



Republic of Zambia

Ministry of Education, Science, Vocational Training and Early Education

Senior Secondary School Course
“O” Level Mathematics Syllabus
(Grades 10-12)



Published by the Curriculum development Centre
P O Box 50092
Lusaka

OCTOBER 2012

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PREFACE

This syllabus has been prepared and produced against the background of the need to set standards for mathematics education and form the country's vision from ECCDE through to Teacher Education in the Zambia.

It is a culmination of surveys of existing materials and policies from a number of countries both in Africa and beyond with progressive mathematics education. It also draws from studies, research and the country's policy documents and aspirations.

The Curriculum Development Centre would in this regard like to thank numerous stakeholders such as teachers, lecturers and other mathematicians who reviewed the working document and made invaluable suggestions.

The following are the underlying principles for the revised upper basic school mathematics curricula:

- Equity and Inclusiveness
- Orderly and logical progression
- Varied teaching methodology
- Integration of knowledge, skills and values

These standards have been defined at two levels; the content and process domains. The content domain is defined according to six themes namely; **Number and Calculations, Algebra, Geometry, Measurement and Estimations, Probability and statistics** and **Functions**. The process domain on the other hand is defined according to five categories. These are; **knowledge and skills, interest, understanding, thinking, application** and **representation** which constitute the general outcomes of the course.

ACKNOWLEDGEMENT

The Mathematics Department of the Curriculum Development Centre gratefully acknowledges the contribution of the Mathematics Technical Committee, Schools and Organisations who offered invaluable suggestions and advice in the finalisation of the Draft Ordinary (“O”) Level School Mathematics Syllabus. We would like to make special mention of the following entities:

Kwame Nkrumah University College

Copperbelt College of Education

Solwezi Technical High School

Hillside Girls’ Secondary School

University of Zambia

JICA corroborating with Hiroshima University

Ndola Girls’ Technical High School

David Kaunda Technical High School

Financial Sector Development Plan (FSDP) Partners

The high quality and well thought ideas of this syllabus would not have been possible without invaluable contributions of the above mentioned organizations and individuals who participated in various consultative meetings held across the country as representatives of their organizations and some in their own capacity as experts in mathematics. We would like to say thank you for the job well done.

INTRODUCTION

This Syllabus is expected to encourage consistent mathematics education for all learners, regardless of location, teacher insight and resources used. This is especially so in light of the outcomes based approach which in certain cases have presented challenges in the depth and scope of coverage for material developers

Efforts have been made to provide a coherent syllabus, in which an orderly and logical progression increases learners understanding of mathematical concepts and avoid unnecessary repetition

It is suggested that a variety of teaching methods be used, though more emphasis should be on those that promote active learning by learners. Teachers should however use their professional judgment in choosing the best techniques in their environments

Content has been divided into six general themes namely; Number and Calculations, Algebra, Geometry, Measurement and Estimations, Probability and statistics and Functions. Specific outcomes are derived based on Blooms taxonomy of cognitive domains levels.

RATIONALE

Mathematics is an important tool for the development and improvement of a person's intellectual competence in logical reasoning, spatial visualization, analysis and abstract thought. When learners have acquired enough knowledge in mathematics they develop numeracy, reasoning, thinking skill and problem solving skills. Mathematics is very important not only in science and technology that is vital for the development of the country but also in everyday life and workplace. Mathematics would equip the learner to live in modern age of Science and technology and enable the learner to contribute to the social and economic development of the country and the world at large. Mathematics plays a vital role in the development of highly skilled and technologically based manpower. Mathematics also prepares and enhances the learners' prospect of employment and further education as it also plays a key role as a tool for other learning areas and subject. Mathematics relates to all subjects and provides necessary mathematical pre-requisites for further education. Other subjects in science and technology heavily depend on mathematics concepts. In order for Zambia to comfortably reach the 2010 millennium goals there has to be a deliberate emphasis on mathematics education.

Mathematics can also be an interesting subject as it can also be a subject of enjoyment and excitement. This offers learners and students an opportunity for creative work and moments of joy and pleasure. It is very interesting for students and indeed all learners when they discover ideas and insights that would help them pursue mathematics even outside school walls.

The study of mathematics will build up understanding and appreciation of basic mathematical concepts and computational skills in order to apply them in everyday life. Mathematics aims at developing clear mathematical thinking and expression in a learner and also develop ability to recognize problem and to solve them with related mathematical knowledge and skills.

Through the study of mathematics learners will develop ethical values necessary for accountability in financial matters. It will develop in them the skills of interpreting and financial information. It will help learners acquire skills for planning, budgeting and effective decision-making.

Assessment

Continuous assessment will be emphasised by using various methods of testing according to topics and themes at various levels. The examinations council of Zambia will prepare detailed procedures on how continuous assessment will be conducted by the teachers. The Examinations Council will also develop examination syllabus to provide teachers with guidelines on the objectives to be tested. The scheme of assessment will consists of school based assessment and final examination that will be conducted by the Examinations Council of Zambia.

School based assessment will be in the form of tests. Tests will be in the form of diagnostic, aptitude, achievement, oral, practice, attitude and performance, exercises, assignments, discussions, investigation, project work etc. School based assessment shall contribute towards certification of all learners.

Time and Period allocation

Time allocation for this syllabus is will require at seven-40 minutes periods per week to complete.

