MINISTRY OF EDUCATION

Republic of Ghana

NATIONAL SYLLABUS FOR MATHEMATICS (PRIMARY SCHOOL 1 - 6)

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PRIMARY SCHOOL MATHEMATICS SYLLABUS

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RATIONALE

Mathematics is a logical, reliable and growing body of concepts, which makes use of specific language and skills to model, analyse and interpret the world. It provides a means of communication that is powerful, concise and precise. As a human activity, mathematics involves creativity in the discovery of patterns of shape and number, the recognition of relationships, the modelling of situations, the interpretation of data and the communication of emerging ideas and concepts.

Mathematics is one of the essential areas of learning. Everyone needs to develop mathematical concepts and skills to help him/her understand and play a responsible role in society. Mathematics education aims to provide students with those skills and understandings. The need for people to be numerate has always been identified as an important outcome. Mathematics education aims to contribute to the development of a broad range of numeracy skills. In an increasingly technological age the possession of problem solving and decision making skills is an essential requisite. Mathematics education provides the opportunity for students to develop these skills and encourages them to become flexible problem solvers.

Achieving these requires a sound mathematics curriculum, competent and knowledgeable teachers who can integrate instruction with assessment, classrooms with ready access to technology, and a commitment to both equity and excellence.

The Mathematics Curriculum has been designed to provide knowledge and mathematical skills to pupils from various backgrounds and levels of ability. Today's world demands that young people should be able to use numbers competently, read and interpret numeric data, reason logically, solve problems involving calculations and mathematical reasoning, as well as communicate effectively with other people using accurate mathematical data and interpretations. Acquisition of these skills will help them in their careers later in life and in the process benefit the society and the nation. That is, the curriculum emphasizes mathematical knowledge and skills that should help the young person to develop basic numeracy competence to be able to function effectively in society.

Several factors have been taken into account when designing the curriculum. These are: mathematical concepts and skills, terminology and vocabulary used, and the level of proficiency of English among teachers and pupils.

It is hoped that with the knowledge and skills acquired in Mathematics, pupils will discover, adapt, modify and be innovative in facing changes and future challenges. The learning of mathematics at all levels involves more than just the basic acquisition of concepts and skills. It involves, more importantly, an understanding of the underlying mathematical thinking, general strategies of problem solving, communicating mathematically and inculcating positive attitudes towards an appreciation of mathematics as an important and powerful tool in everyday life.

GENERAL AIMS

Mathematics education aims to:

- help children appreciate the value of mathematics and its usefulness to them, to develop confidence in their own mathematical ability, to foster a sense of personal achievement and to encourage a continuing and creative interest in mathematics;
- develop in children the skills, concepts, understandings and attitudes which will enable them to cope confidently with the mathematics of everyday life;
- help children develop a variety of problem solving strategies involving mathematics and develop the ability to think and reason logically;
- help children become mathematically literate in a world which is information technology (IT) oriented:
- provide a foundation for those children who may wish to further their studies in mathematics or other subjects where mathematical concepts are essential.

GENERAL OBJECTIVES

The pupil will:

- work co-operatively with other pupils and develop interest in Mathematics
- read and write numbers
- use appropriate strategies to perform number operations
- recognise and use patterns, relationships and sequences and make generalizations
- identify and use functions, formulae, equations and inequalities
- identify and use arbitrary and standard units of measure
- draw and use graphical representations of equations and inequalities
- use the appropriate unit to estimate and measure various quantities.
- identify solids and plane shapes and appreciate them in the environment
- collect, analyse and interpret data and find probability of events
- use the calculator to enhance understanding of numerical computation and solve real-life problems
- manipulate learning materials to enhance understanding of concepts and skills

SPECIFIC MINIMUM OBJECTIVES

In order to achieve the general aims of the mathematics curriculum, teachers must provide opportunities for children to realize the specific minimum objectives which are the National Minimum Standards (NMS) for Primary 3 and 6 numeracy.

NATIONAL MINIMUM STANDARDS (NMS) for Primary 3

NMS for Primary 3, which are the main terminal objectives for Primary 3, listed below are intended to give the teacher an idea of some of the things ALL the pupils should be able to do by the end of third year in primary school. Some targets may be more complicated than they seem and so the syllabus has been designed for the teacher to revisit some of these objectives more than once in the year and possibly again in the following year.

- Read, write and order whole numbers to at least 1000; know what each digit represents.
- Count on or back in tens or hundreds from any two- or three-digit number.
- Identify unit fractions such as $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{5}, \frac{1}{10}$, and use them to find fractions of shapes and numbers.
- Recite addition and subtraction facts for each number up to 20.
- Add and subtract mentally a 'near multiple of 10' to or from a two-digit number.
- Recite facts for the 2, 5 and 10 multiplication tables.
- Understand division and recognise that division is the inverse of multiplication.
- Use units of time and state the relationships between them (second, minute, hour, day, week, month, year).
- Understand and use money notation.
- Choose and use appropriate operations (including multiplication and division) to solve word problems, explaining methods and reasoning.
- Identify right angles.
- Identify lines of symmetry in simple shapes and recognise shapes with no lines of symmetry.
- Solve a given problem by organising and interpreting numerical data in simple lists, tables and graphs.

