMENT STRATEGIES
<ul style="list-style-type: none"> ▪ Calculate the volume of a prism (continued) 	<ul style="list-style-type: none"> ▪ Rationalizing the use of cubic units to measure volume ▪ Calculating volume by counting cubes ▪ Using the cross-section property of a prism to derive the formula for volume ▪ Solving problems involving prisms 	<ul style="list-style-type: none"> ▪ Have students suggest what units can be used to measure volume and rationalize why the cube is the best unit ▪ Allow students to construct cubes and cuboids of various sizes and measure volume by counting cubes ▪ Tabulate results and derive formula through guided discovery ▪ Assign a group project to investigate whether information on volume given on labels of cans, boxes are correct 	<ul style="list-style-type: none"> ▪ Values Education: <ul style="list-style-type: none"> - Establishing the meaning of no volume as it relates to existence ▪ Business Studies: <ul style="list-style-type: none"> Packaging items for sale according to volume 	<ul style="list-style-type: none"> ▪ Questioning to determine levels of understanding of the concept ▪ Observing /listening to ideas presented orally ▪ Performance task ▪ Project Report

COURSE OUTLINE FOR FORM THREE

Strand: ALGEBRA

LEARNING OUTCOME	INSTRUCTIONAL FOCUS	SUGGESTED TEACHING/LEARNING STRATEGIES	INTEGRATED CURRICULUM ACTIVITIES	SUGGESTED ASSESSMENT STRATEGIES
TOPIC: ALGEBRAIC EXPRESSIONS AND IDENTITIES				
Students will be able to: <ul style="list-style-type: none"> ▪ apply the laws and properties of numbers to algebraic expressions. 	<ul style="list-style-type: none"> ▪ Simplifying expressions of the following forms: <ul style="list-style-type: none"> - linear - quadratic - cubic - polynomial in one or two variables, 	<ul style="list-style-type: none"> ▪ Review of concept of “expression” by re-writing mathematical sentences using algebraic notation or expressions. ▪ Use of guided instruction to identify and name the different forms of algebraic expressions. ▪ Use guided instructions to connect the processes as applied to numbers, to perform operations on algebraic expressions. ▪ Use of worksheet to demonstrate the process of simplification of a variety of algebraic expressions, and presenting answers in their simplest form. ▪ Teacher demonstration on how algebraic expressions with rational coefficients can be simplified using techniques as applied in arithmetic. 	<ul style="list-style-type: none"> ▪ Science / Geography: Examination of other curriculum areas for examples of the use of algebraic expressions. ▪ Mathematics strands: Teacher creates situations from Measurement (e.g. perimeter, area, volume) and geometry which require the use of operations to represent algebraic expressions in their simplest form. ▪ Science/Technology Education: Simplifying formulae and calculations in solving problems. 	<ul style="list-style-type: none"> ▪ Oral questioning/Quiz ▪ Assignment: Given an algebraic expression, formulate (real life) situations which could give rise to this expression ▪ Worksheets ▪ Questioning

Strand: ALGEBRA

LEARNING OUTCOME	INSTRUCTIONAL FOCUS	SUGGESTED TEACHING/LEARNING STRATEGIES	INTEGRATED CURRICULUM ACTIVITIES	SUGGESTED ASSESSMENT STRATEGIES
TOPIC: ALGEBRAIC EXPRESSIONS AND IDENTITIES				
<ul style="list-style-type: none"> apply the laws and properties of numbers to algebraic expressions 	<ul style="list-style-type: none"> Determining the L.C.M. of a set of algebraic terms Simplifying rational algebraic expressions involving addition and subtraction. 	<ul style="list-style-type: none"> Using the strategies as applied to finding L.C.M. of a set of numbers the teacher demonstrates how these can be applied to algebra. Using the strategies for adding and subtracting arithmetic expressions, the teacher demonstrates how the same procedure can be applied to algebra. Issue worksheets to provide a variety of sample problems for students. Using a teacher-designed activity, students explore the factorisation of numbers and extend it to algebraic expressions Students use the lengths of sides of a rectangle to represent factors of expressions involving two terms 	<ul style="list-style-type: none"> Science/Technology Education: Simplifying formulae and calculations in solving problems. Values Education : Discussion about identities and their visual representations 	<ul style="list-style-type: none"> Questioning Observation of : <ul style="list-style-type: none"> - Notebooks - Activities - Representation of self. Worksheets Quiz
<ul style="list-style-type: none"> represent different types of algebraic expressions as a product of factors using a variety of strategies. 	<ul style="list-style-type: none"> Concept of factorisation Factorisation of expressions with <ul style="list-style-type: none"> - two terms - three terms - four terms 			<ul style="list-style-type: none"> Activity Sheets Observation of : <ul style="list-style-type: none"> - Notebooks - Activities - Representation of self.

Strand: ALGEBRA

LEARNING OUTCOME	INSTRUCTIONAL FOCUS	SUGGESTED TEACHING/LEARNING STRATEGIES	INTEGRATED CURRICULUM ACTIVITIES	SUGGESTED ASSESSMENT STRATEGIES
TOPIC: ALGEBRAIC EXPRESSIONS AND IDENTITIES				
<ul style="list-style-type: none"> Represent different types of algebraic expressions as a product of factors using a variety of strategies.(continued) 	<ul style="list-style-type: none"> Determining H.C.F. of algebraic terms. Factorisation of linear expressions in not more than two variables. 	<ul style="list-style-type: none"> Using the strategies for finding H.C.F. of a set of numbers the teacher demonstrates how these can be applied to algebra. Students use of H.C.F. method to factorise expressions in two and three terms (not quadratic). Use of guided instruction to group terms and apply the distributive law an appropriate number of times. Independent practice to factorise linear expressions in one or two variables applying HCF and distributive law – worksheets. Teacher demonstration on how rational algebraic expressions can be simplified using techniques as applied in arithmetic. Independent practice to simplify rational algebraic expressions through worksheets. 	<ul style="list-style-type: none"> Interdisciplinary: Students make connections with the use of ‘expressions’ in values education, aesthetics, social studies and the development of spatial skills and communication skills. 	<ul style="list-style-type: none"> Questioning Observation of : <ul style="list-style-type: none"> - Notebooks - Activities - Representation of self. Worksheets Questioning Paper - Pencil Test

Strand: ALGEBRA

LEARNING OUTCOME	INSTRUCTIONAL FOCUS	SUGGESTED TEACHING/LEARNING STRATEGIES	INTEGRATED CURRICULUM ACTIVITIES	SUGGESTED ASSESSMENT STRATEGIES
TOPIC: ALGEBRAIC EXPRESSIONS AND IDENTITIES				
<ul style="list-style-type: none"> represent different types of algebraic expressions as a product of factors using a variety of strategies (continued) 	<ul style="list-style-type: none"> Factorisation of quadratic expressions in not more than two variables and coefficient of the squared term being 'one' 	<ul style="list-style-type: none"> Teacher demonstrates the factorisation of a quadratic expression visually using a rectangle Students investigate and evaluate the above strategy for factorising quadratic expressions Use of guided discovery to determine the factorisation of quadratic expressions by applying: <ol style="list-style-type: none"> the distributive law inspection <p>Group work:</p> <ul style="list-style-type: none"> Students discover the form of the factorisation for the difference of two squares, working in groups 	<ul style="list-style-type: none"> Science/Technology Education: Simplifying formulae and calculations in solving problems. 	<ul style="list-style-type: none"> Questioning Observation of : <ul style="list-style-type: none"> Notebooks Activities Representation of self. Worksheets Mental Quiz (Difference of squares) Group presentations Paper - Pencil Test

Strand: ALGEBRA

LEARNING OUTCOME	INSTRUCTIONAL FOCUS	SUGGESTED TEACHING/LEARNING STRATEGIES	INTEGRATED CURRICULUM ACTIVITIES	SUGGESTED ASSESSMENT STRATEGIES
TOPIC: MODELLING NATURAL PHENOMENA AND REAL LIFE SITUATIONS USING EQUATIONS				
<p>Students will be able to:</p> <ul style="list-style-type: none"> Solve linear simultaneous equations and quadratic equations by calculation and graphically. 	<ul style="list-style-type: none"> Solutions to linear equations using graphs 	<ul style="list-style-type: none"> Review of graphing of linear functions. Guided discussion to interpret the graph of a linear equation in one variable as one with two variables where one variable is held constant. Students investigate the relationship between the solution of linear equations and their graphs by drawing two straight lines Teacher demonstrates the procedures of elimination and substitution to solve linear simultaneous equations Group Activity to investigate the properties of quadratic functions Discuss the use of the graph of a quadratic function to obtain the roots of a quadratic equation. 	<ul style="list-style-type: none"> Science/Technology Education: Solving a variety of problems involving equations. 	<ul style="list-style-type: none"> Questioning Observation of : <ul style="list-style-type: none"> Notebooks Activities Representation of self. Worksheets Verbal response to oral questions Paper-pencil test

Strand: ALGEBRA

LEARNING OUTCOME	INSTRUCTIONAL FOCUS	SUGGESTED TEACHING/LEARNING STRATEGIES	INTEGRATED CURRICULUM ACTIVITIES	SUGGESTED ASSESSMENT STRATEGIES
<ul style="list-style-type: none"> ▪ Solve linear simultaneous equations and quadratic equations by calculation and by graphics. (continued) 	<ul style="list-style-type: none"> ▪ Graphing quadratic functions to obtain roots (continued) ▪ Solving quadratic equations by factorisation ▪ Relationship between graph of a quadratic function and its algebraic representation 	<ul style="list-style-type: none"> ▪ Independent practice to obtain the solutions to a quadratic equation by drawing the graph of two appropriate functions ▪ Teacher demonstrates the application of the process of factorisation in obtaining the roots/solutions of a quadratic equation ▪ Teacher issues a worksheet or sample questions to be done by the students. ▪ Discussion and activity sheet to relate the factorised form of a quadratic function to its corresponding graph and vice versa ▪ Through guided discussion students will recognize the connection between the algebraic method (factorization) and the graphical method and use this information to sketch appropriate graphs of quadratic functions given in algebraic form. 	<ul style="list-style-type: none"> ▪ Science/technology Education: Designing parabolic mirrors and satellite dishes etc. 	<ul style="list-style-type: none"> ▪ Observation of : <ul style="list-style-type: none"> - Notebooks - Activities ▪ Worksheets ▪ Oral questioning ▪ Paper-pencil test

Strand: ALGEBRA

LEARNING OUTCOME	INSTRUCTIONAL FOCUS	SUGGESTED TEACHING/LEARNING STRATEGIES	INTEGRATED CURRICULUM ACTIVITIES	SUGGESTED ASSESSMENT STRATEGIES
<ul style="list-style-type: none"> ▪ Create and solve appropriate equations representing real life situations and natural phenomena and use the solutions to interpret, analyse and evaluate problems. 	<ul style="list-style-type: none"> ▪ Translation of given situations/problems into algebraic equations or series of equations ▪ Applying a suitable strategy to solve these equations. ▪ Evaluation of correctness and assessment of the implications of solution(s). 	<ul style="list-style-type: none"> ▪ Through guided discussion the teacher identifies or simulates appropriate situations/problems which can be modelled algebraically from real life and natural phenomena ▪ Group discussion and interpretation of problems. ▪ Students solve problems using a variety of strategies while working individually or in groups. ▪ Presentation of solutions and/or strategies allowing for class feedback ▪ Interpretation and discussion of solutions and their implications 	<ul style="list-style-type: none"> ▪ Science/Technology Education: Situations and problems involving equations are presented by students ▪ Visual / Performing Arts: displaying equations visually and explaining their purpose 	<ul style="list-style-type: none"> ▪ Observation of skills in translation and strategies used to solve equations (Checklist). ▪ Questioning ▪ Using a rubric to evaluate group presentations. ▪ Observation of students' work ▪ Portfolios