GRADE 10

General Outcomes	Key Competences
<ul style="list-style-type: none"> ▪ Provide clear mathematical thinking and expression in the learner ▪ Develop the learners' mathematical knowledge and skills ▪ Enrich the learners' understanding of mathematical concepts in order to facilitate further study of the discipline ▪ Build up an appreciation of mathematical concepts so that the learner can apply these for problem solving in everyday life. ▪ Enable the learner represent, interpret and use data in a variety of forms ▪ Inculcate a desire to develop different career paths in the learners 	<ul style="list-style-type: none"> ▪ Assimilate necessary mathematical concepts for use in everyday life such as environment and other related disciplines. ▪ Thank mathematically and accurately in problem solving skills and apply these skills to formulate and solve mathematical and other related problems. ▪ Develop necessary skills needed to apply mathematical concepts and skills in other disciplines. ▪ Produce imaginative and creative work from mathematical concepts and ideas. ▪ Develop abilities and ideas drawn from mathematics to reason logically, communicate mathematically, and learn independently without too much supervision (self-discipline). ▪ Development positive attitudes towards mathematics and use it in other subjects such as science and technology. ▪ Apply mathematical tools such as information and communication technology in the learning of other subjects. ▪ Use mathematics for enjoyment and pleasure. ▪ Develop understanding of algebra, geometry, measurements and shapes.

TOPIC	SUBTOPICS	SPECIFIC OUTCOMES	KNOWLEDGE	SKILLS	VALUES
10.1 Number Systems	10.1.1 Sets and logic	10.1.1.1 Explain the concept of sets. 10.1.1.2 Identify different sets.	<ul style="list-style-type: none"> • Sets • Members of sets 	<ul style="list-style-type: none"> • Identification • Comparing 	<ul style="list-style-type: none"> • Interpretation. • Application

TOPIC	SUBTOPICS	SPECIFIC OUTCOMES	KNOWLEDGE	SKILLS	VALUES
		10.1.1.3 Develop appropriate set language. 10.1.1.4 Illustrate Venn diagrams. 10.1.1.5 Carry out operations on sets.	<ul style="list-style-type: none"> Set Notation Operations on Sets Venn diagrams Computations involving Sets 	<ul style="list-style-type: none"> Drawing Calculations Communication Classification 	<ul style="list-style-type: none"> Appreciation Problem Solving Team work
	10.1.2 Real Numbers	10.1.2.1 Find factors of whole numbers 10.1.2.2 Explore the application of commutative ,associative and distributive laws 10.1.2.3 Distinguish between Rational and Irrational numbers	<ul style="list-style-type: none"> Factors of whole numbers Multiples Commutative law Associative law Distributive law Combined operations(-, +,x,÷) Rational and Irrational numbers 	<ul style="list-style-type: none"> Identification Investigation Computation Presentation Communication 	<ul style="list-style-type: none"> Appreciation Interpretation Logical thinking Application Team work
	10.1.3 Common Fractions (Vulgar)	10.1.3.1 Identify, Decimal fractions and percentages 10.1.3.2 Convert vulgar, decimal fractions and percentages 10.1.3.3 Apply the four operations to decimal fractions and percentages	<ul style="list-style-type: none"> Concepts and notation of different fractions Relationships between decimal , vulgar and percentages Equivalence and Equality of fractions Highest Common Factors (HCF) and Lowest Common Multiples (LCM) The four operations on decimals and fractions (-, +, x, ÷) Working with Percentages / Decimal fractions 	<ul style="list-style-type: none"> Identification Conversion Computation Comparison Ordering Deduction 	<ul style="list-style-type: none"> Reasoning Application Problem solving Logical thinking Critical thinking

TOPIC	SUBTOPICS	SPECIFIC OUTCOMES	KNOWLEDGE	SKILLS	VALUES
	10.1.4 Ordering	10.1.4.1 Show relationship between numbers 10.1.4.2 Solve problems involving inequalities	<ul style="list-style-type: none"> Relationship between numbers by use of equality and inequality signs Solving problems involving inequalities 	<ul style="list-style-type: none"> Identification Ordering Sequencing 	<ul style="list-style-type: none"> Presentation Appreciation
	10.1.5 Indices	10.1.5.1 Apply laws of indices 10.1.5.2 Simplify positive, negative and zero indices 10.1.5.3 Simplify fractional indices 10.1.5.4 Solve problems involving indices	<ul style="list-style-type: none"> Laws of indices Positive, Negative and Zero Indices Multiplicative inverse Fractional indices Equations involving indices 	<ul style="list-style-type: none"> Simplification Calculation Observation Identification Communication 	<ul style="list-style-type: none"> Application Problem solving Curiosity Appreciation Team work
	10.1.6 Squares and Square Roots	10.1.6.1 Find squares of numbers 10.1.6.2 Find square roots of numbers.	<ul style="list-style-type: none"> Squares of numbers Square Roots of numbers. 	<ul style="list-style-type: none"> Deduction Calculation Comparison 	<ul style="list-style-type: none"> Application Mathematical thinking Reasoning Appreciation
	10.1.7 Social and Commercial Arithmetic	10.1.7.1 Solve problems involving compound interest, profit, loss discount and Hire purchase 10.1.7.2 Carry out calculations involving foreign currency conversions 10.1.7.3 Calculate premiums, dividend, depreciation, Value Added Tax and Income Tax. 10.1.7.4 Carry out calculations	<ul style="list-style-type: none"> Cost and Selling price Simple and compound interests, Value Added Tax, depreciation, profit, loss, discount and hire purchase. Conversion of currencies Different utility bills Bank and postal charges Social security schemes (e.g. pension, insurance, medical) 	<ul style="list-style-type: none"> Calculation Visualization Observation Investigation Presentation Planning Communication Identification 	<ul style="list-style-type: none"> Comprehension Interpretation Logical thinking Appreciation Honesty Assertiveness Accountability Thriftiness Socialisation Entrepreneurship

