REPUBLIC OF GHANA

MINISTRY OF EDUCATION, SCIENCE AND SPORTS

Republic of Ghana

TEACHING SYLLABUS FOR MATHEMATICS

(JUNIOR HIGH SCHOOL 1 – 3)

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(JUNIOR HIGH SCHOOL)

RATIONALE FOR TEACHING MATHEMATICS

Development in almost all areas of life is based on effective knowledge of science and mathematics. There simply cannot be any meaningful development in virtually any area of life without knowledge of science and mathematics. It is for this reason that the education systems of countries that are concerned about their development put great deal of emphases on the study of mathematics. The main rationale for the mathematics syllabus is focused on attaining one crucial goal: to enable all Ghanaian young persons acquire the mathematical skills, insights, attitudes and values that they will need to be successful in their chosen careers and daily lives. The new syllabus is based on the twin premises that all pupils can learn mathematics and that all need to learn mathematics. The syllabus is therefore, designed to meet expected standards of mathematics in many parts of the world. Mathematics at the Junior High school (J H S) in Ghana builds on the knowledge and competencies developed at the primary school level. The pupil is expected at the J.H.S level to move beyond and use mathematical ideas in investigating real life situations. The strong mathematical competencies developed at the J.H.S. level are necessary requirements for effective study in mathematics, science, commerce, industry and a variety of other professions and vocations for pupils terminating their education at the J.H.S level as well as for those continuing into tertiary education and beyond.

GENERAL AIMS

The syllabus is designed to help the pupil to:

1. develop basic ideas of quantity and space.
2. develop the skills of selecting and applying criteria for classification and generalization.
3. communicate effectively using mathematical terms, symbols and explanations through logical reasoning.
4. use mathematics in daily life by recognizing and applying appropriate mathematical problem-solving strategies.
5. understand the process of measurement and acquire skills in using appropriate measuring instruments.
6. develop the ability and willingness to perform investigations using various mathematical ideas and operations.
7. work co-operatively with other students to carry out activities and projects in mathematics and consequently develop the values of cooperation, tolerance and diligence.
8. use the calculator and the computer for problem solving and investigation of real life situations
9. develop interest in studying mathematics to a higher level in preparation for professions and careers in science, technology, commerce, and a variety of work areas.

GENERAL OBJECTIVES

The pupil will:

1. Work co-operatively with other pupils and develop interest in mathematics.
2. Read and write numbers.
3. Use appropriate strategies to perform number operations.
4. Recognize and use patterns, relationships and sequences and make generalizations.
5. Recognize and use functions, formulae, equations and inequalities.
6. Identify and use arbitrary and standard units of measure.
7. Make and use graphical representations of equations and inequalities.
8. Use the appropriate unit to estimate and measure various quantities.
9. Relate solids and plane shapes and appreciate them in the environment.
10. Collect, analyze and interpret data and find probability of events.
11. Use the calculator to enhance understanding of numerical computation and solve real-life problems.
12. Manipulate learning material to enhance understanding of concepts and skills.

SCOPE OF SYLLABUS

This syllabus is based on the notion that an appropriate mathematics curriculum results from a series of critical decisions about three inseparable linked components: content, instruction and assessment. Consequently, the syllabus is designed to put great deal of emphases on the development and use of basic mathematical knowledge and skills. The major areas of content covered in all the Junior High classes are as follows:

1. Numbers and Investigation with numbers.
2. Geometry
3. Estimation and Measurement
4. Algebra
5. Statistics and Probability

Numbers covers reading and writing numerals in base ten, two, and five and the four basic operations on them as well as ratio, proportion, percentages, fractions, integers and rational numbers. *Investigations with numbers* provides opportunity for pupils to discover number patterns and relationships, and to use the four operations meaningfully. *Geometry* covers the properties of solids and planes, shapes as well as the relationship between them. *Estimation and Measurement* include practical activities leading to estimating and measuring length, area, mass, capacity, volume, angles, time and money. *Algebra* covers algebraic expressions, relations and functions. These concepts are developed to bring about the relationship between numbers and real-life activities. *Statistics and probability* are important interrelated

areas of mathematics. Statistics and probability involve the pupils in collecting, organizing, representing and interpreting data gathered from various sources, as well as understanding the fundamental concepts of probability so that they can apply them in everyday life.
This syllabus does not include problem solving as a distinct topic. Rather, nearly all topics in this syllabus include solving word problems as activities. 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 opportunity 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 Junior High School pupils.

ORGANIZATION OF THE SYLLABUS

The syllabus is structured to cover the three years of Junior High School. Each year's work has been divided into units. JHS 1 has 15 units; JHS 2 has 16 units, while JHS 3 has 8 units of work. 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 is desirable because 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 three years' course are indicated on the next page.

JHS	1	2	3
UNIT			
1	Numbers and Numerals	Numeration systems	Application of Sets
2	Sets	Linear equations and inequalities	Rigid motion
3	Fractions	Angles	Enlargements and Similarities
4	Shape and Space	Collecting and Handling Data	Handling data and Probability
5	Length and Area	Rational numbers	Money and Taxes
6	Powers of natural numbers	Shape and space	Algebraic expressions
7	Introduction to the use of Calculators	Geometric constructions	Properties of Polygons
8	Relations	Algebraic expressions	Investigations with Numbers
9	Algebraic expressions	Number Plane	-
10	Capacity, Mass, Time and Money	Properties of Quadrilaterals	-
11	Integers	Ratio and Proportion	-
12	Geometric constructions	Mapping	-
13	Decimal Fractions	Area and Volume	-
14	Percentages	Rates	-
15	Collecting and Handling Data (Discrete)	Probability	-
16	-	Vectors	-

TIME ALLOCATION

Mathematics is allocated ten periods a week, each period consisting of thirty (30) minutes. The ten periods should be divided into five double periods, each of one-hour duration for each day of the week.

Ø Music and Dance	3
Ø Physical Education	2
Ø Library Work (Reading and Research)	2
Ø SBA Project	2
Ø Worship	2
Ø Free Period	1

SUGGESTIONS FOR TEACHING THE SYLLABUS

General Objectives for this syllabus have been listed early on page iii 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 for the year, 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.

Bear in mind that your class may have some pupils of different physical problems and mental abilities. Some of the children may have high mental ability, while others may be slow learners; some may be dyslexic and not able to read or spell well as the others in the class. All these are special needs children who need special attention. Ensure that you give equal attention to all pupils in your class to provide each of them equal opportunities for learning. Pupils with disabilities may have hidden mathematical talents that can only come to light if you provide them the necessary encouragement and support in class.

General Objectives

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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 that have been sequentially arranged to meet the teaching and learning needs of teachers and pupils.

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 for the year. The numbering of the units is different in mathematics from the numbering adopted in other syllabuses. The unit numbers consist of two digits. The first digit shows the year or class while the second digit shows the sequential number of the unit. A unit number like 1.2 is interpreted as unit 2 of JH1. Similarly, a unit number like 3.5 means unit 5 of JH3. The order in which the units are arranged is to guide you plan your work. 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. The specific objectives begin with numbers 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 refer to the rank order of the specific objective. For instance 1.2.5 means Year 1 or JH1, Unit 2 (of JH1) and Specific Objective 5. In other words 1.2.5 refers to Specific Objective 5 of Unit 2 of JH1. 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, Unit 4 of JH3 has three specific objectives 3.4.1 - 3.4.3. A teacher may want to base his/her test items/questions on objectives 3.4.2 and 3.4.3 and not use the other first objective. A teacher would hence be able to use the syllabus reference numbers to sample objectives within units and within the year to be able to develop a test that accurately reflects the importance of the various skills taught in class.

You will note also that specific objectives have been stated in terms of the pupils i.e. what the pupil will be able to do during and after instruction and learning in the unit. Each specific objective hence 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 shows the mathematical concepts, and operations required in the teaching of the specific objectives. In some cases, the content presented is quite exhaustive. In some other cases, you could provide additional information based upon your own training and current knowledge and information.

Column 4 - Teaching/Learning Activities (T/LA): T/LA activities that will ensure maximum pupil participation in the lessons are 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 pupils' 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. Emphasize the cognitive, affective and psychomotor domains of knowledge in your instructional system wherever appropriate.

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 and interesting problem. Select a practical mathematical 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.

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 we have already said above, 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.

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. It has been realized unfortunately 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 the JHS level are:

Knowledge and Understanding	30%
Application of knowledge	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 Junior High School.

Explanation and key words involved in each of the profile dimensions are as follows:

Knowledge and Understanding (KU)

Knowledge — the ability to, read, count, identify, define, describe, list, name, locate, 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, distinguish, factorize, calculate, expand, measure, predict, 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(AU)

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 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 judgments, 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.

FORM OF ASSESSMENT

It is important that both instruction and assessment be based on the specified profile dimensions. In developing assessment procedures, first select specific objectives in such a way that you will be able to assess a representative sample of the syllabus objectives. Each specific objective in the syllabus is considered a criterion to be mastered by the pupil. When you develop a test that consists of items and questions that are based on a representative sample of the specific objectives taught, the test is referred to as a "Criterion-Referenced Test". It is not possible to test all specific objectives taught in the term or in the year. The assessment procedure you use i.e. class test, homework, projects etc. must be developed in such a way that it will consist of a sample of the important objectives taught over the specified period.

End-of-Term Examination

The end-of-term examination is a summative assessment system and should consist of a sample of the knowledge and skills pupils have acquired in the term. The end-of-term test for Term 3 should be composed of items/questions based on the specific objectives studied over the three terms, using a different weighting system such as to reflect the importance of the work done in each term in appropriate proportions. For example, a teacher may build an end-of- Term 3 test in such a way that it would consist of the 20% of the objectives studied in Term 1, 20% of the objectives studied in Term 2, and 60% of the objectives studied in Term 3.

The diagram below shows the recommended examination structure in Mathematics for the end-of-term test. The structure consists of one examination paper and the School Based Assessment (SBA) formally called Continuous Assessment. Section A is the objective-type answer section essentially testing knowledge and understanding. The section may also contain some items that require application of knowledge. Section B will consist of questions that essentially test "application of knowledge". The application dimension should be tested using word problems that call for reasoning. The SBA should be based on both dimensions. The distribution of marks for the objective test items, questions and SBA should be in line with the weights of the profile dimensions as shown in the last column of the table on the next page.

Distribution of Examination Paper Weights and Marks

Dimensions	Section A	Section B	SBA	Total Marks	Total Marks scaled to 100
Knowledge and Understanding	30	20	10	60	30
Application of knowledge	10	80	50	140	70
Total Marks	40	100	60	200	
% Contribution of Examination Papers	**20**	**50**	**30**		**100**

For testing in schools, the two examination sections could be separate where possible. Where this is not possible, the items/questions for Papers 1 and 2 could be in the same examination paper as two sections; Sections A and B as shown in the example above. Paper 1 or Section A will be an objective-type paper/section testing knowledge and understanding, while Paper 2 or Section B will consist of application questions with a few questions on knowledge and understanding.

Paper 1 or Section A, will be marked out of 40, while Paper 2, the more intellectually demanding paper, will be marked out of 100. The mark distribution for Paper 2 or Section B, will be 20 marks for "knowledge and understanding" and 80 marks for "application of knowledge". SBA will be marked out of 60. The last row shows the percentage contribution of the marks from Paper 1/Section A, Paper 2/Section B, and the School Based Assessment on total performance in the subject tested.

Combining SBA marks and End-of-Term Examination Marks

The new SBA system is important for raising pupils' school performance. For this reason, the 60 marks for the SBA will be scaled to 50. The total marks for the end of term test will also be scaled to 50 before adding the SBA marks and end-of-term examination marks to determine pupils' end of term results. The SBA and the end-of-term test marks will hence be combined in equal proportions of 50:50. The equal proportions will affect only assessment in the school system. It will not affect the SBA mark proportion of 30% used by WAEC for determining examination results at the BECE.

GUIDELINES FOR SCHOOL BASED ASSESSMENT

A new School Based Assessment system (SBA), formally referred to as Continuous Assessment, will be introduced into the school system from September 2008. SBA is a very effective system for teaching and learning if carried out properly. The new SBA system is designed to provide schools with an internal assessment system that will help schools to achieve the following purposes:

- Standardize the practice of internal school-based assessment in all schools in the country
- Provide reduced assessment tasks for each of the primary school subjects
- Provide teachers with guidelines for constructing assessment items/questions and other assessment tasks
- Introduce standards of achievement in each subject and in each class of the school system
- Provide guidance in marking and grading of test items/questions and other assessment tasks
- Introduce a system of moderation that will ensure accuracy and reliability of teachers' marks
- Provide teachers with advice on how to conduct remedial instruction on difficult areas of the syllabus to improve pupil performance

The new 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 12 assessments are labeled as Task 1, Task 2, Task 3 and Task 4. Task 1-4 will be administered in Term 1; Tasks 5-8 will be administered in Term 2, and Tasks 9-12 administered in Term 3. Task 1 will be administered as an individual test coming at the end of the first month of the term. The equivalent of Task 1 will be Task 5 and Task 9 to the administered in Term 2 and Term 3 respectively. Task 2 will be administered as a Group Exercise and will consist of two or three instructional objectives that the teacher considers difficult to teach and learn. The selected objectives could also be those objectives considered very important and which therefore need pupils to put in more practice. Task 2 will be administered at the end of the second month in the term. Task 3 will also be administered as individual test under the supervision of the class teacher at the end of the 11^{th} or 12 week of the term.

