SENIOR FIVE   TERM ONE

THEME: **DATA AND MATHEMATICAL EQUATIONS**

TOPIC 1: **INDICES, LOGARITHMS AND SURDS**   **08 PERIODS**

TOPICAL COMPETENCY: By the end of the topic, the learner should be able to analyse rational and irrational numbers, logarithmic and power functions (indices) through mathematical computations for developing analytical skills and making informed decisions to communicate effectively.

LEARNING OUTCOMES	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
The learner should be able to; a) Apply rules of indices and laws of logarithms to evaluate logarithmic expressions and equations. (k,s,u,gs.)	a) In groups, Learners discuss indices. b) In groups, learners discuss logarithmic notation. c) In pairs, learners brain storm on how to apply laws of indices and logarithms. d) In pairs, learners discuss and solve equations involving indices and logarithms; giving explanations why some of the solutions may not be valid. e) Learners, by use of internet, find out the applications of the concepts of indices and logarithms in the real world.	a) Observe learners as they discuss and note their collaboration, team work and leadership skills. b) Dialogue with the learners as they convert index notation into logarithmic notation; solve index and logarithmic equations noting their mathematical reasoning, critical thinking and effective communication. c) Look at the learners' work and assess their creativity and originality of the ways of solving equations involving logarithms.

b) Relate rational with irrational numbers and solves equations involving surds. (k,s,u,gs.)	a) In groups, learners discuss surds, b) Learners through deductive approach simplify expressions, rationalise and solve equations involving surds. c) Learners, by use of internet, find out and discuss the applications of surds in the real world.	a) Observe learners as they discuss surds, and note their ability to; work with each other, appreciate each other's opinions and develop new ideas. b) Converse with the learners as they solve and simplify equations involving surds, note; communication, critical thinking and problem solving. c) Look at learners' work and assess the extent to which the learners can simplify and apply surds with emphasis on use of technology to manipulate and process information.

SENIOR FIVE   TERM ONE

THEME: Data and Mathematical equations.

TOPIC 2: Equations and Inequalities.   **14 periods**

TOPICAL COMPETENCY: By the end of the topic, the learner should be able to formulate, investigate equations and inequalities by solving equations and inequalities to acquire analytical skills applicable in real world.

LEARNING OUTCOMES	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
The learner should be able to; a) Determine roots of quadratic equations. (k, u, s, v/a, gs)	a) In groups, learners discuss and solve quadratic equations. b) In groups, learners discuss and determine the sums and products of roots quadratic equations c) In groups, learners discuss and determine sums and products of symmetrical functions and deduce the corresponding equations.	a) Observe learners as they solve equations; note learners' ability to share their opinions, relate with others and commitment to learning. b) Prompt the learners to explain techniques of solving quadratic equations with emphasis on mixed abilities, and involvement. c) Assess the correct use of methods of solving quadratic equations; use of sums and products to deduce equations and find out how accurate the calculations are; harmonise.

Analyse situations, formulate equations and solve them to address given challenges. (k, u, s, v/a, gs)	a) In groups, learners discuss and formulate equations; solve simultaneous equations in two and three unknowns.	a) Observe learners as they discuss and present their findings; focus on the learners' ability to listen attentively with comprehension and to suggest and develop new solutions. b) Prompt learners as they present their findings with emphasis on life skills acquisition and use of technology to collaborate and communicate. c) Evaluate their solutions, use feedback sessions to further deepen their understanding of solving equations.

b) Formulate and solve inequalities. (k, u, s, v/a, gs.)	a) In groups, learners discuss and formulate inequalities; solve inequalities; b) In pairs, learners use internet to find out applications of inequalities.	a) Observe learners as they discuss and present their work note learners ability to share opinions, self-direct and commitment to learning. b) Converse with the learners and check whether they are appropriately applying correct methods of solving inequalities, noting their ability to interact effectively with others and be able to give and receive constructive criticism. c) Assess the learners' level of understanding inequalities and clarity of work.

SENIOR FIVE   TERM ONE

THEME: DATA AND MATHEMATICAL EQUATIONS

TOPIC 3: MATRICES   **06 PERIODS**

TOPICAL COMPETENCY: By the end of the topic, the learner should be able to collect, organise and analyse data through solving systems of equations for decision making.

LEARNING OUTCOMES	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
The learner should be able to; a) Organize data into different matrix types and orders for life-long learning. (k, u, s, v/a, gs)	a) In groups, learners through surveys collect data from their environment; form different types of matrices, stating their order.	a) Observe learners while they collect data in the field particularly through audio and video recordings; focus on how they take responsibility for own learning and ability to listen attentively with comprehension. b) Converse with the learners, as they organise data into different matrices; note learners ability to sort and analyse data, write and present coherently. c) As learners present their data in different forms, evaluate the accuracy of their computations and harmonise.

b) Investigates properties of matrices such as determinant and inverse of a 3x3 matrix for life-long learning. (k, s. v/a, u, gs.)	a) Learners in groups, by an inductive approach to compute determinant and inverse of 3x3 matrix.	a) Observe learners as they compute determinants and inverses of matrices and check whether they work with others and try out alternative approaches to generate ideas b) Converse with learners to test their ability to apply different methods to determine the inverse of a 3x3 matrix with focus on mixed abilities and involvement. c) Look at the learners' work and assess their creativity and accuracy of solutions.

c) Solves a 3x3 system of linear equations with unique solution for decision making. (k, u, s, v/a, gs)	a) In groups, learners discuss and solve three linear equations using inverses and row reduction methods. b) By use of internet, learners investigate and discuss applications of matrices in the real world.	a) Observe learners as they solve linear simultaneous equations by using matrix methods; note whether they encourage each other and acknowledge contributions from their peers. b) Converse with the learners; note their attitude toward constructive criticism and mathematical reasoning. c) In the learners' presentation, check the proper use of the matrix methods and harmonise.

SENIOR FIVE   TERM ONE

THEME: DATA AND MATHEMATICAL EQUATIONS

TOPIC 4: POLYNOMIALS   **08 PERIODS**

TOPICAL COMPETENCY: By the end of the topic, the learner should be able to factorise polynomials, by applying discriminants, remainder and factor theorems to acquire analytical skills for lifelong learning.

LEARNING OUTCOMES	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
The learner should be able to; a) Use the discriminant to analyze the nature of the roots of quadratic equations for lifelong learning. (k, u, v/a, s, gs)	In groups, a) Learners discuss discriminant. b) Learners discuss and analyse the nature of roots of quadratic equations.	a) Observe learners as they carry out the activity and present their findings; whether they respect peer opinion; how good is their response toward constructive criticism? b) In the conversation, check learners' ability to tolerate group ideas and adjust their opinions to reach a consensus. c) Assess the learners solutions derived from solving quadratic equations to gauge their understanding of the use of various methods.

b) Determine the roots of polynomials of degree greater than 2 by applying Remainder and Factor theorems for life-long learning. (k, u, v/a, s, gs)	a) In groups, learners discuss long division, remainder and Factor theorems. b) Learners in groups, discuss and factorise polynomials ; solve polynomial equations	a) Observe learners as they use long division to deduce remainder and factor theorems; check whether they can support each other in group work and merge ideas from peers in order to have a positive outcome. b) Converse with the learners as they apply factor theorem to factorize polynomials in order to find out whether they can explain concepts without bias, listen attentively and give alternative ideas. c) Assess the learners' written solutions and check for their understanding of the methods used in obtaining roots of polynomial equations.

SENIOR FIVE   TERM ONE

THEME: DATA AND MATHEMATICAL EQUATIONS

TOPIC 5: PARTIAL FRACTIONS.   **06 PERIODS**

TOPICAL COMPETENCY: By the end of the topic, the learner should be able to distinguish between proper and improper fractions by splitting algebraic fractions into partial fractions which skills are later useful in calculus and other fields.

LEARNING OUTCOMES	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
The learner should be able to; a) Appreciate different types of algebraic fractions and apply long division to split improper fractions to proper fractions for lifelong learning. (k, u, v/a, s, gs)	a) Learners brainstorm on different types of algebraic fractions. b) In groups, learners discuss and use long division to convert improper fractions to proper fractions.	a) Observe learners as they discuss, focus on the learners' ability to write and present information coherently, manage goals and time. b) Listen to the learners as they present and share their findings; paying attention to mixed abilities and learners' involvement. c) Assess learners' work, note the proper usage of long division and check for accuracy of their calculations.

b) Decompose proper fractions into partial fractions for lifelong learning. (k, u, v/a, s, gs)	a) In groups, learners discuss and resolve different types of algebraic fractions with denominators consisting of; (i) Only linear factors (ii) Repeated linear factors (iii) Quadratic expressions which cannot factorise.	a) Observe learners as they present their findings on decomposing proper fractions into partial forms; check on how they take responsibility for their own learning and ability to evaluate different solutions. b) Probe learners to explain clearly the methods used in partial decomposition; focus on learners' involvement and ability to identify the best method of solving a problem. c) Evaluate learners' presentations to explore the accuracy of the methods used.

SENIOR FIVE   TERM ONE

THEME: DATA AND MATHEMATICAL EQUATIONS

TOPIC 6: TRIGONOMETRY   **18 PERIODS**

TOPICAL COMPETENCY: By the end of the topic, the learner should be able to analyse trigonometric concepts, by deriving trigonometric identities and solving trigonometric equations for application in navigation, construction, aviation and other fields.