COURSE OUTLINE FOR FORM THREE

Strand: MEASUREMENT II

LEARNING OUTCOME	INSTRUCTIONAL FOCUS	SUGGESTED TEACHING/LEARNING STRATEGIES	INTEGRATED CURRICULUM ACTIVITIES	SUGGESTED ASSESSMENT STRATEGIES
TOPIC: COMPOUND INTEREST AND DEPRECIATION				
Students will be able to: <ul style="list-style-type: none"> ▪ Explain what is “compound interest.” 	<ul style="list-style-type: none"> ▪ Exploring methods towards appreciation of capital ▪ Differentiating between simple and compound interest 	<ul style="list-style-type: none"> ▪ Performance task: Students collect information from financial institutions on different types of deposit accounts. ▪ Classify different types of accounts according to similarities and understanding how interest is calculated. 	<ul style="list-style-type: none"> ▪ Technology Education: <ul style="list-style-type: none"> - Business Studies explored to collect examples. ▪ Social Studies: <ul style="list-style-type: none"> - Examining national economies - Interview with bank personnel to develop research skills. 	<ul style="list-style-type: none"> ▪ Portfolio assessment: <ul style="list-style-type: none"> - Samples observed - Problems generated ▪ Displays: <ul style="list-style-type: none"> - Information presented on a display board

Strand: MEASUREMENT II

LEARNING OUTCOME	INSTRUCTIONAL FOCUS	SUGGESTED TEACHING/LEARNING STRATEGIES	INTEGRATED CURRICULUM ACTIVITIES	SUGGESTED ASSESSMENT STRATEGIES
<ul style="list-style-type: none"> ▪ Calculate compound interest in a variety of contexts ▪ Explain the meaning of depreciation. 	<ul style="list-style-type: none"> ▪ Calculating compound interest up to three terms ▪ Calculating the amount accumulated after a given period ▪ Solving real life problems involving compound interest ▪ Identifying depreciation as a decrease in value of an item ▪ Recognizing situations where depreciation occurs 	<ul style="list-style-type: none"> ▪ Use of guided discussion <ul style="list-style-type: none"> - to illustrate how interest is compounded for a given period of time; - comparison with the way that simple interest is calculated. ▪ Students generate and solve real life problems using stimuli from banks, advertisements, and so on ▪ Establishment of the meaning of depreciation and appreciation through research and discussion and relating depreciation to the value of an item after a fixed period of time 	<ul style="list-style-type: none"> ▪ Values Education: <ul style="list-style-type: none"> - Rates of interest for lending and borrowing money - No interest policy in Islamic banks ▪ Technology education: <ul style="list-style-type: none"> - Business Studies investigated to collect relevant examples. ▪ Values Education: <ul style="list-style-type: none"> - Changing values of people in society over time - Caring for property to maintain value 	<ul style="list-style-type: none"> ▪ Research presentation ▪ Paper-pencil test ▪ Questioning ▪ Observation of journals/notebook entries

Strand: MEASUREMENT II

LEARNING OUTCOME	INSTRUCTIONAL FOCUS	SUGGESTED TEACHING/LEARNING STRATEGIES	INTEGRATED CURRICULUM ACTIVITIES	SUGGESTED ASSESSMENT STRATEGIES
<ul style="list-style-type: none"> ▪ Calculate depreciation in a variety of contexts. 	<ul style="list-style-type: none"> ▪ Calculating depreciation based on given rates. ▪ Determining the amount - value of item/commodity after depreciation. ▪ Solving a variety of problems involving depreciation. 	<ul style="list-style-type: none"> ▪ Students conduct a field study, working in groups, to investigate businesses which deal with depreciated goods e.g. second-hand book shops, thrift shops, used car dealers etc. ▪ Using data from field study, students will create and solve problems on depreciation. ▪ Students complete a worksheet consisting of problems created and other supplementary problems on depreciation. 	<ul style="list-style-type: none"> ▪ Technology education: <ul style="list-style-type: none"> - Explore depreciation through telemarketing, auction sales etc. 	<ul style="list-style-type: none"> ▪ Group presentation of reports. ▪ Observation of notebook entries. ▪ Worksheet assessment.

Strand: MEASUREMENT II

LEARNING OUTCOME	INSTRUCTIONAL FOCUS	SUGGESTED TEACHING/LEARNING STRATEGIES	INTEGRATED CURRICULUM ACTIVITIES	SUGGESTED ASSESSMENT STRATEGIES
<p>TOPIC: INVESTMENTS Students will be able to:</p> <ul style="list-style-type: none"> ▪ Calculate the returns on different types of investments. 	<ul style="list-style-type: none"> ▪ Defining investment ▪ Identifying various bank deposit accounts as investments ▪ Examining how insurance can serve as a form of investment 	<ul style="list-style-type: none"> ▪ Students investigate the meaning of the word “investment” in the general sense and, through class discussion, they develop a mathematical context. ▪ Through guided discussion, students review the different methods of calculating interest for bank deposits and explain which account will generate greatest returns. ▪ Through a short discourse or by inviting an insurance person to speak to the class, students participate in an interactive discussion on how insurance can generate financial returns. 	<ul style="list-style-type: none"> ▪ Language Arts: Comparing the different meanings of ‘investment’ as used in Mathematics and in everyday life. ▪ Technology education: - Explore investments using the internet ▪ Values Education: - Professional ethics in insurance - Fairness in investment - Rewards for work 	<ul style="list-style-type: none"> ▪ Oral questioning ▪ Observations ▪ Testing ▪ Focus group

Strand: MEASUREMENT II

LEARNING OUTCOME	INSTRUCTIONAL FOCUS	SUGGESTED TEACHING/LEARNING STRATEGIES	INTEGRATED CURRICULUM ACTIVITIES	SUGGESTED ASSESSMENT STRATEGIES
<ul style="list-style-type: none"> ▪ Calculate the returns on different types of investments 	<ul style="list-style-type: none"> ▪ Exploring stocks and shares 	<ul style="list-style-type: none"> ▪ Students work in groups to carry out research on stocks and shares. They will conduct interviews and do simple calculations to investigate strategies for investment 	<ul style="list-style-type: none"> ▪ Social Studies: <ul style="list-style-type: none"> - Conducting research in businesses and the stock market. ▪ Technology Education: <ul style="list-style-type: none"> - Conducting research using the internet and other forms of technology 	<ul style="list-style-type: none"> ▪ Oral group presentation and individual written report ▪ Paper-pencil test

COURSE OUTLINE FOR FORM THREE

Strand: GEOMETRY I

LEARNING OUTCOME	INSTRUCTIONAL FOCUS	SUGGESTED TEACHING/LEARNING STRATEGIES	INTEGRATED CURRICULUM ACTIVITIES	SUGGESTED ASSESSMENT STRATEGIES
<p>TOPIC: PYTHAGORAS' THEOREM Students will be able to:</p> <ul style="list-style-type: none"> ▪ Develop Pythagoras' Theorem. 	<ul style="list-style-type: none"> ▪ Identifying the properties of the hypotenuse of a right-angled triangle ▪ Recognizing that the square of any length is equal to the area of the square whose side corresponds to that length ▪ Recognizing the relationship between the square of the hypotenuse of a right-angled triangle and that of the other sides. 	<ul style="list-style-type: none"> ▪ Use of drawings of a variety of right-angled triangles and guided discussion to allow students to deduce that the hypotenuse is the longest side and that it is located opposite the largest angle. ▪ Using measures from drawings, students will explore possible relationships between the lengths of the sides. They should deduce that linear relationships are not possible. 	<ul style="list-style-type: none"> ▪ Physical Education: <ul style="list-style-type: none"> - Designing and measuring distances along rectangular courts (e.g., basketball, netball, volleyball, badminton courts) ▪ Technology Education: <ul style="list-style-type: none"> - House plans - Fencing of land - Preparing sites for building 	<ul style="list-style-type: none"> ▪ Observation of class work and note books to assess the level of understanding of concepts and the representation of ideas

Strand: GEOMETRY I

LEARNING OUTCOME	INSTRUCTIONAL FOCUS	SUGGESTED TEACHING/LEARNING STRATEGIES	INTEGRATED CURRICULUM ACTIVITIES	SUGGESTED ASSESSMENT STRATEGIES
<ul style="list-style-type: none"> ▪ Applying Pythagoras' Theorem. (continued) 	<ul style="list-style-type: none"> ▪ Solving problems involving Pythagoras' Theorem. 	<ul style="list-style-type: none"> ▪ Students explore squared relationships by placing square cut-outs on each side of the triangle and deduce the relationship among the sides of a right angled triangle. ▪ Discussion of the meaning of a squared length as a measure of area. ▪ Use of guided discovery for students to deduce the theorem. ▪ Use of practical situations for students to create and solve problems, finding missing lengths of sides of right-angled triangles 	<ul style="list-style-type: none"> ▪ Numbers: <ul style="list-style-type: none"> - Concept of an irrational number, That is numbers which do not have an exact square-root. ▪ Values Education: <ul style="list-style-type: none"> - Relationships between different entities can follow fixed patterns 	<ul style="list-style-type: none"> ▪ Authentic task whereby students draw/mark a rectangular court of given dimensions without using a protractor or set square ▪ Paper/pencil test

Strand: GEOMETRY I

LEARNING OUTCOME	INSTRUCTIONAL FOCUS	SUGGESTED TEACHING/LEARNING STRATEGIES	INTEGRATED CURRICULUM ACTIVITIES	SUGGESTED ASSESSMENT STRATEGIES
<ul style="list-style-type: none"> ▪ Use the three basic trigonometrical ratios to calculate lengths for acute-angled triangles. 	<ul style="list-style-type: none"> ▪ Defining the sine, cosine and tangent ratios for right-angled triangles 	<ul style="list-style-type: none"> ▪ Students explore the words opposite and adjacent as they apply to real life and through discussion relate them to the angles and sides of the triangle ▪ Students create a series of examples of triangles with fixed angles and identify the adjacent and opposite sides ▪ Teacher demonstrates how to solve problems involving triangles using the sine, cosine and tangent ratios: Students solve simple problems. ▪ Use of independent practice for students to solve simple problems using each ratio, or including Pythagoras' Theorem. 	<ul style="list-style-type: none"> ▪ Language Arts: <ul style="list-style-type: none"> - Comparing the mathematical meaning of words with meaning in everyday usage ▪ Values Education: <ul style="list-style-type: none"> - Looking at situations from different perspectives 	<ul style="list-style-type: none"> ▪ Observation of notebook entries ▪ Worksheet assessment

Strand: GEOMETRY I

LEARNING OUTCOME	INSTRUCTIONAL FOCUS	SUGGESTED TEACHING/LEARNING STRATEGIES	INTEGRATED CURRICULUM ACTIVITIES	SUGGESTED ASSESSMENT STRATEGIES
TOPIC: SIMILAR TRIANGLES				
<p>Students will be able to:</p> <ul style="list-style-type: none"> Develop the concept of 'similarity' through concrete, visual and abstract representations 	<ul style="list-style-type: none"> Defining what is meant by the term 'similar triangles'. Identifying examples of similarity in real life Differentiating between the terms "same" and "similar" 	<ul style="list-style-type: none"> Students discuss the meaning of similarity by examining the concept in a variety of real life situations Use guided discussion to explore the difference between "same" and "similar" 	<ul style="list-style-type: none"> Visual Arts: Similar figures used in various forms of architectural and craft designs. Technology education: - Plans and elevations Science: - Magnification - Enlargement 	<ul style="list-style-type: none"> Observations Questioning

