

MINISTRY OF EDUCATION



Republic of Ghana

TEACHING SYLLABUS FOR SENIOR HIGH SCHOOL ELECTIVE MATHEMATICS

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RATIONALE FOR TEACHING ELECTIVE MATHEMATICS

The abilities to read, analyze and calculate are the three fundamental skills that are vital for living and working. The level of mathematics one may study depends upon the type of work or profession one may choose in life and on one's aptitude and interest. Elective mathematics deals with reasoning by analogies, making judgments through discrimination of values, analysis of data, and communication of one's thoughts through symbolic expression and graphs.

Elective Mathematics at the Senior High School level builds on the Core Mathematics of Senior High School. It is a requirement as foundation for those who would wish to embark on professional studies in engineering, scientific research, and a number of studies in tertiary and other institutions of higher learning.

GENERAL AIMS

The syllabus is designed to help students to:

- 1 appreciate the use of mathematics as a tool for analysis, critical and effective thinking.
- 2 discover order, patterns and relations.
- 3 communicate their thoughts through symbolic expressions and graphs.
- 4 develop mathematical abilities useful in commerce, trade and public service.
- 5 make competent use of ICT in problem solving and investigation of real life situations.

SCOPE OF CONTENT

Elective mathematics covers the following content areas:

- | | |
|--------------------------|--------------------------------|
| 1. Algebra | 5. Trigonometry |
| 2. Coordinate Geometry | 6. Calculus |
| 3. Vectors and Mechanics | 7. Matrices and Transformation |
| 4. Logic | 8. Statistics and Probability |

PRE-REQUISITE SKILLS AND ALLIED SUBJECTS

Success in the study of Elective Mathematics requires proficiency in English Language and in Core Mathematics. Other subjects that may help the effective study of Elective Mathematics include Physics and Technical Drawing.

ORGANIZATION OF THE SYLLABUS

This syllabus has been structured to cover the three (3) years of Senior High School. Each year's work consists of a number of sections with each section comprising a number of units.

The unit topics for the three years course are indicated in the table below.

SCOPE AND SEQUENCE FOR SHS ELECTIVE MATHEMATICS

	SHS1	SHS2	SHS3
1.	Sets (pg 1)	Coordinate Geometry 2 (pg 14-16)	Matrices (pg 39 - 41)
2.	Surds (pg 1 - 2)	Sequences and Series (pg 17-18)	Linear Transformations (pg 41 - 43)
3.	Binary Operations (pg 3)	Indices and Logarithms (pg 18 - 19)	Logic (pg 44)
4.	Relations and Functions (pg 3 - 4)	Trigonometric Ratios and Rules (pg 20 - 21)	Correlation and Regression (pg 45 - 47)
5.	Polynomial Functions (pg 4 - 7)	Compound and Multiple Angles (pg 21 - 22)	Spearman's Rank Correlation (pg 45 - 47)
6.	Rational Functions (pg 7)	Trigonometric Functions/Equations (pg 22)	Dynamics (pg 48 - 49)
7.	Binomial Theorem (pg 7- 8)	Differentiation (pg 23 - 24)	
8.	Inequalities and Linear Programming (pg 8)	Application of Differentiation (pg 24 - 25)	
9.	Coordinate Geometry I (pg 9-10)	Integration (pg 26)	
10.	Probability I (pg 11)	Application of Integration (pg 26 - 27)	
11.	Vectors I (pg 12 - 13)	Permutation and Combinations (pg 28)	
12.		Probability II (pg 29)	
13.		Statistics I (pg 30 - 32)	
14.		Application of vectors in Geometry (pg 33 - 35)	
15.		Statics (pg 36 - 38)	

TIME ALLOCATION

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

SUGGESTIONS FOR TEACHING THE SYLLABUS

This syllabus has been planned to incorporate almost all branches of mathematics: - Algebra, Logic, Trigonometry, Coordinate Geometry, Calculus, Linear Transformation, Vectors, Mechanics, Statistics and Probability. In a broad framework of this nature, schools will have to adopt team teaching approach for this course. Besides, the teacher's attention is drawn to the use of calculators and ICT in teaching of Elective mathematics.

The syllabus has been built on the core mathematics syllabus. It is therefore necessary for the student to have sound foundation in core mathematics. Teachers are advised to read through the entire syllabus in order to appreciate its scope and demands. Again, teachers are to link up the core and elective syllabuses when dealing especially with the topics.

General Objectives

General objectives have been listed at the beginning of each section. The general objectives are linked to the General Aims of this subject and specify the skills and behaviours the student should acquire after learning the units of a section.

Section and Units

The syllabus has been planned on the basis of sections and units. Each year's work is divided into sections. A section consists of a number of units and specific objectives.

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

Column 1 – Units

The units in column 1 are the major topics of the section. The numbering of the units is different 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 number of the unit. A unit number like 2.1 is interpreted as Unit 1 of SHS 2. Similarly a unit number like 3.4 means Unit 4 of SHS3. This type of unit numbering has been adopted to ensure that the selected topics and skills are taught appropriately in the suggested sequence. The order in which the units are arranged is just to guide you plan your work. If however, you find at some point that teaching and learning in your class will be more effective if you branch to another unit before coming back to the unit in the sequence, you are encouraged to do so. 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.

Column 2 – Specific Objectives

Column 2 shows the specific objectives for each unit. The specific objectives in this syllabus begin with numbers such as 2.1.3 or 3.2.1. These numbers are referred to as "Syllabus Reference Numbers" – SRN. The first digit in this elective mathematics syllabus reference number refers to the year of the SHS class; the second digit refers to the unit, while the third digit refers to the rank order of the specific objective.

For example, 2.1.3 means SHS2, unit1 and specific objective 3. In other words 2.1.3 refers to specific objective 3 of unit 1 of SHS2. Similarly, the syllabus reference number 3.2.1. simply means syllabus objective Number 1 of unit 2 at SHS3. 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, if a unit has five specific objectives 2.4.1 – 2.4.5, the teacher may want to base his/her questions on objectives 2.4.3 to 2.4.5 and not use the other first two specific objectives. In this way

a teacher would sample the objectives within units and within the year to be able to develop a test that accurately reflects the importance of the various concepts and skills taught in class.

You will note also that specific objectives have been stated in terms of the student, - i.e., what the student 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 the teacher has 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 presents a selected body of information that you will need to use in teaching the particular unit. In some cases, the content presented is quite exhaustive. In other cases, you could add more information to the content presented.

Column 4 – Teaching and Learning Activities (T/LA): T/LA activities that will ensure maximum student participation in the lessons are presented in column 4. Avoid instrumental learning and drill-oriented methods and rather emphasize participatory teaching and learning, and also emphasize the cognitive, affective and psychomotor domains of knowledge in your instructional system wherever appropriate. You are encouraged to re-order the suggested teaching and learning activities and also add to them where necessary in order to achieve optimum student learning.

A suggestion that will help your students acquire the habit of analytical thinking and be able to apply their knowledge to problems is to begin each lesson with a real life problem. Select a real life or practical problem for each lesson. The selection must be made such that students can extend the knowledge gained in the previous lesson and other generic skills to new situations not specifically taught in class. This is to enable students see the relevance of mathematics to real life situation. At the beginning of a lesson, state the problem, or write the problem on the board. Let students apply (George Polya’s) problem solving techniques, analyze the problem, suggest solutions, etc., criticize solutions offered, justify solutions and evaluate the worth of possible solutions. There may be a number of units where you need to re-order specific objectives to achieve required learning effects.

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, structured questions, project work, etc. Try to ask questions and set tasks and assignments that will challenge your students to apply their knowledge to issues and problems and engage them in developing solutions and developing positive attitudes towards the subject 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 behaviour 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, therefore, necessary that you develop a scheme of work and lesson plans for teaching the units of this syllabus.

DEFINITION OF PROFILE DIMENSIONS

A central aspect of this syllabus is the concept of profile dimensions that should be the basis for instruction and assessment. A ‘dimension’ is a psychological unit for describing a particular learning behaviour. More than one dimension constitute a profile of dimensions. A specific objective such as follows: “The student will be able to describe...” etc., contains an action verb “describe” that indicates what the student will be able to do after teaching has taken place. 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 student 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 student 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. Instruction in most cases has tended to stress knowledge acquisition to the detriment of other higher level behaviours such as application, analysis, etc. The

importance of learning is to help students to be able to apply their knowledge, develop analytical thinking skills, synthesize information, and use their knowledge in a variety of ways to deal with learning problems and issues in life. 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.

Profile dimensions describe the underlying behaviours for teaching, learning and assessment. In Elective Mathematics, the two profile dimensions that have been specified for teaching, learning and testing are:

Knowledge and Understanding	30%
Application of Knowledge	70%

Each of the dimensions has been given a percentage weight that should be reflected in teaching, learning and testing. The weights, indicated on the right of the dimensions, show the relative emphasis that the teacher should give in the teaching, learning and testing processes. The focus of this syllabus is to get students not only to acquire knowledge but also to understand what they have learnt and apply them in practical situations.

The explanation and key words involved in each of the dimensions are as follows:

Knowledge and Understanding (KU)

Knowledge The ability to:
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:
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 ability to:
Apply rules, methods, principles, theories, etc. to concrete situations that are new and unfamiliar. It also involves the ability to produce, solve, operate, demonstrate, discover, implement, carry out, use, execute, run, load, play, hack, upload, share, edit etc.

Analysis The ability to:
Break down a piece of material into its component parts, to differentiate, compare, 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:
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 or 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.

The action verbs provided under the various profile dimensions and in the specific objectives of the syllabus should help you to structure your teaching such as to achieve the effects needed. Select from the action verbs provided for your teaching, in evaluating learning before, during and after the instruction. Use the action verbs also in writing your test questions.

FORM OF ASSESSMENT

It must be emphasized again that it is important that both instruction and assessment be based on the profile dimensions of the subject. In developing assessment procedures, 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 achieved by the student. When you develop a test that consists of items or questions that are based on a representative sample of the specific objectives taught, the test is referred to as a “Criterion-Referenced Test”. In many cases, a teacher cannot test all the objectives taught in a term, in a year, etc. The assessment procedure you use i.e. class tests, home work, projects, etc. must be developed in such a way that it will consist of a sample of the important objectives taught over a period.

The example below shows an examination consisting of two papers, Paper 1 and Paper 2. School Based assessment has been added to the structure. Paper 1 will usually be an objective-type paper; Paper 2 will consist of structured questions demanding higher order thinking, and school based assessment will consist a number of tasks. The distribution of marks for the questions in the two papers should be in line with the weights of the profile dimensions already indicated and as shown in the last column of the table below.

The West African Examinations Council (WAEC) generally sets about 40 objective test items at the WASSCE. Use this as a guide to develop an objective test paper (Paper 1) that consists of 40 items. Paper 2 could consist of some structured questions and more demanding questions put in sections. In general, let students answer the compulsory section and at least four questions from ten questions put in three parts in Paper 2.

In the sample assessment structure presented below, Paper 1 is marked out of 100; Paper 2 is marked out of 100 and school based assessment is marked out of 60, giving a total of 260 marks. Depending upon the school’s examination and marking systems, you could use a total mark convenient to the teacher and the school. Bear in mind of course, that using a different total mark will change the mark allocations for the test papers, etc.

The last row shows the weight of the marks allocated to each of the four test components. The two papers and SBA are weighted differently. Paper 1, the objective test paper is weighted 20%. Paper 2 is a more intellectually demanding paper and is therefore weighted more than the objective test paper. Paper 2 is designed to test mainly application of knowledge. Papers 2 and the SBA are weighted 30%, and 50% respectively.

Distribution of Examination Paper Weights and Marks

Dimensions	Paper 1	Paper 2	School Based Assessment	Total Marks	% Weight of Dimension
Knowledge and Understanding	30	30	18	78	30
Application of Knowledge	70	70	42	182	70
Total Marks	100	100	60	260	-
% Contribution of Paper	20	30	50	-	100

You will note that Paper 1 has a contribution of 20% to the total marks; Paper 2 has a contribution of 30% to the total marks and SBA has a contribution of 50% to the total marks. The numbers in the cells indicate the marks to be allocated to the items/questions that test each of the dimensions within the respective papers.

