ZIMBABWE

Ministry of Primary and Secondary Education

MATHEMATICS

SYLLABUS

2024-2030

FORMS 5 & 6

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1.0 PREAMBLE

1.1 Introduction

This syllabus is made up of three components which are Pure Mathematics, Mechanics and Statistics. It lays a foundation for further studies in Mathematics and related disciplines. The components in the syllabus integrate historical and cultural contexts, promoting a deeper understanding of the role of Mathematics in society. The syllabus provides opportunities for learners to acquire competencies in science and technology based areas. These areas are necessary for the national human capital development needs and enterprising activities in the 21st century. The learners will be assessed through School Based Continuous Assessment (SBCA) and Summative Assessment (SA).

1.2 Rationale

Mathematics is a universal language that has evolved over time, influenced by diverse cultures and civilisations. This upper secondary Mathematics syllabus aims to connect learners with the rich heritage of mathematical discoveries, highlighting the contributions of ancient African and Zimbabwean cultures. The thrust of the combination of the three mathematical components (Pure Mathematics, Mechanics and Statistics) is to enhance creativity and innovation to undertake technologically and industrially related scientific research and careers such as architecture and engineering, banking and finance, actuarial science, education, medicine, agriculture, meteorology, entrepreneurship among others.

The teaching and learning process in Mathematics at the Form 5 and 6 level is also expected to develop critical thinking and problem-solving skills through explorations of historical and cultural context. This will help to foster appreciation of the multicultural origins of mathematical concepts, enhance understanding of upper secondary level mathematics and encourage interdisciplinary connections between science, technology, engineering and arts. Furthermore, the syllabus emphasises Indigenous Knowledge Systems (IKS) in concept development and contribute positively to Unhu/Ubuntu/Vumunhu through its insistence on integrity and honesty.

1.3 Summary of Content

The syllabus is designed to cover Forms 5-6 Pure Mathematics, Statistics and Mechanics components. It addresses both theory and practical activities. Combining Pure Mathematics, Statistics and Mechanics in this syllabus enhances learners' mathematical skills and also prepares them for real-world applications. This inter-disciplinary approach fosters a deeper understanding of how mathematical theories can be applied to interpret data and solve problems, thus ultimately equipping learners for future challenges in various fields. Learners' performance will be evaluated through Continuous and Summative Assessment.

1.4 Assumptions

The syllabus assumes that the learner has:

- Passed Lower Secondary level Mathematics Syllabus B
- Interest in studying Mathematics at Upper Secondary level

1.5 Cross Cutting Themes

The following are some of the cross-cutting themes in the teaching and learning of Mathematics;

- Health and wellbeing
- Disaster Risk Management
- Climate Change
- Gender equality
- ICT
- Business Enterprise Skills
- Environmental management

2.0 PRESENTATION OF THE SYLLABUS

This syllabus is a single document covering form 5-6 Mathematics. It contains the preamble, aims, objectives, methodology and time allocation, syllabus topics, scope and sequence, competence matrix and assessment procedures.

3.0 AIMS

This syllabus is intended to provide a guideline for Forms 5 - 6 learners which will enable them to:

3.1 develop mathematical knowledge and skills in a way that promote fulfilment and enjoyment and lays a firm foundation for further studies and lifelong learning
3.2 acquire enterprising skills through mathematical modelling, research and project based learning
3.3 develop the abilities to reason logically, communicate mathematically, and learn co-operatively and independently
3.4 understand the nature of Mathematics and its relationship to Science, Technology, Engineering and Arts
3.5 develop an appreciation for and ability to use I.C.T tools in solving problems in mathematics and related disciplines
3.6 develop an appreciation of the role of mathematics in personal, community and national development in line with Unhu/Ubuntu/Vumunhu
3.7 use mathematical problem solving skills and research to explore their history and culture and exploit their heritage

4.0 SYLLABUS OBJECTIVES

Learners should be able to:

4.1 explore the beauty, complexity and application of mathematical concepts
4.2 develop a deep appreciation and enjoyment of Mathematics
4.3 use mathematical skills and techniques that are necessary for further studies
4.4 use mathematical models and techniques to solve problems in life and for sustainable development
4.5 choose strategies to construct arguments and proof in both concrete and abstract settings
4.6 construct arguments through appropriate use of precise statements and logical deduction
4.7 apply mathematical skills and techniques in Science, Technology, Engineering and Arts
4.8 use I.C.T tools in solving problems in mathematics
4.9 exhibit intellectual honesty in performing mathematical tasks in the spirit of Unhu/Ubuntu/Vumunhu
4.10 present data through appropriate representations
4.11 draw inferences through correct manipulation of data

5.0 METHODOLOGY AND TIME ALLOCATION

5.1 Methodology

It is recommended that teachers use techniques in which mathematics is seen as a process which arouse interest and confidence in solving problems in both familiar and unfamiliar contexts. The teaching and learning of mathematics must be learner centred, applying multi-sensory principles.

The following are suggested methods of the teaching and learning of mathematics:

- Guided discovery
- Discussion
- e-learning
- Exposition
- Demonstration and illustration
- Problem solving
- Individualisation
- Simulation
- Visual-tactile
- Educational tours
- Expert guest presentation

- Project based learning
- Scaffolding

5.2 Time Allocation

10 periods of 40 minutes each per week should be allocated for the coverage of the syllabus.

6.0 SYLLABUS TOPICS

The following topics will be covered from Form 5 to 6

Component 1 (Pure Mathematics)

6.1 Algebra
6.2 Geometry and Vectors
6.3 Series and Sequences
6.4 Trigonometry
6.5 Calculus
6.6 Numerical methods
6.7 Complex numbers

Component 2 (Mechanics)

6.8 Vectors
6.9 Forces and equilibrium
6.10 Kinematics of motion in a straight line
6.11 Newton's Laws of motion
6.12 Motion of a projectile

Component 3 (Statistics)

6.13 Representation of data
6.14 Probability
6.15 Discrete random variables
6.16 Continuous random variables

7 SCOPE AND SEQUENCE

COMPONENT 1: PURE MATHEMATICS

7.1 TOPIC 1: Algebra

FORM 5	FORM 6
• Indices , Surds and Proportionality • Polynomials	

• Identities, equations and inequalities • Relations and functions • Matrices	

7.2 TOPIC 2: Geometry and Vectors

FORM 5	FORM 6
• Graphs and coordinate geometry • Vectors (up to three dimensions)	

7.3 TOPIC 3: Sequences and Series

FORM 5	FORM 6
• Sequences • Series	

7.4 TOPIC 4: Trigonometry

FORM 5	FORM 6
• Plane trigonometry • Trigonometrical functions	

7.5 TOPIC 5: Calculus

FORM 5	FORM 6
• Differentiation • Integration • 1st order differential equations	

7.6 TOPIC 6: Numerical methods

FORM 5	FORM 6
• Errors • Iterative methods • Newton-Raphson method • Trapezium Rule	

7.7 TOPIC 7: Complex numbers

FORM 5	FORM 6
• Complex numbers	

COMPONENT 2 (MECHANICS)

7.8 TOPIC 8: Vectors

FORM 5	FORM 6
	• Vector operations • Vector Representation • Vector Applications

7.9 TOPIC 9: Forces and Equilibrium

FORM 5	FORM 6
	• Force fundamentals • Force analysis • Equilibrium of coplanar forces

7.10 TOPIC 10: Kinematics of motion in a straight line

FORM 5	FORM 6
	• Kinematic Principles • Kinematic Analysis • Application of Kinematics of Motion in a straight line

7.11 TOPIC 11: Newton's Laws of motion

FORM 5	FORM 6
	• Newton 's laws of motion • Application of Newton's laws

7.12 TOPIC 12: Motion of a projectile

FORM 5	FORM 6
	• Projectile Motion • Projectile Motion Analysis • Projectile trajectory modelling

COMPONENT 3 (STATISTICS)

7.13 TOPIC 13: Representation of data

FORM 5	FORM 6
	• Data collection • Data Presentation • Measures of central tendency (grouped and ungrouped data) • Measures of Dispersion (grouped and ungrouped data)

7.14 TOPIC 14: Probability

FORM 5	FORM 6
	• Probability Fundamentals • Types of events • Probability tools • Conditional Probability