Strand: GEOMETRY I

LEARNING OUTCOME	INSTRUCTIONAL FOCUS	SUGGESTED TEACHING/LEARNING STRATEGIES	INTEGRATED CURRICULUM ACTIVITIES	SUGGESTED ASSESSMENT STRATEGIES
<ul style="list-style-type: none"> ▪ Develop the concept of 'similarity' through concrete, visual and abstract representations (continued) 	<ul style="list-style-type: none"> ▪ Applying the concept of similarity to triangles. 	<ul style="list-style-type: none"> ▪ Students examine a set of triangular shapes of various sizes where some are the same, similar or different, and asked to match similar pairs ▪ From the pairs selected students observe and compare their features and write a definition of similarity ▪ Students draw a set of similar triangles and measure and compare the length of their sides ▪ Use of guided instruction to lead students to discover that the ratios of the length of the sides are constant 	<ul style="list-style-type: none"> ▪ Social Studies: <ul style="list-style-type: none"> - Scaling and map reading ▪ Home Economics: <ul style="list-style-type: none"> - Garment construction 	<ul style="list-style-type: none"> ▪ Observations ▪ Questioning ▪ Paper-pencil test
<ul style="list-style-type: none"> ▪ Deducing properties of similar triangles: <ul style="list-style-type: none"> - ratio of lengths of corresponding sides being constant 				<ul style="list-style-type: none"> ▪ Observation of note book entries ▪ Oral questioning

Strand: GEOMETRY I

LEARNING OUTCOME	INSTRUCTIONAL FOCUS	SUGGESTED TEACHING/LEARNING STRATEGIES	INTEGRATED CURRICULUM ACTIVITIES	SUGGESTED ASSESSMENT STRATEGIES
<ul style="list-style-type: none"> ▪ Develop the concept of 'similarity' through concrete, visual and abstract representations (continued) 	<ul style="list-style-type: none"> ▪ Solving problems involving similar triangles 	<ul style="list-style-type: none"> ▪ Practice exercises for students to calculate missing sides of triangles using properties of similar triangles. ▪ Use of a variety of problem situations to generate questions on a worksheet for the students to work. 	<ul style="list-style-type: none"> ▪ Technology Education: <ul style="list-style-type: none"> - Determining the heights of trees, towers etc. without actually measuring. 	<ul style="list-style-type: none"> ▪ Paper-pencil test ▪ Worksheet assessment
TOPIC: Polygons				
Students will be able to: <ul style="list-style-type: none"> ▪ develop the concept of a 'polygon' through concrete, visual and abstract representations 	<ul style="list-style-type: none"> ▪ Identifying properties of a polygon: <ul style="list-style-type: none"> - Closed plane figure - Number of sides - Number of angles - Regular vs irregular 	<ul style="list-style-type: none"> ▪ Review, through discussion and demonstration, of the properties of a triangle, and extend to figures with four, five or six sides/angles 	<ul style="list-style-type: none"> ▪ Technology Education: <ul style="list-style-type: none"> - Architecture 	<ul style="list-style-type: none"> ▪ Oral questioning ▪ Observation of note book entries

Strand: GEOMETRY I

LEARNING OUTCOME	INSTRUCTIONAL FOCUS	SUGGESTED TEACHING/LEARNING STRATEGIES	INTEGRATED CURRICULUM ACTIVITIES	SUGGESTED ASSESSMENT STRATEGIES
<p>Students will be able to:</p> <ul style="list-style-type: none"> ▪ Develop the concept of a 'polygon' through concrete, visual and abstract representations 	<ul style="list-style-type: none"> ▪ Naming of polygons according to the number of sides 	<ul style="list-style-type: none"> ▪ Teacher identifies the equilateral triangle as a 'regular' figure and students extend this idea to produce by drawing regular figures with four, five, or six sides. ▪ Students classify different polygons according to the number of sides/angles and name them. 	<ul style="list-style-type: none"> ▪ Art and Craft: <ul style="list-style-type: none"> - Drawing and designing patterns in art, fabric design and models ▪ Science: <ul style="list-style-type: none"> - Biology: cell shape/structure - Chemistry: molecular structure - Physics: close packing of molecules 	<ul style="list-style-type: none"> ▪ Observations ▪ Oral questioning

Strand: GEOMETRY I

LEARNING OUTCOME	INSTRUCTIONAL FOCUS	SUGGESTED TEACHING/LEARNING STRATEGIES	INTEGRATED CURRICULUM ACTIVITIES	SUGGESTED ASSESSMENT STRATEGIES
<p>Students will be able to:</p> <ul style="list-style-type: none"> Solve simple geometric problems involving polygons. 	<ul style="list-style-type: none"> Using triangle properties to derive the formula for calculating the sum of the interior angles of a polygon Calculating interior/exterior angles of regular polygons 	<ul style="list-style-type: none"> Provision of activity sheet where students will divide different regular polygons to get appropriate numbers of triangles. By tabulating the number of sides of a polygon with number of triangles, and observing patterns, students derive the formula for calculating the sum of the interior angles of a polygon of n sides . Using properties of straight lines, regular figures and the sum of all interior angles, students determine the size of each interior/exterior angle in a regular polygon . 	<ul style="list-style-type: none"> Mathematics: Algebra Developing general formulae 	<ul style="list-style-type: none"> Performance task Observation of notebook entries Paper-pencil test

Strand: GEOMETRY I

LEARNING OUTCOME	INSTRUCTIONAL FOCUS	SUGGESTED TEACHING/LEARNING STRATEGIES	INTEGRATED CURRICULUM ACTIVITIES	SUGGESTED ASSESSMENT STRATEGIES
<ul style="list-style-type: none"> ▪ Solve simple geometric problems involving polygons. (continued) ▪ Construct regular polygons (with not more than 10 sides). 	<ul style="list-style-type: none"> ▪ Constructing regular polygons. ▪ Solving problems involving the construction of regular polygons. 	<ul style="list-style-type: none"> ▪ Students solve simple problems involving missing angles in polygons. ▪ Review, through questioning and discussion of the construction of triangles and quadrilaterals and extension of the strategy to construct regular polygons using ruler, compass and protractor. ▪ Students are presented with a worksheet consisting of problems relating to construction of a variety of regular polygons. 	<ul style="list-style-type: none"> ▪ Mathematics: Tesselations and Tangrams ▪ Technology Education: Designing buildings and other smaller items. 	<ul style="list-style-type: none"> ▪ Worksheet assessment ▪ Oral questioning ▪ Observations ▪ Worksheet assessment

COURSE OUTLINE FOR FORM THREE

Strand: GEOMETRY II

LEARNING OUTCOME	INSTRUCTIONAL FOCUS	SUGGESTED TEACHING/LEARNING STRATEGIES	INTEGRATED CURRICULUM ACTIVITIES	SUGGESTED ASSESSMENT STRATEGIES
TOPIC: GEOMETRICAL TRANSFORMATION: ROTATION				
Students will be able to: <ul style="list-style-type: none"> ▪ Investigate and use the properties of rotation geometrically. 	<ul style="list-style-type: none"> ▪ Defining the properties of rotation about a point ▪ Distinguishing between positive and negative rotation, clockwise and counter or anticlockwise rotation about a point 	<ul style="list-style-type: none"> ▪ Use of role play to demonstrate basic properties of rotation and have students take notes of their observations to define related properties. ▪ Use of guided discussion to distinguish between positive and negative rotation, clockwise and counter or anticlockwise rotation. 	<ul style="list-style-type: none"> ▪ Physical Education: <ul style="list-style-type: none"> - Exercise routines ▪ Technology Education: <ul style="list-style-type: none"> - Installation of doors - Working with the lathe - Woodwork ▪ Science: <ul style="list-style-type: none"> - Circular motion - Locating center of gravity of plane shapes. 	<ul style="list-style-type: none"> ▪ Observation of class work and note books to assess the level of understanding of concepts and the representation of ideas. ▪ Oral questioning

Strand: GEOMETRY II

LEARNING OUTCOME	INSTRUCTIONAL FOCUS	SUGGESTED TEACHING/LEARNING STRATEGIES	INTEGRATED CURRICULUM ACTIVITIES	SUGGESTED ASSESSMENT STRATEGIES
<ul style="list-style-type: none"> ▪ Investigate and use the properties of rotation geometrically (continued) 	<ul style="list-style-type: none"> ▪ Locating: <ul style="list-style-type: none"> - the image of an object point - the image of a plane shape - an object point given its image - a plane shape given its image and center of rotation, under a given rotation ▪ Locating the center of rotation and measuring the angle of rotation, given the object and image of a plane shape 	<ul style="list-style-type: none"> ▪ Use of geoboard/chalkboard and compasses or string to demonstrate, using properties defined earlier, location of the image of a point under a given rotation ▪ Through demonstration or guided discovery the critical points in a plane shape are identified and used to locate: <ul style="list-style-type: none"> - the image of a plane shape, - the object of a plane shape, given its image, under a given rotation ▪ Use of guided discussion and geoboard/chalkboard to relate the properties of rotation to approaches that can be used to locate the <ul style="list-style-type: none"> - center of rotation, and - angle of rotation, when given the object and image plane figures. 	<ul style="list-style-type: none"> ▪ Values Education: <ul style="list-style-type: none"> - Relating transformation to people and noting what values remain the same even when there is some physical transformation ▪ Language Arts: <ul style="list-style-type: none"> - Comparing the mathematical meaning of words with meaning in everyday usage 	<ul style="list-style-type: none"> ▪ Oral questioning ▪ Observation of notebook entries ▪ Journal entries

Strand: GEOMETRY II

LEARNING OUTCOME	INSTRUCTIONAL FOCUS	SUGGESTED TEACHING/LEARNING STRATEGIES	INTEGRATED CURRICULUM ACTIVITIES	SUGGESTED ASSESSMENT STRATEGIES
<ul style="list-style-type: none"> ▪ Investigate and use the properties of rotation geometrically (continued) 	<ul style="list-style-type: none"> ▪ Solving geometrical problems involving rotation. ▪ Describing the order of rotational symmetry of plane shapes. 	<ul style="list-style-type: none"> ▪ Students are presented with a variety of problems in a worksheet for practice. ▪ Through guided discussion and demonstration students will uncover the meaning of rotational symmetry and the corresponding order for various plane shapes 		<ul style="list-style-type: none"> ▪ Worksheet assessment ▪ Paper/pencil test
TOPIC: GEOMETRICAL TRANSFORMATION: ENLARGEMENT				
Students will be able to: <ul style="list-style-type: none"> ▪ investigate and use the properties of enlargement of geometrical figures. 	<ul style="list-style-type: none"> ▪ Defining properties of enlargement about a point/center of enlargement. 	<ul style="list-style-type: none"> ▪ Students discuss the meaning of enlargement by examining the use of the word in a variety of real life situations. 	<ul style="list-style-type: none"> ▪ Technology Education: <ul style="list-style-type: none"> - Plans and elevations - Movie projection - Photocopying of documents - Changing font size in word processing, and using the computer 	<ul style="list-style-type: none"> ▪ Observation ▪ Oral questioning