TOPIC	SUBTOPICS	SPECIFIC OUTCOMES	KNOWLEDGE	SKILLS	VALUES
		involving utility bills 10.1.7.5 Carry out calculations involving banking and postal services 10.1.7.6 Carry out calculations involving social security schemes 10.1.7.7 Carry out calculations involving transportation	<ul style="list-style-type: none"> Time tabling in transportation 		
10.2 Computer	10.2.1 Basic elements of a computer 10.2.2 Algorithms 10.2.3 Methods of implementing an algorithm	10.2.1.1 Describe elements of a computer 10.2.2.1 Describe various methods of implementing an algorithm 10.2.3.1 Outline problem solving stages	<ul style="list-style-type: none"> Elements of a computer (i.e. Input, Process and Output Parts) Definition of an algorithm Algorithm (sequence, decision loops) Methods of implementing an algorithm (flow charts and pseudo codes) Stages of problem solving (define a problem, analysis method of solution, write a computer program, document the program) 	<ul style="list-style-type: none"> Designing Investigation Observation Visualisation Modelling 	<ul style="list-style-type: none"> Logical thinking Abstraction Deduction Induction Application Appreciation
10.3 Algebra	10.3.1 Basic Processes	10.3.1.1 Identify like and unlike terms 10.3.1.2 Expand and simplify expressions 10.1.3.3 Evaluate expressions by	<ul style="list-style-type: none"> Identification and simplification of like and unlike terms Expansion and simplification of 	<ul style="list-style-type: none"> Simplification Identification Manipulation Computation 	<ul style="list-style-type: none"> Application Problem solving Orderliness Accuracy Logical thinking

TOPIC	SUBTOPICS	SPECIFIC OUTCOMES	KNOWLEDGE	SKILLS	VALUES
		substitution 10.3.1.3 Factorise algebraic expressions 10.3.1.4 10.3.1.5 Simplify Algebraic fractions	expressions <ul style="list-style-type: none"> Substituting numbers for letters in expressions Factorisation by using common factors, grouping terms, factors of quadratic expressions and difference of two square Addition , subtraction , multiplication and division of algebraic fractions Lowest common multiple 		<ul style="list-style-type: none"> Abstract thinking
	10.3.2 Formulae	10.3.2.1 Construct and use formulae 10.3.2.2 Change the Subject of the Formula	<ul style="list-style-type: none"> Constructing formulae from given situation Use of constructed formula to solve problems Changing Subject of the Formula 	<ul style="list-style-type: none"> Construction Interpretation Manipulation Identification 	<ul style="list-style-type: none"> Logical thinking Application Appreciation Critical thinking Creative thinking
	10.3.3 Linear Equations and Inequations	10.3.3.1 Solve linear equations in one variable 10.3.3.2 Solve linear equations in two variables 10.3.3.3 Solve Simultaneous Equations 10.3.3.4 Solve linear inequations in one variable 10.3.3.5 Solve linear inequations in	<ul style="list-style-type: none"> Linear equations in one and two variables Solutions of Simultaneous equations by Substitution, Elimination and Graphical 	<ul style="list-style-type: none"> Plotting Computation Drawing Communication Identification 	<ul style="list-style-type: none"> Application Interpretation Creative thinking Problem solving Team work

TOPIC	SUBTOPICS	SPECIFIC OUTCOMES	KNOWLEDGE	SKILLS	VALUES
		two variables	Methods <ul style="list-style-type: none"> Linear inequations in one and two variables 		
10.4 Geometry	10.4.1 Angles and Polygons	10.4.1.1 Identify types of angles 10.4.1.2 Solve problems of angles associated with: <ul style="list-style-type: none"> A point A straight line Intersecting and parallel lines 10.4.1.3 Solve problems involving angle properties of polygons.	<ul style="list-style-type: none"> Acute angles Obtuse angles Reflex angles Straight line angles Complete turn angle Related angles Angles associated with a point, straight line, Intersecting and parallel lines Identification of polygons Angle properties of polygons 	<ul style="list-style-type: none"> Resolution Identification Drawing Computation 	<ul style="list-style-type: none"> Application Interpretation Appreciation Problem solving Critical thinking
	10.4.2 Geometrical Constructions	10.4.2.1 Construct angles. 10.4.2.2 Construct angle bisectors 10.4.2.3 Construct perpendiculars to straight lines 10.4.2.4 Construct parallel lines 10.4.2.5 Construct plane geometrical figures	<ul style="list-style-type: none"> 15°, 30°, 45°, 60°, 90° angles Angle bisectors Application of angle bisectors Perpendicular bisector of straight lines Perpendicular of a straight line from a given point Parallel lines 	<ul style="list-style-type: none"> Construction Bisecting Identification Comparing Manipulation 	<ul style="list-style-type: none"> Mathematical thinking and reasoning(Critical thinking) Application Accuracy Creativity Appreciation Entrepreneurship

TOPIC	SUBTOPICS	SPECIFIC OUTCOMES	KNOWLEDGE	SKILLS	VALUES
			<ul style="list-style-type: none"> Construction of plane geometrical figures (triangles, parallelograms, Rhombuses) 		
	10.4.3 Angle of elevation and depression 10.4.4 Bearings and Scale Drawing	10.4.3.1 Calculate angles of elevation and depression 10.4.4.1 Draw shapes using scale drawing and bearings 10.4.4.2 Compute three figure bearing	<ul style="list-style-type: none"> Angle of elevation Angle of depression Scale drawing Three figure bearings 	<ul style="list-style-type: none"> Reading bearing Communication Drawing Computation Accuracy 	<ul style="list-style-type: none"> Interpretation Application Problem solving
	10.4.5 Three dimensional solids	10.4.5.1 Draw nets of solids 10.4.5.2 Solve problems involving lengths of edges and surface area	<ul style="list-style-type: none"> Nets of solids (cones cubes, cuboids, pyramids and cylinders) Edges and vertices of solids Total Length of edges and surface area 	<ul style="list-style-type: none"> Drawing Computation Accuracy Identification 	<ul style="list-style-type: none"> Application Visualisation Accuracy Problem solving Appreciation
	10.4.6 Pythagoras theorem	10.4.6.1 Illustrate the Pythagoras Theorem 10.4.6.2 Apply Pythagoras theorem.	<ul style="list-style-type: none"> Properties of right angled triangles Pythagoras theorem Applying the Pythagoras theorem 	<ul style="list-style-type: none"> Demonstration Calculation Accuracy Application 	<ul style="list-style-type: none"> Interpretation Application Problem solving Accuracy Critical thinking

