# M I N I S T R Y  O F  E D U C A T I O N


Republic of Ghana

# TEACHING SYLLABUS FOR CORE MATHEMATICS

# (SENIOR HIGH SCHOOL)

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## 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 to 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 premises that all students 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 Senior High school (SHS) in Ghana builds on the knowledge and competencies developed at the Junior High School level. The student is expected at the SHS level to develop the required mathematical competence to be able to use his/her knowledge in solving real life problems and secondly, be well equipped to enter into further study and associated vocations in mathematics, science, commerce, industry and a variety of other professions.

## GENERAL AIMS

To meet the demands expressed in the rationale, the SHS Core Mathematics syllabus is designed to help the student to:

1. Develop the skills of selecting and applying criteria for classification and generalization.
2. Communicate effectively using mathematical terms, symbols and explanations through logical reasoning.
3. Use mathematics in daily life by recognizing and applying appropriate mathematical problem-solving strategies.
4. Understand the process of measurement and use appropriate measuring instruments.
5. Develop the ability and willingness to perform investigations using various mathematical ideas and operations.
6. Work co-operatively with other students in carrying out activities and projects in mathematics.
7. Develop the values and personal qualities of diligence, perseverance, confidence, patriotism and tolerance through the study of mathematics
8. Use the calculator and the computer for problem solving and investigations of real life situations
9. Develop interest in studying mathematics to a higher level in preparation for professions and careers in science, technology, commerce, industry and a variety of work areas.
10. Appreciate the connection among ideas within the subject itself and in other disciplines, especially Science, Technology, Economics and Commerce

## GENERAL OBJECTIVES

By the end of the instructional period students will be able to:

1. Develop computational skills by using suitable methods to perform calculations;
2. Recall, apply and interpret mathematical knowledge in the context of everyday situations;
3. Develop the ability to translate word problems (story problems) into mathematical language and solve them with related mathematical knowledge;
4. Organize, interpret and present information accurately in written, graphical and diagrammatic forms;
5. Use mathematical and other instruments to measure and construct figures to an acceptable degree of accuracy;
6. Develop precise, logical and abstract thinking;
7. Analyze a problem, select a suitable strategy and apply an appropriate technique to obtain it's solution;
8. Estimate, approximate and work to degrees of accuracy appropriate to the context;
9. Organize and use spatial relationships in two or three dimensions, particularly in solving problems;
10. Respond orally to questions about mathematics, discuss mathematics ideas and carry out mental computations;
11. Carry out practical and investigational works and undertake extended pieces of work;
12. Use the calculator to enhance understanding of numerical computation and solve real life problems

## SCOPE OF CONTENT

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 Senior High School classes are as follows:

1. Numbers and Numeration.
2. Plane Geometry
3. Mensuration
4. Algebra
5. Statistics and Probability
6. Trigonometry
7. Vectors and Transformation in a Plane

* Problem solving and application (mathematical processes).

"Numbers and Numeration" covers reading and writing numerals in base two through twelve and the four basic operations on them as well as ratio, proportion, and parentages. Fractions, integers and rational and irrational numbers and four operations on them are treated extensively.
Plane geometry covers angles of a polygon, Pythagoras' theorem and its application and circle theorem including tangents. Mensuration covers perimeters and areas of plane shapes, surface areas and volumes of solid shapes. In addition, the earth as a sphere is also treated under mensuration. "Algebra" – Algebra is a symbolic language used to express mathematical relationships. Students need to understand how quantities are related to one another, and how algebra can be used to concisely express and analyze those relationships. "Statistics and Probability" – are important interrelated areas of mathematics. Each provides students with powerful mathematical perspectives on everyday phenomena and with important examples of how mathematics is used in the modern world. Statistics and probability should involve students 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. Trigonometry covers the trigonometry ratios and their applications to angles of elevation and depression. Drawing and interpretation of graphs of trigonometric functions is also covered under trigonometry.

Topics treated under vectors include, representation, operations on vectors, equal and parallel vectors as well as magnitude of vectors and bearing. Transformation deals with rigid motion and enlargement including scale drawing and its application.

“Problem solving and application” has not been made a topic by itself in the syllabus since nearly all topics 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 students 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 has been designed to be within the knowledge and ability range of Senior High School students.

## STRUCTURE AND ORGANIZATION OF THE SYLLABUS

The syllabus is structured to cover the three years of Senior High School. Each year’s work has been divided into units. SHS 1 has 13 units; SHS 2 has 12 units while SHS 3 has 4 units of work. The unit topics for each year have been arranged in a suggested teaching sequence. It is suggested that the students cover most of the basic mathematics concepts in the first term of Year 1 before they begin topics in Elective mathematics. No attempt has been made to break the year’s work into terms. This is deliberate because it is difficult to predict, with any degree of certainty, the rate of progress of students in each year. Moreover, the syllabus developers wish to discourage teachers from forcing the instructional pace but would rather advise teachers to ensure that students 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 students’ knowledge. The unit topics for the three years' course are indicated on the table below.

| UNIT | SHS1 | SHS2 | SHS3 |
|---|---|---|---|
| 1. | Sets and Operations on set | Modular arithmetic | Constructions |
| 2. | Real number system | Indices and logarithms | Mensuration II |
| 3. | Algebraic expressions | Simultaneous linear equation | Logical reasoning |
| 4. | Surds | Percentages II | Trigonometry II |
| 5. | Number Bases | Variation | |
| 6. | Relations and Functions | Statistics II | |
| 7. | Plane Geometry | Quadratic functions | |
| 8. | Linear equations and inequalities | Mensuration I | |
| 9. | Bearing and Vectors in a plane | Plane geometry II (Circle theorems) | |
| 10. | Statistics I | Trigonometry I | |
| 11. | Rigid motion I | Sequences and Series | |
| 12. | Ratio and Rates | Rigid motion II and Enlargement | |
| 13. | Percentages I | | |

## TIME ALLOCATION

Mathematics is allocated five periods a week, each period consisting of forty (40) minutes.

## SUGGESTIONS FOR TEACHING THE SYLLABUS

**General Objectives**

General Objectives for this syllabus have been listed on page iii of the syllabus. The general objectives are directly linked flow to 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.

## 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 students.

## 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 SHS1. Similarly, a unit number like 3.2 means unit 2 of SHS3. 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 SHS1, Unit 2 (of SHS1) and Specific Objective 5. In other words 1.2.5 refers to Specific Objective 5 of Unit 2 of SHS1. Using syllabus reference numbers provides an easy way for communication among teachers and other educators. It further provides an easy way for selecting objectives for test construction. For instance, Unit 4 of SHS2 may have eight specific objectives 2.4.1 - 2.4.8. A teacher may want to base his/her test items/questions on objectives 2.4.2, 2.4.7 and 2.4.7, and not use the other objectives. The 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 students i.e. what the students will be able to do during and after instruction and learning in the unit. Each specific objective hence starts with the following "*The student will be able to…",* this in effect, means that you have to address the learning problems of each individual student. It means individualizing your instruction as much as possible such that the majority of students 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 add some more information based upon your own training and based also on current knowledge and information.

**Column 4 - Teaching/Learning Activities (T/LA):** T/LA activities that will ensure maximum student 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

students to acquire as much knowledge and understanding of mathematics as possible through their own activities. Students' questions are as important as teacher's questions. There are times when the teacher must show, demonstrate, and explain. But the major part of a students' 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. 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 students learning. Emphasize the cognitive, affective and psychomotor domains of knowledge in your instructional system wherever appropriate.

A suggestion that will help your students 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 students 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 students 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 students 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 student will be able to describe….. etc. Being able to "describe" something after the instruction has been completed means that the student has acquired "knowledge". Being able to explain, summarize, give examples, etc. means that the students has understood the lesson taught.

Similarly, being able to develop, plan, construct etc, means that the student has learnt to create, innovate or synthesize knowledge. Each of the specific objectives in this syllabus contains an "action verb" that describes the behaviour the students 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 students 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, students 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 SHS level are:

| | |
|---|---|
| Remembering and Understanding | 30% |
| Applying 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 Senior High School.

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

**Knowledge and Understanding (KU)**

| | |
|---|---|
| Knowledge | The ability to:<br>Remember information, recognize, retrieve, locate, find, do bullet pointing, highlight, bookmark, network socially, bookmark socially, search, google, favourite, recall, identify, define, describe, list, name, match, state principles, facts and concepts. Knowledge is simply the ability to remember or recall material already learned and constitutes the lowest level of learning. |
| Understanding | The ability to:<br>Interpret, explain, infer, compare, explain, exemplify, do advanced searches, categorize, comment, twitter, tag, annotate, subscribe, summarize, translate, rewrite, paraphrase, give examples, generalize, estimate or predict consequences based upon a trend. Understanding is generally the ability to grasp the meaning of some material that may be verbal, pictorial, or symbolic |

**Application of Knowledge (AK)**

The ability to use knowledge or apply knowledge, as implied in this syllabus, has a number of learning/behaviour levels. These levels include application, analysis, innovation or creativity, and evaluation. These may be considered and taught separately, paying attention to reflect each of them equally in your teaching. The dimension “Applying Knowledge” is a summary dimension for all four learning levels. Details of each of the four sub levels are as follows:

| | |
|---|---|
| Application | The process of applying knowledge involves the ability to:<br>Apply rules, methods, principles, theories, etc. to concrete situations that are new and unfamiliar. It also involves the ability to produce, solve, operate, plan, demonstrate, discover, implement, carry out, use, execute, run, load, play, hack, upload, share, edit etc. |
| Analysis | The process of analyzing knowledge involves the ability to:<br>Break down a piece of material into its component parts, to differentiate, deconstruct, attribute, outline, find, structure, integrate, mash, link, validate, crack, distinguish, separate, identify significant points etc., recognize unstated assumptions and logical fallacies, recognize inferences from facts etc. |
| Innovation/Creativity | Innovation or creativity involves the ability to:<br>Put parts together to form a novel, coherent whole or make an original product. It involves the ability to combine, compile, compose, devise, construct, plan, produce, invent, devise, make, program, film, animate, mix, re-mix, publish, video cast, podcast, direct, broadcast, |

suggest (an idea, possible ways), revise, design, organize, create, and generate new ideas and solutions. The ability to innovate or create is the highest form of learning. The world becomes more comfortable because some people, based on their learning, generate new ideas and solutions, design and create new things.

Evaluation - The ability to appraise, compare features of different things and make comments or judgments, contrast, criticize, justify, hypothesize, experiment, test, detect, monitor, review, post, moderate, collaborate, network, refractor, support, discuss, conclude, make recommendations etc. Evaluation refers to the ability to judge the worth or value of some material based on some criteria and standards. Evaluation is a constant decision making activity. We generally compare, appraise and select throughout the day. Every decision we make involves evaluation. Evaluation is a high level ability just as application, analysis and innovation or creativity since it goes beyond simple knowledge acquisition and understanding.

## 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 students. 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.

The diagram below shows a recommended examination structure for end of term examination in Senior High School following the structure of WAEC examination papers. The structure consists of two examination papers. Paper 1 is the objective test paper essentially testing knowledge and understanding. The paper may also contain some items that require application of knowledge. Paper 2 will consist of questions that essentially test "application of knowledge". The application dimension should be tested using questions that call for reasoning. Paper 2 could also contain some questions that require understanding of mathematical principles etc. The SBA should be based on both dimensions. The distribution of marks for Paper 1, Paper 2 and the SBA should be in line with the weights of the profile dimensions as shown in the last column of the table below.

### Distribution of Examination Paper Weights and Marks

| Dimensions | Paper 1 | Paper 2 | 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** |

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.

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.

## GUIDELINES FOR SCHOOL BASED ASSESSMENT

A new School Based Assessment system (SBA) will be introduced into the school system in 2011. 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 Senior High Schools in the country
- Provide reduced assessment tasks for subjects studied at SHS
- Provide teachers with guidelines for constructing assessment items/questions and other assessment tasks
- Introduce standards of achievement in each subject and in each SHS class
- 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 class performance.

SBA may be conducted in schools using the following: Mid-term test, Group Exercise, End-of-Term Test and Project

1. Project: This will consist of a selected topic to be carried out by groups of students for a year. Segments of the project will be carried out each term toward the final project completion at the end of the year. The projects may include the following:

   i) experiment
   ii) investigative study (including case study)\
   iii) practical work assignment

   A report must be written for each project undertaken.

2. Mid-Term Test: The mid-term test following a prescribed SBA format

3. Group Exercise: This will consist of written assignments or practical work on a topic(s) considered important or complicated in the term's syllabus

4. End-of-Tem Test: The end –of-term test is a summative assessment system and should consist of the knowledge and skills students have acquired in the term. The end-of-term test for Term 3 for example, 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 objectives studied in Term 2 and 60% of the objectives studied in Term 3.