NATIONAL MINIMUM STANDARDS (NMS) for Primary 6

NMS for Primary 6, which are the main terminal objectives for education, listed below are intended to give the teacher an idea of some of the things ALL the pupils should be able to do by the end of primary school. Some targets may be more complicated than they seem and so the syllabus has been designed for the teacher to revisit some of these objectives more than once in the year and possibly again at JHS level.

- Multiply and divide decimals mentally by 10 or 100, and integers by 1000, and explain the effect.
- Order a mixed set of numbers with up to three decimal places.
- Reduce a fraction to its simplest form by dividing through by common factors.
- Use a fraction as an operator to find fractions of numbers or quantities (e.g. $\frac{3}{4}$ of 48, $\frac{7}{10}$ of 30, $\frac{15}{100}$ of 200 centimetres).
- Understand percentage as a number of parts in every 100, and find simple percentages of small whole-number quantities.
- Solve simple problems involving ratio and proportion.
- Carry out column addition and subtraction of numbers involving decimals, up to 3 decimal places.
- Derive quickly division facts corresponding to multiplication tables up to 10 × 10.
- Carry out short multiplication and division of numbers involving decimals.
- Carry out long multiplication of a three-digit by a two-digit integer.
- Use a protractor to measure acute and obtuse angles to the nearest degree.
- Calculate the perimeter and area of simple compound shapes that can be split into rectangles.
- Read and plot co-ordinates in all four quadrants.
- Identify and use the appropriate operations (including combinations of operations) to solve word problems involving numbers and quantities, and explain methods and reasoning.
- Solve a problem by extracting and interpreting information presented in tables, graphs and charts.

Appendix A is a list of all the mathematics units (or topics) to be taught in the six year primary school programme. From this list, we can see that the Primary 3 terminal objectives are not all taught in the third year of the primary school programme. Two terminal objectives (i.e. SRN 1.9 and 1.13) are introduced in Primary 1 and revisited for practice throughout the primary programme for consolidation. Similarly, five terminal objectives are taught in Primary 2 and six in Primary 3. Children need to learn all other objectives not listed as terminal in order to master the minimum standards. It is therefore dangerous and not advisable to limit teaching to only the specific minimum objectives which are the least expected of each child in P3 and P6. Teachers are encouraged to challenge children with exceptional ability to go beyond the objectives of their classes.

SCOPE OF SYLLABUS

The mathematics curriculum at the primary level covers five main areas, namely,

- Numbers, and numerals,
- Number operations,
- Measurement, Shape and Space,
- Collecting and Handling Data.
- Problem Solving and Application

Numbers and numerals cover ways numbers are represented/recorded and the quantities for which they stand; the use of symbols, notation to represent and communicate quantities/numbers.

Number operations cover the basic operations on numbers (+, −, × ÷) and accuracy, efficiency and confidence in using them in calculations, mentally, and on paper. Number operations also provides opportunities for the development of pupils ability to estimate and to make approximations, and check the reasonableness of results of calculations; recognise patterns and relationships in mathematics and the real world; and develop the ability to use symbols, notation, graphs and diagrams to represent and communicate mathematical relationships and solve problem.

Measurement, Shape and Space cover geometrical relations in two and three dimensions, and provides opportunities for recognising and appreciating their occurrence in the environment. This content area also provides opportunities for pupils to develop spatial awareness and the ability to recognise and make use of the geometrical properties and symmetries of everyday objects; as well as use geometrical models as aids to solving practical problems in time and space. In addition, the content area also provides opportunities for pupils to develop knowledge and understanding of systems of measurement, their use and interpretation as well as their confidence and competence in using instruments and measuring devices.

Collecting and Handling Data covers identifying situations/problems for data collection, developing the skills of collecting, organising and analysing data, as well as interpreting data presented in tables, charts and graphs of various kinds.

Problem Solving and Application. This syllabus does not include Problem solving and Application as a distinct topic. Rather nearly all topics in this syllabus include solving word problems as activities. These activities relate to issues in real life situations. Teachers are expected to pose problems and set out questions which will help students to think and apply scientific principles using mathematical theory. It is hoped that teachers and textbook developers will incorporate appropriate problems that will require mathematical thinking rather than mere recall and use of standard algorithms. Other aspects of the syllabus should provide opportunities for the pupils to work co-operatively in small groups to carry out activities and projects which may require out-of-school time. The level of difficulty of the content of the syllabus is intended to be within the knowledge and ability range of the Primary school.

The topics for each area have been arranged from the basic to the abstract. Teachers need to teach the basics before the abstract topics are introduced to pupils. It should be noted that there is now equal emphasis on children's ability to use the basic operations (+, −, × ÷) to do calculations both *mentally* and *on paper* with accuracy, efficiency and confidence.

Children come from various backgrounds and have different learning styles and abilities. It must be recognised that each child is an individual whose learning development and rate of progress is different from others. Different children will be ready for particular mathematical content and experiences at different times. It is therefore not expected that all children of the same age will be achieving at the same level at the same time, nor that an individual child will necessarily be achieving at the same level in all content areas of the mathematics curriculum.

It will be noted that most of the units treated in the KG syllabus have been reproduced for Primary 1. This purpose is to ensure that pupils understand and consolidate what they will learn in KG before proceeding to learn primary school mathematics.
Notwithstanding, teachers must as much as possible ensure most children attain the NMS for Primary 3 by the end of the third year in primary school, and those for Primary 6 by the end of primary education.