Strand: GEOMETRY II

LEARNING OUTCOME	INSTRUCTIONAL FOCUS	SUGGESTED TEACHING/LEARNING STRATEGIES	INTEGRATED CURRICULUM ACTIVITIES	SUGGESTED ASSESSMENT STRATEGIES
<ul style="list-style-type: none"> ▪ Investigate and use the properties of enlargement of geometrical figures (continued) 	<ul style="list-style-type: none"> ▪ Developing the meaning of scale factor: <ul style="list-style-type: none"> - positive scale factor - negative scale factor - fractional scale factor ▪ Locating the image of an object under a given enlargement 	<ul style="list-style-type: none"> ▪ Use of interactive demonstration to present enlargements using <ul style="list-style-type: none"> - a magnifying glass - a projector, and identifying the centers of enlargement ▪ Use of simple examples of enlargements, double and triple, to develop the concept of scale factor ▪ Use of activity sheet with guided instructions for students to investigate instances where scale factors are <ul style="list-style-type: none"> - positive - negative - fractions ▪ Students are guided to draw the image of an object under a given enlargement 	<ul style="list-style-type: none"> ▪ Science: <ul style="list-style-type: none"> - Magnification - Enlargement ▪ Social Studies: <ul style="list-style-type: none"> - Scaling and map reading 	<ul style="list-style-type: none"> ▪ Questioning ▪ Observations ▪ Performance task ▪ Performance task ▪ Observation

Strand: GEOMETRY II

LEARNING OUTCOME	INSTRUCTIONAL FOCUS	SUGGESTED TEACHING/LEARNING STRATEGIES	INTEGRATED CURRICULUM ACTIVITIES	SUGGESTED ASSESSMENT STRATEGIES
<ul style="list-style-type: none"> ▪ Investigate and use the properties of enlargement of geometrical figures (continued) 	<ul style="list-style-type: none"> ▪ Comparing areas of plane shapes under an enlargement. ▪ Solving a variety of problems involving enlargements, using similar triangles ▪ Comparing properties of various geometrical transformations 	<ul style="list-style-type: none"> ▪ Using a simple plane shape, students investigate the relationship between the areas of the object and image under an enlargement ▪ After teacher demonstration of how to solve problems involving enlargements, students are presented with a variety of problems for practice ▪ Students work either in groups or individually to tabulate similarities and differences in the properties of: <ul style="list-style-type: none"> - translation - reflections - rotation - enlargement, highlighting similarity and congruency where applicable 	<ul style="list-style-type: none"> ▪ Art and Craft: <ul style="list-style-type: none"> - Drawing pictures on billboards - Designing models ▪ Home Economics: <ul style="list-style-type: none"> - Garment construction 	<ul style="list-style-type: none"> ▪ Observation of notebook entries ▪ Project report and/or oral presentations

COURSE OUTLINE FOR FORM THREE

Strand: SETS, RELATIONS AND FUNCTIONS

LEARNING OUTCOME	INSTRUCTIONAL FOCUS	SUGGESTED TEACHING/LEARNING STRATEGIES	INTEGRATED CURRICULUM ACTIVITIES	SUGGESTED ASSESSMENT STRATEGIES
TOPIC: SET THEORY				
Students will be able to: <ul style="list-style-type: none"> ▪ Solve problems involving three sets using Venn diagrams. 	<ul style="list-style-type: none"> ▪ Representing information on appropriate Venn Diagrams ▪ Analyzing information from a Venn diagram 	<ul style="list-style-type: none"> ▪ Students review the relationships between two sets by drawing Venn diagrams and writing algebraic statements to solve problems ▪ Group work - Investigation of the relationships among three sets visually and algebraically ▪ Demonstration and practice to represent information on appropriate Venn diagrams ▪ Student activity to construct Venn diagrams using algebraic expressions to represent real life information and determine unknown quantities using algebraic methods 	<ul style="list-style-type: none"> ▪ Problem solving : Identification of situation in real life involving 3 sets and its visual representation. 	<ul style="list-style-type: none"> ▪ Observation of problems collected and their visual representation ▪ Group presentations to share the results of the investigation ▪ Paper -pencil Test ▪ Performance Task.

Strand: SETS, RELATIONS AND FUNCTIONS

LEARNING OUTCOME	INSTRUCTIONAL FOCUS	SUGGESTED TEACHING/LEARNING STRATEGIES	INTEGRATED CURRICULUM ACTIVITIES	SUGGESTED ASSESSMENT STRATEGIES
TOPIC: RELATIONS AND FUNCTIONS				
<p>Students will be able to:</p> <ul style="list-style-type: none"> ▪ Distinguish between relations and functions presented in a variety of ways of representation ▪ Use functional notation to obtain ordered pairs of linear and quadratic functions and then represent functions graphically. 	<ul style="list-style-type: none"> ▪ Defining: <ul style="list-style-type: none"> - a relation - a function. ▪ Representing relations and functions as <ul style="list-style-type: none"> - mappings - set of ordered pairs - graphs over <ul style="list-style-type: none"> (i) the set of integers (ii) the set of real numbers ▪ Introduction to functional notation: $f: x \rightarrow ax + b$ $f(x) = ax^2 + bx + c$ 	<ul style="list-style-type: none"> ▪ An activity for students to classify various forms of representing relations by comparing and contrasting the relationship between the domain and range in each case. ▪ Group work – investigation of the graphical representation over the set of real numbers of the different types of relations, to derive the characteristics of a function. ▪ Independent practice to represent relations given in one form to the other two forms. ▪ Demonstration of use of functional notation to represent ‘one- to-one’ and ‘many- to-one’ relations. 	<ul style="list-style-type: none"> ▪ Social studies: Exploration of homogenous and heterogenous relationships and making connections with the different types of relationships discussed mathematically ▪ Language Arts: Journal entry to compare the mathematical meaning of the words “relation”, “function” and “notation” to other meanings 	<ul style="list-style-type: none"> ▪ Observation of the results obtained on completion of the activity sheet. ▪ Oral Quiz ▪ Observation of graphical skills. ▪ Worksheet for practice ▪ Observation of notebook and journal entries

STRAND: SETS, RELATIONS AND FUNCTIONS

LEARNING OUTCOME	INSTRUCTIONAL FOCUS	SUGGESTED TEACHING/ LEARNING STRATEGIES	INTEGRATED CURRICULUM ACTIVITIES	SUGGESTED ASSESSMENT STRATEGIES
<ul style="list-style-type: none"> ▪ Use functional notation to obtain ordered pairs of linear and quadratic functions and represent functions graphically. (continued) 	<ul style="list-style-type: none"> ▪ Calculation of ordered pairs of functions for a given domain or range of a given number system ▪ Use algebraic form of a function to construct the graph and the reversal of the process 	<ul style="list-style-type: none"> ▪ Guided instruction to determine ordered pairs of linear or quadratic functions given elements of the domain or range, within a table or written as an inequality ▪ Group work - construction of linear and quadratic graphs presented in functional notation. 		<ul style="list-style-type: none"> ▪ Worksheet <ul style="list-style-type: none"> - incomplete tables - functions given with the domain and ranges written as inequalities ▪ Paper - pencil test ▪ Group presentations

STRAND: SETS, RELATIONS AND FUNCTIONS

LEARNING OUTCOME	INSTRUCTIONAL FOCUS	SUGGESTED TEACHING/LEARNING STRATEGIES	INTEGRATED CURRICULUM ACTIVITIES	SUGGESTED ASSESSMENT STRATEGIES
<p>TOPIC: INEQUALITIES</p> <p>Students will be able to:</p> <ul style="list-style-type: none"> ▪ Solve linear inequalities using a variety of strategies 	<ul style="list-style-type: none"> ▪ Representing the solution of a linear inequality in the following forms: <ul style="list-style-type: none"> - on a number line - on the coordinate plane - in set and algebraic notation ▪ Solving inequalities expressed as the product of two linear factors greater than, less than or equal to zero 	<ul style="list-style-type: none"> ▪ Demonstration and practice of the use of the number line to display the solution of linear inequalities ($ax + b < c$) expressed algebraically and in words. ▪ Guided instructions to identify the different regions on the coordinate plane described by inequalities of the form $x > b$, $y > c$ ▪ Demonstration and practice of representing the solution of the linear inequality of the form $ax + by > c$ on the coordinate plane by shading the correct region. ▪ Independent practice to represent the solution of inequalities given in one form and in the other two forms. ▪ Group work – devising a method to solve quadratic inequalities and presenting this method for peer evaluation. 	<ul style="list-style-type: none"> ▪ Language Arts: Examine the meaning of the word ‘inequality’ in relation to other disciplines and in real life situations ▪ Visual Arts: Illustrate these understandings visually or using algebraic notation. 	<ul style="list-style-type: none"> ▪ Observation of representations of solutions on number line or coordinate plane. ▪ Group presentations justifying methods used.

STRAND: SETS, RELATIONS AND FUNCTIONS

LEARNING OUTCOME	INSTRUCTIONAL FOCUS	TEACHING/ LEARNING STRATEGIES	INTEGRATED CURRICULUM ACTIVITIES	SUGGESTED ASSESSMENT STRATEGIES
<p>TOPIC: INEQUALITIES</p> <ul style="list-style-type: none"> ▪ Solve linear inequalities using a variety of strategies. 	<ul style="list-style-type: none"> ▪ Deriving rules for algebraic inequalities ▪ Solving inequalities using the rules as derived above. 	<ul style="list-style-type: none"> ▪ An activity using the number line and guided instruction to derive the rules: $x > y \Rightarrow x + a > y + a$ for $a > 0$ $x > y \Rightarrow ax > ay$ for $a > 0$ $x > y \Rightarrow -x < -y$ ▪ Independent practice using a worksheet 		<ul style="list-style-type: none"> ▪ Oral quiz on rules ▪ Worksheets for practice ▪ Paper-pencil test

COURSE OUTLINE FOR FORM THREE

Strand: STATISTICS AND PROBABILITY

LEARNING OUTCOME	INSTRUCTIONAL FOCUS	SUGGESTED TEACHING/LEARNING STRATEGIES	INTEGRATED CURRICULUM ACTIVITIES	SUGGESTED ASSESSMENT STRATEGIES
<p>TOPIC: FREQUENCY DISTRIBUTIONS</p> <p>Students will be able to:</p> <ul style="list-style-type: none"> ▪ Display discrete and continuous data using the appropriate mathematical representation. 	<ul style="list-style-type: none"> ▪ Distinguishing between discrete and continuous data ▪ Constructing a frequency table for discrete data and displaying of data on a bar chart or pie chart ▪ Constructing a grouped frequency table ▪ Displaying continuous data on histograms 	<ul style="list-style-type: none"> ▪ Guided discussion to identify the fundamental differences between discrete and continuous data. ▪ Presentation of statistical problems which require students to collect discrete data. ▪ Organization of data in a frequency table and display of data using an appropriate diagram. ▪ Guided instruction and discussion to develop the steps involved in grouping data into equal class intervals. ▪ Observation of the features of a histogram by examining finished diagrams. ▪ Demonstration and guided instruction to construct histograms from given data. ▪ Independent practice to organize data in a grouped frequency table and displayed on a histogram. 	<ul style="list-style-type: none"> ▪ Real life situations: <ul style="list-style-type: none"> - Discussion on situations where continuous, data is rounded off and displayed as discrete data. e.g. shoe sizes - Collection of histograms used to display data from real life situations 	<ul style="list-style-type: none"> ▪ Evaluation of students' display of data. ▪ Students communicate orally and in writing the steps involved in constructing a grouped frequency table. ▪ Questioning ▪ Observation of students' work/Journals ▪ Paper - pencil test.