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

## Marking SBA Tasks

At the SHS level, students will be expected to carry out investigations involving use of mathematics as part of SBA and other assignments. The suggested guideline for marking investigative project assignments is as follows:

| | | |
|---|---|---|
| 1. | Introduction | 20% |
| 2. | Main text – descriptions, analysis, charts etc. | 40% |
| 3. | Conclusion and evaluation of results/issues | 20% |
| 4. | Acknowledgement and other references | 20% |

In writing a report on an experiment or any form of investigation, the student has to introduce the main issue in the investigation, project or report. The introduction carries a weight of 20%. The actual work, involving description of procedures and processes, use of charts and other forms of diagrammes, and the analysis of data is given a weight of 40%. Conclusions and generalizations from the investigation, project etc. is weighted 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 students 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 20%.

## GRADING PROCEDURE

To improve assessment and grading and also introduce uniformity in schools, it is recommended that schools adopt the following WASSCE grade structure for assigning grades on students' test results. The WASSCE grading system is as follows:

| | | | |
|---|---|---|---|
| Grade A1: | 80 - 100% | - | Excellent |
| Grade B2: | 70 - 79% | - | Very Good |
| Grade B3: | 60 - 69% | - | Good |
| Grade C4: | 55 - 59% | - | Credit |
| Grade C5: | 50 - 54% | - | Credit |
| Grade C6: | 45 - 49% | - | Credit |
| Grade D7: | 40 - 44% | - | Pass |
| Grade D8: | 35 - 39% | - | Pass |

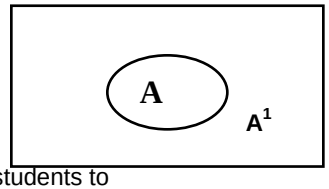
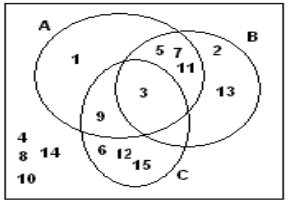
Grade F9: 34% and below - Fail

In assigning grades to students' test results, you are encouraged to apply the above grade boundaries and the descriptors which indicate the meaning of each grade. The grade boundaries i.e., 60-69%, 50-54% etc., are the grade cut-off scores. For instance, the grade cut-off score for B2 grade is 70-79% in the example. When you adopt a fixed cut-off score grading system as in this example, you are using the criterion-referenced grading system. By this system a student must make a specified score to be awarded the requisite grade. This system of grading challenges students to study harder to earn better grades. It is hence a very useful system for grading achievement tests.

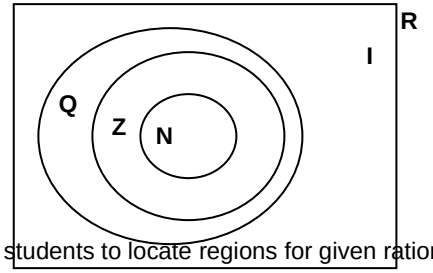
Always remember to develop and use a marking scheme for marking your class examination scripts. A marking scheme consists of the points for the best answer you expect for each question, and the marks allocated for each point raised by the student as well as the total marks for the question. For instance, if a question carries 20 marks and you expect 6 points in the best answer, you could allocate 3 marks or part of it (depending upon the quality of the points raised by the student) to each point , hence totaling 18 marks, and then give the remaining 2 marks or part of it for organization of answer. For objective test papers you may develop an answer key to speed up the marking.

# SENIOR HIGH SCHOOL 1

| UNIT | SPECIFIC OBJECTIVES | CONTENT | TEACHING AND LEARNING ACTIVITIES | EVALUATION |
|---|---|---|---|---|
| **UNIT 1.1**<br><br>**SETS AND OPERATIONS ON SETS** | The student will be able to:<br><br>1.1.1 determine and write the number of subsets in a set | Finding the number of subsets in a set with n elements | Review with students description of sets;<br>- words/set builder notation<br>- listing.<br>- Venn diagrams.<br><br>Guide students to deduce the number of subsets in a set with 'n' elements. i.e. the number of subsets = $2^n$ | Let students<br><br>find the number of subsets in a given set. |
| | 1.1.2 identify the properties of operations on sets. | Properties of Set Operations- Commutativity | Guide students to determine the commutative property of sets involving given sets A and B<br><br>i.e. A ∩ B = B ∩ A ; A U B = B U A | verify commutative, associative and distributive properties of operations on sets |
| | | Associativity | Guide students to determine the associative property of sets involving three given sets A, B and C,<br>i.e. (A U B) U C = A U (B U C) and<br>(A ∩ B) ∩ C = A ∩ (B ∩ C) | |
| | | Distributivity | Guide students to determine the distributive property of sets involving three given sets A, B and C,<br>i.e. A U (B ∩C) = (A U B) ∩ (A U C)<br>A ∩ (B U C) = (A ∩ B) U (A ∩ C)<br>Illustrate the properties with Venn diagrams. | Illustrate properties of set operations using Venn diagrams |

| UNIT | SPECIFIC OBJECTIVES | CONTENT | TEACHING AND LEARNING ACTIVITIES | EVALUATION |
|---|---|---|---|---|
| **1.1 (CONT'D)** | The student will be able to: | | | Let students |
| **SETS AND OPERATIONS ON SETS** | 1.1.3 describe the regions of a Venn diagram in terms of the set operations - union, complement | Description and identification of the regions of Venn diagrams using set operations | Guide students to revise the concept of universal set and the complement of a set in a Venn diagram,<br>E.g.<br>  <br><br>Guide students to<br>(I) describe regions of three (3) intersecting sets<br>(ii) shade regions corresponding to given descriptions<br><br>Assist students to verify (using Venn diagrams) that given any two intersecting sets, A and B,<br>$(A \cup B)' = A' \cap B'$<br>$(A \cap B)' = A' \cup B'$ | draw 2 intersecting sets and shade given regions<br><br>describe shaded regions of 3 intersecting sets |
| | 1.1.4 find solution to practical problems involving classifications using Venn diagrams | Three-set problems using Venn diagrams | Review two-set problems. Guide students to solve problems involving three sets e.g.<br>  <br><br>i. List the elements of (A∩B)∪C<br>ii. What is $n\{(A \cup B)' \cap C\}$ | write or pose 2 set problems involving real life situations<br><br>solve 3 set problems involving real life situations |

| UNIT | SPECIFIC OBJECTIVES | CONTENT | TEACHING AND LEARNING ACTIVITIES | EVALUATION |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| **UNIT 1.2**<br><br>**REAL NUMBER SYSTEM** | The student will be able to:<br><br>1.2.1 distinguish between rational and irrational numbers. | Rational and irrational numbers | Guide students to revise natural numbers, whole numbers and integers.<br><br>Guide students to distinguish between rational and irrational numbers i.e. rational numbers can be expressed as $\frac{a}{b}$, where a and b are real numbers and $b \neq 0$<br><br>Guide students to draw Venn diagrams to illustrate the relationship between the members of the real number system.<br><br>i.e.  <br>Guide students to locate regions for given rational numbers | Let students:<br><br>Identify regions representing given types of real numbers from Venn diagrams and place given real numbers in the appropriate region.<br><br>Copy the Venn diagram and shade the region that contains given rational numbers. |
| | 1.2.2 represent real numbers on the number line. | Real Numbers on the number line | Assist students to locate or estimate the points for real numbers on the number line.<br><br>E.g. …$^{-}$7, $-\frac{1}{2}$, 0, $\frac{1}{2}$, 1, 1.5, 2.17171717, …, $\sqrt{5}$, …<br>Guide students to<br>(i) graph given sets of real numbers on the number line;<br><br>(ii) find the range of values for a given graph.<br>E.g. $-1 \leq x \leq 2$ | illustrate a given range of numbers on the number line (vice versa) |

| UNIT | SPECIFIC OBJECTIVES | CONTENT | TEACHING AND LEARNING ACTIVITIES | EVALUATION |
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| **UNIT 1.2 (CONT'D)** | The student will be able to: | | | Let students: |

| UNIT | SPECIFIC OBJECTIVES | CONTENT | TEACHING AND LEARNING ACTIVITIES | EVALUATION |
|---|---|---|---|---|
| **REAL NUMBER SYSTEM** | 1.2.3 compare and order rational numbers | Comparing and ordering rational numbers | Assist students to compare and order different types of rational numbers E.g. common fractions, whole numbers, percentages, decimal fractions and integers using <,> and the number line.<br>E.g. arrange the fractions; 0.3, $\frac{1}{4}$ , 45% and 28 in ascending order. | arrange sets of rational numbers in order of magnitude. |
| | 1.2.4 approximate by rounding off decimal numbers to a given number of place values | Approximating and rounding off numbers | Guide students to approximate decimal numbers to given place values<br>E.g. 587.3563 to 2 decimal places (nearest hundredth) is 587.36 and 5873456 rounded to the nearest thousand is 5873000. | round off numbers to given number of place values. |
| | 1.2.5 approximate a decimal number to a given number of significant figures | Significant figures | Guide students to approximate given decimal numbers to given number of significant figures<br>E.g. 46.23067 approximated to 5 significant figures is 46.231. | approximate numbers to given number of significant figures. |
| | 1.2.6 express recurring decimals as common fractions. | Recurring decimals | Review changing common fractions to decimals and vice versa.<br>Guide students to realize that a recurring decimal has a digit or a block of digits which keep repeating<br>E.g. 1.666… or $1.\dot{6}$<br>0.727272… or $0.\dot{7}\dot{2}$<br>Guide students to express recurring decimals as fractions of the form $\frac{a}{b}$ where b≠ 0<br>E.g. $0.\dot{7} = \frac{7}{9}$ and $0.\dot{1}\dot{8} = \frac{18}{99} = \frac{2}{11}$<br>Encourage students to verify results using the calculator or computer. | express given recurring decimal fractions as common fractions. |

| UNIT | SPECIFIC OBJECTIVES | CONTENT | TEACHING AND LEARNING ACTIVITIES | EVALUATION |
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| **UNIT 1.2 (CONT'D)**<br><br>**REAL NUMBER SYSTEM** | The student will be able to:<br><br>1.2.7 express very large or very small numbers in standard form. | Standard form | Guide students to express a very large number and a very small number in the form: $k \times 10^n$, where $1 \leq k < 10$ and n is an integer.<br>E.g. $14835 = 1.4835 \times 10^4$<br>$0.0034678 = 3.4678 \times 10^{-3}$ | Let students:<br><br>express given numbers in standard forms and vice versa<br>E.g. The planet Neptune is 4,496,000,000 kilometres from the Sun. Write this distance in standard form. |
| | 1.2.8 state and use properties of operations on real numbers. | Properties of operations<br><br>Commutative property | Guide students to investigate the commutative properties of addition and multiplication.<br>i.e. $a + b = b + a$ and $ab = ba$ | State the properties of operations applied in given mathematical sentences. |
| | | Associative Property | Guide students to investigate the associative property of addition and multiplication.<br>i.e. $(a + b) + c = a + (b + c)$, and<br>$(ab)c = a(bc)$ | apply the appropriate properties to evaluate expressions<br>E.g. $18 \times 22 = 18\ (20+2)$<br>$90 \times 95 = 90\ (100 - 5)$. |
| | | Distributive Property | Guide students to investigate the distributive property of multiplication over addition and subtraction.<br>i.e. $a(b + c) = ab + ac$, and<br>$a(b - c) = ab - ac$. | If a and b are non-zero whole numbers, which of these is not always a whole number: $(a^2 + b^2)$, $(a \times b)$, $(a \div b)$, $(a - b)$, ab |
| | 1.2.9 interpret given binary operations and apply them to real numbers | Binary operations | Guide students to interpret and carry out binary operations on real numbers such as<br>$a * b = 2a + b - ab$<br>$p * q = p + q - 2pq$.<br><br>Encourage students to verify results using the calculator or computer. | carry out defined binary operations over real numbers<br>E.g. If $m * n = m + n + 5$,<br>find $8 * (\bar{}4)$ |