LEARNING OUTCOMES	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
The learner should be able to; a) Relate the sides and angles of triangle to deduce trigonometric ratios and apply the ratios to derive trigonometric identities for life-long learning. (k, u, v/a, s, gs)	a) In groups, learners discuss quadrants to generate sine, cosine and tangent for both positive and negative angles. b) Learners find out and discuss sine, cosine and tangent graphs. c) In pairs, learners discuss and deduce trigonometric ratios of special angles (30^0, 45^0 and 60^0). d) In open discussion, learners relate ratios of angles greater than 90^0 to ratios of acute angles. e) In groups, learners through guided discovery derive Pythagoras identities; eliminate parameters from pairs of parametric trigonometric equations. f) In groups, learners use internet to find out and discuss compound angle formulae and their applications. g) Learners discuss	a) Observe learners in groups, note the; analytical skills, graphical skills and learners ability to comprehend new ideas. b) Dialogue with learners to explain the different approaches used in deriving trigonometric identities and solving trigonometric equations with emphasis on skills development and learners involvement. c) Assess the learners work to; check correctness of the graphs drawn, steps taken, accuracy of identities derived; harmonise their work.

	compound angle formulae and deduce the double angle, multiple angles and factor formulae.	

b) Use the knowledge of trigonometric identities to analyze and solve trigonometric equations and apply them in fields such as navigation, construction, aviation. (k, u, v/a, s, gs)	a) Learners, in groups, through induction, use Pythagoras theorem identities, compound angle, double angle, factor formulae; sine, cosine and tangent rules, $Rcos(\theta + \alpha)$ in solving equations, triangles and simplifying expressions. b) Learners through self-discovery prove inverse trigonometric identities and solve inverse trigonometric equations. c) Learners in groups, find out and discuss solutions to triangles; derivation of formulae relating angles of a triangle to its sides. d) In pairs, learners use internet to find out and discuss applications of trigonometry. **NB: t- formula shouldn't be considered.**	a) As learners discuss in their respective groups, observe and note their level of interactiveness and ability to work effectively in diverse teams. b) As learners present, provoke them to explain different approaches to solving trigonometric equations with emphasis on life skills development. c) Assess learners' written work to find the accuracy of the solutions and different methods used; harmonise learners work.

SENIOR FIVE   TERM ONE

THEME: DATA AND MATHEMATICAL EQUATIONS

TOPIC 7: DESCRIPTIVE STATISTICS.   **14 PERIODS**

TOPICAL COMPETENCY: By the end of the topic, the learner should be able to analyse data through collection, presentation, and evaluation of population and sample parameters in order to predict and plan for self and community development.

LEARNING OUTCOMES	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
The learner should be able to; a) Collect, organize and present statistical data for lifelong learning. (k, u, v/a, s, gs)	a) In groups, learners by surveying from the environment collect data. b) In pairs, learners discuss, organise data and represent it graphically (frequency polygon, histogram, superimpose a frequency polygon to a histogram and ogive)	a) As learners survey, observe their interaction, listening with comprehension, ability to freely share with others and their organisational skills. b) Dialogue with the learners as they organise and present the data, ask questions that elicit team spirit and cooperation and collaboration. c) Assess their graphical presentation of data while focusing on neatness, scale uniformity and proper use of graphing techniques.
b) Manipulate, analyse, interpret data and draw conclusions in order to predict phenomena for purposes of decision making and community development. (k, u, v/a, s, gs)	a) In groups, learners analyse data and determine the average, mode, median, range, variance, standard deviation, percentiles, deciles, quartiles to draw conclusions.	b) Observe learners as they compute different measures of central location and dispersion and note how the work independently with persistence, sort and analyse data. c) Dialogue with the learners as they compute parameters whether they work with others to generate solutions and new possibilities. d) Look at the leaners work and assess accuracy, appropriateness and neatness of presentations.

SENIOR FIVE   TERM ONE

THEME: DATA   AND MATHEMATICAL EQUATIONS

TOPIC 8: INDEX NUMBERS.   **06 PERIODS**

TOPICAL COMPETENCY: By the end of the topic, the learner should be able to analyse changes in variables by determining indices of different variables to predict future trends.

LEARNING OUTCOMES	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
The learner should be able to; a) Compare index numbers of different variables and apply the knowledge to predict future trends. (k, u, v/a, s, gs)	a) In groups, learners discuss simple price index, quantity index and wage index and determine the changes to predict future trends.	a) Observe learners as they present their findings on prices of a commodity, quantity of a commodity consumed and wage of a worker over a period of time, paying attention to learners' ability to work with others to generate solutions, and use of mathematics to justify and support decisions. b) As they present provoke learners to critically analyse changes in prices, quantities and wages, paying attention to socio-economic issues and life skills. c) Evaluate how well learners understood price, wage and quantity indices by noting the accuracy of their computations and the comment attached to the computation.

b) Analyse the cost of living in the community for informed decision making. (k, u, v/a, s, gs)	c) In groups, learners discuss simple aggregate index, simple relative average index, weighted aggregate index and weighted average index	a) Observe learners as they discuss changes in prices, quantities and wages in relation to the base year, pay attention to learners' ability to talk confidently, write and present information coherently. b) Converse with the learners as they calculate aggregate indices, prompt them to explain why there are changes in prices of a commodity over a period of time focusing on social economic issues and citizenship. c) Assess the learners' work to note the proper usage of the formulae and correctness of mathematical computations.

SENIOR FIVE   TERM ONE

THEME: DATA AND MATHEMATICAL EQUATIONS

TOPIC 9: CORRELATION AND SCATTER DIAGRAMS   06 PERIODS

TOPICAL COMPETENCY: By the end of the topic, the learner should be able to investigate the relationship between two quantitative variables through graphical representation and evaluation of correlation coefficients for decision making and prediction.

LEARNING OUTCOMES	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
The learner should be able to; a) Generate and interpret correlation plots and compute correlation coefficients between two data sets. (k, u, v/a, s, gs)	a) Learners record and tabulate the marks obtained in any two subjects at O' Level in their respective groups. b) In pairs, learners through guided discovery plot the data on graph paper, estimate the line of best fit and comment on the relationship between the two subjects c) In groups, learners use internet, library or any other to demonstrate Spearman's and Kendall's rank correlation coefficients of a set of data.	a) Observe learners while they explore various methods of interpreting coefficients emphasizing their capacity to forecast results and make informed decisions or choices; focusing on the level of organization, neatness, ability to draw graphs, learners' computational and problem solving skills. b) Probe learners to critically analyse the plotted points and explain the relationship between the two sets of data focusing on learners' ability to communicate effectively and explore possibilities c) Assess correctness of the methodology in computation of the rank correlation coefficients; harmonise.

b) Argue on relationship between two quantitative variables for prediction and decision making. (k, u, v/a, s, gs)	a) Learners through discussion, comment on calculated results from the rank correlation coefficients and make predictions.	a) Observe learners as they discuss the different approaches of commenting on correlation coefficients focusing on learners' ability to predict outcomes and make reasoned decisions. b) Converse with the learners, as they comment on correlation coefficients paying attention to mixed abilities and learners involvement. c) Assess how learners correctly comment on the correlation coefficients.

SENIOR FIVE   TERM TWO

THEME: CHANGE   **10 PERIODS**

TOPIC 10: INTERPOLATION, EXTRAPOLATION AND LOCATION OF ROOTS.

TOPICAL COMPETENCY: By the end of the topic, the learner should be able locate roots of a function by generating values that lie within a given range for prediction, planning and life-long learning.

LEARNING OUTCOMES	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
The learner should be able to; a) Apply the gradient method of a straight line to estimate the unknown values within or outside a data set for lifelong learning and decision making. (k, u, v/a, s, gs)	a) In pairs or as individuals, learners perform an experiment by measuring temperature change of hot water with time, tabulate the results, analyse the data obtained and predict non tabular values that are within or outside the tabulated values.	a) Observe learners as they record and tabulate experimental results focusing on correct scale interpretation of the thermometer, paying attention to learners' ability to read accurately, write and present information coherently. b) Prompt learners as they analyse data to explain how to predict non-tabular values within and outside the tabulated values by applying the concept of gradient of a line; focusing on their ability to communicate effectively, respect other people's opinions and life skills development. c) Assess learners' work to determine how effectively the steps have been followed, interpretation and accuracy of computations.

b) Investigate the range within which the roots of the function f(x) lie. (k, u, v/a, s, gs)	a) In groups, learners discuss and tabulate [x, f(x)] values within a given range. b) In groups, learners through discussion analyse tabulated values and determine the range in which the root lies.	a) Observe learners as they determine values of f(x) for a given range in x, noting the learners' ability to write and present information coherently. b) Prompt learners to look out for patterns in the tabulated values, note learners ability to work in teams, share opinions and make generalisations. c) Assess the learners' work to determine the accuracy of their computations.
c) Draw graphs of various functions and approximate the root. (k, u, v/a, s, gs)	a) Through guided discovery, learners individually plot given function(s) in a certain range and determine its root(s)	a) Observe the learners as they tabulate and plot points on the graph and note how logically they follow the right steps and how accurately they plot graphs; with emphasis on learners' ability to work independently with persistence. b) Interrogate learners to interpret and explain their graphs, note learners ability to critically share their options. c) Assess learners' graphs to check their interpretations.

SENIOR FIVE   **TERM TWO**

THEME; CHANGE   **06 PERIODS**

TOPIC 11: RESULTANT AND COMPONENTS OF FORCES.

TOPICAL COMPETENCY: By the end of the topic, the learner should be able to determine the resultant and components of forces by resolution for lifelong learning.

Learning Outcomes	Suggested Learning Activities	Sample Assessment Strategies
By the end of the topic, the learner should be able to; a) Determine the resultants of parallel and non- parallel forces. (k, u, v/a, s, gs)	a) In groups, learners analyse the resultant of two or more forces acting at a point.	a) Observe learners as they present their findings and determine the resultant of forces; pay attention to learner's ability to apply trigonometric ratios to resolve components; note their ability to work with others to generate ideas and use mathematics to justify and support decisions. b) Dialogue with the learners to explain how the components of a force are obtained focusing on learners' ability to work with persistence and life skills development. c) Assess the resolved components and the resultant force obtained to determine their accuracy.

d) Evaluate the resultant of forces in polygons for lifelong learning (k, u, v/a, s, gs)	a) In groups, learners discuss resolution of forces and determine resultant forces.	a) Observe learners as they resolve forces into vertical and horizontal components; pay attention to learner's ability to apply trigonometric ratios to resolve forces; note their ability to work with one another to generate ideas and ignore distractors while carrying out tasks. b) Dialogue with the learners to explain how the components of the force are obtained focusing on learners' ability to listen attentively with comprehension and life skills development. c) Assess the resolved components and the resultant force obtained to determine their accuracy.

