MATHEMATICS

OVERALL AIMS OF THE WHOLE CURRICULUM

Background

In Jamaica's Five Year Independence Plan (1963-68) the Government's aim for education was expressed as follows:

The Government affirms its belief in education not only for its inestimable social value in enabling every individual, for his own sake, to develop his personality and his talents to the fullest extent, but equally that each individual might be enabled to make a maximum contribution to society in every respect.

This aim was translated into policy in the 1966 New Deal for Education. Among its goals was that of:

Gearing the education of children in the age group 12-15 so that a greater percentage of pupils would be able to continue formal education – academic, vocational or technical – and benefit from that education, while those who do not will be better able to service Jamaica's manpower needs.

The Junior Secondary Schools built under this programme were to provide:

1. Opportunities for all pupils to progress according to attainment, aptitude and ability.
2. A wide range of subject which will stress the basic subjects while exposing all pupils to a variety of practical subjects. (It is also felt that it is essential that each pupil by the age of 15 should have a good groundwork in the use of English as a communication skill and be able to do the calculations necessary to hold his or her own in everyday life (…) The practical subjects are thought to be necessary as a part of physical development and to give young people an appreciation for the use of tools and to help overcome the phobia which may people have for activities which involve the use of the hands.)3
3. Opportunities for the proper development of those children who will go on to the secondary cycle of secondary education while providing opportunities for pre-vocational education for those who will not continue formal education but who will expect to be acceptable to employers for employment and training.

In 1983, a UNESCO team reported on the status of secondary education in Jamaica and identified major issues to be resolved. The team recommended a restructuring and rationalization of secondary education, centered on the provision of a common core

---

3 Idem.

curriculum for all students in Grades 7-9. Virtually all students in Grades 7-9 would have access to the same programme. The standard national curriculum would guarantee:
the appropriate uniform level of knowledge in social subjects including language and arts, in mathematics and science. (…) There would be an introduction to practical work and industrial arts.

Aims

Education Programme Preparation Project (World Bank IV) (1989-92)

The study, **The Reform of Secondary Education** which informs the curriculum development component of this project, defines a common curriculum as follows:

> A common curriculum is a plan of learning for all children in terms of content, goals and learning experiences; but it must allow for students of different levels of readiness to learn differently and at different rates. In effect, a common curriculum provides all children with the same basic subject matter, but it allows for children with different levels of readiness and ability to proceed at different rates of learning.

The **Study** justifies provision of a common curriculum for Grades 7-9.

Three specific objectives are: to achieve greater **equity** in the secondary school system to Grade 9, to improve the **quality** of learning, and to enhance individual **productivity.**

EQUITY: The most serious flaw in Jamaican secondary education is lack of equity. Children have unequal access to opportunities for learning. Some schools are more effective than others, partly because of the different resources and the use of those resources to provide quality education.

The provision of a common curriculum – along with supporting implementation measures – is recommended as one of the most likely methods of achieving equity in basic educational opportunities.

QUALITY: Providing equal access to education is one thing; providing equal access to quality education is another. There is a serious need for a general improvement in teaching. By the end of Grade 9, adolescents need to have the basics of quality education: literacy, numeracy and enough related knowledge, skills and attitudes to cope with their environment. The objectives of the common curriculum should help to realize these goals.

PRODUCTIVITY: The third objective of a common curriculum is to enable Jamaican students to be productive citizens, whether they continue their academic education, enter technical or vocational training, or enter the world of work. Every child needs a minimum set of cognitive competencies to be productive; and when the majority of students acquire them they will be trainable in the more complex job skills required in

today's workforce. A basic education of nine years is essential if the majority of Jamaicans are to assume professional, skilled or semi-skilled positions, and if they are to have the capacity to acquire more education or training.

The New Curriculum

The curriculum development component of the World Bank IV Project represents the first step in the development of such a common curriculum for students in the first cycle of secondary education (Grades 7-9).

The new curriculum will provide students with opportunities to experience a broad programme as a foundation for life, for further education and for employment. In the short-term it will:

- build on the knowledge, skills and attitudes acquired in primary school
- include a balance of academic and prevocational studies
- include a programme of remediation in literacy and numeracy
- lay the foundation for further study and for employment
- increase students' opportunities for enrichment and fulfillment
- enhance students' ability to make choices that affect the quality and direction of their lives.