APPROACHES TO TEACHING AND LEARNING MATHEMATICS

Problem Solving Approach

A balanced mathematical programme incorporates concept learning and the development, maintenance and application of skills. These should be taught in such a way that children develop their ability to think mathematically.

Children learn mathematical thinking most effectively through the application of concepts and skills in interesting and realistic contexts that are personally meaningful to them. This implies that mathematics is best taught by helping children to solve problems drawn from their own experiences.

Real-life problems are not always closed, nor do they necessarily have only one solution. Determining the best approach for solving a problem when several approaches are possible is a skill frequently required in the workplace. Consequently, children need to be given various opportunities to work on open-ended problems. The solution to problems, which are worth solving, rarely involves only one item of mathematical understanding or just one skill. Rather than remembering a single correct method, problem solving requires children to search for clues and make connections to the various pieces of mathematics and other knowledge and skills, which they have learned. Such problems encourage thinking rather than mere recall.

Closed problems, which follow a well-known pattern of solution, develop only a limited range of skills. They encourage memorisation of routine methods rather than experimentation and investigation. Without diminishing the importance of being fluent with basic techniques, routine methods only become useful tools when children can successfully apply them to non-routine and realistic problems. Good problem solving techniques are characterised by the systematic collection of data or evidence, experimentation (including trial and error followed by improvement), creativity, reflection on and critical evaluation of the process that has been followed. These characteristics may be developed by providing children with opportunities that encourage them to practise and learn simple strategies such as guessing and checking, drawing a diagram, making lists, looking for patterns, classifying, substituting, re-arranging, putting observations into words, making predictions and developing simple proofs.

Learning to communicate about mathematics and through mathematics is part of learning to become a mathematical problem solver and learning to think mathematically. Critical reflection may be developed by encouraging children to share ideas, to use their own words to explain their ideas and to record their thinking in a variety of ways, such as words, symbols, diagrams and models.

The Medium of Instruction

The official medium of instruction in the lower primary is the children's first language (i.e. Ghanaian language). But for mathematics, teachers are encouraged at this level to sometimes combine this with English when teaching the subject because there are no readily available words in many Ghanaian languages for several mathematical terms and symbols.

Teachers should ensure they use language that will facilitate the development and acquisition of mathematical concepts. Once this objective is achieved, however, it is essential that children be exposed to the mathematical ideas in English and listen to adults using the words correctly. Care must be taken to ensure that the English language used is simple and accessible; hence it should be presented in very short sentences in situations involving the appropriate mathematical language. The use of flash cards, displaying the specific mathematical language, is recommended. In the younger classes pictures and real-life objects should be used to facilitate the children's understanding of the language, as do consistency and repetition. At the upper primary level children should be encouraged to express and articulate their explanations, thinking and reasoning in English to strengthen their mathematical communication skills. However, on no account should the use of either language (Ghanaian language or English) be to the detriment of children learning mathematics.

Mathematical Vocabulary

Children's failure to understand mathematical vocabulary manifests itself when they fail to answer questions during lessons, when they fail to carry out a set task and when they do poorly in tests and examinations. Possible reasons for this failure could be that:

- they do not understand the spoken or written instructions; (e.g. draw a line . . .; put a ring around one of these numbers . . .)
- they are not familiar with the mathematical vocabulary; (e.g. difference, sum, product, one-third, estimate, . . .)

- they may be confused about mathematical terms which have different meanings in English; (e.g. table, volume, odd, . . .)
- they may be confused about other words; (e.g. sides and size; width and with; collect and correct, breadth and breath……)

It is for these reasons that children need to acquire the appropriate mathematical vocabulary so that they can fully participate in set tasks and tests. An even more important reason is that mathematical language is crucial to the children's development of thinking. Unless they have the vocabulary to talk about division, perimeter, capacity, etc, they cannot make progress in understanding the various areas of mathematical knowledge.

Since children cannot learn the meaning of words in isolation, the use of questions is crucial in coming to grips with the mathematical ideas and mathematical terms correctly. It is important to ask questions in different ways so those children who do not understand the first time may subsequently pick up the meaning. One should not use only questions that require recall and application of facts but also questions, which require a higher level of thinking and promote good dialogue and interaction. Eventually children will begin to give more complex answers in which they explain their thinking.

All children need regular, planned opportunities to develop their mathematical vocabulary. They need to experience a cycle of oral work, reading and writing. They need oral work based on practical work so that they may have visual images and tactile experience of what mathematical words mean in a variety of contexts. Various forms of oral work include:

- listening to adults and children using words correctly;
- acquiring confidence and fluency in speaking, using complete sentences that include the new words and phrases, sometimes in chorus and sometimes individually;
- describing, defining and comparing mathematical properties, positions, methods, patterns, relationships, and rules;
- discussing ways of tackling a problem, collecting data and organising their work;
- hypothesising or making predictions about possible results;
- presenting, explaining and justifying their methods, results, solutions or reasoning, to the whole class or to a group or partner;
- generalising or describing examples that match a general statement.

They need to read aloud and silently, sometimes as a whole class and sometimes individually. For example, they should read:

- numbers, signs and symbols, expressions and equations;
- instructions and explanations in textbooks, workbooks, handouts, . . .;
- labels on diagrams, charts, graphs and tables.

They need to write and record in a variety of ways, progressing from words, phrases and short sentences to paragraphs and longer pieces of writing. Different forms of writing include:

- writing prose in order to describe, compare, predict, interpret, explain, justify;
- writing formulae, first using words, then symbols;
- sketching and labelling diagrams to clarify their meaning;
- drawing and labelling graphs, charts or tables, and interpreting and making predictions.