Task 4 (and also Task 8 and Task 12) will be a project to be undertaken throughout the term and submitted at the end of the term. Schools will be supplied with 9 project topics divided into three topics for each term. A pupil is expected to select one project topic for each term. Projects for the second term will be undertaken by teams of pupils as Group Projects. Projects are intended to encourage pupils to apply knowledge and skills acquired in the term to write an analytic or investigative paper, write a poem 9 (as may be required in English and Ghanaian Languages), 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.

Apart from the SBA, teachers are expected to use class exercises and home work as processes for continually evaluating pupils' class performance, and as a means for encouraging improvements in learning performance.

Marking SBA Tasks

At the SHS level, pupils will be expected to carry out investigations involving use of mathematics as part of their home work assignments and as part of the SBA. The suggested guideline for marking such assignments and projects is as follows:

1.	Process	20%
2.	Main body of work–	
	-Use of charts and other illustrative material	10%
	-Computations	20%
	-Reasoning (Application of knowledge)	20%
3.	Conclusion and evaluation of results/issues	20%
4.	Acknowledgement and other references	10%

The above guideline is indeed exhaustive but it will help our students to realize that mathematics is not just calculation but rather a system of thinking and solving problems through the use of numbers. Conclusions and evaluation of one's results are very important is given a weight of 20%.

The fourth item, that is, acknowledgement and references is intended to help teach young people the importance of acknowledging one's source of information and data. The pupil should provide a list of at least three sources of references for major work such as the project. The references could be books, magazines, the internet or personal communication from teacher or from friends. This component is given a weight of 10%.

The marks derived from projects, the end of month SBA tests and home work specifically designed for the SBA should together constitute the School Based Assessment component and weighted 60 per cent. The emphasis is to improve pupils' learning by encouraging them to produce essays, poems, and artistic work and other items of learning using appropriate process skills, analyzing information and other forms of data accurately and make generalizations and conclusions. The SBA will hence consist of:

- Ø End-of-month tests
- Ø Home work assignments (specially designed for SBA)
- Ø Project

Other regulations for the conduct of SBA will reach schools from Ghana Education Service.

GRADING PROCEDURE

To improve assessment and grading and also introduce uniformity in schools, it is recommended that schools adopt the following grade boundaries for assigning grades.

Grade A:	80 - 100%	-	Excellent
Grade B:	70 - 79%	-	Very Good
Grade C:	60 - 69%	-	Good
Grade D:	45 - 59%	-	Credit (Satisfactory)
Grade E:	35 - 44%	-	Pass
Grade F:	≤ 34%	-	Fail

In assigning grades to pupils' test results, you may apply the above grade boundaries and the descriptors which indicate the meaning of each grade. For instance, a score of 75% and above is considered "Excellent"; a score of 66% is within the grade boundary of 65-74% and is considered "Very Good". Writing 60% for instance, without writing the meaning of the grade does not provide the pupil with enough information to evaluate his/her performance on the assessment. It is therefore important to write the meaning of the grade alongside the score you write. The grade descriptors, Excellent, Very Good etc do not provide enough feedback to pupils. You should therefore provide short diagnostic information along side the grade descriptor or write other comments such as:

- Good work, keep it up
- Could do better
- Hard working pupil
- Not serious in class; more room for improvement etc.

The grade boundaries are also referred to as grade cut-off scores. When you adopt a fixed cut-off score grade system as in this example, you are using the criterion-referenced grading system. By this system a pupil must make a specified score to earn the appropriate grade. This system of grading challenges pupils to study harder to earn better grades. It is hence very useful for achievement testing and grading.

JUNIOR HIGH SCHOOL 1

<table>
<tr><th>UNIT</th><th>SPECIFIC OBJECTIVES</th><th>CONTENT</th><th>TEACHING AND LEARNING ACTIVITIES</th><th>EVALUATION</th></tr>
<tr>
<td>UNIT 1.1

NUMBER AND NUMERALS</td>
<td>The pupil will be able to:

1.1.1 count and write numerals up to 100,000,000</td>
<td>Counting and writing numerals from 10,000,000 to 100,000,000</td>
<td>
TLMs: Abacus, Colour-coded materials, Place value chart

Guide pupils to revise counting and writing numerals in ten thousands, hundred thousands and millions.

Using the idea of counting in millions, guide pupils to recognize the number of millions in ten million as (10,000,000 = 10 × 1,000,000)

Using the non-proportional structured materials like the abacus or colour-coded materials, guide pupils to count in ten millions.

Show, for example, 54,621,242 on a place value chart.
<table>
<tr><th colspan="3">Millions periods</th><th colspan="3">Thousands periods</th><th colspan="3">Hundreds periods</th></tr>
<tr><td>H</td><td>T</td><td>O</td><td>H</td><td>T</td><td>O</td><td>H</td><td>T</td><td>O</td></tr>
<tr><td></td><td>5</td><td>4</td><td>6</td><td>2</td><td>1</td><td>2</td><td>4</td><td>2</td></tr>
</table>
Point out that the commas between periods make it easier to read numerals.

Assist pupils to read number names of given numerals (E.g. 54,621,242) as; Fifty four million, six hundred and twenty one thousand, two hundred and forty two.
</td>
<td>Let pupils:

read and write number names and numerals as teacher calls out the digits in a given numeral (E.g. 72,034,856)

bring in news papers or magazines that mention numbers in millions

mention numbers they hear on TV and radio reports (this can be taken as projects to be carried out weekly for pupils to record)</td>
</tr>
</table>

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
1.1 (CONT'D) **NUMBER AND NUMERALS**	The pupil will be able to: 1.1.2 identify and explain the place values of digits in a numeral up to 100,000,000	Place value	Using the abacus or place value chart guide pupils to find the place value of digits in numerals up to 8-digits. Discuss with pupils the value of digits in given numerals. E.g. in 27,430,561 the value of 6 is 60, the value of 3 is 30,000, the value of 7 is 7,000,000, etc Discus with pupils the difference between the place value of a digit in a numeral and the value of a digit in a numeral.	Let pupils: write the value of digits in given numerals
	1.1.3 use < and > to compare and order numbers up to 100,000,000	Comparing and Ordering numbers up to 100,000,000	Guide pupils to use less than (**<**) and the greater than (**>**) symbols to compare and order whole numbers, using the idea of place value.	compare and order given whole numbers (up to 8-digits)
	1.1.4 round numbers to the nearest ten, hundred, thousand and million	Rounding numbers to the nearest ten, hundred, thousand and million	Guide pupils to use number lines marked off by tens, hundreds, thousands, and millions to round numerals to the nearest ten, hundred, thousand, and million. Using the number line guide pupils to discover that; (i) numbers greater than or equal to 5 are rounded up as 10 (ii) numbers greater than or equal to 50 are rounded up as 100 (iii) numbers greater than or equal to 500 are rounded up as 1000	write given numerals to the nearest ten, hundred, thousand, or million
	1.1.5 identify prime and composite numbers	Prime and Composite numbers	Guide pupils to use the sieve of Eratosthenes to identify prime numbers up to 100. Discuss with pupils that a prime number is any whole number that has only two distinct factors- itself and 1. A composite number is any whole number other than one that is not a prime number.	

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
1.1 (CONT'D) **NUMBER AND NUMERALS**	The pupil will be able to: 1.1.6 find prime factors of natural numbers	Prime factors	Guide pupils to use the Factor Tree to find factors and prime factors of natural numbers. Express a natural number as a product of prime factors only.	Let pupils: express a given natural number as the product of prime factors only.
	1.1.7 identify and use the HCF of two natural numbers in solving problems	Highest Common Factor (HCF) of up to 3-digit numbers	Guide pupils to list all the factors of two or three natural numbers E.g. 84 and 90 Set of factors of 84 = {1, 2,3, 4, 6, 7, 12, 14, 21,28, 42, 84} Set of factors of 90 = {1, 2, 3,5, 6, 9, 10, 15,18, 30, 45, 90} Guide pupils to identify which numbers appear in both lists as common factors Set of common factors = {1, 2, 6} Guide pupils to identify the largest number which appears in the common factors as the Highest Common Factor(H.C.F), i.e. 6 Also, guide pupils to use the idea of prime factorization to find the HCF of numbers. Pose word problems involving HCF for pupils to solve	find the HCF of two or three given natural numbers solve word problems involving HCF E.g. A manufacturer sells toffees which are packed in a small box. One customer has a weekly order of 180 toffees and another has a weekly order of 120 toffees. What is the highest number of toffees that the manufacturer should pack in each box so that he can fulfil both orders with complete boxes?
	1.1.8 identify and use the LCM of two or three natural numbers to solve problems	Least common multiples (LCM) up to 2-digit numbers	Guide pupils to find the Least Common Multiple (LCM) of given natural numbers by using; • Multiples; E.g. 6 and 8 Set of multiples of 6 = {6, 12, 18, 24, 30, 36, 42, 48, …} Set of multiples of 8 = {8, 16, 24, 32, 40, 48,…} Set of common multiples = {24, 48, …} L.C.M of 6 and 8 = {24} • Product of prime factors; E.g. 30 and 40 Product of prime factors of 30 = $2 \times 3 \times 5$ Product of prime factors of 40 = $2 \times 2 \times 2 \times 5$ $\therefore$L.C.M of 30 and 40 = $2 \times 2 \times 2 \times 3 \times 5 = 120$	find the L.C.M of two or three natural numbers

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
1.1 (CONT'D) **NUMBER AND NUMERALS**	The pupil will be able to:		Pose word problems involving LCM for pupils to solve	Let pupils: solve word problems involving L.C.M E.g. Dora and her friend are walking through the sand. Dora's footprints are 5cm apart and her friend's footprints are 4cm apart. If her friend steps in Dora's first footprint. What is the minimum number of steps that her friend should take before their footprints match again?
	1.1.9 carry out the four operations on whole numbers including word problems	Addition, Subtraction, Multiplication and Division of whole numbers including word problems	Guide pupils to add and subtract whole numbers up to 8-digits Guide pupils to multiply 4-digit whole numbers by 3-digit whole numbers up to the product 100,000,000 Guide pupils to divide 4-digit whole numbers by 1 or 2-digit whole numbers with or without remainders Pose word problems involving addition, subtraction, multiplication and division of whole numbers for pupils to solve	add and subtract given 8-digit whole numbers multiply given 4-digit whole numbers by 3-digit whole numbers divide given 4-digit numbers by 1 or 2 digit numbers solve word problems involving addition, subtraction, multiplication and division of whole numbers.
	1.1.10 state and use the properties of basic operations on whole numbers	Properties of operations	Guide pupils to establish the commutative property of addition and multiplication i.e. $a + b = b + a$ and $a \times b = b \times a$ Guide pupils to establish the associative property of addition and multiplication. i.e. $(a + b) + c = a + (b + c)$ and $(a \times b) \times c = a \times (b \times c)$	

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
1.1 (CONT'D) **NUMBER AND NUMERALS**	The pupil will be able to		Guide pupils to establish the distributive property i.e. $a \times (b + c) = (a \times b) + (a \times c)$ Guide pupils to establish the zero property (identity) of addition. i.e. $a + 0 = 0 + a = a$, therefore zero is the identity element of addition Guide pupils to establish the identity property of multiplication. i.e. $a \times 1 = 1 \times a = a$, therefore the identity element of multiplication is 1 Guide pupils to find out the operations for which various number systems are closed.	Let pupils: use the properties of operations to solve problems E.g. $4 \times n = 6 \times 4$ find n.
	1.1.11 find good estimates for the sum, product and quotient of natural numbers	Estimation of sum, product and quotient of natural numbers	Discuss with pupils that an estimate is only an approximate answer to a problem. The estimate may be more or less than the actual. To find the estimate of a sum, guide pupils to round up or down each addend and add. Example; Actual: 5847 + 8132 = 13, 979 Estimate: 6000 + 8000 = 14,000 Guide pupils to use rounding up or down `to estimate products. Example; Actual: 327 × 2 = 654 Estimate: 300 × 2 = 600 Guide pupils to use multiples of ten to estimate a 2-digit quotient. E.g. $478 \div 6$ $70 \times 6 = 420$ $80 \times 6 = 480$ Guide pupils to identify that since 478 is between 420 and 480, the quotient will be less than 80 but greater than 70.	estimate a given sum, product or quotient solve real life problems involving estimation

