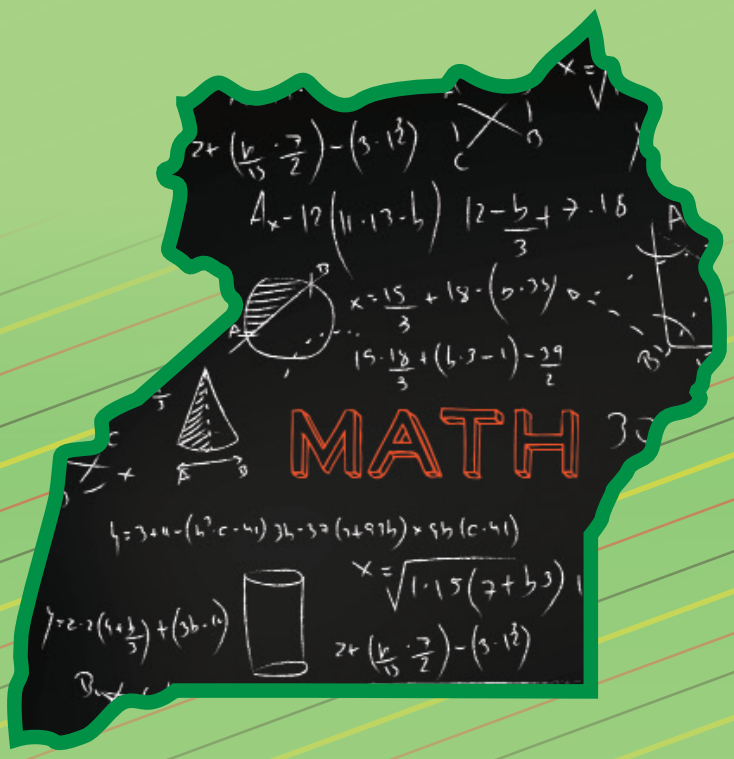
THE REPUBLIC OF UGANDA
Ministry of Education and Sports

ADVANCED SECONDARY CURRICULUM



SUBSIDIARY MATHEMATICS SYLLABUS

NCDC
NATIONAL CURRICULUM DEVELOPMENT CENTRE
2025

ADVANCED SECONDARY
CURRICULUM

SUBSIDIARY MATHEMATICS
SYLLABUS

2025

NCDC
NATIONAL CURRICULUM
DEVELOPMENT CENTRE

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FOREWORD

The Ministry of Education and Sports, through the National Curriculum Development Centre (NCDC), aligned the Advanced Level Curriculum with the competency-based Lower Secondary Curriculum (LSC) to ensure a smooth learner transition from lower secondary to advanced level.

The two-year aligned Advanced Secondary Curriculum adopted learner-centered approaches, inquiry-based, and discovery methods. The learning outcomes give the learner hands-on experiences in real-life situations while being cognizant of different learner abilities and learning styles. The syllabus focuses on assessment for learning with emphasis on criterion-referenced assessment. It further provides learners with the opportunity to enhance the 21st-century skills and values that were acquired at the lower secondary level.

This Subsidiary Mathematics syllabus is fundamental in providing tools for analysing and interpreting data in all fields of life. It is also essential for logical reasoning and making informed decisions. It promotes acquisition of Higher-Order Thinking Skills (HOTS) such as inquiry, creativity and innovation, decision-making, critical thinking and problem-solving. It calls for the use of learner-centred pedagogies with hands-on experience by the learners in real life situations, while acknowledging different learner abilities and learning styles.

As the Minister responsible for Education, I, endorse this syllabus as the official document for teaching and learning Subsidiary Mathematics at the Advanced Level of secondary education in Uganda.

Hon. Janet Kataaha Museveni
First Lady and Minister of Education & Sports

ACKNOWLEDGMENTS

The National Curriculum Development Centre (NCDC) is indebted to the Government of Uganda for financing the alignment of the Advanced Level Curriculum to Lower Secondary Education in Uganda.

Our gratitude goes to the Ministry of Education and Sports for overseeing the adaptation of the curriculum, the Curriculum Task Force of the Ministry of Education and Sports for the oversight role and making timely decisions whenever necessary, and members of the public who made helpful contributions towards shaping this curriculum.

NCDC is also grateful to Members of Parliament, schools, universities, and other tertiary institutions, the writing panels, and professional bodies, for their input in the design and development of the Adapted A level curriculum. To all those who worked behind the scenes to finalise the adaptation process of this teaching syllabus, your efforts are invaluable.

NCDC takes responsibility for any shortcomings that might be identified in this publication and welcomes suggestions for effectively addressing the inadequacies. Such comments and suggestions may be communicated to NCDC through P. O Box 7002, Kampala, or Email: admin@ncdc.go.ug or on the Website: www.ncdc.go.ug

Dr Grace K. Baguma
Director
National Curriculum Development Centre

1.0 INTRODUCTION

The Advanced Secondary Curriculum has been aligned with the Lower Secondary competency-based model for ease of progression of learners from the Lower to Advanced Secondary Level. The alignment is a result of the analysis of the Advanced Level Curriculum published in 2013, to determine whether the content is:

i) appropriate,
ii) high pitched or overloaded,
iii) covered at lower secondary,
iv) obsolete, or
v) repeated in different topics and redundant.

The results from the curriculum analysis revealed that there were overlaps of concepts with what was covered at the Lower Secondary, as well as concepts within different topics of the same subject. In addition, a number of syllabuses had content that is no longer necessary for today's contemporary society and the 21st century.

1.1. Changes in the Curriculum

The alignment of the A-Level Curriculum to that of the Lower Secondary led to changes in the pedagogies of learning from a knowledge- and objective-based, to an integrated and learner-centred competency-based approach. The adapted syllabus, therefore, is a result of rationalising, integrating, and merging content with overlaps and similar skills, dropping topics that had been studied at Lower Secondary, or are no longer critical and relevant for the current learning needs, while upgrading those that were of low competencies to match with the advanced level. The programme planner details the learning progression derived from the learning outcomes. The detailed syllabus section unfolds the learning experiences with corresponding assessment strategies.

This Subsidiary Mathematics syllabus is part of the Advanced Secondary Curriculum. The teacher is encouraged to read the whole syllabus before planning your teaching programme, since many topics have been merged, upgraded, or removed. While aligning this syllabus, efforts were made to ensure a smooth progression of concepts from the Lower Secondary Level, adapting topics and content with familiar features that are of value to the learner and society. In addition, the process of developing this syllabus document removed what was considered obsolete, high pitched as well as content overlaps and overloads.

1.2. Classroom Based Assessment

This syllabus requires classroom learning to be experiential, through the suggested learning activities for the acquisition of the learning outcomes. This is the gist of a learner-centred and activity-based approach to learning, which emphasises the acquisition of required competencies. Formative assessment in Subsidiary Mathematics will focus on the acquisition of knowledge and skills, through performance of the learning activities.

The learning activities sprout from the learning outcomes, which are evidenced by acquiring and demonstrating the application of the desired skills, to show that learning has taken place. The sample assessment strategies have been provided to guide the teacher on classroom-based assessment. The teacher can develop more assessment strategies based on the same principles of observation, conversation, and product, for the acquisition of the desired knowledge, skills, values, and attitudes. (See detailed syllabus)

1.3. Learners with Special Educational Needs (SEN)

The Advanced Secondary Curriculum is designed to empower all learners, including those with Special Educational Needs (SEN), to reach their full potential and contribute meaningfully to the nation. By incorporating inclusive strategies, the curriculum ensures equitable access to high-quality learning opportunities while maintaining high academic standards. It emphasises creating an inclusive learning environment that supports the diverse needs of learners with SEN, enabling them to succeed alongside their peers.

1.4 Generic Skills

Generic skills are embedded within all subjects and are essential for learning and workforce readiness. These skills enable learners to engage with the entire curriculum effectively and prepare them for lifelong learning. These skills equip learners with the ability to adapt to change and navigate life's challenges in the 21st century.