Mental Exercises

From Primary 2, the first five to ten minutes of each period must be devoted to mental work. The aim should be to develop speed and accuracy in applying the four rules, to ensure a mastery of the requisite tables and to prepare the class for the day's main lesson in mathematics. At least one half of the mental exercises given must relate to work that is to follow in the main lesson.

In order that the limited time available may not be wasted, the teacher must get the mental exercises prepared beforehand. A notebook to be seen by the Headteacher along with the lesson notes, should be kept, in which the teacher should set down the mental exercises for each day. Pupils will write the numbers 1 to 10 (up to 20) in two columns, leaving adequate space against the numbers for the answers. The teacher will then dictate the mental exercises from his note-book at a reasonably brisk pace and without repetition.

A variation from dictated mental work is to give out prepared individual cards with graded exercises on them which the class should do as speed work, or when time permits, to write on the blackboard before the period begins, The drawback of the last two variations is that they make it easy for some pupils to scribble down hidden calculations instead of doing the work mentally.

When mental work is being prepared it should be remembered that the same process can be tested by using a variety of expressions. The examples that follow are intended as no more than patterns to help the teacher to make up his own exercises in the light of the main lesson planned for the day or of any weaknesses that previous mental work may have revealed.

Addition

1. 4 plus 5.
2. Add 6 and 5.
3. What is the sum of 3 and 7?
4. Increase 10 by 5.
5. Find the total of 7 and 3.

Subtraction

1. Subtract 5 from 8.
2. From 9 take 5.
3. 10 minus 9.
4. What is the difference between 7 and 12?
5. What must be added to 8 to make 11?

Multiplication

1. 2 times 5.
2. Multiply 3 by 4.
3. What must be divided by 2 to give 4?

Division

1. Divide 10 by 2.
2. Share 6 oranges between 2 girls.
3. How many times is 2 contained in 8?
4. What must be multiplied by 2 to give 10?

Short Methods and Sundry Tables

1. Find the cost of 2 oranges at 10 pesewas each.
2. 4 x 2.
3. 3 x 5.
4. How many minutes from 10 o'clock in the morning to 12 noon?

Since the aim of mental drills is to give practice and increase children's confidence in recalling their basic number facts, exercises set should be easy enough for every child to obtain at least half of the total score. Teachers should use variety of teaching strategies including games, music and physical activities as well as rewards to motivate children to practice and increase their confidence in recalling their basic number facts.

Catering for Individual Needs (Differentiation)

According to the national constitution, all children should be given the opportunity to achieve the maximum of their potential. Children of lower ability need to have the opportunity to experience a range of mathematics, which is appropriate to their level of development, interests and capabilities. Equally children with exceptional ability in mathematics must be extended (i.e. challenged) and not simply be expected to carry out different repetitions of work they have already mastered.

As new experiences cause children to refine their existing knowledge and ideas, so they construct new knowledge. The extent to which teachers are able to facilitate this process significantly affects how well children learn. It is important that they are given opportunities to relate their new learning to knowledge and skills, which they have developed in the past (i.e. making connections).

Some children fail to reach their potential because they do not see the applicability of mathematics to their daily lives and because they are not encouraged to connect new mathematical concepts and skills to experiences, knowledge and skills they already have. As a result these children develop a negative attitude towards mathematics. The development of more positive attitudes to mathematics and a greater appreciation of its usefulness are the key to improving child participation.

Teachers should note that punishing pupils who get their sums wrong is against children's rights and professionally not allowed.

Use of Teaching Learning Materials (TLMs)

Concrete Materials or Manipulatives

The importance of the use of TLMs to help children form mathematical concepts is well known. Using TLMs provides a foundation of practical experience on which children can build abstract ideas. It encourages them to be inventive, helps to develop their confidence and encourages independence.

Teachers need to make use of an appropriate range of apparatus to focus the children's thinking on the concept to be developed, modifying the TLMs as the learner's understanding grows. The use of manipulatives also facilitates the children's thinking during the problem solving process.

Textbooks

Textbooks contain materials that provide children with practice and enrichment. They contain ideas for problem solving situations, which develop mathematical skills and understanding. There should be regular, planned opportunities for children to read mathematics textbooks both in class and at home. However teachers must realise that a textbook is just one tool to help with the implementation of the syllabus.

Information and Communication Technology (ICT)

Computers and calculators are learning tools which children can use to discover and reinforce new ideas. ICT can provide children with opportunities to:

- learn from feedback;
- observe patterns;
- see connections;
- work with dynamic images;
- explore data;
- "teach" the computer by giving it simple instructions.

Mathematics Across the Curriculum

Teachers need to help children appreciate the importance of mathematics in their lives. They may achieve this by using the Thematic Approach or by asking colleagues teaching other subjects to provide examples and contexts that may be used in mathematics lessons. Setting students projects that cut across subjects is one way of teaching mathematics across the curriculum.