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
1.1 (CONT'D) **NUMBER AND NUMERALS**	The pupil will be able to:		Guide pupils to use multiples of 100 to estimate a 3-digit quotient. E.g. $5372 \div 6$ $700 \times 6 = 4200$ $800 \times 6 = 4800$ $900 \times 6 = 5400$ Guide pupils to identify that since 5372 is between 4800 and 5400, the quotient will be less than 900 but greater than 800. Pose real life problems involving estimation for pupils to solve. E.g. ask pupils to find from a classroom shop, the cost of a bar of soap. Pupils then work out, how much they will need approximately, to be able to buy four bars of soap	Let pupils:
UNIT 1.2 **SETS**	1.2.1 identify sets of objects and numbers	Sets of objects and numbers	Guide pupils to collect and sort objects into groups and let pupils describe the groups of objects formed Guide pupils to form other sets(groups) according to a given criteria using objects and numbers Introduce the concept of a set as a well defined collection of objects or ideas Guide pupils to use real life situations to form sets. E.g. a set of prefects in the school	form sets using real life situations
	1.2.2 describe and write sets of objects and numbers	Describing and writing Sets	Introduce ways of describing and writing sets using: • Defining property; i.e. describing the members (elements) of a set in words. E.g. a set of mathematical instruments. • Listing the members of a set using only curly brackets'{ }' and commas to separate the members. E.g. **S** = {0, 1, 2,…, 26} **NOTE**: Use capital letters to represent sets. E.g. **A** = {months of the year}.	describe and write sets using words as well as the curly brackets

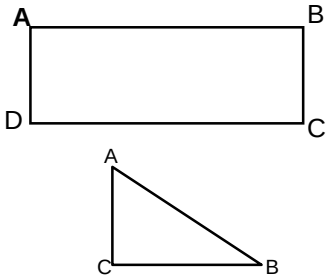
UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
1.2 (CONT'D) **SETS**	The pupil will be able to: 1.2.3 distinguish between different types of sets	Types of Sets (Finite, Infinite, Unit and Empty [Null] Sets)	Guide pupils to list members of different types of sets, count and classify the sets as: 1. **Finite Set** (a set with limited number of members) 2. **Infinite Set** (a set with unlimited number of elements). 3. **Unit set** (a set with a single member). 4. **Empty** (Null): - a set with no elements or members. **Note:** Use real life situations to illustrate each of the four sets described above.	Let Pupils: state with examples the types of sets
	1.2.4 distinguish between equal and equivalent sets	Equal and Equivalent Sets	Guide pupils to establish equal sets as sets having the same members. E.g. **P** = {odd numbers between 2 and 8} $\Rightarrow$ **P** = {3, 5, 7}. **Q** = {prime numbers between 2 and 8} $\Rightarrow$ **Q** = {3, 5, 7}, **P** is equal to **Q**. Introduce equivalent sets as sets having the same number of elements. E.g. **A** = {1, 3, 5, 7} and **B** = {Δ, , θ, Ω}; **A** is equivalent to **B**. **Note: P** and **Q** are also equivalent sets but sets **A** and **B** are not equal sets. Thus all equal sets are equivalent but not all equivalent sets are equal	identify and state two sets as equivalent or equal sets
	1.2.5 write subsets of given sets with members up to 5	Subsets	Brainstorm with pupils on the concept of a universal set. Explain subsets as the sets whose members can be found among members of another set. E.g. if **A =** {1, 2, 3,…,10} and **B** = {3, 4, 8}, then set **B** is a subset of set **A**. Introduce the symbol of subset '$\subset$'. E.g. B $\subset$ A or A $\supset$ B. **Note:** Introduce the idea of empty set as a subset of every set and every set as a subset of itself	

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
1.2 (CONT'D) **SETS**	The pupil will be able to: 1.2.6 list members of an intersection and union of sets	Intersection and Union of Sets	Guide pupils to form two sets from a given set. E.g. Q = {whole numbers up to 15} A = {0,1,10,11,12} B = {1, 3, 4, 12} Let pupils write a new set containing common members from sets A and B, i.e. a set with members 1 and 12 as the intersection of sets A and B. Introduce the intersection symbol '$\cap$' and write A intersection B as $A \cap B = \{1, 12\}$. Let pupils list all the members of two sets without repeating any member to form a new set. Explain that this new set is called the ***union*** of sets A and B. It is written as $A \cup B$ and read as A union B.	Let pupils: identify and list the union and intersection of two or more sets
UNIT 1.3 **FRACTIONS**	1.3.1 find the equivalent fractions of a given fraction	Equivalent fractions	**TLMs:** Strips of paper, Fraction charts, Addition machine tape, Cuisenaire rods, etc. Revise the concept of fractions with pupils Guide pupils to write different names for the same fraction using concrete and semi-concrete materials. Assist pupils to determine the rule for equivalent fractions i.e. $\frac{a}{b} = \frac{a}{b} \times \frac{c}{c}$ Thus to find the equivalent fraction of a given fraction, multiply the numerator and the denominator of the fraction by the same number.	write equivalent fractions for given fractions
	1.3.1 compare and order fractions	Ordering fractions	Compare two fractions using paper folding. E.g. one-half of a sheet of paper is greater than one-fourth of the paper.	

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
1.3 (CONT'D) **FRACTIONS**	The pupil will be able to:		Assist pupils to use the symbols <, > and = to compare fractions. E.g. $\frac{1}{4} < \frac{1}{2} \; or \; \frac{1}{2} > \frac{1}{4} \; and \; \frac{1}{2} = \frac{2}{4}$ Guide pupils to discover that: *the closed end of the symbols* **<** *or* **>** *always points to the smaller number and the open end to the bigger number* Order fractions in ascending and descending (order of magnitude) using concrete and semi concrete materials as well as charts showing relationships between fractions.	Let pupils: arrange a set of given fractions in • ascending order • descending order
	1.3.2 add and subtract fractions with 2-digit denominators	Addition and subtraction of fractions including word problems	Using the concept of equivalent fractions, guide pupils to add and subtract fractions with 2-digit denominators. E.g. (1) $\frac{2}{15} + \frac{1}{12}$ Equivalents of $\frac{2}{15}$ are $\frac{4}{30}, \frac{6}{45}, \frac{8}{60} \ldots$ and that of $\frac{1}{12}$ are $\frac{2}{24}, \frac{3}{36}, \frac{4}{48}, \frac{5}{60} \ldots$ The common equivalent fractions above are $\frac{8}{60}$ and $\frac{5}{60}$ so $\frac{2}{15} + \frac{1}{12} = \frac{8}{60} + \frac{5}{60} = \frac{13}{60}$ $similarly \; \frac{2}{15} - \frac{1}{12} = \frac{8}{60} - \frac{5}{60} = \frac{3}{60}$ Assist pupils to use the concept of Least Common Multiple (L.C.M) to write equivalent fractions for fractions to be added or subtracted. Pose word problems involving addition and subtraction of fractions for pupils to solve.	solve word problems involving addition and subtraction of fractions

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
1.3 (CONT'D) FRACTIONS	The pupil will be able to: 1.3.3 multiply fractions	Multiplication of fractions including word problems	Revise with pupils multiplication of a fraction by a whole number and vice versa E.g. (i) $\frac{3}{4}\times 8$ (ii) $12\times\frac{2}{3}$ Guide pupils to multiply a fraction by a fraction, using concrete and semi-concrete materials as well as real life situations. Perform activities with pupils to find a general rule for multiplying a fraction by a fraction as $\frac{a}{b}\times\frac{c}{d}=\frac{ac}{bd}$ Let pupils discover that to multiply a fraction by a fraction, find: (i) the product of their numerators (ii) the product of their denominators Pose word problems involving multiplication of fractions for pupils to solve.	Let pupils: solve word problems involving multiplication of fractions
	1.3.4 divide fractions	Division of fractions including word problems	Guide pupils to divide a whole number by a fraction by interpreting it as the number of times that fraction can be obtained from the whole number. E.g. $3\div\frac{1}{4}$ is interpreted as "How many one-fourths are in 3 wholes?" and is illustrated as: $\frac{1}{4}$ $\frac{1}{4}$ $\frac{1}{4}$ $\frac{1}{4}$ $\frac{1}{4}$ $\frac{1}{4}$ $\frac{1}{4}$ $\frac{1}{4}$ $\frac{1}{4}$ $\frac{1}{4}$ $\frac{1}{4}$ $\frac{1}{4}$ There are therefore 12 one-fourths in 3 wholes.	divide: (i) a whole number by a fraction (ii) a fraction by a whole number (iii) a fraction by a fraction solve word problems involving division of fractions

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
1.3 (CONT'D) **FRACTIONS**	The pupil will be able to:		Guide pupils to find the meaning of the reciprocal of a number (multiplicative inverse) by answering the following: (i) $4\times\frac{1}{4}$ (ii) $6\times\frac{1}{6}$ (iii) $\frac{3}{2}\times\frac{2}{3}$ Explain to pupils that since the answer to each of the questions is 1, it means that $\frac{1}{4}$ is the reciprocal of 4, $\frac{1}{6}$ is the reciprocal of 6 and that of $\frac{3}{2}$ is $\frac{2}{3}$ Note: The product of a number and its reciprocal is 1. Guide pupils to use the idea of division and multiplication as inverses of each other to deduce the rule for dividing fractions i.e. $\frac{4}{9}\div\frac{5}{7}=n \Rightarrow \frac{4}{9}=\frac{5}{7}\times n$ (multiplication is the inverse of division) multiply both sides of $\frac{4}{9}=\frac{5}{7}\times n$ by the reciprocal of $\frac{5}{7}$ to obtain, $\frac{4}{9}\times\frac{7}{5}=n\times\frac{5}{7}\times\frac{7}{5}$ $\frac{4\times7}{9\times5}=n\times1$ Therefore $\frac{4}{9}\div\frac{5}{7}=\frac{4}{9}\times\frac{7}{5}=\frac{28}{45}$ n = $\frac{28}{45}$	Let pupils:

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
1.3 (CONT'D) FRACTIONS	The pupil will be able to:		Guide pupils to deduce the rule that to divide by a fraction, multiply the dividend by the reciprocal of the divisor. i.e. $\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \times \frac{d}{c}$ Pose word problems involving division of fractions for pupils to solve.	Let pupils:
UNIT 1.4 **SHAPE AND SPACE**	1.4.1 draw plane shapes and identify their parts	Plane shapes	**TLMs:** Empty chalk boxes, Cartons, Tins, Cut-out shapes from cards. Real objects of different shapes, Solid shapes made from card boards: prisms – cubes, cuboids, cylinders; pyramids – rectangular, triangular and circular pyramids. **Revision:** Assist pupils to identify lines, line segments, rays and flat surfaces. Guide pupils to identify straight edges and flat surfaces of solid shapes as lines and planes respectively. Guide pupils to draw plane shapes like rectangles, squares and triangles, and name their vertices with letters. E.g. 	describe plane shapes by the letters of their vertices and draw them E.g. draw triangle POQ and rectangle WXYZ

<table>
<tr><th>UNIT</th><th>SPECIFIC OBJECTIVES</th><th>CONTENT</th><th>TEACHING AND LEARNING ACTIVITIES</th><th>EVALUATION</th></tr>
<tr>
<td>1.4 (CONT'D)
SHAPE AND SPACE</td>
<td>The pupil will be able to:

1.4.2 find the relation between the number of faces, edges and vertices of solid shapes</td>
<td>Relation connecting faces, edges and vertices of solid shapes</td>
<td>Revision: Assist pupils to classify real objects into various solid shapes such as prisms and pyramids.

Guide pupils to make nets of solid shapes from cards and fold them to form the solid shapes.

Put pupils in groups and guide them to count and record the number of faces, edges and vertices each solid shape has using either the real objects or solid shapes made from cards.