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| **UNIT 1.3**<br><br>**ALGEBRAIC EXPRESSIONS** | The student will be able to: | | | Let students |
| | 1.3.1 express statements in mathematical symbols | Algebraic expressions | Assist students to express simple statements involving algebraic expressions in mathematical symbols. | translate statements involving algebraic expressions in mathematical symbols. |
| | 1.3.2 add and subtract algebraic expressions | Operations on algebraic expressions | Guide students to add, subtract and simplify algebraic expressions involving the four basic operations. | add and subtract algebraic expressions.. |
| | 1.3.3 multiply two binomial expressions | Binomial expressions | Assist students to multiply two binomial expressions and simplify<br>E.g. $(a + b)(c + d) = c(a + b) + d(a + b)$<br>$= ac + bc + ad + bd$ | expand and simplify product of two binomial expressions. |
| | 1.3.4 factorize algebraic expressions | Factorization | Guide students to identify common factors in algebraic expressions and factorize (index of the variable not exceeding 2). | factorize given algebraic expressions with variable index not exceeding 2. |
| | 1.3.5 apply difference of two squares to solve problems | Difference of two squares | Assist students to develop the rule of difference of two squares<br>i.e. $a^2 - b^2 = (a + b)(a - b)$<br><br>Guide students to apply the idea of difference of two squares to evaluate algebraic expressions,<br>E.g. $x^2 - y^2 = (x + y)(x - y)$, i.e. $6.4^2 - 3.6^2$<br>$= (6.4 + 3.6)(6.4 - 3.6) = 10 \times 2.8 = 28.$ | apply difference of two squares to simplify algebraic expressions |

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| **UNIT 1.3 (CONT'D)**<br><br>**ALGEBRAIC EXPRESSIONS** | The student will be able to:<br><br>1.3.6 perform operations on simple algebraic fractions. | Operations on algebraic fractions with monomial denominators | Guide students to add and subtract algebraic fractions with monomial denominators.<br>E.g. $\frac{2}{a}+\frac{1}{x}=\frac{2x+a}{ax}$ | Let students<br><br>solve problems involving addition and subtraction of algebraic fractions with monomial and binomial denominators. |
| | | Operation on algebraic fractions with binomial denominators | Assist students to add and subtract algebraic fractions with binomial denominators.<br>E.g.<br>$\frac{1}{x-b}+\frac{1}{x-a}=\frac{2x-a-b}{(x-b)(x-a)}$,<br>where $x \neq a$, $x \neq b$ | |
| | 1.3.7 determine the conditions under which algebraic fraction is zero or undefined | Zero or Undefined algebraic fractions | Discuss with students the condition under which an algebraic expression is zero.<br>E.g. $\frac{3a}{5y}$, is zero. When 3a = 0, i.e. a = o<br><br>Assist students to determine the condition under which an algebraic expression is undefined<br>E.g. $\frac{1}{2-2x}$ is undefined when 2 – 2x = 0, or when x=1. | solve for the value of variables in algebraic fractions for which the fraction is zero.<br><br>find the value of a variable for which an algebraic fraction is undefined. |

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| | The student will be able to: | | | Let students: |
| **UNIT 1.4 SURDS.** | 1.4.1 simplify surds | . Simplifying surds. | Guide students to simplify surds of the form $\sqrt{a}$<br>E.g. $\sqrt{8} = 2\sqrt{2}$<br>$\sqrt{27} = 3\sqrt{3}$<br>$\sqrt{72} = 6\sqrt{2}$<br>Assist students to simplify the product of surds.<br>i.e.<br>$\sqrt{a} \times \sqrt{b} = \sqrt{ab}$<br>$(\sqrt{a})^2 = a$<br>$\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$ | simplify surds of the form $\sqrt{a}$ and products of surds.<br>use the relations in surds to solve problems |
| | 1.4.2 carry out operations involving surds | Addition, subtraction and multiplication of surds. | Guide students to find sums, differences and products of surds. | solve problems involving addition, subtraction and multiplication of surds |
| | 1.4.3 rationalize a surd with monomial denominator | Rationalization of surds with monomial denominators. | Guide students to rationalize surds with monomials denominators.<br>E.g. $\frac{2}{\sqrt{3}} = \frac{2}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = \frac{2\sqrt{3}}{3}$ | simplify and rationalize the denominators of surds |

| UNIT | SPECIFIC OBJECTIVES | CONTENT | TEACHING AND LEARNING ACTIVITIES | EVALUATION |
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| **UNIT 1.5**<br><br>**NUMBER BASES** | The student will be able to: | | | Let students: |
| | 1.5.1 convert base ten numerals to other bases and vice-versa | Converting base ten numerals to numerals in other base and vice versa. | Guide students to revise number bases by converting base ten numerals to bases two and five and vice-versa.<br>Guide students to convert given numerals from base ten to numerals in other bases up to base twelve. | convert numerals in base ten to numerals in other bases and vice-versa. |
| | 1.5.2 solve simple equations involving number bases | Equations involving number bases | Guide students to solve equations involving number bases<br>E.g. $132_x = 42_{ten}$ | solve for the base of a number in equations involving number bases. |
| | 1.5.3 perform operations on number bases other than base ten | Operations on numbers involving number bases other than base ten. | Guide students to add and subtract numbers in bases other than base ten. | construct addition table in given base other than base ten and use it to solve problems |
| | | • Addition and subtraction | Guide students to construct addition tables for bases other than base ten. | solve problems on number bases (other than base ten) involving addition and subtraction |
| | | • Multiplication | Guide students to find the product of two numbers and construct multiplication table in a given base other than base ten. | |

| UNIT | SPECIFIC OBJECTIVES | CONTENT | TEACHING AND LEARNING ACTIVITIES | EVALUATION |
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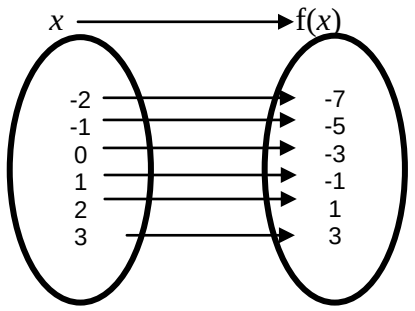
| | The student will be able to: | | | Let students |
| **UNIT 1.6**<br>**RELATIONS AND FUNCTIONS** | 1.6.1 distinguish between the various types of relations. | Types of relations | Review with students, relations between two sets; arrow diagrams; ordered pairs; domain; co-domain; range.<br><br>Use expressions of real life relations such as “is the father of”, is the wife of” to describe relations.<br>(Encourage students to develop the sense of belongingness) | find the range of function defined by a given set of ordered pairs<br>E.g. determine the range of function defined by the set of ordered pairs {(2,3),(1,4),(5,4),(0,3)} |
| | | | Guide students to use arrow diagrams to illustrate types of relations including ‘’one-to-one’’, ‘’one-to-many’’, ‘’many- to-one’’ and ‘’many-to-many’’ relations. | determine the type of relation described by a given set of ordered pairs or in a given arrow diagram. |
| | 1.6.2 Identify functions from other relations. | Functions | Use arrow diagrams to guide students to identify the relations ‘’one-to-one’’ and ‘’many-to-one’’ as functions. | give reasons why a given relation is or is not a function |
| | 1.6.3 determine the rule for a given mapping | Mapping | Assist students to determine the rule for a given mapping on the set of real numbers<br>  <br><br>The rule is: f(x) = 2x – 3. | determine the rule for a given function. |

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| **1.6 (CONT'D)** | The student will be able to: | | | Let students |
| **RELATIONS AND FUNCTIONS** | 1.6.4 draw graphs for given linear functions | Graphs of Linear Functions | Guide students to form table of values for a given linear function defined on the set of real numbers for a given domain.<br><br>Guide students to use completed tables to plot points, draw graphs and read values from the graphs. | draw graphs of given linear functions and read values of the function for a given pre-image and vice versa |
| | 1.6.5 find the gradient of a straight line, given the co-ordinates of two points on the line | Gradient of a straight line | Assist students to use graph (or square grid) to develop the ratio $\frac{y_2-y_1}{x_2-x_1}$ as the gradient of a straight line joining the points $(x_1, y_1)$ and $(x_2, y_2)$. | find the gradient of a line from given coordinates of points on the line |
| | 1.6.6 find the equation of a straight line | Equation of a straight line | Guide students to derive the equation of a line from $\frac{y-y_1}{x-x_1} = \frac{y_2-y_1}{x_2-x_1}$ where (x, y) is an arbitrary point on the line | find the equation of a line from given points on the line |
| | 1.6.7 find the distance between two points | Magnitude of a line segment | Discuss with the students different forms of equation of a straight line i.e. (i) $y = mx + c$ (ii) $ax + by + c = 0$<br><br>Guide students to find the distance between two points with coordinates $(x_1, y_1)$ and $(x_2, y_2)$ as $d = \sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$ | find the length of a line joining two given points |
| | 1.6.8 draw graphs for given quadratic functions | Graphs of Quadratic functions | Guide students to draw table of values for quadratic functions defined on the set of real numbers for a given domain and use the table of values to draw quadratic graphs and also to read values from the graphs. | draw the graphs of given quadratic functions<br><br>read the value of the function for a given pre-image and vice versa |

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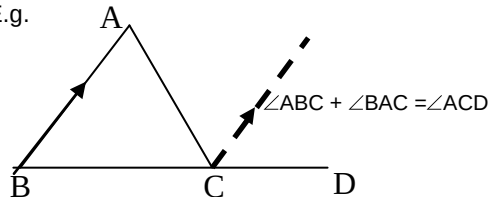
| **UNIT 1.7**<br>**PLANE GEOMETRY I** | The student will be able to: | | | Let students: |
| | 1.7.1 calculate the angles at a point | Angles at a point | Revise with students the sum of angles on a straight line by measuring using a protractor.<br><br>Assist students to use protractors to measure angles at a point to verify that they add up to $360^0$. | find missing angles in given diagrams |
| | 1.7.2 state and use the properties of parallel lines | Parallel lines<br>Relationships between corresponding angles, vertically opposite angles, alternate angles and adjacent angles, supplementary angles | In groups let students draw parallel lines and a transversal and, measure all the angles to discover the relationships between; corresponding angles, vertically opposite angles, alternate angles, adjacent angles, and supplementary angles. | find missing angles between parallel lines and a transversal |
| | 1.7.3 state and use the exterior angle theorem of a triangles | Exterior angle theorem | Guide students to measure the interior and the exterior angles of a triangle to verify the exterior angle theorem of a triangle.<br>E.g.<br>  <br><br>Guide students to use the idea of corresponding and alternate angles to verify the exterior angle theorem of a triangle.<br><br>Guide students to apply this knowledge to find the value of missing angles in a triangle | find missing angles of triangles from given diagrams |

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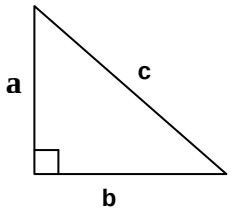
| **UNIT 1.7 (CONT'D)** | The student will be able to: | | | Let students: |
| **PLANE GEOMETRY I** | 1.7.4 identify various properties of special triangles | Special triangles<br>Isosceles and equilateral triangles | Revise different types of triangles including scalene, isosceles equilateral and right-angled triangles.<br><br>Guide students to establish the properties of isosceles and equilateral triangles.<br><br>E.g. (i) the line of symmetry of an isosceles triangle bisects the base and the angle opposite it, and is perpendicular to the base<br>(ii) an isosceles triangle has one line of symmetry and one rotational symmetry<br><br>(ii) an equilateral triangle has three lines of symmetry, the lines are congruent, and has rotational symmetry of order 3. | use properties of special triangles to find missing angles in triangles<br><br>identify some Ghanaian symbols that are symmetrical<br>E.g. 'Gye Nyame' symbol.<br><br>identify special triangles in some Ghanaian symbols. |
| | 1.7.5 state and use the relationship between the hypotenuse and the two other sides of a right-angled triangle (i.e. Pythagoras theorem) | Right–angled triangle | Guide students to use practical activities, including the use of the geoboard to identify the right-angled triangle and discover the relationship between the hypotenuse and the other two sides.<br><br>  <br><br>$c^2 = a^2 + b^2$<br><br>Guide students to use the Pythagoras theorem to find the missing side of given right–angled triangle when two sides are given. | solve problems involving the application of the Pythagoras theorem.<br><br>The vertices are P(1, 2), Q(4, 6) and R(- 4,12)<br><br>Show whether or not the triangle PQR is a right-angled triangle. |