Strand: STATISTICS AND PROBABILITY

LEARNING OUTCOME	INSTRUCTIONAL FOCUS	SUGGESTED TEACHING/LEARNING STRATEGIES	INTEGRATED CURRICULUM ACTIVITIES	SUGGESTED ASSESSMENT STRATEGIES
TOPIC: FREQUENCY DISTRIBUTIONS (Continued)				
<p>Students will be able to:</p> <ul style="list-style-type: none"> ▪ Display continuous data using the appropriate mathematical representation. (continued) 	<ul style="list-style-type: none"> ▪ Displaying continuous data using a frequency polygon ▪ Discussing and interpreting smooth frequency polygons 	<ul style="list-style-type: none"> ▪ Guided instruction to develop the steps that are involved in drawing the frequency polygon. ▪ Discussion on the various features of the frequency polygon and the resulting effect of varying the class size. ▪ Identify that as the number of class intervals increase the frequency polygon becomes more like a smooth curve. ▪ Provide a variety of problems on a worksheet where students will draw frequency polygons. 	<ul style="list-style-type: none"> ▪ Technology Education: Use of technology to display data 	<ul style="list-style-type: none"> ▪ Assignment on construction of frequency polygon ▪ Oral questioning ▪ Observation of students' notebook ▪ Worksheet assessment.

Strand: STATISTICS AND PROBABILITY

LEARNING OUTCOME	INSTRUCTIONAL FOCUS	SUGGESTED TEACHING/LEARNING STRATEGIES	INTEGRATED CURRICULUM ACTIVITIES	SUGGESTED ASSESSMENT STRATEGIES
<p>TOPIC: MEASURES OF CENTRAL TENDENCY</p> <p>Students will be able to:</p> <ul style="list-style-type: none"> ▪ analyse frequency distributions using measures of central tendency. 	<ul style="list-style-type: none"> ▪ Distinguishing between the mode and modal class ▪ Comparing the median and median class ▪ Comparing the methods for calculating the mean from ungrouped and grouped frequency distributions 	<ul style="list-style-type: none"> ▪ Reflection on the definition of mode of discrete data and extension of concept to continuous data. ▪ Students determine the modal class of a frequency distribution given in a table or on a histogram. ▪ Students develop a procedure for finding the median class of a grouped frequency distribution displayed as a table or histogram. ▪ Discussion on the method of calculating the mean of an ungrouped frequency distribution. 	<ul style="list-style-type: none"> ▪ Business Studies/Technology Education: Stocking of businesses according to popularity in sales. ▪ Values Education: Discussion of the normal distribution displayed graphically and its relationship to norms in society. 	<ul style="list-style-type: none"> ▪ Students communicate ways of identifying modal class. ▪ Observation of responses to activity sheets. ▪ Oral questioning.

Strand: STATISTICS AND PROBABILITY

LEARNING OUTCOME	INSTRUCTIONAL FOCUS	SUGGESTED TEACHING/LEARNING STRATEGIES	INTEGRATED CURRICULUM ACTIVITIES	SUGGESTED ASSESSMENT STRATEGIES
<p>TOPIC: MEASURES OF CENTRAL TENDENCY</p> <ul style="list-style-type: none"> Analyse frequency distributions using measures of central tendency. 	<ul style="list-style-type: none"> Selecting the appropriate measure of central tendency for a given statistical problem. 	<ul style="list-style-type: none"> Investigation to determine which value within the class interval should be used to calculate the mean of grouped frequency distributions. Presentation of problems for students to analyse data and choose the most suitable measure of central tendency in the process. 	<ul style="list-style-type: none"> Business Studies/Technology Education: Stocking of businesses according to popularity in sales. 	<ul style="list-style-type: none"> Oral questioning Paper - Pencil test on all three measures Evaluation of group presentation justifying choice

PART THREE

STRATEGIES/METHODOLOGIES

TEACHING AND LEARNING STRATEGIES

The mathematics classroom needs to be one in which students should be actively engaged in doing mathematics. It is no longer acceptable to view mathematics as a set of isolated rules and procedures that the teacher transmits to the student. Instead, the student must begin to see mathematics as a useful tool for understanding the world. Classroom activities and student assignments must be structured to provide opportunities for students to communicate, reason mathematically, make connections and solve problems. It is important that problem-solving be taught as an essential part of every strand. Problem-solving strategies should be modeled in such a way as to encourage students to employ various strategies.

The learning environment is one in which students and teachers regularly use mathematical resources and technology, actively discuss problems, make conjectures, share solutions, verify reasoning and value multiple approaches and representations. The learning environment needs to be a safe one where students feel comfortable to share alternative approaches and make suggestions.

Mathematics as a discipline has a broad base content organized along various strands; number operations and number theory, geometry, measurement, algebra, sets, relations and functions, statistics and probability. However, developing mathematical literacy is much more than acquiring a body of knowledge. Mathematical thinking requires formulating questions, developing and using algorithms appropriately, communication, making connections, reasoning and problem solving. Teachers need to balance the acquisition of procedural skills with the attainment of conceptual understanding.

Teaching strategies must grow out of the recognition that the learner actively constructs meaning and acquires knowledge in different ways. To address these realities, teaching the curriculum must involve a variety of instructional strategies such as:

- Discourse, including higher level questioning
- Investigation and exploration of real life issues
- Solving a problem in various ways and explaining or defending the strategy used
- Collaborative learning - working in small groups or pairs
- Meaningful activities that provide opportunities for explanations, questions, justification, observation, and the use of resources
- Devising, examining and refining strategies for solving problems
- Journal writing
- Portfolios
- Projects/presentations
- Integration with other core areas of the curriculum
- Concept maps / organizers
- Infusing technology and values education into the curriculum
- Storytelling
- Brainstorming

- Activity sheets
- Checklists
- Modeling, using tasks involving the psychomotor, cognitive and affective domains.

There are three aspects of mathematics that must be emphasized as part of the instructional process. These are concept development, algorithmic procedures with emphasis on computational proficiency, and problem solving. Each aspect requires a different instructional approach.

Concept development:

Concepts are ideas which require understanding in order to provide a foundation on which other knowledge and skills can be developed. The instructional approach requires active teaching using the constructivist perspectives of sense perception, reflection, collaboration, consensus and sharing. Students are allowed to communicate effectively, reason, make connections with other curriculum areas and real life situations, use problem-solving skills, and use various representational forms.

Guidelines for teaching concepts:

- Examine examples and non-examples
- Make connections with real life situations
- Build on students' knowledge and experiences
- Engage students in explorations and facilitate discussion
- Provide students with time and opportunities to move from the concrete representation to the abstract/symbolic
- Provide opportunities for students to explain, reason, debate, question and come to their own understanding
- Encourage the use of appropriate language and terminology.

Value of concept learning for students:

- Decreases rote memorization and promotes relational understanding
- Enables students to examine an idea, problem or question using the first principle approach
- Develops students' discriminatory and critical thinking skills
- Increases students' self-confidence in their ability to reason mathematically.

Algorithmic procedures:

Algorithms are procedures for calculating or carrying out the various processes in solving problems. Ideally algorithmic procedures should be introduced after concepts are developed. The instructional approach should vary to meet the needs of the students and should incorporate Howard Gardner's theory of multiple intelligence which includes nine major areas of intelligences: musical, bodily-kinesthetic, logical-mathematical, linguistic, spatial, interpersonal, intra-personal, naturalistic and creative. The goal should be to achieve mastery learning. To attain excellence in mathematics, students should be taught through their strengths and be nurtured to learn in areas that are not their natural strengths. Mastery learning requires direct teaching, guided practice and independent practice.

Guidelines for teaching algorithms:

- Develop rather than present an algorithm, where possible
- Encourage discussion of a variety of student-developed algorithmic procedures and point out efficiency as desirable in using an algorithm
- Provide opportunity for guided and individual practice
- Apply algorithm in as many different situations as experienced by students
- Use creative ways to assist students in remembering an algorithm by acknowledging that students are intelligent in different ways.

Value of learning algorithmic procedures for student:

- Enables students to acquire procedural fluency
- Improves problem-solving skills
- Increases efficiency
- Improves mathematical achievement.

Problem-Solving:

Students will only become prolific problem solvers by determining solutions to challenging problems. Routine problems such as application problems, taught in relation to each strand in mathematics, are insufficient to develop creative thinking skills, although they contribute significantly in the development of critical thinking skills. Non-routine problems are derived from real life or recreational situations. The co-operative learning strategy is recommended for the instructional approach. This requires that the classroom is organized for group work and that students are provided with the time and resources necessary to foster collaboration, effective communication, reflection and sharing.

Guidelines for teaching problem solving:

Polya's model is recommended as a guide to be used in teaching problem-solving. Using this model he identifies four steps in the problem-solving process:

Step 1:Understanding the problem:

- Formulate questions
- Elicit information given
- Determine what is required

Step 2:Planning to solve the problem:

- Suggest a strategy
- Conduct an experiment
- Make a drawing, diagram or model
- Use patterns
- Compute
- Organize a list or table
- Simplify or simulate
- Use deduction
- Work backwards
- Use an equation

Step 3:Solving the problem

- Carry out the selected strategy
- Obtain a solution
- If no solution is obtained, repeat Steps 2 and 3 until a solution is obtained.

Step 4:Review the problem

- Discuss various strategies used to obtain a solution
- Create variations or entirely new problems by extending the given problem.

Value of problem solving for students:

- Develops students' creative and critical thinking skills
- Encourages teamwork and collaboration
- Promotes respect for self and others
- Foster a positive attitude towards Mathematics
- Enhances students' potential for learning.

SUGGESTED ACTIVITIES

The effective implementation of the Mathematics curriculum has been a great challenge for teachers over the years. Modern educational research suggests that a more student-centred approach may be most appropriate for the delivery of the Mathematics curriculum. Using this approach, students will engage themselves in the construction of mathematical knowledge and the development of appropriate mathematical skills. At the same time, teachers will be required to prepare challenging tasks that will encourage students to develop their *critical* and *creative thinking* skills.

Critical thinking skills can be developed using routine problems which provide opportunities for students to demonstrate convergent reasoning. Accordingly, by using this strategy, the learner operates as a convergent thinker and seeks the correct answer in one way only.

On the other hand, creative thinking skills can be developed using non-routine problems through the development of divergent reasoning. In this way, the learner operates as a divergent thinker and produces many solutions to a problem using familiar methods in new and original ways.

A challenging task is one which:

- Depicts a real life issue or problem
- Uses manipulatives, drawings or generalizations
- Is interesting
- Has a sound mathematical base
- Is accessible on some level to all students
- Allows for extensions and connections
- Can be solved in a variety of ways.

Each activity should involve the processes of communication, representation, reasoning, connection and problem-solving.

- **Communication/representation**

- Use of mathematical language and symbols
- Use of visuals, expressions, equations and inequations
- Use of oral presentations involving technology
- Logical presentations
- Interpretation, analysis, synthesis and evaluation of the mathematical thinking and strategies of others
- Use of a variety of representations to model and interpret physical, social and mathematical phenomena
- Selection, application and translation of mathematical representations to solve problems.

- **Reasoning**

- Use of deductive and inductive reasoning
- Development of mathematical proofs
- Evaluation of mathematical arguments
- Recognition of reasoning and proof as fundamental aspects of mathematics.

- **Connection**

- Recognition and use of connections across strands in mathematics
- Recognition and application of mathematics in contexts across the core curriculum subjects and in real life situations
- Making connections with mathematics through projects and investigations.