The last but one column shows the total marks allocated to each of the dimensions. The numbers in this column are additions of the numbers in the cells and they agree with the profile dimension weights indicated in the last column. Of the total marks of 210, the 78 marks for Knowledge and Understanding is equivalent to 30%. The 182 marks for “Application” is equivalent to 70% of the total marks.

Item Bank: Obviously the structure of assessment recommended in this syllabus will need a lot of work on the part of the teacher. In preparation for setting examination papers, try to develop an item bank. The term “item bank” is a general term for a pool of objective items, and essay questions. As you teach the subject, try to write objective test items, essay questions and structured essay questions To fit selected specific objectives which you consider important to be tested. If you proceed diligently, you will realize you have written more than 100 objective test items, and more than 30 essay questions in a space of one year. Randomly select from the item bank to compose the test papers. Select with replacement. This means, as items/questions are selected for testing, new ones have to be written to replace those items/questions already used in examinations. Items and questions that have been used in examinations may also be modified and stored in the item bank.

An important issue in the preparation for a major examination such as the WASSCE, is the issue of test wiseness. To be ‘test wise’ means that the student knows the mechanics for taking a test. These mechanics include writing the index number and other particulars accurately and quickly on the answer paper; reading all questions before selecting the best questions to answer; apportioning equal time to each question or spending more time on questions that carry more marks; making notes on each question attempted before writing the answer; leaving extra time to read over one’s work; finally checking to see that the personal particulars supplied on the answer sheet are accurate. Some good students sometimes fail to do well in major examinations because of weakness in the mechanics of test taking; because they are not test wise. Take your final year students through these necessary mechanics so that their performance in major examinations may not be flawed by the slightest weakness in test taking.

GUIDELINES FOR SCHOOL-BASED ASSESSMENT (SBA)

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 assignmentA 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-Term 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.

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 structure 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.

In assigning grades to students' test results, you may apply the above grade boundaries and the descriptions, which indicate the meaning of each grade. The grade boundaries are also referred to as grade cut-off scores. When you adopt a fixed cut-off score grading system 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.

SENIOR HIGH SCHOOL - YEAR 1

SECTION 1: ALGEBRA 1

General Objectives: The student will:

1. apply set theory in solving problems
2. recognize the difference between a relation and a function
3. use the principles related to polynomial functions
4. apply the concept of binary operations to any given situation
5. resolve rational function into partial fractions,
6. find domain, range, zero of a rational function and state when it is undefined.
7. use the binomial theorem in approximations.
8. apply solutions of simultaneous linear inequalities to linear programming.

UNIT	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 1.1 Sets	The student will be able to: 1.1.1 establish set identities and apply them.	Algebra of sets De Morgan's laws	Revise two-set problems with students Assist students to establish set identities: $(A \cup B \cup C)' = A' \cap B' \cap C'$; $(A \cap B \cap C)' = A' \cup B' \cup C'$; $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$; $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$	Let students: use De Morgan's laws to solve related problems
	1.1.2 find solutions to three-set problems.	Three-set problems	Assist students to solve real life problems involving three-sets and the use of Venn diagrams	use algebra of sets to solve real life problems involving three sets
Unit 1.2 Surds	1.2.1 carry out the four operations on surds.	Surds of the form $a + b\sqrt{n}$, where n is not a perfect square,	Assist students to add, subtract and multiply surds	find the sum and products of surds and simplify them
Unit 1.2 (cont'd) Surds	1.2.2 rationalize surds with binomial denominators.	Rationalizing surds with binomial denominators	Assist students to write the conjugate form of a given surd	rationalize surds with binomial denominators

UNIT	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
Unit 1.3 Binary Operations	The student will be able to:	Properties of binary operations Closure Identity and inverse elements	Guide students to rationalize surds, e.g. $\frac{a+b\sqrt{n}}{c+d\sqrt{m}} = \frac{a+b\sqrt{n}}{c+d\sqrt{m}} \times \frac{c-d\sqrt{m}}{c-d\sqrt{m}}$ Revise the idea of binary operations Assist students to investigate the commutative and associative properties of binary operations Assist students to determine whether or not for any two given binary operations, one distributes over the other Assist students to determine whether or not a given set is closed under a given binary operation E.g. $x * y = \sqrt{xy} \quad \text{where } x, y \in R$ Assist students to find the identity element (e) of a binary operation satisfying $a * e = e * a = a$ Guide students to find the inverse of an element, a , for a given binary operation satisfying $a * a^{-1} = a^{-1} * a = e$ where a^{-1} is the inverse of a	Let students: E.g. Simplify $\frac{2+\sqrt{3}}{3-2\sqrt{2}}$ use the properties of binary operations to solve related problems determine whether or not the result of a binary operation is a member of the given set. find the identity element of a given binary operation and determine the inverse of any element in the given set
	1.3.1 determine the commutative, associative and distributive properties of binary operations.		1.3.2 determine the property of closure.	1.3.3 find the identity element and use it to find the inverse of a given element.

UNIT	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
Unit 1.4 Relations and Functions	The student will be able to:			Let students:
	1.4.1 represent functions graphically.	Graphical representation of a function	Revise the idea of relations, functions and types of functions Assist students to represent functions graphically Introduce the use of graphic calculators and computers to investigate nature of graphs of functions Guide students to determine whether a given function is one-to-one	use mapping diagrams to establish various types of relations determine whether or not a given function is one-to-one
	1.4.2 determine the domain and range of a function.	Domain and range of a function	Assist students to state the domain of a function as the set of values of x that makes the function defined Guide students to state the range of a function as the set of values of y (dependent variable) that can result from the substitutions for the independent variable, x	find the domain and range of a given function
	1.4.3 determine the inverse of a one-to-one function.	Inverse of a function	Assist students to find the inverse of a function and state the domain e.g. if $f : x \rightarrow 3x + 4$ then the inverse relation is $f^{-1} : x \rightarrow \frac{1}{3}x - \frac{4}{3}, \quad x \in R$	find the inverse of a given function
1.4.4 determine the composite of two given functions.	Composite functions	Assist students to find the composite of two functions defined as $f \circ g(x) = f[g(x)]; \quad g \circ f(x) = g[f(x)]$ Use real life situations to introduce composite functions. E.g., Suppose $h(x)$ = husband of x and $m(x)$ = mother of x . Then, $hom(x)$ = the husband of the mother of x which is a step father or father of x , and $moh(x)$ = mother of the husband of x , which is the mother-in-law of x . Include composites of inverses of functions	find $f \circ g$; $g \circ f$; $f^{-1} \circ g^{-1}$ of given real life functions and interpret the results	

UNIT	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
Unit 1.5 Polynomial functions Unit 1.5 (cont'd) Polynomial functions	The student will be able to: 1.5.1 recognise linear and quadratic functions.	Linear and quadratic functions	Assist students to associate a linear function with the straight line graph. Assist students to associate quadratic function with the parabola. Encourage the use of graphic calculators and computers to investigate the shapes of graphs as coefficients of the variables and the constants change. Guide students to express the quadratic function $f(x) = ax^2 + bx + c$ in the form $f(x) = a(x + d)^2 + k$, where k is the maximum or the minimum value	Let students: find the maximum and minimum values/points of given quadratic functions
	1.5.2 sketch the curve of a quadratic function.	Sketching curves of quadratic functions	Assist students to sketch curves of quadratic functions and indicate their shapes Guide students to identify the vertex, the axis of symmetry, maximum and minimum points, increasing and decreasing parts of a parabola	sketch given quadratic curves and identify the axes of symmetry, turning points, etc
	1.5.3 solve quadratic equations by method of completing the squares and by formula.	Solving quadratic equations Completing the square Quadratic formula	Assist students to solve quadratic equations using the method of completing the squares Assist students to deduce the general formula of a quadratic equation $ax^2 + bx + c = 0$, that is, $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ and use it to solve quadratic equations	solve quadratic equations using (i) method of completing the squares (ii) quadratic formula
	1.5.4 use the discriminant to describe the nature of roots of quadratic equations.	Roots of quadratic equations	Assist students to use the discriminant $d = b^2 - 4ac$ to describe the nature of the roots of quadratic equations as	state the nature of roots of given quadratic equations. E.g. Find the values of k that make the equation $x^2 - (k + 1)x + k = 0$

UNIT	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
Unit 1.5 (cont'd) Polynomial functions	The student will be able to:		(i) equal, if $b^2 - 4ac = 0$ (ii) real and unequal, if $b^2 - 4ac > 0$ (iii) imaginary, if $b^2 - 4ac < 0$ Assist students to find the relation between the roots α and β and coefficients a, b, c of $ax^2 + bx + c = 0, a \neq 0$: $\alpha + \beta = \frac{-b}{a}, \text{ and } \alpha\beta = \frac{c}{a}$ Assist students to use these relations to write other quadratic equations with given roots	Let students: has equal roots. use sum and product of roots in setting up quadratic equations E.g. If α and β are the roots of $2x^2 - 5x - 3 = 0$, find $\alpha + \beta$ and $\alpha\beta$.
	1.5.5 define a polynomial function.	Definition of polynomial functions	Assist students to define a polynomial function as $f(x) = a_n x^n + a_{n-1} x^{n-1} + \dots + a_0, a \neq 0$ e.g. $f(x) = 3x^4 - 2x^3 + 4x^2 - x + 3$	state the degree of a given polynomial function
	1.5.6 recognise and draw the graph of a cubic function.	Cubic functions	Assist students to draw graphs of cubic functions for a given interval. NB: The use of graphic calculator or computer for investigating cubic functions should be encouraged	draw graphs of cubic functions for given intervals
	1.5.7 perform the basic algebraic operations on polynomials.	Algebra of polynomials Addition and subtraction Multiplication Division	Assist students to add and subtract two polynomials Assist students to find the product of two polynomials Guide students to carry out division of one polynomial by another of lesser degree and state the remainder eg. $(x+1) \overline{)x^4 + 3x^3 + x^2 - 1}$ The use of synthetic division is allowed.	add, subtract, multiply and divide given polynomial functions

UNIT	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
	The student will be able to:			Let students:
Unit 1.5 (cont'd) Polynomial functions Unit 1.6 Rational functions	1.5.8 use the remainder and factor theorems to find the factors and remainders of a polynomial of degree not greater than 4.	Remainder and factor theorems	Assist students to use the remainder theorem to find the remainder R when the polynomial $f(x)$ is divided by $(x \pm a)$ as $f(\mp a) = R$ Guide students to discover that if $(x \pm a)$ is a factor of a polynomial $f(x)$ then $f(\mp a) = 0$	find the remainder/factor of a polynomial of degree not greater than four when divided by a polynomial of lower degree
	1.5.9 find the factors and zeros of a polynomial function.	The factors and roots of a polynomial functions/ equations up to $n = 3$	Assist students to use the factor theorem to find the factors of a given polynomial function and roots of $f(x) = 0$	solve for the zeros (roots) of given polynomial functions (equations)
	1.6.1 recognise a rational function and determine the domain and range.	Rational functions of the form $Q(x) = \frac{f(x)}{g(x)}, g(x) \neq 0$	Assist students to recognize a rational function Assist students to obtain the domain, zeros and the range of rational functions	state the domain and zeros of rational functions
	1.6.2 carry out the four basic operations on rational functions.	Operations on rational functions	Assist students to add, subtract, multiply and divide simple rational functions	perform operations involving rational functions
	1.6.3 resolve rational functions into partial fractions.	Partial fractions	Assist students to write rational functions as partial fractions of various forms.	express given rational functions as partial functions. E.g. Find the partial fraction decomposition of $\frac{11x+2}{2x^2+x-1}$
Unit 1.7 Binomial Theorem	1.7.1 write down the Binomial expansion for positive integral index.	Binomial Theorem	Assist students to write down the Binomial expansion using the Pascal's Triangle Assist student to discover and write the expansion using the binomial theorem for positive integral index. Lead students to apply the theorem to expand	write the expansion for given binomial expressions