<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 1.7 (CONT'D)<br><br>PLANE GEOMETRY<br><br><br><br><br><br><br><br><br>I</td><td>The student will be able to:<br><br>1.7.6 state and use the properties of quadrilaterals<br><br><br><br><br><br><br><br>1.7.7 calculate the sums of interior angles and exterior angles of a polygon<br><br><br><br><br><br><br><br><br><br><br><br><br>1.7.8 identify various plane shapes (including the special triangles) by their geometric properties -</td><td><br><br>Quadrilaterals<br><br><br><br><br><br><br><br><br><br>Polygons</td><td><br><br>Guide students to use cut-out shapes and fold to establish congruent sides, congruent angles and, lines of symmetry of quadrilaterals such as parallelograms, kites, rectangles, etc.<br><br>Guide students to use the idea of sets to sort shapes with common properties.<br>A. E.g. Given that P = {parallelograms}, Q = {quadrilaterals with all sides equal} and R = {rectangles}. If P, Q and R are subsets of the set U = {kite, square, rectangle, rhombus}. What is P∩Q?<br><br>Guide students to establish the relation between the number of sides and the number of triangles in any polygon with 'n' sides.<br><br>Assist students to complete the table below.<br><table><tr><th rowspan="2">Polygon</th><th colspan="2">Number of</th><th rowspan="2">Sum of Angles</th></tr><tr><th>Sides</th><th>Triangles</th></tr><tr><td>Triangle</td><td>3</td><td>1</td><td>180º</td></tr><tr><td>Quadrilateral</td><td>4</td><td>2</td><td>360º</td></tr><tr><td>Pentagon</td><td></td><td></td><td></td></tr><tr><td>Hexagon</td><td></td><td>.</td><td>.</td></tr><tr><td>.</td><td>.</td><td>.</td><td>.</td></tr><tr><td>.</td><td></td><td></td><td></td></tr><tr><td>.</td><td>.</td><td></td><td></td></tr><tr><td>n-sided polygon</td><td>n</td><td></td><td></td></tr></table><br>Guide them to use their results to find the formula for finding the sum of the interior angles of a regular polygon; i.e. sum of angles = $(n - 2)180^{\circ}$<br><br>Guide students to perform activities to find the sum of the exterior angles of a regular polygon.</td><td>Let students:<br><br>find the number of lines of symmetry of given quadrilaterals.<br>E.g. Rhombus<br>Parallelogram, etc.<br><br>Is the statement "square ∈ (P∪Q∪R)" true?<br><br><br><br><br><br><br><br>calculate the sum of interior angles of given polygon<br><br><br><br><br><br><br><br><br><br><br><br><br>find an interior or exterior angle of a polygon using the ideas of the sum of interior angles and exterior angles of a regular polygon.</td></tr>
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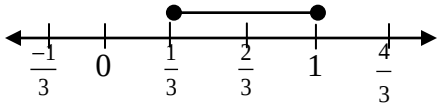
| UNIT | SPECIFIC OBJECTIVES | CONTENT | TEACHING AND LEARNING ACTIVITIES | EVALUATION |
|---|---|---|---|---|
| **UNIT 1.8 FORMULARS, LINEAR EQUATIONS AND INEQUALITIES** | The student will be able to: | | | Let students |
| | 1.8.1 construct a formula (or algebraic expression) for a given mathematical task. | Formula | Guide students to construct a formula for a given mathematical task. E.g. Aku has *y* cedis more than Baku, if Baku has *x* cedis, then Aku has (x + y) cedis. | construct a formula for a given mathematical task, E.g. Aku has y mangoes more than Baku. If Baku has x mangoes, how many do they have altogether? |
| | 1.8.2 change the subject of formula | Change of subject of an equation | Guide students to find one variable in terms of the others in a relation. | make a variable the subject of a given formula E.g. Make r the subject of the formula $V = \frac{1}{3}\pi r^2 h$ . |
| | 1.8.3 find solution sets for linear equations in one variable. | Solution sets of linear equations in one variable | Guide students to find solution sets of given linear equations in one variable E.g. $\frac{5x-2}{3} = \frac{3x+2}{2}$ T = {x : x =10} | find the truth sets of linear equations in one variable. |
| | | Word problems involving linear equations in one variable | Guide students to solve word problems involving linear equations in one variable. | solve word problems involving linear equations in one variable. |
| | 1.8.4 solve word problems involving linear equations in one variable | Linear inequalities in one variable | Find and illustrate truth sets of linear inequalities in one variable on the number line. E.g. $0 \leq 3x - 1 \leq 2$ $\frac{1}{3} \leq x \leq 1$   | solve problems involving linear inequalities in one variable and show the solution on the number line. |
| | 1.8.6 solve word problems involving linear inequalities in one variable | Word problems involving linear inequalities in one variable | Guide students to solve word problems involving linear inequalities in one variable | solve real life problems involving linear inequalities |

| UNIT | SPECIFIC OBJECTIVES | CONTENT | TEACHING AND LEARNING ACTIVITIES | EVALUATION |
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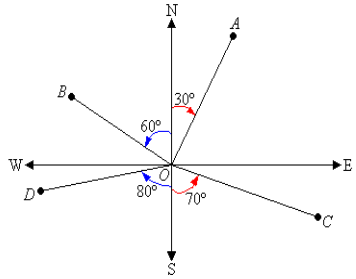
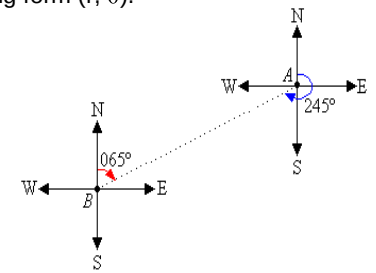
| **UNIT 1.9**<br><br>**BEARINGS AND VECTORS IN A PLANE** | The student will be able to:<br><br>1.9.1 interpret bearing as direction of one point from another. | Bearing of a point from another. | Guide students to state the bearing of a point from a given point. For example, in the figure the bearing of A from O is B is 300º.<br><br>Guide students to state direction to a point in number of degrees east or west of north or south. For example, in the figure the direction of A from O is N30ºE; B is N60ºW from O; and C is S70ºE from O.<br>  <br> | Let students:<br><br>record angle measure in 3-digits.<br><br>Find the direction of D from O. |
| | 1.9.2 write the distance and bearing of one point from another as (r, θ). | Distance-bearing form | Guide students to deduce and write the bearing of one point from another in the distance-bearing form (r, θ).<br>  <br><br>E.g. the distance and bearing of A from B is (5cm, 065º). | find the bearing of a point C from A, given the bearing of B from A and the bearing of C from B. |

| UNIT | SPECIFIC OBJECTIVES | CONTENT | TEACHING AND LEARNING ACTIVITIES | EVALUATION |
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| **UNIT 1.9 (CONTD)** | The student will be able to: | | | Let students: |
| **BEARINGS AND VECTORS IN A PLANE** | 1.9.3 find the bearing of a point A from another point B, given the bearing of B from A. | Reverse bearing | Assist students to deduce reverse bearings i.e. if B is $\theta^o$ from A, then A is<br>(i) $(180 + \theta)^0$ from B for $0^0 < \theta < 180^0$<br>(ii) $(\theta - 180)^0$ from B for $180^0 < \theta < 360^0$<br>E.g. the reverse bearing of bearing of B from A is $245^o$ | find the bearing of one point from another, given the reverse bearing. |
| | 1.9.4 distinguish between scalar and vector quantities | Scalar and vector quantities | Guide students to use diagrams to illustrate the idea of scalar and vector quantities. | distinguish between scalar and vector quantities |
| | 1.9.5 represent vectors in various forms | Vector notation and representation | Guide students to identify the following:<br>(a) free vector notation; **a**, **u**, etc.<br>(b) position vector notation; $\overrightarrow{OP}$ , $\overrightarrow{OB}$ , etc.<br>(c) representation of vectors in component form $\begin{pmatrix} x \\ y \end{pmatrix}$<br>(d) in bearing-magnitude form $(r, \theta^0)$ | express given vectors with the appropriate notations |
| | 1.9.6 add and subtract vectors, | Addition and subtraction of vectors | Guide students to add and subtract vectors. E.g.<br>(a) $\begin{pmatrix} x_1 \\ y_1 \end{pmatrix} + \begin{pmatrix} x_2 \\ y_2 \end{pmatrix} = \begin{pmatrix} x_1 + x_2 \\ y_1 + y_2 \end{pmatrix}$<br>(b) $\begin{pmatrix} x_1 \\ y_1 \end{pmatrix} - \begin{pmatrix} x_2 \\ y_2 \end{pmatrix} = \begin{pmatrix} x_1 - x_2 \\ y_1 - y_2 \end{pmatrix}$ | find the sum and difference of given vectors |
| | 1.9.7 multiply a vector by a scalar | Multiplying a vector by a scalar | Guide students to multiply a vector by a scalar k.<br>E.g. $k\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} kx \\ ky \end{pmatrix}$ | multiply given vectors by given scalars |

| UNIT | SPECIFIC OBJECTIVES | CONTENT | TEACHING AND LEARNING ACTIVITIES | EVALUATION |
|---|---|---|---|---|
| **UNIT 1.9 (CONTD)** | The students will be able to: | | | Let students |
| **BEARINGS AND VECTORS IN A PLANE** | 1.9.8 express the components of a vector in column form | Column vectors | Guide students to use graph to determine components of vectors in column form for given coordinates<br>E.g. A ($x_1$, $y_1$) and B ($x_2$ , $y_2$) in the Oxy plane;<br>(a) $\overrightarrow{OA}=\begin{pmatrix}x_1\\y_1\end{pmatrix},\overrightarrow{OB}=\begin{pmatrix}x_2\\y_2\end{pmatrix}$<br>(b) $\overrightarrow{AB}=\begin{pmatrix}x_2-x_1\\y_2-y_1\end{pmatrix}$ | find the vector AB given coordinates of A and B<br>find the coordinates of B, given the vector AB and the coordinates of A.<br>find the diagonals of a quadrilateral ABCD in vector component form, given the coordinates of the vertices |
| | 1.9.9 add two vectors using the triangle law of vector addition. | Triangle law of vectors | Using graphs guide students to deduce the triangle law of vectors addition.<br>i.e. $\overrightarrow{AB} + \overrightarrow{BC} = \overrightarrow{AC}$ where A, B and C are points in the Oxy plane. | add two given vectors |
| | 1.9.10 state the conditions for two vectors to be equal or parallel | Equal and Parallel vectors | Assist students to establish conditions for vectors to be equal or parallel :<br>i.e. If. $\begin{pmatrix}x_1\\y_1\end{pmatrix}=\begin{pmatrix}x_2\\y_2\end{pmatrix}$ , then $x_1 = x_2$ and $y_1 = y_2$ .<br>If $\begin{pmatrix}x_1\\y_1\end{pmatrix}$ is parallel to $\begin{pmatrix}x_2\\y_2\end{pmatrix}$ then<br>$\begin{pmatrix}x_1\\y_1\end{pmatrix}=k\begin{pmatrix}x_2\\y_2\end{pmatrix}$, where k is a scalar. | use the idea of equal and parallel vectors to solve related problems |

| UNIT | SPECIFIC OBJECTIVES | CONTENT | TEACHING AND LEARNING ACTIVITIES | EVALUATION |
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| **UNIT 1.9 (CONTD)**<br><br>**BEARINGS AND VECTORS IN A PLANE** | 1.9.11 find the negative vector of a given vector<br>. | Negative vectors | Assist students to find the negative vector of a given vector. E.g. the negative vector of<br>$\vec{AB} = \begin{pmatrix} -3 \\ 2 \end{pmatrix}$ is $-\overrightarrow{AB} = \vec{BA} = \begin{pmatrix} 3 \\ -2 \end{pmatrix}$ | find negative vectors of given vectors in component form |
| | 1.9.12 find the magnitude and direction of a vector. | Magnitude and direction of a vector | Guide students to find the magnitude and direction of a given vector.<br>i.e. if $\vec{AB} = \begin{pmatrix} x \\ y \end{pmatrix}$, then $\lvert \vec{AB} \rvert = \sqrt{x^2 + y^2}$<br>and direction is given by $\theta = \tan^{-1}\left(\frac{Y}{X}\right)$ | find the magnitude and direction of given vectors. |
| **UNIT 1.10**<br><br>**STATISTICS I** | 1.10.1 organise data in frequency tables (i.e. ungrouped and grouped) | Frequency distribution tables | Guide students to identify situations and problems for data collection, and state appropriate methods for the collection of the data.<br><br>Guide students to prepare frequency tables for grouped and ungrouped data.<br>(exclude unequal class intervals) | construct frequency tables for grouped and ungrouped data. |
| | 1.10.2 read, interpret, and draw simple inferences from, data/information presented in tables | Data presented in tables | Assist students to interpret data/information presented in tables. E.g. mileage chart. league tables, etc.<br><br>Guide students to draw simple inferences from tabular data. | Interpret and draw simple inferences from tabular data |

