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Republic of Zambia

Ministry of Education

MATHEMATICS II SYLLABUS

SECONDARY EDUCATION ORDINARY LEVEL
FORM 1 - 4

DEVELOPED BY THE CURRICULUM DEVELOPMENT CENTRE
LUSAKA
2024

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TABLE OF CONTENTS

VISION

Quality, life long education for all which is accessible, inclusive and relevant to individual, national and global needs

PREFACE

The **Mathematics II Syllabus for Form 1 to 4** is designed to equip learners with a comprehensive understanding of Mathematics concepts, fostering a deep appreciation for the role of Mathematics in everyday life and its applications in various fields. This syllabus aims to develop learners' analytical thinking, problem-solving skills, creativity and innovative thinking through a structured and progressive learning approach.
Mathematics, is central, bridges the gap between physical and biological sciences, providing insights into the composition, structure, properties and changes of matter. This syllabus emphasizes the importance of a hands-on, inquiry-based learning experience, encouraging learners to explore, practice and engage in scientific reasoning.

This Mathematics Syllabus for Form 1 to 4 aims to create a stimulating and supportive learning environment where learners can develop a profound understanding of Mathematics. By fostering curiosity, critical thinking and practical skills, the syllabus prepares learners for further education and careers in science and technology, contributing to their overall intellectual and personal growth.

It is hoped that this Mathematics syllabus will inspire learners to explore the fascinating world of Mathematics and appreciate its significance in shaping the future.

Joel Kamoko (Mr.)
Permanent Secretary- Educational Services
MINISTRY OF EDUCATION

ACKNOWLEDGEMENT

The development of this Mathematics syllabus was a collaborative effort involving various stakeholders. Many thanks go to individuals, institutions and organizations that provided the financial and technical input to the successful development of this syllabus. These include; the subject teachers from schools, lecturers from colleges and universities in Zambia, officers from the Directorate of Secondary Education, Directorate of Teacher Education and Specialised Services (TESS), Directorate of National Science Centre (NSC) and the Examinations Council of Zambia (ECZ).

Their valuable insights, expertise, and feedback were instrumental in shaping the content, structure, and overall direction of this syllabus. We appreciate their dedication, time, and effort in helping the Ministry of Education to design and develop a comprehensive and relevant Mathematics syllabus.

Last but not the least, I recognise the commitment and hard work of all the staff at the Curriculum Development Centre (CDC) in ensuring that this syllabus comes to reality.

Charles Ndakala, (Dr.)
Director – Curriculum Development
MINISTRY OF EDUCATION

INTRODUCTION

This syllabus is committed to providing an enriching and supportive educational environment where learners can develop a life-long interest for Mathematics. By promoting inquiry, curiosity, and a passion for Mathematics, we aim to prepare learners not only for academic success but also for their future roles as informed and responsible citizens in a scientifically advanced society.

We are confident that this Mathematics syllabus will inspire and empower learners to achieve their full potential, equipping them with the knowledge and skills necessary to navigate and contribute to the world around them. This syllabus is designed to ensure learners develop a deep understanding of Mathematical concepts while also acquiring practical skills and competences needed for further education and careers in Mathematics.

Problem-solving is a critical skill in Science, Technology, Engineering and Mathematics (STEM) fields, including Mathematics. STEM is an educational program developed to prepare primary and secondary school learners for college, graduate study and careers in the STEM fields. In addition to subject-specific learning, STEM aims to foster inquiring minds, logical reasoning and collaboration skills. Here are some strategies and techniques to enhance problem-solving skills:

1. Define the Problem: Clearly articulate the problem and identify the key questions.
2. Gather Information: Collect relevant data and research the topic/subject/task(s).
3. Identify Key Concepts: Determine the fundamental principles and concepts related to the problem.
4. Develop a Hypothesis: Formulate a tentative explanation or solution.
5. Design Experiments: Plan and conduct experiments to test hypotheses.
6. Analyse Data: Interpret and evaluate the results.

STEM Mathematics encompasses the following aspects:

- **Scientific**: Gaining insights into the natural world through observation, experimentation, and logical reasoning supported by evidence.
- **Technological**: Utilizing software tools and simulations for data analysis and visualization.
- **Engineering**: Creating and optimizing laboratory tools and processes.
- **Mathematical**: Using Mathematical principles and techniques to address real-world situations.

These STEM aspects of Mathematics are crucial for advancing understanding of mathematical concepts, developing new technologies, and solving real-world problems.

Structure of the Syllabus

The syllabus is organised into four levels, corresponding to Forms 1 to 4, with each level building upon the knowledge and skills acquired in the previous year. The content is divided into topics, each focusing on specific concepts of Mathematics.