UNIT	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
Unit 1.7 (cont'd) Binomial Theorem	The student will be able to: 1.7.2 use the combination method to determine the coefficient and exponent of a given term in an expansion.	Combination method	binomial with rational index. Assist students to use intuitive method to establish that $\binom{n}{r} = {}^n C_r = \frac{n!}{(n-r)!r!}$, n is a positive integer and $r \leq n$ Assist students to use the combination method to determine the coefficient and exponents of terms in an expansion $(a + b)^n = \sum_{r=0}^n \binom{n}{r} a^{n-r} b^r$ [Proof not required]	Let students: use combination method to find the indicated coefficients of terms in a binomial expansion. E.g. Find the x^2 term and the constant term in the expansion of $\left(2x - \frac{1}{2x}\right)^{12}$
	1.7.3 use the expansion for $(1+x)^n$ to approximate exponential values.	Expansion and use of $(1+x)^n$ to approximate exponential values	Assist students to expand $(1+x)^n$ and use it to find approximate exponential values. E.g. Evaluate $(0.998)^4$ by writing $(0.998)^4 = (1-0.002)^4$ and then substituting $x = 0.002$ in the expansion of $(1+x)^4$.	use binomial expansion to approximate exponential values E.g. Use binomial expansion to evaluate $(0.998)^5$
Unit 1.8 Inequalities and Linear programming	1.8.1. recognise a linear inequality in two variables and draw its graph.	Linear inequalities in two variables	Assist students to identify linear inequalities in 2 variables Assist students to draw the graphs of given linear inequalities	draw the graphs of a given linear inequalities
	1.8.2. use graphical approach to solve simultaneous inequalities and interpret.	Linear programming	Guide students to find solutions of simultaneous linear inequalities using graphical method Assist students to apply the solutions to linear programming	solve practical problems on linear inequalities in two variables (linear programming)

UNIT	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION																					
	<p>The student will be able to:</p> <p>1.8.3.recognise and solve quadratic inequalities.</p>	<p>Quadratic inequalities</p>	<p>Assist students to identify quadratic inequalities as $ax^2 + bx + c \leq 0$ and $ax^2 + bx + c \geq 0$, etc, where $a \neq 0$</p> <p>Assist students to solve quadratic inequalities using analytic, deductive table and graphical approach.</p> <p>e.g. $x^2 - 5x + 6 < 0$, $(x - 2)(x - 3) < 0$, That is $x > 2$ and $x < 3$, $2 < x < 3$ as shown in the table below.</p> <table border="1" data-bbox="1043 536 1565 679"> <tr> <td>x</td> <td></td> <td>2</td> <td></td> <td></td> <td>3</td> <td></td> </tr> <tr> <td>x-2</td> <td>-</td> <td>0</td> <td>-</td> <td>-</td> <td>+</td> <td>+</td> </tr> <tr> <td>x-3</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table>	x		2			3		x-2	-	0	-	-	+	+	x-3							<p>Let students:</p> <p>solve real life problems involving quadratic inequalities</p> <p>E.g. Find the set of values of x for which $1 + 2x - 3x^2 < 0$</p>
x		2			3																				
x-2	-	0	-	-	+	+																			
x-3																									

SENIOR HIGH SCHOOL - YEAR 1

SECTION 2 COORDINATE GEOMETRY I

General Objectives: The student will:

1. appreciate the concept of straight lines and apply them in related problems
2. relate gradients of parallel, perpendicular and intersecting lines

UNIT	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
Unit 1.9 Straight line	The student will be able to:			Let students
	1.9.1 find the mid-point of a line segment joining two given points.	Midpoint of a line segment	Revise distance between two given points as an application of the Pythagoras theorem Guide students to find the coordinates of the mid-point of a line segment joining two given points	find the coordinates of the midpoint of a line joining two given points
	1.9.2 find the coordinates of a point which divides a given line in a given ratio.	Division of a line segment in a given ratio	Guide students to find the coordinates of a point which divides a line joining two points internally in a given ratio $m : n$ Guide students to find the coordinates of a point which divides a line joining two points externally in a given ratio $a : b$	find the coordinates of a point dividing a given line in a given ratio
	1.9.3 find the equation of a straight line.	Equation of a straight line	Guide students to find the equation of a straight line in the various forms: (i) two-point form (ii) gradient-intercept form (iii) gradient and one point form (iv) general (standard) form	find the equations of lines with given information

UNIT	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
Unit 1.9 (cont'd) Straight line	The student will be able to: 1.9.4 write the equation of a line passing through an external point and parallel to or perpendicular to a given line.	Parallel and perpendicular lines	Assist students to determine the gradient of a line that is parallel to a given line Guide students to find the gradient of a line that is perpendicular to a given line Assist students to write the equation of a line passing through a point and parallel to or perpendicular to a given line Include the equation of perpendicular bisector of a line joining two given points	Let students find the equation of a line parallel or perpendicular to a given line. E.g. Find the equation of a straight line parallel to $3x - 5y - 10 = 0$ and passing through $(6, -4)$
	1.9.5 find the perpendicular distance from an external point to a line.	Perpendicular distance from an external point to a line	Assist students to find the perpendicular distance from an external point $P(x_1, y_1)$ to a given line $ax + by + c = 0$ using the formula $d = \left \frac{ax_1 + by_1 + c}{\sqrt{a^2 + b^2}} \right $	calculate the perpendicular distance from a point to a given line E.g. Find the perpendicular distance of the point $P(8, 3)$ from the line $3x - 4y + 8 = 0$
	1.9.6 calculate the acute angle between two intersecting lines.	Acute angle between two intersecting lines	Guide students to find gradients m_1 and m_2 of two intersecting lines and find the angle between them using the appropriate formula: For $m_1 \times m_2 \neq -1$, $\tan \theta = \left \frac{m_1 - m_2}{1 + m_1 m_2} \right $ But if $m_1 \times m_2 = -1$, then the lines are perpendicular.	calculate the angle between two intersecting lines. E.g. Find two possible values of p if the lines $px - y - 3 = 0$ and $3x + y + 1 = 0$ intersect at 45°

SENIOR HIGH SCHOOL - YEAR 1

SECTION 3 PROBABILITY I

General Objectives: The student will:

1. explain and use the probability scale from 0 to 1
2. list the sample space of an experiment and
3. calculate the probabilities of independent and mutually exclusive events
4. use knowledge of conditional probability to solve real life problems.

UNIT	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 1.11 Probability 1	<p>The student will be able to:</p> <p>1.11.1 define probability as ratio of number(s) in an event to number(s) in the sample space.</p> <p>1.11.2 distinguish between mutually exclusive and independent events.</p> <p>1.11.3 calculate simple conditional probabilities.</p>	<p>Equally likely events</p> <p>Mutually exclusive and independent events</p> <p>Conditional probability</p>	<p>Revise sample space, events and compound events and relative frequency.</p> <p>Assist students to calculate probabilities involving compound events</p> <p>Assist students to solve simple problems using both the addition and multiplication laws of probability.</p> <p>(i) $P(A \cup B) = P(A) + P(B) - P(A \cap B)$</p> <p>(ii) If A and B are mutually exclusive then $A \cap B = \phi$ and $P(A \cap B) = 0$ $P(A \cup B) = P(A) + P(B)$;</p> <p>If A and B are independent, then $P(A \cap B) = P(A) \times P(B)$ therefore $P(A \cup B) = P(A) \times P(B)$</p> <p>Assist students to calculate simple conditional probabilities</p> <p>Note: Probability of event A, given that B had occurred is defined by:</p> $P(A/B) = \frac{P(A \cap B)}{P(B)}$ <p>Again if A and B are independent then $P(A/B) = P(A)$</p>	<p>Let students:</p> <p>calculate probabilities involving compound events</p> <p>apply addition and multiplication laws to calculate probabilities</p> <p>calculate simple conditional probabilities. E.g. Find the probability of scoring a number less than five in a single toss of a die if the toss resulted in an even number</p>

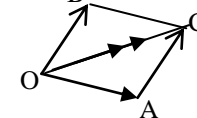
SENIOR HIGH SCHOOL - YEAR 1

SECTION 4 VECTORS I

General Objectives: The student will:

1. write vectors in components /Cartesian and magnitude – direction (bearing) forms
2. find resultants of vectors

UNIT	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
Unit 1.12 Vectors in a plane	The student will be able to: 1.12.1 represent vectors in the form $x\mathbf{i} + y\mathbf{j}$.	Representation of vectors in standard basis form	Revise concept of vectors and representation of vectors in component and magnitude-direction forms Discuss the notation \mathbf{i} and \mathbf{j} for the unit vectors $\begin{pmatrix} 1 \\ 0 \end{pmatrix}$ and $\begin{pmatrix} 0 \\ 1 \end{pmatrix}$ along x-axis and y-axis respectively Assist students to represent given vectors in the form $x\mathbf{i} + y\mathbf{j}$	Let students: write vectors in the standard basis form
	1.12.2 find the resultant of given vectors.	Resultant of vectors	Assist students to find the resultant of given vectors in the standard basis form	find the resultant of given vectors in standard basis form
	1.12.3 add vectors using triangle, parallelogram and polygon laws of addition.	Triangle, parallelogram and polygon laws of addition	Assist students to find the resultant \vec{OC} by completing the parallelogram with \vec{OA} and \vec{OB} as adjacent sides $\vec{OB} = \vec{AC} \Rightarrow \vec{OC} = \vec{OA} + \vec{AC}$ $\therefore \vec{OC} = \vec{OA} + \vec{OB}$	Assist students to use the polygon law to find the resultant of given vectors forming the sides of a polygon



UNIT	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
Unit 1.12 (cont'd) Vectors in a plane	The student will be able to:			Let students:
	1.12.4 use scale drawing to find the resultant of vectors given in magnitude-direction form.	Scale drawing and resolution of vectors	Assist students to draw the resultants of vectors given in magnitude-direction form by scale drawing Assist students to resolve vectors into components and vice versa	resolve vectors given in magnitude-direction forms into components and vice versa. E.g. Find the resultant of the following vectors (10m, 070°) and (15m, 260°) by (a) scale drawing (b) resolution
	1.12.5 establish and use properties of addition of vectors and scalar multiplication of vectors.	Properties of addition of vectors Scalar multiplication of vectors	Assist students to establish the commutative, associative and distributive properties of addition of vectors Guide students to use the properties to solve problems on vectors	use properties of addition of vectors to solve problems
	1.12.6 use position vectors to find free vectors	Position vectors	Assist students to identify the position vector of a point A relative to point O as vector \overrightarrow{OA} Let students use the addition of vectors to derive the relation, $\overrightarrow{AB} = \overrightarrow{OB} - \overrightarrow{OA} = \underline{b} - \underline{a}$ for the (position vectors of B and A	use position vectors to find the vector joining two given points in the Cartesian plane. E.g. P(3, 1), Q(-3, 4), R(3, 6) and S(x, y) are the vertices of a parallelogram PQRS. Find the values of x and y.
	1.12.7 calculate unit vectors	Unit vectors	Assist students to calculate a unit vector of a given vector as $\hat{a} = \frac{a}{ a }$	

SENIOR HIGH SCHOOL - YEAR 2

SECTION 1 CO-ORDINATE GEOMETRY II

General Objectives: The student will:

1. recognise the equation of the circle and use it in related problems
2. solve problems related to the parabola

UNIT	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
Unit 2.1 The circle	The student will be able to: 2.1.1 find the equation of a circle.	Equation of a circle	Assist students to use the idea of distance formula to find the equation of a circle, (i) centre, the origin and a given radius as $x^2 + y^2 = r^2$ (ii) given a centre (a, b) and a radius as $(x - a)^2 + (y - b)^2 = r^2$ Assist students to write the equation of a circle in the general form as $x^2 + y^2 + 2gx + 2fy + c = 0$, where $(-g, -f)$ is the centre of the circle Guide students to use the general form of the equation to write the equation of a circle passing through three given points Assist students to find equation of a circle on a given diameter using the mid-point approach.	Let students: write the equation of a circle in the standard form using given information. E.g. Find the equation of a circle centre $(3, 4)$ and which passes through $(6, 8)$.
	2.1.2 determine the centre and the radius from a given equation of a circle.	Finding the centre and radius given the equation of a circle	Assist students to find the centre and radius of the circle from a given equation of a circle by (i) comparing coefficients with the general form (ii) completing the squares	find the centre and radius of a circle given its equation. E.g. Find the centre and radius of the circle $x^2 + y^2 - 4x + 6y + 9 = 0$