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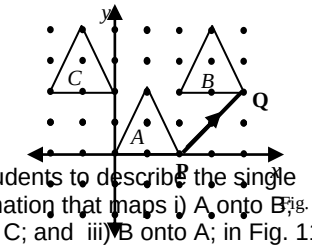
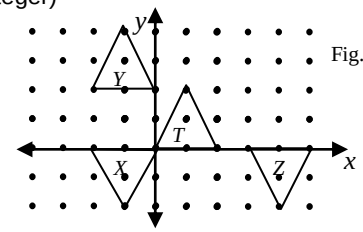
|---|---|---|---|---|
| **UNIT 1.10 (CONTD)**<br><br>**STATISTICS I** | The student will be able to:<br><br>1.10.3 represent data on a suitable graph and interpret given graphs | Graphical representation of data. | Guide students to use appropriate graph to represent data from real life situations like test scores, rainfall, health records, imports, exports etc.<br>Note Use pie charts and bar charts for ungrouped data and histograms for grouped data.<br><br>Encourage students to use computer to do these charts. | Let students<br><br>represent data in frequency tables on suitable charts |
| | 1.10.5 calculate the mean using appropriate formula | Mean of a distribution.<br><br>. | Assist students to interpret given graphs<br><br>Assist students to calculate the mean using the formulae:<br>(i) $\bar{x} = \frac{\sum x}{n}$ for ungrouped data<br>(ii) $\bar{x} = \frac{\sum fx}{\sum f}$ for grouped data.<br><br>Encourage students to use calculator or computer to check their results. | calculate the mean of a given data using the appropriate formula |

| UNIT | SPECIFIC OBJECTIVES | CONTENT | TEACHING AND LEARNING ACTIVITIES | EVALUATION |
|---|---|---|---|---|
| **UNIT 1.11**<br>**RIGID MOTION I** | 1.11.1. identify and translate an object or point by a translating vector and describe the image | Translation by a vector. | Guide students to identify translation vectors and recongnise that the vector in Fig. 11.1 is $\vec{PQ}=\begin{pmatrix}2\\2\end{pmatrix}$<br>  <br><br>Fig. 11.1<br>Assist students to describe the single transformation that maps i) A onto B; ii) A onto C; and iii) B onto A; in Fig. 11.1 | describe in Fig. 11.1 the single transformation that maps B onto C |
| | | | Assist students to translate points and plane figures by given vectors. | translate plane figures and points by given vectors and state the image points |
| | 1.11.2 identify and explain the reflection of an object in a mirror line | Reflection in a line. | Guide students to identify some Ghanaian (or adinkra) symbols that have translation transformation | |
| | | | Guide students to identify lines of reflection (mirror line) and state their equations (limit line to x=k; y=k and y=kx; where k is an integer)<br>  <br><br>Fig. 11.2<br>Describe the single transformation that maps T onto X; X onto Y; and X onto Z. | Draw in Fig. 11.2 the image of Y under the transformation 'reflection in the line y=x'.<br><br>describe in Fig. 11.2 the two transformations that map Y onto Z; |

| UNIT | SPECIFIC OBJECTIVES | CONTENT | TEACHING AND LEARNING ACTIVITIES | EVALUATION |
|---|---|---|---|---|
| **UNIT 1.11 (CONTD)** | The student will be able to: | | | Let students |
| **RIGID MOTION** | 1.11.3 describe the image points of shapes in a reflection | Characteristics of reflection | Assist students to draw shapes on graph sheets and find their images under reflections in given mirror lines.<br><br>Assist students to discuss the characteristics - size, orientation, angles, etc. - of reflection | draw images of geometric shapes under reflection in given mirror lines and state the points |
| **UNIT 1.12**<br><br>**RATIO AND RATES** | 1.12.1 divide a quantity in a given ratio. | Ratio | Guide students to revise the idea of ratio by finding how many times one quantity is of the other.<br>E.g. 7 and 21 are in the ratio 1 : 3<br><br>Assist students to share given quantities in given ratios.<br>E.g. Share GH ¢2.5m in the ratio 3 : 2. | solve word problems involving division of quantities in given ratios |
| | 1.12.2 interpret scales used in drawing plans and maps and use them to calculate distances between two points | Scales | Guide students to examine maps, plans and topographical sheets and identify the scales used.<br>E.g. a scale of 1:125000 means 1cm on the map represents 125000 cm on the ground. | draw plans of given places and shapes<br><br>find actual distances between two points on a map for a given scale |
| | 1.12.3 convert foreign currencies into Ghana cedis and vice versa | Foreign exchange | Guide students to use given scales to draw plans of given areas in the locality or in the school and let them draw geometric shapes using scales.<br><br>Guide students to use rates obtained from Forex Bureau or banks to convert given amounts in foreign currencies to Ghana cedis and vice versa.<br>E.g. If $1 = GH ¢1.44, express $25.60 in cedis | convert given amounts of foreign currencies into Ghana cedis and vice versa |

| UNIT | SPECIFIC OBJECTIVES | CONTENT | TEACHING AND LEARNING ACTIVITIES | EVALUATION |
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| **UNIT 1.12 (CONT'D)** | The student will be able to: | | | Let students |
| **RATIO AND RATES** | 1.12.4 explain and use common rates such as $kmh^{-1}$, $ms^{-1}$ and those used in utility bills | Rates | Guide students to solve problems involving rates. E.g. speed, wages and salaries<br><br>Guide students with samples to study population charts to explain the idea of rates. | solve practical problems involving rates - salaries, wages, overtime and piece-rate |
| | 1.12.5 draw travel graphs and interpret them. | Travel Graphs. | Guide students to draw a distance–time graph from a given data and use it to calculate average speed, total distance traveled, total time taken, etc. | draw distance-time graphs for a given data and interpret. |
| | 1.12.6 calculate and compare population densities | Population Density. | Assist students to calculate population density as population per square kilometer (collect data from statistical service department or the internet). | calculate and compare population densities in urban and rural areas |

| UNIT | SPECIFIC OBJECTIVES | CONTENT | TEACHING AND LEARNING ACTIVITIES | EVALUATION |
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| | The student will be able to: | | | Let students: |
| **UNIT 1.13** | | | | |
| **PERCENTAGES I** | 1.13.1 compare two amounts or quantities by expressing one as a percentage of the other. | Comparison by percentages | Assist students to express one quantity as percentage of another.<br><br>Guide students to calculate percentage increase or decrease on prices of goods and services. | calculate the value of one quantity as a percentage of another. |
| | 1.13.2 do money–making calculations that apply percentages. | Discount, Commission, Simple Interest. | Guide students to calculate discount as money saved on goods bought and commission as money earned in a transaction.<br><br>Assist students to calculate the price of goods when discount and commission are given.<br><br>Guide students to use current bank rates to calculate interests on savings and loans | solve problems involving discount and commission. |
| | 1.13.3 Do money-spending calculations that apply hire purchase. | Hire Purchase. | Guide students to explain and perform calculations involving hire purchase.<br><br>NB: the use of calculator to check computation should be encouraged | work out hire purchase payments over given periods |

# SENIOR HIGH SCHOOL 2

| UNIT | SPECIFIC OBJECTIVES | CONTENT | TEACHING AND LEARNING ACTIVITIES | EVALUATION |
|---|---|---|---|---|
| **UNIT 2.1** | The student will be able to: | | | Let students: |
| **MODULAR ARITHMETIC** | 2.1.1 calculate the value of numbers for a given modulo. | Calculation of a number for a given modulo. | Guide students to use the clock face to determine the modulus of a number.<br><br>Use the idea of remainders to assist students to determine the modulo of a number.<br>E.g. 27 = 2 mod 5<br>8 = 2 mod 6 | calculate the value of numbers for a given modulo. |
| | 2.1.2 add and multiply numbers in a given modulo. | Addition (⊕) and multiplication(⊗) tables in given modulo. | Guide students to construct addition ⊕ and multiplication (⊗) tables in a given modulo. | find the sum and product of any two given numbers in given modulo<br><br>construct addition (⊕) and multiplication (⊗) tables in given modulo; use the tables to find the truth sets of statements |

| UNIT | SPECIFIC OBJECTIVES | CONTENT | TEACHING AND LEARNING ACTIVITIES | EVALUATION |
|---|---|---|---|---|
| **UNIT 2.2**<br><br>**INDICES AND LOGARITHMS** | The student will be able to: | | | Let students: |
| | 2.2.1 write in exponent form the repeated factors of a number | Laws of indices. | Revise with students the first two laws of indices<br>i.e. $a^x \times a^y = a^{(x+y)}$<br>$a^x \div a^y = a^{(x-y)}$<br><br>Guide students to discover further rules governing indices<br>i.e. $(a^m)^n = a^{mn}$<br>$a^{-m} = \frac{1}{a^m}$<br>$a^{\frac{m}{n}} = \sqrt[n]{a^m}$<br><br>Guide students to deduce the value for a non-zero number with zero exponent<br>i.e. $a^o = 1$ | solve problems involving repeated factors |
| | 2.2.2 solve equations involving indices. | Solving equations involving indices. | Assist students to solve simple equations involving indices.<br><br>E.g. $8^x = 32$<br>$2^{3x} = 2^5$<br>$3x = 5$<br>$x = \frac{5}{3}$ | solve equations involving indices. |

| UNIT | SPECIFIC OBJECTIVES | CONTENT | TEACHING AND LEARNING ACTIVITIES | EVALUATION |
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| **2.2 (CONT'D) INDICES AND LOGARITHMS** | The student will be able to:<br>2.2.3 relate indices to logarithms in base ten. | Relating indices to logarithms in base ten | Guide students to express given numbers as powers of 10.<br>E.g. $100 = 10^2$<br>$10{,}000 = 10^4$ | Let students:<br>write an expression in indices using logarithm<br>E.g. $x = 10^y \Rightarrow \log_{10} x = y$ |
| | 2.2.4 deduce the rules of logarithms and apply them. | Rules of logarithms and their applications | Guide students to identify the relation between indices and logarithms.<br>i.e. $x = 10^n \Leftrightarrow \log_{10} x = n$<br>Guide students to discover the rules of logarithms.<br>E.g. $\log_{10}(A \times B) = \log_{10} A + \log_{10} B$<br>$\log_{10} \frac{A}{B} = \log_{10} A - \log_{10} B$<br>$\log_{10} A^x = x \log_{10} A$<br>Assist students to use the rules to simplify logarithmic expressions and solve problems. | use the rules to solve logarithmic problems. |
| **UNIT 2.2 (CONT'D)**<br>**INDICES AND LOGARITHMS** | 2.2.5 find the anti-logarithm of a given number. | Anti-logarithms of given numbers. | Guide students to explain anti-logarithm of a given number<br>i.e. if the log of 2 in base 10, (i.e. $\log_{10}2$) is 0.3010, then the antilog of 0.3010 in base 10, (i.e. $\text{antilog}_{10} 0.3010 = 10^{0.3010} = 2$).<br>Assist students to read the anti-logarithm of given numbers using<br>(i) tables<br>(ii) calculators | find the anti-logarithms of given numbers using tables and calculators. |

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| **UNIT 2.3**<br><br>**SIMULTANEOUS LINEAR EQUATION** | The student will be able to:<br><br>2.3.1 use graphical method to find solution sets of two given linear equations in two variables | Graphical method for solving linear equations in two variables | Guide students to use the graphical method to find the solution sets of two linear equations in two variables; E.g.<br>(I) $2x + 5y = 10$<br>$x = 4$<br>(II) $2x + 5y = 10$<br>$y = 3$<br>(III) $2x + 5y = 10$<br>$x - 2y = 4$ | Let students<br><br>use graphical method to find the solution set of two linear equations in two variables |
| | 2.3.2 use elimination and substitution methods to find solution sets of two given linear equations in two variables | Elimination and substitution methods for solving linear equations in two variables | Guide students to find the solution set of pairs of linear equations in two variables using<br>(i) the elimination method and<br>(ii) the substitution method. | find the solution set of two linear equations in two variables |
| | 2.3.3 solve word problems involving simultaneous linear equations | Solving word problems involving simultaneous linear equations in two variables | Pose word problems involving simultaneous linear equations in two variables for students to solve.<br>E.g. A family of three adults and two children paid GH₵8.00 for a journey. Another family of four adults and three children paid GH₵11.00 as the fare for the same journey. Calculate the fare for<br>(i) an adult<br>(ii) a child<br>(iii) a family of four adults and five children | solve word problems involving simultaneous linear equations |