Let pupils record their findings using the following table:

<table>
<tr><th>Solid shapes</th><th>No. of faces</th><th>No. of edges</th><th>No. of vertices</th></tr>
<tr><td>1. Cube
2. Cuboid
3.Cylinder
4. Cone
5. Prism</td><td></td><td></td><td></td></tr>
</table>

Pupils brainstorm to determine the relation between the number of faces, edges and vertices of each solid shape.

i.e. F + V - 2 = E or F + V = E + 2

Encourage pupils to think critically and tolerate each other's view toward solutions.</td>
<td>Let pupils:

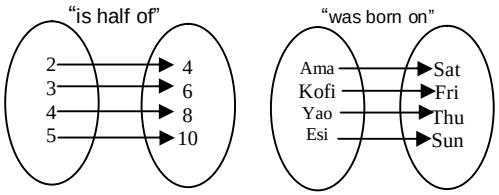
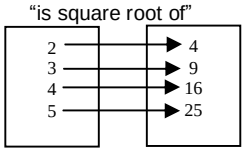
calculate the number of faces, vertices and edges of solid shapes using the relation F + V – 2 = E</td>
</tr>
<tr>
<td>UNIT 1.5
LENGTH AND AREA</td>
<td>1.5.1 solve problems on perimeter of polygons</td>
<td>Perimeter of polygons</td>
<td>TLMs: Geoboard, Graph paper, Rubber band Cut-out shapes (including circular shapes), Thread, Graph Paper

Revise the concept of perimeter as the total length or measure round a plane shape using practical activities.</td>
<td></td>
</tr>
</table>

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
1.5 (CONT'D) LENGTH AND AREA	The pupil will be able to:		In groups guide pupils to find the perimeter of polygons using the Geoboard. Through various practical activities assist pupils to discover the perimeter of a rectangle as *P = 2(Length + Width)* Guide pupils to also discover that the perimeter of a regular polygon is $P = n \times Length$, where n is the number of sides. Pose word problems for pupils to solve	Let pupils: find the perimeter of given polygons solve word problems involving perimeter of polygons
	1.5.2 solve problems on circumference of a circle	Perimeter of a circle (Circumference)	Revise parts of a circle and the idea that circumference is the perimeter of a circle using real objects like; Milk tin, Milo tin, etc Guide pupils to carry out practical activities in groups to discover the relationship between the circumference and the diameter of a circle as; Circumference $\approx 3 \times$ Diameter. The approximate value of $C \div d$ is denoted by the Greek letter π. Pupils can be encouraged to use the calculator to check the value of π. Therefore $C = \pi d$ *or* $C = 2\pi r$ (since $d = 2r$) Guide pupils to use the relation $\mathbf{C = 2\pi r}$ to find the circumference of circles Pose word problems involving circumference of circles for pupils to solve. **Note:** Encourage pupils to share ideas in their groups	find the circumference of a circle given its radius or diameter and vice versa solve word problems involving the circumference of a circle
	1.5.3 find the area of a rectangle	Area of a rectangle	Assist pupils to perform practical activities in groups using the Geoboard or graph sheets to discover the area of a rectangle/square as Length $\times$ Width (L $\times$ W) Guide pupils to find the area of rectangles given the perimeter and vice versa.	find the area of a rectangle given its dimensions determine the length or width of rectangle from its area

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
1.5 (CONT'D) LENGTH AND AREA	The pupil will be able to:		Pose word problems involving area of rectangles and squares for pupils to solve	Let pupils: determine the area of a square given its perimeter solve word problems involving area of rectangles and squares
UNIT 1.6 POWERS OF NATURAL NUMBERS	1.6.1 find the value of the power of a natural number	Positive powers of natural numbers with positive exponents (index)	**TLMs:** Counters**,** Bottle tops**,** Small stone. Guide pupils to illustrate with examples the meaning of repeated factors using counters or bottle tops. E.g. $2 \times 2 \times 2 \times 2$ is repeated factors, and each factor is 2 Guide pupils to discover the idea of the power of a number E.g. $2 \times 2 \times 2 \times 2 = 2^4$ and 2^4 is the power. i.e. Power 2^4 (4: Index or exponent; 2: base) Guide pupils to distinguish between factors and prime factors of natural numbers. Assist pupils to write a natural number as powers of a product of its prime factors E.g. $72 = 2 \times 2 \times 2 \times 3 \times 3 = 2^3 \times 3^2$	write powers of given natural numbers write natural numbers as powers of a product of its prime factors
	1.6.2 use the rule (i) $a^n \times a^m = a^{(n+m)}$ (i) $a^n \div a^m = a^{(n-m)}$ to solve problems	Multiplication and division of powers	Guide pupils to perform activities to find the rule for multiplying and dividing powers of numbers. i.e. (i) $a^n \times a^m = a^{(n+m)}$ (ii) $a^n \div a^m = a^{(n-m)}$ where $n > m$.	solve problems involving the use of the rule $a^n \times a^m = a^{(n+m)}$ and $a^n \div a^m = a^{(n-m)}$ where $n > m$

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
1.6 (CONT'D) POWERS OF NATURAL NUMBERS	The pupil will be able to: 1.6.3 use the fact that the value of any natural number with zero as exponent or index is 1	Zero as an exponent	Perform activities with pupils to discover that for any natural number **a, $a^0 = 1$** i.e. (i) $2^4 \div 2^4 = \frac{2\times2\times2\times2}{2\times2\times2\times2} = 1$ (ii) $2^4 \div 2^4 = 2^{4-4} = 2^0 = 1$	Let pupils: solve problems involving the use of the rule $a^n \div a^m = a^{(n-m)}$ where n = m
UNIT 1.7 **INTRODUCTION TO CALCULATORS**	1.7.1 identify some basic keys on the calculator and their functions	Basic functions of the keys of the calculator Calculator for real life computation	Introduce pupils to some of the basic keys of a calculator and guide them to use it properly. E.g. C, MR, M+, $+/-$, $\sqrt{}$ etc. Let pupils use the calculator to solve real life problems involving several digits and/or decimal places. **Note**: Guide pupils to use the calculator to check their answers from computations in all areas where applicable.	solve real life problems involving several digits or decimals using the calculator
UNIT 1.8 RELATIONS	1.8.1 identify and write relations between two sets in everyday life	Relations between two sets in everyday life	Guide pupils to identify the relation between pairs of sets in everyday life, like; Ama "is the sister of" Ernest, Doris "is the mother of" Yaa, etc. Guide pupils to realize that in mathematics we also have many relations. E.g. 2 "is half of" 4 3 "is the square root of" 9 5 "is less than" 8 **Note:** Encourage pupils to work as a team and have the sense of belongingness	find the relation between a pair of given sets make Family Trees of their own up to their grand parents

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
1.8 (CONT'D) RELATIONS	The pupil will be able to: 1.8.2 represent a relation by matching and identify the domain and the co-domain	Representing a relation	Guide pupils to identify that relation can be represented by matching diagram. i.e.  - 	Let pupils: find the domain in a given relation find the co-domain of a given relation
		Domain	Assist pupils to identify the domain as the set of elements in the first set from the direction of the matching diagram E.g. from the relation "is half of" the domain D = {2, 3, 4, 5}	
		Co-domain	Assist pupils to identify the co-domain as the set of elements in the second set from the direction of the mapping diagram. E.g. from the relation "was born on" the co-domain is {Monday, Friday, Saturday, Sunday}	
	1.8.3 find the range of a relation given the domain	Range of a relation	Guide pupils to identify the range as a subset of the Co-domain. E.g. the range for the relation "was born on" is R = {Monday, Friday, Sunday}	find the range of a given relation
	1.8.4 write and give examples of a set of ordered pairs that satisfy a given relation	Relation as ordered pair	Guide pupils to write ordered pairs that satisfy a given relation. E.g. from the relation "is a square root of" the relation as a set of ordered pairs is {(3, 9), (4, 16), (5, 25), (6, 36)} **Note**: Emphasise the order of the pairs and encourage pupils to be precise and orderly	write pair of members that satisfy a given relation

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 1.9 **ALGEBRAIC EXPRESSIONS**	The pupil will be able to: 1.9.1 find the members of a domain that make an open statement true	Open statements	Guide pupils to revise closed statements as either true or false statements E.g. (a) 7 nines is 64 (false) (b) 2 + 3 = 5 (true) (c) $4 \times 6 = 10$ (false) Guide pupils to note that open statements are statements which do not have any definite response. Make open statements with defined domain for pupils to identify members of the domain that make the statements true. E.g. x > 6; D = {x : x = 5, 6, 7, 8, 9, 10}	Let pupils: indicate if a given statement is true or false find the member in a given domain that makes a given statement true
	1.9.2 add and subtract algebraic expressions	Addition and subtraction of algebraic expressions	Guide pupils to simplify algebraic expressions E.g. (i) 3a + 5b + 2a – b (ii) 3p + 4p – p Perform activities like “think of a number” game with pupils E.g. think of a number, add 2 to it and multiply the sum by 3 $(x + 2) \times 3 = 3x + 6$. Think of another number, multiply it by 2, add 4 to the result i.e. $(y \times 2) + 4 = 2y + 4$ Add the results; $(3x + 6) + (2y + 4) = 3x + 2y + 10$.	simplify given algebraic expressions including word problems
	1.9.3 multiply simple algebraic expressions	Multiplication of algebraic expressions	Guide pupils to multiply the given algebraic expressions E.g. (i) $3b \times b$ (ii) $5a \times 2b$ (iii) $4b \times 3b$ Guide pupils to perform activities like “think of a number” game which involves multiplying algebraic	multiply pairs of given expressions including word problems

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
			expressions.	
UNIT 1.10 **CAPACITY, MASS, TIME AND MONEY**	The pupil will be able to: 1.10.1 add and subtract capacities	**CAPACITY:** Addition and subtraction of capacities	**TLMs:** Tea and Table spoons**,** Soft drink cans and bottles**,** Measuring cylinders, Jugs and Scale balance **Revision:** Pupils to estimate capacities of given containers and verify by measuring. Guide pupils to change measures of capacities in millilitres (ml) to litres (l) and millilitres (ml) and vice versa. Perform activities with pupils involving adding and subtracting capacities in millitres and litres.	Let pupils: solve word problems involving addition and subtraction of capacities
	1.10.2 add and subtract masses of objects	**MASS:** Adding and subtracting masses of objects	**Revision:** Pupils to estimate masses of objects and verify by measuring to the nearest kilogram. Guide pupils to find the masses of familiar objects using scale balance and then add and find their differences	solve word problems involving, addition and subtraction of masses
	1.10.3 use the relationship between the various units of time	**TIME:** Relationships between various units of time	Guide pupils to find the relation between days, hours, minutes and seconds. Take pupils through activities, which involve addition and subtraction of duration of different events.	identify the relationship between the various units of time
	1.10.4 solve word problems involving time	Word problems involving the relationship between days, hours, minutes and seconds	Guide pupils to solve word problems involving the relationship between the various units of time.	solve word problems involving the relationship between the various units of time
	1.10.5 solve word problems involving addition and subtraction of various amounts of money	**MONEY:** Addition and subtraction of money including word problems	Guide pupils to add and subtract monies in cedis and pesewas. Pose word problems on spending and making money for pupils to solve	solve word problems involving the addition and subtraction of amounts of money solve word problems on spending and making

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
				money
UNIT 1.11 **INTEGERS**	The pupil will be able to: 1.11.1 explain situations resulting to concept of integers and locate integers on a number line	The idea of integers (Negative and positive integers)	Discuss with pupils everyday situations resulting in the concept of integers as positive and negative whole numbers. E.g.: 1. Having or owing money 2. Floors above or below ground level 3. Number of years BC or AD Guide pupils to write negative numbers as signed numbers. E.g. (– 3) or (¯3) as negative three. Use practical activities to guide pupils to match integers with points on the number line.	Let pupils: locate given integers on a number line
	1.11.2 compare and order integers	Comparing and ordering integers	Guide pupils to use the number line to compare integers. Guide pupils to arrange three or more integers in ascending or descending order. Guide pupils to use the symbols for greater than (>) and less than (<) to compare integers	compare and order two or more given integers
	1.11.3 add integers	Addition of integers	Introduce how to find the sum of integers using practical situations. E.g. adding loans and savings. Guide pupils to find the sum of two integers using the number line (both horizontal and vertical representation) Guide pupils to discover the commutative and associative properties of integers Introduce the zero property (identity) of addition. E.g.(– 5) + 0 = 0 + (– 5) = – 5 Introduce the inverse property of addition. E.g. (– 3) + 3 = 3 + (– 3) = 0.	solve problems involving addition of integers