7.15 TOPIC 15: Discrete random variables

FORM 5	FORM 6
	• Discrete Random Variables • Special Discrete Probability Distributions

7.16 TOPIC 16: Continuous random variables

FORM 5	FORM 6
	• Continuous Random Variables • Special Continuous Probability Distribution (Normal Distribution)

8 COMPETENCY MATRIX

8.1 FORM 5

8.1.1 TOPIC 1: Algebra

SUB TOPIC	OBJECTIVES Pupils should be able to:	CONTENT (Skills, attitudes, values and knowledge)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
Indices, Surds and Proportionality	• state the laws of indices • use the laws of indices to solve problems • simplify surds • solve equations involving surds • solve problems involving proportionality	• Laws of indices • Disguised quadratic equations • Simultaneous equations • Surds • Types of Variation: -Direct -Inverse -Joint -Partial	• Discussing the laws of indices • Solving equations involving indices • Simplifying surds • Solving equations involving surds • Modelling situations involving variations	• ICT tools • Relevant texts • Braille materials • Environment
Polynomials	• carry out polynomial operations • use the Remainder and Factor theorems to find the unknown constants • complete the square of a quadratic polynomial • sketch the graph of a quadratic function	• Addition, subtraction, multiplication and division of polynomials • Remainder theorem • Factor theorem • Quadratic function • Quadratic equation	• Carrying out polynomial operations • Applying remainder and factor theorems • Completing the square of a quadratic polynomial	• ICT tools • Talking books • Relevant texts • Braille materials • Environment

SUB TOPIC	OBJECTIVES Pupils should be able to:	CONTENT (Skills, attitudes, values and knowledge)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
	• use the discriminant of a quadratic expression to determine the nature and number of roots		• Sketching graphs of quadratic functions • Solving quadratic equations	
Identities, equations and inequalities	• distinguish between identity, equation and inequality • find the unknown constants using polynomial identities • solve simultaneous equations involving one linear and one quadratic • solve inequalities • decompose rational polynomials into partial fractions	• Identity • Simultaneous equations involving one linear and one quadratic • Quadratic, cubic and rational inequalities • Partial fractions	• Discussing differences between identity, equation and inequality • Balancing a polynomial identity • Solving simultaneous equations • Solving inequalities • Expressing rational fractions into partial fractions	• ICT tools • Talking books • Relevant texts • Braille materials • Environment
Relations and Functions	• define a relation, domain and range • describe the types of relations • define a function as a mapping • sketch simple graphs of functions for a given domain • find the inverse of a function • illustrate in graphical terms the relationship between a function and its inverse • find the composite functions	• Relation • Domain and range • Types of relations • Inverse function • Composite function • Logarithmic function • Exponential function • Exponential growth and decay • Modulus function(absolute value)	• Discussing relation, Domain and range • Describing types of relations • Defining a function as a mapping • Sketching simple graphs for a given domain • Finding the inverse of a function • Determining composite functions	• ICT tools • Talking books • Relevant texts • Braille materials • Environment

SUB TOPIC	OBJECTIVES Pupils should be able to:	CONTENT (Skills, attitudes, values and knowledge)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
	• sketch the graph of a natural logarithmic function and exponential function • solve logarithmic equations • solve exponential equations • solve logarithmic inequalities • solve exponential inequalities • explain exponential growth and decay • solve exponential equations • use logarithms to transform a given relationship to a linear form • define modulus function • sketch the graph of a modulus function • solve equations involving absolute value • solve inequalities involving absolute value	• Equations involving modulus • Modulus inequalities	• Sketching the graph of natural logarithmic function • Sketching the graph of an exponential function • Solving logarithmic and exponential equations and inequalities • Explaining exponential growth and decay • Reducing non-linear relationship to linear form • Defining the modulus function • Sketching graphs of the modulus functions • Solving equations and inequalities involving the absolute value	
Matrices (up to order 3)	• outline types of matrices • carry out basic operations with matrices • calculate the determinant of a square matrix	• Types of matrices • Basic operations • Determinant and inverse	• Discussing null, identity, singular and non-singular matrices	• ICT tools • Talking books • Relevant texts • Braille materials • Environment