SENIOR FIVE   TERM TWO

THEME: CHANGE

TOPIC 12: LINEAR MOTION.   **08 PERIODS**

TOPICAL COMPETENCY: By the end of the topic, the learner should be able to derive and analyse the equations of linear motion by applying them to moving bodies in the real world.

Learning Outcomes	Suggested Learning Activities	Sample Assessment Strategies
By the end of the topic, the learner should be able to; a) Derive the equations of linear uniform motion. (k, u, v/a, s, gs)	a) In groups, the learners discuss the meanings of displacement, velocity and acceleration. b) In groups, learners through induction derive the equations of linear uniform motion by different methods.	a) Observe learners as they discuss terms used and derive equations in linear motion. Pay attention to learners' ability to carry out tasks with persistence, write and present information coherently. b) Dialogue with learners, prompt them to derive the equations of motion using different methods; focusing on the accuracy and validity of the method used paying attention to learners' ability to work effectively with one another to generate new ideas. c) Assess the learners' derived equations; check for the accuracy and validity of their solutions.

Apply equations of motion to solve problems in the real world situation. (k, u, v/a, s, gs)	a) In groups, Learners through discussion apply equations of linear uniform motion to solve problems. b) In groups, learners discuss velocity time – graphs.	a) Observe learners as they apply the equations of motion to solve various problems; note learners' ability to take responsibility of their own learning and working independently with persistence. b) Prompt learners to explain how different equations are applied in various cases focusing on their ability to sort, analyse information and evaluate different solutions c) Assess the learners work and check for correctness and validity of the solutions. Harmonise learners' findings. .

SENIOR FIVE   TERM TWO

THEME: DATA AND MATHEMATICAL EQUATIONS

TOPIC 13: PROBABILITY THEORY.   **12 PERIODS**

TOPICAL COMPETENCY: By the end of the topic, the leaner should be able to evaluate probabilities through applying the probability laws and theorems to predict the occurrence of events.

LEARNING OUTCOMES	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY

The learner should be able to;
 	
 a) Appreciate the probability theorems to determine the chances of occurrence of events. (k, u, v/a, s, gs)
	a) Learners through brainstorming, discuss the terms probability, an event, sample space and probability range.
	 b) In groups, learners discuss tree diagram, table of outcomes, permutations and combinations to generate the possibility space.
	 c) In groups, learners through discussion;
	    (i) Relate set theory to probability theory and design a contingency table
	    (ii) Determine the chance of occurrence of different events in different situations.
		a) Observe learners as they discuss the terms used in probability and determine probabilities, note learners' level of involvement, ability to create new ideas and explain concepts without bias.
		 b) In discussion ask the learners to explain how generate sample space using different methods focusing on learners ability to innovate alternatives, listen attentively with comprehension and harmonise their presentations
		 c) Check the accuracy and validity of the probabilities obtained, under various methods focusing on learners' ability to identify the best method of solving a problem.

b) Apply the acquired skills to predict other occurrences and plan for the future. (k, u, v/a, s, gs)	a) Learners use the internet or any other source to find out and discuss;
	    (i) Bayes theorem to determine probabilities of occurrence of events.
	    (ii) Situations that require the application of probability theory in daily life.
		a) Observe learners as they present their findings; focus on learners' ability to effectively express their views, search for new ideas, predict outcomes and make reasoned decisions.
		b) As the learners present their findings on the application of probability in daily life, focus on learners' ability to critically share and explain opinions without bias.
		c) Check the accuracy and validity of the probabilities obtained; harmonise their findings.

SENIOR FIVE   TERM TWO

THEME: APPLICATION

TOPIC 14: COORDINATE GEOMETRY 1.   **08 PERIODS**

TOPICAL COMPETENCY: By the end of the topic, the learner should be able to determine geometric components by analysing the Cartesian coordinate systems for real world situations.

LEARNING OUTCOMES	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
The learner should be able to; a) Determine lengths, gradients of lines and angles between two lines for long life learning. (k, u, v/a, s, gs)	a) In groups, learners discuss concepts of mid-points, length of a line, and gradient of lines, parallel and perpendicular lines.	a) Observe the learners as they discuss coordinate geometric components, focus on learners' ability to respect peer opinions, accomplish work in a specified time and support others in a group. b) Through peer presentations, prompt learners to explain relationships between coordinate geometric components focusing on learners active listening, understanding of concepts and life skills development. c) Assess the learners' written exercises and check whether the ideas and methods used are correct. Harmonise learners' findings.

b) Determine the angle between two lines and the distance of a point from a line. (k, u, v/a, s, gs)	a) In groups, learners discuss equation of a line, angle between two lines, point of intersection between lines, and distance of a point from a line. b) In pairs, learners use internet or any other source to find out and discuss applications of coordinate geometry in the real world.	a) Observe the learners as they present their findings, pay attention to learners' ability to talk confidently, write and present information coherently. b) Converse with learners paying attention to learners' ability to evaluate correct solutions and follow steps logically. c) Assess the learners' written exercises to see the correctness of their work and ability to reason mathematically.

SENIOR FIVE   TERM TWO

THEME: CHANGE

TOPIC 15: DIFFERENTIATION 1.   **24 PERIODS**

TOPICAL COMPETENCY: By the end of the topic, the learner should be able to determine gradient function and sketch curves by differentiating functions for optimization of resources and other applications in real world.

LEARNING OUTCOMES	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
The learner should be able to; a) Relate the gradient of a line to the gradient of a function at a point and determine gradient functions of polynomials using first principles. (k, u, v/a, s, gs)	a) In groups, learners discuss and differentiate functions using first principles. b) Through induction, learners' in groups determine gradient functions using power rule. c) In groups, learners discuss tangents and normal to a curve at a given point.	a) Observe learners as differentiate functions; pay attention on learners' ability to take feedback, work independently with persistence and give constructive criticism. b) Converse with the learners to relate gradient of a curve to gradient of a line focus learners ability to critically share and explain opinions without bias. c) Assess their written work to find out the correctness of their presentations and harmonise.

b) Determine the stationary points and classify them using the derivative tests and sketch particular curves. (k, u, s, v/a, gs)	a) In groups, through guided discovery learners determine the maximum and minimum values of given functions. b) In groups, leaners through discussions, determine stationary points and their nature. c) As individuals, through guided discovery, sketch the graphs of the given functions.	a) As learners determine stationary points and do the sketches; focus the learners ability to plan and carry out investigations and evaluate different solutions b) Converse with leaners prompt them to distinguish between maximum and minimum values paying attention to life skills development c) Look at the learners sketched curves and asses their creativity, originality and representation of critical points (minimum, maximum, inflexion and intercepts).

c) Differentiate functions involving products, quotients, implicit, parametric and composite quantities. (k, u, v/a, s, gs)	a) In groups, learners discuss and;
	   (i) Differentiate compound functions using Chain, Product and quotient rules.
	   (ii) Differentiate implicit and parametric functions.
		a) Observe learners as they differentiate different functions, pay attention to learners' ability to move a team towards a common goal, to carry out independent findings and ask engaging questions.
		b) Prompt learners to explore different alternatives of differentiating functions focusing on learners' ability to think of alternative approaches to carry out investigations and ask open ended questions to achieve clarification.
		c) Assess the learners' written work and note their creativity innovativeness and the accuracy of their mathematical computations.

d) Apply the concepts of differentiation in optimization of resources, motion, small changes and rates of change. (k, u, v/a, s, gs)	a) learners in groups discuss: (i) Small changes to determine approximate roots of numbers. (ii) Rates of change in optimization. (iii) Applications of differentiation in real world.	a) Observe learners in group discussion as they approximate roots, apply rates of change in optimization; note learners' ability to work with others towards a common goal, get along with others and explain idea without bias. Insight to apply concepts with ease focusing on accuracy and clarity of their work. b) Converse with the learners to suggest applications of differentiation in the real world focusing learners' ability to take feedback and work with patience. c) Evaluate learners work to determine the depth of their knowledge in differentiation and broaden it where necessary.

SENIOR FIVE   TERM TWO

THEME: DATA AND MATHEMATICAL EQUATIONS

TOPIC 16: DISCRETE RANDOM VARIABLES.   **14 PERIODS**

TOPICAL COMPETENCY: By the end of the topic, the learner should be able to analyse discrete random variables by quantifying outcomes of random occurrences and representing such outcomes graphically to solve personal and societal problems.

LEARNING OUTCOMES	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
The learner should be able to; a) Generate and compute the parameters of discrete random occurrences. (k, u, v/a, s, gs)	a) In pairs, learners perform an experiment, record the outcomes of a random variable X, the corresponding probabilities to form a probability distribution and use it to determine the cumulative distribution. b) As individuals, through induction learners represent the p.d.f and c.d.f of discrete random variables graphically and use them to determine parameters of the distribution. c) In groups, leaners discuss and determine the E(x) and Var(x) and simplification of expressions such as $E(aX + b)$.	a) Observe learners as they record and tabulate experimental results, putting emphasis on learners' ability to accurately organise the outcomes in the distribution table, write and present information coherently. b) Converse and engage learners to explain properties of discrete random variables, p.d.f and c.d.f; focusing learners' ability to ask engaging questions, seek clarification and life skills development. c) Assess learners' probability distribution, graphs to determine how well their work is. Harmonise learners' findings.
b) Demonstrate the understanding of a binomial distribution function to solve personal and societal problems. (k, u, v/a, s, gs)	a) In pairs, learners perform a binomial experiment and use it to determine probabilities of success p, and failure q, for n trials. b) In groups, learners discuss and	a) Observe learners as they determine probabilities p and q for n trials note; the correctness of the probabilities obtained putting emphasis on learners' ability to

	determine probabilities using Binomial formula and the mathematical tables. c) In groups, learners discuss mean, mode and variance of a binomial distribution and its application in real world.	manipulate data and work with others towards a common goal. b) In conversation engage learners on the use of the binomial formula and tables to determine probabilities and note their ability to substitute, compute and read probabilities, take turns while discussing, and follow steps logically. c) Look at the learners work and asses their creativity and understanding of binomial distribution in various situations; harmonise.

