



Republic of Zambia

Ministry of Education, Science, Vocational Training and Early Education

Junior Secondary School Course

Mathematics Syllabus

(Grades 8 and 9)



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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
- 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.

ACKNOWLEDGEMENTS

The Mathematics Department of the Curriculum Development Centre gratefully acknowledges the contributions of participants of the Technical Committee, Schools and Organisations whose officers offered invaluable suggestions and advice in the finalization of the Primary School Mathematics Syllabus. We would like to make special mention of the following entities:

- The University of Zambia
- Colleges of Education
- Examinations Council of Zambia
- JICA in collaboration with Hiroshima University
- Primary and secondary schools countrywide
- Line Ministries
- Church Organizations and NGOs

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 for junior secondary schools aims at enabling learners acquire mathematical knowledge, values and skills for the further study of the subject at the senior Secondary level as well as application in their daily lives. It is for this reason that teachers focus on encouraging communication of mathematical ideas among learners, emphasise on problem solving and application to real life situations besides cultivating interest of the subject.

The syllabus is structured in such a way that the learner is encouraged to apart from laying emphasis on mathematics concepts and principles emphasises critical and creative thinking. It is recommended to teachers that since Mathematics is a discipline with hierarchical concepts and skills, they should present it in an integrated and spiral approach.

Cecilia N. Sakala (Mrs.)
Director, Standards and Curriculum
Ministry of Education and Vocational Training

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 consist 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 will require at seven-40 minutes periods per week to complete.

GRADE 8

General Outcomes	Key Competences:
<ul style="list-style-type: none"> ▪ Provide clear mathematical thinking and expression in the learner ▪ Develop the learners' mathematical AND ICT 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 and ICT 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 	<ul style="list-style-type: none"> ▪ 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 and ICT concepts and skills in other disciplines. ▪ Develop abilities and ideas drawn from mathematics to reason logically, communicate mathematically and technologically, 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
8.1SETS	8.1.1 The Universal Set 8.1.2 Membership of a set 8.1.3 Number of elements 8.1.4 The empty set 8.1.5 Equal and equivalent sets	8.1.1.1 Illustrate the universal set. 8.1.2.1 State members of a set 8.1.3.1 Identify and list members of a set and use symbols \in and \notin .	<ul style="list-style-type: none"> • Universal set • Membership and symbolisation of a set. • Cardinal number of elements. 	<ul style="list-style-type: none"> • Listing, identification • Drawing • Discrimination • Analysing • Calculation 	<ul style="list-style-type: none"> • Appreciation of sets • Accuracy • Interpretation • Team work • Quality work

TOPIC	SUBTOPICS	SPECIFIC OUTCOMES	• KNOWLEDGE	• SKILLS	• VALUES
	8.1.6 Subsets	8.1.3.2 State number of elements for any given set. 8.1.4.1 Identify set with no elements. 8.1.4.2 identify empty set symbols (ie { } or ϕ) 8.1.5.1 Identify equal and equivalent sets. 8.1.6.1 Find the number of subsets of a given set, 8.1.6.2	<ul style="list-style-type: none"> The empty set and its symbolisation. Equal and equivalent sets Subsets and use of subsets formula (i.e. 2^n Where n is number of elements). 	<ul style="list-style-type: none"> Classification Communication 	
8.2 FRACTIONS & DECIMALS	8.2.1 Vulgar Fractions 8.2.2 Decimal numbers 8.2.3 Ordering Fractions and Decimals	8.2.1.1 Describe and operate on fractions. 8.2.1.2 Identify and reduce reducible fractions 8.2.2.1 Apply operational principles of fractions 8.2.2.2 Work with decimal numbers arising from proper and improper fractions 8.2.2.3 Operate on decimal numbers 8.2.3.1 Order fractions and decimal numbers	<ul style="list-style-type: none"> Proper, improper and mixed fractions. Reduction of fractions to lowest terms. Concept and notation of different fractions. Addition and subtraction (taking place values into account). Multiplication and Division. Determination of magnitude and symbolisation (either in ascending or descending order) 	<ul style="list-style-type: none"> Discrimination Identification Ordering Calculation Accuracy 	<ul style="list-style-type: none"> Problem solving Critical thinking Quality work Team work Accuracy