- **Form 1**: Real numbers, Sets, Integers, Estimations and Approximations, Algebra, Coordinate Geometry, Relations and Functions, Angles and Polygons, Financial Arithmetic, Directions and Bearings, Similarity and Congruency, Right Angled Triangles and Mensuration.
- **Form 2**: Index Notation, Number Bases, Equations and Inequalities, Algebra, Matrices, Variations, Mensuration, Symmetry and Probability.
- **Form 3**: Quadratic Equations and Inequalities, Functions, Graphs of Functions, Systems of Equations, Coordinate Geometry, Sequences and Series, Exponential and Logarithmic Functions, Geometrical Constructions and Loci, Travel Graphs and Statistics.
- **Form 4**: Linear programming, Vectors in two dimensions, Trigonometry, Earth Geometry, Geometrical Transformation and Calculus.

Suggested Teaching Methodology

The effective teaching methodologies in STEM Mathematics include:

- **Conducting Research:** Demonstrate key principles and encourage curiosity among learners.
- **Collaborative learning**: Pair learners to work together, promoting peer-to-peer teaching, discussion, and problem-solving.
- **Conceptual learning:** Connect Mathematical concepts to everyday life, industry, or current events, making learning relevant and meaningful.
- **Differentiated instructions:** Tailor teaching to meet diverse learning styles, abilities, and interests of different learners.
- **Feedback and Reflection:** Encourage learners to reflect on their learning, providing constructive feedback to guide improvement.
- **Inquiry-based learning**: Encourage learners to explore, investigate, and discover Mathematical concepts through hands-on experiments and activities.
- **Integration of Technology:** Use digital tools (MATLAB, GeoGebra, Decimals, python, R…), simulations, and visualisations to enhance engagement, understanding, and analysis.
- **Problem-based learning**: Present real-world problems requiring learners to apply Mathematical knowledge to solve problems.
- **Project -based learning:** Assign open-ended projects, allowing learners to design, conduct, and present research or applications of Mathematical concepts.

By implementing these methodologies, a teacher can create an engaging, inclusive, and effective STEM mathematics learning environment.

Time Allocation

The standard minimum learner-teacher contact time for Mathematics at secondary school level is 4 hours per week, translating into six (6) periods. One period lasts 40 minutes, with each lesson having 80 minutes. The contact time at Secondary school level is planned in such a way as to give ample time for practical based activities.

Assessment

This assessment shall include a variety of methods to evaluate the competences of learners in terms of knowledge, skills, and general understanding of Mathematical concepts. The assessment will involve both formative and summative. Summative assessment will be used to evaluate learners learning at the end of the O level Mathematics course to measure learners' achievement against specific competences through Final examinations. Formative assessment will be used to track learner progress and knowledge throughout the teaching and learning process.

However, assessments shall follow the following pattern:

- School Based Assessment (SBA) shall comprise assignments, projects, practical work, research, class tests and end of term tests during the period of study and as guided by the Examinations Council of Zambia (ECZ). This shall carry 30% of the total marks.
- Summative assessment shall carry 70% of the total marks.

The Examinations Council of Zambia (ECZ) shall prepare detailed procedures or guidelines on how SBA will be conducted by the teachers and the management of the assessment results. The standardised national examination shall be administered at the end of Form 4 by the Examinations Council of Zambia.

KEY COMPETENCES

COMPETENCE	DESCRIPTORS
Analytical Thinking	To Analyze and interpret data, making evidence-based conclusions.
Collaboration	To work together, promoting peer-to-peer teaching, discussion, and problem-solving.
Communication	To Communicate mathematical information effectively, both orally and in writing.
Critical Thinking	To enhance learners' ability to think critically and solve problems through logical reasoning based on conclusions.
Entrepreneurship	To manage finances through application of financial arithmetic skills.
Problem Solving	To use mathematical knowledge, critical thinking, and analytical skills to overcome obstacles and challenges in understanding mathematical concepts and processes.
Financial Literacy	To Calculate profit and loss and to demonstrate the understanding of banking and financial services
Digital literacy	To upload and download information and produce graphs for data analysis.
Emotional intelligence	To work effectively with others.