SUB TOPIC	OBJECTIVES Pupils should be able to:	CONTENT (Skills, attitudes, values and knowledge)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
	• find inverse of a 3x3 non-singular matrix • apply the result $(AB)^{-1} = B^{-1}A^{-1}$ • solve simultaneous equations in three variables using matrix method	• System of linear equations	• Adding, subtracting and multiplying matrices • Calculating the determinant of a square matrix (up to 3x3 matrix) • Finding inverse of a 3x3 non-singular matrix • Using the result $(AB)^{-1} = B^{-1}A^{-1}$ to solve problems • Solving simultaneous equations in three variables using matrix method	

8.1.2 TOPIC 2: Geometry and Vectors

SUB TOPIC	OBJECTIVES Pupils should be able to:	CONTENT (Skills, attitudes, values and knowledge)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
Graphs and Coordinate geometry	• sketch graphs of the form y = f (x), where $f(x) = kx^n$ and $n = \frac{1}{2}$ or n is an integer, and where f(x) is a quadratic or cubic polynomial • locate solutions of equations using sketches of graphs • find equations of parallel and perpendicular straight lines • calculate the distance between two points • reduce an equation to appropriate linear form in solving problems (such as $y = ax^2 + b$ when *y* is plotted against x^2) • find the equation of a circle • solve problems involving equation of a circle • define a curve using parametric equation	• Curve sketching • Coordinate geometry • Equation of a circle • Parametric equations	• Sketching graphs of the form y = f (x), where $f(x) = kx^n$ and $n = \frac{1}{2}$ or n is an integer, and where f(x) is a quadratic or cubic polynomial • Exploring solutions of equations by sketching graphs • Finding equations of parallel and perpendicular lines • Computing the distance between two points (including perpendicular distance of a point from a straight line) • reduce an equation to appropriate linear form in solving problems (such as $y = ax^2 + b$ when y is plotted against x^2) • finding equation of a circle	• ICT tools • Braille materials and equipment • Talking books or software • Relevant texts

SUB TOPIC	OBJECTIVES Pupils should be able to:	CONTENT (Skills, attitudes, values and knowledge)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
			• solving problems involving equation of a circle • Defining a curve using parametric equations	
Vectors (up to three dimensions)	• define position and free vector • carry out addition, subtraction and scalar multiplication of vectors • use unit, displacement and position vector to solve problems • use dot product to find the angle between two vectors • find vector equation of a straight line • find vector equation of a plane	• Vector notation • Vector operations • Types of vectors • Dot product • Angle between two vectors • Vector equation of a line • Vector equation of a plane	• Discussing the use of position and free vectors in life • Carrying out vector operations • Using unit, displacement and position vectors to solve problems • Using dot product to find the angle between two vectors • Finding vector equation of a straight line • Finding vector equation of a plane	• ICT tools • Braille materials and equipment • Talking books or software • Relevant texts

8.1.3 TOPIC 3: Series and Sequences

SUB TOPIC	OBJECTIVES Pupils should be able to:	CONTENT (Skills, attitudes, values and knowledge)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
Sequences	• define a sequence • use sequence definitions such as Un = n^2 and Un+1 = 2Un to calculate successive terms • distinguish among constant, periodic, oscillating, converging, and diverging sequences • define arithmetic and geometric progressions • find the general term of a progression • solve problems involving sequences	• Sequences • Arithmetic and geometric progressions	• Discussing the meaning and value of sequences in life • Calculating successive terms using sequence definition such as Un = n^2 and Un+1 = 2Un • Discussing the behaviour of constant, periodic, oscillating, converging, and diverging sequences • Discussing examples of arithmetic and geometric progressions • Finding the	• ICT tools • Braille materials and equipment • Talking books or software • Relevant texts

SUB TOPIC	OBJECTIVES Pupils should be able to:	CONTENT (Skills, attitudes, values and knowledge)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
			general terms and other terms of arithmetic and geometric progressions • Representing life phenomena using mathematical models involving sequences and exploring their applications in life	
Series	• use Σ, n! and $\binom{n}{r}$ notation • find the sum of given arithmetic and geometric terms • find sum to infinity of given converging geometric series • expand expressions of $(a + b)^n$ where n is a	• Σ, n! and $\binom{n}{r}$ notation • Arithmetic and geometric progressions • Binomial expansion	• Using the,Σ, n! and notation to solve problems • Computing the sum of given arithmetic and geometric terms • Finding sum to infinity of given converging	• ICT tools • Braille materials and equipment • Talking books or software • Relevant texts • Environment