GRADE 11

General Outcomes	Key Competences
<ul style="list-style-type: none"> ▪ Provide clear mathematical thinking and expression in the learner ▪ Develop the learners’ mathematical knowledge and skills ▪ Enrich the learners’ understanding of mathematical concepts in order to facilitate further study of the discipline ▪ Build up an appreciation of mathematical concepts so that the learner can apply these for problem solving in everyday life. ▪ Enable the learner represent, interpret and use data in a variety of forms ▪ Inculcate a desire to develop different career paths in the learners 	<ul style="list-style-type: none"> ▪ Assimilate necessary mathematical concepts for use in everyday life such as environment and other related disciplines. ▪ Think mathematically and accurately in problem solving skills and apply these skills to formulate and solve mathematical and other related problems. ▪ Develop necessary skills needed to apply mathematical concepts and skills in other disciplines. ▪ Produce imaginative and creative work from mathematical concepts and ideas. ▪ Develop abilities and ideas drawn from mathematics to reason logically, communicate mathematically, and learn independently without too much supervision (self-discipline). ▪ Development positive attitudes towards mathematics and use it in other subjects such as science and technology. ▪ Apply mathematical tools such as information and communication technology in the learning of other subjects. ▪ Use mathematics for enjoyment and pleasure. ▪ Develop understanding of algebra, geometry, measurements and shapes.

TOPIC	SUB TOPIC	SPECIFIC OUTCOME	KNOWLEDGE	SKILLS	VALUES
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TOPIC	SUB TOPIC	SPECIFIC OUTCOME	KNOWLEDGE	SKILLS	VALUES
11.1 RATIO AND PROPORTION	11.1.1 Ratios 11.1.2 Direct and Inverse proportion 11.1.3 Scale of a map	11.1.1.1 Solve problems involving ratios 11.1.2.1 Solve problems involving direct and indirect proportion 11.1.3.1 Calculate the scale on a map 11.1.3.2 Calculate length and area using a given scale	<ul style="list-style-type: none"> Proportional parts Direct and inverse proportion Representative Fraction (Scale) Area (Similarity) 	<ul style="list-style-type: none"> Computation Representation Analysis 	<ul style="list-style-type: none"> Comprehension Judgement Problem solving Accuracy Measurement Mathematical Thinking Logical reasoning
11.2 SEQUENCES AND SERIES	11.2.1 Sequences 11.2.2 Series 11.2.3 Arithmetic progression 11.2.4 Geometric progression	11.2.1.1 Identify a sequence 11.2.2.1 Describe a series 11.2.3.1 Illustrate an arithmetic progression (AP) 11.2.3.2 Find the nth term of the AP 11.2.3.3 Find the sum of an AP 11.2.3.4 Find the arithmetic mean 11.2.4.1 Identify a geometric progression (GP) 11.2.4.2 Find the nth term of a GP 11.2.4.3 Find the geometric mean 11.2.4.4 Find the sum of a geometric progression	<ul style="list-style-type: none"> Sequences and Series Fibonacci series Arithmetic and Geometrical Progressions. The nth terms of AP and GP Sums of APs and GPs Arithmetic and geometric means 	<ul style="list-style-type: none"> Identification Ordering Sequencing. Distinguishing 	<ul style="list-style-type: none"> Creativity Prediction Appreciation of maths in nature. Problem solving Relate
11.3 QUADRATIC EQUATIONS	11.3.1 Factorisation method 11.3.2 Completing square method 11.3.3 Quadratic	11.3.1.1 Solve quadratic equations using factorisation method 11.3.2.1 Solve quadratic equations using completing of square	<ul style="list-style-type: none"> Factorisation Squares and square roots Completing the square Substitution 	<ul style="list-style-type: none"> Computation Identification 	<ul style="list-style-type: none"> Decision making Judgement Application Logical thinking

TOPIC	SUB TOPIC	SPECIFIC OUTCOME	KNOWLEDGE	SKILLS	VALUES
	formula 11.3.4 Application of quadratic equations	method 11.3.3.1 Solve quadratic equations using quadratic formula method 11.3.4.1 Apply quadratic equations to solve real life problems	<ul style="list-style-type: none"> Quadratic formula Quadratic equation 		
11.3 MATRICES	11.4.1 Order of a matrix 11.4.2 Types of matrices 11.4.3 Addition and Subtraction 11.4.4 Scalar Multiplication 11.4.5 Multiplication of matrices Inverse of a matrix 11.4.6 Application	11.4.1.1 Express information in form of matrix 11.4.1.2 State order of a matrix 11.4.2.1 Transpose of a matrix 11.4.3.1 Add and subtract matrices 11.4.4.1 Multiply a matrix by a scalar 11.4.5.1 Multiply matrices 11.4.5.2 Use the null and identity matrices 11.4.5.3 Calculate the determinant of a 2 by 2 matrix 11.4.5.4 Find the inverse of a 2 by 2 matrix 11.4.6.1 Solve linear equations in two variables using inverse method 11.4.6.2 Use Cramer's rule to solve linear equations in two variables	<ul style="list-style-type: none"> Notation Order of matrices Transpose Corresponding entries Adding and Subtracting matrices Multiplying matrices by a scalar Multiplying matrices The null (zero) and identity matrices Determinant and Inverse of a 2x2 matrix Singular matrices Solving linear equation in two variables using matrices Cramers Rule 	<ul style="list-style-type: none"> Discrimination Interpretation Computation Comparison 	<ul style="list-style-type: none"> Appreciation Creativity Analysis