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| **UNIT 2.4**<br><br>**PERCENTAGES II** | The student will be able to:<br><br>2.4.1 solve real life problems involving compound interest | Compound interest for a given period. (up to 4 years) | Guide the students to revise simple interest and other applications of percentages with students<br><br>Guide students to calculate compound interest of any given amount. (formula is accepted but not required) | Let students:<br><br>calculate the compound interest on a given amount for a given number of years |
| | 2.4.2 determine the depreciation of an item over a specified period | Depreciation. | Discuss with students examples of things that lose their values with passage of time. E.g. cars, fridges( i.e. depreciated assets)<br><br>Calculate the depreciation of an item for a given period.<br><br>Use of a calculator or a computer to check computation should be encouraged<br><br>**Note** Formula is accepted but not required | solve practical problems:<br>E.g.<br>A car bought for GH¢5000.00 depreciates at 10% per annum. Calculate the value after 4 years. |

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| **UNIT 2.4 (CONT'D)**<br><br>**PERCENTAGES II** | The student will be able to: | | | Let students: |
| | 2.4.3 identify business partnerships and the way they function. | Financial Partnership | Guide students to discover how partnership businesses are formed between two or more persons. i.e. equal capital and by ratio. | list different forms of business partnerships |
| | 2.4.4 calculate and share interest or profit in a given ratio. | Interest (Profit) on capital. | Guide students to calculate profits shared at the end of a given period in the ratios of their initial capitals. | calculate profit(s) in a given ratio |
| | 2.4.5 calculate interest on savings and loans. | Banking | Assist students to discover the typical transactions, services provided and bank charges; e.g.<br>– savings/loans<br>– treasury bill/fixed deposit<br>– bank transfers<br>– cot; etc. | describe different types of transactions done at the banks |
| | | | Guide students to identify specimen copies of forms used in bank transactions and assist students to fill them; e.g.<br>– payment cheques and<br>– pay-in-slips. | complete specimens of pay-in-slip and cheques |
| | | | Guide students to calculate interest on savings and loans with current interest rates. | calculate simple interest on a given amount of savings/loans |

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| **UNIT 2.4 (CONT'D)**<br><br>**PERCENTAGES II** | The student will be able to: | | | Let students: |
| | 2.4.6 calculate taxes paid on goods and services. | Income Tax | Guide students to identify the government agencies responsible for collecting income taxes.<br><br>NB.: Encourage students to appreciate the need for people to pay taxes.<br><br>Assist students to calculate income tax using a given tax schedule. | calculate the income tax for a given income. |
| | 2.4.7 calculate and explain the value added tax. (VAT) | Value Added Tax (VAT) | Assist students to identify some goods and services that attract VAT and calculate the VAT on them. | find the VAT on a bill for services or sales |
| | 2.4.8 calculate electricity, water and telephone bills. | Household bills | Guide students to identify the various household bills such as electricity bills, water bills and telephone bills.<br><br>Assist students with samples to use the Public Utility Regulatory Committee Approved Tariffs to calculate water and electricity bills.<br><br>**Note:** Emphasize the need for students to be prudent in the use of these utilities. | calculate the total bill paid by a household at the end of the month at a given rate |

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| **UNIT 2.5**<br><br>**VARIATION** | The student will be able to: | | | Let students: |
| | 2.5.1 write direct variations in symbols for given proportional relations | Direct variation | Guide students to express direct variations in symbols for the proportional relations.<br><br>Number (**n**) \| 1 \| 2 \| 3 \| 10 \| 25<br>Cost (**c**) \| 3p \| 6p \| 9p \| 30p \| 75p<br><br>E.g. In the table the variation relation between the number of items (n) and cost (c) is<br>$c \propto n \Rightarrow c = kn$<br>where k is the constant of variation. | use symbols to write mathematical statements for direct variations |
| | 2.5.2 solve problems involving direct variation. | Solving problems involving direct variations | Guide students to solve problems involving direct variations. | solve everyday life problems involving direct variations |
| | 2.5.3 solve problems involving indirect variations | Indirect variations (inverse variations) | Assist students to<br>(i) express word problems involving inverse variation in mathematical symbols<br>E.g. **p** varies inversely as **t** written as<br>$p \propto \frac{1}{t} \Rightarrow p = \frac{k}{t}$<br>(ii) solve problems involving inverse (indirect) variation | write word problems involving indirect variations in mathematical symbols and solve them |
| | 2.5.4 solve problems involving joint variations. | Solving problems involving joint variations. | Assist students to solve real life problems involving joint variations.<br>$p \propto \frac{x}{y} \Rightarrow p = \frac{kx}{y}$ | solve word problems involving joint variations. |

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| **2.5 (CONT'D)**<br><br>**VARIATION** | The student will be able to:<br><br>2.5.5 solve problems involving partial variations. | Partial variations. | Guide students to recognise partial variation.<br><br>Guide students to write an equation involving partial variation.<br>E.g. y is partly constant and partly varies inversely as *t* is written as<br>$y = k + \frac{c}{t}$<br>where k and c are constants<br><br>Guide students to solve problems involving partial variations. | Let students:<br><br>solve problems involving partial variations. |
| **UNIT 2.6**<br><br>**STATISTICS II** | 2.6.1 draw a histogram for given data | Histogram | Guide students to revise the drawing of frequency table for ungrouped and grouped data; use it to draw histogram and estimate the mode from the histogram.<br>(Restrict to groups of equal intervals). | represent a given data by a histogram<br><br>estimate the mode from a histogram |
| | 2.6.2 calculate the mean of a given data | Mean | Guide students to find the mean of ungrouped and grouped data using;<br>$\bar{x} = \frac{\sum x}{n}$<br>and<br>$\bar{x} = \frac{\sum fx}{\sum f}$ respectively<br>where *x* is the class mid-point (in case of grouped data)<br><br>(accept assumed mean method but not required) | calculate mean of given data<br><br>. |

| UNIT | SPECIFIC OBJECTIVES | CONTENT | TEACHING AND LEARNING ACTIVITIES | EVALUATION |
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| **UNIT 2.6 (CONT'D)**<br><br>**STATISTICS II** | The student will be able to:<br><br>2.6.3 draw cumulative frequency curves (Ogive) and interpret them. | Cumulative Frequency Curves (Ogive). | Guide students to draw cumulative frequency curves using data and use the curves to estimate:<br><br>(i) lower and upper quartiles;<br>(ii) median;<br>(iii) deciles and percentiles, etc | Let students:<br><br>draw a cumulative frequency curve and use it to estimate;<br><br>(i) lower and upper quartiles;<br>(ii) median;<br>(iii) given deciles and percentiles; |
| | 2.6.4 calculate and interpret standard deviation and variance of ungrouped data. | Standard deviation and Variance | Guide students to calculate and interpret standard deviation and variance of an ungrouped data.<br><br>Eg method of ungrouped data<br>Sd = $\sqrt{\frac{\sum (x - \bar{x})^2}{n}}$<br>Variance = $(Sd)^2$<br><br>E.g.<br>The scores from an English test are: 30, 50, 70, 76, 26, 60, 42, 38, 92, and 49, with $\bar{x}$ = 53.3: Sd = 21.1<br>The scores from a Mathematics test are: 80, 48, 60, 40, 32, 54, 62, 31, 86 and 55, with $\bar{x}$ = 53.0 and Sd = 15.7<br>Therefore, English scores are more spread around the mean.<br><br>Encourage **s**tudents to use spreadsheet or computers to draw graphs and calculate mean, mode, median and standard deviation and compare with their own results. | calculate and interpret standard deviation and variance |

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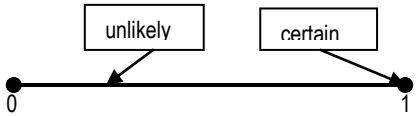
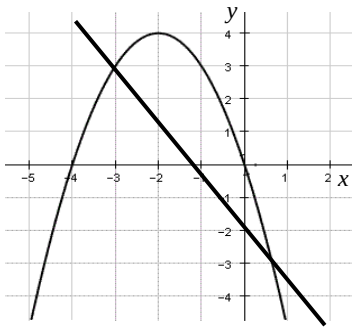
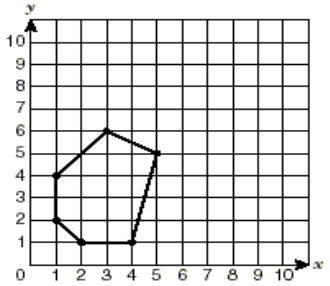
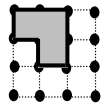
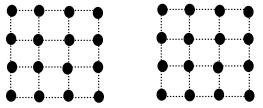
| **UNIT 2.7**<br><br>**PROBABILITY** | The student will be able to: | | | Let students: |
| | 2.7.1 determine the sample space of a simple experiment. | Sample Space of simple experiments | Guide students to perform simple experiments such as tossing a coin once, throwing a die once, etc. and list the sample spaces as the set of all possible outcomes, E.g. sample space for throwing a die once is S = {1, 2, 3, 4, 5, 6} | make a list of all possible outcomes of a simple experiment |
| | 2.7.2 determine the sample space of a compound experiment. | Sample Space of compound experiment. | Guide students to perform compound experiments such as tossing two coins, tossing a coin and throwing a die, etc. and list the sample spaces. | make a list of all possible outcomes of a compound experiment |
| | 2.7.3 calculate the probability of an event | Probability of an event | Assist students to calculate the probability of an event; i.e. $P(E) = \frac{n(E)}{n(S)}$<br><br>Guide students to establish the following facts: P(S) = 1; P(ϕ) = 0; 0 ≤ P(A) ≤ 1; $P(A^{/}) = 1 - P(A)$<br><br>Assist students to put probability vocabulary in order of likeliness on a probability scale – impossible, likely, unlikely, equally likely, certain, very likely etc.<br>  | calculate the probability of given events<br><br>estimate the probability of given events/statements and place these on a probability scale<br>E.g.<br>i) The day after Monday will be Tuesday<br>ii) A new born baby will be a girl |
| | 2.7.4 interpret '***or***' in probability as addition. | Addition law for mutually exclusive events. | Guide students to realize that mutually exclusive events do not have anything in common.<br>i.e. P(A or B) = P(A) + P(B) | apply the addition law to calculate probabilities of mutually exclusive events |
| | 2.7.5 interpret '***and'*** in probability as multiplication. | Multiplication law for independent events. | Guide students to realize that for two independent events, the probability of event A and event B happening together is<br>P(A and B) = P(A) x P(B) | apply the multiplication law to calculate the probability of independent events |

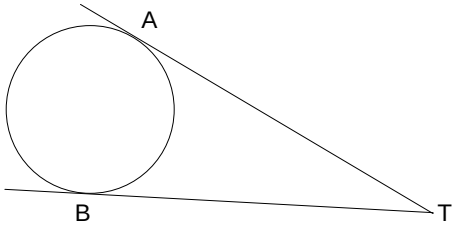
| UNIT | SPECIFIC OBJECTIVES | CONTENT | TEACHING AND LEARNING ACTIVITIES | EVALUATION |
|---|---|---|---|---|
| **UNIT 2.8**<br><br>**QUADRATIC FUNCTIONS AND EQUATIONS** | The student will be able to:<br><br>2.8.1 identify and solve quadratic equations by factorization | Solving quadratic equations by factorization | Guide students to solve quadratic equations by factorization.<br>E.g. for the truth set of $2x^2 + 5x - 12 = 0$,<br>$(x + 4)(2x - 3) = 0$<br>$T = \{x : x = -4, \frac{3}{2}\}$ | Let students:<br><br>solve given quadratic equations by factorization. |
| | 2.8.2 identify and solve quadratic equations by graphical method | Graphical solution of quadratic equations | Guide students to complete tables of values for given quadratic functions and draw graphs of the functions on graph sheets.<br><br>Assist students to find the truth sets of quadratic equations from graphs. | solve given quadratic equations graphically. |
| | 2.8.3 find the minimum and maximum values and points from graphs. | Minimum and maximum values and points of quadratic graphs. | Guide students to find the maximum and minimum values from graphs and state the coordinates of the points where these occurs | find and state the maximum/minimum points and values of graphs they draw. |
| | 2.8.4 identify the line of symmetry and write its equation. | Equation of line of symmetry. | Assist students to establish that the quadratic graph is symmetrical about a vertical line and write its equation as $x = k$, where k is a real number. | find the line of symmetry from a quadratic graph and write its equation |