TOPIC	SUBTOPICS	SPECIFIC OUTCOMES	• KNOWLEDGE	• SKILLS	• VALUES
8.3 SQUARES & CUBES	8.3.1 Squares 8.3.2 Cubes	8.3.1.1 describe perfect squares 8.3.1.2 Find squares of whole numbers 8.3.2.1 describe cubes 8.3.1.3 Find cubes of whole numbers.	<ul style="list-style-type: none"> Squared whole numbers. Cubed whole numbers. 	<ul style="list-style-type: none"> Calculations Interpretation Accuracy identification 	<ul style="list-style-type: none"> Accuracy Problem solving Critical thinking Quality work Team work
8.4 NUMBER AND SEQUENCES	8.4.1 Sequences 8.4.2 Fibonacci series	8.4.2.1 Generate a sequence in a decreasing and increasing order. 8.4.2.1 Generate Fibonacci series	<ul style="list-style-type: none"> Identification of sequences. Identification of Fibonacci series. 	<ul style="list-style-type: none"> Identification Interpretation Sequencing 	<ul style="list-style-type: none"> Reasoning creativity. Prediction Appreciation Accuracy Team work
8.5 DIRECTED NUMBERS	8.5.1 The number line 8.5.2 Addition and subtraction 8.5.3 Idea of ordering integers	8.5.1.1 Draw and label the number line appropriately 8.5.1.2 Add and Subtract integers using the number line. 8.5.2.1 Add and Subtract integers without using the number line 8.5.3.1 Order integers	<ul style="list-style-type: none"> The number line Positioning integers on the number line. Addition and Subtraction of integers. Ordering integers/directed numbers 	<ul style="list-style-type: none"> Drawing Labelling Adding Subtracting Interpretation. Ordering 	<ul style="list-style-type: none"> Enquiry Quality work Accuracy Appreciation Team work
8.6 PERCENTAGES	8.6.1 Conversions 8.6.2 Application	8.6.1.1 Show relationship between fractions, decimals and percentages. 8.6.1.2 Convert fractions and decimal numbers to percentages and vice versa 8.6.2.1 Solve problems involving fractions, decimals and percentages.	<ul style="list-style-type: none"> Relationship between fractions, decimals and percentages Conversion from fractions to percentages and vice versa; Conversion from decimals to 	<ul style="list-style-type: none"> Calculation. Conversions Accuracy Communication Application 	<ul style="list-style-type: none"> Creativity. Problem solving Team work Quality work

TOPIC	SUBTOPICS	SPECIFIC OUTCOMES	• KNOWLEDGE	• SKILLS	• VALUES
			percentages and vice versa.		
8.7 NUMBER BASES	8.7.1 Conversions from base ten. 8.7.2 Conversions to denary. 8.7.3 Conversions between bases other than denary. 8.7.4 Addition and subtraction	8.7.1.1 Convert any given number in base 10 to bases 2, 5 and 8. 8.7.1.2 Convert from denary to bicimal numbers of the form 1110.1, up to 1 'bicimal place'. 8.7.2.1 Convert any given number in bases 2, 5 and bicimal to base 10 8.7.3.1 Convert binary to base 5 and vice versa. 8.7.4.1 Add and subtract numbers in base 2 and base 5.	<ul style="list-style-type: none"> Conversion from denary to base 2 or base 5. Conversion from base 2 to base 5 and vice versa. Conversion from denary to bicimal numbers of the form 1110.1, up to 1 'bicimal place' and vice versa. Convert any given number in bases 2, 5 and bicimal to base 10 Addition and subtraction in base 2 and base 5. 	<ul style="list-style-type: none"> Conversion calculation Addition subtraction Division Accuracy 	<ul style="list-style-type: none"> Application creativity. Critical thinking. Appreciation Team work Quality work
8.8 COMPUTER STUDIES	8.8.1 Simple definition of computer (Input, Process, Output) 8.8.2 Flow charts 8.8.3 Decision boxes	8.8.1.1 Define computer 8.8.1.2 Construct flow charts 8.8.2.1 Construct decision boxes	<ul style="list-style-type: none"> Construction of: Flow charts and decision boxes 	<ul style="list-style-type: none"> Designing Drawing and labelling Sequencing 	<ul style="list-style-type: none"> Creativity Logical thinking. Critical thinking Accuracy Quality work
8.9 SOCIAL & COMMERCIAL ARITHMETIC	8.9.1 Exchange rates and buying 8.9.2 Utility bills 8.9.3 Banks and Post Office services	8.9.1.1 Calculate the cost of goods priced in foreign currency. 8.9.2.1 Calculate costs of utility bills and services arising from	<ul style="list-style-type: none"> Conversion of currencies (from local to foreign currency and vice versa). 	<ul style="list-style-type: none"> Multiplication Division Addition, subtraction, Entrepreneurshi 	<ul style="list-style-type: none"> Appreciation problem solving. Socialisation Team work