TOPIC	SUB TOPIC	SPECIFIC OUTCOME	KNOWLEDGE	SKILLS	VALUES
11.5 SYMMETRY	11.5.1 Lines of symmetry of plane figures 11.5.2 Rotational symmetry 11.5.3 Symmetry of solids	11.5.1.1 Use properties of lines of symmetry in two dimensions 11.5.1.2 Apply properties of rotational symmetry 11.5.2.1 Locate lines of symmetry and centres of rotation 11.5.2.2 Determine the order of rotational symmetry 11.5.3.1 Determine symmetry of solids	<ul style="list-style-type: none"> Plane figures Line of symmetry of plane figures Symmetrical and asymmetrical shapes Properties of rotational symmetry Lines of symmetry and centres of rotation Order of symmetry Plane and axis of symmetry 	<ul style="list-style-type: none"> Identification Drawing Rotating 	<ul style="list-style-type: none"> Recognition of patterns (aesthetics) Direction Visualisation Application Mathematical thinking and reasoning
11.6 COORDINATE GEOMETRY	11.6.1 Coordinate and the mid point 11.6.2 Length of a straight line between two points 11.6.3 Gradient 11.6.4 Equation of a straight line 11.6.5 Parallel and perpendicular lines	11.6.1.1 Calculate the mid-point of two points 11.6.2.1 Calculate the length of a straight line 11.6.3.1 Calculate the gradient of a line segment 11.6.4.1 Find the equation of a straight line 11.6.5.1 Find the gradients of parallel and perpendicular lines 11.6.5.2 Use gradients of parallel and perpendicular lines to find equations	<ul style="list-style-type: none"> Gradient Mid point Length (distance formula) Gradient point form Gradient Intercept form Double intercept form Parallel lines Perpendicular lines 	<ul style="list-style-type: none"> Calculation Drawing Sketching Substitution Labelling Deduction 	<ul style="list-style-type: none"> Problem solving Application Appreciation Reasoning Recognition Interpretation Relation

TOPIC	SUB TOPIC	SPECIFIC OUTCOME	KNOWLEDGE	SKILLS	VALUES
11.7 CONGRUENCE AND SIMILARITY	11.6.1 Congruence 11.6.2 Similarity 11.6.3 Lengths, areas and volumes of similar figures	11.5.1.1 Use congruence in problems requiring simple logical deductions (with regard to triangles and quadrilaterals) 11.5.2.1 Calculate the unknown sides/angles in similar figures 11.5.3.1 Illustrate relationships between area and volume of similar figures 11.5.3.2 Calculate the area/volume in similar figures	<ul style="list-style-type: none"> • Congruent triangles • Congruent quadrilaterals • Properties of congruent figures • Similar polygons and solids • Properties of similar figures • Applications on similarity and congruency 	<ul style="list-style-type: none"> • Computation • Calculation • Identification 	<ul style="list-style-type: none"> • Interpretation • Comparison • Creativity • Awareness • Problem solving • Deduction
11.7 CIRCLE THEOREMS	11.7.1 Parts of a circle 11.7.2 Alternate segment 11.7.3 Angles properties of a circle 11.7.4 Tangent to a circle 11.7.5 Cyclic quadrilateral	11.7.1.1 Describe parts of a circle 11.7.2.1 Solve problems using angle properties of a circles	<ul style="list-style-type: none"> • Parts a circle • Tangent to a circle • Cyclic quadrilateral • Angle in a semicircle • Angle in the same segment • Opposite sides of a cyclic quadrilateral • Angle at the centre twice one at the circumference • Two tangents from an external point • External angle of a cyclic Quadrilateral 	<ul style="list-style-type: none"> • Analysis • Identification • Computation • Relating 	<ul style="list-style-type: none"> • Awareness • Interpretation • Application

TOPIC	SUB TOPIC	SPECIFIC OUTCOME	KNOWLEDGE	SKILLS	VALUES
			<p>equal to the opposite interior angle</p> <ul style="list-style-type: none"> Point of contact of a tangent and radius 		
11.8 MENSURATION	11.8.1 Perimeter, 11.8.2 Area 11.8.3 Volume 11.8.4 Application of perimeter, area and volume	11.8.1.1 Calculate perimeter of plain figures 11.8.2.1 Calculate areas of figures 11.8.3.1 Calculate volume of solids 11.8.3.4 Solve application problems involving perimeter, area volume and density	<ul style="list-style-type: none"> Perimeter, area of figures Volume of solid Density Units of measure Conversions of units of measure 	<ul style="list-style-type: none"> Computation Interpretation 	<ul style="list-style-type: none"> Judgment Accuracy Problem solving Application Relating
11.9 CONSTRUCTION AND LOCI	11.9.1 Loci in two dimension 11.9.2 Loci in three dimension	11.9.1.1 Construct locus of point in two dimensions 11.9.1.2 Construct circum circle of a triangle 11.9.1.3 Construct an inscribed circle 11.9.1.4 Construct an escribed circle 11.9.2.1 Describe locus of point in three dimensions	<p>Locus of points equidistant</p> <ul style="list-style-type: none"> From a Point From two fixed points From two intersecting line From a Straight line Locus of points which subtends a constant angle Locus of points such that the area 	<ul style="list-style-type: none"> Construction Drawing Calculation Identification 	<ul style="list-style-type: none"> Aesthetics Appreciation Application Problem solving Accuracy Creativity