SENIOR FIVE   TERM TWO

THEME: CHANGE

TOPIC 17: ERROR ANALYSIS.   **10 PERIODS**

TOPICAL COMPETENCY: By the end of the topic, the learner should be able to quantify the magnitude of error in mathematical operations and functions by analysing error expressions for lifelong learning and decision making.

LEARNING OUTCOMES	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
The learner should be able to; a) Analyze the magnitude of error in the different mathematical operations and functions. (k, u, v/a, s, gs)	a) Learners brainstorm and define types of errors; the terms used in error analysis and explain cases where errors may arise. b) In groups, learners through discussion compute absolute, relative and percentage error. c) In groups, learners investigate and determine the minimum and maximum values/ limits of accuracy.	a) Observe the leaners as they discuss, note their ability to consult and seek guided engagements, attend to the needs of the group and can freely express themselves. b) Converse with the learners to expound on learners understanding; focus on learners' ability to express gratitude and reach mutual understanding during interactions. c) Assess the learners write ups to evaluate their level of understanding of the concepts.

b) Analyze the precision and accuracy in contextual problems. (k, u, v/a, s, gs)	a) In groups, learners through discussion apply; i) The technique of differentiation to compute errors in functions. ii) Knowledge of errors in optimization in business.	a) As learners apply various techniques of differentiation to determine errors in functions; note the accuracy of the methods used paying attention to leaners ability to think of alternative approaches to carry out investigation. b) Converse with the learners and provoke them to think of how errors are applied in optimisation of resources; focus on learners ability to work with others without segregation c) Look at learners' written exercises to examine the methods used to determine errors, their applicability in real life situations and the degree of accuracy in the computations made.

SENIOR FIVE   TERM TWO

THEME: DATA AND MATHEMATICAL EQUATIONS

TOPIC 18: SERIES.   **12 PERIODS**

TOPICAL COMPETENCY: By the end of the topic, the learner should be able to analyse different number patterns by determining sums of sequences for mathematical generalisation and analysis applied in real world situations such as simple and compound interests.

LEARNING OUTCOMES	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
a) Analyse series with a constant ratio between successive terms and its application in real world. (k, u, v/a, s, gs)	a) In groups, learners through discussion: (i) Generate series with a constant ratio between successive terms (G.P) from sequences. (ii) Derive expressions for the nth-term and the sums of a (G.P); apply the derivations to solve numerical problems.	a) Observe learners as they generate, apply G.Ps to solve numerical problems; note learners' ability to identify a G.P, derive correct expression for the nth-term and the sums of the G.P; focusing on the learners' ability to help and support each other and applaud supplements from team members. b) Prompt learners to apply G.Ps to determine sums, number of terms, first term and common difference at attention to leaners ability to express clearly with confidence. c) Evaluate learners work to establish the correctness and accuracy of their solutions. Harmonise learners' findings.

	b) In groups, learners through discussion : (i) Analyse convergence of G.P to find the sum to infinity of a GP. (ii) Applications of series in real world such as computation of interest in business and banking industry. **NB: Proof by induction shouldn't be considered.**	a) Observe learners as they discuss Geometric Progressions note learners' ability to help and support each other. b) Prompt learners to apply series to solve real world challenges focusing their ability to sort, analyse information to make generalisation. c) Evaluate learners work to establish the correctness and accuracy of their solutions.

SENIOR FIVE   TERM THREE

THEME: APPLICATION

TOPIC 19: VECTORS.   **24 PERIODS**

TOPICAL COMPETENCY: By the end of the topic, the learner should be able to analyse lines and planes in 2D and 3D by manipulating vector algebra and vector geometry and apply the concepts for personal and community development.

LEARNING OUTCOMES	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
The learner should be able to; a) Relate points, lines and planes in the 2D and 3D coordinate systems. (k, u, v/a, s, gs)	a) Learners in groups discuss and review vector concepts in 2D (scalar and vector quantities, vector notation, position vectors, Equal and parallel vectors, vector algebra, vector modulus, ratio theorem) and apply to 3D	a) Observe learners as they discuss vector concepts; note their level of understanding of vector concepts paying attention to learners' ability to explain concepts being discussed. b) Implore learners to determine how deep they understand vector algebra. Focus on learners ability to freely share their opinions and explain ideas without bias c) Assess learners work to find the accuracy and correctness. Add information where necessary to improve their understanding.

	b) In groups, learners use internet, library or any other source to; (i) Derive vector, parametric and Cartesian forms of equations of a straight line. (ii) Determine the point of intersection between two lines.	a) Observe learners as they present different forms of equations of a straight line, pay attention to the notations; focusing on learners' ability to manage goals and time. b) Dialogue with the learners as they present findings on point of intersection between two lines; check whether they listen attentively with comprehension and whether they take responsibility for their own learning. c) Look at the leaners work and assess accuracy and appropriateness of their presentations.

b) Compute scalar and cross products of vectors; apply them to determine angles and equations of planes. (k, u, v/a, s, gs)	a) In groups, learners discuss and develop the formulae for : (i) Vector, parametric and Cartesian equations of a plane. (ii) Point of intersection between a line and a plane. (iii) Line of intersection between two planes	a) Observe learners as they present different forms of equations of a plane, pay attention to the notations; focus on learners' ability to manage goals and time. b) Dialogue with the learners as they present findings on point of intersection between a line and a plane and the line of intersection between two planes; check whether they listen attentively with comprehension and take responsibility for own learning. c) Look at the leaners work and assess accuracy, appropriateness of their presentations
	b) In groups, learners discuss dot /scalar product and determine the angle between: (i) Two vectors. (ii) Two lines. (iii) Two planes. (iv) A line and a plane. c) In groups, learners discuss and determine the: (i) Perpendicular distance between two parallel lines (ii) Distance of a point from a plane.	a) As learners present their findings, observe the correct use of the scalar product paying attention to learners' ability to identify direction and normal vectors. b) Interrogate learners to determine their level of comprehension in applying the dot product in different situations, paying attention to learners' ability to think of alternative approaches to address a given problem. c) Assess learners' written work to check for the correct

use of the dot product and
accurate presentations.

SENIOR FIVE   TERM THREE

THEME: DATA AND MATHEMATICAL EQUATIONS

TOPIC 20: PERMUTATIONS AND COMBINATIONS   10 PERIODS

TOPICAL COMPETENCY: By the end of the topic, the learner should be able to determine possible arrangements and selections of objects for lifelong learning and real-world applications.

LEARNING OUTCOMES	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
The learner should be able to; a) Arrange objects in a definite order. (k, u, v/a, s, gs)	a) In groups, learners discuss and; (i) Arrange 2, 3 or 4 different objects in a row and determine the number of possible arrangements/ permutations. (ii) Derive the relationship between the number of objects (n) and number of possible arrangements(r). (iii) Obtain different permutations (with or without repetition and circular cases).	a) Evaluate how well learners arrange the objects in a row and ask them to explain how they come up with the arrangements; state the number of arrangements. b) Converse with the learners to derive the relationship between possible arrangements(r)that can be made from(n) objects; paying attention to clarity of learners' opinion and ability to listen attentively with comprehension. c) Prompt learners to apply the relationship $n_{p_r=\frac{n!}{(n-r)!}}$ to various situations, noting how accurate their calculations are.

b) Analyse various expressions used in arrangements and selections for lifelong learning. (k, u, v/a, s, gs)	a) In groups, learners discuss and ;
	
	   i. Determine the number of different selections which can be formed from 2, 3 or 4 different objects.
	
	  ii. Derive the relationship between the number of objects (n) and different selections/ combination(r).
	
	  iii. Determine the number of permutations and combinations for cases involving restrictions.
		a) Evaluate how well learners and select r objects from a group of n objects, ask them to explain how they come up with the selections; state the number of selections that can be made and how r objects can be arranged.
		
		b) Converse with the learners to derive the relationship between possible selections r, that can be made from n objects; paying attention to clarity of learners' opinion and ability to listen attentively with comprehension.
		
		c) Prompt learners to apply the relationship $n_{C_r = \frac{n!}{(n-r)!r!}} = \frac{n_{p_r}}{r!}$ to various situations, noting how accurate their calculations are.

SENIOR FIVE   TERM THREE

THEME: CHANGE

TOPIC 21: INTEGRATION 1.   **22 PERIODS**

TOPICAL COMPETENCY: By the end of the topic, the learner should be able to determine definite and indefinite integrals by use of power rule of integration for lifelong learning.

LEARNING OUTCOMES	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
The learner should be able to: a) Integrate definite and infinite integrals of the form $\int x^n dx$ where $n \neq -1$ and relate integration to differentiation (k, u, v/a, s, gs)	a) In groups, learners through discussion : (i) Determine indefinite integrals and evaluate definite integrals of the form $\int_a^b f(x)dx$ (ii) Relate differentiation to integration.	a) Observe the learners as they relate differentiation to integration, evaluate integrals; note their ability to consult and share their work; b) Converse with learners to elucidate their understanding; note their ability to explain concept clearly without bias and work in groups to achieve a common goal. c) Assess the correctness of their work and harmonise

b) Apply integration in various fields such as, motion, areas and volumes. (k, u, v/a, s, gs)	a) In groups, through induction learners apply integration to determine to: 　i.　Solve problems involving kinematics (motion), 　ii.　Determine areas under the curve, 　iii.　Determine volumes of solids of revolution on rotation about x- axis and y-axis, 　iv.　Investigate the mean value of a function.	a) Observe learners in groups as they discuss; evaluate how well they express their views paying attention to use of integration in various fields and focusing on the feasibility of their solutions. b) Converse with learners to elucidate their understanding; note their ability to explain concept clearly without bias and work in groups to achieve a common goal. c) Assess the correctness of their work and harmonise

SENIOR FIVE   TERM THREE

THEME: CHANGE

TOPIC 22: FORCE AND NEWTON'S LAWS.   **18 PERIODS**

TOPICAL COMPETENCY: By the end of the topic, the learner should be able to analyse the effect of forces on bodies by applying Newton's laws to solve problems in real world phenomena.