UNIT	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
Unit 2.1 (cont'd) The circle	<p>The student will be able to:</p> <p>2.1.3 find the equations of a tangent and a normal to a circle and find the length of a tangent from an external point.</p> <p>2.1.4 find the equation of the locus of a variable point which moves under a given condition.</p>	<p>Tangent and normal to a circle</p> <p>Loci</p>	<p>Assist students to find the equation of a tangent to a given circle</p> <p>Assist students to find the equation of a normal to a given circle</p> <p>Guide students to find the length of a tangent to a given circle from an external point</p> <p>Assist students to find the locus of a point equidistant from two fixed points</p> <p>Assist students to find the locus of a point P(x, y) such that PA is perpendicular to PB where A and B are fixed points</p> <p>Assist students to find the locus of a point moving under other given conditions e.g. $AP = 3 PB$, where A and B are fixed points, and $PM ^2 + PN ^2 = 26$, where M and N are fixed points</p> <p>Assist students to describe completely such loci.</p>	<p>Let students:</p> <p>find the equations of a tangent and normal to a circle at a given point</p> <p>find the length of a tangent to a circle from a given external point. E.g. Find the length of the tangent to the circle $x^2 + y^2 - 8x + 10y + 5 = 0$ from the point (5, 7).</p> <p>solve loci related problems</p>

UNIT	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
Unit 2.2 Parabola	<p>The student will be able to:</p> <p>2.2.1 find the equation of a parabola given the directrix and focus.</p> <p>2.2.2 sketch the various forms of a parabola.</p> <p>2.2.3 find the equations of the tangent and normal to a Parabola.</p>	<p>Equation of a parabola</p> <p>Sketching a parabola</p> <p>Tangent and normal</p>	<p>Assist students to recognize the equation of a parabola of the forms: $y^2 = 4ax$ and $x^2 = 4ay$</p> <p>Guide students to find the equation of parabola given the directrix and focus</p> <p>Assist students to find the directrix and focus from the equation of a parabola.</p> <p>Assist students to use a given directrix and focus to sketch a parabola</p> <p>Assist students to determine the equation of the axis of symmetry of a parabola</p> <p>Guide students to use ICT to investigate the nature of graphs of various forms of parabola by changing the directrix and focus</p> <p>Guide students to find the equation of a tangent to a parabola by solving the equations $y = mx + c$ and $y^2 = 4ax$ simultaneously</p> <p>Assist students to deduce the equation of a normal from the equation of a tangent</p>	<p>Let students:</p> <p>write the equation of a parabola given a directrix and focus</p> <p>determine the focus and directrix from the equation of a parabola</p> <p>sketch the graph of a given parabola and find the equation of the axis of symmetry</p> <p>find the equations of the tangent and normal to a parabola at a given point.</p> <p>E.g.</p> <p>Find the equations of the tangent and normal to the parabola $y^2 = 12x$ at the points $P(2, 4)$ and $Q(2, -4)$. At what point in the Oxy plane will the tangents at P and Q meet?</p>

SENIOR HIGH SCHOOL - YEAR 2

SECTION 2 ALGEBRA II

General Objectives: The student will:

1. recognize the importance of sequences and series in everyday life situations
2. use knowledge of sequences and series to solve real life problems
3. apply laws of logarithms and logarithmic functions in mathematical models.

UNIT	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
	The student will be able to			Let students
Unit 2.3 Sequences and Series	2.3.1 apply linear sequence to solve real life problems.	Application of linear sequence	<p>Revise concepts of linear sequence and finding the nth term. Include arithmetic mean</p> <p>Use practical situations e.g. salary increment, to illustrate linear sequences</p> <p>Assist students to apply linear sequence to solve real life problems</p>	solve real life problems involving linear sequence. E.g. A display in a supermarket consists of milk tins piled up in the form of a pyramid. There are 25 tins on the bottom layer and each successive layer has 2 fewer tins. How many tins are displayed?
	2.3.2 apply exponential sequence and series to real life situations.	Exponential Sequence (Geometric Progression GP)	<p>Revise concepts of exponential sequence and finding the nth term of a GP.</p> <p>Assist students to calculate the geometric mean of three consecutive terms of a GP</p> <p>Use practical situations, e.g. Depreciation and compound interest, to illustrate exponential sequences</p> <p>Assist students to find the sum of the first n terms of an exponential series using the rule:</p> $S_n = \frac{u_1(1-r^n)}{1-r}, \quad r < 1,$	<p>Solve real life problems involving exponential sequence.</p> <p>E.g. The original value of a car is ₦80m. If the car depreciates by 15% every year, find how much it is worth after</p> <p>i) 2 years ii) 4 years.</p>

UNIT	SPECIFIC OBJECTIVE The student will be able to	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION Let students
Unit 2.3 (cont'd) Sequences and Series	2.3.3 find an explicit formula for the nth term of a recurrence sequence.	Recurrence sequence	$\text{or, } S_n = \frac{u_1(r^n - 1)}{r - 1}, r > 1$ <p>and the limit of the sum as $S_\infty = \frac{u_1}{1-r}, r < 1$</p> <p>Assist students to apply exponential sequence to solve real life problems</p> <p>Assist students to recognize recurrence sequence and find its terms, e.g. $u_{n+1} = 3 + u_n, u_1 = 1$</p> <p>Assist students to find an explicit formula for the general rule for the recurrence sequence.</p> <p>Assist students to express recurring decimals as series and determine their limits, e.g.</p> $0.99999 = \frac{9}{10} + \frac{9}{10^2} + \frac{9}{10^3} + \frac{9}{10^4} + \dots$	<p>After how many years is the car worth $\text{€}35,496,416.00$?</p> <p>generate the terms of a recurrence sequence and find an explicit formula for the sequence</p>
Unit 2.4 Indices and Logarithmic Functions	2.4.1 use the laws of indices and logarithms to solve simple problems. 2.4.2 solve equations involving indices. 2.4.3 solve equations involving logarithms including changing the base.	Laws of indices and logarithms. Equations involving indices Equations involving logarithm and change of base	<p>Assist students to evaluate the products, quotients and powers of numbers using the laws of indices and logarithms</p> <p>Assist students to solve equations involving indices e.g. $2^{\sqrt{x}} = 8^x, 3^{2x} - 2 \times 3^x - 3 = 0$</p> <p>Assist students to solve simple equations involving logarithms e.g. Solve: $2^x = 7$</p> <p>Guide students to change the base of a given logarithm and use it to solve related problems.</p>	<p>evaluate products, quotients and powers using indices and logarithm. E.g. Given that $\log_3 5 = 1.465$, evaluate without using table or calculator, $\log_3 25 + \log_3 15$</p> <p>solve equations involving indices</p> <p>solve equations involving logarithms and change of base E.g. Solve $\log_2 x + 4 \log_x 2 = 5$</p>

UNIT	SPECIFIC OBJECTIVE The student will be able to	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION Let students
Unit 2.4 (cont'd) Indices and Logarithmic Functions	2.4.4 reduce relations to linear form using logarithm and draw the graph.	Graphs of exponential relations and their applications	<p>That is $\log_a b = \frac{1}{\log_b a}$</p> <p>(ii). $\log_a b = \frac{\log_c b}{\log_c a}$</p> <p>Assist students to obtain the linear form of the relation, $y = ax^b$ as $\log y = b \log x + \log a$ and draw the graph.</p> <p>Guide students to recognize the similarity between the above relations and the line $y = mx + c$</p> <p>Assist students to obtain the linear form of the relation, $y = ab^x$ as $\log y = \log a + x \log b$, and draw the graph.</p> <p>Assist students to estimate the values of the constants a and b from their graphs and determine graphically one value given the other.</p> <p>Introduce the use of graphic calculators and computer in drawing logarithmic graphs</p>	draw and interpret graphs of the relations $y = ab^x$ and $y = ax^b$

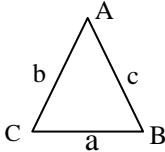
SENIOR HIGH SCHOOL - YEAR 2

SECTION 3 TRIGONOMETRY

General Objectives: The student will:

1. apply the concept of the trigonometric ratios and their reciprocals to solve related problems
2. use trigonometric identities to find solutions to trigonometric equations of compound and multiple angles.
3. apply trigonometry to solve related problems.

UNIT	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
Unit 2.5 Trigonometric ratios and rules	The student will be able to: 2.5.1 determine trigonometric ratios and their reciprocals.	Basic trigonometric ratios and their reciprocals	<p>Assist students to revise the three basic trigonometric ratios; sine, cosine and tangent</p> <p>Guide students to find the basic trigonometry ratios using the quadrants.</p> <p>Assist students to find the reciprocals of the trigonometric ratios</p> <p>Assist students to relate trigonometric ratios to Cartesian co-ordinates of the point (x, y) on the circle $x^2 + y^2 = r^2$</p> <p>Assist students to derive the trigonometric identities e.g. $\tan \theta = \frac{\sin \theta}{\cos \theta}$; $\cos^2 \theta + \sin^2 \theta = 1$; $1 + \tan^2 \theta = \sec^2 \theta$, etc</p> <p>Assist students to form the concept of negative angles and to establish the following relations $\sin(-\theta) = \sin(360^\circ - \theta) = -\sin \theta$ $\cos(-\theta) = \cos(360^\circ - \theta) = \cos \theta$</p>	<p>Let students:</p> <p>use basic trigonometric ratios and reciprocals to prove given trigonometric identities</p> <p>evaluate sine, cosine and tangent of negative angles</p>

UNIT	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
Unit 2.5 (cont'd) Trigonometric ratios and rules	<p>The student will be able to:</p> <p>2.5.2 convert angles into radians.</p> <p>2.5.3 state and use the sine and cosine rules.</p> <p>2.5.4 apply the sine and cosine rules to solve problems involving bearings.</p>	<p>Angles in radians</p> <p>Sine and Cosine rules</p> <p>Application of sine and cosine rules to bearings</p>	<p>$\tan(-\theta) = \tan(360^\circ - \theta) = -\tan \theta$</p> <p>Students to be encouraged to use the calculator to verify these relations</p> <p>Assist students to obtain radian equivalents of angles. [π radians = 180°]</p> <p>Assist students to deduce the sine rule:</p> $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C},$  <p>where a, b and c are the sides of a triangle</p> <p>Guide students to use the sine rule to solve related problems</p> <p>Assist students to deduce the cosine rule: $a^2 = b^2 + c^2 - 2bc \cos A$, etc and use it to solve triangles.</p> <p>Assist students to apply the sine and cosine rules to solve problems involving bearings</p>	<p>Let students:</p> <p>calculate the radian equivalents of given angles</p> <p>solve triangles using the sine and cosine rules</p> <p>apply sine and cosine rules to solve real life problems. E.g. An aeroplane can fly at 800kmh^{-1} in still air. The pilot sets a course due east when there is a wind blowing at 80kmh^{-1} from the south-west. Find the magnitude and direction of the velocity of the aeroplane relative to the ground.</p>

UNIT	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
Unit 2.6 Compound and Multiple angles	The student will be able to: 2.6.1 use simple trigonometric identities to find trigonometric ratios for compound angles.	Compound angles	Guide students to derive the compound angles identities: $\sin(A \pm B) = \sin A \cos B \pm \sin B \cos A$ $\cos(A \pm B) = \cos A \cos B \mp \sin A \sin B$ $\tan(A \pm B) = \frac{\tan A \pm \tan B}{1 \mp \tan A \tan B}$ Assist students to use the identities to solve related problems Encourage students to use calculators and specific values to verify these relations	Let students: prove the compound angle identities and apply them to evaluate given angles without using calculators. E.g. Find (i) $\sin 75^\circ$ (ii) $\sin 15^\circ$ without using calculator leaving your answer as a surd.
	2.6.2 use simple trigonometric identities to find trigonometric ratios for multiple angles.	Multiple angles (up to 3A)	Assist students to derive the double angle identities for $\sin 2A$, $\cos 2A$ and $\tan 2A$ and use them to write identities for $\sin 3A$ and $\cos 3A$ in terms of $\sin A$ and $\cos A$ respectively Encourage students to use the calculator and specific values to verify these relations	prove multiple angle identities. E.g. Express $\sin 3A$ and $\cos 3A$ in terms of $\sin A$ and $\cos A$ respectively
Unit 2.7 Trigonometric Functions	2.7.1 draw graphs of trigonometric functions.	Graphs of trigonometric functions - $\tan x$	Revise graphs of $\sin x$ and $\cos x$ Assist students to draw the graph of $\tan x$ and compare it with the sine and cosine graphs. Encourage students to use the calculator and computer to investigate the nature of graphs of trigonometric functions	draw the graphs of $\sin x$, $\cos x$ and $\tan x$ and use them to estimate given values of x
	2.7.2 solve trigonometric equations (up to quadratic).	Solving trigonometric equations (up to quadratic)	Assist students to find solution sets to trigonometric equations up to quadratic. E.g. $2\sin^2 x - \sin x - 3 = 0, 0^\circ \leq x \leq 360^\circ$ Encourage students to use the calculator and computer to draw graphs of trigonometric functions and find their solutions (graphical approach)	solve trigonometric equations