- **Problem solving**

- Use of the process of mathematical problem solving in investigations and projects
- Solving problems that occur in Mathematics and other contexts
- Use of a problem solving approach to introduce and teach concepts and skills
- Solving a variety of problems.
- Developing a range of problem solving strategies.

SAMPLE ACTIVITIES-

Strand: Number operations and number theory
Topic: Representation of numbers
Reference: Adapted from Atlantic Canada Mathematics Curriculum
Activity: Representing very small and very large numbers in scientific notation

1. Teachers will guide students, who would be organized in groups, to use three different resources, to compile a list of very large and very small numbers written in scientific notation or standard form. One of the resources should be the internet.

A NUMBER REPRESENTED IN SCIENTIFIC NOTATION IS IN THE FORM:

$$A \times 10^n, \text{ where } n \in \mathbf{Z}, \text{ the set of Integers and } 1 \leq A < 10$$

Indicate clearly the context in which each number has this representation.
 Arrange the numbers in ascending order, and justify your ordering.

2. Students are asked to record, in scientific notation, the distances of five planets from the sun and to rank these distances in order of size.
3. Students are asked to record the mass of five specific insects and arrange those numbers in descending order.

Example: Compare 4.2×10^{-3} , 42.3×10^{-4} and 0.421×10^{-2} and arrange them in descending order of size. Justify your ordering.

- 4 is less than -3 which is less than -2, however 0.421 is less than 4.2 which is less than 42.3

Therefore, it is difficult to compare the size of the numbers in the form given.
 Rewrite the numbers in the decimal form.

$$4.2 \times 10^{-3} = 0.0042 \quad 42.3 \times 10^{-4} = 0.00423 \quad 0.421 \times 10^{-2} = 0.00421$$

Now it is easier to compare the numbers using the place value concept.

0.00423 is greatest, then 0.00421 and 0.0042 which is least.

Therefore, the numbers arranged from the greatest to least are:

$$42.3 \times 10^{-4}, 0.421 \times 10^{-2}, 4.2 \times 10^{-3}$$

Strand: Measurement
Topic: Prisms
Reference: Atlantic Canada Mathematics Curriculum
Activity: Calculating Volume

Students work in groups to solve the following problems by using drawings as the strategy to derive the solution. Each group will be required to explain the strategy used, to work the problem and check their answer. Each group will present to the class their responses to one problem to the class.

PROBLEMS

1. Estimate the mass of water in a barrel that has a radius of 20cm and a height of 80cm. What assumptions did you make?
2. The swimming pool at the sports complex was drained, except for 2cm of water at the bottom. This did not seem like much, so the worker left the pool at the end of the day and detached the drain hose. The 2cm of water leaked out overnight and collected in a weight-lifting room in the basement. The pool has dimensions 50m by 20m. The weight room has dimensions 7.2m by 5m. How deep was the water in the weight room the next morning?

The complex has no means of draining the water from the weight room except through a Wet Vac, which holds 15 litres of water. How many times will you have to fill the Wet Vac to remove all the water from the weight room?

3. During a water shortage, the public was advised to put a brick in their toilet tanks as a water-saving measure. How will this help to save water?

The Carter family has a main-floor bathroom that they use most frequently. The tank is 40cm by 15cm at the base and the water fills to a height of 30cm. When a brick measuring 10cm by 20cm by 5cm is placed in the tank, the water still fills to the same level. How much water is saved per fill-up of the tank? John estimated that the toilet is flushed 24 times a day on weekends and 12 times a day on week-days. At this rate determine how much water can be saved during the months of May and June?

Strand: Algebra

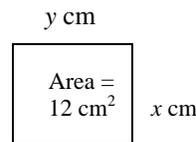
Topic: Factorisation

Activity: Using diagrams to factorize algebraic expressions.

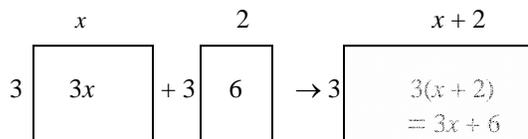
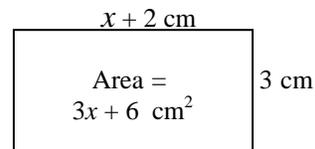
Students are asked to use diagrams to derive the solutions to the following situations.

1. If a rectangle has an area of 12cm^2 , what are the possible lengths of the sides in cm if these lengths are integers?

$$(x,y) = (1,12), (2, 6) \text{ or } (3, 4)$$



2. Represent $3x+6$ as the area of a rectangle. What are the lengths of the sides of the rectangle.



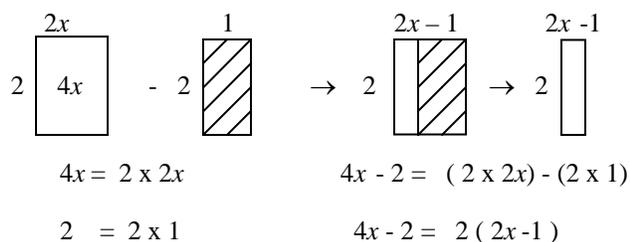
$$3x = 3 \times x$$

$$6 = 3 \times 2$$

$$3x+6 = (3 \times x) + (3 \times 2)$$

$$3x+6 = 3(x+2)$$

3. Represent $4x-2$ as the area of a rectangle. What are the lengths of the sides of the rectangle?



$$4x = 2 \times 2x$$

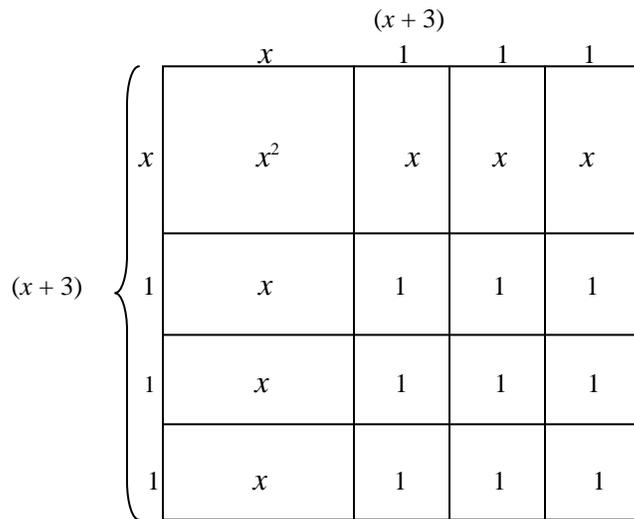
$$2 = 2 \times 1$$

$$4x-2 = (2 \times 2x) - (2 \times 1)$$

$$4x-2 = 2(2x-1)$$

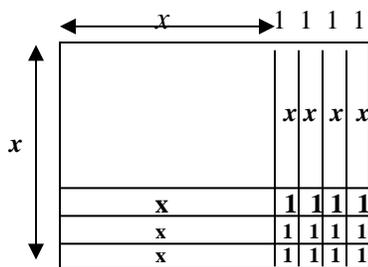
4. Can $5x + 6$ be factorised? Explain your answer.

5. Represent $x^2 + 6x + 9$ as the area of a rectangle and hence factorize $x^2 + 6x + 9$



$$(x+3)(x+3) = x^2 + 6x + 9$$

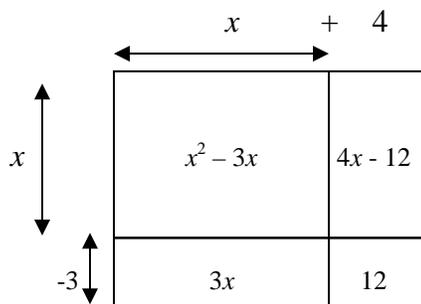
6. Represent $x^2 + x - 12$ as the area of a rectangle and hence factorize $x^2 + x - 12$



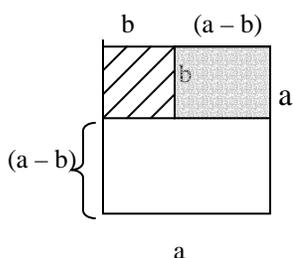
$$x^2 + x - 12 = (x^2 - 3x) + (4x - 12)$$

$$= x(x-3) + 4(x-3)$$

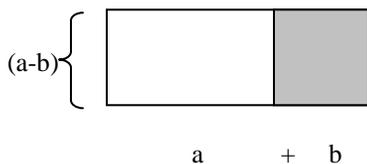
$$x^2 + x - 12 = (x+4)(x-3)$$



7. Factorize the difference of two squares

e.g. $a^2 - b^2$ 

Area cut off = b^2
 Area left over = $a^2 - b^2$



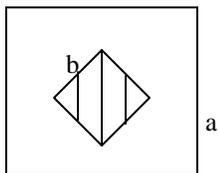
$$(a - b)(a + b) = a^2 - b^2$$

$$a(a - b) + b(a - b)$$

$$= a^2 - ab + ab - b^2$$

$$= a^2 - b^2$$

8. Extension Activity



The figure shows a square of side 'b' cut from a square of side 'a' with its edges parallel to the diagonals of the larger square.

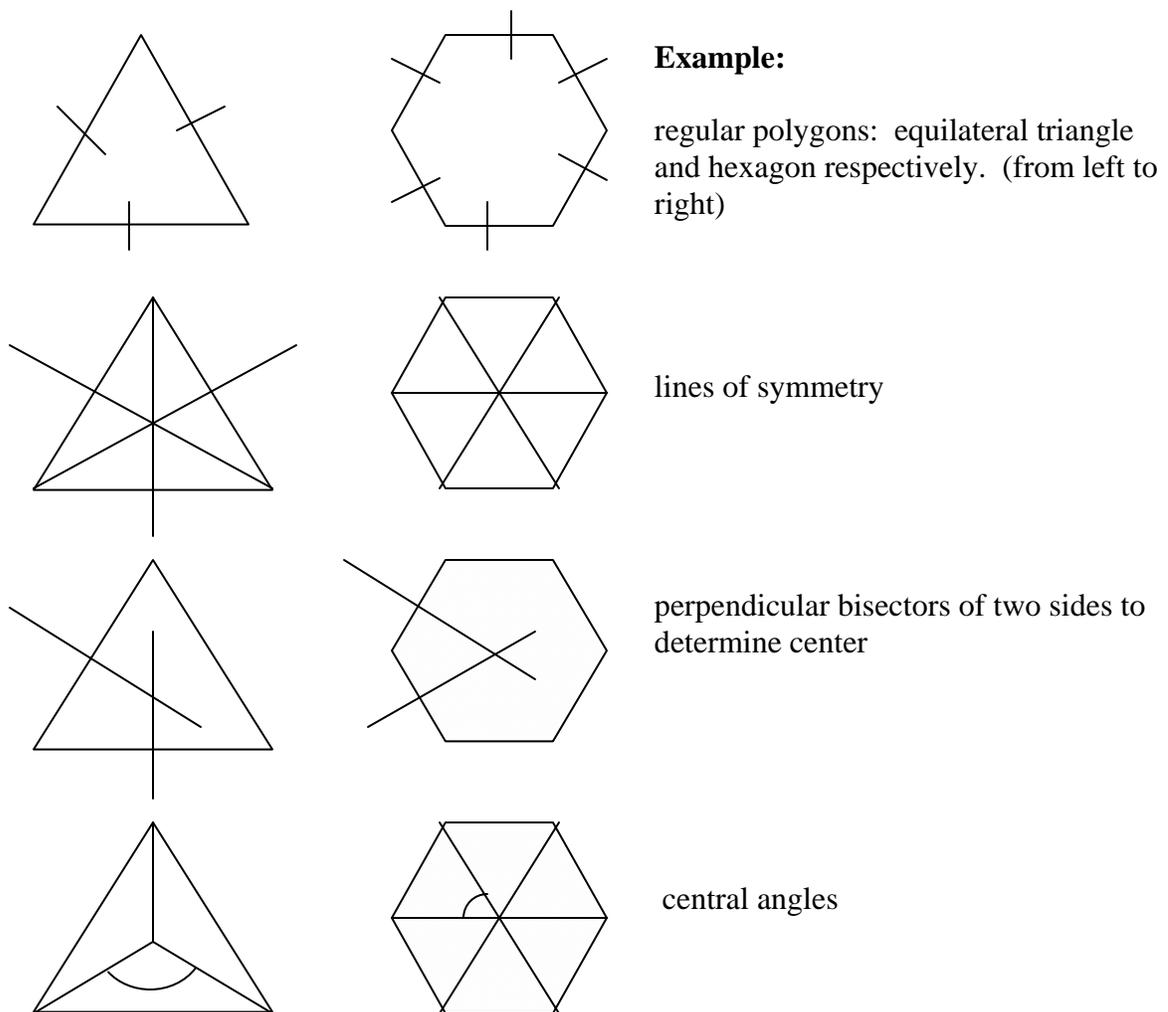
- How many lines of symmetry does the remaining shape have?
- Can you cut it into 4 congruent quadrilaterals?
- Can you fit these together to form a square with another square hole at its center?