Learning Outcomes	Suggested Learning Activities	Sample Assessment Strategies
The learner should be able to; a) Apply Newton's laws on bodies under gravity and on smooth surfaces to solve problems in real world phenomena. (k, u, v/a, s, gs)	a) In groups, learners discuss Newton's laws of motion. b) Through discussion, learners apply Newton's laws to connected particles and bodies on horizontal, vertical and inclined smooth surfaces.	a) Observe learners as they explain Newton's laws of motion, pay attention to learners' ability to listen attentively with comprehension and take responsibility for own learning. b) Dialogue with learners as they apply Newton's laws to connected particles and bodies on horizontal, vertical and inclined smooth surfaces; focusing on their ability to write and present work coherently and life skills development c) Look at learners work and check the correctness of their solutions and harmonise learners' solutions.

SENIOR FIVE   TERM THREE

THEME: DATA AND MATHEMATICAL EQUATIONS

TOPIC 23: BINOMIAL THEOREM.   **10 PERIODS**

TOPICAL COMPETENCY: By the end of the topic, the learner should be able to expand functions with rational powers using binomial theorem for life-long learning

LEARNING OUTCOMES	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
The learner should be able to; a) Relate the rows of Pascal's triangle to binomial coefficients, derive Binomial expansion and use it to expand rational functions. (k, u, v/a, s, gs)	a) In groups, learners discuss and construct Pascal's triangle, use it to generate Binomial coefficients of the terms of the expansion of $(a + b)^n$, for n= 1, 2, 3, 4...; b) In groups, learners discuss Binomial expansion and expand functions with rational powers in ascending and descending order.(N.B Extend the binomial expansions to expressions like; $$(1 + x + x^2)^n$$ .use partial fractions in binomial expansions).	a) Observe leaners in groups as they construct Pascal's triangle and generate Binomial coefficients; note learners' ability to create, manipulate and establish relationships in mathematical data; focus on the accuracy of their computations. b) Converse with learners as they derive Binomial expansion and use it to expand rational functions to a given number of terms. c) Asses the accuracy of the terms of the expansion.

b) Apply binomial expansion to determine the nth of a term of a given function and evaluate roots of numbers. (k, u, v/a, s, gs)	a) In groups, learners through discussion determine particular terms of binomial expansions, evaluate roots of numerical values using binomial expansions and determine the range of validity of expansion for a given rational function.	Converse with learners' as they determine the nth term of functions and evaluate roots of numbers; note the correct use of binomial theorem, accuracy of the roots and learners' ability to help each other to solve tasks. Assess leaners work with emphasis on range of validity of the expansions.

SENIOR FIVE   TERM THREE

THEME: DATA AND MATHEMATICAL EQUATIONS

TOPIC 24: CONTINUOUS RANDOM VARIABLES.   22 PERIODS

TOPICAL COMPETENCY: By the end of the topic, the learner should be able to describe the characteristics of a continuous random variable by using the probability density and cumulative distribution functions to determine probabilities that lie in a given range for quantifying outcomes of random occurrences.

LEARNING OUTCOMES	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
The learner should be able to; a) Generate and compute the parameters of continuous random occurrences. (k, u, v/a, s, gs)	a) In groups, learners through discussion; (i) Describe a continuous random variable and explain the properties of its p.d.f. (ii) Determine probabilities, measures of central location and dispersion and sketch the p.d.f. b) In pairs, learners use the internet or any other source find out and discuss cumulative distribution function. (**extend the knowledge of C.R.V to uniform distribution**)	a) Observe learners as they describe and apply the properties of p.d.fs to generate probabilities, determine and sketch the c.d.f noting the ability to apply c.r.v concepts and proper graphical techniques; focus on learners' ability to apply integration to evaluate probabilities, their perspective and ability to seek peer support; assess the learners' accuracy and validity of their presentations. b) Converse with learners as they determine the parameters of c.r.vs and sketches of the p.d.fs; pay attention to learners' ability to use analytical and graphical skills to solve tasks. c) Look at the learners work assess the originality and accuracy of their calculations.

b) Demonstrate the understanding of a normal distribution function. (k, u, v/a, s, gs)	a) In groups, learners discuss normal and standard normal distributions and their properties. b) In groups, learners discuss standardisation of random variables and use of normal distribution tables /calculators to determine probabilities.	a) Observe learners as they discuss the properties of normal distribution, stardardising variables and how they use tables to obtain probabilities; check on the correctness of the standardised variable and accuracy of the table values read. b) Dialogue with learners as they use table and calculators focusing on their ability to, sort, analyse and read information accurately; evaluate their work with emphasis on standardisation, reading of table values and de-standardisation process. c) Look at the learners work assess the originality and accuracy of their calculations.

SENIOR SIX   TERM ONE

THEME: DATA AND MATHEMATICAL EQUATIONS

TOPIC 25: NORMAL APPROXIMATION TO BINOMIAL   06 PERIODS

TOPICAL COMPETENCY: By the end of the topic, the learner should be able to apply knowledge of normal distribution to approximate binomial distribution through solving problems with large sample for personal and community benefit.

LEARNING OUTCOMES	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
The learner should be able to; a) Transform a binomial random variable to a normal using continuity correction. (k, u, v/a, s, gs)	a) In groups learners; (i) Discuss conditions for a binomial distribution to be approximated by normal distribution and how to obtain continuous variables. (ii) Determine the expectation and variance.	a) Observe learners as they discuss; noting how they work with others to generate new ideas and their ability to evaluate different solutions. b) Prompt learners to determine the parameters; focusing on mixed abilities and involvement as they freely explain concepts. c) Assess and check on the correctness of the learners work and harmonise.
b) Appreciate both the binomial and normal distributions to approximate normal to binomial. (k, u, v/a, s, gs)	a) In groups, learners perform an experiment tossing a coin 50 times and determine the probabilities of any number of heads or tails obtained.	a) Observe learners as they plan and carry out investigations, try out innovative alternatives to develop solutions. b) Prompt learners on how to use calculators and read tables focusing on their ability to read accurately, sort and analyse information. c) Look at learners' work, assess the correctness of the values obtained.

SENIOR SIX   TERM ONE

THEME: APPLICATION

TOPIC 26: FINANCIAL MATHEMATICS   **12 PERIODS**

TOPICAL COMPETENCY: By the end of the topic, learners should be able to develop financial literacy by analysing financial mathematical concepts and make decisions for self and national development.

LEARNING OUTCOMES	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY

The learner should be able to;
 	
a) Develop financial literacy through interest rate theory and differentiating between nominal and effective interest rate. (k, u, v/a, s, gs)
	a) Learners in groups, discuss;
	(i) different types of interest rates:
	   ✓ Simple interest rate
	   ✓ Compound interest rate
	   ✓ Continuous compounding
	as quoted by financial institutions.
	(ii) Use basic time unit and conversion period for any financial institution such as microfinance, Sacco or commercial bank to analyse:
	   ✓ Nominal interest rate
	   ✓ Effective interest rate
	   ✓ Force of interest and determine which of the interests is offered by the respective financial institution.
		a) Observe learners as they discuss taking note of their ability to talk confidently and explain ideas/opinions clearly;
		b) Converse with the learners noting their ability to share and seek clarification and support.
		c) Assess learners presentations with a view to validate the authenticity of methods used and accuracy of their computations.

	b) Learners through ; (i) Induction, analyse Government bonds and Treasury bills at a given interest rate as internal government loans. (ii)discussion, explain the advantages and disadvantages of investing in Government bonds and treasury bills for given interest rates to ❖ An individual	a) Observe learners as they analyse government bonds and treasury bills; pay attention to learners' ability to use mathematics to justify and support decisions. b) Probe them to enhance their reasoning and understanding focus; note how well they

	❖ A fund manager
	❖ Government.
	(iii) Use of internet, library or any other source, read and make presentations about government bonds and treasury bills, as internal government loan, and write a financial report he/she could give as a:
	  (i) A government minister
	  (ii) A CEO of a Sacco, Microfinance or a bank
	  (iii) A bank, Sacco or Microfinance agent
	  (iv) A businessperson
	  (v) A community leader
	  (vi) A family member
	In regards to
	  ❖ Interest rates
	  ❖ Loan
	  ❖ Treasury bonds and bills
		collaborate, respect views of one another, and the originality of ideas;
		c) Assess presentations and reports to identify clarity, originality and accuracy of their work.

b) Investigate annuities to enhance future security through a series of payments in order to financially protect retirement decisions. (k, u, v/a, s, gs)	Learners through induction;
	
	(i) differentiate between types, forms and classifications of annuities by computing:
	  ❖ Immediate annuity.
	  ❖ Annuity-due.
	(ii) differentiate between annuities and perpetuities and compute:
	❖ Immediate perpetuity
	❖ Perpetuity -due
	N.B (Learners are taken out to some financial institutions to get a real feel of industry involved in interest rates, loans and annuities. Student justifies the need for him/her to start up a
	❖ Sacco
	❖ Soft loan company
	in relation to all the financial
		a) Observe learners as they discuss; focusing on learners' ability to use imaginations to explore possibilities, predict outcomes and make reasoned decisions.
		b) Converse with the learners, ask questions that provoke them to relate mathematics with real life situations.
		c) Assess learners' written work to find out the correct use of formulae and accuracy of computed solutions.

	literacy theory of interest rates, loans, CBR, government bonds, treasury bills, annuities and perpetuities.)	