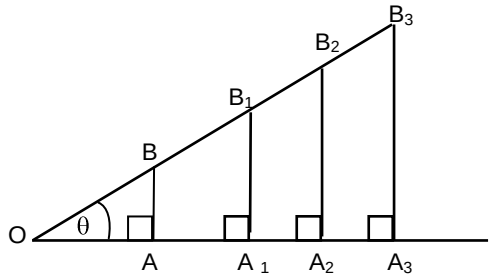
| UNIT | SPECIFIC OBJECTIVES | CONTENT | TEACHING AND LEARNING ACTIVITIES | EVALUATION |
|---|---|---|---|---|
| **UNIT 2.8 (CONTD)** | The student will be able to: | | | Let students: |
| **QUADRATIC FUNCTIONS AND EQUATIONS** | 2.8.5 solve simultaneous equations involving one linear and one quadratic using graphs | Solving linear and quadratic equations using graphs. | Guide students to solve simultaneous equations, one linear, one quadratic by drawing the two graphs on the same axes.<br>  <br><br>Encourage the use of computers to investigate the shapes of quadratic graphs as the values of the constants change. | find on the graph the values of x and y which satisfy the two equations simultaneously. |
| . | 2.8.6 use quadratic graph to solve related equations | Solving related quadratic equations | Assist students to solve related equations using the quadratic graph;<br>i.e. use the graph of $y = ax^2 + bx + c$ to solve $ax^2 + dx + k = 0$ where a, b, c, d and k are constants. | use graph of $y = ax^2 + bx + c$ to solve $ax^2 + dx + k = 0$ for various values of k |
| | 2.8.7 find the range of values of x for which y is increasing or decreasing. | Increasing/Decreasing values of quadratic graphs. | Assist students to determine the range of values of x for which the graph is increasing or decreasing. | find the range of values of x for which a given graph is increasing or decreasing. |
| | 2.8.8 find the range of values of x for which y is positive or negative | Positive/Negative values of quadratic graph. | Guide students to determine the range of values of x for which a quadratic graph is positive or negative. (i.e. above or below the x-axis). | find the range of values of x for which y is positive or negative. |

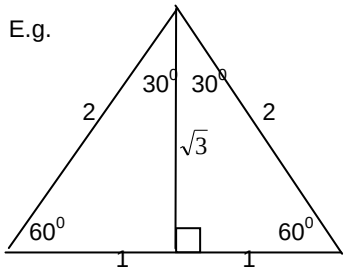
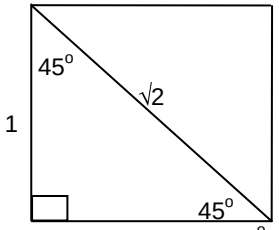
| UNIT | SPECIFIC OBJECTIVES | CONTENT | TEACHING AND LEARNING ACTIVITIES | EVALUATION |
|---|---|---|---|---|
| **UNIT 2.9**<br><br>**MENSURATION I** | The student will be able to:<br><br>2.9.1 find the length of an arc of a circle | Length of an arc. | Revise parts of the circle with students.<br><br>Guide students to deduce the formula for the length of an arc of a circle.<br><br>i.e. $\frac{\theta}{360} \times 2\pi r$<br>where $\theta$ is the angle subtended at the centre of the circle by the arc; and<br>***r*** is the radius of the circle. | Let students:<br><br>calculate the length of arcs of given circles |
| | 2.9.2 calculate the perimeter of plane figures. | Perimeter of plane figures | Revise the perimeters of rectangles and squares with students<br><br>Guide students to deduce the formula for the perimeter of sectors i.e. $\frac{\theta}{360} \times 2\pi r + 2r$<br><br>Guide students to find the perimeter of other plane figures with various sides. | find the perimeter of given plane figures<br><br>calculate the perimeter of the shape in Figure 2.9.2 leaving your answer in surds |

| UNIT | SPECIFIC OBJECTIVES | CONTENT | TEACHING AND LEARNING ACTIVITIES | EVALUATION |
|---|---|---|---|---|
| **2.9 (CONT'D) MENSURATION I** | The student will be able to: | | | Let students: |
| | 2.9.3 calculate the areas of sectors and segments | Areas of sectors and segments. | Guide students to revise the area of a circle and triangle.<br><br>Guides students to establish the formulae for the areas of a sector and a segment.<br>i.e. Area of sector = $\frac{\theta}{360} \times \pi r^2$<br>Area of segment = (area of sector – area of triangle). | draw shapes that have the same area as another given shape in square grids.<br><br>calculate the areas of sectors and segments of given circles |
| | 2.9.4 find the areas of quadrilaterals | Areas of quadrilaterals | Guide students to find the areas of given quadrilaterals. E.g. trapezium, rhombus, etc.<br><br>Assist students to find the areas of given polygons in a grid.<br>E.g. If the squares in the coordinate plane are 1cm by 1cm, the area of the shape can be calculated by dividing the shape into quadrilaterals and triangles<br>Fig. 2.9.2  | find the areas of given quadrilaterals.<br><br>given that the area of each square in this 3 by 3 grid is 1cm$^2$,<br>i. how many triangles can be drawn having the same area as this hexagon, using the points at the corners of the squares as vertices? *[draw 3 by 3 grids and investigate]*<br>  <br>ii. which of the triangles has the largest perimeter?<br>  |

| UNIT | SPECIFIC OBJECTIVES | CONTENT | TEACHING AND LEARNING ACTIVITIES | EVALUATION |
|---|---|---|---|---|
| **UNIT 2.10** | The student will be able to: | | | Let students: |
| **PLANE GEOMETRY II (CIRCLES)** | 2.10.1 draw circles for given radii. | The Circle as a Locus. | Guide students to find all points which are a given distance from a fixed point.<br>E.g. fix a point O and find all points which are 5cm from O. | draw circles of varying radii. |
| | 2.10.2 state and use the circle theorems | Circle Theorems | Assist students to find the relationship between the angle subtended at the centre and that at the circumference by an arc.<br><br>Guide students to find the value of the angle subtended by a diameter at the circumference.<br><br>Guide students to find the relationship between opposite angles of a cyclic quadrilateral. | find missing angles using circle theorems. |
| | 2.10.3 identify the tangent as perpendicular to the radius at the point of contact. | Perpendicularity of Tangent and Radius of a Cirlce | Guide students to verify that the tangent is perpendicular to the radius at the point of contact. | construct a tangent to a circle using the property of the tangent and radius. |
| | 2.10.4 verify that the angle between the tangent and the chord at the point of contact is equal to the angle in the alternate segment. | Angle between Tangent and a Chord. | Assist students to verify the alternate angle theorem by drawing. | find missing angles using the alternate angle theorem |

| UNIT | SPECIFIC OBJECTIVES | CONTENT | TEACHING AND LEARNING ACTIVITIES | EVALUATION |
|---|---|---|---|---|
| **UNIT 2.9 (CONT'D) PLANE GEOMETRY II (CIRCLES)** | The student will be able to:<br><br>2.10.5 verify that tangents drawn from an external point to the same circle are equal when measured from their point of contact | Tangents from an External Point. | Guide students to verify that two tangents drawn from an external point, T, to a circle at points A and B are equal in length<br><br>i.e. \|AT\| = \|BT\|<br><br>  <br> | Let students:<br><br>solve for missing angles in a given diagram. |

| UNIT | SPECIFIC OBJECTIVES | CONTENT | TEACHING AND LEARNING ACTIVITIES | EVALUATION |
|---|---|---|---|---|
| **UNIT 2.11**<br><br>**TRIGONOMETRY I** | The student will be able to:<br><br>2.11.1 define and compute the tangent, sine and cosine of an acute angle in degrees. | .<br><br>Tangent, sine and cosine of acute angles. | Guide students to use appropriate diagrams to define trigonometric ratios.<br><br>E.g.<br>  <br><br>Tan θ = $\frac{AB}{OA} = \frac{A_1B_1}{OA_1} = \frac{A_2B_2}{OA_2} = \frac{A_3B_3}{OA_3}$<br><br>Sin θ = $\frac{AB}{OB} = \frac{A_1B_1}{OB_1} = \frac{A_2B_2}{OB_2} = \frac{A_3B_3}{OB_3}$<br><br>Cos θ = $\frac{OA}{OB} = \frac{OA_1}{OB_1} = \frac{OA_2}{OB_2} = \frac{OA_3}{OB_3}$<br><br>Guide students to read the values of given trigonometric ratios of acute angles from tables and calculators. | Let students:<br><br>express the tangent, sine and cosine in relation to the sides of a given acute angle in a right-angled triangle<br><br>read values of given trigonometric ratios of acute angles from tables and calculators |

| UNIT | SPECIFIC OBJECTIVES | CONTENT | TEACHING AND LEARNING ACTIVITIES | EVALUATION |
|---|---|---|---|---|
| **UNIT 2.11 (CONT'D)**<br><br>**TRIGONOMETRY I** | The student will be able to:<br><br>2.11.2 calculate the values of trigonometric ratios of 30º 45ºand 60º | The trigonometric ratios of 30º, 45º and 60º. | Guide the students to draw an equilateral triangle of dimensions (e.g. 2-units) and use it to derive the trigonometric ratios for 30º and 60º.<br><br>E.g.<br>  <br><br>sin 30º = $\frac{1}{2}$ cos 30º= $\frac{\sqrt{3}}{2}$<br>sin 60º = $\frac{\sqrt{3}}{2}$ cos 60º = $\frac{1}{2}$<br><br>Assist students to draw a square of side one unit, draw one of the diagonals and use the diagonal and two sides to derive the value of trigonometric ratios of 45$^o$<br><br>  <br><br>sin 45$^o$ = $\frac{1}{\sqrt{2}} = \frac{\sqrt{2}}{2}$<br>Cos 45$^o$ = $\frac{1}{\sqrt{2}} = \frac{\sqrt{2}}{2}$<br>tan 45$^o$ = 1 | Let students:<br><br>find the trigonometric ratios of the angles 30º ,60º and 45º |

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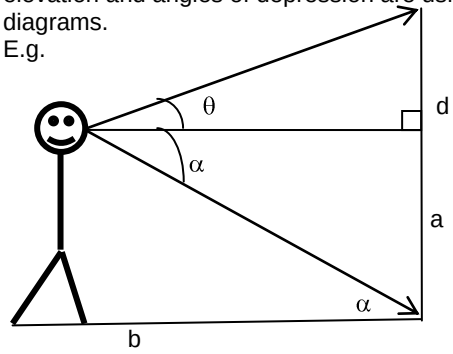
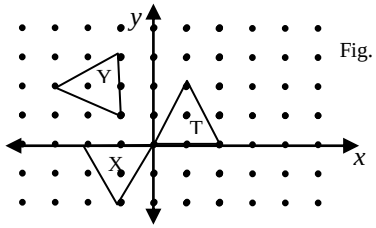
| UNIT | SPECIFIC OBJECTIVES | CONTENT | TEACHING AND LEARNING ACTIVITIES | EVALUATION |
|---|---|---|---|---|
| **UNIT 2.10 (CONT'D)** | The student will be able to: | | | Let students: |
| **TRIGONOMETRY I** | 2.11.3 use the calculator to read the values of sine, cosine and tangent of angles up to 360º | The use of calculators to read sine, cosine and tangent of angles between 0º and 360º. | Guide the students to use their calculators to find trigonometric ratios for given angles from $0^0$ and $360^0$. | find the values of sine, cosine and tangent of given angles using calculators |
| | 2.11.4 find the inverse of trigonometric ratios | Inverse of trigonometric ratios. | Assist students to find the inverse of given trigonometric ratios using tables or calculators. | find the inverse of given angles |
| | 2.11.5 calculate angles of elevation and angles of depression | Angles of elevation and depression. | Discuss with students what angles of elevation and angles of depression are using diagrams.<br>E.g.<br>  <br><br>θ is the angle of elevation = $\tan^{-1}\left(\frac{d}{b}\right)$<br>α is the angle of depression = $\tan^{-1}\left(\frac{a}{b}\right)$ | explain what angles of elevation and depression are<br>solve problems involving angles of elevation and angles of depression. |
| | 2.11.6 apply the use of trigonometric ratios to calculate distances and heights | Application of trigonometric ratios. | Pose problems of real life situations involving trigonometric ratios for students to solve. | apply trigonometric ratios to solve problems on real life situations |