UNIT	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
	<p>The student will be able to:</p> <p>2.7.3 calculate the maximum and minimum points of a given trigonometric function.</p>	<p>Maximum and minimum points of trigonometric functions</p>	<p>Revise graphs of trigonometric functions of the form $f(x) = a \sin x + b \cos x$</p> <p>Guide students to express the trigonometric function, $f(x) = a \sin x + b \cos x$ in the forms $R \cos(x \pm \alpha)$ or $R \sin(x \pm \alpha)$ for $0^\circ \leq \alpha \leq 90^\circ$</p> <p>Assist students to use the result to calculate the maximum and minimum points of the function</p>	<p>Let students:</p> <p>find the maximum and minimum points of given trigonometric functions</p>

SENIOR HIGH SCHOOL- YEAR 2

SECTION 4 CALCULUS

General Objectives: The student will:

1. appreciate the principles of differentiation and Integration
2. carry out differentiation and integration on polynomials
3. explain all relevant terms under differentiation and integration
4. apply differentiation in related processes e.g. kinematics, small changes, etc
5. apply differentiation to determine gradient of a curve at a point, the turning points, etc.
6. apply integration to determine areas under curves, volumes of revolution, etc

UNIT	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
Unit 2.8 Differentiation	The student will be able to: 2.8.1 find the limit of a function and relate it to the gradient of a curve.	Limit of a function	Assist students to form the concept of a limit Assist students to find the limits of functions of the forms: $\lim_{x \rightarrow 2} 2x^2 - 2x + 1$, $\lim_{x \rightarrow 1} \frac{x^3 - 1}{x - 1}$, $\lim_{x \rightarrow \infty} \frac{1}{2^x}$, etc Let students draw lines through a given point, P on a curve cutting the curve again at $Q_1, Q_2, Q_3, \dots, Q_n$ with Q approaching P . Let students compare the gradients of the various lines with that of the tangent at P .	Let students: evaluate limits of given functions
	2.8.2 find the limit of simple trigonometric functions.	Limit of simple trigonometric functions	Assist students to find the limits of $\sin x$ and $\cos x$, as x approaches zero, etc. using tables or calculators. Guide students to use tables or calculators to discover that the $\lim_{x \rightarrow 0} \frac{\sin x}{x} = 1$	determine the derivative of simple trigonometric functions

UNIT	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
Unit 2.8 (cont'd) Differentiation	<p>The student will be able to:</p> <p>2.8.3 differentiate polynomials and simple trigonometric functions from first principles.</p> <p>2.8.4 recognise and use the rules of differentiation.</p>	<p>Differentiation from first principles</p> <p>Rules of differentiation</p>	<p>Assist students to find the derivative of polynomials ($n \leq 3$) from first principles using the idea of small increment, Δx and Δy or the definition</p> $\frac{dy}{dx} = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ <p>Limit differentiation from first principles to only polynomials</p> <p>Assist students to differentiate polynomials using the power rule, i.e.</p> <p>(i)</p> $\frac{d}{dx}(x^n) = nx^{n-1}$ <p>(ii) Differentiation of sums and differences</p> $\frac{d}{dx}(x^n \pm x^m) = \frac{d}{dx}(x^n) \pm \frac{d}{dx}(x^m)$ <p>Assist students to differentiate functions which are products of polynomials [e.g. $f(x) \times g(x)$] using the product rule</p> <p>Assist students to differentiate rational expressions of the form</p> $H(x) = \frac{f(x)}{g(x)}, \text{ where } g(x) \neq 0$ <p>using the quotient rule</p> <p>Assist students to use the chain rule to differentiate function of a function of the form $(ax^n + b)^m$ or</p> $G(x) = f(x)^m$	<p>Let students:</p> <p>find the derivatives of given functions from first principles</p> <p>use the various rules of differentiation to find the derivatives of given functions</p>

UNIT	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
Unit 2.9 Applications of Differentiation Unit 2.9 (cont'd) Applications of Differentiation	The student will be able to:			Let students:
	2.8.5 differentiate implicit functions.	Differentiation of implicit functions	Assist students to differentiate implicit functions	find the derivatives of given implicit functions. E.g. Find the derivative of $x^3 + y^3 = xy$ with respect to
	2.9.1 find the equations of a tangent and normal to a curve at a point.	Equations of tangent and normal to a curve	Assist students to apply differentiation to find the equations of tangents and normals to given curves	apply derivatives to find the equations of tangents and normals to given curves at given points of contact
	2.9.2 find the rates of change and small changes.	Rates of changes	Assist students to apply the chain rule to find the rates of change and small changes Assist students to calculate the percentage changes	solve real life problems involving rates of change
	2.9.3 find the maxima and minima values and points.	Maxima and minima	Guide students to find the turning points (stationary points) of curves and determine their nature Assist students to find the second derivative of functions and use it to determine the nature of turning points Assist students to apply derivatives to solve maxima and minima problems	apply derivatives to solve maxima and minima problems. E.g. A farmer wishes to construct a rectangular goat pen using an existing wall as one of its sides with 60 metres of fencing. Calculate the dimensions of the pen that would allow for maximum grazing area.
2.9.4 sketch curves up to cubic functions.	Curve sketching	Assist students to (i) use the idea of calculus to obtain the turning points of functions, (ii) find the intercepts and use these points to sketch curves	apply derivatives to sketch given curves	

UNIT	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
Unit 2.10 Integration	The student will be able to: 2.9.5 solve simple problems involving linear kinematics	Linear kinematics	Assist students to solve problems involving linear kinematics – displacements, velocity and acceleration	Let students: apply derivatives to solve problems on linear kinematics E.g. A ball is thrown vertically upwards and its height (h metres) above the ground at a time t seconds is given by $h = 16t - 4t^2$. Find the velocity and acceleration after one second and the maximum height reached.
	2.10.1. integrate polynomials.	Indefinite integral	Assist students to recognise integration as the reverse of differentiation Assist students to integrate monomials. E.g. $\int x^n dx = \frac{x^{n+1}}{n+1} + C$, $n \neq -1$ and C is a constant Assist students to integrate polynomials	integrate given functions. E.g. $\int (x^2 - \sqrt{x}) dx$
Unit 2.10 (cont'd) Integration	2.10.2. find definite integrals.	Definite Integrals	Assist students to find values for definite integrals for given limits of the form $\int_a^b f(x) dx$	evaluate given definite integral. E.g. Evaluate $\int_0^1 (4x^3 - 3x^2 + 2) dx$
	2.10.3. find definite integrals by the substitution method.	Integration by substitution	Assist students to find integrals by the substitution method e-g $\int x\sqrt{x^2 + 2} dx$ where we let $u = x^2 + 2$ so that $du = 2xdx$	integrate given functions by method of substitution
	2.10.4. integrate simple trigonometric functions.	Integration of simple trigonometric functions	Assist students to integrate simple trigonometric functions e.g. $\int \sin x dx$	find the integral of simple trigonometric functions

UNIT	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
Unit 2.11 Application of integration	The student will be able to: 2.11.1 solve simple problems involving linear kinematics.	Kinematics	Assist students to apply integration to solve simple problems involving kinematics - displacements, velocity and acceleration	Let students: solve real life problems involving kinematics. E.g. A particle moves along a straight line OP such that its velocity after t seconds is given by $v = t - \frac{1}{18}t^2$. (i) Find the time it takes the particle to reach the point P; (ii) How far is the particle from O when it changes direction
	2.11.2 find the area under a curve.	Areas under curves	Assist students to sketch given curves and identify the specific areas Assist students to apply definite integral to find the indicated area under the curve	apply integration to calculate areas under given curves. E.g Find the area under the parabola $y = x^2 - 2x + 2$ above the x -axis, between $x = 0$ and $x = 1$
	2.11.3 find volumes generated when curves are rotated about the x- and y- axes.	Volumes of revolution	Assist students to find the volumes of solids of revolution about (i) the x-axis and (ii) the y-axis using the rules $V = \int_a^b \pi y^2 dx$ and $V = \int_a^b \pi x^2 dy$ respectively	apply integration to calculate the volume of solids of revolution. E.g. Find the volume of the solid formed by revolving the region under the curve $y = x^2 + 1$, from $x = 0$ to $x = 2$ about the x-axis
Unit 2.11 (cont'd) Application of integration	2.11.4 calculate an approximate value of a definite integral using the Trapezium Rule.	The Trapezium Rule	Assist students to recognize that the area under a curve is approximately equal to that in the trapezium formed by the limits. Assist students to establish the trapezium rule and apply it to find area under curves.	use the trapezium rule to approximate the value of a given definite integral. E.g. Using the trapezium rule with 5 ordinates, calculate $\int_1^2 \frac{1}{x} dx$

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SECTION 5 PERMUTATION, COMBINATION & PROBABILITY

General Objectives: The student will:

1. differentiate between permutation (dealing with arrangement) and combination (dealing with selection)
2. recognize probability as ratio of equally likely events
3. distinguish between mutually exclusive and independent events
4. find probability using the binomial probability rule

UNIT	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
Unit 2.12 Permutation and Combination	The student will be able to: 2.12.1 arrange objects or things in a row.	Permutation – ordered choices	Assist student to distinguish between ordered and un-ordered choices Lead students to use the formula, ${}^n P_r = \frac{n!}{(n-r)!}$ to solve problems involving permutation. Students to be encouraged to check their answers using the calculator.	Let students: solve real life problems on permutation
	2.12.2 arrange n objects in a circular form.	Circular Arrangement	Assist students to arrange a given number of objects in a circular form Assist students to discover and use the rule $(n-1)!$ to find the number of ways of arranging n objects in a circular form	solve real life problems on circular arrangements. E.g. How many distinct ways can 5 people sit around a circular table?
	2.12.3 draw objects from a collection with and without replacement.	Combination Drawing with replacement Drawing without replacement	Assist students to find the number of ways of drawing objects from a collection with replacement. Assist students to find the number of ways of drawing objects from a collection without replacement. Assist students to use the formula ${}^n C_r = \frac{n!}{r!(n-r)!}$ to find the number of ways of selecting r objects from n given objects	solve real life problems on combination. E.g. How many ways can 4 red and 2 blue balls be drawn (without replacement) from a bag containing 6 red and 4 blue balls?

UNIT	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
Unit 2.13 Probability II	<p>The student will be able to:</p> <p>2.13.1 use idea of combination to calculate simple probabilities.</p> <p>2.13.2 use binomial distribution to calculate simple probabilities.</p>	<p>Application of combination</p> <p>Binomial probability</p>	<p>Assist students to find the number of ways of selecting r objects from a collection with a given condition.</p> <p>Students should be encouraged to check their answers using the calculator</p> <p>Assist students to calculate simple probabilities using combination. e.g. Probability of drawing 3 green and 2 white marbles from a box containing 5 green and 6 white marbles is:</p> $P(\text{3green and 2 white}) = \frac{{}^5C_3 \times {}^6C_2}{{}^{11}C_5}$ <p>Introduce the concept of binomial distribution Discuss the features of a binomial distribution, e.g. There are n independent trials; the probability of an event remains constant from trial to trial; and the probability of success is p and of failure is $q = 1 - p$ Assist students to calculate simple probabilities using the binomial distribution given by, $P(x = r) = {}^nC_r p^r q^{n-r}$ n is the number of trials- p is the probability of success, q is the probability of failure $\Rightarrow q = 1 - p$, and r is the number of successes..</p>	<p>Let students:</p> <p>apply combination to solve real life problems on probability. E.g. What is the probability of forming a committee of 3 boys and 2 girls from a class of 15 boys and 10 girls?</p> <p>apply binomial distribution to calculate probabilities</p>

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SECTION 6 STATISTICS I

General Objectives: The student will:

1. represent data graphically and interpret the graph.
2. calculate the measures of location and spread and interpret them.

