CONTENT AREAS	COMPETENCIES	DESCRIPTIVE STATEMENTS
NUMBER AND OPERATIONS • real number system	Demonstrate understanding in the various numbers in the number system and their operations	• Identify and group numbers into the number types. • Perform operations such as addition, subtraction, multiplication and division on the various numbers (e.g. natural numbers, whole numbers, integers, rational numbers)
• Binary operations and properties (e.g. closure, identity element, commutativity, associativity and distributive properties)	• Demonstrate knowledge and understanding of binary operations e.g. closure, commutativity identity, associativity distributive property)	• Define the properties of real numbers (closure, commutativity, identity, associativity, distributive property) and perform calculations on them
• Surds, radical equations, indices and logarithms	• Demonstrate understanding of definition of surds, exponents and logarithms and any laws needed to solve real life problems	• Simplify expressions using the laws of exponents for rational exponents • Establish between which two integers a given simple surd lies. • Add, subtract, multiply and divide simple surds. • Solve simple equations involving surds • Simplify logarithmic expression and equation and apply them in solving real life problems.
• Ratio, rates, and percentages	• Demonstrate understanding in ratios and rates and percentages	• Explain and use common rates such as Km/h, rate of payment per hour, payment of wages and those used in utility bills. • Express one quantity as a percentage of the other • Calculate percentages of given quantities.

		• Calculate percentage changes. • Apply percentages in • Simple interest income tax • Compound interest • Depreciation
ALGEBRA AND FUNCTIONS • Factorizations and expansion of algebraic expressions • Change of subject • polynomials • Equations	Demonstrate understanding in factorizing, binomials, trinomials, Quadratic expressions Demonstrate understanding in changing subject in given formula Demonstrate understanding in polynomials	Manipulate algebraic expressions by • multiplying a binomial by a trinomial; • factorizing trinomials • factorizing the difference and sums of two cube • factorizing by grouping in pairs; and • simplifying, adding and subtracting • algebraic fractions with denominators of squares (limited to sum and difference of squares). • Solve literal equations (changing the subject of formulae); • Perform substitutions and evaluation when given certain values. • Perform operations such as addition, subtraction, multiplication and division in polynomials • Find the zeros of polynomials Solve: ☐ linear equations in one variable ☐ quadratic equations making use of: • factorization

	Demonstrate understanding in solving different types of equations.	• quadratic formula
		Completing of squares
		  • Write a quadratic equation in the form $y = (x \pm a)^2 \pm c$
		  • use $y = (x \pm a)^2 \pm c$ to find the minimum value, maximum value, sketch a quadratic curve and explain the shifts from $y = x^2$
		  • exponential equations
		  • logarithmic equations
		  • linear inequalities
		  • system of linear equations up to two variables
		  • word problems.
		  • Demonstrate competencies in solving System of linear equation (Up to two variables) and inequalities

• sequences and series (arithmetic sequences and series and geometric sequences and series)
 	
• Variations (e.g. direct indirect and joint)
	Demonstrate understanding in sequences and series	Solve
		  • number pattern (linear number pattern and quadratic pattern)
		  • arithmetic progression (AP)
		  • geometric progression (GP)
		  • sum of first in terms of AP and GP
		
		Solve questions on
		  • direct variation
		  • indirect variation
		  • joint variation

	Demonstrate understanding in solving questions on variations	
Geometry and measurement • Points and line segments • Angles (angles at a point, angles properties of parallel lines • Properties of 2 D figures e.g., triangle and quadrilaterals • Perimeters and areas of 2D and 3D figures. • Volume and surface areas of 3D figures • Coordinate geometry • Geometrical construction	Demonstrate understanding in geometry and measurement	• Know definition for lines and line segment and give examples in real life. • Know the definition of the different types of angles e.g., acute, obtuse, reflex, right angles. • Solve questions relating to angles at a point, adjacent angles on a straight line, angles in a triangles and quadrilaterals, properties of angles of parallel lines e.g. (corresponding, alternate and co-interior) on the angles. • Identify various geometrical shapes in 2 Ds and 3Ds • Solve related problems including areas and perimeters of 2Ds and Perimeters and areas and volumes and surfaces areas of and 3 Ds e.g. cuboid cubes cones and cylinders • Locate points in the Cartesian plane, drawing lines to join plotted points and determine the equation of lines drawn in the Cartesian plane. Solve for • slopes of a lines and its interpretations. • equation of a circle when given three points on the circle, the center and a point on the circle and the end points of the diameter finding the radius of a circle • mid-points between two points and distance between two points. • know the parts of a circle e.g., center, radius, diameter, chord, segment, sector circumference,