SENIOR SIX   TERM ONE

THEME: APPLICATION

TOPIC 27: INSURANCE MATHEMATICS   08 PERIODS

TOPICAL COMPETENCY: By the end of the topic, learners should be able to assess potential risks of events and developing financial policies by minimising the cost of risk for self and national development

LEARNING OUTCOMES	SUGGEST ED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
The learner should be able to; a) Assess types of life insurances and potential risks of events so as to defend insurance cover and policies. (k, u, v/a, s, gs)	a) In groups, learners; (i) Find out and discuss the concept of future life time T in an insurance setting. (ii) Through induction, use standard actuarial notations to determine future life time and calculate values of some actuarial notations, using the analytical distributions of T.	a) Observe learners as they present their findings on the concept of future life time T; pay attention on learners' ability to effectively communicate ideas and predict future outcomes. b) Converse with the learners and ask questions that provoke them to explain the terms used in the notations; pay attention to learners mixed abilities and involvement. c) Assess the computed values of life time to ascertain their accuracy and harmonise the findings.
b) Apply random variables to generate future life probability distributions and life tables in order to predict future life time of a life aged x	a) Learners in groups, through; (i) Induction construct, read and explain life tables from real data and calculate premiums for the different types of life insurance. (ii) discussion, find out	a) Observe learners as they discuss; note their ability to manipulate data and communicate effectively, identify problems and ways forward.

in order to develop and support financial policies that minimizes the cost of risk. (k, u, v/a, s, gs)	different factors that impact the cost of insurance premiums. (iii) use of internet/library or any other source write a report about the insurance product he/she would undertake giving reasons for his/her choice.	b) Converse with the learners provoking their mathematical reasoning and note their ability to appreciate criticism from others. c) Assess learner reports to determine learners understanding of insurance premiums, pay attention to the correct use of tables and accuracy of their calculations.

SENIOR SIX   TERM ONE

THEME: CHANGE

TOPIC 28: DIFFERENTIATION 2   **20 PERIODS**

TOPICAL COMPETENCY: By the end of the topic, the learner should be able to analyse trigonometric, exponential, inverse trigonometric and logarithmic functions by differentiation for lifelong learning.

LEARNING OUTCOMES	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
The learner should be able to; a) Differentiate trigonometric functions. (k, u, v/a, s, gs)	a) In pairs, learners find out and discuss differentiation of trigonometric ratios from first principles and other differentiation methods.	a) Observe learners as they present their findings on differentiating trigonometric functions. Pay attention to how they write and coherently present their work, listen attentively to others and with comprehension. b) Converse with learners to check learners' use of various techniques, noting their ability to interpret and interrogate mathematical data. c) Assess learners' work keenly looking at correct differentiation of expressions.
b) Differentiate exponential, logarithmic and inverse trigonometric functions for lifelong learning. (k, u, v/a, s, gs)	a) In groups, learners discuss and differentiate exponential, logarithmic and inverse trigonometric functions.	a) Observe the learners as they work out tasks on differentiation noting how learners choose appropriate methods. b) Dialogue with learners on the correct and appropriate methods to be used focusing on learners' ability to interact and share opinions. c) Assess learners' exercises, note the correctness of the methods and accuracy of their solutions.

SENIOR SIX   TERM ONE

THEME: CHANGE

TOPIC 29: INTEGRATION 2   **36 PERIODS**

TOPICAL COMPETENCY: By the end of the topic, the learner should be able to determine definite and indefinite integrals by applying various techniques of integration for acquisition of analytical skills.

LEARNING OUTCOMES	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
The learner should be able to; a) Determine definite and indefinite integrals of algebraic, trigonometric, inverse trigonometric, exponential and logarithmic functions using various techniques of integration for lifelong learning. (k, u, v/a, s, gs)	a) Through discussions and guided discovery, the learners in groups integrate functions: (i) by change of variable (ii) by recognising a function and its derivative (iii) by use of Pythagoras theorem identities and double angle formulae for powers of trigonometric ratios. (iv) involving exponential and logarithmic expressions (v) involving partial fractions	a) Observe the learners as they integrate various functions using different techniques; note their ability to apply the different methods and analytical skills. b) Converse with learners paying attention to learners' ability to communicate effectively and take responsibility for their own learning. c) Assess learners written work, check for accuracy, coherence and correct evaluation of integrals.

b) Apply the knowledge of integration by parts and trigonometric substitutions to determine definite and indefinite integrals for lifelong learning. (k, u, v/a, s, gs)	a) In an open discussion, learners:
	   (i) Apply integration by parts to integrate products of functions.
	   (ii) Apply trigonometric substitutions to integrate expressions of the form:
	
	$\int \frac{1}{\sqrt{a^2-b^2x^2}}\,dx, \quad \int \frac{1}{a^2+b^2x^2}\,dx$
	
	NB: t-substitution should not be considered.
		a) Observe the learners noting their ability to look out for patterns and make generalisations as well as applying different methods to solve a problem.
		b) Converse with learners paying attention to learners' ability to communicate effectively and listen critically to compare different perspectives.
		c) Assess learners written work, check for accuracy, coherence and correct evaluation of integrals.

SENIOR SIX   TERM ONE

THEME: CHANGE

TOPIC 30: MACLAURIN'S THEOREM   **04 PERIODS**

TOPICAL COMPETENCY: By the end of the topic, the learner should be able to evaluate polynomial approximations by applying Maclaurin's theorem to express differentiable functions as power series for life-long learning.

LEARNING OUTCOMES	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
The learner should be able to; a) Describe the procedure for finding Maclaurin's polynomial for a given differentiable function. (k, u, v/a, s, gs)	a) Through open discussion, learners generate successive derivatives of a given function when x = 0, use the derivatives to generate Maclaurin's polynomial expansion in the form: $f(x) = f(0) + xf'(0) + \frac{x^2 f''(0)}{2!} + \cdots$	a) Observe the learners as they apply Maclaurin's theorem; pay attention to learners' ability to explain ideas and drawing opinions from group discussions. b) Dialogue with learners as they derive Maclaurin's polynomial expansions focusing on the accuracy of the terms of the expansion and analyse different outputs. c) Assess learners' work for correct expression and harmonise their findings.
b) Apply Maclaurin's series expansion to expand and evaluate functions at given values of x for life-long learning. (k, u, v/a, s, gs)	a) In groups, learners discuss and apply Maclaurin's series to generate power series given differentiable functions, evaluate the limit /approximate value of a function at a given value of x.	a) Observe the learners as they expand and evaluate functions; focus on learners' ability to interact and work effectively with others to generate ideas. b) Provoke learners to approximate the value of a function for a given value of x noting how they logically reason and use questioning to evaluate different responses. c) Look at the learners work and assess the accuracy of their solutions. Harmonise their findings.

SENIOR SIX   TERM ONE

THEME: CHANGE

TOPIC 31: TRAPEZIUM RULE.   **10 PERIODS**

TOPICAL COMPETENCY: By the end of the topic, the learner should be able to estimate definite integrals numerically through evaluating the approximate area under a curve and analyse resultant errors for decision making and lifelong learning.

LEARNING OUTCOMES	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
The learner should be able to; a) Numerically evaluate different definite integrals using the trapezoidal rule. (k, u, v/a, s, gs)	a) In groups learners discuss and; (i) Sketch given curves and divide the given interval into trapezoidal strips of equal width. Create an interval within which the area is to be estimated. (ii) Approximate the area under the curve within the given interval by summing up the areas of trapezoidal strips.	(a) Observe learners as they sketch curves and evaluate areas over certain intervals; focus on learners' ability to interact and work effectively with one another to generate ideas. (b) Implore learners to approximate the areas under curves and note their ability to explain ideas clearly and persistence at working through detailed steps. (c) Look at the learners' presentations and assess the accuracy of their solutions. Harmonise learners' findings.

b) Compare numerical and analytical solutions and analyse resultant errors. (k, u, v/a, s, gs)	a) Learners, through groups, discuss and determine the exact area under a given curve; analyse the resultant error as a result of applying the trapezoidal rule.	a) Observe learners as they determine areas under curves; note their ability to work together and appreciate each other's opinions. b) Converse with learners as they work; encourage them to seek for support where necessary, note their ability to respond positively to correction. c) Look at learners' presentations; assess correctness and accuracy of the findings. Harmonise the varying solutions.

SENIOR SIX   TERM TWO

THEME: Change

TOPIC 32: Further curve sketching.   **10 periods**

TOPICAL COMPETENCY: By the end of the topic, the leaner should be able to analyse curves by applying the knowledge of differentiation and coordinate geometry for lifelong learning.

LEARNING OUTCOMES	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
The learner should be able to; Apply the derivative of a function to analyse its properties for lifelong learning. (k, u, v/a, s, gs)	a) In groups, learners discuss and determine the stationary points of curves and distinguish between them.	a) Observe learners as they discuss; focus on learners' analytical skills and ability to carry out mathematical manipulation. b) Dialogue with learners to determine ways of distinguishing between stationary points; pay attention to life skills development, mixed abilities and involvement. c) Assess learners to note the correctness, accuracy and clarity of their work.

b) Establish the region in which the curve is defined by analysing critical values; investigate the behaviour of the curve to obtain the asymptotes and sketch the curve. (k, u, v/a, s, gs)	a) In pairs, learners through induction; (i) Determine the asymptotes and intercepts of curves, (ii) Determine the values for which the functions are defined and deduce the turning points. (iii) Sketch curves	a) Observe the learners as they sketch curves; note learners' ability to discuss and exchange ideas openly. b) Implore learners to clarify their arguments objectively and rationally as they sketch the curves. c) Look at the sketched curves and assess learners' graphical and analytical skills. Harmonise by clearing learners, misconceptions.

SENIOR SIX   TERM TWO

THEME: APPLICATION

TOPIC 33: LINEAR OPTIMIZATION.   **08 PERIODS**

TOPICAL COMPETENCY: By the end of the topic, the learner should be able to maximise or minimise specified objectives through modeling and solving linear optimization problems for industrial management and decision-making contexts.