TOPIC	SUBTOPICS	SPECIFIC OUTCOMES	• KNOWLEDGE	• SKILLS	• VALUES
	8.9.4 Simple interest 8.9.5 Budgeting 8.9.6 Car and property insurance 8.9.7 Calculations Involving mass 8.9.8 Types of bank accounts	rates (electricity and water) 8.9.3.1 Calculate cost of services rendered at banks and post offices 8.9.3.2 Calculate simple interest 8.9.1.2 Generate simple household budget 8.9.1.3 Calculate cost of goods bought on hire purchase and discount 8.9.1.4 Insurance, premium, policy holder, 8.9.1.5 Mass conversions 8.9.1.6 Define types of bank accounts.	<ul style="list-style-type: none"> • Calculation of prices of goods involving foreign currency. • Calculation of cost of goods bought on hire purchase and discount • Calculation of the cost of a given service. • Calculation of simple interest • Writing a simple budget. • Conversions involving mass 	p <ul style="list-style-type: none"> • Budgeting conversions • Calculation • Interpretation • Communication • Planning 	<ul style="list-style-type: none"> • Accuracy • Honest • Assertiveness • Empathy • Thriftiness • Team work • Quality work • Critical thinking
8.10 ALGEBRAIC EXPRESSIONS & FORMULA	8.10.1 Simplification of algebraic expressions. 8.10.2 Replacements 8.10.3 Solving simple equations 8.10.4 Construction of simple formulae	8.10.1.1 Reduce algebraic expression by identifying like and unlike terms 8.10.1.2 Simplify algebraic expressions by applying the four operations 8.10.1.3 Apply the distributive law 8.10.2.1 Simplify expressions by replacing variables for numbers 8.10.3.1 Solve simple equations using the additive and multiplicative inverse 8.10.4.1 Construct simple formula from given statement.	<ul style="list-style-type: none"> • Relate letters to numbers and/ or vice versa. • Identify and match like terms. • Distinguish between variables and coefficients. • Simplification by addition and subtraction. • replacing variables for numbers • Identification of type of inverse 	<ul style="list-style-type: none"> • Calculation • Contrasting • Substitution • Identification, representation • Formulation of equations • Problem solving • Interpretation 	<ul style="list-style-type: none"> • Systematic working. • Accuracy • Mathematical thinking, problem solving • Logical and abstract thinking • Team work • Quality work

TOPIC	SUBTOPICS	SPECIFIC OUTCOMES	• KNOWLEDGE	• SKILLS	• VALUES
			<ul style="list-style-type: none"> Principle of solving equations Representation of mathematical sentences for symbols 		
8.11 MATRICES	8.11.1 Order of matrices 8.11.2 Operations on matrices	8.11.1.1 Define matrices by identifying number of rows and columns 8.11.1.2 Distinguish a 1x2 from a 2x1 matrix 8.11.2.1 Add and subtract matrices of the same order	<ul style="list-style-type: none"> Definition and notation of matrices by their rows and columns(up to 2x2) Adding and subtracting matrices with corresponding entries 	<ul style="list-style-type: none"> Identification interpretation Addition and subtraction Comparison 	<ul style="list-style-type: none"> Appreciation Creativity Accuracy Orderliness Team work
8.12 PLANE COORDINATES	8.12.1 The Cartesian Graph (XOY plane) 8.12.2 Plotting coordinates 8.12.3 Drawing shapes	8.12.1.1 Draw the XOY plane 8.12.2.1 Plot the ordered pair (x,y) on the XOY plane 8.12.2.2 Read the ordered pair (x,y) on the XOY plane 8.12.3.1 Draw different shapes by joining given coordinates	<ul style="list-style-type: none"> Drawing the XOY plane Identifying the X, Y axes and the origin Ordered pair of the points (X,Y) Plotting ordered pairs Drawing shapes by joining ordered pairs 	<ul style="list-style-type: none"> Drawing and labelling Identification Plotting Reading Accuracy Interpretation 	<ul style="list-style-type: none"> Orderliness Creativity Quality work Team work Application
8.13 SHAPES & SYMMETRY	8.13.1 Two dimensional shapes 8.13.2 Lines of symmetry	8.13.1.1 Identify and draw two dimensional shapes 8.13.1.2 Give properties of two dimensional shapes 8.13.2.1 Identify lines of symmetry in two dimensional shapes	<ul style="list-style-type: none"> Two dimensional shapes(different type of triangles, Quadrilaterals) Distinguish various types of two dimensional 	<ul style="list-style-type: none"> Identification Drawing Comparing 	<ul style="list-style-type: none"> Recognition of patterns (aesthetics) Quality work Accuracy Team work Creativity

TOPIC	SUBTOPICS	SPECIFIC OUTCOMES	• KNOWLEDGE	• SKILLS	• VALUES
			<ul style="list-style-type: none"> shapes(triangles, square, rectangle, rhombus, kite, parallelogram & trapezium) lines of symmetry in two dimensional shapes Symmetrical and asymmetrical shapes 		<ul style="list-style-type: none"> Entrepreneurship
8.14 PERIMETER & AREA	8.14.1 Perimeter 8.14.2 Area	8.14.1.1 Find perimeter of plane shapes 8.14.2.1 Calculate area of plane shapes	<ul style="list-style-type: none"> Perimeter of plane shapes(quadrilaterals, triangles, , and their composite shapes) Area of plane shapes in Square units(square, rectangle, triangle, parallelogram, Rhombus, Kite, trapezium, and circle) 	<ul style="list-style-type: none"> Calculation Drawing Identification Accuracy Interpretation 	<ul style="list-style-type: none"> Accuracy Team work Quality work Creativity Logical thinking Critical thinking
8.15 THREE DIMENSIONAL SOLIDS	8.15.1 Three dimensional shapes (Solids) 8.15.2 Nets of solids 8.15.3 Volume	8.15.1.1 Identify and name three dimensional shapes or solids 8.15.2.1 Identify and draw nets of solids 8.15.3.1 Find volume of cube & cuboid	<ul style="list-style-type: none"> Three dimensional shapes(Cube, cuboid, cylinder, pyramid and cone) Edges and faces on a three dimensional shape(Cube, cuboid, cylinder, pyramid and cone) 	<ul style="list-style-type: none"> Drawing and labelling Calculation Identification Interpretation Accuracy Comparing Designing 	<ul style="list-style-type: none"> Application Quality work Logical thinking Accuracy Team work