The key generic skills include:

1

Critical thinking and problem-solving

i) Planning and carrying out investigations
ii) Sorting and analysing information
iii) Identifying problems and proposing solutions
iv) Predicting outcomes and making reasoned decisions
v) Evaluating different solutions

2

Co-operation and Self-Directed Learning

i) Working effectively in diverse teams
ii) Interacting effectively with others
iii) Taking responsibility for own learning
iv) Working independently with persistence
v) Managing goals and time

3

Creativity and Innovation

i) Using imaginations to explore possibilities
ii) Working with others to generate ideas
iii) Suggesting and developing new solutions
iv) Experimenting with innovative alternatives
v) Looking for patterns and making generalisation

4

Communication

i) Listening attentively and with comprehension
ii) Talking confidently and explaining ideas/opinions clearly
iii) Reading accurately and fluently
iv) Writing and presenting information coherently
v) Using a range of media to communicate ideas

5

Mathematical Computation

i) Using numbers and measurements accurately
ii) Interpreting and interrogating mathematical data
iii) Using mathematics to justify and support decisions

6

Information and Communication Technology (ICT) Proficiency

i) Using technology to create, manipulate and process information
ii) Using technology to collaborate, communicate and refine work

7

Diversity and Multicultural Skills

i) Appreciate cultural diversity
ii) Respectfully responding to people of all cultures
iii) Respecting positive cultural practices
iv) Appreciating ethnicity as a cradle for creativity and innovation

1.5. Cross-cutting Issues

These are issues which young people need to learn about, and are not confined to a particular subject but are studied across subjects. They help learners to develop an understanding of the connections between the subjects and the complexities of life as a whole. They are;

i) environmental awareness,
ii) health awareness,
iii) life skills,
iv) mixed abilities and involvement,
v) socio-economic challenges, and
vi) citizenship and patriotism.

These are a concern to all mankind irrespective of their areas of speciality. They are infused in the different learning outcomes of the different subjects.

1.6. Values

The curriculum is based on a clear set of values. These values underpin the whole curriculum and the work of schools. Learners need to base themselves on these values as citizens of Uganda. These values are derived from Uganda's National Ethical Values Policy (2013). They are;

i) respect for humanity and environment,
ii) honesty, uphold and defend the truth at all times,
iii) justice and fairness in dealing with others,
iv) hard work for self-reliance,
v) integrity; moral uprightness and sound character,
vi) creativity and innovation,
vii) social responsibility,
viii) social harmony,
ix) national unity, and
x) national consciousness and patriotism.

These are not taught directly in lessons, nor are they assessed by pen and paper. However, they are incorporated in some learning outcomes and are developed as learners progress.

1.7. Information and Communication Technology (ICT) Integration

The integration of ICTs into teaching and learning is strongly encouraged in this A-level adapted curriculum. ICT enhances the implementation of competency-based learning by fostering learner engagement, creativity, and lifelong learning. Teachers are encouraged to use technology to create interactive content, such as digital simulations and videos, to illustrate abstract or complex concepts effectively. Integrating ICT not only enhances the learning experience but also equips learners with essential digital skills for the 21st century.

ICT teachers should endeavour to assist other subject teachers in making the ICT integration process a reality. The table below shows a sample of suggested ICT tools that may be applied to given tasks.

Sample Task in the Syllabus	Suggested ICT Tool
Fieldwork	Use of cameras to take photos and record videos
Locate places on a map	Use digital maps such as Google Maps or an equivalent application.
Presentation in class	Use presentation applications or online presentation tools like Canva
Search for keywords and meanings	Use an online dictionary or search online
Make drawing/graphics	Use drawing tools like Draw.io or publishing software/Word processor
Roleplay, narrations	Use audio and video recordings
Demonstrations	Use audio/video recordings, models, simulations, or virtual labs
Analyse and present data	Use spreadsheet software or any other analytics tools
Group discussions	Mind mapping software
Search for extra reading materials	Download files from the Internet from academic Databases
Writing equations and formulae	Use equation editors like MathType
Carry out academic search/research	Use the Internet, AI models, and other academic applications like "Encarta", "Britannica", etc.
Collaborate with others across the world	Form learning networks with blogs, social media, emails, and videoconferencing tools like Zoom, MS Teams, Webex, Google Meet or any other networking application.

1.8. Projects and Project-Based Learning in Subsidiary Mathematics

Projects and project-based learning are integral part of the teaching and learning of Subsidiary Mathematics in the 21st century. Learners will undertake mathematical projects designed to enhance their understanding of fundamental mathematical concepts and explore how mathematics can address real-life problems in their immediate environment.

Teachers are encouraged to guide learners in selecting projects that are manageable, relevant and easily linked to what is happening in your local environment such as analysing scientific data, solving basic optimization problems, or interpreting economic trends. While doing this, make effort to keep aligned to the learning outcomes of the topic you are teaching.

Through guided research and teacher support, learners will gain hands-on experience in using mathematical tools, solving practical problems, and effectively communicating their findings.

This initiative will support the development of essential competencies such as analytical thinking, problem solving, computational accuracy, and effective communication, which are critical in the 21st century.

1.9. The Aims of Secondary Education

The secondary education in Uganda aims to:

i) instil and promote national unity, an understanding of the social and civic responsibilities, strong love and care for others and respect for public property, as well as an appreciation of international relations and beneficial international co-operation.
ii) promote an appreciation and understanding of the cultural heritage of Uganda including its languages.
iii) impart and promote a sense of self discipline, ethical and spiritual values, personal and collective responsibility and initiative.
iv) enable individuals to acquire and develop knowledge and an understanding of emerging needs of society and the economy.
v) provide up-to-date and comprehensive knowledge in theoretical and practical aspects of innovative production, modern management methods in the field of commerce and industry and their application in the context of socio-economic development of Uganda.
vi) enable individuals to develop basic scientific, technological, technical, agricultural and commercial skills required for self-employment.
vii) enable individuals to develop personal skills of problem solving, information gathering and interpretation, independent reading and writing, self-improvement through learning and development of social, physical and leadership skills such as are obtained through games, sports, societies and clubs.
viii) lay the foundation for further education.
ix) enable the individual to apply acquired skills in solving problems of community, and to develop a strong sense of constructive and beneficial belonging to that community.
x) instil positive attitudes towards productive work and strong respect for the dignity of labour and those who engage in productive labour activities.
xi) develop a positive attitude towards learning as a lifelong process.

1.10. Aims of the Advanced Secondary Curriculum

The aims of the Advanced Level Curriculum include:

i) To adopt a competency-based learning approach.
ii) To develop holistic education for personal and national development based on clear shared values.
iii) To develop key skills which are essential to work and life and promote life-long learning.
iv) To adopt an integrated approach to learning that develops the ability of learners to apply learning.
v) To improve on assessments by incorporating school-based assessment into End of Cycle Assessment.
vi) To emphasise learner's participation through engagement with the community.
vii) To prepare learners for further education.

1.11. Rationale for teaching Subsidiary Mathematics at Advanced Level

The Advanced Level Subsidiary Mathematics syllabus aims to:

i) Build on basic mathematical concepts to deepen learners' understanding of the subject at Advanced Level and enhance their ability to construct mathematical models.
ii) Equip learners to use mathematics as a clear and effective means of communication, emphasizing precision and logical thought in their expressions.
iii) Inspire learners to develop a positive attitude towards mathematical problem-solving and logical reasoning, fostering confidence in applying mathematical techniques to unfamiliar real-life situations.
iv) Empower learners to present and interpret mathematical information in diagrammatic, tabular, and graphic forms, preparing them for further education, vocational application, and informed decision-making.

1.12. Subject Overview

The areas of study have been re-organised within the syllabus to come up with the adapted version. The subject areas of study are: data analysis, effective mathematical communication, and practical problem-solving skills.

This Advanced Level Subsidiary Mathematics syllabus enables the learner to:

i) Analyse data and mathematical equations thereby developing critical thinking skills for decision making.
ii) Interpret and present data in various forms for logical and effective mathematical communication and lifelong learning.
iii) Develop logical reasoning and problem-solving skills, fostering confidence in addressing unfamiliar real-life situations.

1.13. Time Allocation

The learners shall be engaged for six (6) forty-minute periods per week, from senior five to senior six.

1.14. Suggested Approaches to Teaching and Learning Subsidiary Mathematics

The suggested approaches enhance learning and empower teachers to support learners so that they acquire the planned competencies. This necessitates teachers to work alongside learners to guide, support, and supervise them as they progress through the learning process. These approaches include:

i) Inquiry-based learning: Learners are encouraged to investigate through research that is directed by their interest, and solve problems through questions and scenario. Thus, enhancing critical thinking, communication and research skills.

ii) Experiential learning: Learners actively participate in hands-on experiences during research and learn through reflecting upon what they are doing which leads to development of reflective skills.
iii) Problem and project-based learning: Learners find solutions to problems through their experience in research and projects. This leads to development of critical thinking, social, and research skills.
iv) Case-based learning: Learners refer to real world scenarios to discuss and analyse them, enabling them to develop critical thinking, analytical, and research skills.
v) Discovery learning: Learners construct their own knowledge through active participation which encourages them to critically think, ask questions, and hypothesise through research.