TOPIC	SUB TOPIC	SPECIFIC OUTCOME	KNOWLEDGE	SKILLS	VALUES
			<ul style="list-style-type: none"> of triangles is constant • Circum circle • Inscribed circle • Inscribed 		
11.10 TRIGONOMETRY	11.10.1 Three trigonometric ratios on a right angled triangle 11.10.2 Special angles 11.10.3 Three trigonometric ratios in quadrants 11.10.4 Sine and Cosine rules 11.10.5 Area of a triangle 11.10.6 Sine, cosine and tangent curves 11.10.7 Application of trigonometry	11.10.1.1 Define the three trigonometric ratios on a right angled triangle 11.10.1.2 Calculate sides and angles of a right angled triangle 11.10.2.1 Work with special angles (60° , 45° and 30°) 11.10.3.1 Determine the signs of the three trigonometric ratios in the quadrants 11.10.4.1 Solve sides and angles of non right angled triangles 11.10.5.1 Calculate areas of a non right angled triangles 11.10.6.1 Draw graphs for sine, cosine and tangent curves 11.10.7.1 Use trigonometry to solve practical problems (Include three dimension questions)	<ul style="list-style-type: none"> • Pythagoras Theorem • sine, cosine and tangent ratios on a right angled triangle • special angles (60°, 45° and 30°) • Sides and angles of right angled triangles using the three trigonometric ratios • Sine rule • Cosine rule • Area of non right angled triangles • Sine, Cosine and tangent curves • Application of trigonometry 	<ul style="list-style-type: none"> • Comparison • Identification • Computation 	<ul style="list-style-type: none"> • Relate • Systematic • Reasoning • Interpret • Problem solving • Accuracy • Application
11.11 APPROXIMATIONS	11.11.1 Nearest unit 11.11.2 Decimal places 11.11.3 Significant	11.11.1.1 Round off to specified degree of accuracy 11.11.1.2 Approximate measures to a given degree of	<ul style="list-style-type: none"> • Principle of rounding off • Significance of zero 	<ul style="list-style-type: none"> • Communication • Computation 	<ul style="list-style-type: none"> • Interpretation • Application • Relate • Accuracy

TOPIC	SUB TOPIC	SPECIFIC OUTCOME	KNOWLEDGE	SKILLS	VALUES
	figures 11.11.4 Standard form 11.11.5 Relative and absolute error	accuracy 11.11.2.1 Write numbers to specified number of decimal places 11.11.3.1 Write numbers correct to the required number of significant figures 11.11.4.1 Write numbers in standard form 11.11.5.1 Work with relative and absolute errors	and other numbers <ul style="list-style-type: none"> Scientific notation Relative error Absolute error 	<ul style="list-style-type: none"> Comparison 	<ul style="list-style-type: none"> Reasoning
11.12 PROBAB ILITY	11.12.1 Concept of probability 11.12.2 Experimental and Theoretical probability 11.12.3 Laws of probability 11.12.4 Tree Diagrams and Outcome Tables	11.12.1.1 Appreciate the concept of probability 11.12.2.1 Solve problems involving experimental and theoretical probabilities 11.12.3.1 Compute probabilities using the laws of probability 11.12.4.1 Use tree diagrams and outcome tables to compute probabilities 11.12.4.2 Calculate probabilities of mutually exclusive events and compound events 11.12.4.3 Find probabilities of independent events	<ul style="list-style-type: none"> Concept of probability Experimental probability Theoretical probability Mutually exclusive Independent and dependent events Compound events Continuous sample space Tree diagram Outcome tables 	<ul style="list-style-type: none"> Computati on interpretat ion Communic ation Analysis Research 	<ul style="list-style-type: none"> Interpret Application Mathematical thinking and reasoning Prediction
11.13 STATISTI	11.13.1 Concept of statistics	11.13.1.1 Appreciate the concept of statistics	<ul style="list-style-type: none"> Collection of data 	<ul style="list-style-type: none"> Computati on 	<ul style="list-style-type: none"> Interpret

TOPIC	SUB TOPIC	SPECIFIC OUTCOME	KNOWLEDGE	SKILLS	VALUES
C	11.13.2 Data presentation 11.13.3 Measures of central tendency	11.13.2.1 Collect, classify and tabulate data 11.13.2.2 Interpret data 11.13.3.1 Calculate mean, mode and median of grouped and ungrouped data 11.13.3.2 Interpret mean, mode and median	<ul style="list-style-type: none"> classification and tabulation of data : pie chart, bar and compound bar chart, stem and leaf, histogram, line graphs, frequency table and polygon , Grouped and ungrouped data Data Interpretation mean , mode and median assumed mean 	<ul style="list-style-type: none"> Interpretation Communication Analysis Research Drawing Tabulation 	<ul style="list-style-type: none"> Application Mathematical thinking and reasoning Prediction
11.14 RELATIONS AND FUNCTIONS	11.14.1 Relations 11.14.2 Domain and range 11.14.3 Representation of relations 11.14.4 Types of relations 11.14.5 Functions 11.14.6 Representation	11.14.1.1 Describe a relation 11.14.2.1 Determine domain and range 11.14.2.2 Determine objects and images 11.14.3.1 Represent relations 11.14.4.1 Identify types of relations 11.14.5.1 Determine whether a	<ul style="list-style-type: none"> Relation Domain Range Representation: arrow diagrams, formula, ordered pairs Many to one One to many 	<ul style="list-style-type: none"> Matching Comparing Drawing Computation 	<ul style="list-style-type: none"> Interpret Application Relate Reasoning

TOPIC	SUB TOPIC	SPECIFIC OUTCOME	KNOWLEDGE	SKILLS	VALUES	
	of functions 11.14.7 Types of functions 11.14.8 Linear functions 11.14.9 Inverse functions 11.14.10 Graphs of linear functions 11.14.11 Application	relation is function or not 11.14.6.1 Represent functions 11.14.7.1 Distinguish types of functions 11.14.8.1 Identify linear functions 11.14.9.1 Find inverses of one-to-one functions 11.14.10.1 Draw graphs of linear functions 11.14.11.1 Solve problems involving linear functions	<ul style="list-style-type: none"> Many to many One to one formula, functional notation, set builder notation, arrow diagrams Functions formula, functional notation, set builder notation, arrow diagrams One to one Many to one Objects Images Inverse Graphs 	<ul style="list-style-type: none"> Matching Comparing Drawing Computation 	<ul style="list-style-type: none"> Interpret Application Relate Reasoning 	
11.15	VARIATION	11.15.1 Variation 11.15.2 Direct and Inverse Variation 11.15.3 Joint and Partial Variation 11.15.4 Graphs 11.15.5 Applications	11.15.1.1 Use notation of variation appropriately 11.15.2.1 Distinguish between direct and inverse variation 11.15.3.1 Distinguish between joint and partial variation 11.15.4.1 Draw and Interpret graphs of variation of direct and inverse variation 11.15.5.1 Solve problems involving variations	<ul style="list-style-type: none"> Notation direct inverse Joint Partial Graphs of direct and inverse variation 	<ul style="list-style-type: none"> Communication Calculate Deduction 	<ul style="list-style-type: none"> Reasoning Inference Interpretation Application