FORM 1

TOPIC	SUB-TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
1.1. REAL NUMBERS	1.1.1. Types of Numbers	1.1.1.1. Use the different types of numbers in real life.	• Exploring different types of numbers through research (*natural numbers, integers, whole numbers, prime numbers, odd numbers, even numbers, composite numbers, squares and square roots, cubes and cube roots*) • Distinguishing between rational and irrational numbers • Evaluating square and cube roots • Creating patterns and puzzles of different types of numbers (*including the use of ICT tools*)	Different types of numbers used in real life correctly
1.2. SETS	1.2.1 Set Builder Notation	1.2.1.1. Apply the concept of set-builder notation and set operations in real life	• Exploring sets in the environment • Exploring types of sets • Interpreting set builder notation • Presenting sets in set builder notation	The concept of set builder notation and set operations applied correctly
	1.2.2 Operations on Sets	1.2.2.1. Apply the concept of set operations in real life	• Performing single and combined operations involving intersection, union and complement of sets (*combining up to three sets*) • Illustrating sets using Venn diagrams	

TOPIC	SUB-TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
			• Finding the number of elements in a given set, $n(A)$ • Describing the shaded region using set notation • Shading regions described by a set notation • Applying distributive, associative and commutative laws of set operations • Using ICT tools to enhance understanding the concepts of Sets	
1.3 **INTEGERS**	1.3.1 The Four Operations	1.3.1.1 Apply the four operations on integers in real life situation	• Exploring integers • Comparing situations which depict integers such as loss and profit in business, low and high temperatures, elevation below and above sea level • Adding integers • Subtracting integers • Multiplying integers • Dividing integers • Applying combined operations on integers • Using ICT tools to enhance understanding of integers	The four operations applied on integers accurately in real life situations
1.4 **ALGEBRA**	1.4.1 Algebraic Expressions	1.4.1.1. Apply algebraic expressions in different life contexts	• Constructing algebraic expressions from word statements • Relating letters and numbers (*terms*)	Algebraic expressions applied correctly in different life contexts accordingly

TOPIC	SUB-TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
			• Identifying variables and coefficients in an algebraic expression • Grouping like and unlike terms. • Simplifying algebraic expressions • Applying Commutative, Associative and Distributive (CAD) laws • Expanding and simplifying algebraic expressions • Factorising algebraic expressions using common factors • Applying the four operations on algebraic expressions • Evaluating algebraic expressions by substituting variables with numbers	
1.5. ESTIMATION AND APPROXIMATION	1.5.1 Estimation and Approximation in Context.	1.5.1.1 Use Estimation and Approximation in practical context.	• Exploring the concept of Estimation and Approximation • Estimating measures and comparing them with actual measurements • Interpreting errors (*absolute, relative, percentage*) and tolerance • Approximating measurements/numbers by	Estimation and approximation used appropriately in practical context.

TOPIC	SUB-TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
			rounding off to the nearest degree of accuracy (*unit, fraction or decimal*) • Stating the number of significant figures in a given number • Expressing numbers in scientific notation or standard form • Approximating numbers in scientific notation to a given degree of accuracy • Using Project-based activities to apply estimation and approximation	
1.6. COORDINATE GEOMETRY	1.6.1 The Cartesian Plane	1.6.1.1 Apply the concept of the Cartesian Plane in real life	• Exploring ways of finding a location • Exploring the Cartesian plane • Identifying the x-axis, y-axis and the origin • Numbering of the x and y axes • Plotting and labelling points on the Cartesian plane • Reading co-ordinates (x, y) on the Cartesian plane • Joining points to come up with different shapes	The concepts of Cartesian plane applied correctly in real life

TOPIC	SUB-TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
			• Naming shapes formed. • Drawing straight lines • Determining the mid-point of two points • Finding the gradient of a straight line • Finding the equation of a straight line • Using ICT tools to enhance understanding the concept of Coordinate Geometry	
1.7. RELATIONS AND FUNCTIONS	1.7.1 Types of Relations and Functions	1.7.1.1 Apply the concepts of relations and functions in real life situations	• Exploring relationships in the society • Exploring different types of relations • Describing different types of relations (*one to one, one to many, many to one and many to many)* • Representing relations using ordered pairs, arrow diagrams, tables, graphs, and mappings • Determining features which make a mapping into a function • Representing a function in the form f: x⟶ a or f(x) = a • Recognising the domain and range	The concepts of relations and functions applied in real life situations correctly

TOPIC	SUB-TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
			• Finding the range of the function given the domain • Finding a function given a set of ordered pairs • Drawing graphs of linear functions and reflecting them • Using ICT tools to enhance the understanding of Relations and Functions	
1.8. ANGLES AND POLYGONS	1.8.1 Properties of Angles and Polygons	1.8.1.1 Apply the concept of angles and polygons in different contexts	• Exploring shapes in the environment • Exploring angles and polygons (*regular and irregular*) • Identifying angles related with straight lines • Calculating the sizes of angles represented by a variable between intersecting lines, lines from a point and triangles (*interior and exterior angles*) • Describing properties of interior and exterior angles of regular polygons • Calculating interior, exterior and sum of interior angles of a regular polygon • Distinguishing angles of	The concept of angles and polygons applied in different contexts appropriately