Features of the New Curriculum

The new curriculum is designed to be:

- **Responsive:** developed in response to national goals and student needs, by teams of teachers, education officers and specialists (Jamaican and international consultants).
- **Broad and balanced:** centered around five core subjects (Language Arts; Mathematics; Resource and Technology; Science; Social Studies) plus Career Education. (The Curriculum Framework is shown on page xii)
- **Multi-level:** (there are three levels: **Foundation 1** and **2**; **Normative** and **Enrichment**). While the content will be similar for all students, activities will vary to match the stages of development of the students in the class.
- **Articulated**: building on the primary school curriculum for Grades 1-6; preparing students for work or for CXC and other examination courses in Grades 10-11.
- **Differentiated**: certificates will reflect what each student has achieved.
- **Socially responsible**: students will work in collaboration with others and take on responsibility for their own learning.

Long Term Objectives

The new curriculum will eventually provide for additional subjects, some optional areas of study, clearly defined achievement levels and a final certificate based on statements of students' achievements.

PHILOSOPHY

We live in a dynamic society with knowledge increasing at an unpredictable rate. With the accompanying advance in technology, developing countries are no longer insulated from the effects of these changes, as evidenced by the extent to which the whole world is fast becoming a global village with constant interaction on many levels. One goal of education is the preparation of the young not only for this changed world, but also with the willingness and ability to face new and changing situations.

Mathematics continues to be an important component in the formation of the educated person and as such, mathematics education should reflect the goals of education in a dynamic society. We must therefore address not only the acquisition of skills and mastery of ideas. We must address more than the accumulation of facts and principles. Mathematics education in the age of information must place emphasis on the higher skills of discussion, interpreting and evaluation. Also, the acquisition of communication skills must become one of its prime goals.

As the ability to communicate demands a level of understanding of concepts within the range of ones' real life experiences, not only must every effort be made to establish clear understanding of previous knowledge, but to introduce new concepts in the context of real life experiences. This should enhance understanding.

Since many mathematical ideas are abstract in nature, every effort must be made to reduce the range of such concepts at the lower level. It is the understanding and grasp of concepts in practical experiences that give children the confidence to go on to more abstract ideas in later years.

Mathematics is all around us with situations that are not necessarily cast in a 'right-wrong' mould, but generate the need to observe, discuss, relate, analyze and draw conclusions. In drawing upon the wealth of environmental situations, children can be led to investigate, experience success and develop the level of confidence to talk mathematics.

Based on the philosophy that mathematics is all around us and that everyone uses and understands some mathematics, the Mathematics Curriculum for Grades 7-9 is designed to:

1. explore the existing body of knowledge;
2. correct, where necessary, and build upon this knowledge through activities related to everyday life, through applying (mathematical) principles of

investigating, reasoning, estimating, forming conjectures and testing them, and through meaningful communication;

3. expand knowledge through the formation of new concepts while establishing the inter-relatedness of mathematics with other disciplines;
4. enable the development of attitudes of self-awareness and self-confidence, appreciation of enquiry, independent thinking, willingness to share, and cooperation with others in the pursuit of knowledge.

In keeping with this philosophy, learning activities should incorporate life experiences using them to correct faulty concepts, to reinforce previously learnt ones and build new ones. Mathematics should therefore be placed in contexts that give meaning to ideas and concepts.

Problem statements that arise from everyday experiences that are not necessarily textbook situations should be the focus of instruction, and at every level the students should be encouraged to formulate their own problems and ask questions that signal their own understanding and interest.

While the curriculum seeks to explore student's existing body of knowledge, instruction must challenge them to expose and use their previous knowledge in new learning situations. Learning must become, for the learner, an active experience in which the teacher guides rather than dictates the pace and assimilation of knowledge.

There should be ample opportunities for individual, group and whole class activities with an acceptable apportionment of time to all these kind of activities. Group activities offer opportunities for the students to talk about and test their ideas, listening to and evaluating their peers, thus helping them to develop their ability to communicate and reason. At the same time group activities give the teachers opportunities for closer interaction with the students. In group activities individuals develop the confidence in their own ideas which enables their participation in whole class situations.

RATIONALE

Children from a very early age, begin to encounter basic ideas that will gradually evolve into more sophisticated mathematical concepts. Given a set of building blocks, for example, a young child will be able to group them close together, spread them out to form a line or even arrange them according to colour. These are mathematical concepts being developed in young children through their many discoveries as they play with objects in their environment. It is with these early experiences that children gradually begin to associate language. The teaching of mathematics serves to enhance and expand these creative abilities into logical and conceptual mathematical competencies.