NOTE: The suggested teaching and learning strategies in this syllabus are not exhaustive. Teachers are encouraged to devise other teaching strategies to enable the learner to achieve the learning outcomes and develop prescribed competences.

1.15. Programme Planner

Term	Topics	Sub-topics	Periods
Senior Five Term 1	1. Matrices	1.1 Simultaneous Equations in 2 variables 1.2 Simultaneous Equations in 3 variables	20
	2. Quadratics	2.1 Formation of Quadratic Equations 2.2 Optimising Quadratic Functions	22
	3. Descriptive Statistics	3.1 Measures of Variation (Dispersion) 3.2 Measures of Relative Positions	30
		Total	**72**
Term 2	4. Numerical Concepts	4.1 Equations Reducing to Quadratics 4.2 Logarithms	22
	5. Series	5.1 Arithmetic Progression 5.2 Geometric Progression	16
	6. Permutations and Combinations	6.1 Permutations 6.2 Combinations	18
	7. Time Series Analysis	7.1 Moving Averages 7.2 Index Numbers	16
		Total	**72**
Term 3	8. Scatter Diagrams and Correlations	8.1 Scatter Diagrams 8.2 Correlations	20
	9. Vectors	9.1 Magnitude and Direction of Vectors 9.2 Dot Product (Scalar Product) and Angle Between Two Vectors	23
	10. Trigonometry	10.1 Trigonometric (Pythagorean) Identities 10.2 Special Angles in Trigonometry 10.3 Quadratic Trigonometric Equations	29
		Total	**72**
Senior Six Term 1	11. Probability Theory	11.1 Conditional Probability	32
	12. Differentiation	12.1 Derivative of a Function 12.2 Maximization and Minimization 12.3 Curve Sketching 12.4 Displacement, Velocity and Acceleration	40
		Total	**72**

Term 2	13. Integration	13.1 Definite and Indefinite Integrals 13.2 Area Under the Curve 13.3 Displacement, Velocity and Acceleration	36
	14. Random Variables	14.1 Discrete Random Variables 14.2 Continuous Random Variables	36
		Total	**72**
Term 3	15. Probability Distributions	15.1 Binomial Distribution 15.2 Normal Distribution	36
	16. Differential Equations	16.1 Concept of a Differential Equation 16.2 Solutions of a Differential Equation	24
		Total	**60**

1.16. Note to users:

Each topic has a competency - a broad statement that brings out what the learner is expected to do at the end of the topic. The competency is broken down into learning outcomes, for which suggested learning activities and sample assessment strategies are developed as represented in the three columns as follows:

Learning outcomes	Suggested learning activities	Sample assessment strategy
A statement of the knowledge (k), understanding (u), skills (s), generic skills (gs), values (v), and attitudes (a) expected to be learned by the end of a topic. Hence, every learning outcome is coded with k, u, s, gs, and v/a to guide the teacher on what to consider during a lesson.	The sort of hands and minds on engagements, which enable the learner to achieve the learning outcome including the generic skills and values. They are designed to enable learners to Discover, Explain, Apply and Analyse (DEAA) as they participate in knowledge construction.	Opportunities for assessment within the learning process that is, during and after the lesson.

The learning activities and assessment strategies in the syllabus are "suggested" and "samples" respectively and not exhaustive. The teacher is encouraged to develop more learning activities and assessment strategies that are based on the learning outcomes. In addition, the teacher is free to customise the suggested learning activities to make them suitable for their respective learning environments and for learners with Special Educational Needs (SEN).

2.0 DETAILED SYLLABUS

SENIOR FIVE TERM 1

TOPIC 1: Matrices

Duration: 20 Periods

Competency: The learner applies matrices to represent data for solving real-world problems.

Learning Outcomes The learner should be able to:	Suggested Learning Activities	Sample Assessment Strategies
a) present data from real life scenarios using matrices for informed decision making. (k, s, u, v/a, gs)	a) In group discussions, learners review: i) matrix formation ii) the order of matrices iii) types of matrices iv) operations on matrices (addition, subtraction and multiplication). b) Through field visits, learners collect and present data like type and number of library books or members of different school clubs in a matrix form using ICT tools or otherwise.	a) Observe learners as they review properties of matrices, collect and present data in matrix form, noting learners' ability to: i) listen attentively and with comprehension, ii) sort and analyse information, and iii) demonstrate justice and fairness in dealing with others. b) Engage learners and gauge their ability to explore types of operations on and properties of matrices, guiding them with thought-provoking questions to foster insightful discussions on presenting data using ICT tools or otherwise. c) Assess learners' written or ICT-aided work to check accuracy of the types of and operations on matrices, data presentation in matrix form.
b) solve real life problems like resource allocation, financial management using matrices. (k, s, u, v/a, gs)	a) Through Think- Pair- Share, learners review the determinant of a 2X2 matrix. b) Through group discussions, learners apply determinant method (Cramer's rule) to solve simultaneous equations in two variables	a) Observe learners as they discuss determinant of matrices to solve simultaneous linear equations, noting learners' ability to: i) use mathematics to justify and support decisions, ii) interact effectively with others, and

	derived from real world contexts. c) In groups, using inductive approach, learners discuss the determinant of a 3x3 matrix. d) Through group discussions, learners explore how to solve simultaneous equations in 3 variables using Cramer's rule (determinant method). e) Individually, the learner uses the internet or other sources to investigate the application of matrices in real life.	iii) exhibit hard work for self-reliance. b) Through thought-provoking questions, examine learners' ability to apply matrix method in solving simultaneous equations in two and three variables. c) Assess learners' written work to check: i) correctness of the calculation of the determinant of matrices, ii) accuracy of the determinant of matrices, iii) application of matrix method to solve simultaneous equations in two and three variables, and iv) use of the internet or other sources to investigate the application of Matrices in real life.

TOPIC 2: Quadratics

Duration: 22 Periods

Competency: The learner applies concepts of quadratic equations to solve real-life problems in different contexts.

Learning Outcomes The learner should be able to:	**Suggested Learning Activities**	**Sample Assessment Strategies**
a) examine the relationship between the sum and product of the roots of quadratic equations in solving real-life problems. (k, u, gs, v/a)	a) Through group discussions, learners review factorisation and completing the square of quadratic expressions. b) Using Think- Pair- Share, learners discuss how to interpret the sum and product of roots.	a) Observe learners as they discuss sum and product of roots, focusing on their ability to: i) use imagination to explore possibilities ii) work with others to generate ideas iii) demonstrate justice and fairness for others. b) Engage learners and judge their ability to carry out factorisation, completing the square of quadratic expressions and interpreting the sum and product of roots. c) Assess the learners' work to check the accuracy of completing the square. Evaluate their ability to correctly apply the relationships between roots and the general quadratic equation.
b) solve real-life problems such as optimizing areas or maximizing profits, minimizing losses using concepts of quadratic equations. (k, u, gs, v/a)	a) In groups, learners discuss and identify minimum/ maximum values by completing squares. b) Individually, learners use the internet/ library or other sources to find out applications of quadratics in real life situations.	a) Observe learners as they discuss their work on optimization of quadratic functions. Focus on their ability to: i) take responsibility for own learning ii) interpret and interrogate mathematical data iii) show hard work and self-reliance. b) Through conversation, prompt learners and establish their ability to obtain optimal values from quadratic functions. c) Assess the clarity and accuracy of learners' written work on: i) maximum and minimum values of quadratic functions. ii) applications of quadratics in real life situations.

TOPIC 3: Descriptive Statistics

Duration: 30 Periods

Competency: The learner analyses statistical measures to effectively interpret data from real-life contexts enabling them to make informed decisions.