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
1.11 (CONT'D) INTEGERS	The pupil will be able to: 1.11.4 subtract positive integers from integers	Subtraction of positive integers	Guide pupils to recognize that '-1' can represent the operation 'subtract 1' or the directed number 'negative 1'. Guide pupils to subtract a positive integer and zero from an integer. • Use practical situations such as the use of the number line, counters, etc. • Use the property that $a + 0 = a$; $-a + 0 = -a$; $4 + 0 = 4$ and $-4 + 0 = -4$. Pose problems, which call for the application of subtraction of positive integers for pupils to solve.	Let pupils: subtract positive integers solve word problems involving subtraction of positive integers
	1.11.5 multiply and divide Integers by positive integers	multiplication and Division of integers	Guide pupils to multiply integers by positive integers. E.g. $(+2) \times 3 = 6$ or $2 \times 3 = 6$ $-2 \times (+3) = -6$ or $-2 \times 3 = -6$ Guide pupils to divide integers by positive integers without a remainder. E.g. $-15 \div 5 = -3$ and $+15 \div 5 = 3$. Introduce pupils to the use of calculators in solving more challenging problems involving integers.	solve simple problems involving multiplication and division of integers without using calculators use calculators to solve more challenging problems E.g. (i) $(-26) \times 15$ (ii) $\frac{252}{30} \times \frac{(-20)}{30}$
UNIT 1.12 GEOMETRIC CONSTRUCTIONS	1.12.1 explain a locus	The idea of locus	Demonstrate the idea of locus as the path of points obeying a given condition	
	1.12.2 construct simple locus	Constructing: - circles	Guide pupils to construct the circle as a locus (i.e. tracing the path of a point **P** which moves in such a way that its distance from a fixed point, say **O** is always the same).	describe the locus of real life activities(E.g. high jumper, 400m runner, etc) describe the locus of a

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
1.12 (CONT'D) GEOMETRIC CONSTRUCTIONS	The pupil will be able to:	- perpendicular bisector - bisector of an angle -parallel lines	Guide pupils to construct a perpendicular bisector as a locus (i.e. tracing the path of a point P which moves in such a way that its distance from two fixed points [say **A** and **B**] is always equal). Guide pupils to construct an angle bisector as a locus of points equidistant from two lines that meet. Guide pupils to construct parallel lines as a locus (i.e. tracing the path of a point say P which moves in such a way that its distance from the line AB is always the same).	circle Let pupils: bisect a given line bisect a given angle construct a parallel to a given line
UNIT 1.13 **DECIMAL FRACTIONS**	1.13.1 express fractions with powers of ten in their denominators as decimals	Converting common fractions to decimal fractions	Revise with pupils the concept of decimal fractions with a number line marked in tenths. E.g. $\frac{6}{10} = 0.6$ (read as six-tenths equals zero point six). Guide pupils to find decimal fractions from common fractions with powers of ten as their denominators. E.g. (i) $\frac{7}{10} =$ may be stated as $7 \div 10 = 0.7$. (ii) $\frac{3}{100} = 3 \div 100 = 0.03$ (iii) $\frac{4}{1000} = 4 \div 100 = 0.004$. Guide pupils to find decimal fractions from fractions with their denominators expressed in different forms using equivalent fractions to get denominator a power of 10 E.g. $\frac{2}{5} = \frac{2\times2}{5\times2} = \frac{4}{10} = 0.4$	convert common fractions with powers of ten as their denominators to decimal

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
1.13 (CONT'D) DECIMAL FRACTIONS	The pupil will be able to: 1.13.2 convert decimal fractions to common fractions	Converting decimal fractions to common fractions	Guide pupils to find common fractions from decimal fractions E.g. $0.3 = \frac{3}{10}$, $0.6 = \frac{6}{10} = \frac{3}{5}$ **Note:** Use practical situations such as the conversion of currencies.	Let pupils: convert common fractions to decimals and vice versa
	1.13.3 compare and order decimal fractions	Ordering decimal fractions	Guide pupils to write decimal fractions as common fractions and order them	order decimal fractions
	1.13.4 carry out the four operations on decimal fractions	Operations on decimal fractions	Guide pupils to add decimal fractions in tenths, hundredths and thousandths Guide pupils to subtract decimal fractions up to 3 decimal places Guide pupils to multiply decimal fractions E.g. $0.3 \times 0.7 = \frac{3}{10} \times \frac{7}{10} = \frac{21}{100} = 0.21$ Guide pupils to divide decimal fractions E.g. (i) $0.48 \div 0.2 = \frac{48}{100} \div \frac{2}{10}$ $= \frac{48}{100} \times \frac{10}{2} = \frac{24}{10} = 2.4$ (ii) $0.5 \div 0.5 = \frac{5}{10} \div \frac{5}{10} = \frac{5}{10} \times \frac{10}{5} = 1$	add decimal fractions up to decimals in hundredths subtract decimal fractions in thousandths solve problems on multiplication of decimal fractions **Note:** You may encourage the use of calculators to check answers
	1.13.5 correct decimal fractions to a given number of decimal places	Approximation	Guide pupils to write decimal fractions and correct them to a given number of decimal places Introduce the pupils to the rule for rounding up or down	round up or down decimals to given number of decimal places
	1.13.6 express numbers in standard form	Standard form	Guide pupils to establish the fact that standard form is used when dealing with very large or small numbers and the number is always written as a number between 1 and 10 multiplied by a power of	convert numbers to the standard form

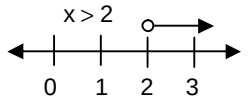
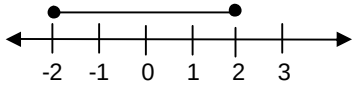
UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
			10. E.g. $6284.56 = 6.28456 \times 10^3$	
UNIT 1.14 PERCENTAGES	The pupil will be able to: 1.14.1 find the percentage of a given quantity	Finding percentage of a given quantity	Revise the idea of percentages as a fraction expressed in hundredths, E.g. $\frac{1}{4} = \frac{1\times100}{4\times100} = \frac{100}{4}\left(\frac{1}{100}\right) = \frac{25}{100}$ = 25% Revise changing percentages to common fractions. E.g. 25% = $\frac{25}{100} = \frac{25\times1}{25\times4} = \frac{1}{4}$ Guide pupils to find a percentage of a given quantity. E.g. 12½ % of GH¢300 i.e. $\frac{25}{2} \times \frac{1}{100} \times$ GH¢300 = GH¢ 37.50	Let pupils: find a percentage of a given quantity
	1.14.2 express one quantity as a percentage of a similar quantity	Expressing one quantity as a percentage of a similar quantity	Guide pupils to express one quantity as a percentage of a similar quantity. E.g. What percentage of 120 is 48 i.e. $\frac{48}{120}\times\frac{100}{100} = 4\left(\frac{10}{100}\right) = \frac{40}{100}$ = 40%	express one quantity as a percentage of another quantity
	1.14.3 solve problems involving profit or loss as a percentage in a transaction	Solving problems involving profit/loss percent	Guide pupils to find the profit/loss in a given transaction Guide pupils to express profit/loss as a percentage of the capital/cost price, as; Profit percent = $\frac{profit}{capital}\times100$ Loss percent = $\frac{loss}{capital}\times100$	find the profit/loss percent of a real life transaction

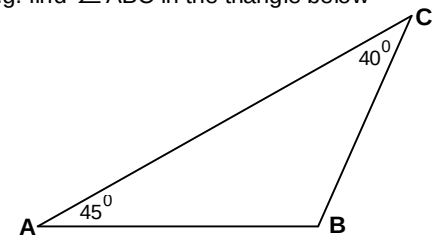
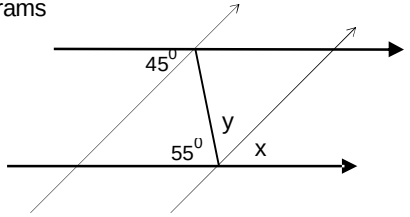
UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 1.15 COLLECTING AND HANDLING DATA (DISCRETE)	The pupil will be able to: 1.15.1 collect data from a simple survey and/or from data tables	Collecting data	Guide pupils to carry out simple surveys to collect data, such as marks scored in an exercise, months of birth of pupils, etc	Let pupils: Collect data from news papers, sporting activities, etc and record them
	1.15.2 organize data into simple tables	Handling Data	Guide pupils to organize the data collected into simple frequency distribution tables	organize data in table form
	1.15.3 find the Mode, Median and Mean of a set of data	Mode, Median and Mean	Guide pupils to find the mode, median and the mean of discrete data collected. Brainstorm with pupils to find out which of the measures is the best average in a given situation (use practical examples).	calculate the mode, median and mean from a discrete data

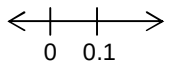
JUNIOR HIGH SCHOOL 2

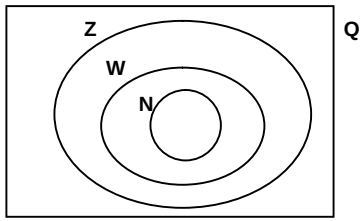
UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 2.1	The pupil will be able to:			Let pupils :
NUMERATION SYSTEMS	2.1.1 explain some symbols used in Hindu-Arabic and Roman numeration systems	Brief history of numbers(Hindu-Arabic and Roman numerals)	Introduce Hindu-Arabic and Roman numerals and the development of numbers	rewrite some Hindu-Arabic numerals in Roman numerals
	2.1.2 explain and use the bases of numeration of some Ghanaian languages	Ghanaian numeration system	Guide pupils to identify the various bases of numeration systems in some Ghanaian languages and read number words in some Ghanaian languages up to hundred(100)	state the bases of numeration systems of some Ghanaian languages
	2.1.3 read and write base ten numerals up to one billion	Base ten numerals up to one billion (1,000,000,000 = 10^9)	Guide pupils to read and write base ten numerals up to one billion (1,000,000,000)	write number names for given base ten numerals and vice versa
	2.1.4 read and write bases five and two numerals	Reading and writing bases five and two numerals	Guide pupils to read and write bases five and two numerals using multi-based materials. E.g. *214_{five} is read as "two, one, four base five" and 101_{two} is read as "one, zero, one base two"* Assist pupils to complete base five number chart up to 1110_{five} Assist pupils to complete base two number chart up to 11110_{two}	read a given numeral in bases five and two fill in missing numerals in bases five and two number charts
	2.1.5 convert bases five and two numerals to base ten	Converting bases five and two numerals to base ten numerals	Assist pupils to convert base five and two numerals to base ten numerals and vice versa.	convert bases five and two numerals to base ten and vice versa

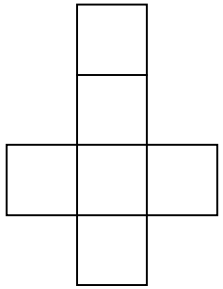
UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
2.1 (CONT'D) NUMERATION SYSTEMS	The pupil will be able to: 2.1.6 explain numbers used in everyday life	Uses of numerals in everyday life	Guide pupils to identify various uses of numbers in everyday life. E.g. telephone numbers, car numbers, house numbers, bank account numbers, etc	Let pupils : state various uses of numbers in everyday life
UNIT 2.2 LINEAR EQUATIONS AND INEQUALITIES	2.2.1 translate word problems to linear equations in one variable and vice versa	Linear equations • mathematical sentences for word problems	Guide pupils to write mathematical sentences from word problems involving linear equations in one variable. E.g. the sum of the ages of two friends is 25, and the elder one is 4 times older than the younger one. Write this as a mathematical sentence? i.e. let the age of the younger one be x ∴ age of elder one = 4x 4x + x = 25	write mathematical sentences from given word problems involving linear equations in one variable
		• word problems for given linear equations	Guide pupils to write word problems from given mathematical sentences E.g. x + x = 15 i.e. the sum of two equal numbers is 15	write word problems for given mathematical sentences
	2.2.2 solve linear equations in one variable	Solving linear equations in one variable	Using the idea of balance, assist pupils to solve simple linear equations E.g. 3x + 5 = 20 i.e. 3x + 5 – 5 = 20 – 5 3x = 15 x = 5 Note: flag diagrams can also be used	solve simple linear equations
	2.2.3 translate word problems to linear inequalities	Making mathematical sentences involving linear inequalities from word problems	Guide pupils to write mathematical sentences involving linear inequalities from word problems. E.g. think of a whole number less than 17 i.e. x < 17	write mathematical sentences involving linear inequalities from word problems
	2.2.4 solve linear inequalities	Solving linear inequalities	Using the idea of balancing, guide pupils to solve linear inequalities E.g. 2p + 4 < 16 2p + 4 – 4 < 16 – 4 2p < 12 $\Rightarrow p < 6$	solve linear inequalities