TOPIC	SUBTOPICS	SPECIFIC OUTCOMES	• KNOWLEDGE	• SKILLS	• VALUES
			<ul style="list-style-type: none"> • Drawings of nets of solids • volume of cube & cuboid. 		
8.16 ANGLES	8.16.1 Types of angles 8.16.2 Measuring angles	8.16.1.1 Identify different types of angles 8.16.1.2 Find complementary and supplementary angles 8.16.2.1 Use protractor to measure angles 8.16.2.2 Find angles within triangles and quadrilaterals	<ul style="list-style-type: none"> • Different types of angles(acute, right, obtuse, reflex, straight angles and a complete turn) • Complementary and supplementary angles • Measuring angles using a protractor • Angle properties • Interior and exterior angles • Angle sum of triangle. 	<ul style="list-style-type: none"> • Identification • Interpretation • Measuring • Calculation • Drawing • Accuracy • Comparing • Manipulation 	<ul style="list-style-type: none"> • Curiosity • Accuracy • Quality work • Team work • Logical thinking
8.17 GEOMETRICAL CONSTRUCTION	8.17.1 Construction of Angles 8.17.2 Construction of lines	8.17.1.1 Construct $90^{\circ}, 60^{\circ}$ angles 8.17.2.1 Construct parallel lines 8.17.2.2 Construct perpendiculars	<ul style="list-style-type: none"> • Use of ruler, set square and a compass • Construction of perpendiculars(to a given line , perpendicular bisector and from given point) 	<ul style="list-style-type: none"> • Construction • Manipulation • Accuracy • Drawing • Bisecting • Dividing lines • Identification • Comparing 	<ul style="list-style-type: none"> • Accuracy • Creativity • Logical thinking • Orderliness • Appreciation
	8.18.1 Angle Bisectors 8.18.2 Construction of triangles 8.18.3 Construction of	8.18.1.1 Use compasses to bisect angles (giving rise to other angles) 8.18.1.2 Construct $45^{\circ}, 30^{\circ}$,	<ul style="list-style-type: none"> • Use of mathematical instruments 	<ul style="list-style-type: none"> • Construction, drawing and demonstration • Design 	<ul style="list-style-type: none"> • Accuracy, concentration, dependability and patience

TOPIC	SUBTOPICS	SPECIFIC OUTCOMES	• KNOWLEDGE	• SKILLS	• VALUES
	polygons 8.18.4 Patterns	15°· 75° angles 8.18.1.3 Construct triangles, circum- circles and inscribed circles 8.18.1.3 Construct polygons 8.18.1.3 Design patterns derived from construction			• Aesthetics
8.19 BEARINGS	8.19.1 Bearings	8.18.1.1 Identify the main points on a compass 8.18.1.2 Find the three figure bearings of one point from another	<ul style="list-style-type: none"> • Points on Compass (N, E, W and S) • Presentation of three figure bearing 	<ul style="list-style-type: none"> • Reading Communication • Identification • Drawing • Labelling • Accuracy 	<ul style="list-style-type: none"> • Interpretation • Application • Reasoning • Accuracy • Quality work • Appreciation of bearings
8.19 APPROXIMATION & ESTIMATION	8.19.1 Approximation and Estimation	8.19.1.1 Round off numbers. 8.19.1.2 State significant figures	<ul style="list-style-type: none"> • Principle of rounding off • numbers to nearest unit, given number of decimal places and place values • Highlight the Significance of zero and other numbers. 	<ul style="list-style-type: none"> • Demonstration • Communication • Estimation • Calculation • Identification 	<ul style="list-style-type: none"> • Interpretation • Application • Appreciation • Team work
8.20 RATIO & PROPORTION	8.20.1 Ratio 8.20.2 Proportional parts	8.20.1.1 Use representative fractions (RF) 8.20.2.1 Solve problems that involve proportions	<ul style="list-style-type: none"> • Fractional parts Representation • Direct and inverse proportion 	<ul style="list-style-type: none"> • Computation Representation • problem solving • comparing • Accuracy • Identification. 	<ul style="list-style-type: none"> • Reasoning • Problem solving • Critical thinking • Appreciation application • Team work