Learning Outcomes The learner should be able to:	**Suggested Learning Activities**	**Sample Assessment Strategies**
a) examine measures of relative position and data variability to make informed decisions in real-life contexts. (k, u, v/a, gs)	a) Through group work and exploration, learners review: i) data types, ii) collection, classification and organization of data using frequency distribution tables, iii) estimation of measures of central tendency (mean, mode, median) iv) representation of data b) In groups, learners analyse measures of relative position (percentiles, deciles, quartiles) through discussion and Hands on -Minds on activities to; i) assess data variability, ii) determine the use of relative positions in interpreting data distribution, and iii) identify value positions and apply these concepts to real-life scenarios like performance analysis and data comparison.	a) Observe learners as they discuss measures of relative position and data variability, assessing their ability to; i) interact effectively with others, ii) listen attentively and with comprehension, and iii) exhibit social harmony. b) Engage with learners and evaluate their ability to; i) organize and present data on measures of central tendency and ii) apply measures of relative position to interpret data distribution and identify specific value positions. c) Assess learners' written work and focus on: i) correctness of constructed frequency distribution tables, ii) accuracy in computing measures of central tendency and relative location, and iii) interpretation of data, and ability to solve real-life problems.

b) apply measures of dispersion to predict trends and make informed decisions in real-life contexts. (k, u, v/a, gs)	a) Using learning stations, learners analyse a data set to calculate the range, variance, standard deviation and explore how variability influences decision-making.	a) Observe learners as they interpret and analyse mathematical data using measures of dispersion. Look for: i) evidence of hard work for self-reliance, ii) ability to plan and carry out investigations iii) sort and analyse information. b) Engage learners in a discussion and examine their ability to analyse a data set, to calculate the range, variance, and standard deviation, and how variability influences decision-making. c) Assess learners' written work, analysis reports and charts. Focus on learners' ability to: i) interpret data and apply measures of dispersion to real-world scenarios ii) correctly calculate range, variance, and standard deviation and verify whether their conclusions are clear, logical and well-supported.

SENIOR FIVE TERM 2

TOPIC 4: Numerical Concepts

Duration: 22 Periods

Competency: The learner applies indices and logarithms to solve societal problems involving exponential relationships and scaling in various fields.

Learning Outcomes The learner should be able to:	**Suggested Learning Activities**	**Sample Assessment Strategies**
a) solve real-world scenarios using laws of indices. (k, s, u, v/a, gs)	a) Using a Socratic circle, learners review: i) powers as indices, ii) the laws of indices, iii) the simplification of expressions; Engaging in discussions to deepen their understanding and explore real-world applications. b) Through group discussions, learners solve real-world scenarios, such as exponential growth and decay, that reduce to quadratics, using the laws of indices and interpret the solutions within context.	a) Observe learners as they discuss indices and relate them to logarithms noting their ability to: i) plan and carry out investigations ii) talk confidently and explain opinions clearly, iii) exhibit justice and fairness in dealing with others. b) Engage learners in a discussion and evaluate their ability to: i) solve equations that simplify to quadratics using the laws of indices; and ii) interpret their solutions of real-world scenarios such as exponential growth and decay. c) Assess clarity and accuracy of learners written work as they apply the laws of indices to: i) solve real-world problems; ii) simplify equations to quadratics; and iii) interpret the solutions in contexts like exponential growth, decay, demonstrating application of these concepts.

b) interpret the solutions of logarithmic equations in linear form to address real-world contexts. (k, s, u, v/a, gs)	a) In groups, learners explore the relationship between logarithms and indices, logarithmic notation and the laws of logarithms. b) Through a Socratic circle, learners discuss how to apply laws of indices and logarithms in solving equations. c) Learners apply concepts of indices and logarithms to real-world scenarios, such as exponential growth, decay, navigation, and music, through a project-based investigation, utilising online resources or other materials.	a) Observe learners as they interpret solutions to logarithmic equations within real-world contexts, focusing on their ability to: i) interact effectively with others ii) work with others to generate ideas iii) hard work for self-reliance. b) Engage learners in a dialogue and judge their ability to: i) solve logarithmic equations, ii) illustrate logarithmic notation iii) demonstrate the relationship between indices and logarithms, and their application to real-world problems c) Assess learners' project work, ensuring accuracy in solving logarithmic equations and logical reasoning in interpreting solutions. Evaluate their ability to connect mathematical computations with real-world scenarios.

TOPIC 5: Series

Duration: 16 Periods

Competency: The learner applies principles and techniques of series to analyse trends and business problems to enhance decision-making skills.

Learning Outcomes The learner should be able to:	Suggested Learning Activities	Sample Assessment Strategies
a) distinguish between Arithmetic and Geometric Progressions by recognising business related and financial applications. (k, s, u, v/a, gs)	a) Through group discussions, learners review pattern Identification, generation of sequences and number of terms in a sequence. b) Learners explore the pattern obtained, to sum the terms of that sequence to form a series using common difference or common ratio. c) In pairs, learners explore the definitions, formulas, and distinguishing features of each type of series, calculating terms, and determining whether the series are Arithmetic or Geometric.	a) Observe learners as they discuss arithmetic and geometric progressions, noting their ability to: i) interact effectively with others, ii) suggest and develop new ideas, and iii) exhibit justice and fairness in dealing with others. b) In a conversation through quizzes and peer feedback, examine learners' ability to: explore the differences between Arithmetic and Geometric series, nth term and sum of n terms of n terms of an AP and GP. c) Assess learners' written work for: i) correctness of nth term and sum of n terms of an AP and GP; and ii) accuracy in determining whether the series are Arithmetic or Geometric.
b) analyse business-related problems using arithmetic and geometric progressions. (k, s, u, v/a, gs)	a) In groups, learners discuss real-life financial scenarios such as instalment payments, interest growth, or pricing trends and identify whether these situations follow an arithmetic or geometric progression. They examine the patterns, discussing key	a) Observe learners as they discuss and apply arithmetic and geometric progressions in real-life, noting their ability to: i) use imaginations to explore possibilities,

	differences. and share their findings in a class presentation. b) Learners participate in a simulation where they act as financial advisors to a client with a specific financial goal (e.g., saving for a large purchase or planning for retirement). c) Using both Arithmetic and Geometric Progressions, learners design different savings or investment plans, discussing which plan might be more suitable based on the client's goals and timeline.	ii) predict outcomes and make reasoned decisions, and iii) exhibit creativity and innovation. b) In a conversation, evaluate learners' ability to discuss application of Arithmetic and Geometric Progression in real-life financial scenarios. c) Assess the learners' written work and ascertain proper application of the Arithmetic and Geometric progressions in real world scenarios such as investment growth and payment schemes and enhanced decision making.

TOPIC 6: Permutations and Combinations

Duration: 18 Periods

Competency: The learner applies knowledge of permutations and combinations to solve problems related to counting, arranging, and selecting items in different fields.

Learning Outcomes The learner should be able to:	**Suggested Learning Activities**	**Sample Assessment Strategies**
a) employ the knowledge of basic principles of counting in situations like sports team line-ups, library book displays, and line management during meal times to make informed decisions. (k, s, u, v/a, gs)	a) In groups, learners explore the basic principle of counting and how it is applied in arrangement of items to determine the number of ways in which a certain number of items can be arranged in a row/ line and circle. b) Learners brainstorm on how to: i) relate the number of ways of arranging in a row/line and circle n unlike objects to $n!$ ii) formulate examples and determine solutions using the formula $n!$	a) Observe learners as they discuss basic principles of counting, with focus on learners' ability to: i) talk confidently and explain ideas clearly ii) plan and carry out investigation iii) showcase respect for humanity and environment. b) In a conversation, prompt and evaluate learners' ability to: i) use the basic principle of counting ii) apply the principle in arrangement of items in a row/line and circle relating it with $n!$ c) Assess the learners' written work and check for correctness of the calculations as they use the formula $n!$
b) apply the knowledge of permutations in arrangement of items, paying attention to the order, for effective organisation of events from real life situations. (k, s, u, v/a, gs)	a) In groups, learners arrange sets of items in a specific order. b) In groups, learners explore and determine the number of ordered arrangements, relating their findings to the formula n_{P_r} using simple examples. c) In pairs, using various case studies, learners	a) Observe learners as they discuss arrangement of items paying attention to the order, with focus on how they: i) plan and carry out investigation, ii) listen attentively and with comprehension, and iii) exhibit justice and fairness in dealing with others.

	discuss how permutations are applicable in real life situations such as cryptography, programming, genetics and scheduling. Learners formulate and solve scenarios.	b) In a conversation, examine the ability of learners to deal with different sets of items and make arrangements, paying attention to the order and relate their findings to the formula n_{P_r} c) Assess the learners' written work and check for correctness of formulated scenarios and the appropriate use of the formula n_{P_r} in solving problems.
c) analyse the impact of different constraints in selection of items, for effective organization of events and activities. (k, s, u, v/a, gs)	a) In different groups, learners: i) discuss how to deal with selections from different sets of items. ii) determine the number of selections and relate their findings to the formula n_{C_r}, examining simple examples to solidify their understanding. b) After listening to guest speakers from relevant fields (e.g., a statistician, a computer scientist), in pairs learners discuss how combinations are applicable in real life situations. They formulate scenarios and practice finding solutions using the formula for combinations.	a) Observe learners as they discuss selection of items from a set with focus on how they: i) plan and carry out investigation ii) identify problems and ways forward iii) showcase justice and fairness in dealing with others. b) In a conversation, examine learners' ability to select from different sets of items and relate their findings to the formula n_{C_r}. c) Assess the learners' written work or presentation and check for correctness of formulated scenarios and the appropriate use of the formula n_{C_r} in solving problems.