UNIT	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
Unit 2.14 Statistics	The student will be able to:			Let students:
	2.14.1 draw a histogram from grouped data.	Histogram	Revise histogram with equal intervals with students Assist students to construct frequency table with unequal intervals and guide them to calculate the frequency densities Assist students to draw histogram for data with unequal intervals and use it to estimate the median	draw a histogram with unequal intervals and use it to estimate the median
	2.14.2 draw a cumulative frequency curve and use it to estimate the quartile and inter-quartile ranges.	Cumulative Frequency Curve (Ogive)	Revise drawing of cumulative frequency curves and estimation of medians, deciles and percentiles from the graph Assist students to estimate the quartiles from the graph and use them to calculate the inter-quartile and semi-inter-quartile ranges	draw cumulative frequency curves and use them to estimate semi inter-quartile ranges
2.14.3 calculate the mean, mode and median from a grouped frequency table.	Measures of central tendency	Assist students to use the assumed mean method to calculate the mean of grouped data using the formula $\bar{x} = A + \frac{\sum fd}{\sum f},$ where A = the Assumed mean, and $d = x - A$ = deviation from the assumed mean	calculate the mean of a set of given data using the assumed mean method	

UNIT	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
<p>Unit 2.14 (cont'd) Statistics</p>	<p>The student will be able to:</p>		<p>Assist students to calculate the mode using the formula</p> $Mode = L_1 + \left(\frac{\Delta_1}{\Delta_1 + \Delta_2} \right) C$ <p>where,</p> <p>L_1 = the lower class boundary of the modal class</p> <p>Δ_1 = excess frequency of modal class over frequency of the next lower class</p> <p>Δ_2 = excess frequency of modal class over frequency of the next higher class</p> <p>C = the size of the modal class</p> <p>Assist students to calculate the median using the formula</p> $Median = L_1 + \left(\frac{\frac{1}{2}N - \sum F_1}{F_m} \right) C$ <p>where</p> <p>L_1 = the lower class boundary of the median class</p> <p>N = total frequency</p> <p>$\sum F_1$ = sum of frequencies of all classes lower than the median class</p> <p>F_m = frequency of the median class</p> <p>C = the size of the median class</p>	<p>Let students:</p> <p>calculate the mode and median from a grouped data.</p>

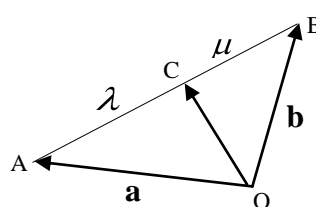
UNIT	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
<p>Unit 2.14 (cont'd) Statistics</p>	<p>The student will be able to:</p> <p>2.14.4 calculate the variance and standard deviation of a set of data.</p>	<p>Measures of dispersion</p>	<p>Assist students to calculate the range for a given set of data</p> <p>Assist students to calculate the mean deviation using the formula Mean Deviation (MD)</p> $MD = \frac{\sum x - \bar{x} }{n}$ <p>for simple data without frequencies;</p> <p>and</p> $MD = \frac{\sum f_i x_i - \bar{x} }{\sum f_i}$ <p>for frequency distributions</p> <p>Assist students to calculate the variance and standard deviation from ungrouped data using the true mean</p> <p>Given a population of N data values, the variance and standard deviation are given by</p> $\sigma^2 = \frac{\sum (x - \mu)^2}{N} \quad \text{and} \quad \sigma = \sqrt{\frac{\sum (x - \mu)^2}{N}}$ <p>where μ is the population mean</p> <p>Discuss the interpretation of standard deviation with students</p> <p>Assist students to calculate the variance and standard deviation from a grouped data using the true mean by</p> $\sigma^2 = \frac{\sum f(x - \bar{x})^2}{\sum f}$ <p>Assist students to use the assumed mean to calculate the standard deviation, i.e.</p> $sd = \sqrt{\frac{\sum fd^2}{\sum f} - \left(\frac{\sum fd}{\sum f}\right)^2}$	<p>Let students:</p> <p>calculate the mean deviation, variance and standard deviation of a set of grouped data and interpret the result</p>

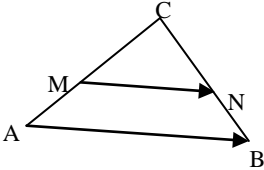
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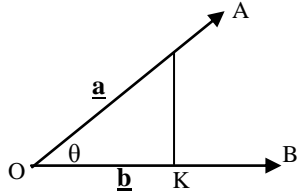
SECTION 7 VECTORS II

General Objectives: The student will:

1. apply vectors and dot product of vectors to solve problems
2. use vector approach to derive trigonometric identities
3. find the vector in the direction of another given vector

UNIT	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
Unit 2.15 Application of Vectors to Geometry	The student will be able to: 2.15.1 apply vectors to solve simple geometric problems.	Application of vectors to geometry.	Revise equality, addition, subtraction, and scalar multiplication of vectors in the form $a\mathbf{i} + b\mathbf{j}$ and $\begin{pmatrix} a \\ b \end{pmatrix}$ Assist students to deduce the position vector of a point that divides a line segment internally in a ratio $(\lambda : \mu)$ shown in the diagram as $\vec{OC} = \frac{\mu\vec{OA} + \lambda\vec{OB}}{\mu + \lambda} = \frac{\mu\mathbf{a} + \lambda\mathbf{b}}{\mu + \lambda}$  Assist students to find the position vector of a point that divides a line segment externally in a given ratio	Let students: find the position vector of a point that divides a line segment both internally and externally in a given ratio

UNIT	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
<p>Unit 2.15 (cont'd)</p> <p>Application of Vectors</p>	<p>The student will be able to:</p> <p>2.15.2 use the idea of scalar product to find angle between two vectors.</p> <p>2.15.3 use vectors to establish sine and cosine rules.</p>	<p>Concept of Scalar (Dot) product for finding angle between two vectors</p> <p>The sine and cosine rules</p>	<p>Assist students to prove, for example, that if M and N are the mid-points of sides AC and BC respectively of triangle ABC shown, then $\overrightarrow{MN} = \frac{1}{2} \overrightarrow{AB}$</p>  <p>Assist students to find the dot product of two given vectors. E.g. The dot product of the vectors $\mathbf{u} = a\mathbf{i} + b\mathbf{j}$ and $\mathbf{v} = c\mathbf{i} + d\mathbf{j}$ is given by $\mathbf{u} \cdot \mathbf{v} = ac + bd$</p> <p>Assist students to establish the fact that angle between two vectors is the angle between the directions of the vectors</p> <p>Assist students to use the concept of scalar product to find the angle between any two vectors i.e $\mathbf{a} \cdot \mathbf{b} = \mathbf{a} \mathbf{b} \cos\theta$ where θ is the angle between the vectors</p> <p>Lead students to establish the fact that if $\mathbf{a} \cdot \mathbf{b} = 0$, then \mathbf{a} and \mathbf{b} are perpendicular</p> <p>Assist students to use vector approach to derive the relations: For any triangle with sides a, b, and c,</p> <p>(i) Sine rule: $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$</p> <p>(ii) Cosine rules: $a^2 = b^2 + c^2 - 2bc \cos A$ $b^2 = a^2 + c^2 - 2ac \cos B$ $c^2 = a^2 + b^2 - 2abc \cos C$</p>	<p>Let students:</p> <p>find the dot product of two given vectors</p> <p>apply scalar (dot) products to calculate angle between two vectors. E.g. Given that $\mathbf{p} = 5\text{ cm}$, $\mathbf{q} = 12\text{ cm}$ and $\mathbf{p} + \mathbf{q} = \sqrt{229}$, find</p> <p>(i) the angle between the vectors \mathbf{p} and \mathbf{q}.</p> <p>(ii) (ii) the scalar (dot) product of \mathbf{p} and \mathbf{q}</p> <p>use vector approach to derive the sine and cosine rules</p>

UNIT	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
Unit 2.15 (cont'd) Application of Vectors	The student will be able to: 2.15.4 use vector approach to derive trigonometric identities. 2.15.5 find the projection of one vector on another.	Compound angles for cosine and sine. Direction vectors	Guide students to use vector approach to derive compound angle identities: $\cos(A \pm B) = \cos A \cos B \mp \sin A \sin B$ $\sin(A \pm B) = \sin A \cos B \pm \cos A \sin B$ Assist students to apply $\mathbf{a} = \mathbf{a} \hat{\mathbf{a}}$ where $\hat{\mathbf{a}}$ is the unit vector of \mathbf{a} to establish that the projection of vector \mathbf{a} on \mathbf{b} is <div style="display: flex; align-items: center; justify-content: center; margin: 10px 0;"> $\mathbf{a} \cdot \frac{\mathbf{b}}{ \mathbf{b} } = \mathbf{a} \cos \theta$  </div> Note that the projection of \overrightarrow{OA} on \overrightarrow{OB} is $ \mathbf{a} \cos \theta$	Let students: use vector approach to derive the compound angle identities find the vector in the direction of another given vector

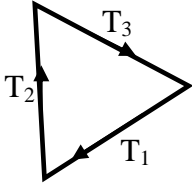
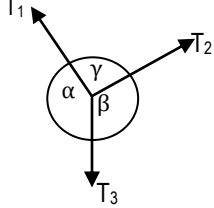
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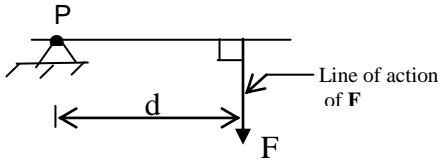
SECTION 8 MECHANICS I

General Objectives: The student will:

1. recognize forces as vectors
2. distinguish between static and dynamics
3. resolve forces and find their resultants
4. determine coefficient of friction
5. find moments about a point
6. apply ideas in mechanics to solve practical problems

UNIT	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
Unit 2.16 Statics	The student will be able to: 2.16.2 distinguish between scalar and vector quantities.	Differences between scalar and vector quantities	Guide students to recognize mass, distance and speed as scalar quantities and velocity, acceleration, force and momentum as vector quantities. Discuss the definitions of various quantities with students Assist students to use appropriate units - e.g. kg, m, s, ms^{-1} Assist students to realize that, for example, a speed of $15 ms^{-1}$ in the direction 060° is the velocity vector $(15ms^{-1}, 060^\circ)$. Similarly, $(10ms^{-2}, 030^\circ)$ is an acceleration vector and $(5N, 040^\circ)$ is a force vector	Let students: classify given quantities under scalars and vectors
	2.16.3 resolve forces acting at a point.	Coplanar forces acting at a point	Assist students to resolve forces acting at a point and find their resultant. e.g. the resolution of the force $(5N, 030^\circ)$ is $\begin{pmatrix} 5 \cos 60^\circ \\ 5 \sin 60^\circ \end{pmatrix}$ or $\begin{pmatrix} 5 \sin 30^\circ \\ 5 \cos 30^\circ \end{pmatrix}$	resolve given forces and find the magnitude and direction of the resultant

UNIT	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
Unit 2.16 (cont'd) Statics	The student will be able to: 2.16.4 find the resultant of forces and consider forces in equilibrium.	Equilibrium of particles Resultant of forces Lami's theorem	Assist students to establish the fact that a particle acted upon by forces $F_1, F_2, F_3, \dots, F_n$ is said to be in equilibrium if $F_1 + F_2 + F_3 + \dots + F_n = 0$ Assist students to determine tensions in strings that are suspending particles Discuss with students Lami's theorem in relation to $\frac{T_1}{\sin \beta} = \frac{T_2}{\sin \alpha} = \frac{T_3}{\sin \gamma}$ where T_1, T_2 , and T_3 are three forces acting on the body and α, β and γ are the angles between them <div style="display: flex; justify-content: space-around; align-items: center;">   </div> Guide students to apply Lami's Theorem to solve simple problems on equilibrium system of forces and lead students to appreciate the Lami's theorem is equilibrium to the sine rule.	Let students: determine the force that will keep a particle under given forces in equilibrium. E.g. A object C of weight $20N$ is suspended by two light strings AC and BC from points A and B on the same horizontal level above C. $AB = AC = 12cm$ and $CB = 8cm$. Find the tensions in AC and BC apply Lami's theorem to solve related problems