TOPIC	SUBTOPICS	SPECIFIC OUTCOMES	• KNOWLEDGE	• SKILLS	• VALUES	
8.21	PROBABILITY	8.22.1 Experimental Probability	8.21.1.1 Explain the concept of probability 8.21.1.2 Experiment of outcomes. 8.21.1.3 Demonstrate favourable and possible outcomes	<ul style="list-style-type: none"> Terms related to probability(occurrence, favourable outcome, possible outcome, certainty and impossibility/zero) 	<ul style="list-style-type: none"> Demonstration interpretation Communication Observation Presentation 	<ul style="list-style-type: none"> Critical thinking Application Predication
8.22	STATISTICS	8.23.1 Data collection 8.23.2 Data presentations	8.23.1.1 Identify instruments for data collection 8.22.1.1 Draw simple frequency tables 8.22.1.2 Tabulate data	<ul style="list-style-type: none"> Data collection instruments(questionnaire, interviews) Presentation of data (pictographs, bar charts, pie charts and line graphs) 	<ul style="list-style-type: none"> Drawing Tabulation Research Presentation Representation Interpretation Communication Analysing 	<ul style="list-style-type: none"> Application enquiry Creativity Accuracy Quality work Honest Accountability
8.24	FUNCTIONS	8.24.1 Relations 8.24.2 Mappings	8.24.1.1 Describe different types of relationships 8.24.1.2 Describe the type of relationships between two sets 8.24.2.1 Map functions as a form of relationship 8.24.2.2 Demonstrate functions 8.24.2.3 Find range when function is given	<ul style="list-style-type: none"> Types of relationships(one to one, one to many) Corresponding elements Relationships between elements of domain and range Demonstration of functions Sets of Ordered pairs 	<ul style="list-style-type: none"> Matching Comparing Drawing Identification Classification Communication Analysing 	<ul style="list-style-type: none"> Interpretation Reasoning Quality work Team work Logical thinking Critical thinking Self consciousness

GRADE 9

<p>General Outcomes</p> <ul style="list-style-type: none"> ▪ Provide clear mathematical thinking and expression in the learner ▪ Develop the learners' mathematical AND ICT 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 and ICT 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 	<p>Key Competences:</p> <ul style="list-style-type: none"> ▪ 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 and ICT concepts and skills in other disciplines. ▪ Develop abilities and ideas drawn from mathematics to reason logically, communicate mathematically and technologically, 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.
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TOPICS	SUBTOPICS	SPECIFIC OUTCOMES	KNOWLEDGE	SKILLS	VALUES
9.1 SETS	9.1.1 Set builder notation 9.1.2 Intersection of sets 9.1.3 Union of sets 9.1.4 Set complement 9.1.5 Application on sets	9.1.1.1 Interpret the set builder notation 9.1.2.1 Find the intersection set (should include more than two sets) 9.1.3.1 Use single set operation symbol (eg. $A \cup B \cup C$ or $A \cap B \cap C$) 9.1.4.1 Interpret the set	<ul style="list-style-type: none"> • Language of sets • Venn diagrams • Interpretation and representation of data on Venn diagrams • Use correct symbolisation 	<ul style="list-style-type: none"> • Drawing suitable diagram • Relating & Interpretation 	<ul style="list-style-type: none"> • Problem solving • Creativity • application

TOPICS	SUBTOPICS	SPECIFIC OUTCOMES	KNOWLEDGE	SKILLS	VALUES
		<p>complement including its symbol (ie A', B' etc)</p> <p>9.1.4.2 Use combined set operation symbols (eg $A \cup B' \cap C$, $A' \cap B \cup C$, $A' \cap B' \cup C$ etc)</p> <p>9.1.5.1 Apply simple operation on sets</p>			
9.2 EXPONENTS (INDICES)	<p>9.2.1 Laws of indices</p> <p>9.2.2 Operations with indices</p>	<p>9.2.1.1 Interpret the positive, zero, negative indices</p> <p>9.2.2.1 Apply the addition and subtraction rules to indices</p>	<ul style="list-style-type: none"> • Laws of indices • Evaluating indices with respect to the four operation 	<ul style="list-style-type: none"> • Computation • Mathematical manipulation 	<ul style="list-style-type: none"> • Problem solving • Reasoning
9.3 USING SCIENTIFIC CALCULATORS	<p>9.3.1 Square roots</p> <p>9.3.2 Cube roots</p>	<p>9.3.1.1 Identify the square root symbol</p> <p>9.3.1.2 Find square root of perfect squares</p> <p>9.3.2.1 Identify the cube root symbol</p> <p>9.3.2.2 Find cube roots of Cubes</p>	<ul style="list-style-type: none"> • Factors of numbers • Multiples of numbers • Multiplication & division and inverse operations 	<ul style="list-style-type: none"> • Calculations • Computation 	<ul style="list-style-type: none"> • Reasoning, memorising and application
9.4 DIRECTED NUMBERS	<p>9.4.1 Multiplication</p> <p>9.4.2 Division</p>	<p>9.4.1.1 Find product of two multiplicand with the same or different signs</p> <p>9.4.2.1 Find quotient of two dividends with the same or different signs</p>	<ul style="list-style-type: none"> • Multiplication of integers • Division of integers 	<ul style="list-style-type: none"> • Compare • Contrast • compute 	<ul style="list-style-type: none"> • Problem solving • understanding
9.5 REAL NUMBERS	9.5.1 Rational and Irrational numbers	9.5.1.1 Tell the difference between rational & irrational numbers	<ul style="list-style-type: none"> • Approximation • Ordered pairs • XOY plane 	<ul style="list-style-type: none"> • Relate • Match • calculate 	<ul style="list-style-type: none"> • Reasoning • application
9.6 PYTHAGORAS THEOREM	<p>9.6.1 Pythagoras theorem</p> <p>9.6.2 Application</p>	9.6.1.1. Identify sides in the Right angled triangle (i.e. two adjacent sides and hypotenuse)	<ul style="list-style-type: none"> • Square numbers and square roots • Area of squares 	<ul style="list-style-type: none"> • Drawing • Calculation 	<ul style="list-style-type: none"> • Application