It is evident, therefore, that mathematics has a vital role in the process of development and is considered to be one of the "basics" of education. The process of education must provide for opportunities to develop and extend mathematical competencies through the use of effective problem-solving processes. The ability to reason and apply mathematics

in problem situations is considered an integral part of the basic skills required for mathematical literacy. The ability to solve problems increases with importance in light of the rapidly changing demands of today's technological society. Mathematics plays an important role:

- in our everyday lives as we interact in society
- at the workplace, whatever our vocation might be
- by developing within each individual the problem-solving skills that we all need
- in equipping us to meet the challenges of technology.

The Grades 7-9 Mathematical Curriculum is designed to meet these needs through the inclusion of relevant mathematical concepts, skills and attitudes.

GOALS AND GENERAL OBJECTIVES

The Mathematics Curriculum developed for Grades 7-9 has as its goals:

1. The development of the problem-solving approach to learning mathematics and the willingness to accept the challenges of new situations.
2. The development of skills of creativity, enquiry, conjecturing, testing and generalizing.
3. The development of an awareness of number size and meaning, and the skills of estimation and approximation as means of establishing the reasonableness of answers.
4. The development of the meaning of measure as an attribute of an entity.
5. The development of an understanding of basic mathematical concepts and the ability to transfer this understanding to other situations within and outside the subject.
6. The development of an awareness of mathematics across the curriculum.
7. The development of the ability to discuss, interpret and evaluate data.
8. The acquisition of the language of mathematics to enable communication.
9. The development of an appreciation of technology as an aid to the learning experience.
10. The appreciation of mathematics in the environment and its application to real life experiences.
11. The reinforcement of the enjoyment of doing mathematics.

Upon completion of this course it is expected that students will be able to:

1. Demonstrate the mathematical competence necessary to function in society. This includes the ability to:

    a) recall or recognize mathematical facts, definitions and symbols;

b) count, measure and handle money
c) conceptualize spatial properties.

2. Perform mathematical manipulations. This includes the ability to:

a) do straight-forward computations with confidence;
b) manipulate mathematical ideas

3. Demonstrate an understanding of mathematical concepts and processes. This includes the ability to:

a) communicate ideas effectively;
b) transform from one type of representation to another e.g. words to symbols and vice versa; equations to graphs, etc.
c) apply (mathematical) knowledge and understanding in new situations, both common and complex.

4. Use mathematics and mathematical reasoning to analyze given situations. This includes the ability to:

a) make conjectures;
b) gather information or numerical data needed for investigating/exploring an idea;
c) arrange and present findings logically.

5. Select knowledge, information and techniques that are needed to solve a particular problem (social, technical or academic) and apply these in the actual solution of the problem.

6. Appreciate the importance and relevance of mathematics as a necessary and valuable tool in everyday life.

SCOPE AND SEQUENCE BY STRANDS

INTRODUCTION

The Scope and Sequence by Strands reflects several recent research developments, and in particular, the emphasis of the National Council of Teachers of Mathematics Curriculum and Evaluation Standards.

We feel strongly that teachers being aware of the time constraints upon them, the level of attainment of their students and the level of interest being shown, should be the best judges of when to move from one strand of work to another. We strongly suggest the writing of unit plans, lasting from two to four weeks in most cases, in order to keep the syllabus on track and work varied.

WORK SHOULD NOT BE LIMITED TO ANY SINGLE STRAND FOR MORE THAN 4 WEEKS. EVERY STRAND HAS AN IMPORTANT ROLE TO PLAY IN THE INDIVIDUAL'S DEVELOPMENT.

It is expected that if concepts rather than algorithms are properly taught, the need for re-teaching, remediation and revision will be seen to be much less than was previously the case.

What follows is laid out in four columns – the prerequisites for Grade 7 refer to the Primary School experience. Thereafter, prerequisites are to be found in the previous grade's work.

FINALLY, THE SCOPE AND SEQUENCE BY STRANDS IS ONLY A GUIDE. IF YOUR STUDENTS CAN GO FURTHER AND DEEPER INTO A TOPIC, DO NOT FEEL OBLIGED TO STOP. THE WORKLOAD IS A SUGGESTED <u>MINIMUM</u> THAT IS TO BE TAUGHT IN ALL SCHOOLS AT THE GRADES INDICATED.