TOPIC	SUB-TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
			elevation from angles of depression • Finding angles of depression and elevation • Using ICT and project-based activities in angles and polygons	
1.9. FINANCIAL ARITHMETIC	1.9.1 Financial Interests	1.9.1.1 Apply Financial Arithmetic in real life	• Exploring financial arithmetic • Calculating compound interest. • Carrying out calculations that involve Shares, dividends and investment bonds • Calculating charges involving, postal (courier), mobile money, bank and logistics post services • Calculating the cost of goods bought on hire purchase • Calculating taxes such as Value Added Tax (VAT), Income Tax, Import Duty and Pay As You Earn (PAYE) • Working out payments for piece work and over time • Generating budgets	Financial Arithmetic applied in real life accordingly

TOPIC	SUB-TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
			(*Considering charges in previous learning activities*) • Carrying out Project based activities on Financial Arithmetic • Using ICT tools to enhance understanding of Financial Arithmetic	
1.10. DIRECTIONS AND BEARINGS	1.10.1 Navigational Bearings	1.10.1.1. Apply concepts of directions and bearings in real life situations	• Exploring concepts of positions, directions and bearings • Identifying the four cardinal points on the compass (*North, East, West and South*) • Describing the direction of a place from a given point using the compass points (NE, NNE) • Identifying, reading and writing bearings in different formats: Compass/Quadrant bearings ($N40^0$W), Three figure bearings (270, 025, 005) and Degree-minutes-seconds bearings ($270^0\ 30'\ 12''$) • Demonstrating compass and three figure bearings using a pair of compasses	The concepts of directions and bearings applied in real life situations correctly

TOPIC	SUB-TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
			and a protractor • Drawing and labelling diagrams to represent directions and bearings • Describing the bearing of a place from a given point • Creating computer simulations to visualise directions and bearings	
1.11. SIMILARITY AND CONGRUENCY	1.11.1 Similar and Congruent Figures	1.11.1.1 Use the concepts of similarity and congruency in real contexts	• Exploring similar things in the surrounding. • Exploring the concepts of similarity and congruency • Identifying similar and congruent shapes in the environment • Making similar and congruent shapes and objects • Designing similar and congruent shapes using ICT tools • Creating appropriate scale drawings (e.g classroom, football pitch) • Calculating the scale on a map • Calculating length and area using a given scale • Calculating the length, area	The concepts of similarity and congruency used in real contexts accordingly

TOPIC	SUB-TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
			and volume of similar figures using ratios	
1.12. RIGHT ANGLED TRIANGLES	1.12.1 Pythagoras Theorem	1.12.1.1 Use Pythagoras Theorem in real life situations	• Exploring the use of the right angles in the environment • Exploring the Pythagoras theorem • Identifying sides in the right-angled triangle (*two adjacent sides and hypotenuse*) • Deriving the Pythagoras theorem • Solving a variety of questions involving Pythagoras theorem • Using ICT to visualise and solve questions related to right-angled triangles	Pythagoras theorem used in real life situations accordingly
1.13. MENSURATION	1.13.1. The Circle	1.13.1.1 Apply concepts of the circle in real life situations	• Exploring the circular things in the environment • Identifying parts of the circle. • Demonstrating how to obtain the value of Pi through practical activities • Finding the circumference,	The concepts of a circle applied in real life situations correctly

TOPIC	SUB-TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
			arc length using radius or diameter of the circle [constant pi (π =3.14) or (π =3.142) or ($\pi = \frac{22}{7}$)] • Finding the perimeter of a sector • Establishing the formula for the area of circle (by demonstration) • Calculating the area of a circle [constant pi (π = 3.14) or (π =3.142) or ($\pi = \frac{22}{7}$)] • Calculating the area of a sector (*minor and major*) • Using ICT tools to illustrate concepts of the circle	

FORM 2

TOPIC	SUB-TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
2.1. INDEX NOTATION	2.1.1. Indices	2.1.1.1 Apply concepts of indices in real life context	• Analysing patterns (*growth rates, inflation rates, compound interest...)* • Exploring concepts of indices. • Interpreting positive, negative, zero and fractional indices • Simplifying and evaluating positive, negative, zero and fractional indices • Formulating the laws of indices to solve a variety of questions • Solving equations involving indices • Using laws of indices to solve questions in different fields such as Banking, Engineering and Computer science • Using ICT tools to evaluate indices • Using Project based activities to enhance the understanding of Index Notation	The concepts of indices applied correctly in real life context

TOPIC	SUB-TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
2.2 NUMBER BASES	2.2.1 Conversions and Arithmetic in Different Bases	2.2.1.1 Use number bases in different context	• Exploring number systems used in different context such as in computers, packaging, encoding and so on • Exploring the concept of number bases in counting system • Illustrating the numeration used in some explored base system such as 2, 5 and 8 • Converting from base ten to base 2, 5 and 8 • Converting from bases 2, 5 and 8 to base 10 • Converting from base 2 to base 5 and from base 5 to base 2 • Converting from denary to bicimal numbers of the form 1110.1 up to 3 bicimal places • Converting from bicimal numbers to denary • Adding and subtracting numbers in base 2, 5 and 8 • Multiplying and dividing numbers in base 2, 5 and 8 • Using ICT to help understand number bases	Number bases used correctly in different context