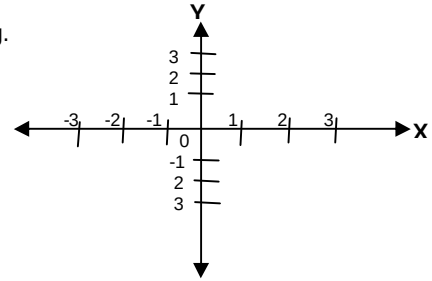
UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
2.2 (CONT'D) LINEAR EQUATIONS AND INEQUALITIES	The pupil will be able to: 2.2.5 determine solution sets of linear inequalities in given domains	Solution sets of linear inequalities in given domains	Guide pupils to determine solution sets of linear inequalities in given domains. E.g. if $x < 4$ for whole numbers, then the domain is whole numbers and the solution set = {0, 1, 2, 3}	Let pupils: determine the solution sets of linear inequalities in given domains
	2.2.6 illustrate solution sets of linear inequalities on the number line	Illustrating solution sets of linear inequalities on the number line	Assist pupils to illustrate solution sets on the number line. E.g. (i) $x > 2$  (ii) $-2 \leq x \leq 2$  	illustrate solution sets of linear inequalities on the number line
UNIT 2.3 ANGLES	2.3.1 use the protractor to measure and draw angles	Measuring and drawing angles using the protractor	**TLMs:** Protractor**,** Cut-out triangles Introduce pupils to the various parts of the protractor (E.g., the base line, centre and divisions marked in the opposite directions) Guide pupils to measure angles using the protractor Guide pupils to draw angles using the protractor	measure given angles with the protractor draw angles with the protractor
	2.3.2 identify and classify the different types of angles	Types of angles	Guide pupils to relate square corner to right angles (i.e. 90^0) Guide pupils to identify and classify: • Acute angles • Right angles • Obtuse angles • Straight angles • Reflex angles • Complementary and Supplementary angles	identify and classify the various types of angles

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
2.3 (CONT'D) ANGLES	The pupil will be able to:			Let pupils :
	2.3.3 discover why the sum of the angles in a triangle is 180^0	Sum of angles in a triangle	Using cut-out angles from triangles, guide pupils to discover the sum of angles in a triangle Guide pupils to draw triangles and use the protractor to measure the interior angles and find the sum	measure and find the sum of angles in given triangles
	2.3.4 calculate the size of angles in triangles	Solving for angles in a triangle	Using the idea of sum of angles in a triangle, guide pupils to solve for angles in a given triangle. E.g. find $\angle$ABC in the triangle below  	find the sizes of angles in given triangles
	2.3.5 calculate the sizes of angles between lines	Angles between lines • vertically opposite angles • corresponding angles • alternate angles	Assist pupils to demonstrate practically that: 1. vertically opposite angles are equal 2. corresponding angles are equal 3. alternate angles are equal Assist pupils to apply the knowledge of angles between lines to calculate for angles in different diagrams E.g.  	find the sizes of angles between lines Calculate for angles in different diagrams
	2.3.6 calculate the exterior angles of a triangle	Exterior angles of triangles	Guide pupils to use the concept of straight angles to calculate exterior angles of a given triangle	calculate exterior angles of triangles

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 2.4 COLLECTING AND HANDLING DATA	The pupil will be able to:			Let pupils :
	2.4.1 identify and collect data from various sources	Sources of data	Guide pupils through discussions to identify various sources of collecting data E.g. examination results, rainfall in a month, import and exports, etc	state various sources of collecting data
	2.4.2 construct frequency table for a given data	Frequency table	Assist pupils to make frequency tables by tallying in groups of five and write the frequencies.	prepare a frequency table for given data
	2.4.3 draw the pie chart, bar chart and the block graph to represent data	Graphical representation of data • pie chart • bar chart • block graph • stem and leaf plot	Guide pupils to draw the pie chart, bar chart and the block graph from frequency tables Guide pupils to represent a given data using the sterm and leaf plot	draw various graphs to represent data
	2.4.4 read and interpret frequency tables and charts	Interpreting tables and graphs	Guide pupils to read and interpret frequency tables and graphs by answering questions relating to tables and charts/graphs	interpret given tables and charts E.g. answer questions from: 1. frequency table 2. pie chart 3. bar chart, etc
UNIT 2.5 RATIONAL NUMBERS	2.5.1 identify rational numbers	Rational numbers	Guide pupils to identify rational numbers as numbers that can be written in the form $\frac{a}{b}$; $b \neq 0$ E.g. – 2 is a rational number because it can be written in the form – 2 = $\frac{4}{-2}$ or $\frac{-10}{5}$	identify rational numbers
	2.5.2 represent rational numbers on the number line	Rational numbers on the number line	Assist pupils to locate rational numbers on the number line E.g. – 1.5, 0.2, 10%, $\frac{2}{3}$ 10% = 0.1  	represent rational numbers on the number line

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
	The pupil will be able to:			Let pupils :
2.5 (CONT'D) RATIONAL NUMBERS	2.5.3 distinguish between rational and non-rational numbers	Rational and non-rational numbers	Guide pupils to express given common fractions as decimals fractions. Assist pupils to identify terminating, non-terminating and repeating decimals. Guide pupils to relate decimal fractions that are non-terminating and non-repeating numbers that are not rational	explain why 0.333 is a rational number but π is not
	2.5.4 compare and order rational numbers	Comparing and ordering rational numbers	Guide pupils to compare and order two or more rational numbers.	arrange a set of rational numbers in ascending or descending order
	2.5.5 perform operations on rational numbers	Operations on rational numbers	Guide pupils to add, subtract, multiply and divide rational numbers.	add and subtract rational numbers multiply and divide rational numbers
	2.5.6 identify subsets of the set of rational numbers :	Subsets of rational numbers	Guide pupils to list the members of number systems which are subsets of rational numbers: {Natural numbers} = {1, 2, 3,…} denoted by N {Whole numbers} = {0, 1, 2, 3,…} denoted by W. {Integers} = {…-2, -1, 0, 1, 2,…} denoted by Z {Rational numbers} denoted by Q. Guide pupils to explain the relationship between the subsets of rational numbers by using the Venn diagram  Assist pupils to find the union and intersection of the subsets. E.g. N ∩ W = N.	find the intersection and union of subsets of rational numbers

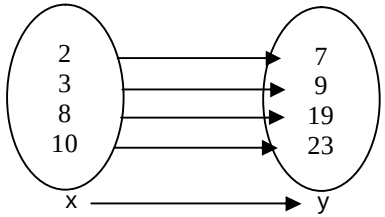
UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
	The pupil will be able to			Let pupils :
UNIT 2.6 **SHAPE AND SPACE**	2.6.1 identify common solids and their nets	Common solids and their nets	**TLMs:** Cube, Cuboids, Pyramids, Cones, Cylinders. Revise nets and cross sections of solids with pupils. Guide pupils to identify the nets of common solids by opening the various shapes. E.g. Cuboids 	make nets of solid shapes
UNIT 2.7 **GEOMETRIC CONSTRUCTIONS**	2.7.1 copy an angle	Copying an angle	Guide pupils to copy an angle equal to a given angle using straight edges and a pair of compasses only	copy a given angle
	2.7.2 construct angles of 90^0, 45^0, 60^0 and 30^0	Constructing angles of: 90^0, 45^0, 60^0, and 30^0	Guide pupils to use the pair of compasses and a straight edge only to construct 90^0 and 60^0. Guide pupils to bisect 90^0 and 60^0 to get 45^0 and 30^0 respectively.	construct angles: 90^0, 60^0, 45^0 and 30^0
	2.7.3 construct triangles under given conditions	Constructing triangles	Guide pupils to use a pair of compasses and a straight edge only to construct: • Equilateral triangle • Isosceles triangle • Scalene triangle • A triangle given two angles and one side • A triangle given one side and two angles • A triangle given two sides and the included angle	construct a triangle with given conditions
	2.7.4 construct a regular hexagon	Constructing a regular hexagon	Guide pupils to construct a regular hexagon.	construct a regular hexagon with a given side

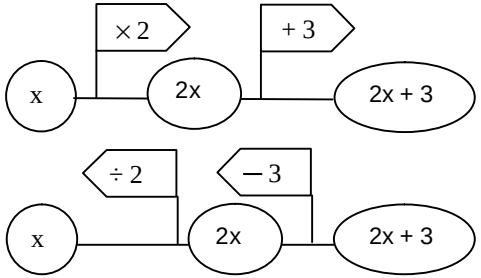
UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
	The pupil will be able to:			Let pupils:
UNIT 2.8 **ALGEBRAIC EXPRESSIONS**	2.8.1 expand simple algebraic expressions	Expansion of algebraic expressions	Revise with pupils the commutative and associative properties of operations Guide pupils to expand simple algebraic expressions using the idea of the distributive property involving multiplication and addition E.g. $3(a + 5) = (3 \times a) + (3 \times 5)$ $= 3a + 15.$	expand simple algebraic expressions. write out algebraic expressions requiring the use of the distributive property from word problems
	2.8.2 find the value of algebraic expressions when given particular cases	Substituting the values of variables in algebraic expressions	Guide pupils to substitute values into algebraic expressions and solve them E.g. What is $3x + 4y$ if $x = 3$ and $y = 6$ i.e. $3(3) + 4(6) = 9 + 24 = 33$.	find the value of an expression when the values of the variables are given
	2.8.3 factorise simple binomials	Factorisation	Guide pupils to find the common factors in two or more terms E.g. • $3x + 4xy = x(3 + 4y)$ • $12ab – 16b = 4b(3a – 4)$	factorise given algebraic expressions
UNIT 2.9 **NUMBER PLANE**	2.9.1 identify and label axes of the number plane	Axes of the number plane	**TLMs:** Graph Paper Guide pupils to draw the horizontal and vertical axes on a graph sheet and label their point of intersection as the origin (**O**). Guide pupils to mark and label each of the axes with numbers of equal intervals and divisions. E.g. 	draw number planes and label the axes

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
	The pupil will be able to:			Let pupils:
2.9 (CONT'D) NUMBER PLANE	2.9.2 assign coordinates to points in the number plane	Coordinates of points [ordered pair (**x, y**)]	Assist pupils to identify the coordinates of a point and write them as ordered pair (**x, y**), where the first co-ordinate represent x the distance of the point from the origin along the horizontal axis and the second co-ordinate represent y its distance along the vertical axes.	write down the coordinates of points shown on the number plane
	2.9.3 locate and plot points for given coordinates	Locating and plotting points	Assist pupils to locate and plot points on the number plane for given coordinates.	plot given coordinates on the number plane
	2.9.4 draw graph of set of points lying on a line	The graph of a line	Guide pupils to plot points (lying on a straight line) and join them with a straight edge to give the graph of a straight line. E.g. plot the points (**0, 0**) (**1, 1**) (**2, 2**) (**3, 3**) on the graph sheet and join them with a straight edge.	draw the graph of a straight line given a set of points calculate the gradient of a line i. from a graph of a line ii. Given two points
	2.9.5 find the gradient of a line		Guide pupils to find the gradient of the line drawn.	
UNIT 2.10 PROPERTIES OF QUADRILATERALS	2.10.1 identify the properties of rectangle, parallelogram, kite, trapezium and rhombus	Quadrilaterals	**TLMs:** Cut-out shapes (rectangles, parallelograms, kites, trapeziums and rhombus) **Rectangle:** Guide pupils to discover that a rectangle is a four-sided plane shape with each pair of opposite sides equal and parallel and the four interior angles are right angles. Let pupils also identify that a square is a rectangle with all sides equal. **Parallelogram** Guide pupils to discover that a parallelogram is a four-sided plane shape with each pair of opposite sides equal and parallel and each pair of interior opposite angles are equal. **Note:** Let pupils recognise that a rectangle is also a parallelogram.	identify types of quadrilaterals from a number of given shapes

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
2.10 (CONT'D) PROPERTIES OF QUADRILATERALS	The pupil will be able to:		**Kite** Guide pupils to discover that a kite is a four-sided plane with each pair of adjacent sides equal. **Trapezium** Guide pupils to discover that a Trapezium is a four-sided plane shape with only one pair of opposite sides parallel. **Rhombus** Guide pupils to discover that a Rhombus is a four-sided plane shape with all four sides equal. **Note:** Differentiate between the square and other types of Rhombus by using the interior angles.	Let pupils:
UNIT 2.11 RATIO AND PROPORTION	2.11.1 express two similar quantities as a ratio	Comparing two quantities in the form a : b	Guide pupils to compare two similar quantities by finding how many times one is of the other and write this as a ratio in the form a : b E.g. Express 12km and 18km as a ratio i.e. 12 : 18 = $\frac{12}{18} = \frac{2}{3}$ = 2 : 3	find the ratio of one given quantity to another
	2.11.2 express two equal ratios as a proportion	Expressing two equal ratios as a proportion	Guide pupils to express two equal ratios as a proportion. E.g. 12km, 18km and 6 hours, 9 hours can be expressed as a proportion as follows; 12km : 18km = 6 hours : 9 hours 2 : 3 = 2 : 3 i.e. $\frac{12km}{18km} = \frac{6hours}{9hours}$	express given ratios as a proportion