		• Use reflection, rotation, translation and enlargement techniques in transformation • Apply the concepts of similarity, dilations in solving real life problems • Construct geometrical figures making use of pair of compasses and ruler only. • Apply locus in circle geometry
• **Trigonometry and vectors** • Right angled triangles, • Pythagorean triples • Pythagoras theorems and its applications (e.g. finding the length of a ladder leaning against a wall, angles of elevation and depression) • Trigonometric ratios • Trigonometric equations • phase shift of sine graphs, cosines graphs and tangents Amplitude and period	• Demonstrate understanding in the concepts of trigonometry	Solve questions on • right angled triangles • Pythagorean triples • Pythagoras theorems and its applications (finding the length of a ladder leaning against a wall, angles of elevation and depression) Solve • questions by applying trigonometric ratios • trigonometric equations • on double angle • on multiple angle • Sine rule • Cosine rule • apply the concepts of phase shift of sine graphs and cosine graphs, Amplitude and period to solve problems limited to sine, cosine and tangent graphs

Vectors and Bearing • Algebra of vectors, vector • representation notation components of vector, vector • operations, magnitude and direction of a vector. • Teaching types of bearings and their applications.	Demonstrate knowledge in the concepts of vectors	Solve questions on • vector representation notations (distance-bearing $(K, \emptyset)$, component forms $\binom{x}{y}$, Cartesian forms $x_i + y_j$ • components of vector • vector operations • magnitude and direction of a vector • types of bearings and their applications
Calculus • Limits of functions (Excluding indeterminate forms) • Derivative of polynomial and rational functions (up to second order derivatives) product, quotient, chain rules • Application of differential calculus (e.g. maxima and minima values, equations of tangents and normal to curves) • Integral calculus (definite and indefinite integrals) • Curve sketching	Demonstrate knowledge in the concepts of calculus	• Find limits of polynomial functions. • Find derivatives of polynomial functions up to second order. • Apply the techniques such as quotient, product, chain rules to find derivative of functions. • Solve questions on integral calculus (Definite and indefinite integrals. Excluding integration by parts and substitution method • Apply differential and integral calculus in Maxima and minima values, equations of tangents and normal to curves • Apply differential calculus in solving problems on curve sketching.

Data handling and probability	Demonstrate knowledge in data collection procedures and statistical processes.	• state data collection procedures and when to apply them.
• data collection methods		• Construct tally tables and frequency distribution tables
• scales of measurement		• Find the averages (mean, mode and median) from a grouped and ungrouped data,
• processing of data (frequency distribution),		• Solving questions on graphical interpretation of data and analysis e.g. bar graph, pie chart, histogram, cumulative frequency
• Representation of data (e.g. bar graphs, pie chart histogram and line graphs, cumulative frequency graphs)		• Calculate and interpret measure of dispersions e.g. range, variance and standard deviation, quartiles and percentiles and apply them to solve real life statistical problems
• Measure of central tendencies (mean, median, mode and their (averages)		• Define probability
• Measures of dispersion (range variance, standard deviation)		• State the axioms of probability.
• Quartiles and percentiles		• define sample spaces and events.
• Definition of probability		• state conditions for mutually exclusive events and give real life of mutually exclusive events
• Axioms of probability		• state conditions for independent events
• Events		• state the addition law of probability of two events A and B: $P\,(A\ or\ B) = P\,(A) + P(B) - P\,(A\ and\ B)$
• Mutually exclusive events, inclusive events, complementary events independent events	Demonstrate understanding in	• State the product rule
	• probability	• apply techniques such as tree diagrams, contingency table and Venn diagrams in solving probability problems.
• Addition law	• samples and events	
• Product rule	• mutually exclusive events	• State the conditional probability. Give real life events of conditional probability.
• Techniques in solving probability problems such	• independent events	
	• complementary events	

as tree diagrams, contingency tables and Venn diagrams • Conditional probability	• addition law • product rule • Venn diagrams • contingency tables • tree diagrams • conditional probability	• Use the fundamental counting principles and counting rules to solve practical probability problems (combination and permutations)

SHS - MATHEMATICS

Subject Outcomes (Depth of Knowledge)

Content Areas	Level 1 Remembering (Recall)	Level 2 Understanding (Skill/Concepts)	Level 3 Applying (Strategic Thinking)	Level 4 Analyzing/Evaluating/Creating (Extended Thinking)	Total
Number and Operations	2	3	3	2	**10**
Algebra and Functions	1	3	3	3	**10**
Geometry and Measurements	1	3	2	3	**9**
Trigonometry and Vectors	2	2	4	3	**11**
Calculus	1	2	1	3	**7**
Data Handling and Probability	2	2	5	4	**13**
Total	9 (15%)	15 (25%)	18 (30%)	18 (30%)	**60 (100%)**