SUB TOPIC	OBJECTIVES Pupils should be able to:	CONTENT (Skills, attitudes, values and knowledge)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
	positive integer, and of $(1 + x)^n$, where n is a rational number and $\|x\| < 1$ • solve problems involving series • use standard results for Σr, Σr^2 and Σr^3 to find related sums • use Maclaurin's • series for approximation • solve problems involving Maclaurin's series	• Standard results • Maclaurin's series	geometric series • Expanding expressions of $(a + b)^n$ where n is a positive integer, and of $(1 + x)^n$, where n is a rational number and $\|x\| < 1$ • Representing life phenomena using mathematical models involving series and exploring their applications in life • Finding related sums using standard results for Σr, Σr^2 and Σr^3 • Using Maclaurin's series for approximation • Solving problems	

SUB TOPIC	OBJECTIVES Pupils should be able to:	CONTENT (Skills, attitudes, values and knowledge)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
			involving Maclaurin's series • Representing life phenomena using mathematical models involving series and exploring their applications in life	

8.1.4 TOPIC 4: Trigonometry

SUB TOPIC	OBJECTIVES Pupils should be able to:	CONTENT (Skills, attitudes, values and knowledge)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
Plane **Trigonometry**	• define a radian • convert degrees to radians and vice versa • calculate the length of an arc • find the area of a sector • solve problems involving lengths of arcs, areas of sectors and segments • use small angle approximation for sin x, cos x and tan x	• Degrees and radians • Length of arc • Area of sector • Area of segment	• Discussing the concept of degrees and radians, their relationships and the significance of using radians • Deriving and using the formulae for length of an arc and the area of a sector • Solving problems involving lengths of arcs, areas of	• ICT tools • Braille materials and equipment • Talking books or software • Relevant texts

SUB TOPIC	OBJECTIVES Pupils should be able to:	CONTENT (Skills, attitudes, values and knowledge)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
			sectors and segments • Using small angle approximation for sin x, cos x and tan x	
Trigonometrical Functions	• sketch the graphs of trigonometrical functions • transform the graphs of trigonometrical functions • solve trigonometrical equations • prove trigonometrical identities • solve problems using trigonometrical identities	• Graphs of Trigonometrical functions (sin x, cos x, tan x and their reciprocals) • Trigonometrical equations • Trigonometrical identities (**excluding half angle identities**)	• Sketching and transforming the graphs of trigonometrical functions • Finding solutions of trigonometrical equations • Proving trigonometrical identities • Solving problems involving trigonometrical identities • Representing life phenomena using mathematical models involving trigonometrical functions and exploring their applications in life	• ICT tools • Braille materials and equipment • Talking books or software • Relevant texts

SUB TOPIC	OBJECTIVES Pupils should be able to:	CONTENT (Skills, attitudes, values and knowledge)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES

8.1.5 TOPIC 5: Calculus

SUB TOPIC	OBJECTIVES Pupils should be able to:	CONTENT (Skills, attitudes, values and knowledge)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
Differentiation	• differentiate polynomials from first principles • differentiate polynomials, rational functions, natural logarithms, exponentials and trigonometrical functions • differentiate products and quotients • carry out differentiation of parametric and implicit functions • locate stationary points and determine their nature • solve problems involving differentiation	• First principles differentiation of polynomials • Polynomials, rational functions, natural logarithms, exponentials, trigonometrical functions • Products and quotients • Parametric equations • Implicit functions • Gradient, tangents, normal, rates of change and stationary points	• Differentiating polynomials from first principles • Differentiating polynomials, rational functions, natural logarithms, exponentials and trigonometrical functions • Differentiating products and quotients • Carrying out differentiation of parametric and implicit functions • Locating stationary points and	• ICT tools • Braille materials and equipment • Talking books or software • Relevant texts

SUB TOPIC	OBJECTIVES Pupils should be able to:	CONTENT (Skills, attitudes, values and knowledge)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
			determining their nature • Solving problems involving differentiation • Representing life phenomena using mathematical models involving differentiation and exploring their applications in life	