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
	The pupil will be able to:			Let pupils:
2.11 (CONT'D) RATIO AND PROPORTIONS	2.11.3 solve problems involving direct and indirect proportions	Direct and Indirect proportions	Guide pupils to solve problems involving direct proportion using: (a) Unitary method E.g. If the cost of 6 items is GH¢1800, find the cost of 10 items; i.e. Cost of 1 = GH ¢ $\frac{1800}{6}$ = GH¢300 ∴ cost of 10 = GH¢300 x 10 = GH¢3000 (b) Ratio method Express the two quantities / ratios as proportion. The ratios are 6 : 10 = 1800 : n $\frac{6}{10} = \frac{1800}{n}$ n = $\frac{10 \times 1800}{6}$ n = 10 x 300 n = GH¢3000	solve real life problems involving direct and indirect proportions
	2.11.4 share a quantity according to a given proportion	Application of proportion	Guide pupils to apply proportions in sharing quantities among themselves. E.g. Ahmed and Ernest shared the profit gained from their business venture according to the proportion of the capital each contributed. If Ahmed contributed GH¢100 and Ernest contributed GH¢800 and Ernest's share of the profit was GH¢100, how much of the profit did Ahmed receive?	apply proportions to solve word problems
	2.11.5 use proportion to find lengths, distances and heights involving scale drawing	Scale drawing using proportions	Guide pupils to find lengths, distances and heights involving scale drawings. E.g. The height of a tower of a church building in scale drawing is 2cm. If the scale is 1cm to 20m. How tall is the actual tower?	find the actual distances from scale drawings E.g. maps

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
2.11 (CONT'D) RATIO AND PROPORTION	The pupil will be able to:		i.e. 1m = 100cm ∴ 20m = 2000cm 1 : 2000 = 2 : h $\frac{1}{2000} = \frac{2}{h}$ h = 2 x 2000 = 4000cm ∴ actual height = 40m.	Let pupils:
UNIT 2.12 MAPPING	2.12.1 identify mapping as a special relation	Idea of mapping	Revise the idea of a relation between a pair of sets. Guide pupils to identify a mapping as a correspondence between two sets.	explain mapping using real life situations
	2.12.2 deduce the rule for a mapping	Rule for mapping	Guide pupils to deduce the rule of a mapping.  the rule is x → 2x + 3	find the rule for a given mapping
	2.12.3 find the inverse of a given mapping	Inverse mapping	Guide pupils to discover that inverse mapping is (i) going backwards from the second set to the first set. (ii) reversing the operations and their order in a rule. Use the flag diagram in this case.	find the inverse of a mapping

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
2.12 (CONT'D) MAPPING	The pupil will be able to:		E.g. y = 2x + 3  ∴ inverse rule is $\frac{x-3}{2}$	Let pupils:
	2.12.4 make a table of values for a rule of a mapping	Making a table of values for a given rule	Guide stuents to make tables of values by substituting a set of values into a given rule E.g. y = 2x + 3 **x** | **2x + 3** | **y** 1 | 2(1) + 3 | 5 2 | 2(2) + 3 | 7 3 | 2(3) + 3 | 9	make a table of values for a given rule of a mapping
UNIT 2.13 AREA AND VOLUME	2.13.1 find the area of a triangle	Area of a triangle	**TLMs:** Cut out shapes: (triangles, rectangles, cubes, cuboids, circles, cylinder), Geoboard Using the geoboard, guide pupils to discover the area of a triangle from the rectangle. Guide stuents to use the relation to find the area of triangles. i.e. Area of triangle = $\frac{1}{2}bh$	find the area of a given triangle
	2.13.2 find the area of a circle	Area of a circle	Guide pupils in groups to discover the area of a circle in relation to the area of a rectangle. Through practical activities, guide pupils to establish the relationship between the area of a circle, the radius and the pi (π).	find the area of a given circle

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
2.13 (CONT'D) AREA AND VOLUME	The pupil will be able to:			Let pupils:
	2.13.3 calculate the volume of a cube and a cuboid	Volume of a cuboid	Guide pupils to demonstrate practically to establish the relation between the volume and the dimensions of a cuboid/cube. Guide pupils to find the volume of a cuboid/cube.	find the volume of a cuboid/cube
	2.13.4 calculate the volume of a cylinder	Volume of a cylinder	Guide pupils to discover the relationship between the volume, base area (circle) and the height of a cylinder. Guide pupils to calculate the volume of a cylinder using the formula $v = \pi r^2 h$	calculate the volume of a given cylinder
	2.13.5 solve word problems involving area and volume	Word problems involving area and volume	Guide pupils to solve word problems involving area and volume of shapes.	solve word problems involving area and volume of shapes
UNIT 2.14 RATES	2.14.1 express two quantities as a rate	Rate as a ratio of one given quantity to another given quantity	Guide pupils to recognise rate as the ratio of one given quantity to another given quantity. E.g. A car consumes 63 litres of petrol per week. i.e. 9 litres per day. Explain other examples of rates E.g. bank rates, discount rates etc.	express two quantities used in everyday life as a rate
	2.14.2 solve problems involving rates	Simple interest, Discount and Commission	Guide pupils to solve problems involving: (a) <u>Simple Interest</u> E.g. Calculate the simple interest on savings of GH¢1000 for one year at 20% interest rate. i.e. GH¢1000 x $\frac{20}{100}$ = GH¢200	find the simple interest on savings

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
2.14 (CONT'D) RATES	The pupil will be able to:		(b) Discount E.g. A discount of 10% is allowed on goods worth GH¢6000. What is the new price? i.e. $\frac{10}{100}$ x 6000 = GH¢600 ∴discount = GH¢600 New price = GH¢5400 (c) Comission E.g. Calculate 15% commission on a sale of GH¢1000 i.e. $\frac{15}{100}$ x 1000 = GH¢150	Let pupils: calculate the discount and new price of goods find commission on sales
UNIT 2.15 PROBABILITY	2.15.1 identify outcomes which are equally likely	Outcomes of an experiment (equally likely outcomes)	Guide pupils to identify random experiments. E.g. Tossing a coin, tossing a die or dice. Let pupils take the results of an experiment as outcomes. Let pupils identify outcomes of a random experiment with same chance of occurring as equally likely outcomes.	list all the possible equally likely outcomes of a given experiment
	2.15.2 find the probability of an outcome	Probability of an outcome	Guide pupils to define the probability of an outcome. i.e. Probability is $\frac{\text{No. of successes}}{\text{Total No. of Possible outcomes}}$	find the probability of an outcome
UNIT 2.16 VECTORS	2.16.1 locate the position of a point given its bearing and distance from a given point	Bearing of a point from another point	**TLMs:** Graph sheet, Protractor, Ruler Guide pupils to describe bearing of the cardinal points, North, East, South and West as $000^0(360^0)$, 090^0, 180^0 and 270^0 respectively.	determine the bearing of a point from another point

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
	The pupil will be able:		Guide pupils to locate the positions of points given their bearings from a given point.	Let pupils:
2.16 (CONT'D) VECTORS	2.16.2 identify the length and bearing of a vector	Idea of a vector	Guide pupils to identify a vector as a movement (distance) along a given bearing. Guide pupils to take the distance along a vector as its length and the 3 – digit clockwise angle from the north as its bearing	draw a vector given its length and bearing measure the length and bearing of a vector
	2.16.3 identify a zero vector	Zero vector	Guide pupils to identify a zero vector.	
	2.16.4 identify the components of a vector in the number plane	Components of a vector	Guide pupils to demonstrate graphically in the number plane to develop the concept of component of a vector *AB* as the horizontal and vertical distances travelled from A to B E.g. $\overrightarrow{AB} = \begin{pmatrix} 4 \\ 3 \end{pmatrix}$	find the components of vectors
	2.16.5 identify equal vectors	Equal vectors	Guide pupils to identify equal vectors as • having the same magnitude (length) • having the same direction • the **x** - components are the same • the **y** - components are the same.	identify equal vectors
	2.16.6 add two vectors in component form	Addition of two vectors	Guide pupils to add vectors using the graphical method Guide pupils to discover that If $\overrightarrow{AB} = \begin{pmatrix} a \\ b \end{pmatrix}$ and $\overrightarrow{BC} = \begin{pmatrix} c \\ d \end{pmatrix}$ then $\overrightarrow{AC} = \overrightarrow{AB} + \overrightarrow{BC}$ $= \begin{pmatrix} a \\ b \end{pmatrix} + \begin{pmatrix} c \\ d \end{pmatrix} = \begin{pmatrix} a+c \\ b+d \end{pmatrix}$	find the sum of vectors in component form

JUNIOR HIGH SCHOOL 3

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 3.1 **APPLICATION OF SETS**	The pupil will be able to: 3.1.1 draw and use Venn diagrams to solve simple two set problems	Two set problems	Guide pupils to determine the universal set of two sets Guide pupils to represent sets on the Venn diagram Guide pupils to find the complement of a set and represent it on the Venn diagram Guide pupils to use the Venn diagram to solve two set problems	Let pupils: list the members of a universal set find the complement of a set solve two set problems using Venn diagrams
	3.1.2 find and write the number of subsets in a set with up to 5 elements	Number of subsets	Guide pupils to write all the subsets of sets with elements up to 5	list the subsets of given sets with elements up to 4
	3.1.3 find the rule for the number of subsets in a set		Guide pupils to find the number of subsets in a set with • one element • two elements, etc Guide pupils to deduce the pattern made by the number of subsets in sets with various number of elements (0, 1, 2,…, n) as $\mathbf{2^n}$ **Note:** • the empty set is a subset of every set • every set is a subset of itself	use the rule to find the number of subsets in a given set

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 3.2 **RIGID MOTION**	The pupil will be able to: 3.2.1 identify congruent figures	Congruent shapes	**TLMs:** Geoboard, Cut-out shapes, Mirror, Graph paper, Tracing paper Guide pupils to identify congruent figures by: (a) placing two plane shapes (E.g. triangles) on top of one another to see whether their corresponding sides and angles are equal (b) exploring with different plane shapes (E.g. triangles) to determine the conditions necessary for congruency	Let pupils: identify congruent figures from a set of plane shapes
	3.2.2 identify and explain a translation of an object or shape by a given vector	Translation by a given vector	Guide pupils to slide shapes or templates without turning, move a chair in a given direction in a straight line to demonstrate translation. Guide pupils to use the Geoboard to show that a translation maps each point of a shape into another point (i.e. image) in a certain distance in a given direction.	translate a given figure by a given vector
	3.2.3 locate images of points of an object under a given translation	Images of points under a given translation	Guide pupils to write the initial (object) points and the final (image) points in a given translation to determine the movement (translation vector). Guide pupils to determine the images of points under a given translation vector	determine the images of points of an object under a given translation vector
	3.2.4 identify and explain a reflection of an object (shape) in a given mirror line	Reflection	Guide pupils to carry out different activities with concrete objects to indentify the reflection of an object (shape) in a given mirror line. E.g. • looking through the mirror • making ink devils • making patterns with folded sheets of paper	draw the mirror line for a given reflection

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
	The pupil will be able to:			Let pupils:
3.2 (CONT'D) RIGID MOTION	3.2.5 locate image points of an object (shape) under a reflection in a given mirror line		Guide pupils to carry out activities using graph sheets to identify the points of an image from that of the object.	state the object points/ coordinates and its corresponding image points /coordinates in a given reflection
	3.2.6 identify a rotation of an object (shape) about a centre and through a given angle of rotation	Rotation	Let pupils give examples of turnings in everyday life to explain rotation as moving an object by turning about a fixed point called centre of rotation. Guide pupils to rotate different shapes and observe the center (origin) and the angle of rotation. Guide pupils to observe the differences in clockwise and anti-clockwise rotations. Guide pupils to rotate objects (shapes) about a point (origin) and observe the number of times the object will return to its original position.	
	3.2.7 find the images of points of an object (shape) through rotation given the centre and angle of rotation	Rotating figures using graph sheets	Guide pupils to rotate a shape (object) through a given centre and angle of rotation using graph sheets Guide pupils to state the object points and its corresponding image points under a given rotation	state the object point or co-ordinates and its corresponding image point or co-ordinates under a given rotation
	3.2.8 identify an object (shape) and its image under a translation, reflection and rotation as congruent	Congruency in transformation	Guide pupils to apply the concept of congruent figures to discover that transforming a shape by translation, reflection and rotation will produce a congruent figure.	determine whether images under translations, reflections and rotations are congruent to their respective objects
	3.2.9 identify symmetrical objects and shapes	Symmetrical shapes and objects	Guide pupils to perform activities to discover the idea of symmetry. Guide pupils to give examples of symmetrical objects in everyday life.	give examples of objects and shapes that are symmetrical