Scope of Work Grades 7 – 9

Scope and Sequence by Strands

Prerequisites	Grade 7	Grade 8	Grade 9
1. Number • Sort and classify objects by different attributes • Basic Place Value ideas • Facility in counting - forwards, backwards and in simple multiples • Simple number patterns	**1.1** Number **1.1.1** The digits **1.1.2** Numerals **1.1.3** Place Value **1.1.4** Addition and subtraction **1.1.5** Multiplication and division **1.1.6** Approximation **1.1.7** Short cuts to computation **1.1.8** Some special numbers	**1.5** Integers & Rational Numbers **1.5.1** Extend the number line to include negative numbers **1.5.2** Recognize and apply negative numbers appropriately **1.5.3** Compare and order integers and rational numbers **1.5.4** The four operations on	**1.11** Integers & Rational Numbers **1.11.1** Make comparison between and order integers and rational numbers with less reliance on the number lines **1.11.2** Add, subtract, multiply and divide integers **1.11.3** Add, subtract, multiply and divide decimal fractions

	numbers (including HCF and LCM) **1.1.9** Divisibility tests **1.1.10** Use of a pocket calculator **1.1.11** Illustrating procedures with flow charts **1.1.12** Ordering **1.1.13** Counting **1.1.14** Sequencing and number patterns **1.1.15** Comparing **1.1.16** Using numbers to solve real problems	operations on integers **1.5.5** Further work on number patterns	**1.11.4** Add, subtract, multiply and divide common fractions **1.11.5** Significant figures as a means of approximation

Scope of Work Grades 7 – 9

Scope and Sequence by Strands

Prerequisites	Grade 7	Grade 8	Grade 9

Number (cont'd)	**1.2** Fractions **1.2.1** The idea of a fraction **1.2.2** Fractions as the result of division **1.2.3** Equivalent fractions **1.2.4** Mixed Numbers **1.2.5** Computation using fractions **1.2.6** Ordering fractions **1.3** Percentages **1.3.1** Find the given percent of a whole number **1.3.2** Express one quantity as a percentage of another **1.4** Sets **1.4.1** The language of sets	**1.6** Number Bases **1.6.1** The arithmetic operations of addition, subtraction and multiplication on numbers written in base 2 and 5 **1.6.2** Conversion of numbers written in base 2 and base 5 to base 10 and vice versa **1.7** Common and Decimal Fractions and Percentages **1.7.1** Rounding off to a given numb er of decimal places **1.7.2** Estimate the results of computations with decimals, fractions and percentages **1.7.3** Conversion between common fractions, decimal fractions and percentages **1.7.4** Concept of fractions as ratios	**1.12** Indices **1.12.1** Index as an indication of repeated multiplication **1.12.2** The index notation **1.12.3** Multiplication of numbers in index form **1.12.4** Powers on the calculator **1.13** Standard Form **1.13.1** Understand the need for standard form (by observation on the calculator) **1.13.2** Write numbers greater than 10 in standard form stating the degree of accuracy

	1.4.2 Types of sets **1.4.3** Use of symbols **1.4.4** Venn diagrams		

Scope of Work Grades 7 – 9

Scope and Sequence by Strands

Prerequisites	Grade 7	Grade 8	Grade 9

Number (cont'd)		**1.8** Use of Calculator **1.8.1** Using the calculator to solve real problems **1.8.2** Assessing the reasonableness of an answer given by a calculator **1.8.3** Investigating number patterns using a calculator **1.9** Square Numbers and Square Roots **1.9.1** (Figurative) number patterns **1.9.2** Square numbers **1.9.3** Square roots of perfect squares **1.9.4** Squares and square roots on the calculator **1.10** Venn Diagrams **1.10.1** Sorting sets from data given in	**1.14** Ratio **1.14.1** Comparison of two quantities as a ratio **1.14.2** Solve problems which involve ratio **1.14.3** Identify quantities in proportion **1.15** Computers **1.15.1** Difference between a computer and a calculator **1.15.2** Parts of a computer **1.15.3** Difference between hardware and software **1.15.4** Spreadsheets, databases, statistics programmes, maths software, games and simulation **1.16** Venn Diagrams

		verbal form **1.10.2** Using Venn diagrams to illustrate data **1.10.3** Obtaining data from Venn diagrams	**1.16.1** Sorting sets from data given in verbal form (3 or more) **1.16.2** Illustrating information by using Venn diagrams **1.16.3** Obtaining information from Venn diagrams (3 or more