Integration	• integrate polynomials, rational functions, exponential functions and trigonometrical functions • integrate by recognition, by substitution and by parts • evaluate definite integrals of polynomials, rational functions, exponential functions and trigonometrical functions • apply integration to find areas and volumes	• Polynomials • Rational functions • Exponential functions (e^{ax+b}) • Trigonometrical functions **(excluding hyperbolic functions)** • Integration by recognition • Integration by substitution • Integration by parts **(including natural logarithmic functions)** • Polynomials • Rational functions • Exponential functions • Trigonometrical functions **(excluding hyperbolic functions)** • Application of integration to areas and volumes	• Finding Integrals of polynomials, rational functions, exponential functions and trigonometrical functions • Discussing integration by recognition • Integrating by substitution • Performing integration by parts • Evaluating definite integrals of polynomials, rational functions, exponential functions and trigonometrical functions • Applying integration to find areas and volumes • Representing life phenomena using mathematical models involving integration and exploring their application in life	• ICT tools • Braille materials and equipment • Environment • Relevant texts

SUB TOPIC	OBJECTIVES Pupils should be able to:	CONTENT (Skills, attitudes, values and knowledge)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
1st Order Differential Equations	• formulate a statement involving a rate of change as a differential equation • find the general solution of a differential equation where variables are separable • find a particular solution of a differential equation given initial conditions • solve problems involving 1st order differential equations with separable variables	• Rates of change • Separation of Variables • General solution • Particular solution	• Formulating statements involving rates of change as differential equations • Finding the general solution of a differential equation where variables are separable • Finding particular solutions of differential equations given initial conditions • Solving problems involving 1st order differential equations with separable variables	• ICT tools • Braille materials and equipment • Talking books or software • Relevant texts

8.1.6 TOPIC 6: Numerical Methods

SUB TOPIC	OBJECTIVES Pupils should be able to:	CONTENT (Skills, attitudes, values and knowledge)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
Errors	• define error • distinguish between absolute error and relative error • estimate errors in calculation including the use of $\delta y \approx \frac{dy}{dx}\delta x$	• Absolute error • Relative error	• Defining error • Distinguishing between absolute error and relative error • Estimating errors in calculations including the use of $\delta y \approx \frac{dy}{dx}\delta x$	• ICT tools • Environment • Braille materials and equipment • Talking books • Relevant texts
Iterative methods	• locate the root of an equation by graphical means or sign change • solve equations using iterative procedure • find an equation given an iterative formula	• Iterative methods	• Approximating the root of an equation by graphical means or sign change • Deriving an iterative formula for solving a given equation • Solving equations using iterative procedure • finding an equation given an iterative formula • Recognising cases where the iterative method may fail to	• ICT tools • Environment • Braille materials and equipment • Talking books • Relevant texts

SUB TOPIC	OBJECTIVES Pupils should be able to:	CONTENT (Skills, attitudes, values and knowledge)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
			converge to the required root	
Newton - Raphson	• solve equations using the Newton –Raphson method	• Newton – Raphson method	• Deriving the Newton – Raphson formula • Solving equations using the Newton– Raphson method • Solving problems using iterative procedures in determining the root	• ICT tools • Environment • Braille materials and equipment • Talking books • Relevant texts
Trapezium Rule	• estimate the area under a curve using the trapezium rule • solve problems using the trapezium rule	• Trapezium rule	• Deriving the trapezium rule • Estimating the area under a curve using the trapezium rule	• ICT tools • Environment • Braille materials and equipment • Talking books • Relevant texts

8.1.7 TOPIC 7: Complex numbers

SUB TOPIC	OBJECTIVES Pupils should be able to:	CONTENT (Skills, attitudes, values and knowledge)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
Complex Numbers	• define a complex number • find the modulus, argument and conjugate of a complex number • represent a complex number on the Argand diagram • carry out operations with complex numbers • solve polynomial equations with at least one pair of non-real roots • convert a complex number from one form to another • solve equations using the De-Moivre's theorem	• Complex numbers • Conjugate • Modulus and argument • Argand diagram • Addition, subtraction, multiplication, division and realisation of complex numbers • Equations (up to order 5) • Ordinary form • Polar form • Exponential form • De-Moivre's theorem	• Defining a complex number • Solving polynomial equations with at least one pair of non-real roots • Converting a complex number from one form to another • Dividing and multiplying complex numbers expressed in polar form • Solving equations using the De-Moivre's theorem	• Relevant texts • ICT tools • Braille material and equipment • Environment • Talking books