TOPIC 7: Time Series Analysis

Duration: 16 Periods

Competency: The learner analyses the effectiveness of moving averages and index numbers on prediction of trends of events and their impact on policy decisions.

Learning Outcomes The learner should be able to:	Suggested Learning Activities	Sample Assessment Strategies
a) contrast between odd and even number of moving points to plot graphs of moving averages from real life situations. (k, s, u, v/a, gs)	a) In groups, learners explore the formulae and distinguish features of odd-point and even-point moving totals. b) In pairs, learners explore the skills of: i) calculating odd and even moving point averages, and ii) drawing and interpreting graphs of moving averages.	a) Observe learners as they discuss odd point and even point moving totals and averages, noting their ability to: i) interact effectively with others ii) sort and analyse information iii) showcase justice and fairness in dealing with others. b) In a conversation, examine learners' ability to explore the differences between odd and even number of moving points. c) Assess learners' write ups to check correctness of: i) identification of the trend of events. ii) odd point and even point moving totals. iii) odd and even moving averages.
b) predict trends of events from graphs for informed decisions using real life scenarios. (k, s, u, v/a, gs)	a) In groups, learners discuss the application of graphs of moving averages in making predictions when planning and choosing priorities.	a) Observe learners as they discuss moving averages, noting their ability to: i) plan and carry out investigation ii) identify problems and ways forward iii) showcase justice and fairness in dealing with others. b) In a conversation, judge learners' ability to apply moving averages in real–life scenarios such as bond markets and risk management.

		c) Assess the learners' graphical drawing and ascertain the proper application of the moving averages in real world scenarios.
c) evaluate index numbers and make analysis to inform the placement of priorities in real life. (k, s, u, v/a, gs)	a) Learners through think-pair-share, explore the formulae and distinguishing features of: i) Simple Index numbers/relatives, ii) Simple Aggregate index, iii) Simple average/cost of living index, iv) Weighted average/cost of living, v) Value index, and vi) Weighted aggregate index. b) In groups, learners calculate index numbers for different sets of data extracted from newspapers, internet etc, make analysis and predictions on trends of prices, consumption and the cost of living. c) Individually, learners conduct a research project on the impact of inflation on a particular sector of the economy.	a) Observe learners as they discuss price indices, note their ability to: i) interact effectively with others, ii) listen attentively with comprehension, and iii) exhibit justice and fairness in dealing with others. b) In a conversation, evaluate learners' ability to: i) differentiate between simple price index, unweighted price indices/ simple aggregate price index and weighted price indices; and ii) calculate index numbers for different sets of data and make analysis on trends of prices, consumption and the cost of living. c) Assess the learners' written work and check for correctness of calculations and interpretation of: i) price relative, ii) simple price index number, iii) simple aggregate price index, iv) weighted average price index, v) weighted aggregate price index, vi) value index, and vii) cost of living index.

SENIOR FIVE TERM 3

TOPIC 8: Scatter Diagrams and Correlations

Duration: 20 Periods

Competency: The learner interprets data from real life scenarios to understand relationships between two variables in various contexts for decision making and prediction.

Learning Outcomes The learner should be able to:	Suggested Learning Activities	Sample Assessment Strategies
a) interpret scatter graphs to visualise relationships and trends using real-world data from scientific experiments, economics, geography for prediction and decision making. (k, u, v/a, s, gs)	a) In groups, learners analyse a real-life case study involving two variables, such as study time and exam scores. They collect or simulate relevant data and organise it systematically. b) Using Think-Pair-Share, learners represent the relationship between two variables through a scatter diagram with an appropriate scale and draw the line of best fit through the mean point to make predictions. (Learners can use visual tools) c) In groups, learners interpret positive and negative correlations, such as between study time and exam scores, to make informed decisions and discuss the implications of their findings in the class.	a) Observe learners as they draw and interpret scatter graphs. Note their ability to: i) interact effectively with others ii) take responsibility for own learning, iii) demonstrate social responsibility. b) Converse with the learners and examine their ability to analyse; i) the choice of scales, ii) plotted points, iii) relationship between two sets of data. Give learners a task to also draw a line of best fit for prediction. c) Assess learners' written work for: i) correctness and logical organisation of the dataset. ii) a neatly constructed scatter graph with labelled axes and uniform scale. iii) a clear line of best fit. iv) accurate prediction.

b) analyse the type and strength of correlation between two variables for prediction and decision making (k, u, s, v/a, gs).	a) Through think- pair and share, learners calculate the Spearman's rank correlation coefficient from a data set to assess the strength and direction of the relationship between two variables, such as student rankings in different subjects, study habits, and academic performance quantitatively.	a) Observe learners as they calculate the Spearman's rank correlation coefficient. Focus on their ability to: i) sort and analyse information ii) predict outcomes and make reasoned decisions iii) demonstrate creativity and innovativeness. b) Converse with learners and judge their ability to: i) apply the formula for Spearman's rank correlation ii) assess the strength and direction of the relationship and the significance of their findings in the context of student rankings. c) Assess the learners' written report or analysis for: i) accuracy of Spearman's rank correlation calculation ii) accuracy of the results iii) correct explanation of the strength and direction of the relationship between the two variables.

TOPIC 9: Vectors

Duration: 23 Periods

Competency: The learner analyses vector concepts and operations to solve mathematical and physical problems in 2D spaces in various fields.

Learning Outcomes The learner should be able to:	**Suggested Learning Activities**	**Sample Assessment Strategies**
a) perform operations to determine magnitude and direction in 2D spaces in real-world situations. (k, s, u, v/a, gs)	a) Through think- pair and share, learners review; i) vector definitions, ii) vector notations, iii) position vectors, iv) displacement vectors, and v) vector algebra in 2D. b) Learners work in groups to discuss scalar multiplication on vectors and utilise digital tools such as GeoGebra or Desmos to visualise the resulting changes. c) Individually, learners explore magnitude and direction of a vector in 2D spaces and real-world situations like engineering, computer graphics design, and sports and present to the plenary	a) Observe learners as they discuss vector concepts in 2D noting their ability to: i) interpret and interrogate mathematical data ii) use technology to create, manipulate and process information iii) exhibit creativity and innovation. b) Converse with learners and examine their ability to: i) present different vector notations, operations and apply scalar multiplication ii) apply magnitude and direction in 2D and real-world situations. c) Assess learners' work for: i) correct use of the digital tools to demonstrate a clear understanding of scalar multiplication on vectors. ii) correctness of vector algebra in 2D. iii) correctness of magnitude and direction of a vector.
b) analyses the dot product (scalar product) and angle between two vectors to solve problems in	a) In groups, learners demonstrate how to compute dot product and angle between two vectors to solve problems in real-world	a) Observe the learners as they discuss dot /scalar product and determine the angle between two vectors. Note learners' ability to: i) work effectively in diverse teams,

real-world contexts. (k, s, u, v/a, gs)	contexts such as physics, engineering, and navigation.	ii) work independently with persistence, and iii) showcase creativity and innovativeness. b) Engage learners and evaluate their ability to apply dot product and angle between two vectors to real-life situations. c) Assess learners' written work to check for correct use of the dot product and the accuracy of the angle between two vectors.

TOPIC 10: Trigonometry

Duration: 29 Periods

Competency: The learner analyses trigonometric concepts to solve real-world problems in various fields.