TOPIC	SUB-TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
2.3. EQUATIONS AND INEQUALITIES	2.3.1. Linear Equations and inequalities	2.3.1.1. Apply linear equations and inequalities in daily context	• Exploring scenarios involving comparisons and the balancing of quantities in the environment • Formulating linear equations and inequalities from word statements • Solving equations and inequalities in one variable (*including fractions, grouping of terms and expansion*) • Changing the subject of the formula of an equation • Exploring different ways of solving linear equations in two variables (*graphical, elimination and substitution*) • Solving linear inequalities in one variable and presenting the solutions in different ways such as number line, graphical, set builder notation and solution set • Sketching/drawing graphs of linear inequalities and shading the wanted regions (*in one and two variables*) • Using ICT tools to sketch/draw and solve linear equations and inequalities	Linear equations and inequalities applied correctly in daily context

TOPIC	SUB-TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
2.4. ALGEBRA	2.4.1. Basic Processes	2.4.1.1 Apply basic processes of algebra in different contexts	• Exploring patterns and relationships in relation to algebra • Factorising by grouping terms, quadratic expressions and difference of two squares • Adding, subtracting, multiplying and dividing algebraic fractions • Simplifying algebraic fractions using Lowest Common Multiples (LCM) and factorisation	Basic Processes of algebra applied accurately in different contexts
	2.4.2 Remainder and Factor Theorem	2.4.2.2 Use the remainder and factor theorems in different contexts	• Exploring the remainder and factor theorems • Using the theorem to find quotient and remainder (*including long and synthetic division methods*) • Factorising cubic expressions • Solving cubic equations • Solving identical cubic equations • Using ICT tools to apply concepts of the remainder and factor theorems	The remainder and factor theorems used correctly in real life contexts

TOPIC	SUB-TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
2.5. MATRICES	2.5.1. Matrix Operations	2.5.1.1. Use matrix operations in day to day activities	• Exploring the concept of matrices. • Identifying different types of matrices (*row, column, square, zero, rectangular, equal, diagonal, identity*) • Stating the order of Matrices • Transposing Matrices • Performing basic Matrix operations on Matrices (*addition, subtraction, scalar multiplication and multiplication up to order 3 ×3)* • Calculating determinants of a 2×2 and a 3×3 matrix • Using the concept of determinants to find the inverse of a 2×2 and 3×3 matrix • Proving matrices using Commutative, Associative and Distributive (CAD) laws and other matrix properties $[eg. [AB]^T = B^T A^T, [A^{-1}]^{-1} = A]$ • Solving systems of linear equations in two and/or three variables using Matrices • Using ICT tools and software to calculate matrix operations and the inverse	Matrix operations used correctly in day to day activities

TOPIC	SUB-TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
2.6. VARIATION	2.6.1. Types of Variation	2.6.1.1 Apply the concept of variation in daily contexts.	• Exploring related proportions in the environment such as age and height, water temperature and depth and so on • Exploring the concept of variation • Identifying types of variations (*direct, inverse, joint and partial*) • Solving different types of variations • Presenting variations graphically • Illustrating variation by incorporating multimedia elements such as videos, animations and interactive graphics	The concept of variation applied correctly in daily context

TOPIC	SUB-TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
2.7. MENSURATION	2.7.1. Three Dimensional Shapes	2.7.1.1. Use the concept of three dimensional shapes in everyday life	• Exploring three dimensional shapes (*include the use of ICT tool*s) • Identifying three dimensional shapes such as prisms, cones and pyramids • Drawing nets and deriving formulae of prisms, cones and pyramids • Calculating surface area of three dimensional figures (*pyramid, cone, cylinder and triangular prism*) • Calculating volume of cylinder and triangular prism • Calculating volume of cones and pyramids (*rectangular and triangular pyramids*). Calculating volume of con • Using Project based activities to measure surface area and volume of regular and irregular shapes	Concepts of three dimensional shapes used correctly in everyday life

TOPIC	SUB-TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
2.8. SYMMETRY	2.8.1 Symmetry of plane and solid shapes	2.8.1.1 Use the concepts of symmetry in real life situations	• Exploring symmetry of different shapes (Plane and solid shapes). • Describing rotational symmetry about a point (plane shapes) • Describing rotational symmetry about an axis (solid shapes) • Determining planes of symmetry of solids • Using ICT tools to simulate symmetry of plane and solid shapes • Using Project based activities to relate the concept of symmetry of plane and solid shapes	Symmetry of plane and solid shapes used correctly in real life situations