- Can you find the lengths of the sides of the new squares in terms of 'a' and 'b'?

Strand: Geometry
Topic: Polygons
Reference: Atlantic Canada Mathematics Curriculum
Activity: Exploring polygons

Students will perform the following tasks:

1. Draw a series of regular polygons with from 3 to 10 sides.
2. Work in pairs to draw in the lines of symmetry for each polygon. Identify any patterns which emerge and explain them.
3. Determine the center of each polygon by determining the intersection point of the perpendicular bisectors of the sides of the polygons. When each vertex of the polygon is joined to the center, the angles formed are called the central angles. Record the measures of the central angles for the series of regular polygons. Identify any patterns which emerge and explain them.



Strand: **Relations and Functions**
Topic: **Inequalities**
Activity: **Using the number line to derive the rules of inequality.**

The teacher introduces the symbols: ‘<’ means ‘less than’ and ‘>’ means ‘greater than’. The teacher draws a chalk line on the floor or places a length of rope across the floor. Students are asked to stand along the length of the line/rope evenly spaced and ALL facing in the same direction. Each student has a number written on the floor to mark their position along the number line. The numbers must range from a negative quantity to a positive quantity. e.g. –15 to + 15 with zero (0) as the starting point.

Movement to the RIGHT is POSITIVE
 Movement to the LEFT is NEGATIVE

1. Identify two students e.g. Students in positions numbered 2 and 5. Ask these students to move 3 places to the right, then 3 places to the right again and 3 places again.

Students must call out their positions.

Students compare their starting position with their final positions using the symbols ‘>’ or ‘<’. Repeat the process with other students and with movements both to the right and to the left.

$$2 + 3 < 5 + 3$$

$$5 + 3 < 8 + 3$$

$$8 + 3 < 11 + 3$$

2. Identify two students. Ask them to move to positions that correspond to their negative counterparts. Write down inequality statements based on the direction of the movement from the starting position to the final position.
3. Identify two students with numbers of opposite signs and ask them to move to zero. Students are asked to express orally inequality statements based on the direction of the movement from the starting point.
4. On copies of the number line made on paper, students are asked to draw diagrams to represent the movements made in the activities above.
5. Students examine the results of their classmates, make general statements and write these statements in algebraic terms.

Strand: Statistics and Probability
Topic: Constructing a frequency table for continuous data and display on a histogram.

Reference: Mebson, RS. Mathematics in School, January 1997, P 44

Activity: Football Scores.

Students are asked to bring recent football results from any or all of the following:

- (i) Colleges League
- (ii) English Premier League
- (iii) Italian League
- (iv) World Cup Matches

Questions

- (1) When is the best time to go for a snack other than at the intermission of a football game?
- (2) If you are a football coach when do you have to be most defensive?

Students create a frequency table to tally the number of goals in each time period. Students should decide on the time interval to use.

Sample:

Time Interval (in minutes)	Tally	Frequency
< 1		
1 – 9		
10 – 18		
19 – 27		
28 – 36		
37 – 45		
46 – 54		
55- 63		
64 – 72		
73 – 81		
82 – 90		
> 90		

The use of a 9- minute interval allows match lengths to be split into halves. Other intervals can be used eg. - 5 minutes, 15 minutes, 10 minutes. Students should investigate these intervals.

- Students draw a histogram of their results and comment on the reasons for the high points and the low points. They answer the first set of questions posed.
- Students discuss differences among their results, and discuss possible weaknesses in data collection.
- Students pose other statistical questions which the data may be able to answer.
- Students explore different ways of representing the data.

SUGGESTED RESOURCES

The implementation of the Mathematics curriculum requires adequate resources to enable teachers to use a student-centred approach based on the constructivist perspective. For too long teachers have used only chalk, chalk-board and the lecture method to deliver the mathematics curriculum. This methodology ignores the variety of ways in which children learn and the developmental stages of the child. Howard Gardner's research in multiple intelligences has identified the following teaching materials with the respective intelligence.

INTELLIGENCE	TEACHING MATERIALS
Linguistic	books, tape recorders, computers, tapes, stamp sets
Logical-mathematical	calculators, manipulatives, science equipment, games, rulers
Spatial	graphs, maps, video, lego, art materials, optical illusions, cameras, picture library, visuals
Bodily-kinesthetic	building tools, clay, sports equipment, tactiles
Musical	musical instruments, CDs, tapes
Interpersonal	board games, party supplies, props for role play
Intra-personal	self-checking materials, journals, newspapers, materials for projects, activity sheets.

According to Jerome Bruner (1964), mathematical concepts are best learnt when represented in three basic modes: enactive, iconic and symbolic. The enactive mode presents materials in a concrete or physical form thus supporting the use of manipulatives in the instructional process. The iconic mode, however, involves representing materials in a visual or pictorial form. It also includes the stage when an act is recreated mentally. Accordingly, students should be encouraged to draw and use diagrams wherever possible to clarify concepts and to solve problems. In the symbolic mode there is the movement towards greater abstraction. Symbolic representation is facilitated by language competence and presents materials using words or symbols.

The predominant use of the lecture method, which relies on print material and the skills of listening, speaking, reading and writing, is therefore not catering for the ways in which most students learn best. It is recommended that whenever possible mathematical instruction should proceed from the enactive through the iconic to the abstract modes of representation. At the same time, teachers need to be aware of the individual differences of the learners in terms of their varying intelligences as outlined by Howard Gardner, and the way that individuals tend to remember things as outlined in the Cone of Learning as developed by Bruce Hyland.

The Use of Technology

The use of technology to assist instruction in mathematics is not only essential but necessary if students are to be educated to meet the needs of the 21st century. The debate on whether calculators should be introduced in the classroom is obsolete. Students must experience mathematical concepts in real life contexts and should not be deterred by difficulties in computation. The appropriate use of the calculator in real life situations certainly provides adequate justification for its use in the classroom. But it can also be used within the classroom context to assist students in finding patterns and relations among numbers. However, in order for this experience to be meaningful to the student, a proper understanding of the concepts must have been previously established. This indeed is the challenge for our teachers, and innovative ways must be employed to facilitate this aspect of learning.

The Computer

Today, the computer has practically replaced the typewriter as a word processing unit. It has the added advantage of being more versatile and can be extremely useful in the presentation of project reports. It also provides a volume of information for research via the internet. The computer can provide teachers with resource material for professional development in teaching practice, student learning, curriculum development and resources. It can be used to enhance instruction or to provide reinforcement and remedial exercises for individual students. It can also assist the teacher in a differentiated classroom by enabling him/her to provide activities for all students at the level required and to keep track of the students' performances.

The Multi-media Library

The multi-media library in each school is a resource facility through which the technological and print resources including mathematical journals are available for instructional use.

Curriculum Guide

In the context of curriculum change, this curriculum guide is one of the key print resources. It provides an overview of the relevant curriculum. It identifies learning outcomes, instructional focus, suggested teaching and learning strategies, suggested integrated activities and suggested assessment strategies as are applicable for the effective delivery of the curriculum.

Teachers' Guide

The teachers' guide is a companion document that is produced to work hand in hand with the curriculum guide. It helps the teacher to locate the relevant learning outcomes of the content and strategies in established theoretical framework and provides examples of

worthwhile tasks for instruction and/or assessment. It also aims at directing practitioners to proposed ways of presenting curriculum content through an appropriate number of lessons and goes further to provide detailed sample lesson plans.

Textbooks

Textbooks are resources that can be used to facilitate curriculum delivery. It is very important though for teachers to recognize this and use them to supplement and/or support the curriculum and not be misguided to treat them synonymously with the curriculum document.

HOT LINKS

- Computer Curriculum Corporation: Software for Mathematics.
<http://www.ccc.net.com>
- Association for Supervision and Curriculum Development (ASCD): Videos, CD-ROMs, audio tapes/discs. <http://www.ascd.com>
- Riverdeep Interactive Learning: <http://www.riverdeep.net>
- Compass Learning At-A-Glance: <http://www.compasslearning.com>
- Eisenhower National Clearinghouse for mathematics and science education:
<http://www.enc.org/topics/change;>
<http://www.enc.org/weblinks/lessonplans/math/>
- The National Curriculum for England online (UK): <http://www.nc.uk.net>
- <http://www.educationworld.com/math/>
- History of Math Archives: <http://www.groups.dcs.st-and.ac.uk/~history/>
- Mathematics learning forums for teachers:
<http://www.edc.org/CCT/mlf/MLF.html>

There are many other sites on the internet which can be accessed for relevant information. However the speed with which the technology is changing means that some of these sites may become obsolete within a short period of time. Teachers are therefore advised to access current information and locate sites before requiring students to do so.

PART FOUR
EVALUATION

ELABORATION OF ASSESSMENT AND EVALUATION

Assessment is the way of collecting data about what students know, understand and are able to do. When the quantitative or qualitative descriptions obtained from assessments are judged in relation to some goal, objective or outcome, the process is called evaluation.

The purpose of evaluation is to provide feedback to:

- students and parents on the students' progress towards achieving the learning outcomes of the curriculum, and to assist the students in identifying their strengths and weaknesses and to guide them in decision making when choosing career options.
- teachers on the instructional process, to guide them in programme planning to meet the needs and interests of their students and the national curriculum and to improve their delivery of the curriculum.
- administrators, educators, stakeholders and policy makers on the effectiveness of the curriculum in achieving the goals of education, and in the placement of students in appropriate groupings to continue their education.

The purpose of assessment is to collect sufficient data about each student in order to make informed judgements based on the use of valid, reliable and relevant measuring instruments. An instrument is reliable when it consistently measures an individual's performance, giving the same results. An instrument is valid when it measures what it is designed to do. According to The National Council of Teachers of Mathematics (NCTM) "*A standard is a statement that can be used to judge the quality of a mathematics curriculum or methods of evaluation. Thus standards are statements about what is valued.*" The Mathematics curriculum is designed so that the learning outcomes for each content strand are derived from the goals of mathematics, which are linked to the goals of education and the essential learning outcomes. In summary, the intent of these goals is that students will become mathematically empowered and technologically sound to make an effective contribution to their society, thus realizing the vision of the Mathematics curriculum.