Learning Outcomes The learner should be able to:	Suggested Learning Activities	Sample Assessment Strategies
a) use trigonometric ratios and their reciprocals to solve right angled triangle problems in real-life contexts such as construction and navigation. (k, u, s, v/a, gs)	a) Through group discussions, learners review sine, cosine, tangent of an angle of any magnitude using the quadrants of a unit circle and trigonometric ratios of angles greater than 90^0. b) Individually, learners use the trigonometric ratios of sine, cosine, and tangent to determine their corresponding reciprocals and share with the class. c) Using Think–Pair–Share, learners solve real-life problems involving trigonometric ratios such as determining the height of a wall using a ladder's angle and length, in construction contexts. d) Through guided discovery, learners use a right-angled triangle to explore the sine, cosine and tangent ratios of the special angles (30°, 45°, and 60°) and solve trigonometric problems in real life scenarios.	a) Observe learners as they solve right angled triangle problems in real-life context noting how they: i) plan and carry out investigations, ii) identify problems and ways forward, and iii) show social responsibility. b) Converse with learners and examine their ability to explore the sine, cosine and tangent ratios of the special angles (30°, 45°, and 60°) and solve trigonometric problems in real-life scenarios. c) Assess the learners' work. Look out for correctness of; i) a labelled diagram of the scenario, ii) a step-by-step calculation and explanation, and iii) the final answer and conclusion in relation to real-world scenarios.
b) apply trigonometric identities to solve practical problems in fields such as	a) Through Socratic circle, learners use the Pythagorean theorem and algebraic reasoning to derive Pythagorean	a) Observe learners as they discuss and derive trigonometric identities, noting learners' ability to: i) evaluate different solutions ii) identify problems and ways forward

physics and engineering. (k, u, s, v/a, gs)	trigonometric identities: $\sin^2\theta + \cos^2\theta = 1$, $\tan^2\theta + 1 = \sec^2\theta$ and $\cot^2\theta + 1 = \operatorname{cosec}^2\theta$ b) In groups, learners explore how trigonometric identities simplify calculations and are an integral part to solving real world problems in various fields.	iii) exhibit integrity; moral uprightness and sound character. b) In conversation examine the learners' ability to: i) derive trigonometric identities using the Pythagorean theorem and algebraic reasoning ii) explore the relationships between the identities and apply reasoning to prove their validity. c) Assess learners' written proofs of the trigonometric identities for correctness and how these identities are integral to solving real -world problems.
c) Solve quadratic trigonometric equations to address real-world problems in contexts like engineering and architecture. (k, u, s, v/a, gs)	a) Using Think–Pair–Share, learners review the sketching of $\sin\theta$, $\cos\theta$ and $\tan\theta$ graphs and how the properties of the graphs assist in solving quadratic trigonometric equations. b) In groups, learners engage in a guided inquiry activity to analyse a quadratic trigonometric equation, such as $2\sin^2\theta - \cos\theta = 1$, using factoring and trigonometric identities. They explore how these mathematical techniques are applied to real-world contexts, such as addressing engineering challenges in fields like construction and design.	a) Observe learners as they solve quadratic trigonometric equations from real-world challenges noting their ability to: i) work effectively in diverse teams, ii) interact effectively with others, and iii) exhibit creativity and innovativeness. b) Converse with learners and evaluate their ability to analyse the key features of sine and cosine graphs and how these features assist in solving quadratic trigonometric equations, with real-world applications. c) Assess learners' written solutions. Focus on the correctness of: i) the quadratic trigonometric equation, including a step-by-step explanation, ii) a sketch graph, and iii) a reflection on how these concepts apply to real-world construction contexts.

SENIOR SIX TERM 1

TOPIC 11: Probability Theory

Duration: 32 Periods

Competency: The learner applies the knowledge of probability theory in predictions and decision-making processes.

Learning Outcomes The learner should be able to:	Suggested Learning Activities	Sample Assessment Strategies
a) estimate the chances of occurrence of two related events for prediction and decision making in real life situations (k, s, u, v/a, gs).	a) In group discussions, learners review: i) sample space. ii) Outcome (event). iii) Experimental and theoretical probabilities. iv) Laws of probability and set theory. v) Probability situations "AND" and "OR". vi) types of events (Mutually exclusive and independent events). b) In groups, learners discuss how to generate possibility space using tree diagrams and explore the use of permutations and combinations. c) Through Think-Pair-Share, learners relate set theory to probability theory, design a contingency table and use it to determine the chance of occurrence of different events in different situations.	a) Observe learners as they review the terms and laws applied in probability of two related events. Take note of learners' ability to: i) listen attentively with comprehension ii) use numbers and measurements accurately iii) exhibit respect for humanity and environment. b) In a conversation evaluate learners' ability to generate sample space using different methods and determine probabilities. c) Assess learners' write-ups or diagrams and check for accuracy and validity of the probabilities obtained using various methods of solving a societal problem.
b) evaluate conditional probabilities for two related events to predict outcomes and make reasoned decisions. (k, s, u, v/a, gs)	a) Collaboratively, learners explore tree diagrams (restricted to two pickings) to solve conditional probability problems involving real-world contexts such as business (e.g. customer behaviour analysis), healthcare (e.g.	a) Observe learners as they discuss and explore conditional probability. Document learners' ability to: i) plan and conduct investigations, ii) sort and analyse information, and

	diagnostic tests) and quality control in manufacturing. b) In pairs, learners use in - class experiments such as drawing with and without replacement (restricted to two pickings) to demonstrate how conditional probability works in practice; deepening the understanding of their use in real-world contexts.	iii) exhibit creativity and innovativeness. b) Probe learners and judge their ability to: i) apply tree diagrams or otherwise, to represent conditional probability; and ii) apply conditional probability in various fields using real-life scenarios. c) Assess the learner's presentation or written report and check for correct use of the tree diagram or formula and accuracy of calculations in solving problems.

TOPIC 12: Differentiation

Duration: 40 Periods

Competency: The learner applies differentiation techniques in optimisation and analysing rates of change to interpret their significance in real life.

Learning Outcomes The learner should be able to:	Suggested Learning Activities	Sample Assessment Strategies
a) explore the gradient of a curve at a point to deduce derivative of a function in analysing real-world problems. (k, u, v/a, s, gs)	a) Through Think-Pair- Share, learners deduce that gradient of the tangent line at a point on the curve equals the derivative at a point. b) In groups, learners discuss and determine the derivatives of linear, quadratic and cubic functions $0 < n < 4$ (positive integers only) c) Through induction, learners in groups, determine the second derivative of functions using the first derivative. d) Learners, in groups, discuss and apply the following formula in different situations $\frac{d(\ln x)}{dx} = \frac{1}{x}$ (Proof of the formula not needed)	a) Observe learners as they discuss the derivative of a function paying attention to their ability to: i) work with others to generate ideas. ii) suggest and develop new solutions iii) showcase creativity and innovativeness b) Probe learners and evaluate their ability to differentiate linear, quadratic and cubic functions and determine the gradient function. c) Assess learners' written work to find out the correctness of the: i) derivative at a point. ii) derivatives of linear, quadratic and cubic functions. iii) second derivatives of functions. iv) use of the formula $\frac{d(\ln x)}{dx} = \frac{1}{x}$
b) formulate functions from real life situations for optimisation. (k, u, s, v/a, gs)	a) Through discovery, learners in groups determine the value(s) of x for which the first derivative is 0 i.e. $\frac{dy}{dx} = 0$	a) Observe learners as they determine the maximum and minimum values of given/formulated functions. Focus on their ability to: i) plan and carry out investigations

	b) Through group discussions, learners determine the value of x for which the function is either minimum or maximum to determine the maximum and minimum values of given functions e.g. Profit functions, Cost reduction functions. c) Learners, through Think- Pair- Share, formulate functions from real-life situations for optimisation.	ii) exhibit creativity and innovativeness iii) evaluate different solutions b) Converse with learners and examine their ability to: i) explain and distinguish between maximum and minimum values of functions ii) formulate functions from real life situations for optimisation. c) Assess learners' write ups for correctness and accuracy of: i) value of x for which the function is either minimum or maximum. ii) the maximum and minimum values of given functions.
c) apply the knowledge of differentiation to solve real-world problems to make informed decisions. (k, u, s, v/a, gs)	a) Through guided discovery, learners: i) Determine turning points of the quadratic curve by differentiation. ii) Investigate the nature of turning points (Maximum or Minimum points) using the sign change or second derivative methods. iii) Determine the intercepts to sketch the quadratic curves iv) Apply differentiation concepts to growth, optimization of resources, velocity, displacement and acceleration, etc v) explore and give justification why $\frac{dr}{dt} = v(t)$ and $\frac{dv}{dt} = a(t)$.	a) Observe learners as they apply differentiation concepts. Focus on learners' ability to: i) talk confidently and explain ideas clearly, ii) suggest and develop new solutions, and iii) exhibit hard work and self-reliance. b) Converse with leaners examining their ability to: i) determine intercepts and sketch curves; and ii) apply differentiation concepts to real-life situations c) Assess the learners' written work to find out the correctness of: i) calculations and nature of turning points in curve sketching, ii) application of differentiation in real-life situations.

SENIOR SIX TERM 2

TOPIC 13: Integration

Duration: 36 Periods

Competency: The learner applies integration techniques to solve problems involving areas, accumulation of quantities and other real-world applications.