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
	The pupil will be able to:			Let pupils:
3.2 (CONT'D) RIGID MOTION	3.2.10 relate the lines of symmetry of shapes (objects) to the mirror line of a reflection	Line of symmetry for shapes and objects	Guide pupils to use plane mirrors to link the idea of the line of symmetry to the line of reflection (mirror line). Guide pupils to identify and give examples of objects (shapes) which have mirror symmetry. Guide pupils to fold cut-out shapes to discover lines of symmetry in given shapes (E.g. polygons)	draw lines of symmetry for given shapes (objects)
	3.2.11 identify objects (shapes) with rotational symmetry	Rotational symmetry	Guide pupils to carry out activities to identify objects (shapes) which can be rotated about a centre through an angle (a fraction of a complete turn) and fitted exactly on top of its original position to establish concept of rotational symmetry. Guide pupils to give examples of objects (shapes) which have rotational symmetry. Guide pupils to identify objects/shapes which have both line of symmetry and rotational symmetry.	draw objects (shapes) which have rotational symmetry name objects (shapes) having both line and rotational symmetry
UNIT 3.3 ENLARGEMENTS AND SIMILARITIES	3.3.1 carry out an enlargement on a geometrical shape given a scale factor	Enlargement of geometrical shapes	Guide pupils to draw the enlargement of a geometrical figure given a scale factor (E.g. triangles, rectangles) **Note:** In enlargement there is centre of enlargement and a scale factor.	draw an enlargement of a shape using a given scale factor
	3.3.2 determine the scale factor given an object and its image	Finding scale factor	Guide pupils to find the scale factor by determining the ratio of the sides of an image to the corresponding sides of the object.	find the scale factor of an enlargement
	3.3.3 state the properties of enlargements	Properties of enlargement	Guide pupils to observe that: • if the scale factor (**K**) is greater than 1 or less than – 1, the enlargement is a magnification, i.e. the image is larger than the image. • if the scale factor (**K**) is between – 1 and 1 (i.e. a fraction), the enlargement is a	

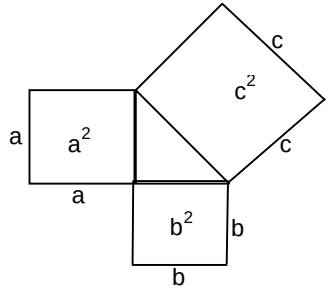
UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
3.3 (CONT'D) ENLARGEMENTS AND SIMILARITIES	The pupil will be able to:		reduction, i.e. the image is smaller than the object. • if the scale factor (**K**) is negative, the object and its image are in opposite sides of the centre of the enlargement. Guide pupils to identify the properties of an enlargement with the scale factor **K**, i.e. relationship between: • size of sides of an object and its image • angles in the vertices of an object and its image. • shape of an object and its image	Let pupils: state properties of enlargement
	3.3.4 identify an object and its image as similar figures and write a proportion involving the sides of the two figures	Similar figures	Guide pupils to observe that the corresponding sides of similar figures are proportional Guide pupils to identify an object and its image as similar Guide pupils to determine a proportion involving the sides of two similar figures.	identify similar figures in the environment (as a project) solve problems on proportion involving the sides of similar figures
	3.3.5 identify scale drawing as a reduction of a figure (shape)	Scale drawing as a reduction	Guide pupils to identify scale drawing as a reduction of a figure. (E.g. scale drawing in map reading) Guide pupils to convert the sizes of real objects to scale. Guide pupils to draw real objects (plane shapes) to scale.	identify some objects in the environment and draw them to scale
UNIT 3.4 HANDLING DATA AND PROBABILITY	3.4.1 read and interpret information presented in tables	Reading and interpreting data in tabular form	Guide pupils to read and interpret tables like rainfall charts and VAT/currency conversion tables. Guide pupils to perform experiments and make frequency tables of the results of a random survey or experiment (e.g throwing dice for a given number of times and taking traffic census)	interpret a given chart

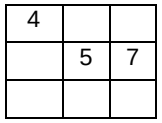
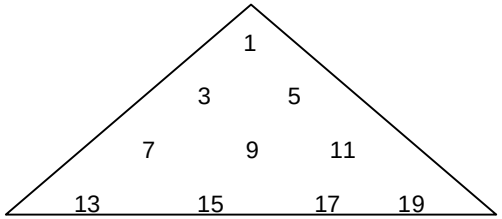
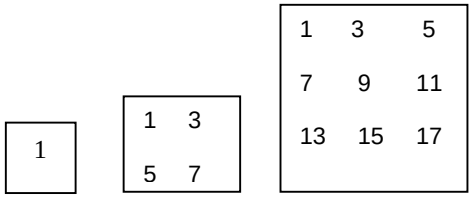
UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
3.4 (CONT'D) HANDLING DATA AND PROBABILITY	The pupil will be able to:		Guide pupils to calculate mode, median and mean from frequency distribution tables.	Let pupils: make a frequency table from a set of data and use it to calculate/find: • mode • median • mean
	3.4.2 find the relative frequency of a given event	Probability • Relative frequency	Guide pupils to discuss the meaning of relative frequency (i.e. *the number of outcomes of a given event out of the total number of outcomes of an experiment*) *or* (*dividing a frequency by the total frquency*) Guide pupils to determine the relative frequency of an event. E.g. the relative frequency of an even number showing when a die is thown is 3 out of 6.	calculate the probability of simple events E.g. probability of hitting a number on a dart
	3.4.3 find the probability of a given event	Finding the probability of a given event	Guide pupils to carry out various experiments and find out the possible outcomes. Guide pupils to determine the probability of an event. E.g. the probability of a 3 showing up when a die is thrown is $\frac{1}{6}$. Guide pupils to calculate probability from frequency distribution tables.	determine the relative frequency of an event using frequency distribution tables
UNIT 3.5 MONEY AND TAXES	3.5.1 calculate wages and salaries	Calculating wages and salaries	Guide pupils to identify and explain wages and salaries. Guide pupils to calculate wages and salaries of workers.	calculate the daily and weekly wages of a worker calculate the monthly and annual salaries of a worker
	3.5.2 identify and explain various transactions and services at the bank	Transactions and services provided by banks	Guide pupils to identify the basic transactions and services provided by a bank.	

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
3.5 (CONT'D) MONEY AND TAXES	The pupil will be able to:		Guide pupils to find out the meaning of interest rates. Guide pupils to calculate: • Interest rates • Simple interest on savings and loans Guide pupils to calculate charges for certain services at the bank (E.g. Bank drafts, Payment order, etc)	Let pupils calculate: • Interest rates • Simple interest on savings • Interest on loans • Other bank charges
	3.5.3 identify and explain types of insurance and calculate insurance premiums	Insurance (premiums and benefits)	Guide pupils to identify types of insurance policies. Guide pupils to calculate insurance premiums and benefits.	calculate total premium paid for an insurance coverage over a given period of time
	3.5.4 find and explain the income tax payable on a given income	Income Tax	Guide pupils to identify the government agency responsible for collecting income tax. Discuss with pupils incomes that are taxable. Guide pupils to calculate income tax payable by a person earning a given income.	calculate the income tax for a given income
	3.5.5 calculate VAT/NHIS on goods and services	Calculating VAT/NHIS	Guide pupils to identify VAT/NHIL as a sales-tax added to the price of goods and services. Guide pupils to identify goods and services attracting VAT/NHIL. Guide pupils to calculate VAT/NHIL on goods and services.	calculate VAT/ NHIL on given goods and services

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
	The pupil will be able to:			Let pupils:
UNIT 3.6 ALGEBRAIC EXPRESSIONS	3.6.1 change the subject of a formula	Change of subject	Guide pupils to change subjects of formulae that involve the inverses of the four basic operations. E.g. • make ***h*** the subject of the formula $v = \pi r^2 h$ • make ***x*** the subject of the formula $p = 2(x + y)$	make a variable a subject of a given formula
	3.6.2 substitute values of given variables	Substitution of values	Guide pupils to substitute values of given variables into algebraic expressions E.g. Given that $\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$ find R if $R_1 = 1$ and $R_2 = 3$	substitute given values into a formula and simplify
	3.6.3 multiply two simple binomial expressions	Binomial expansion	Revise addition and multiplication of integers with pupils Guide pupils to multiply two simple binomials. E.g. • (a + 2)(a + 3) • (a – 2)(a + 3) • (a – 2)(a – 3)	expand the product of two simple binomials
	3.6.4 factorize expressions that have simple binomial as a factor	Factorization	Guide pupils to find the binomial which is a factor in expressions and factorize. E.g. 3(b + c) – 2a(b + c) = (b + c)(3 – 2a) Guide pupils to regroup terms and factorize the binomial that is the common factor. E.g. ab + ac + bd + cd = (ab + ac) + (bd + cd) = a(b + c) + d(b + c) = (b + c)(a+d)	solve problems involving factorisation of simple binomials

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 3.7 PROPERTIES OF POLYGONS	The pupil will be able to: 3.7.1 identify and name the types of triangles	Types of triangles	**TLMs:** Cut-out plane shapes, Protractor, Scissors and Graph sheets Revise the angle properties of triangles with pupils Guide pupils to perform activities to identify and draw the different types of triangles. Guide pupils to state the differences in the triangles in terms of size of angle and length of the sides.	Let pupils: classify given triangles
	3.7.2 determine the sum of interior angles of a given regular polygon	Interior angles of regular polygons	**Revision:** Guide pupils to revise the sum of the interior angles of a triangle. Guide pupils to determine the number of triangles in a given regular polygon Guide pupils to relate the sum of interior angles of a triangle and the number of triangles in a regular polygon to determine the sum of inerior angles in regular polygons. Guide pupils to determine the relation between the number of sides (***n***) and the sum (**S**) of the interior angles of regular polygons. i.e. **S** = $(n-2) \times 180^0$ Pose word problems involving the sum of interior angles of a regular polygon for pupils to solve.	calculate: • the size of an interior angle of a regular polygon given the number of sides and the sum of the interior angles • sum of interior angles given the number of sides • number of sides given the sum of interior angles
	3.7.3 determine the exterior angles of a polygon	Exterior angles of polygons	Guide pupils to identify the exterior angle of a polygon using practical activities Guide pupils to discover that the sum of the exterior angles of any polygon is 360^0. Guide pupils to calculate the size of exterior angles of given regular polygons.	find the size of exterior angle of a given regular polygon
	3.7.4 state and use the Pythagorean theorem in relation to a right-angled triangle	Pythagorean theorem	Guide pupils to carry out practical activities to establish that *"the sum of the squares of the lengths of the two shorter sides of a right-angled triangle is equal to the squares of the length of the longest side (hypotenuse)".*	use the Pythagorean theorem to solve problems on right-angled triangle

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
3.7 (CONT'D) PROPERTIES OF POLYGONS	The pupil will be able to:		 Guide pupils to form squares on the three sides and compare the areas by arranging unit squares in them. Guide pupils to state and use the Pythagorean theorem (i.e. $c^2 = a^2 + b^2$)	Let pupils:
UNIT 3.8 INVESTIGATION WITH NUMBERS	3.8.1 find the relation between a number and its factors	Sum of factors	Guide pupils to find the factors of natural numbers and find their sum Guide pupils in groups to classify natural numbers into the following groups: • those greater than their sum of factors • those less than their sum of factors • those equal to their sum of factors (Perfect numbers)	find the perfect numbers in a given set of numbers
	3.8.2 express an even number as the sum of two prime numbers	Relationship between prime and even numbers	Guide pupils to express even numbers greater than as the sum of two prime numbers.	find out the pair of prime numbers that can sum up to a given even number
	3.8.3 recognize the pattern in a given sequence of numbers and continue it	Sequence of numbers	Guide pupils to study the pattern in a given list of numbers and continue it. E.g. • 2, 4, 6, 8, … • 1, 2, 4, 8, 16, … • 11, 7, 3, -1, … • 1, 1, 2, 3, 5, 8, … Guide pupils to explain the rule for getting the next term in a given sequence.	write the next three terms of a given sequence

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
	The pupil will be able to			Let pupils:
3.8 (CONT'D) INVESTIGATION WITH NUMBERS	3.8.4 complete a 3 by 3 magic square :	Magic squares	Guide pupils to arrange the numbers 1, 2, 3,…, 9 in the 3 by 3 square below so that the sums along the rows, columns and diagonals are the same. 	complete a given magic square
	3.8.4 identify patterns made by odd numbers arranged as triangles and squares	Patterns in sets of odd numbers	Guide pupils to study the triangle and squares of numbers below  Guide pupils to find the sum of numbers in each row in the triangle and comment on their results.  Guide pupils to find the sum of the numbers along the diagonal of each square and comment on their results.	find the sum of numbers in a given row in a given triangle find the sum of the numbers along the diagonal of a given square