TOPICS	SUBTOPICS	SPECIFIC OUTCOMES	KNOWLEDGE	SKILLS	VALUES
		9.6.1.2 State the Pythagoras theorem 9.6.2.1 Solve problems involving pythagoras theorem	• Equations		
9.7 NUMBER BASES	9.7.1 Conversion from denary 9.7.2 Conversion between bases 9.7.3 Multiplication and division	9.7.1.1 Convert from denary to bases 2, 5 & 8 and vice versa 9.7.1.2 Convert from denary to bicimal numbers of the form 1110.101 up to 3 bicimal places and vice versa 9.7.2.1 Convert from one base to another other than base 10 (i.e. Bases 2, 5 and 8 only) 9.7.3.1 Carry out multiplication & division in base 2 & 5	• Place value • Conversion from one base to another • Multiplication & Long division	• Computation	• Reasoning • application
9.8 COMPUTER STUDIES	9.8.1 Decision boxes 9.8.2 Loops 9.8.3 Simple high level languages (e.g. Pascal)	9.8.1.1 Construct decision boxes 9.8.2.1 Identify and create loops in flow charts 9.8.3.1 Write simple computer programmes 9.8.3.2 Use simple programmes to calculate area, volume, find averages and resolve linear equations	• Sequencing activities • Basic programming • Area, volume, averages and linear equations	• Design • Demonstration	• Logical thinking
9.9 SOCIAL & COMMERCIAL ARITHMETIC	9.9.1 Simple Financial transactions 9.9.2 Pension and Property Insurance 9.9.3 Dividends and Premiums	9.9.1.1 Distinguish between salaries and wages 9.9.1.2 Work out payments for piece work & work per hour 9.9.1.3 Compute deductions	• Distinguish salary from wages and income tax from value added tax (VAT) • Four operations of	• Computations related with the four operations • Decision	• Comprehension • Application • Problem solving and Entrepreneurship

TOPICS	SUBTOPICS	SPECIFIC OUTCOMES	KNOWLEDGE	SKILLS	VALUES
		<p>from salaries</p> <p>9.9.1.4 Pay As you Earn (PAYE). (Include Tax bands and calculations involved)</p> <p>9.9.1.5 Calculate over time</p> <p>9.9.2.1 Distinguish & calculate income tax and value added tax (VAT)</p> <p>9.9.2.2 Calculate problems related to hire purchase</p> <p>9.9.2.3 Calculate depreciation and appreciation</p> <p>9.9.3.1 Carry out calculations that involve premiums and dividends</p>	<p>addition, subtraction, multiplication a& division</p> <ul style="list-style-type: none"> Percentages 		<ul style="list-style-type: none"> Socialisation
9.10 ALGEBRAIC MANIPULATION S	<p>9.11.1 Equations and inequations</p> <p>9.11.2 Subject of formula.</p>	<p>9.11.1.1 Solve equations and inequations in one variable (include those with fractions)</p> <p>9.11.1.2 Evaluate algebraic expressions by substituting variables with their given values</p> <p>9.11.1.3 Solution sets of equations and Inequations</p> <p>9.11.1.4 Sketch solutions of equations and Inequations (shade the wanted region)</p> <p>9.11.2.1 Manipulate equations by changing subject of the formula</p>	<ul style="list-style-type: none"> Equations & inequations Subject of the formula 	<ul style="list-style-type: none"> Manipulation Accuracy and problem solving 	<ul style="list-style-type: none"> Reflection Systematic working & adjustment