LEARNING OUTCOMES	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
The learner should be able to; a) Critically formulate and model linear optimization problems to conjecture optimization models for real-world situations. (k, u, v/a, s, gs)	a) In groups, learners discuss and determine: (i) The decision variables in a real-world linear programming problem. (ii) Constraints as algebraic inequalities (using the decision variables identified). (iii) And write the objective in algebraic form (using the decision variables)	a) Observe learners as they determine decision variables, constraints and the objective; note learners' ability to interact and work effectively with one another to generate ideas; b) Converse with learners as they work through problems; take note of their persistence on work and encourage them to seek for support where necessary. c) Assess the learners' presentations for correctness and accuracy. Harmonise their solutions
	b) In pairs, learners discuss and: (i) Draw graphs of individual constraints and combine these graphs to identify the	a) Observe the learners and note their ability to support each other and work

	feasible region. (ii) Locate the extreme points (corners) of the feasible region and their coordinates. (iii) Evaluate the objective function at each vertex. (iv) Record the vertex coordinates and objective function values in a table. (v) Determine the optimal objective function by comparing the objective function values	with persistence. b) Converse with learners as they work through the problems; pay attention to ability to interpret and respond appropriately to others' mathematical arguments both in oral and written forms. c) Look at the solutions and validate the methods and solutions presented.
b) Investigate and critique possible solutions of linear programming problems by graphical and primal-simplex tableau methods. (k, u, v/a, s, gs)	a) In groups, learners use internet/library/any other source to: (i) Design a primal simplex tableau for a linear programing problem of two or three variables. Reduce the tableau and state the optimal solutions ✓ Standard form. ✓ Introducing slack variables. ✓ Creating the tableau. ✓ Pivot variables. ✓ Creating a new tableau. ✓ Checking for optimality. ✓ Identify optimal values. (Extend to: Project work: Real-world optimization problems such as minimizing costs,	a) Observe the learners as they record their findings; note their ability to seek new knowledge and support from different sources and how they use the obtained information for self learning/projects. b) Converse with the learners as they work through problems; pay attention to their ability to be part of a collective effort and adoption of different approaches to the tasks. c) Look at the findings, assess

	maximizing profits, number of trucks, types of materials, types of clothes, number of machines and others so that the learner: (i) Formulates a linear programming problem, the objective function and constraints. (ii) Change a minimization to a maximization problem and vice versa. (iii) Mathematically model it.)	and harmonise learners' presentations.

SENIOR SIX   TERM TWO

THEME: DATA AND MATHEMATICAL EQUATIONS

TOPIC 34: SAMPLING DISTRIBUTION.   **10 PERIODS**

TOPICAL COMPETENCY: By the end of the topic, the learner should be able to estimate population parameters by using sample distributions to resolve real world phenomena.

LEARNING OUTCOMES	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
The learner should be able to; a) Compute point and interval estimation of population parameters. (k, u, v/a, s, gs)	a) Learners through group discussion differentiate between a population and sample; determine point and interval estimates of population parameters	a) Observe learners as they discuss noting the use of past experience to solve new problems as they try to understand concepts without using rote memorization. b) Dialogue with learners noting the right choice of relevant information/ formulae focusing on their ability to relate concepts and generate new ideas. c) Assess the learners' work for correctness and accuracy. Harmonise their presentations.

b) Apply confidence intervals and point estimation to resolve real world challenges. (k, u, v/a, s, gs)	a) In groups learners find out and discuss how to compute the confidence intervals for the population mean when the population variance is known and unknown for n ≥30	a) Observe learners as they discuss taking note of their ability to integrate mathematical knowledge and skills to solve real life problems. b) Dialogue with learners, focusing on their ability to correctly read and interpret mathematical tables, and working together in harmony. c) Look at learners' work, assess the accuracy and coherence of the work. Harmonise their presentations.

SENIOR SIX   TERM TWO

THEME: DATA AND MATHEMATICAL EQUATIONS

TOPIC 35: STATISTICAL INFERENCE.   **08 PERIODS**

TOPICAL COMPETENCY: By the end of the topic, a learner should be able to analyse data by formulating inferences for decision making in quantifiable occurrences.

LEARNING OUTCOMES	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
The learner should be able to; a) Develop and/or formulate inferences. (k, u, v/a, s, gs)	a) In an open discussion learners, find out and develop the possible three forms of Null hypothesis and Alternative hypothesis for different real-world situations	a) Observe learners as they develop the possible forms of the null and alternative hypotheses; focus on their open mindedness to new methods and approaches in accomplishing tasks. b) Converse with the learners while noting their willingness to work with one another, ability to liaise and share opinions. c) Assess learners work for correctness and accuracy. Harmonise their positions.
	b) Learners in groups, discuss and determine the two kinds of errors that can be made in hypothesis testing ✓ Type I error (level of significance) ✓ Type II error	a) Observe learners as they determine the two kinds of errors: Type I and Type II; focus on their willingness to seek support and take up unusual challenges. b) Provoke learners to explain the difference between the errors noting their ability to share and compare work. c) Look at and assess learners'

		presentations and harmonise the varying responses.
b) Test and analyze different forms of hypothesis about a population mean. (k, u, v/a, s, gs)	a) In groups, learners: (i) Collect data in a way designed to test the hypothesis and perform hypothesis tests on the population mean μ, for ❖ One-tailed test. ❖ Two-tailed test. (ii) Decide whether to reject or accept a null hypothesis; decide whether the results of a research study support a particular theory which applies to a population.	a) Observe learners as they collect data and perform hypotheses tests for single and double tail cases; note their ability to categorise information using various criteria, share and compare work. b) Converse with learners as they work through problems, encourage learners to seek support where necessary; note their ability to respond to correction and criticism. c) Look at and assess learners' presentations and harmonise the conclusions whether particular hypotheses are accepted or rejected.
	b) In groups, learners use internet/library/ any other source to find out and discuss the application of the test of hypothesis for decision making in real-life situations using the 6 steps of hypothesis testing.	a) Observe learners as they do research using internet/ library/other resources. Focus on the learners' ability to share and willingness to venture into new grounds. b) Converse with learners and encourage them to seek support from

		different sources. Note their ability to judge the validity of arguments presented in various sources. c) Assess learners' written research findings and harmonise them for consistence.
	c) In groups, learners discuss how to apply acquired tools to different real-life data by making inference about population mean μ, where data is thought to have been drawn	a) Observe learners as they apply acquired tools in areas such as project management and decision making; focus on the ability to share approaches, sort and analyse information. b) Converse with the learners, ask questions that elicit perseverance and patience noting their ability to listen attentively with comprehension. c) Assess their presentations for correctness and accuracy. Harmonise their responses.

SENIOR SIX   TERM TWO

THEME: Change

TOPIC 36: Iterative Methods.   **12 periods**

TOPICAL COMPETENCY: By the end of the topic, the leaner should be able to determine solutions to non-linear functions through various iterative methods for decision making.

LEARNING OUTCOMES	SUGGESTED LEARNING ACTIVITIES	SAMPE ASSESSMENT STRATEGY
The learner should be able to; a) Generate and test the convergence of various iterative schemes for approximation of a root of a non-linear function. (k, u, v/a, s, gs)	a) In groups, learners through induction: (i) Create the iteration schemes by re-arranging the given function f(x) =0 in the form $x_{n+1}= f(x_n)$. (ii) Investigate which iterative scheme among those formed is more appropriate by testing for convergence and determine the root of the function.	a) Observe learners as they generate different iterative schemes and test for convergence; check on validity of the method used to test for convergence. b) Dialogue with learners on the most appropriate method to be used, note the level of understanding to test for convergence and determine the root of the function focusing on learners' ability to plan and carryout investigation. c) Look at the learners work and Assess their creativity, originality and correctness of their solutions.
b) Approximate the root of a non-linear function using convergent iterative schemes for decision making. (k, u, v/a, s, gs)	a) In groups, learners discuss linear interpolation and Newton's Raphson formula and apply them to determine the root of the equation f(x) =0.	a) Observe learners as they present their finding on how to apply linear interpolation and Newton's Raphson method to determine the root of the function. b) Prompt the learners to explain techniques used in determining the root of the function focusing on their ability to interact effectively with one another. c) Assess learners work and check out for correctness of computations. Harmonise

		learners' work.

SENIOR SIX   TERM TWO

THEME: APPLICATION

TOPIC 37: COORDINATE GEOMETRY 2   **24 PERIODS**

TOPICAL COMPETENCY: By the end of the topic, the learner should be able to describe geometric relations and analyse geometric figures represented by means of equations in two dimensional space by applying algebra to draw classifications in relation to their behavior for application in real world situations.

LEARNING OUTCOMES	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
The learner should be able to; a) Create a locus of points and derive its equation using geometric expressions given for long life learning. (k, u, v/a, s, gs)	a) In groups, learners to discuss the loci of points under different constraints.	a) Observe the learners as they determine the loci of points; note the learners' ability to apply geometric relations and algebraic concepts; focus on learners' ability to accurately carry out mathematical computations and critically share opinions with out bias. b) Dialogue with learners and ask questions to elucidate loci; note learners ability to listen attentively and explain ideas clearly. c) Assess learners work for correctness. Harmonise learners' work.

b) Apply the knowledge of loci to derive the equation of a circle, analyse the circle and its applications in the real world. (k, u, v/a, s, gs)	a) In groups, learners discuss : (i) The equation of a circle (ii) The equation of a tangent to a circle at a given point, (iii) point(s) of intersection of two circles, (iv) Conditions for touching circles. (v) Length of tangent to a circle from a point. (vi) Parametric equations of circles.	a) Observe the learners as they analyse a circle paying attention to learners' ability to draw relationships to make conclusions. b) Converse with learners to examine the understanding of the concepts of circles; pay attention to life skills development. c) Look at learners work and assess their creativity and understanding of circles Harmonise learners' work.