GRADE 12

General Outcomes	Key Competences
<ul style="list-style-type: none"> ▪ Provide clear mathematical thinking and expression in the learner ▪ Develop the learners’ mathematical knowledge and skills ▪ Enrich the learners’ understanding of mathematical concepts in order to facilitate further study of the discipline ▪ Build up an appreciation of mathematical concepts so that the learner can apply these for problem solving in everyday life. ▪ Enable the learner represent, interpret and use data in a variety of forms ▪ Inculcate a desire to develop different career paths in the learners 	<ul style="list-style-type: none"> ▪ Assimilate necessary mathematical concepts for use in everyday life such as environment and other related disciplines. ▪ Thank mathematically and accurately in problem solving skills and apply these skills to formulate and solve mathematical and other related problems. ▪ Develop necessary skills needed to apply mathematical concepts and skills in other disciplines. ▪ Produce imaginative and creative work from mathematical concepts and ideas. ▪ Develop abilities and ideas drawn from mathematics to reason logically, communicate mathematically, and learn independently without too much supervision (self-discipline). ▪ Development positive attitudes towards mathematics and use it in other subjects such as science and technology. ▪ Apply mathematical tools such as information and communication technology in the learning of other subjects. ▪ Use mathematics for enjoyment and pleasure. ▪ Develop understanding of algebra, geometry, measurements and shapes.

TOPIC	SUB TOPIC	SPECIFIC OUTCOME	KNOWLEDGE	SKILLS	VALUES
12.1 GRAPHS OF FUNCTIONS	12.1.1 Quadratic and cubic	12.1.1.1 Draw graphs of quadratic and cubic	<ul style="list-style-type: none"> • Graphs • Zeros the function 	<ul style="list-style-type: none"> • Drawing • Computation 	<ul style="list-style-type: none"> • Interpretation • Reasoning

	<p>functions</p> <p>12.1.2 Inverse functions</p>	<p>functions</p> <p>12.1.1.2 Use graphs to find solutions at points of intersection</p> <p>12.1.1.3 Use graphs to compute zeros of functions</p> <p>12.1.1.4 Determine gradients of curves at given points</p> <p>12.1.1.5 Determine turning points and their natures</p> <p>12.1.1.6 Estimate areas under curves</p> <p>12.1.2.1 Draw graphs of inverse functions</p>	<ul style="list-style-type: none"> • Solutions of intersecting graphs • Gradient • Area • Trapezium • Counting square • Maximum and minimum points 	<ul style="list-style-type: none"> • Deduction 	<ul style="list-style-type: none"> • Application • Mathematical thinking and reasoning
<p>12.2 TRAVEL GRAPHS</p>	<p>12.2.1 Distance - time graphs</p> <p>12.2.2 Velocity - time graphs</p>	<p>12.2.1.1 Compute average speed</p> <p>12.2.1.2 Calculate total distance</p> <p>12.2.2.1 Determine acceleration and retardation</p> <p>12.2.2.2 Draw travel graphs</p> <p>12.2.2.3 Calculate the distance in a velocity time graph</p>	<ul style="list-style-type: none"> • Drawing • Average speed • Acceleration • Distance/area under the graph in a velocity time graph • Concept of similarity 	<ul style="list-style-type: none"> • Drawing • Computation • Deduction • Estimation • 	<ul style="list-style-type: none"> • Interpretation • Reasoning • Application • Mathematical thinking and reasoning • Relating • Creativity

<p>12.3 LINEAR PROGRAMMING</p>	<p>12.3.1 Linear inequalities in one variable</p> <p>12.3.2 Linear inequalities in two variables</p> <p>12.3.3 Linear programming</p>	<p>12.3.1.1 Find solution sets of linear inequalities.</p> <p>12.3.2.1 Plot graphs of inequalities in two variables.</p> <p>12.3.2.1 Shade wanted or unwanted regions</p> <p>12.3.2.2 Describe the wanted or unwanted regions.</p> <p>12.3.2.3 Determine maximum and minimum values</p> <p>12.3.2.4 Use the search line to determine the maximum and minimum values</p>	<ul style="list-style-type: none"> • Solution sets of linear inequalities • Inequality graphs in two variables • Wanted and unwanted regions • Maximum and minimum • Search line 	<ul style="list-style-type: none"> • Describing • Drawing • Shading • Presentation • communication • Programming • Deduction • Discrimination 	<ul style="list-style-type: none"> • Logical thinking • Reflection • Decision making • Designing • Planning • problem solving • Interpretation • Application • Accuracy
<p>12.4 TRANSFORMATIONS</p>	<p>12.4.1 The concept of transformation</p> <p>12.4.2 Translation</p> <p>12.4.3 Reflection.</p> <p>12.4.4 Rotation.</p> <p>12.4.5 Enlargement</p> <p>12.4.6 Stretch</p> <p>12.4.7 Shear</p> <p>12.4.8 Combined</p>	<p>12.4.1.1 Explain the concept of transformation</p> <p>12.4.2.1 Use a column vector to translate an object</p> <p>12.4.3.1 Reflect objects across mirror lines (mediator) to</p> <p>12.4.3.2 Use matrices to reflect objects</p> <p>12.4.3.3 Find mirror lines and matrices of reflections</p> <p>12.4.4.1 Rotate objects by</p>	<ul style="list-style-type: none"> • Object • Image • Translation • Translation vector • Mediator • Matrices • Reflection • Rotations • Centre of Rotation • Angle of rotation • Shear • Stretch 	<ul style="list-style-type: none"> • Transforming • Deduction • Comparison • Plotting 	<ul style="list-style-type: none"> • Logical thinking • Problem solving • Application • Creative thinking