Learning Outcomes The learner should be able to:	Suggested Learning Activities	Sample Assessment Strategies
a) relate integration and differentiation to integrate definite and infinite integrals including natural logarithms in real-world contexts. (k, u, v/a, s, gs)	a) Through guided discovery, learners explore how differentiation and integration are inverse operations; linking the two concepts. b) Through problem-based learning (PBL), learners use the integration formula $\int \frac{1}{x} dx = \ln x + C$ to solve real-world problems, such as accumulated costs in economics (proof not required).	a) Observe learners as they integrate definite and infinite integrals including natural logarithms, noting their ability to: i) interpret and interrogate mathematical data, ii) use mathematics to justify and support decisions, and iii) exhibit respect for humanity and environment. b) Probe learners to evaluate their ability to apply differentiation and integration as inverse operations in practical scenarios in economics, engineering etc. c) Assess learners' write-ups for correct application of integration techniques, including step-by-step solutions to solve real-world problems.
b) apply integration concepts to determine areas under curve, velocity and displacement functions in real-world scenarios. (k, u, s, v/a, gs)	a) Using guided discovery approach, learners: i) sketch quadratic curves ii) explore how to calculate the area between a curve and the x-axis in a given interval, a line and a curve, two curves.	a) Observe learners as they apply integration concepts, noting learners' ability to; i) sort and analyse information, ii) interpret and interrogate mathematical data, and iii) exhibit creativity and innovativeness

	For example, in a physics context, learners can model the trajectory of a projectile and use integration to calculate the distance travelled over a given time interval. b) Using collaborative learning, learners apply integration in real-world scenarios such as obtaining velocity and displacement functions from given variable acceleration and velocity functions in physics and engineering contexts.	b) Converse with learners and examine their ability to apply integration techniques to determine areas under curve, velocity and displacement functions c) Assess learners' written work for; i) accurately created sketches of quadratic curves, ii) detailed calculations of areas under the curves and the x-axis in a given interval, a line and a curve, two curves, iii) accuracy of velocity and displacement functions, and iv) correct conclusions of the real-world applications.

TOPIC 14: Random Variables

Duration: 36 Periods

Competency: The learner analyses concepts of random variables to model real-world situations in various contexts for informed decision making.

Learning Outcomes The learner should be able to:	Suggested Learning Activities	Sample Assessment Strategies
a) utilise the concept of discrete random variables to solve real-world problems such as quality control and game theory. (k, u, v/a, s, gs)	a) In groups, learners perform experiments in class, such as flipping coins, rolling dice or drawing cards from a deck, and list the possible outcomes to identify a random variable and discrete random variable. b) Through guided discovery, learners record the outcomes of a random variable X e.g. the number of heads obtained from tossing two coins and determine the corresponding probabilities to generate probability distributions. c) Through group discussions, learners explore the properties of probability distribution function (p.d.f) of a discrete random variable, and use these properties in determining probabilities of events to sketch the graph of a p.d.f. d) Through Think – Pair-Share, learners determine the mode and median of a discrete random variable. e) In groups learners discuss and analyse the data from case studies, calculate probabilities, expected values, variances and standard deviation using the formulae and present their findings.	a) Observe learners as they, apply concepts of discrete random variables noting their ability to: i) interact effectively with others ii) look for patterns and make generalizations iii) exhibit social harmony. b) Engage learners in a conversation and evaluate their ability to: i) determine the probabilities for each outcome ii) relate total probability to the outcomes. iii) calculate expectation E(X), variance Var (X) and standard deviation of a discrete random variable. c) Assess learners' written work for: i) accuracy of the possibilities generated, ii) accuracy of mode and median, and iii) correctness of calculations of E(X), Var(X) and standard deviation.

b) employ the concept of continuous random variables to solve real-world problems in contexts. (k, u, v/a, s, gs)	a) In groups, learners perform experiments such as time taken to complete a task, distance travelled, or speed of an object to understand the concept of continuous random variable. b) Through project-based learning, learners discover the properties of continuous random variables by collecting data and interpreting their probabilities in a real-world context. For example, heights and weights of students in class, temperature in a room, etc. c) Through Think-Pair-Share, learners distinguish between continuous and discrete random variables. d) In pairs, learners calculate probabilities of continuous random variables of events in real world situations like: heights and weight of students in class, and temperature in a room. e) In group discussions, learners use knowledge of integration to compute the probabilities, expectation, variance and standard deviation of a continuous random variable in order to analyse data using the formulae and present their findings to the class	a) Observe learners as they apply concepts of continuous random variables taking note of their ability to; i) use imaginations to explore possibilities. ii) work with others to generate ideas, and iii) show respect for humanity and environment. b) In conversation with learners, examine their ability to: i) apply the properties of continuous random variables; and ii) use integration to compute the probabilities, expectation, variance and standard deviation. c) Assess learners' write ups and project reports and check for correctness and accuracy of: i) application of properties of continuous random variables, ii) the difference between continuous and discrete random variables, and iii) calculations of probabilities, E(X), Var(X) and standard deviation of a continuous random variable.

SENIOR SIX TERM 3

TOPIC 15: Probability Distributions

Duration: 36 Periods

Competency: The learner interprets binomial and normal distributions for analysis of data patterns and trends in real-world contexts.

Learning Outcomes The learner should be able to:	Suggested Learning Activities	Sample Assessment Strategies
a) interpret a binomial distribution to solve real-world problems involving success-failure scenarios. (k, u, v/a, s, gs)	a) In groups, learners conduct an experiment such as rolling a die 10 times and recording number of times 'a 4 or higher number appears', record their results in a table, showing the number of successes for each set of 10 trials to review theoretical and experimental probabilities. They can also do the same with a coin. b) Through group discussions, learners explore the meaning of the following terms as associated with Binomial distribution; i) number of trials (n), ii) number of successes (x), iii) probability of success in a single trial (p), iv) probability of failure in a single trial (q), and v) probability of exactly k successes in n trials $P(X = k)$. c) Learners, in pairs, perform a binomial experiment and use it to determine probabilities of success and failure in a number of trials ($n \leq 20$). d) Through Think-Pair-Share, learners apply Binomial formula or use mathematical tables to determine probabilities of real-life binary	a) Observe learners as they discuss concepts of binomial distribution, putting emphasis on learners' ability to: i) interpret and interrogate mathematical data, ii) interact effectively with others, and iii) exhibit creativity and innovativeness. b) Converse with learners and evaluate them as they: i) explain terms associated with binomial distribution; and ii) determine probabilities using the formula or mathematical tables. c) Assess learners' written work and check for: i) the correctness of terminologies, ii) correct substitutions in the formulae iii) accuracy of the values of mean, mode and variance of a binomial distribution obtained, and

	outcomes such as Return on Investment (Profit/loss), Disease Diagnosis (positive/negative), and Match outcome (Win/Loss. e) In groups, learners discuss mean, mode, and variance of a binomial distribution and its application in real-world such as expected return on investment, expected number of defects in a production process, optimise inventory based on the most likely demand, measure the uncertainty of outcomes, etc.	iv) correct use of calculator or tables.
b) interpret the normal distribution to solve real-world problems involving normally distributed data (k, u, v/a, s, gs)	a) In groups, learners discuss normal distributions, standard normal distributions and their properties for better comprehension of the concept. b) In groups, learners discuss standardization of random variables and use of cumulative normal distribution tables/calculators to: i) determine probabilities, ii) compare data points to the mean, iii) compare distributions, and iv) visualise data spread. c) In groups, learners discuss the applications of normal distribution function to solve societal problems such as data visualization, economic forecasting, analysing treatment outcomes, modelling communication networks, etc.	a) Observe learners as they discuss normal distribution, noting the learners' ability to: i) interact effectively with others, ii) work with others to generate ideas, and iii) exhibit justice and fairness in dealing with others. b) Dialogue with learners to establish their ability to: i) standardise a random variable, ii) apply the parameters; mean (μ), standard deviation (σ), variance (σ^2) associated with the Normal distribution, and iii) apply the normal distribution function to solve societal problems

		c) Assess learners' write ups work for coherence and accuracy of: i) properties of the Normal distribution, ii) application of parameters; Mean (μ), Standard deviation (σ) and Variance (σ^2) in calculations of probabilities, and iii) Calculation of parameters (de-standardisation) to solve societal problems.

TOPIC 16: Differential Equations

Duration: 24 Periods

Competency: The learner analyses problems involving rates of change for prediction of alterations in various natural and social phenomena over a period of time.