C) Apply the knowledge of loci to derive the equation of a parabola, analyse the parabola and its applications in the real world. (k, u, v/a, s, gs)	a) In groups, learners discuss (i) Terms used for a parabola (focus, directrix, centre/vertex, latus rectum, chords) (ii) Equation of a parabola and draw its sketch, (iii) parametric equations of a parabola, (iv) Equation of the tangent, normal and the chord to the parabola. **NB: Exclude ellipse and hyperbola.**	a) Observe the learners as they define terms and analyse a parabola paying attention to learners' ability to draw relationships to make conclusions and give constructive ideas. b) Converse with learners to examine the understanding of the concepts of a parabola; pay attention learners ability to freely communicate ideas and life skills development. c) Look at learners work and assess their creativity and understanding of a parabola

THEME: DATA AND MATHEMATICAL EQUATIONS

TOPIC 38: COMPLEX NUMBERS.   **24 PERIODS**

TOPICAL COMPETENCY: By the end of the topic, the learner should be able to examine the algebra of complex numbers through analysing imaginary and real parts.

LEARNING OUTCOMES	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
The learner should be able to; (a) Appreciate that numbers can be expressed with real and imaginary parts and manipulate them for further applications. (k, u, v/a, s, gs)	(a) In groups, learners through discussion; (i) Determine roots of negative numbers (ii) Solve quadratic equations with complex roots. (iii) Analyse the algebra of complex numbers. b) In groups, learners discuss locus of a complex number c) As individuals, learners through guided discovery represent locus of a complex number on a complex plane.	(a) Observe learners as they solve equations; note learners' ability to apply methods of solving a quadratic equation to determine roots; focus on learners' ability to work with others to generate ideas. (b) Implore learners to apply algebraic concepts to simplify and analyse complex numbers; pay attention on gender inclusiveness and mixed abilities. (c) Assess learners work to determine the accuracy of computations. Harmonise learners' work.

b) Graphically analyse complex numbers, determine their polar forms and apply De Moivre's theorem to simplify trigonometric expressions and solve equations. (k, u, v/a, s, gs)	a) Guide learners through induction to; (i) Express complex numbers in polar forms. (ii) To apply De Moivre's theorem in determining roots of real and complex numbers, simplification of trigonometric expressions and solving equations.	a) Observe learners as they determine and sketch the loci of complex numbers; pay attention to learners ability to evaluate different solutions and ask questions to achieve clarification. b) Converse with learners to trigger them to apply algebraic concepts to determine the loci of complex numbers and apply De Moivre's theorem to simplify expressions and solve equations; focus on learners mixed abilities and involvement. c) Assess learners work to identify the accuracy and clarity of their computation, analyse their analytical and graphical skills.

SENIOR SIX   TERM THREE

THEME: APPLICATION

TOPIC 39: MATHEMATICAL COMMUNICATION.   **10 PERIODS**

TOPICAL COMPETENCY: By the end of the topic, the learner should be able to effectively communicate and visualize scientific writings, research and findings through the use of mathematical software applications for educational, business and technological advancement.

LEARNING OUTCOMES	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
The learner should be able to; a) Typeset and present mathematical statements by use of Latex software to develop mathematica communication skills. (k, u, v/a, s, gs)	a) In pairs, through guided discovery, learners: (i) install and configure ✓Latex editor ✓Miktex software ✓Maple software ✓Mathematica software (ii) Typeset mathematical literature using latex.	a) Observe learners as they install and configure Latex editor, Miktex, Maple and Mathematica software applications; note the abilities of learners to support each other and seek for guidance. b) Converse with learners with emphasis on promotion of media literacy and Communication technology; Note learners' ability to use technology to communicate. c) Assess the learners' work as they apply the software applications and give guidance where necessary.
b) Perform and visualize analytical solutions by use of mathematical software(s) such as Maple, Mathematica to	a) In groups, learners' discuss and; (i) Implement Maple and Mathematica software applications	a) Observe learners as they implement various applications; note their ability to

examine classroom solutions. (k, u, v/a, s, gs)	in various mathematical topics (Differentiation and integration of functions, solving equations, systems of linear equations and differential equations, curve sketching; plots, data interpolation) (ii) Identify wrong answers, common errors that emerge from student responses to calculus problems using Maple or Mathematica. (iii) Explain the impact of Maple/Mathematica software on student understanding of calculus.	interpret and interrogate mathematical data and use of technology to create, manipulate and process information; b) converse with the learners as they use Latex editor, Miktex, Maple and Mathematica software applications; note the abilities of learners to support each other and seek for guidance, apply technology to simplify work and enhance understanding. c) Assess the learners' experience and work as they apply technology to handle hitherto manual processes.

SENIOR SIX   TERM THREE

THEME: Change

TOPIC 40: Differential equations.   **14 periods**

TOPICAL COMPETENCY: By the end of the topic, the learner should be able to analyse differential equations by formulating and solving first order differential equations using various techniques for acquisition of analytical skills and optimisation.

LEARNING OUTCOMES	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
The learner should be able to; a) Demonstrate the ability to derive and analyse deferential equations using various techniques. (k, u, v/a, s, gs)	a) In groups, learners discuss and form differential equations. b) In groups, learners discuss and solve first order differential equations using various techniques.	a) Observe the learners as they discuss and form differential equations, pay attention to learners' ability to suggest, develop new ideas and evaluate different solutions. b) Dialogue with them pay attention to ability to seek guidance and support and ask engaging questions to achieve clarity. c) Look at the solutions and take keen interest in the use of correct methods and neat presentations.

b) Apply deferential equations to solve real world situations such as in population growth, price of commodities and temperature variations. (k, u, v/a, s, gs)	a) In groups, learners discuss the applications of differential equations in real world.	a) Observe the learners as they present findings; note their urge to seek new knowledge by use of ICT and other resources. b) Converse with learners as they present their work; pay attention to ability to seek guidance and support. c) Look at and assess the learner findings. Harmonise their presentations.

SENIOR SIX   TERM THREE

THEME: CHANGE

TOPIC 41: FLOW CHARTS.   **12 PERIODS**

TOPICAL COMPETENCY: By the end of the topic, the learner should be able to develop and represent different models through analysis of various algorithms and use the skills acquired to solve emerging challenges.

LEARNING OUTCOMES	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
The learner should be able to; a) Generate an algorithm for solving a given function. (k, u, v/a, s, gs)	a) In groups, learners (i) Brainstorm on the activities and perform logically to resolve given challenges. (ii) Discuss and determine logical steps required to solve a given mathematical problem.	(a) Observe learners as they brainstorm and determine logical steps required to solve given mathematical problems; note the ability to share and compare work. (b) Converse with learners as they work through problems, encourage learners to seek for support where necessary; note their ability to respond to correction. (c) Look at learners' presentation and harmonise the varying solutions.
b) Construct flowcharts and perform dry runs. (k, u, v/a, s, gs)	a) In groups, learners discuss and (i) Determine algorithms and present them on flow charts. (ii) Test the logical flow of the algorithms and perform dry runs.	a) Observe learners as they determine and represent algorithms on flow charts; focus on learners' ability to interact and work effectively with one another to generate ideas. b) Implore learners to carry out computations and note their persistence at working through detailed steps and look at different patterns and make

		generalisations. c) Look at the learners presentations and assess the accuracy of their solutions.
c) Implement a variety of numerical algorithms to solve real world phenomena. (k, u, v/a, s, gs)	a) In groups, learners discuss and analyse various formulae, algorithms and flow charts for simplifying and resolving day to day challenges.	a) Observe learners as they discuss and analyse various situations that require a flow-chart implementation; note their ability to seek clarification and share views. b) Converse with the learners, look at how they interpret and interrogate mathematical data and manage goals and time. c) Assess the various flow-charts and dry runs for validity and accuracy. **(NB. This is a potential area for project work. A learner can explore the application of moderate computer programming to implement an algorithm)**

SENIOR SIX   TERM THREE

THEME: APPLICATION

TOPIC 42: BIO-MATHEMATICAL MODELING.   **12 PERIODS**

TOPICAL COMPETENCY: By the end of the topic, learner should be able to model population and community dynamics by formulating and solving differential equations in fields such as biology, ecology, fisheries, environment, and epidemics and use them to describe and communicate the dynamic aspects of life.

LEARNING OUTCOMES	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
The learner should be able to; a) Design deterministic logistic models describing population dynamics of different ecologies in order to understand the dynamics predict and suggest controls on some activities of a population for decision making and policy formation. (k, u, v/a, s, gs)	a) Learners in groups, through induction: (i) Explain why and how population change in size and structure over time is determined by birth, death, immigration and emigration. (ii) Draw compartment diagrams, formulate and determine points of equilibrium of a population dynamics model; Use the information to make predictions about future population sizes.	a) Observe learners as they explain population changes in size and structure over a period of time; note learners' ability to think of alternatives to address a situation, and act respectfully around others. b) Converse with the learners, prompt them to explain how to draw and present compartment diagrams of different population dynamics, finding the fixed points of the mathematical models and analyze them; focusing on their ability to sort and analyse information, predict outcomes and make reasoned decisions. c) Assess the learners work focusing on the correctness and validity of points of equilibrium, mathematical models

		and predictions.
b) Develop mathematical models for community dynamics in order to analyze the survival, co-existence or extinction of species due to community interactions to describe, develop policies and communicate the dynamic aspects of life. (k, u, v/a, s, gs)	a) In groups, learners through induction: (i) Formulate, solve and analyse community dynamics within different species with, Harvesting, Competition and Prey-predator. (ii) Analyse simple models, watch a documentary or read a text about interactions of species and make conclusions. (iii) Solve community dynamics models to determine equilibrium points, nature of equilibrium points to further understand population dynamics, food webs, invasive species, and predator/prey relationships in ecological populations and communities.	a) Observe learners as they analyse simple models. Note learners' ability to use imaginations to explore possibilities and try out innovative ideas. b) Converse with learners to explain, describe, formulate and interpret community dynamic models; focusing on learners' ability to read, interpret and carry out investigations. c) Assess the learners work, check the validity of their solutions and predictions, then harmonise.