	transformations	<p>construction</p> <p>12.4.4.2 Rotate objects using matrices</p> <p>12.4.4.3 Find the centre, angle and direction of rotation</p> <p>12.4.4.4 Find matrices of rotation</p> <p>12.4.5.1 Enlarge objects by construction</p> <p>12.4.5.2 Enlarge objects by matrix method</p> <p>12.4.5.3 Find the centre, scale factor and matrix of enlargement</p> <p>12.4.6.1 Stretch objects by construction</p> <p>12.4.6.2 Stretch objects by matrix method</p> <p>12.4.6.3 Find the stretch factor, invariant line</p> <p>12.4.6.4 Use matrices to stretch objects</p> <p>12.4.7.1 Shear objects by constructions</p> <p>12.4.7.2 Shear objects by matrix method</p> <p>12.2.7.3 Find shear factors and invariant lines</p> <p>12.4.7.4 Determine shear matrices</p> <p>12.4.8.1 Solve problems involving combined transformations</p>	<ul style="list-style-type: none"> • Enlargement • Centre of enlargement • Scale factors • Area scale factor • Invariant line • Determinant of a matrix 		
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			12.4.8.2 Find area scale factors by determinant method			
12.5	EARTH GEOMETRY	12.5.1 The concept of earth geometry 12.5.2 Small and great circles 12.5.3 Latitudes and Longitudes 12.5.4 Distance along the circle of latitudes and longitudes 12.5.5 Speed in Knots and time	12.5.1.1 Explain the concept of earth geometry 12.5.2.1 Distinguish between small and great circles 12.5.3.1 Calculate distance along parallels of latitudes and longitude in kilometres and nautical miles 12.5.3.2 Calculate the shortest distance between two points on the surface of the earth 12.5.5.1 Calculate speed in knots and time	<ul style="list-style-type: none"> • Earth • South and north poles • southern and northern hemisphere • small and great circle(including Greenwich and equator) • Longitude and latitude • Length ,chord , arc and sector • Circumference • Distance in kilometre and nautical mile • Longitude and time • Greenwich mean time • Time • Speed 	<ul style="list-style-type: none"> • Identification • Naming • Location • Drawing • Illustrating • Calculating • Comparing • Labelling 	<ul style="list-style-type: none"> • Application • Problem solving • Interpretation •
12.6	VECTORS	12.6.1 The concept of vectors 12.6.2 Representation and Notation of vectors 12.6.3 Addition	12.6.1.1 Describe a vector 12.6.2.1 Represent and denote a vector 12.6.3.1 Add and subtract vectors 12.6.4.1 Apply translations on vectors 12.6.5.1 Calculate magnitudes	<ul style="list-style-type: none"> • Vectors in two dimension • Representation and notation • Addition and subtraction (triangular and parallelogram laws) • Resultant vectors • Component form 	<ul style="list-style-type: none"> • computation • Identification • Location • Comparing • Deduction • Representation 	<ul style="list-style-type: none"> • Application • Interpretation • Logical thinking • Abstract thinking • Problem solving • Sense of direction • Decision

	and subtraction 12.6.4 Translation 12.6.5 Magnitude 12.6.6 Scalar multiplication 12.6.7 12.6.8 Collinearity Vector geometry	of vectors 12.6.6.1 Multiply vectors by scalars 12.6.7.1 Determine collinearity of points 12.6.8.1 Solve geometrical problems involving vectors	<ul style="list-style-type: none"> • Translation • Magnitude/Modulus • Direction • Scalar Multiplication • Collinearity • Position vectors • Free vectors • Ratios (Mid point theorem) • Vector geometry • Scalars and parrallelism 		
12.7 STATISTICS	12.7.1 Grouped and ungrouped data 12.7.2 12.7.3 Measures of dispersion Cumulative frequency tables	12.7.1.1 Work with grouped and ungrouped data 12.7.2.1 Construct cumulative frequency tables 12.7.2.2 Draw cumulative frequency curves 12.7.2.3 Draw relative cumulative curves 12.7.3.1 Find quartiles 12.7.3.2 Calculate the range interquartile range, and semi interquartile range 12.7.3.3 Calculate the percentiles 12.7.3.4 Calculate variance and standard deviation for ungrouped and	<ul style="list-style-type: none"> • Cumulative frequency tables • Cumulative frequency curves (ogive) • Relative cumulative frequency curves • Quartiles • Percentiles • Variance • Standard deviation • Grouped data • Ungrouped data 	<ul style="list-style-type: none"> • Presentation • Drawing • Computation • Observation • Communication • Visualisation • Deduction 	<ul style="list-style-type: none"> • Accuracy • Interpretation • Accountability • Application • Analysis

		grouped data			
12.8 INTRODUCTI ON TO CALCULUS	12.8.1 Differentia tion 12.8.2 Integration	12.8.1.1 Explain concept of differentiation 12.8.1.2 Find limits 12.8.1.3 Differentiate functions from first principle 12.8.1.4 Use rules of differentiation to find derivatives of functions 12.8.1.5 Compute stationary points 12.8.1.6 Use the second derivatives or method of signs to determine nature of stationary points 12.8.1.7 Distinguish a tangent and a normal 12.8.1.8 Calculate equations of tangents and normals 12.8.2.1 Compute indefinite integrals 12.8.2.2 Evaluate simple definite integrals	<ul style="list-style-type: none"> • Differentiation • Limits • Product rule; chain rule and quotient rule • Indefinite integrals • Definite integrals • Stationary points • Points of inflexion • Tangents • Normal • Maximum and minimum points 	<ul style="list-style-type: none"> • Differentiation • Integration 	<ul style="list-style-type: none"> • Mathematical reasoning • Application • Logical thinking • Problem solving • Interpretation