Learning Outcomes The learner should be able to:	Suggested Learning Activities	Sample Assessment Strategies
a) formulate differential equations using various real-life scenarios to make informed decisions. (k, u, v/a, s, gs)	a) In group discussions, learners review equations such as $y = x^2$ to: i) determine the first derivative; and ii) discuss a derivative being an instantaneous rate of change to explore the concept of a differential equation. b) Through Think- Pair- Share, learners discuss how to identify and form a differential equation.	a) Observe the learners as they review the first derivative and discuss differential equation. Note their ability to: i) interact effectively with others, ii) identify problems and ways forward, and iii) exhibit justice and fairness. b) Dialogue with learners, analysing their ability to identify and form differential equations. c) Assess learners' written work, taking keen interest in the accuracy of formulated differential equations.
b) analyse real world situations using differential equation techniques. (k, u, v/a, s, gs)	a) Through Think- Pair – Share, learners explore general and particular solution of a first order differential equation using integration. b) Through guided discovery, learners discuss solving differential equations with separable variables related to natural occurrences. c) Through exploration, learners in pairs, use the internet and other sources to discuss practical applications of differential equations in real world and present to the whole class.	a) Observe the learners as they discuss and search for applications of differential equations; noting their ability to: i) interact effectively with others, ii) sort and analyse information, and iii) demonstrate hard work for self-reliance. b) Converse with learners, judging their ability to: i) solve first order differential equations with separable variables and ii) analyse applications of differential equations in real life. c) Assess the learners' written work, focusing on the relevancy and correctness of the applications of differential equations in real life.

3.0 ASSESSMENT

3.1 Assessing Subsidiary Mathematics

This Advanced Secondary Curriculum sets new expectations for learning, with a shift from Objectives to Learning Outcomes that focus mainly on the application of knowledge and deeper learning that leads to the acquisition of skills. These Learning Outcomes require a different approach to assessment. The "Learning Outcomes" in the syllabi are set out in terms of Knowledge, Understanding, Skills, Values and Attitudes. This is what is referred to by the letters k, u, s v & a.

It is not possible to assess values and attitudes in the same way as knowledge, understanding, and skills because they are more personal and variable, and are long-term aspirations. This does not mean that values and attitudes are not important or cannot be assessed. They too can be assessed but not easily done through tests and examinations. Values and attitudes can be assessed over a period of time through observing and having interactions with the learner.

To assess knowledge and its application, understanding, and skills, we need to look for different things. Knowledge can be assessed to some extent through written tests, but the assessment of skills, application of what is learnt, and deeper understanding requires different approaches. Because of this, the role of the teacher in assessment becomes much more important. This section focuses on knowledge, understanding, and skills.

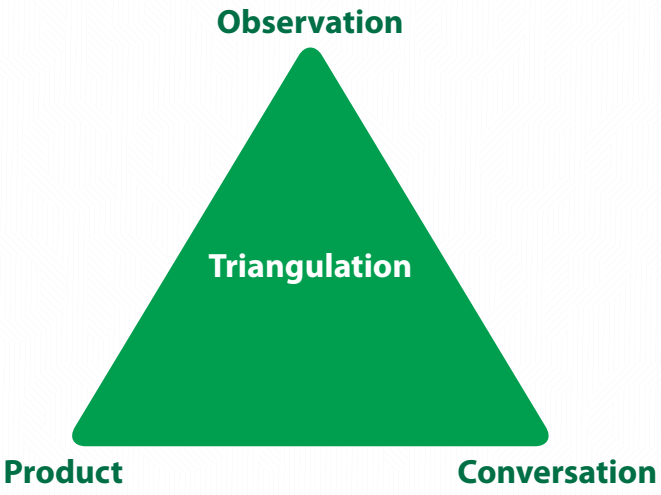
3.2 Formative Assessment

In this curriculum, the teacher's role in assessment is not only to write tests for the learner but also to make a professional judgment about the learner's learning during the teaching and learning process. The professional judgment is about how far the learner achieves the Learning Outcomes that are set out in this syllabus. To make these judgments the teacher needs to look at how well the learner is performing in terms of each Learning Outcome.

The formative assessment opportunities occur in three forms. They can be done through:

a) **Observation** – watching learners working. This is good for assessing skills, values and attitudes.
b) **Conversation** – asking questions and talking to learners. It is good for assessing knowledge and understanding.
c) **Product** – appraising the learner's work. It can be in form of writing, report, translation, calculation, presentation, map, diagram, model, drawing, or painting. In this context, a "product" is seen as something physical and permanent that the teacher or the learner can keep and look at.

When all three are used, the information from any one can be checked against the other two forms of assessment opportunity. For example; evidence from "observation" can be checked against evidence from "conversation" and "product". This is often referred to as "triangulation"



3.3 Assessing Generic Skills

The Generic Skills have been built into the syllabuses and are part of the Learning Outcomes. It is, therefore, not necessary to assess them separately. It is the increasingly complex context of the subject content that provides progression in the Generic Skills, and so they are assessed as part of the subject Learning Outcomes. Assessing generic skills is done with the help of an observation checklist and scoring rubric.

3.4 Assessing Values/Attitudes

It is not possible to assess values and attitudes in the same way as knowledge, understanding and skills because they are more personal and variable and are long-term aspirations. This does not mean that attitudes are not important. It means that we must value things that we cannot easily assess through tests and examination. However, values and attitudes can be assessed over a long period of time through observing and interactions.

3.5 Assessment of Project-based learning

Project-based learning is a teaching method in which learners gain knowledge and skills by engaging for an extended period of time to investigate and respond to an authentic challenge. The task must have a driving question and it involves sustained inquiry.

Project-based learning is assessed using a rubric and an observation checklist.

3.6 Examinations

There will be only one school based summative assessment at the end of the year. There will no longer be examinations or tests set at the beginning and end of every term. Instead, there will be a summing up of on-going teacher assessments made in the context of learning through end of topic scenario-based tasks (Activities of Integration). The learner will also be subjected to the end of cycle assessment for certification.

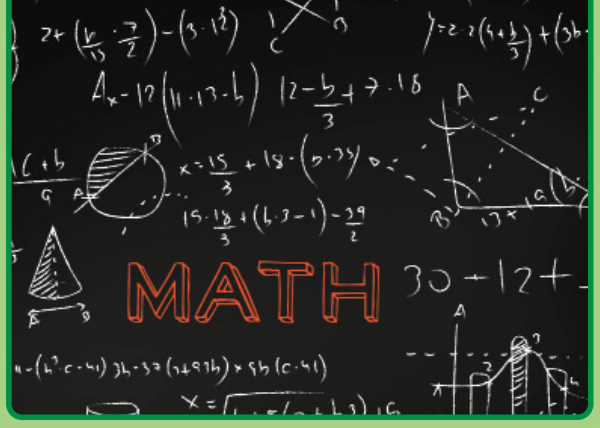
3.7 Record-Keeping

In competency-based learning, accurate and comprehensive record keeping is crucial to track learners' progress and achievements. Therefore, the teacher and school must keep accurate records about learners' achievement.

Various assessment tools and strategies are employed to capture learners' demonstration of abilities and achievements, including observation checklists, rubrics, and scoring grids. These tools provide a holistic picture of learners' strengths, weaknesses, and areas for improvement. The collected data and evidence from these assessments should be correctly recorded and maintained in learners' files, portfolios, and anecdotal notes.

Glossary of Key Terms

Term	Definition
competency-based curriculum	One in which learners develop the ability to apply their learning with confidence in a range of situations.
differentiation	The design or adaptation of learning experiences to suit an individual learner's needs, strengths, preferences, and abilities.
formative assessment	The process of judging the learner's performance, by interpreting the responses to tasks, in order to gauge progress and inform subsequent learning steps.
generic skills	Skills which are deployed in all subjects, and which enhance the learning of those subjects. These skills also equip young people for work and for life.
inclusion	An approach to planning learning experiences which allows each student to feel confident, respected and safe and equipped to learn at his or her full potential.
learning outcome	A statement which specifies what the learner should know, under-stand, or be able to do within a particular aspect of a subject.
process skill	A capability acquired by following the programme of study in a particular learning area; enables the learner to apply the knowledge and understanding of the learning area.
sample assessment activity	An activity which gives a learner the opportunity to show the extent to which s/he has achieved the learning outcomes. This is usually part of the normal teaching and learning process, and not something extra at the end of the topic.
suggested learning activity	An aspect of the normal teaching and learning process that will enable a formative assessment to be made.



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