Here are some opportunities that link Mathematics to other subjects:

English

In mathematics general accuracy in using language can be promoted through:

- interpreting questions orally and in writing;
- clarifying the precise meaning of words or mathematical terms;
- discussing the essential ideas identified in the questions and interpreting them to identify the mathematical content;
- creating an awareness of patterns of language by asking children to explain, argue and present their conclusions to others;
- drawing their attention to the statements involved in mathematical reasoning and proof, such as if … then, because, therefore, …

Science

Almost every scientific investigation or experiment is likely to require one or more of the mathematical skills of classifying, counting, measuring, calculating, estimating, recording in tables and graphs. Children will, for example, order numbers, including decimals, calculate means and percentages, decide whether it is more appropriate to use a line graph or bar chart and plot, interpret, and predict from graphs.

Creative Arts

Measurements are often needed in Creative Arts. Many patterns and constructions in our own and other cultures are based on properties of shapes, including symmetry and spatial ideas. Designs may need enlarging or reducing, introducing ideas of multiplication or ratio.

Citizenship Education

Discussing evidence in history or geography may involve measurement, estimation and approximation skills, and making inferences. Children will make statistical enquiries, for example, in analysing population data to explore and compare lifestyles. The study of maps includes the ideas of angle, direction, position and scale.

Physical Education, Music, Drama

Athletic activities use measurement of height, distance and time. Ideas of counting, time, symmetry, pattern (beats and rhythm), movement, position and direction are used extensively in music, dance and competitive games. Role Play provides children with opportunities to relate mathematics to real-life experiences.

Assessment in Mathematics

Evaluation of children's achievement is an essential part of mathematics education. This is necessary for various purposes:

- to give teachers feedback on the success of their methods and approaches and to assist planning for new learning (formative);
- to assess the children's readiness for new learning and to find out what they have learnt (summative).

Diagnostic assessment procedures enable teachers to discover difficulties that individual children may be having. Appropriate diagnostic assessment may reveal that the reason for a particular student's lack of progress is a lack of understanding achieved at an earlier time and the difficulty may be relatively easily addressed. Diagnosis may also reveal that the child is very talented and is simply bored by lack of stimulation. Diagnostic assessments enable teachers to plan further learning activities specifically designed to meet the learning needs of individual children. Worthwhile diagnosis may be carried out by employing closed and open-type questions. In the lower primary teachers are encouraged to use the diagnostic assessment instrument in Appendix A and B.

School Based Assessment (SBA) should focus both on what children know and can do, and on how they think about mathematics. It should involve a broad range of tasks and problems and requires the application of a number of mathematical ideas. Skills assessed should include the ability to communicate findings, to present an argument and to exploit an intuitive approach to a problem.

Assessment should be an integral part of the normal teaching and learning programme. It should involve multiple techniques, including written, oral and demonstration formats. Group and team activities should also be assessed. In SBA, teachers should avoid carrying out only tests which focus on a narrow range of skills (or profile dimensions) such as the correct application of standard algorithms (procedures). While such skills are important, a consequence of a narrow assessment procedure, which isolates skills or knowledge, is that children tend to learn in that way. Mathematics becomes for them a set of separate skills and concepts with little obvious connection to other aspects of learning or to their world.

SBA should also be undertaken to provide children and their parents with an indication of the child's progress. When marking children's work and giving feedback (oral or written) teachers should indicate what the children have done well and what they need to do to improve and to act on feedback given to them. In summarising the results of evaluations of children's achievement, teachers should report what the children have achieved and how well they achieved it. A grade or mark alone is insufficient. As part of SBA, children are expected to take an NMS test namely School Education Assessment (SEA) to determine whether or not they have reached the minimum standards for Primary 2, 4 and 6.

Another NMS test namely National Education Assessment (NEA) is given at the end of Primary 3 and 6 to all children to determine whether or not they have reached the NMS stated for the two key stages of the educational system. The NEA is given to 5% of all pupils across the country in Primary 3 and Primary 6.

FORM OF ASSESSMENT

From September 2012, the form of assessment in schools will follow the requirements of the School Based Assessment (SBA) system. Schools will assess pupils/students at the end of the first four weeks, at the end of the eighth week and at the end of the eleventh week. Each test is called "Class Assessment Task (CAT)". CAT1 will be administered at the end of the first four weeks of the term; CAT2 will be administered at the end of eight weeks of the term, and CAT3 will be administered at the end of the eleventh week, while the End-of-Term test will come possibly at the end of the twelfth week.

Apart from the three CATs and the end-of-term test, pupils/students will be required to carry out a project for each term. The project for the term will constitute CAT4 in the first term. Projects are intended to encourage pupils to apply knowledge and skills acquired in the term to write an analytic or investigative paper, use science and mathematics to solve a problem or produce a physical three-dimensional product as may be required in Creative Arts and in Natural Science.

Assessment in the school system will hence follow the guideline below:

<u>Term 1</u>

CAT1 – End of week 4 of Term 1
CAT2 – End of week 8 of Term 1
CAT3 - End of week 11 of Term 1
CAT4 – Project work to be submitted at the end of the 11th week
End-of-term examination administered at the end of the twelfth week

<u>Term 2</u>

CAT5 – End of week 4 of term 2
CAT6 – End of week 8 of term 2
CAT7 – End of week 11 of term 2
CAT8 – Project work to be submitted at the end of the 11th week
End-of-term examination administered at the end of the twelfth week

<u>Term 3</u>

CAT9 – End of week 4 of term 3
CAT10 – End of week 8 of term 3
CAT11 – End of week 11 of term 3
CAT12 – Project work to be submitted at the end of the 11th week
End-of-term examination administered at the end of the twelfth week

The information detailed above is further provided in the diagramme on the next page.