| UNIT | SPECIFIC OBJECTIVES | CONTENT | TEACHING AND LEARNING ACTIVITIES | EVALUATION |
|---|---|---|---|---|
| **UNIT 2.12**<br><br>**SEQUENCES AND SERIES** | The student will be able to:<br><br>2.12.1 continue a sequence with more terms. | Patterns of sequence | Guide students to examine and continue a sequence of numbers.<br>E.g. Sticks of equal length are arranged as shown in the Fig. 2.12.<br>  <br>Figure 1 Figure 2<br>Fig 2.12.  <br>Figure 3<br>If the pattern is continued, how many sticks will be used to make Figure 10? | Let students:<br><br>write the next two or more terms of a given sequence. |
| | 2.12.2 recognize an arithmetic progression (AP) and find the nth term or general term | Arithmetic Progression | Guide students to identify common (or constant) difference and find the $n^{th}$ term of an A.P.<br>i.e. $U_n = a + (n - 1)d$ | write the nth term of given arithmetic progressions for given values of n. |
| | 2.12.3 find the sum of the first n terms of an AP | Sum of the first n terms of an AP. | Assist students to deduce and use the rule for finding the sum ($S_n$) of the first n terms an AP.<br>i.e. $S_n = \frac{n}{2}\{a + U_n\}$<br>$= \frac{n}{2}\{2a + (n-1)d\}$<br>E.g. In Fig. 2.12 above, how many sticks will be used to make the $n^{th}$ Figure? | find the sum of n terms of an AP. |
| | 2.12.4 recognise a geometric progression (GP) or Exponential sequence | Geometric Progression (or Exponential sequence) | Guide students to use real situations to illustrate a GP. E.g. Depreciation, | solve everyday problems using the concept of GP |
| | 2.12.5 find an expression for the general term of a GP | General term of a GP | Guide students to deduce the general term of a GP as $U_n = ar^{n-1}$ ; where a is the first term and r , the common ratio | |

| UNIT | SPECIFIC OBJECTIVES | CONTENT | TEACHING AND LEARNING ACTIVITIES | EVALUATION |
|---|---|---|---|---|
| **UNIT 2.13**<br><br>**RIGID MOTION II AND ENLARGEMENT** | The student will be able to:<br><br>2.13.1. identify shapes with rotational symmetry | Rotational symmetry | Assist students to sort plane shapes according to their order of rotational symmetry. | Let students:<br><br>identify some Ghanaian (or adinkra) symbols that have rotational symmetry and state the order of rotational symmetry. |
| | 2.13.2. identify the image of an object (or point) after a rotation about the origin (or point) | Rotation | Guide students to identify the image of a plane figure after a rotation about the origin,<br>  <br><br>Fig. 13.1<br>Assist students to describe in Fig. 13.1 the single transformation that maps T onto X and T onto Y.<br><br>Guide students to derive the rules for rotation using graphical method<br>E.g. Anticlockwise about the origin (0,0) through<br>$90^o$ ; (x, y) → (-y, x)<br>$180^o$ ; (x, y) → (-x, -y), etc.<br><br>Include clockwise rotation about the origin and rotation about a point other than the origin | identify a rotation among a set of movements<br><br>draw a given plane figure on a graph paper and rotate it through given angles about the origin and about a given point |

| UNIT | SPECIFIC OBJECTIVES | CONTENT | TEACHING AND LEARNING ACTIVITIES | EVALUATION |
|---|---|---|---|---|
| **UNIT 2.13**<br><br>**RIGID MOTION II AND ENLARGEMENT** | The student will be able to:<br><br>2.13.3 carry out an enlargement of a plane shape given a scale factor<br><br>2.13.4 identify a scale drawing as an enlargement/reduction of a plane figure (shape).<br><br>2.13.5 establish the relationship between the areas and volumes of plane figures and solids and their images | Enlargement<br><br>Scale drawing<br><br>Areas and Volumes of similar figures. | Revise examples of turning in everyday life situation to explain rotation<br><br>Guide students through construction to find the images of plane figures under rotation.<br><br>Guide students to find images of plane figures under enlargement from the origin for given scale factors.<br><br>Guide students to use scale drawing to enlarge or reduce plane figures.<br><br>Assist students to discover the relationship between the areas and volumes of similar figures and solids.<br>i.e. Area of image : Area of object = $K^2$:1<br>and<br>Volume of Image : Vol. of solid = $K^3$ : 1<br>where k is the scale factor | Let students:<br><br>draw the images of plane figures under enlargement from the origin for given scale factors.<br><br>use scale drawing to enlarge or reduce plane figures given the scale and calculate their areas and volumes |

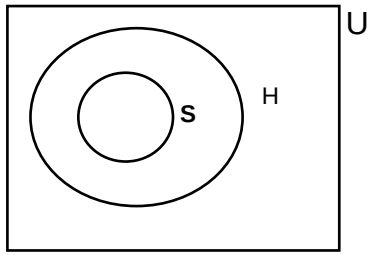
# SENIOR HIGH SCHOOL 3

| UNIT | SPECIFIC OBJECTIVES | CONTENT | TEACHING AND LEARNING ACTIVITIES | EVALUATION |
|---|---|---|---|---|
| **UNIT 3.1** | The student will be able to: | | | Let students: |
| **CONSTRUCTION** | 3.1.1 construct $75^o$ $105^o$ $135^o$and $150^o$ | Construction of $75^o$ $105^o$ $135^o$ and $150^o$. | Review the construction of $30^o$, $45^o$ , $60^o$ and $90^o$ with the students.<br><br>Guide students to construct angles $75^o$, $105^o$, and $135^o$. | construct some given angles. |
| | 3.1.2 construct a triangle or quadrilateral under given conditions | Construction of Triangles and Quadrilaterals. | Assist students to use a pair of compasses and ruler only to construct;<br>1. a triangle, given two sides and an included angle;<br>2. a triangle, given two angles and a side.<br>3. a quadrilateral under given conditions. | construct triangles and quadrilaterals under given conditions |
| | 3.1.3 construct a particular loci | Constructing loci | Guide students to construct the locus of points equidistant from two or more fixed points and two or more intersecting straight lines | solve loci related problems through construction |

| UNIT | SPECIFIC OBJECTIVES | CONTENT | TEACHING AND LEARNING ACTIVITIES | EVALUATION |
|---|---|---|---|---|
| **UNIT 3.2**<br><br>**MENSURATION II**<br><br>**(SURFACE AREA, VOLUME OF SOLIDS AND THE EARTH AS A EARTH)** | The student will be able to: | | | Let students: |
| | 3.2.1 draw nets of prisms | Nets of prisms. | Guide students to identify solids with uniform cross-section as prisms E.g. triangular prisms, rectangular prism, square prism, etc.<br><br>Guide students to use cut-out shapes to form the nets of open/close prisms and identify the faces. | draw nets of given prisms<br><br>find the perimeter of the largest rectangle that can be made with 24 square cut-outs |
| | 3.2.2 calculate surface areas of prisms | Surface Areas of Prisms. | Guide students to discover that the total surface area is the sum of the areas of all the faces.<br>E.g. Cuboid - Area = 2bl + 2bh + 2lh<br>Closed cylinder - A = $2\pi r$ (r + h) | calculate the total surface area of prisms of given dimensions. |
| | 3.2.3 calculate volumes of prisms | Volume of prisms | Assist students to calculate volume of prisms by multiplying the area of uniform cross-section by the height or length. | calculate the volume of prisms of given dimensions. |
| | 3.2.4 calculate the total surface area of a cone. | Surface Area of a Cone | Let students open a cone and examine the net.<br><br>Guide students to draw the net and measure the angle of the sector.<br><br>Guide students to deduce the formula for finding the surface area of a cone as<br>A = Curved Surface + Base Area<br>$\frac{\theta}{360} \times \pi l^2 + \pi r^2$<br>$= \pi \left( \frac{\theta}{360} \times l^2 + r^2 \right)$ | calculate the total surface area of a cone of given dimensions. |

| UNIT | SPECIFIC OBJECTIVES | CONTENT | TEACHING AND LEARNING ACTIVITIES | EVALUATION |
|---|---|---|---|---|
| **UNIT 3.2 (CONT'D)**<br><br>**MENSURATION II** | The student will be able to:<br><br>3.2.5 calculate the volume of a cone | Volume of a Cone. | Guide students to:<br><br>Assist student to establish the formula for finding the volume of a cone.<br>i.e. $V = \frac{1}{3}\pi r^2 h$ | Let students:<br><br>use the formula to find volume of a given cone. |
| | 3.2.6 calculate the total surface area of a pyramid | Surface Area of a Pyramid. | Guide students to calculate the total surface area of a pyramid as the sum of the areas of the triangular faces and the base. | calculate the total surface areas of pyramids of given dimensions |
| | 3.2.7 calculate the volumes of Pyramids | Volume of a pyramid. | Guide students to deduce the formula for the volume of a pyramid<br>i.e. Volume = $\frac{1}{3}$ x base Area x h | calculate the volumes of given pyramids |
| | 3.2.8 calculate surface area of a sphere | Surface area of a sphere | Guide students to find the surface areas of spheres of given radii using the formula<br>$A = 4\pi r^2$ | calculate surface area of given radii |
| | 3.2.9 calculate the volume of a Sphere | Volume of a sphere | Guide students to establish the formula for finding the volume of a sphere. i.e.<br>$V = \frac{4}{3}\pi r^3$ | calculate the volume of spheres of given radii |
| | 3.2.10 calculate distance along a given latitude and longitude | Distances of arcs of spheres | Guide students to draw a sphere and indicate two points on the same latitude or the same longitudes (great circles).<br><br>Guide students to draw a sphere and illustrate two points on the same latitude but different longitudes<br><br>Guide students to calculate distances between two towns on the earth surface. | solve real life application problems<br>E. g .time taken for aeroplanes to fly between two towns etc |

| UNIT | SPECIFIC OBJECTIVES | CONTENT | TEACHING AND LEARNING ACTIVITIES | EVALUATION |
|---|---|---|---|---|
| **UNIT 3.3**<br><br>**LOGICAL REASONING** | The student will be able to: | | | Let students: |
| | 3.3.1 identify and form true or false statements. | Statements<br>. | Guide students to identify true or false statements. | identify true or false statements. |
| | 3.3.2 form the negation of simple statements. | Negation of statements | Guide students to write statements in negation form.<br>E.g. Kofi is not a lazy boy is the ***negation*** of Kofi is a lazy boy. | negate given statements |
| | 3.3.3 draw conclusions using the implication sign statements made. | Implications<br>$\Rightarrow$ , $\Leftrightarrow$ | Assist students to use the implication sign to draw conclusions from statements made.<br>E.g. $3x-2=10 \Rightarrow x=4$<br>Discuss the use of the symbol, $\Leftrightarrow$ with students<br>E.g. $3x-2=10 \Rightarrow x=4$<br>and if $x=4 \Rightarrow 3x-2=10$<br>so, $3x-2=10 \Leftrightarrow x=4$ | draw conclusion from statements made using the implication sign<br><br>use the symbol $\Leftrightarrow$, iff (if and only if) to draw conclusions from given statements |

| UNIT | SPECIFIC OBJECTIVES | CONTENT | TEACHING AND LEARNING ACTIVITIES | EVALUATION |
|---|---|---|---|---|
| **UNIT 3.3 (CONT'D)**<br><br>**LOGICAL REASONING** | The student will be able to:<br><br>3.3.4 use Venn diagrams to determine the validity or otherwise of implications or conclusions. | Validity of implications | :<br><br>Guide students to draw Venn diagrams to illustrate given statements E.g. consider the statement:<br>P : All students are hardworking<br>S = {students}<br>H = {hardworking people}<br>U = {People}<br><br>  <br><br><br>Assist students to determine whether given conclusions are valid or not | Let students:<br><br>use Venn diagrams to determine the validity or otherwise of given statements |

| UNIT | SPECIFIC OBJECTIVES | CONTENT | TEACHING AND LEARNING ACTIVITIES | EVALUATION |
|---|---|---|---|---|
| **UNIT 3.4**<br><br>**TRIGONOMETRY II** | The student will be able to: | | | Let students: |
| | 3.4.1 draw the graphs of simple trigonometric functions and identify maximum and minimum values | Graphs of trigonometric functions | Guide students to prepare tables for given trigonometric functions for : $y = a\sin x$ and $y = b\cos x$ in the range $0^0 \le x \le 360^0$<br><br>Guide students to use their tables to draw the graphs of the functions and find the maximum and minimum values. | draw graphs of given trigonometric functions and use them to solve related problems |
| | 3.4.2 draw the graphs of trigonometric functions and use them to solve trigonometric equations<br><br>. | Trigonometric equations | Guide students to draw simple graphs of trigonometric functions of the form : $f(x) = a\sin x + b\cos x$ in the range where $0° \le x \le 360°$<br><br>Guide students to use their graphs to solve equations such as : $a\sin x + b\cos x = 0$, $a\sin x + b\cos x = k$ , etc. | find on graphs of trigonometric functions the values of x which satisfy the two functions simultaneously. |

# REFERENCES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