Evaluation should be used to determine the readiness of the student to receive a new concept or skill. That is to say it should inform and instruct. It should also be used to check the progress of students at various points of the instructional process. This is referred to as formative or continuous assessment and evaluation. When this is done at the end of the instructional process. This form of evaluation is referred to as summative assessment and evaluation.

Attainment targets or benchmarks are established to ensure that the standard set is being achieved. Attainment targets cover the ranges of knowledge, skills and understanding that students are expected to master as they progress towards the standard.

Assessment should reflect the instructional process, but it is distinctly different to it. The curriculum is designed to be delivered using student-centred approaches. Assessment is

considered an integral part of the instructional process. ‘Performance assessment’ according to William G. Wraga, a district supervisor in New Jersey, “gained in popularity in response to a growing realization that paper and pencil tests measure a narrow range of learning and measure that learning at least once removed from tangible student effort.”

The evaluation standards for student assessment are derived from the vision and goals of the Mathematics curriculum and are summarized as follows:

- Mathematical power - having the ability to explore, make conjectures, reason logically, compute efficiently and solve problems using a variety of mathematical methods
- Mathematical thinking - the ability to be a creative and critical thinker who can solve both routine and non-routine problems
- Mathematical inquiry - the ability to investigate one’s environment using scientific and statistical processes
- Mathematical communication - the ability to use mathematical terminology, symbols and representations efficiently and accurately and to present mathematical responses orally, graphically or in writing, clearly, coherently and concisely
- Mathematical reasoning - the ability to recognize the logic in mathematical arguments through its structure and principles and to present proofs, verifications and justifications as evidence
- Mathematical problem solving - the ability to apply the four steps in solving problems to issues or tasks related to real life situations across all strands in the Mathematics curriculum
- Mathematical knowledge, concepts and procedures - the ability of students to demonstrate number and spatial sense, master computation, make estimations and apply mathematical skills to their everyday lives.
- Mathematical disposition - students’ attitudes to others and to mathematics; motivational level; willingness to take risks in their mathematical thinking and to work as a team.
- Mathematical connection - students’ ability to relate mathematical concepts and ideas within the discipline, across other subject areas and to real life situations.

Standards are used to define learning outcomes. The general learning outcomes for each strand in mathematics are:

- **Number operations and number theory**
Students will demonstrate number sense, master computation, understand the structure of number and apply the laws and principles of number.
- **Measurement**
Students will demonstrate an understanding of and apply concepts and skills associated with linear measurement in 2-dimensions and 3-dimensions and consumer arithmetic related to other strands, disciplines and in real life situations.

- **Algebra**
Students will provide evidence of their powers of reasoning with abstract entities and use equations and inequations to model situations in the real world.

- **Geometry.**
Students will demonstrate spatial sense and apply geometric concepts, properties and relationships to routine and non-routine problems in the world around them.

- **Sets, Relations and Functions**
Students will explore, recognize, represent and apply set notation, set language, patterns and relationships to relevant situations in the real world.

- **Statistics and Probability**
Students will solve problems involving the collection, display, analysis and interpretation of data; design, represent and solve problems involving uncertainty and use statistics and probability in decision making.

For each general curriculum outcome a specific learning outcomes are defined for each strand. (See course outline in Part 2)

Levels of performance standards in mathematics are defined as follows:

- **Level one** - performance is below expectation.
- **Level two** - performance is satisfactory but some assistance is required.
- **Level three** - performance is satisfactory and independent.
- **Level four** - performance is beyond expectation.

Performance indicators are descriptions of exactly what students would be able to do at each level for each standard and learning outcome. It is these descriptive statements that are used in alternative assessment and authentic assessment procedures to qualify different levels of performance in designing rubrics. Rubrics, therefore, are “printed sets of guidelines that distinguish performances or products of different quality” (Blum & Arter, 1996). Standards, levels and indicators of performance allow educators to measure a wider range of learning and to do so using a variety of strategies other than paper-pencil tests.

EVALUATION TOOLS AND STRATEGIES

The evaluation tools are the measuring instruments that are selected for assessing students' learning. When selecting a measuring instrument, teachers should:

- Align the instrument with the learning outcome that is being measured. For example, students constructing triangles should be measured using a checklist and observation while students are engaged in the activity. It could be done over the entire unit of instruction. The teacher could decide to collect a series of marks and use them to evaluate the students at the end of the unit. This will contribute to the students' course work evaluation
- Ensure that the items to be used for measuring are reflective of the three levels of thinking in mathematics - knowledge/recall/computation, algorithmic thinking and problem solving
- Choose content that is meaningful, relevant and of interest to students
- Ensure that the duration of the activity is sufficient and appropriate to the age and level of development of the students
- Prepare and pilot the measuring instrument before the assessment date
- Decide on the rubric, grading process or marking scheme before using the instrument
- Decide on the performance indicator before using the instrument.

There are many strategies, other than the paper-pencil test, that can be used for assessment. Those suggested in the course outline are journals, presentations, projects, interviews, observation checklist, portfolio, activities, performance tasks, record keeping, worksheets, mental quizzes, home-work assignments, peer and self evaluation. Some of the basic purposes for which these strategies may be used are listed below.

- Pencil and paper tests provide opportunities for students to:
 - show understanding of a concept in various ways. For example represent $3x + 2y$ concretely and pictorially
 - explain, compare, describe and show
 - demonstrate mastery of skills (solve, calculate)
 - decide which mathematics to apply and which strategies to use to solve problems.
- Journal writing provides opportunities for students to:
 - convey understanding
 - explain their approach to solving a problem
 - respond to prompts. For example, "What was the main idea of today's lesson?" or "Explain to a friend in a letter how the formula for area of a circle was developed".

- Presentations provide opportunities for students to:
 - explain to the class their solution to a problem
 - report on findings
 - demonstrate creativity and the use of aesthetic expression
 - learn to become active listeners
 - become critical thinkers and to learn questioning techniques
 - value others' ways of thinking as they listen to each other.

- Projects provide opportunities for students to:
 - consolidate different areas of mathematics
 - use research skills and technology
 - use strengths and interests and enhance multiple intelligences
 - acquire self-confidence and respect for self and others through collaboration and discussion
 - acquire skills in self and peer evaluation by their awareness of the criteria for assessment, that is the use of rubrics
 - view examples of excellence.

- Interviews provide opportunities for students to:
 - have conferences with teachers either individually or in groups to assess understanding of concepts - a useful strategy for remediation
 - respond to higher order questioning and also to ask higher order questions.

- Observation checklists provide opportunities for students to:
 - be observed by the teacher as they work individually, in pairs or in groups. The teacher observes pre-determined behaviours and uses a checklist to record observations.

- Portfolios provide opportunities for students to:
 - collect samples of their work so that they themselves can see evidence of progress in mathematics
 - reflect on what they already know, what they have recently learnt, and what they still need to know
 - observe their self-development
 - express themselves aesthetically.

- Performance tasks and activities provide opportunities for students to:
 - acquire positive attitudes to mathematics
 - acquire and integrate knowledge
 - extend and refine knowledge
 - model productive habits of the mind
 - relate mathematics to real life issues through authentic activities
 - use manipulatives to demonstrate understanding of concepts, skills and problems.

 - Peer and self evaluation provide opportunities for students to:
 - provide feedback in a constructive manner
 - show respect for each other
 - become aware of their own thinking (meta-cognition).
-

CROSS-REFERENCING TO TEACHERS' GUIDE

The Teachers' guide will present samples of the tools and strategies for evaluation as they relate to the learning outcomes for the various class levels. For example, some of the learning outcomes and the relevant suggested assessment strategies have been summarized here from the course outline for Form Three in Part 2.

Strand: Number Operations and Number Theory

Learning Outcome: Represent large and small numbers in scientific notation.

Suggested Assessment Strategy: Journal entry.

Students are asked to write in their journals, two examples of numbers represented in scientific notation using a negative and a positive power of 10 respectively. Through discussion they will indicate clearly what each number represents and rewrite each number in decimal form. The teacher will examine each student's journal for conceptual understanding of representing numbers in scientific notation.

Strand: Measurement

Learning outcome: Calculate the volume of prisms

Suggested assessment strategy: Make portfolio.

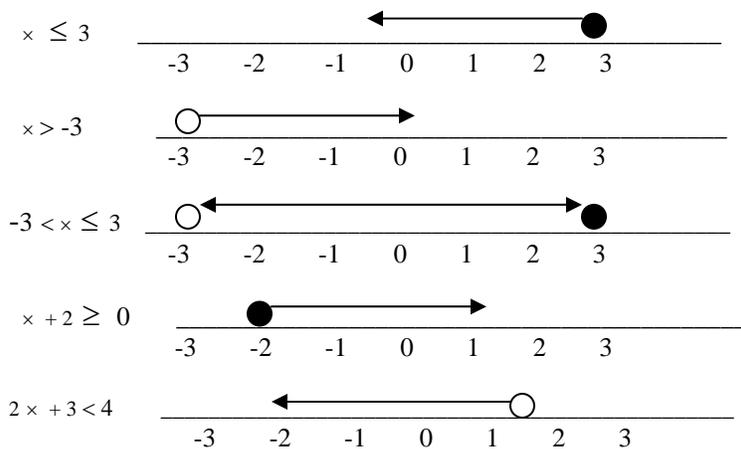
Students would present the solutions to three problems in a portfolio being as creative, efficient and accurate as possible. The teacher will review each student's solutions, and students will have the opportunity to improve on their responses based on guidelines given by the teacher. This interchange will continue until the final submission date for evaluation.

Strand: Relations and functions

Learning Outcome: Solve linear inequalities using a number line.

Suggested Assessment Strategy: Observation of the representation of solutions on a number line.

Students will display the solution of linear inequalities on a number line using the appropriate symbolism. Example:-



The teacher marks each display as it is completed by the student.

The Teachers' Guide will present information to support the delivery of the Mathematics curriculum. It will provide information on the learner and how to plan a programme of work to include unit and lesson plans. Furthermore, the guide will contain sample units and lessons to guide teachers in their classroom practice. The Curriculum document and Teachers' Guide are national documents that state the expectations of the stakeholders. Administrators and teachers are required to adapt them to the needs of the students under their charge.

BIBLIOGRAPHY

- Ashbacher, R. Pamela et al. (1992). *A Practical Guide to Alternative Assessment*. Association for Supervision and Curriculum Development(ASCD). Alexandria, Virginia.
- Blum, R.E. & Arter, J.A. (1996). *A Handbook for Student Performance Assessment in an Era of Restructuring*. Association for Supervision and Curriculum Development (ASCD). Alexandria, Virginia.
- Debnam, Betty.(1997). *The Mini Page, The Gazette, Montreal, Multiple Intelligences*. Universal Press Syndicate.
- Gardner, Howard.(1997). Kinds of Minds.
- Marzano J. Robert.(1993). *Assessing Student Outcomes, Performance Assessment Using the Dimensions of Learning Model*. Association for Supervision and Curriculum Development(ASCD). Alexandria, Virginia
- British Columbia
Ministry of Education. *Evaluating Mathematical Development Across Curriculum*.
Province of British Columbia.
- National Council of Teachers of Mathematics (NCTM).(2000).*Principles and Standards for School Mathematics*. Printed in the United States of America.
- Wilkie, Susan; MacKellar, Brenda.(2000). *Helping students Make Sense of Mathematics*. National Council of Teachers of Mathematics (NCTM) Canadian Regional Conference. Halifax, Nova Scotia.
- Wraga, G. William.(1994). *Performance Assessment: A Golden Opportunity To Improve the Future*. NASSP Bulletin/September 1994.