TOPIC	SUB-TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
2.9. PROBABILITY	2.9.1 Introduction to Probability	2.9.1.1 Apply concepts of probability in real life contexts	• Exploring concepts of probability. • Demonstrating probability activities using coins, playing cards, dice and other games of chance • Describing terms related to probability such as random, occurrence, favourable outcome, possible outcome, certainty, events, biased and impossibility/ uncertainty • Determining possible outcomes of an event • Computing probabilities using laws of probability • Calculating probabilities involving mutually exclusive and independent events • Calculating probability using tree diagrams and grids • Working out probability involving continuous sample space. • Using project-based activities to apply probability	The concepts of probability applied correctly in real life context

FORM 3

TOPIC	SUB TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
3.1. EQUATIONS AND INEQUALITIES	3.1.1Quadratic Equations and Inequalities	3.1.1.1 Use concepts of quadratic equations and inequalities in real life context	• Exploring quadratic equations and inequalities. • Formulating quadratic equations from word statement • Expressing quadratic equations in standard form, $ax^2 + bx + c = 0, a \neq 0$ • Solving quadratic equations using different methods such as factorization and completing the square method • Deriving the quadratic formula • Solving quadratic equations using the quadratic formula method • Formulating quadratic inequations from word statement • Solving quadratic inequalities • Using the discriminant to determine the nature of roots • Using the roots to find the quadratic equation • Using ICT tools to solve quadratic equations and inequalities	The concepts of quadratic equations and inequalities used correctly in real life context

TOPIC	SUB TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
3.2. FUNCTIONS	3.2.1 Functions and their Transformations	3.2.1.1. Use concepts of functions in real life contexts	• Exploring concepts of functions • Finding the inverse of a function • Drawing graphs of an inverse function • Evaluating modulus of a function • Drawing graphs of modulus functions • Simplifying and evaluating composite functions [up to three functions, $fogoh(x)$] • Use ICT tools in functions (*smart boards, simulations, Python, R, GeoGebra and MATLAB…)*	The concepts of functions used correctly in real life contexts
	3.2.2. Graphs of Functions	3.2.2.1. Use graphs of functions in real life context	• Exploring graphs of functions • Identifying key features of the graph (*cap:* $\cap$ *or cup :* $\cup$*)* • Sketching/drawing graphs of quadratic functions of the form $ax^2 + bx + c = f(x), a \neq 0$ • Determining the vertex/ turning point, axis of symmetry, and the intercepts on the graph of a quadratic function	Graphs of functions used appropriately in real life context

TOPIC	SUB -TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
			• Finding the turning point and its nature (*maximum or minimum*) • Using the graphical method to solve quadratic equations • Expressing cubic functions in standard form $ax^3 + bx^2 + cx + d = f(x), a \neq o$. • Drawing graphs of cubic functions • Using the graph to find solutions to cubic equations • Estimating the area under the graph. (*Counting boxes, Trapezium rule, Simpson rule*) • Estimating the gradient of a curve at a given point • Using ICT tools to sketch/draw graphs	
3.3. SYSTEMS OF EQUATIONS	3.3.1 Simultaneous Equations	3.3.1.1. Apply concepts of systems of equations in real life context	• Exploring systems of equations • Solving systems of equations with one linear and one quadratic • Solving linear systems of equations with three variables • Using ICT tools to determine the solutions of systems of equations	The concepts of systems of equations applied correctly in real life context.

TOPIC	SUB TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
3.4. COORDINATE GEOMETRY	3.4.1 Coordinate Geometry	3.4.1.1. Apply coordinate geometry in real life situations	• Calculating the distance between two points • Finding the Equation of a straight line (*gradient - intercept form, two Point form /double intercept form*) • Finding the gradient of parallel and perpendicular lines • Using gradients of parallel and perpendicular lines to find equations • Finding coordinates of a point of intersection • Determining collinearity of points • Finding area of rectilinear figures • Using ICT tools to enhance learning and problem-solving in coordinate geometry *(GeoGebra, Desmos, MATLAB, Mathematica…)*	Concepts of coordinate geometry applied correctly in real life situations.
3.5 SEQUENCES AND SERIES	3.5.1 Arithmetic and Geometric Progressions	3.5.1.1 Use concepts of arithmetic and geometric progressions in real life context	• Exploring different types of sequences and series • Generating arithmetic progression (AP) and geometric progression (GP) • Finding the nth term of an arithmetic and geometric	The concepts of arithmetic and geometric progressions used correctly in real life context