MODE OF ADMINISTRATION OF TASKS

TASK	TERM	TIME OF ADMINISTRATION	DESCRIPTION OF TASK	NOTES/REMARKS	SCORES
1	1	End of 4th week	Individual Test		10
5	2				10
9	3				10
2	1	End of 8th week	Group Exercise	Two or three instructional objectives the teacher considers very important and challenging to teach and learn should be used	10
6	2				10
10	3				10
3	1	11th 0r 12th week	Individual Test		10
7	2				10
11	3				10
4	1	The whole term	Project Work/Group Project work	Nine project topics divided into 3 topics for each term. Each pupil should be guided to select one project work in each term. For a group project work the pupils should do it in teams.	20
8	2				20
12	3				20
					The total for each term is 50%

CAT1, CAT5 and CAT9 will generally consist of an objective test, with possibly structured questions or story problems depending upon the subject.

CAT2, CAT6 and CAT10 will be based on 1, 2 or 3 topics that the teacher identifies as important but difficult for pupils/students to learn in the first and second month of the term. CAT2, CAT6 and CAT10 will be organized as Group Exercise where groups of pupils/students will discuss and learn by the co-operative learning approach and each group's work awarded marks by the teacher. The group exercise could also be based on some practical work such as in ICT and BDT.

CAT3, CAT7 and CAT11 will be administered tasks consisting of objective items, structured questions and possibly practical exercises.

It is expected that the administration of all the CATs will be completed by the end of the eleventh week of the term to allow schools enough time to prepare for the administration of the end-of-term examination.

Because of increasing numbers in classrooms, project work will be carried out as group projects where each project will be planned and carried out by a group of pupils/students. Schools will be supplied with at least six project topics for each class for the year. Groups of pupils/students will be expected to select a project topic of their interest in each term in the first two weeks of the term, carry out the project over the next two months and submit their completed project by the end of the eleventh week.

End-of-term Examination

The end-of-term examination should be developed to consist of Section A and Section B. Section A will be the objective items section; Section B will be the structured questions section. Depending upon the requirements of the subject, there could be a Section C, the practical test component.

Home Work and Class Exercises

Home work and class exercises are very important aspects of formative evaluation in the teaching and learning process but will not be included in the SBA. Teachers are however, expected to give homework and class exercises as part of the regular teaching and learning process.

SBA at JHS3

SBA will terminate at the end of the first term of JHS3 after completing CATs 1- 4. This is to allow JHS3 students the time to prepare for the BECE coming at the end of April of the next year.

Purposes of SBA

The SBA system will consist of 12 assessments a year instead of the 33 assessments in the previous continuous assessment system. This will mean a reduction by 64% of the work load compared to the previous continuous assessment system.

The purposes of the new SBA are as follows:

- To provide a reduced but more effective system of internal school assessment replacing the former Continuous Assessment system which was rather tedious for both teachers and pupils/students
- To standardize the practice of internal school assessment throughout the country
- To provide teachers with guidelines for constructing assessment items/questions
- To provide teachers with advice on how to conduct remedial instruction to improve pupil/student school performance
- To provide guidance in marking and grading test items and questions and carry out general appraisal of pupil/student performance

SBA Handbook

Details of the SBA system are contained in the “Teachers’ Handbook on School Based Assessment”. The details include issues on the following:

- Characteristics of the SBA
- Structure of the SBA and mark allocation for the SBA
- Directions for developing and administering the SBA and the end-of-term examination
- Using SBA for improving learning; including marking and grading systems
- Guidelines for project development and project assessment

The handbook contains sample items and questions for all subjects from Primary 1 to JHS3. Teachers are expected to use the sample items and questions provided in the handbook as guides for developing their own items and questions for the CATs and end-of-term examinations.

Accompanying the SBA Handbook are the following records:

- Primary School/JHS SBA Register
- Pupil's/Student's Report Card
- Pupil's/Student's Progress Record (i.e. Cumulative record)

Teachers are encouraged to obtain copies of the SBA Handbook to guide them in carrying out the SBA process.

DEFINITION OF PROFILE DIMENSIONS

The concept of profile dimensions was made central to the syllabuses developed from 1998 onwards. A 'dimension' is a psychological unit for describing a particular learning behaviour. More than one dimension constitutes a profile of dimensions. A specific objective may be stated with an action verb as follows: The pupil will be able to describe….. etc. Being able to "describe" something after the instruction has been completed means that the pupil has acquired "knowledge". Being able to explain, summarize, give examples, etc. means that the pupil has understood the lesson taught.

Similarly, being able to develop, plan, solve problems, construct, etc. means that the pupil can "apply" the knowledge acquired in some new context. Each of the specific objectives in this syllabus contains an "action verb" that describes the behaviour the pupil will be able to demonstrate after the instruction. "Knowledge", "Application", etc. are dimensions that should be the prime focus of teaching and learning in schools. Unfortunately it has been realized that schools still teach the low ability thinking skills of knowledge and understanding and ignore the higher ability thinking skills. Instruction in most cases has tended to stress knowledge acquisition to the detriment of the higher ability behaviours such as application, analysis, etc. The persistence of this situation in the school system means that pupils will only do well on recall items and questions and perform poorly on questions that require higher ability thinking skills such as application of mathematical principles and problem solving. For there to be any change in the quality of people who go through the school system, pupils should be encouraged to apply their knowledge, develop analytical thinking skills, develop plans, generate new and creative ideas and solutions, and use their knowledge in a variety of ways to solve mathematical problems while still in school. Each action verb indicates the underlying profile dimension of each particular specific objective. Read each objective carefully to know the profile dimension toward which you have to teach.