TOPICS	SUBTOPICS	SPECIFIC OUTCOMES	KNOWLEDGE	SKILLS	VALUES
9.11 MATRICES	9.10.1 Multiplication of matrices 9.11.2 Application of matrices	9.11.2.1 Multiplication of a matrix by a scalar 9.11.2.2 Multiply matrices of compatible orders (emphasise on 2x2 matrices) 9.11.2.3 Calculate the determinant and inverse of a 2 x 2 matrix 9.11.2.4 Solve simultaneous (systems of) equations using matrices	<ul style="list-style-type: none"> • Order of matrices • Multiplication of matrices • Simultaneous equations 	<ul style="list-style-type: none"> • Computation and Interpretation 	<ul style="list-style-type: none"> • Analysis and application
9.12 SYSTEMS OF EQUATIONS	9.12.1 Systems of equations	9.12.1.1 Solve simultaneous equations in two variables	<ul style="list-style-type: none"> • Sketching equations & inequations • Simultaneous equations • (Elimination and substitution methods) 	<ul style="list-style-type: none"> • Drawing & representation • Application 	<ul style="list-style-type: none"> • Interpretation and problem solving
9.13 SYMMETRY	9.13.1 Three dimensional shapes 9.13.2 Rotational symmetry	9.13.1.1 Recognise and draw three dimensional shapes 9.13.2 Sketch reflections and rotations on the XOY plane	<ul style="list-style-type: none"> • Symmetry & three dimensional shapes • XOY plane, plotting & two dimensional shapes 	<ul style="list-style-type: none"> • Identifying & drawing • Plotting 	<ul style="list-style-type: none"> • Creativity & reflection • Interpretation
9.14 CIRCLE	9.14.1 Parts of a circle 9.14.2 Tangents	9.14.1.1 Identify circumference, radius, diameter, cord, arc, sector and segment 9.14.1.2 Experiment on the foundation of the constant pi (π) using circular objects 9.14.1.3 Calculate	<ul style="list-style-type: none"> • Circles and cylinders • Circumference, area and the diameter • The constant pi (π) • Straight lines and tangency 	<ul style="list-style-type: none"> • Drawing • Calculation 	<ul style="list-style-type: none"> • Interpretation & application • Accuracy

TOPICS	SUBTOPICS	SPECIFIC OUTCOMES	KNOWLEDGE	SKILLS	VALUES
		circumference, radius, diameter and area of the circle. 9.14.2.1 Recognise and draw tangent to a circle			
9.15 SOLIDS	9.15.1 Surface area 9.15.2 Volume II	9.15.1.1 Calculate surface area of solids (cube, cuboid, cylinder) 9.15.1.2 Find volume of cylinder	<ul style="list-style-type: none"> • Three dimensional shapes • Faces, vertices and edges of solids 	<ul style="list-style-type: none"> • Drawing and computation 	<ul style="list-style-type: none"> • Application and accuracy
9.16 POLYGONS	9.16.1 Regular and Irregular polygons 9.16.2 Interior and exterior angles 9.16.3 Sum of interior angles of polygons	9.16.1.1 Identify regular & irregular polygons (e.g. quadrilateral, pentagon, hexagon etc) 9.16.2.1 Define properties of interior & exterior angles of polygons 9.16.3.1 Calculate specified interior angles of regular polygons	<ul style="list-style-type: none"> • Identification of polygons • Interior and exterior angles of polygons • Angle calculation 	<ul style="list-style-type: none"> • Identification and definition • Calculation and interpretation 	<ul style="list-style-type: none"> • Comprehension & accuracy
9.17 BEARINGS	9.17.1 Three-figure bearings 9.17.2 Scale drawing	9.17.1.1 Find the bearing of a given point from another 9.17.2.1 Use scale drawing to solve problems involving bearings	<ul style="list-style-type: none"> • Compass bearing • Ratio & proportion • Use of ruler, protractor and compass 	<ul style="list-style-type: none"> • Drawing & Measuring • Construction 	<ul style="list-style-type: none"> • Accuracy • Interpretation
9.18 SIMILARITY & CONGRUENCY	9.18.1 Similar figures 9.18.2 Congruent figures	9.18.1.1 Illustrate properties of different figures in order to determine similarity 9.18.1.2 Calculate problems involving similar figures. 9.18.2.1 Illustrate properties of different	<ul style="list-style-type: none"> • Properties determining similarity • Properties determining congruency • Calculations relating to application of 	<ul style="list-style-type: none"> • Computation & problem solving 	<ul style="list-style-type: none"> • Interpretation, comparison creativity and awareness

TOPICS	SUBTOPICS	SPECIFIC OUTCOMES	KNOWLEDGE	SKILLS	VALUES
		<p>figures in order to determine congruency</p> <p>9.18.2.2 Calculate problems involving congruent figures.</p> <p>9.18.2.3 Use unitary method of calculation</p>	<p>similarity and congruency</p>		
9.19 ANGLES	<p>9.19.1 Angles associated with parallel lines</p> <p>9.19.2 Angles related to geometrical shapes</p>	<p>9.19.1.1 Illustrate vertically opposite, alternate and corresponding angles</p> <p>9.19.1.2 Identify equal angles based on pair of parallel lines</p> <p>9.19.2.1 Describe angle properties of geometrical shapes</p> <p>9.19.2.2 Calculate angle sum of triangles</p> <p>9.19.2.3 Calculate interior angles of polygons</p>	<ul style="list-style-type: none"> • Types and sizes of angles • Angle properties • Formulae 	<ul style="list-style-type: none"> • Computation • Drawing & Problem solving 	<ul style="list-style-type: none"> • Awareness, reasoning appreciation and application
9.20 GEOMETRICAL CONSTRUCTION	<p>8.19.2 Angle Bisectors</p> <p>8.19.3 Construction of triangles</p> <p>8.19.4 Construction of polygons</p> <p>8.19.5 Patterns</p>	<p>8.19.5.1 Use compasses to bisect angles (giving rise to other angles)</p> <p>8.19.5.2 Construct 45°, 30°, 15°, 75° angles</p> <p>9.20.2.1 Construct triangles, circum- circles and inscribed circles</p> <p>9.20.3.1 Construct polygons</p> <p>9.20.4.1 Design patterns derived from construction</p>	<ul style="list-style-type: none"> • Use of mathematical instruments 	<ul style="list-style-type: none"> • Construction, drawing and demonstration • Design 	<ul style="list-style-type: none"> • Accuracy, concentration, dependability and patience • Aesthetics
9.21 STANDARD	9.21.1 Scientific Notation	9.21.1.1 Write numbers in	<ul style="list-style-type: none"> • Scientific notation 	<ul style="list-style-type: none"> • Calculate 	<ul style="list-style-type: none"> • Reasoning