UNIT	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
Unit 2.16 (cont'd) Statics	The student will be able to: 2.16.5 find moments of forces.	Moments of forces	Assist students to determine the moment of a force as Moment of force (m) is defined as the product of the magnitude of force (F) and the perpendicular distance (d) of line of force from the axis; i.e. $m = F \times d$  Guide students to use the principle of moments to solve simple problems	Let students: state and use the principle of moments to solve related problems. E.g. Two pupils, Aku and Aba are sitting on a non-uniform plank AB of mass 24 kg and length 2 m. the plank is pivoted at M, the midpoint of AB. C is the centre of mass AB and $ AC = 0.8m$. If Aku's mass is 24 kg and she sits at A while the mass of Aba is 30 kg, find where Aba can sit for the plank to be horizontal
	2.16.6 determine coefficient of friction between bodies.	Friction	Assist students to distinguish between smooth and rough planes and explain the meaning of friction and coefficient of friction Guide students to determine coefficient of friction between a body and a rough plane	calculate the coefficient of friction between bodies in contact. E.g. A particle of weight 30N rests in equilibrium on a rough horizontal surface. A string is attached to the particle making an angle of 30° with the horizontal. If the tension in the string is 4N, find the magnitude of the frictional force acting on the particle

SENIOR HIGH SCHOOL - YEAR 3

SECTION 1 MATRICES AND LINEAR TRANSFORMATIONS

General Objectives: The student will:

1. use linear transformations to find images of points and object points
2. apply linear transformation in finding reflections and rotations of points and plane figures
3. recognize the use of matrices in linear transformations

UNIT	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
Unit 3.1 Matrices	The student will be able to:			Let students:
	3.1.1 recognise a matrix and state its order	Idea of a matrix	<p>Assist students to use everyday situations to explain the idea of matrices, e.g. League tables, seating arrangements in class.</p> <p>Guide students to state the order of given matrices</p> <p>Assist students to identify the types of matrices – unit , zero, diagonal, square and rectangular matrices</p>	state the order of a given matrix and indicate the type
	3.1.2 apply equal matrices in related problems	Equal matrices	<p>Assist students to recognize that if two matrices are equal, their corresponding elements are equal.</p> $\begin{pmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{pmatrix} = \begin{pmatrix} b_{11} & b_{12} \\ b_{21} & b_{22} \end{pmatrix}$ $\Leftrightarrow a_{11} = b_{11}, a_{12} = b_{12}, a_{21} = b_{21}, a_{22} = b_{22}$ <p>Guide students to use the idea of equal matrices to find missing entries in a given matrix.</p>	apply equality of matrices to find missing entries of given matrices
3.1.3 add and subtract matrices.	Addition and subtraction of matrices	<p>Assist students to add and subtract matrices (up to 3×3) by adding or subtracting corresponding elements</p> $\begin{pmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{pmatrix} \pm \begin{pmatrix} b_{11} & b_{12} \\ b_{21} & b_{22} \end{pmatrix} = \begin{pmatrix} a_{11} \pm b_{11} & a_{12} \pm b_{12} \\ a_{21} \pm b_{21} & a_{22} \pm b_{22} \end{pmatrix}$	find the sum and difference of given matrices. E.g. A shopkeeper has two separate shops which she opens on Monday,	

UNIT	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION																																
Unit 3.1 (cont'd) Matrices	<p>The student will be able to:</p> <p>3.1.4 multiply a matrix by a scalar and a matrix by a matrix</p>	<p>Multiplication of matrices</p> <p>Multiplication of a matrix by a scalar.</p> <p>Multiplication of matrices (up to 3×3 matrices)</p>	<p>(Use real life situations)</p> <p>Assist students demonstrate that the zero matrix is the identity matrix for addition i.e $O + A = A + O = A$</p> <p>Assist students to recognize that multiplication of a matrix by a scalar k involves multiplying each element of A by k</p> $k \begin{pmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{pmatrix} = \begin{pmatrix} ka_{11} & ka_{12} \\ ka_{21} & ka_{22} \end{pmatrix}$ <p>Assist students to multiply an $m \times n$ matrix by an $n \times 1$ matrix, e.g</p> $\begin{pmatrix} a & b \\ c & d \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} ax+by \\ cx+dy \end{pmatrix}$ <p>Guide students to multiply two 2×2 matrices:</p>	<p>Let students:</p> <p>Wednesday and Friday. In a particular week she made the following sales in the two shops. Represent the total sales she made in the week in a matrix form</p> <p style="text-align: center;">Shop A</p> <table border="1" data-bbox="1727 448 2085 655"> <tr> <td></td> <td>Fanta</td> <td>Malta</td> <td>Energy</td> </tr> <tr> <td>Mon</td> <td>10</td> <td>8</td> <td>6</td> </tr> <tr> <td>Wedn</td> <td>8</td> <td>7</td> <td>9</td> </tr> <tr> <td>Fri</td> <td>11</td> <td>9</td> <td>12</td> </tr> </table> <p style="text-align: center;">Shop B</p> <table border="1" data-bbox="1727 703 2085 911"> <tr> <td></td> <td>Fanta</td> <td>Malta</td> <td>Energy</td> </tr> <tr> <td>Mon</td> <td>9</td> <td>10</td> <td>8</td> </tr> <tr> <td>Wedn</td> <td>7</td> <td>9</td> <td>10</td> </tr> <tr> <td>Fri</td> <td>13</td> <td>11</td> <td>15</td> </tr> </table> <p>find the product of a matrix by a scalar and a matrix by a matrix</p> <p>E.g. Given that</p> $A = \begin{pmatrix} 2 & 3 \\ 7 & 1 \end{pmatrix} \text{ and}$ $B = \begin{pmatrix} 1 & 5 \\ -3 & 4 \end{pmatrix}$ <p>find AB and BA and comment.</p>		Fanta	Malta	Energy	Mon	10	8	6	Wedn	8	7	9	Fri	11	9	12		Fanta	Malta	Energy	Mon	9	10	8	Wedn	7	9	10	Fri	13	11	15
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UNIT	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
Unit 3.1 (cont'd) Matrices	<p>The student will be able to:</p> <p>3.1.5 find the inverse of a 2×2 matrix.</p>	<p>Inverse of a 2×2 matrix</p> <p>Determinant of a 2×2 matrix</p>	$\begin{pmatrix} a & b \\ c & d \end{pmatrix} \begin{pmatrix} p & q \\ r & s \end{pmatrix} = \begin{pmatrix} ap+br & aq+bs \\ cp+dr & cq+ds \end{pmatrix}$ <p>Assist students to multiply two 3×3 matrices</p> <p>NB. We multiply matrices that are conformable. Matrix multiplication is not commutative.</p> <p>Assist students to find the determinants of 2×2 matrices. That is, if</p> $A = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$ <p>then $\det A = A = ad - bc$</p> <p>Assist students to find the adjoint matrix as</p> $\begin{pmatrix} d & -b \\ -c & a \end{pmatrix}$ <p>Guide students to write the inverse of the matrix A as</p> $A^{-1} = \frac{1}{ad - bc} \begin{pmatrix} d & -b \\ -c & a \end{pmatrix}$ <p>where $ad - bc \neq 0$</p>	<p>Let students:</p> <p>find the inverses of given 2×2 matrices</p>

UNIT	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
Unit 3.2 Linear transformations	The student will be able to: 3.2.1 use linear transformation to calculate image and object points.	Images of points and object points under linear transformation	Assist students to find images of various points under linear transformations of the form $(x, y) \rightarrow (x', y')$, where $x' = ax + by$ and $y' = cx + dy$	Let students: find images of points under given linear transformations
	3.2.2 state the matrix representing a linear transformation.	Matrix of a linear transformation [Restrict to 2×2 matrices]	Assist students to write down the matrix of a linear transformation, e.g. the matrix of the linear transformation $x' = 4x - 3y$ and $y' = 5x + 2y$ is $A = \begin{pmatrix} 4 & -3 \\ 5 & 2 \end{pmatrix}$	determine the matrices of given linear transformations
	Unit 3.2 (cont'd) Linear transformations 3.2.3 find the inverse of a linear transformation.	Inverse of a linear transformation	Assist students to find the inverse of linear transformation by (i) finding the matrix of transformation A (ii) finding the inverse of the matrix A^{-1} (iii) using the inverse matrix to write the inverse of the linear transformation; i.e. $A^{-1} \begin{pmatrix} x \\ y \end{pmatrix}$	find the inverses of given linear transformations
3.2.4 find the composition of linear transformations.	Composition of linear transformations	Assist students to find the composition of linear transformations by (i) writing the matrices A and B of the given transformations (ii) finding the matrix product AB (iii) writing the linear transformation for AB as the composition of the linear transformations i.e. $AB \begin{pmatrix} x \\ y \end{pmatrix}$ Guide students to interpret $AB \begin{pmatrix} x \\ y \end{pmatrix}$ as the transformation for the matrix B followed by transformation for the matrix A.	find a single linear transformation that represents the composition of two given linear transformations	

UNIT	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
Unit 3.2 (cont'd) Linear transformations	The student will be able to: 3.2.5 recognise the identity transformations.	Identity transformations	Assist students to state the matrices of transformation corresponding to special linear transformations i. $\begin{pmatrix} \cos 2\theta & \sin 2\theta \\ \sin 2\theta & -\cos 2\theta \end{pmatrix}$, the general matrix for reflection in a line through the origin making an angle θ with the positive x-axis ii. $\begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$ for reflection in x-axis iii. $\begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}$ for reflection in y-axis iv. $\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$ for reflection in the line $y = x$. v. $\begin{pmatrix} \cos \theta & -\sin \theta \\ \sin \theta & \cos \theta \end{pmatrix}$ for anticlockwise rotation through θ about the origin. Include enlargement by a scale factor k , centre the origin	Let students: use the identity transformations to reflect and rotate given points.
	3.2.6 find the equation of the image of a line under a linear transformation.	Linear transformation of a line	Assist students to find the equation of the image of a given line under a linear transformation.	find the equation of the image of a line under a given linear transformation

SENIOR HIGH SCHOOL - YEAR 3

SECTION 2 LOGIC

General Objectives: The student will:

1. appreciate the concepts of logical reasoning
2. apply the concepts to determine the validity of compound statements
3. draw valid conclusions from truth tables
4. apply the rule of logic to deduce valid conclusions from arguments in general
5. be able to convince others logically on the validity of statements made

UNIT	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION															
Unit 3.3 Logic	<p>The student will be able to:</p> <p>3.3.1 identify compound statements.</p> <p>3.3.2 draw implications from given statements and their converses.</p> <p>3.3.3 draw the truth table of a compound statement.</p>	<p>Compound statements</p> <p>Implications and their converses</p> <p>The truth table</p>	<p>Assist students to form compound statements from simple statements using the connectives \wedge and \vee</p> <p>Assist students to form converse statements and comment on them</p> <p>Assist students to draw implications from given statements using the implication sign e.g. $P \Rightarrow Q$</p> <p>Assist students to draw the truth table using the rule of logic</p> <p>E.g.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="text-align: center;">P</td> <td style="text-align: center;">Q</td> <td style="text-align: center;">$P \Rightarrow Q$</td> </tr> <tr> <td style="text-align: center;">T</td> <td style="text-align: center;">T</td> <td style="text-align: center;">T</td> </tr> <tr> <td style="text-align: center;">T</td> <td style="text-align: center;">F</td> <td style="text-align: center;">F</td> </tr> <tr> <td style="text-align: center;">F</td> <td style="text-align: center;">T</td> <td style="text-align: center;">T</td> </tr> <tr> <td style="text-align: center;">F</td> <td style="text-align: center;">F</td> <td style="text-align: center;">T</td> </tr> </table> <p>Include negation, conjunction and disjunction.</p>	P	Q	$P \Rightarrow Q$	T	T	T	T	F	F	F	T	T	F	F	T	<p>Let students:</p> <p>use connectives to form compound statements and state their converses</p> <p>draw conclusions from given statements</p> <p>draw the truth table for given compound statements</p>
P	Q	$P \Rightarrow Q$																	
T	T	T																	
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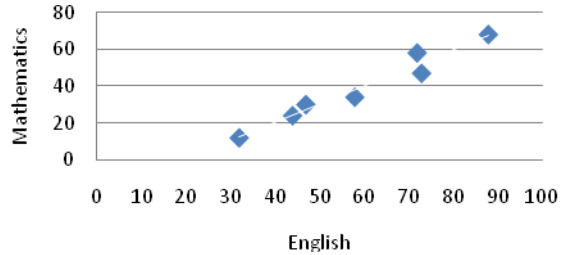
UNIT	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
	3.3.4 use the truth table to deduce conclusions of compound statements.	Validity of arguments	Assist students to use the truth table in drawing conclusions using the rule of syntax: true or false statement, rule of logic applied to arguments, implications and deductions.	draw valid conclusions from compound statements using the truth table