In Mathematics, the two profile dimensions that have been specified for teaching, learning and testing at lower primary and upper primary are:

	Primary 1 - 3	**Primary 4 - 6**
Knowledge and Understanding	40%	30%
Application of Knowledge	60%	70%

Each of the dimensions has been given a percentage weight that should be reflected in teaching, learning and testing. The weights indicated on the right of the dimensions, show the relative emphasis that the teacher should give in the teaching, learning and testing processes at the two primary levels. You will notice that the profile dimensions are weighted differently for P1-3 and P4-6. This is to indicate the change in emphasis as pupils move up in education and in maturity.

The explanation and key words involved in each of the profile dimensions are indicated on the next page.

Knowledge and Understanding (KU)

Knowledge	the ability to remember, recall, identify, define, describe, list, name, match, state principles, facts and concepts. Knowledge is simply the ability to remember or recall material already learned and constitutes the lowest level of learning.
Understanding	the ability to explain, summarize, translate, rewrite, paraphrase, give examples, generalize, estimate or predict consequences based upon a trend. Understanding is generally the ability to grasp the meaning of some material that may be verbal, pictorial, or symbolic.

Application of Knowledge (AK)

The ability to use knowledge or apply knowledge, as implied in this syllabus, has a number of learning/behaviour levels. These levels include application, analysis, synthesis, and evaluation. These may be considered and taught separately paying attention to reflect each of them equally in your teaching. The dimension "Application of knowledge" is a summary dimension for all four learning levels.

Details of each of the four sub-levels of application are as follows:

Application	the ability to apply rules, methods, principles, theories, etc. to concrete situations that are new and unfamiliar. It also involves the ability to produce, solve, plan, demonstrate, discover, etc.
Analysis	the ability to break down material into its component parts; to differentiate, compare, distinguish, outline, separate, identify significant points, etc.; ability to recognize unstated assumptions and logical fallacies; ability to recognize inferences from facts, etc.
Synthesis	the ability to put parts together to form a new whole. It involves the ability to combine, compile, compose, devise, plan, revise, design, organize, create, generate new ideas and solutions, etc.
Evaluation	the ability to appraise, compare features of different things and make comments or judgement, compare, contrast, criticize, justify, support, discuss, conclude, make recommendations, etc. Evaluation refers to the ability to judge the worth or value of some material based on some criteria.

STRUCTURE AND ORGANIZATION OF THE SYLLABUS

General Objectives

General Objectives for this syllabus have been listed on page 4 of the syllabus. The general objectives flow from the general aims of mathematics teaching listed on the first page of this syllabus. The general objectives form the basis for the selection and organization of the units and their topics. Read the general objectives very carefully before you start teaching. After teaching all the units, go back and read the general aims and general objectives again to be sure you have covered both of them adequately in the course of your teaching.

Years and Units

The syllabus has been planned on the basis of Years and Units. Each year's work is covered in a number of units sequentially arranged and in a meaningful manner such that each unit’s work will provide the necessary and enabling skills for the next unit. A description of the contents of each column is as follows:

Syllabus Structure

The syllabus is structured in five columns: Units, Specific Objectives, Content, Teaching and Learning Activities and Evaluation. A description of the contents of each column is as follows:

Column 1 - Units The units in column 1 are the major topics of the year. You are expected to follow the unit topics according to the linear order in which they have been presented. However, if you find at some point that teaching and learning in your class will be more effective if you branched to another unit before coming back to the unit in the sequence, you are encouraged to do so.

Column 2 - Specific Objectives: Column 2 shows the Specific Objectives for each unit and it has a special numbering system such as 1.2.5 or 3.4.1. These numbers are referred to as "Syllabus Reference Numbers". The first digit in the syllabus reference number refers to the year/class; the second digit refers to the unit, while the third refers to the rank order of the specific objective. For instance 1.2.5 means Year 1 or Primary 1, Unit 2 (of Class 1) and Specific Objective 5. In other words 1.2.5 refers to Specific Objective 5 of Unit 2 of Primary 1. Similarly, the syllabus reference number 3.4.1 simply means Specific Objective number 1 of Unit 4 of Primary 3. Using syllabus reference numbers provides an easy way for communication among teachers and educators. It further provides an easy way for selecting objectives for test construction. For instance, if Unit 4 of Primary 3 has seven specific objectives 3.4.1 - 3.4.7, a teacher may want to base his/her test items/questions on objectives 3.4.4 to 3.4.7 and not use the other first three objectives. In this way, a teacher would sample the objectives within units to be able to develop a test that accurately reflects the importance of the various specific objectives and skills taught in class.

You will notice that specific objectives have been stated in terms of the pupil's ability, i.e. what the pupil will be able to do during and after instruction and learning in the unit. Hence each specific objective starts with the following "The pupil will be able to….." This in effect, means that you have to address the learning problems of each individual pupil. It means individualizing your instruction as much as possible such that the majority of pupils will be able to master the objectives of each unit of the syllabus.

Column 3 - Content: The "content" in the third column of the syllabus presents a selected body of information that you will need in teaching the particular unit. In some cases, the content presented is quite exhaustive. In some other cases, you could add some more information based upon your own training and based also on current knowledge and information.