TOPICS	SUBTOPICS	SPECIFIC OUTCOMES	KNOWLEDGE	SKILLS	VALUES
FORM	9.21.2 Estimation	standard form or scientific notation (i.e. $A \times 10^n$ where n is an integer and $1 \leq A < 10$) 9.21.2.1 Estimate numbers in scientific notation to given degree (i.e. specified number of significant figure, decimal places etc.)	<ul style="list-style-type: none"> Distinguish indices between large and small numbers Estimate numbers to given degree 	<ul style="list-style-type: none"> Compare Identify Estimation 	<ul style="list-style-type: none"> Problem solving Understanding
9.22 RATIO & PROPORTION	9.22.1 Ratio 9.22.2 Application	9.22.1.1 Formulate variation statements (Both direct and inverse) 9.22.2.1 Demonstrate the application of ratio (e.g. In currency exchange rates, Representative fraction etc)	<ul style="list-style-type: none"> Fractions, increase and decrease Representative fraction (RF) 	<ul style="list-style-type: none"> Computation Problem solving Multiplication & division 	<ul style="list-style-type: none"> Mathematical thinking and reasoning Interpretation
9.23 PROBABILITY	9.23.1 Theoretical probability	8.22.2.1 Chances in coins, playing cards and dice) 8.22.2.2 Interpret probability values and distinguish certainty from impossible events	<ul style="list-style-type: none"> Distinguish between Dependent & Independent events Occurrences 	<ul style="list-style-type: none"> Communication Analysis 	<ul style="list-style-type: none"> Judgement Critical thinking Application
9.24 STATISTICS	9.24.1 Frequency tables 9.24.2 Graphing 9.24.3 Measures of central tendency 9.24.4 Mean from frequency tables	9.24.1.1 Generate simple frequency table from given data 9.24.4.1 Construct specified statistical graphs to interpret given data (i.e. Line graph, Pie chart, Compound bar chart)	<ul style="list-style-type: none"> Statistical presentations Types of statistical graphs Central tendency 	<ul style="list-style-type: none"> Drawing Presenting data Computation Research 	<ul style="list-style-type: none"> Interpretation Mathematical thinking & reasoning

TOPICS	SUBTOPICS	SPECIFIC OUTCOMES	KNOWLEDGE	SKILLS	VALUES
		9.24.4.2 Discover typical uses of these statistical graphs 9.24.3.1 Find the mode, median and mean from ungrouped data 9.24.3.2 Find Mean from frequency tables			
9.25 FUNCTIONS	9.25.1 Relations and Mappings 9.25.2 Sets of ordered pairs	9.25.1.1 Identify mappings from arrow diagrams. 9.25.2.1 Solve simple functions of ordered pairs.	<ul style="list-style-type: none"> • Making arrow diagrams to show relations and mappings. 	<ul style="list-style-type: none"> • Drawing • Computation 	<ul style="list-style-type: none"> • Decipher, interpret, relate • Appreciation and application
9.26 EQUATION OF A STRAIGHT LINE	9.26.1 Graphs	9.26.1.1 Graph linear functions (i.e. $y = mx + c$)	<ul style="list-style-type: none"> • XOY plane and plotting points 	<ul style="list-style-type: none"> • Drawing • Plotting 	<ul style="list-style-type: none"> • Comprehension and Application
9.27 COMPUTER STUDIES	9.27.1 Simple functions of a computer 9.27.2 Input and output devices 9.27.3 Storage devices of data 9.27.4 Flow charts 9.27.5 Computer programs	9.27.1.1 Define Simple functions of a computer 9.27.2.1 List Input and output devices 9.27.3.1 List Storage devices of data 9.27.4.1 Construct flow chats using standard flow symbols 9.27.5.1 High level computer languages (e.g. Pascal)	<ul style="list-style-type: none"> • Define Simple functions of a computer • List Input and output devices • List Storage devices of data • Flow charts • Write simple Pascal language program • Tell output from simple Pascal program. 	<ul style="list-style-type: none"> • Drawing • Listing • Computation. 	<ul style="list-style-type: none"> • Judgement • Critical thinking • Application