TOPIC	SUB TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
			progression • Finding the number of terms of an AP and a GP • Finding arithmetic and geometric means between two terms of a progression • Finding the sum of a given number of terms in an AP and GP • Finding the sum to infinity of a GP • Using ICT tools in arithmetic and geometric progression such as creating algorithms for managing data structures	
3.6 EXPONENTIAL AND LOGARITHMIC FUNCTIONS	3.6.1 Properties of Exponential and Logarithmic functions	3.6.1.1 Use concepts of exponential and logarithmic functions in real life contexts	• Exploring exponential and logarithmic functions • Using laws of indices to solve exponential equations • Expressing an exponential function as a logarithmic function • Expressing a logarithmic function as an exponential function • Drawing/sketching the graphs of exponential and logarithmic functions • Comparing a graph of an exponential function to its	The concepts of exponential and logarithmic functions used correctly in real life contexts

TOPIC	SUB TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
			corresponding logarithmic function *(inverse*) • Formulating the laws of logarithms • Using laws of indices and logarithms to solve equations (*including natural logarithms*) • Using Project-based activities to solve exponential and logarithmic functions	
3.7. GEOMETRICAL CONSTRUCTION AND LOCI	3.7.1. Construction and Loci	3.7.1.1. Use geometrical construction and loci in real life contexts	• Exploring geometrical construction and loci • Constructing 60^0, 90^0 and 120^0 • Bisecting angles to obtain angles such as 15^0, $45^0$and 75^0 • Describing the locus of points equidistant from two intersecting lines • Bisecting lines • Describing the locus of points equidistant between two points • Constructing parallel lines • Describing the locus of points at a fixed distance from a line • Constructing geometrical shapes (*triangles, rectangles, squares, parallelogram and trapezium…)* • Constructing circumscribed	Geometrical construction and loci used in real life contexts accurately

TOPIC	SUB TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
			and inscribed circles • Describing the locus of points equidistant from a point • Proving angle properties of a circle using geometric construction • Using geometric constructions to make designs • Using ICT tools in geometrical construction and loci	
3.8 TRAVEL GRAPHS	3.8.1 Distance and velocity time graphs	3.8.1.1 Apply the concepts of distance and velocity time graphs in real life situations	• Exploring distance and velocity time graphs • Drawing distance - time graphs • Interpreting distance - time graphs • Calculating average speed, distance and time • Converting speed from one unit to another *(from km/h to m/s…)* • Drawing velocity - time graphs • Interpreting velocity - time graphs • Calculating velocity, acceleration and retardation/deceleration • Calculating the area under a velocity -time graph (*Relating* area to distance) • Relating the concept of similarities to distance and	Distance and velocity time graphs applied correctly in real life situations

TOPIC	SUB TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
			velocity time graphs • Using ICT tools in distance and velocity time graphs	
3.9. STATISTICS	3.9.1 Statistical Presentations and Measures of Dispersion	3.9.1.1 Use statistical presentations and measures of dispersion in real life situations	• Exploring methods of data presentation • Presenting data on frequency tables, histograms, line graph, bar chat and frequency polygons (*Grouped and ungrouped*) • Interpreting statistical graphs • Finding the modal and median class • Finding Mean for grouped and ungrouped data • Calculating variance and standard deviation for ungrouped and grouped data. (*Including the use of calculator*) • Constructing cumulative and relative cumulative frequency tables • Drawing cumulative and relative cumulative frequency curves • Calculating the range, inter quartile range, semi-inter quartile range and percentiles • Using Project - based activities in statistical presentations and measures of dispersion	Statistical presentations and measures of dispersion used correctly in real life situations

FORM 4

TOPIC	SUB TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
4.1. LINEAR PROGRAMMING	4.1.1 Linear Programming	4.1.1.1 Apply the concepts of Linear Programming in real life contexts	• Exploring the concepts of Linear Programming • Drawing graphs of linear equations and inequalities in one and two variables (*as a recap*) • Interpreting mathematical models • Shading the unwanted regions • Describing the wanted and unwanted region • Identifying points in the feasible region • Determining the maximum and minimum values using methods such as testing points and a search line • Using Project based activities such as designing business models, transaction applications and flow charts in linear programming	The concepts of Linear Programming applied correctly in real life contexts
4.2. VECTORS	4.2.1 Vectors in two Dimensions	4.2.1.1 Use the concepts of two dimensional vectors in real life situations	• Exploring concepts of two dimensional vectors • Distinguishing vector and scalar quantities (*direction, magnitude*) • Denoting a vector with notations; $\boldsymbol{a}$, $\underline{a}$, $\overrightarrow{AB}$, $ai + bj$ (*include the use of the Cartesian plane*) • Distinguishing position vectors from free vectors	The concepts of vectors in two dimensions used correctly in real life situations