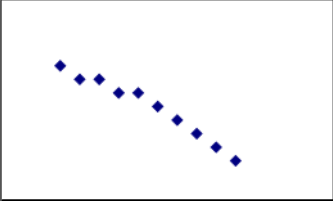
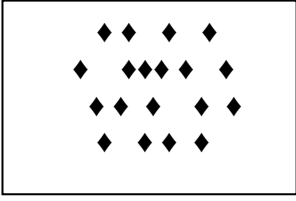
SENIOR HIGH SCHOOL - YEAR 3

SECTION 3 STATISTICS II

General Objectives: The student will:

1. represent bivariate data graphically and interpret the graph
2. use the equation of the line of best fit to make predictions
3. calculate correlation coefficients between two sets of data
4. use correlation coefficient to compare the relationship between the two variables

UNIT	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION																
<p>Unit 3.4. Correlation and Regression</p>	<p>The student will be able to: 3.4.1 draw the scatter diagram for a given data</p>	<p>The scatter diagram</p>	<p>Assist students to distinguish between univariate and bivariate distributions and to draw the scatter diagrams for bivariate distributions.</p> <p>Scatter diagram is used to graphically display bivariate distributions. One variable is along the x-axis and the other along the y-axis. E.g. The test scores of seven students in English and Mathematics are as shown:</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>English (x)</td> <td>12</td> <td>24</td> <td>30</td> <td>34</td> <td>47</td> <td>58</td> <td>68</td> </tr> <tr> <td>Mathematics(y)</td> <td>32</td> <td>44</td> <td>47</td> <td>58</td> <td>73</td> <td>72</td> <td>88</td> </tr> </table> <p>The ordered pairs (12, 32), (24, 44), etc are plotted in the x-y plane in (a)</p> <div style="text-align: center;">  </div> <p style="text-align: right;">A</p> <p>Assist students to use graphic calculators and computers to display bivariate distributions to cross</p>	English (x)	12	24	30	34	47	58	68	Mathematics(y)	32	44	47	58	73	72	88	<p>Let students: draw scatter diagrams for given sets of bivariate data</p>
English (x)	12	24	30	34	47	58	68													
Mathematics(y)	32	44	47	58	73	72	88													

UNIT	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
<p>Unit 3.4 (cont'd)</p> <p>Correlation and Regression</p>	<p>The student will be able to:</p> <p>3.4.2 identify and explain the various forms of correlation</p> <p>3.4.3 draw the line of best fit and use it to predict one variable given the other.</p>	<p>Forms of correlation in bivariate distributions</p> <p>Line of best fit Equation of line of best fit (regression)</p>	<p>check their result</p> <p>Discuss the various forms of correlation with students.</p> <p>Assist students to explain positive, negative and no correlations.</p> <ul style="list-style-type: none"> - If the points cluster around a straight line with a positive slope as shown in (a), then there is a positive correlation between the two variables, that is, as one increases so does the other. - If the points cluster around a straight line with a negative slope as shown in diagram (b), then there is a negative correlation between the two variables, that is, as one increases the other decreases. - If the points are randomly scattered, as shown in diagram (c), then there is no linear correlation (relationship) between the two variables. <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">(b)</div> <div style="text-align: center;">(c)</div> </div> <div style="display: flex; justify-content: space-around; align-items: center;">   </div> <p>Assist students to draw the line of best fit by first computing the:</p> <ol style="list-style-type: none"> (i) mean values \bar{x} and \bar{y} for all values of x and y; (ii) mean values \bar{x}_1 and \bar{y}_1 respectively for which x is less than \bar{x}; (iii) mean values \bar{x}_2 and \bar{y}_2 respectively for which x is greater than \bar{x} 	<p>Let students:</p> <p>distinguish among various types of scatter diagrams</p> <p>draw the line of best fit and find its equation by graph and by least squares method</p>

UNIT	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION																																																						
Unit 3.4. (cont'd) Correlation and Regression	The student will be able to:		<p>NB. The line of best fit must pass through (\bar{x}, \bar{y}) and either (x_1, y_1) or (x_2, y_2).</p> <p>Guide students to use the line of best fit to predict/estimate the value of a variable when one is given.</p> <p>Assist students to determine the equation of the line of best fit from the graph</p> <p>Guide students to find the equation of line of best fit by least squares method: $y = a + bx$; (regression of y on x)</p> <p>where $\sum y = an + b\sum x$ and $\sum xy = a\sum x + b\sum x^2$</p> <p>Assist students to use the equation to predict one variable given the other.</p> <p>Include regression of x on y .</p>	Let students:																																																						
Unit 3.5 Spearman's Rank Correlation Coefficient	3.5.1 calculate the correlation coefficient by ranking.	Spearman's rank correlation coefficient (Include data with ties)	<p>Assist students to calculate the correlation coefficient using the Spearman's rank correlation coefficient formula $r_s = 1 - \frac{6\sum d^2}{n(n^2 - 1)}$</p> <p>Example: The Spearman's rank correlation for the data on scores of 7 students in English and Mathematics tests in 3.4.6 is calculated as follows:</p> <table border="1" data-bbox="1077 1161 1682 1385"> <thead> <tr> <th>x</th> <th>y</th> <th>R_x</th> <th>R_y</th> <th>R_x - R_y (d)</th> <th>d²</th> </tr> </thead> <tbody> <tr><td>12</td><td>32</td><td>7</td><td>7</td><td>0</td><td>0</td></tr> <tr><td>24</td><td>44</td><td>6</td><td>6</td><td>0</td><td>0</td></tr> <tr><td>30</td><td>47</td><td>5</td><td>5</td><td>0</td><td>0</td></tr> <tr><td>34</td><td>58</td><td>4</td><td>4</td><td>0</td><td>0</td></tr> <tr><td>47</td><td>73</td><td>3</td><td>2</td><td>1</td><td>1</td></tr> <tr><td>58</td><td>72</td><td>2</td><td>3</td><td>-1</td><td>1</td></tr> <tr><td>68</td><td>88</td><td>1</td><td>1</td><td>0</td><td>0</td></tr> <tr><td>Total</td><td></td><td></td><td></td><td></td><td>2</td></tr> </tbody> </table>	x	y	R _x	R _y	R _x - R _y (d)	d ²	12	32	7	7	0	0	24	44	6	6	0	0	30	47	5	5	0	0	34	58	4	4	0	0	47	73	3	2	1	1	58	72	2	3	-1	1	68	88	1	1	0	0	Total					2	
x	y	R _x	R _y	R _x - R _y (d)	d ²																																																					
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UNIT	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
	<p>The student will be able to:</p> <p>3.5.2 interpret correlation coefficients.</p>	<p>Interpretation of correlation coefficients</p>	$r_s = 1 - \frac{6 \sum d^2}{n(n^2 - 1)} = 1 - \frac{12}{7(49 - 1)} = 1 - \frac{1}{28} = \frac{27}{28} = 0.964$ <p>Assist students to draw conclusions from the coefficient calculated.</p> <p>Note: the value of r_s lies between -1 and 1.</p> <p>If $r_s = 1$ then there is perfect positive correlation between the two sets of data</p> <p>If $r_s = -1$, then there is perfect negative correlation, or complete disagreement between the two sets of data</p>	<p>Let students:</p> <p>interpret correlation coefficients of a given sets of data</p>

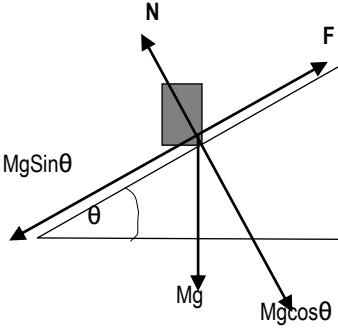
SENIOR HIGH SCHOOL- YEAR 3

SECTION 4 MECHANICS II

General Objectives: The student will:

1. recognize forces as vectors
2. distinguish between static and dynamics
3. resolve forces and find their resultants
4. determine coefficient of friction
5. find momentum and impulse
6. apply ideas in mechanics to solve practical problems

UNIT	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
Unit 3.6 Dynamics	The student will be able to:			Let students:
	3.6.1 explain the concepts of motion, time and space.	Concepts of motion –Displacement, velocity (Relative velocity) and acceleration.	Assist students to explain the concept of dynamics and relate it to statics Assist students to draw and interpret distance – time, and velocity – time graphs	draw graphs of motion and interpret them use the equations of motions to solve real-life problems. E.g.
	3.6.2 state and use Newton’s equations of motion to solve simple problems.	Equations of Motion Newton’s laws	Assist students to deduce and use the following Newton’s laws of motion to solve related problems: (i) $F = ma$ (ii) $v = u + at$ (iii) $s = ut + \frac{1}{2}at^2$ (iv) $v^2 = u^2 + 2as$	A particle of mass 2 kg at rest is acted upon by three forces $F_1 = (20\text{ N}, 090^\circ)$, $F_2 = (8\text{ N}, 210^\circ)$ and $F_3 = (8\text{ N}, 330^\circ)$.
3.6.3 solve simple problems involving motion under gravity.	Motion under Gravity	Assist students to solve simple problems on motion under gravity involving: (i) particles projected vertically upwards (ii) particles falling freely under gravity (Ignore air resistance)	Calculate the resultant force and the acceleration of the particle. solve real-life problems involving motion under gravity E.g. A boy standing on top a building 112 m high throws a ball vertically upwards with an initial	

UNIT	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
<p>Unit 3.6 (cont'd) Dynamics</p>	<p>The student will be able to:</p> <p>3.6.4 find the force up an inclined plane.</p>	<p>Motion along inclined planes</p>	<p>Assist students to resolve a force up an inclined plane into Normal and Frictional Force</p>  <p>Assist students to solve simple related problems</p>	<p>Let students:</p> <p>velocity of 96 ms^{-1}</p> <p>(a) Find the ball's height and velocity at time t.</p> <p>(b) When does the ball hit the ground and what is the impact velocity?</p> <p>(c) When is the velocity zero?</p> <p>solve real life problems involving motion along inclined planes</p> <p>E.g.</p> <p>A body of mass 8kg rests on a smooth plane inclined at 30° to the horizontal. Find the least value of the force required to keep it in equilibrium and the resultant reaction of the plane. [Take $g = 10\text{ms}^{-2}$]</p>

UNIT	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
	<p>The student will be able to:</p> <p>3.6.5 apply the principles of conservation of linear momentum to solve simple problems on direct impact.</p>	<p>Direct impact</p>	<p>Guide students to distinguish between momentum and impulse</p> <p>Assist students to apply the principle of conservation of linear momentum:</p> <p>(i) $m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2$</p> <p>(ii) $m_1u_1 + m_2u_2 = (m_1 + m_2)v$</p> <p>(Exclude coefficient of restitution)</p>	<p>Let students:</p> <p>state and use the principle of conservation of linear momentum to solve real life problems.</p> <p>E.g. Two particles A and B with masses 3 kg and 4 kg moving with velocities</p> <p>$\mathbf{u}_1 = 2\mathbf{i} + 3\mathbf{j}$ and</p> <p>$\mathbf{u}_2 = -\mathbf{i} + 4\mathbf{j}$</p> <p>respectively, collide. After collision particle A moves with velocity $2\mathbf{i} - \mathbf{j}$. Determine the velocity of particle B after collision.</p>

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