Column 4 - Teaching/Learning Activities (T/LA): T/LA that will ensure maximum pupil participation in the lessons is presented in Column 4. The General Aims of the subject can only be most effectively achieved when teachers create learning situations and provide guided opportunities for pupils to acquire as much knowledge and understanding of mathematics as possible through their own activities. Pupils' questions are as important as teacher's questions. There are times when the teacher must show, demonstrate, and explain. But the major part of a pupil's learning experience should consist of opportunities to explore various mathematical situations in their environment to enable them make their own observations and discoveries and record them. Teachers should help pupils to learn to compare, classify, analyze, look for patterns, spot relationships and come to their own conclusions/deductions. Avoid rote learning and drill-oriented methods and rather emphasize participatory teaching and learning in your lessons. You are encouraged to re-order the suggested teaching/learning activities and also add to them where necessary in order to achieve optimum pupil learning.

A suggestion that will help your pupils acquire the capacity for analytical thinking and the capacity for applying their knowledge to problems and issues is to begin each lesson with a practical problem. Select a practical problem for each lesson. The selection must be made such that pupils can use knowledge gained in the previous lesson and other types of information not specifically taught in class. The learning of any skill considered important must start early. From age six, engage your pupils in analytical thinking and practical problem solving techniques.

Column 5 - Evaluation: Suggestions and exercises for evaluating the lessons of each unit are indicated in Column 5. Evaluation exercises can be in the form of oral questions, quizzes, class assignments, essays, project work, etc. Try to ask questions and set tasks and assignments, etc. that will challenge pupils to apply their knowledge to issues and problems as has already been said, and that will engage them in developing solutions, and in developing observational and

investigative skills as a result of having undergone instruction in this subject. The suggested evaluation tasks are not exhaustive. You are encouraged to develop other creative evaluation tasks to ensure that pupils have mastered the instruction and behaviours implied in the specific objectives of each unit.

Lastly, bear in mind that the syllabus cannot be taken as a substitute for lesson plans. It is necessary that you develop a scheme of work and lesson plans for teaching the units of this syllabus.

ORGANIZATION OF THE SYLLABUS

The syllabus is structured to cover the six years of Primary School Education. Each year's work has been divided into units. The unit topics for each year have been arranged in the sequence in which teachers are expected to teach them. No attempt has been made to break each year's work into terms. This would have been desirable but it is quite difficult to predict, with any degree of certainty, the rate of progress of pupils during those early stages. Moreover, the syllabus developers wish to discourage teachers from forcing the instructional pace but would rather advise teachers to ensure that pupils progressively acquire a good understanding and application of the material specified for each year's class work. It is hoped that no topics will be glossed over for lack of time because it is not desirable to create gaps in pupils' knowledge. The unit topics for the six years' course are presented in the table on the next page.

Appendix 'A'

Unit topics for the six year primary school mathematics

Unit	Primary 1	Primary 2	Primary 3	Primary 4	Primary 5	Primary 6
1.	Counting Objects	Numbers and Numerals 0 - 100	Numbers and Numerals 0 - 10,000	Shape and Space	Numbers and 0 – 1,000,000	Sets of Numbers
2.	Number and Numerals I	Addition 0 - 18	Addition and Subtraction (Sum up to 9999)	Numbers and Numerals 0 - 100,000	Sets of Numbers	Operations on Fractions
3.	Addition (Up to 9)	Subtraction 0 - 18	Length and Area	Investigation With Numbers I	Collecting and Handling Data	Addition and Subtraction (Sum 0 - 10,000,000)
4.	Number and Numerals II	Numbers and Numerals 0 - 1,000	Fractions I	Addition and Subtraction (Sum up to 100,000)	Addition and Subtraction (Sum up to 1,000,000)	Decimal Fraction and Percentage
5.	Subtraction 0 - 9	Measurement of Length, Capacity and Mass(weight)	Collecting and Representing Data as graph	Measurement of Mass/weight and Time	Measurement of Length, Mass and Capacity	Measurement of Length, Capacity and Mass
6.	Solid Shapes	Addition (Sums 0 - 99)	Estimating and Measuring Capacity and Mass (weight)	Fractions I	Shape and Space I	Ratio and Proportion
7.	Ten and Ones	Subtraction with Numbers less than 100	Multiplication of numbers	Multiplication	Multiplication and Division	Shape and Space
8.	Addition and Subtraction	Fractions	Division	Division	Shape and Space II	Collecting and Handling Data
9.	Measurement of Length, Capacity and Mass	Measurement of Time and Money	Plane Shapes	Fractions II	Area and Volume	Multiplication and Division
10.	Measurement of Time and Money	Addition (Sums 0 - 999)	Measurement of Time and Money	Measurement of Length and Area	Operations on Fractions	Investigation with Numbers
11.	Collecting and Handling Data	Subtraction (Numbers less than 1000)	Fractions II	Shape and Space II	Decimal Fractions and Percentages	Measurement of Area and Volume
12.	Addition and Subtraction of Number (0 - 99)	Multiplication		Collecting and Handling Data	Collecting and Handling Data II	Money
13.		Division		Investigation with Numbers II	Number Plane	Chance
14.		Collecting and Handling Data		Measurement of Capacity and Volume	Ratio	Number Plane
15.		Shape and Space			Investigation with Numbers	
16.					Measurement of Time	