TOPIC	SUB TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
			• Finding position vector of a point • Applying position vectors in calculations • Adding and subtracting vectors (*including directed line segments*) • Applying translations on vectors • Finding magnitude of a vector • Multiplying vectors by scalars • Finding unit vector • Using (*scalar*) product of two vectors • Using dot product to find angles between two vectors • Solving vector equation of a straight line • Determining collinearity of points and parallelism • Solving vector geometry (*Include ratio and mid-point theorems*) • Using ICT tools and Project based activities in vectors	
4.3. TRIGONOMETRY	4.3.1 Trigonometric Functions	4.3.1.1 Apply the concepts of trigonometric functions in real life contexts	• Exploring concepts of trigonometric functions • Describing the six trigonometric functions • Calculating sides and angles of a right angled triangle • Working with special angles (30^o, 45^o and 60^o) • Determining the signs of the	The concepts of trigonometric functions applied correctly in real life context

TOPIC	SUB TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
			three trigonometric ratios in the quadrants • Solving simple trigonometric equations involving the six trigonometric functions • Solving trigonometric functions involving modulus • Proving identities • Solving equations involving compound and multiple angles • Finding sides and angles of non-right angled triangles (*sine rule, cosine rule)* • Calculating area of a triangle • Drawing/sketching graphs for sine, cosine and tangent curves • Drawing/sketching graphs of sine, cosine and tangent functions of the form, bSinkA, bCos kA, bTan kA where b≠ 0. • Drawing/sketching graphs of modulus trigonometric functions • Using ICT tools and Project based activities in trigonometry such as bridge design analysis, analysing light and optics, surveying and land measurement	
4.4. EARTH GEOMETRY	4.4.1 Latitudes and Longitudes	4.4.1.1 Apply the concept of Earth Geometry in real life	• Exploring concepts of Earth Geometry	The concept of Earth Geometry applied correctly

TOPIC	SUB TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
		context.	• Identifying great circles such as the equator and all longitudes with their opposite meridians and small circles (*latitudes*) • Locating points using latitudes and longitudes • Finding the difference in latitudes and longitudes • Calculating distance along parallels of latitudes and longitudes in Kilometres and Nautical miles (*include standard units*) • Calculating the shortest distance between two points on the surface of the Earth • Calculating time difference between two given points • Calculating speed in knots • Using ICT tools to apply the concept of Earth Geometry	in real life context
4.5. GEOMETRICAL TRANSFORMATIONS	4.5.1 Isometries and non-isometries	4.5.1.1 Apply concepts of geometrical transformations in real life situations	• Exploring geometrical transformations • Using a column vector to translate an object • Reflecting geometrical shapes by way of mirror lines and matrix • Rotating geometrical shapes by way of construction and matrix • Finding the centre of rotation, direction and angle by construction and formula	The concept of geometrical transformations applied correctly in real life situations

TOPIC	SUB TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
			• Finding a matrix of rotation using different methods • Dilating objects using different methods such as construction and matrix method • Finding the centre, scale factor and dilation matrix • Stretching objects using different methods such as construction and matrix method • Finding centre, area, scale factor, invariant line and stretch matrix • Shearing objects by different methods such as construction and matrix method • Finding the shear factor, invariant line and shear matrix • Performing combined transformations on objects • Using ICT tools and Project-based activities in geometrical transformations	
4.6. CALCULUS	4.6.1. Differentiation	4.6.1.1 Use concepts of differentiation in real life situations	• Exploring concepts of differentiation. • Deriving the first principle of differentiation • Differentiating functions from first principles (*include limits*) • Finding the derivative of a polynomial using power rule,	Concepts of differentiation used correctly in real life situations

TOPIC	SUB TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
			product rule, quotient rule and chain rule • Finding the derivative of implicit functions • Finding equations of tangent and normal • Finding the second derivative to determine the nature of a stationary point (*turning points and points of inflection*) • Differentiating exponential functions. • Differentiating trigonometric functions • Calculating rates of change (*small increments, velocity and acceleration*) • Using ICT tools and Project based activities in differentiation	

TOPIC	SUB TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
	4.6.2. Integration	4.6.2.1 Apply concepts of integration in real life context	• Exploring concepts of integration. • Integrating terms with integer powers and their sum (*excluding 1/ x or* x^{-1}) • Integrating polynomials with fractional powers • Integrating functions of the form $(ax + b)^n$ where a and b are constants and n is an integer • Integrating trigonometric and exponential functions • Finding definite integrals • Finding area under a curve • Finding area bounded by a curve and a straight line • Finding area bounded by curves of polynomials • Finding volume formed when a curve is rotated through 360^o (*for both x and y axes)* • Finding area of the region under velocity and acceleration time graphs. • Solving questions involving velocity and acceleration • Using ICT tools and Project-based activities in integration	The concepts of integration applied correctly in real life context