COMPETENCY MATRIX

8.2 FORM 6
MECHANICS

8.2.8 TOPIC 8: Vectors

SUB TOPIC	OBJECTIVES Pupils should be able to:	CONTENT (Skills, attitudes, values and knowledge)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
Vector Operations	• carry out vector operations • resolve vectors • find the resultant vectors • find the moment of a force • solve problems involving the moment of a force	• Triangle law for vectors • Resolution • Resultant vector • Moment of a force • Resultant moment	• Carrying out vector operations • Resolving vectors • Finding the resultant vectors • Finding the moment of a force • Solving problems involving the moment of a force	• ICT tools • Braille materials and equipment • Relevant texts
Vector Representation	• use Cartesian unit vectors, position vectors and displacement vectors to solve problems • find the vector equation of a line • find the vector equation of the path of a moving particle	• Cartesian unit vector • Position vector • Vector equation of a line • Vector equation of the path of a moving particle	• Using Cartesian unit vectors, position vectors and displacement vectors to solve problems • Finding the vector equation of a line	• ICT tools • Braille materials and equipment • Relevant texts

SUB TOPIC	OBJECTIVES Pupils should be able to:	CONTENT (Skills, attitudes, values and knowledge)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
			• Finding the vector equation of the path of a moving particle	
Vector Application	• determine the point of intersection of two vectors • find the position vector of the point of intersection of two lines	• Position vector of the point of intersection of two lines	• Determining the point of intersection of two vectors • Finding the position vector of the point of intersection of two lines	• ICT tools • Braille materials and equipment • Talking books or software • Relevant texts

8.2.9 TOPIC 9: Forces and equilibrium

SUB TOPIC	OBJECTIVES Pupils should be able to:	CONTENT (Skills, attitudes, values and knowledge)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
Force Fundamentals	• define a force • identify the forces acting on a body in a given situation • represent forces by vectors	• Definition of a force • Types of forces • Representation of force by vectors	• Defining a force • Identifying the forces acting on a body in a given situation • Representing forces by vectors	• ICT tools • Geo-board • Environment • Relevant texts • Braille materials
Force Analysis	• find resultants and components of vectors	• Resultant and components	• Finding resultants and components of vectors	• ICT tools • Geo-board • Environment

SUB TOPIC	OBJECTIVES Pupils should be able to:	CONTENT (Skills, attitudes, values and knowledge)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
	• use resultants and components of vectors to formulate equations	• Composition and resolutions	• Using resultants and components of vectors to formulate equations	• Relevant texts • Talking books • Braille materials
Equilibrium of coplanar forces	• represent a contact force between two surfaces by two components: the normal and frictional forces • calculate friction • solve problems involving the equilibrium of a single rigid body under the action of coplanar forces	• Equilibrium of a particle • Friction	• Representing a contact force between two surfaces by two components: the normal and frictional forces • Calculating friction • Solving problems involving the equilibrium of a single rigid body under the action of coplanar forces	• ICT tools • Geo-board • Environment • Relevant texts • Talking books • Braille materials

8.2.10 TOPIC 10: Kinematics of motion in a straight line

SUB TOPIC	OBJECTIVES Pupils should be able to:	CONTENT (Skills, attitudes, values and knowledge)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
Kinematic Principles	• define distance(x) displacement(s), speed, velocity(v) and acceleration(a)	• Motion in a straight line • Velocity • Acceleration	• Defining distance(x) displacement(s), speed, velocity(v) and acceleration(a)	• ICT tools • Geo-board • Environment • Relevant texts • Talking books • Braille materials
Kinematic Analysis	• use differentiation and integration with respect to time to solve simple problems concerning displacement, velocity and acceleration • sketch the graphs of: ➢ (x-t) ➢ (s-t) ➢ (v-t) ➢ (a-t) • interpret the (x-t), (s-t), (v-t) and (a-t) graphs • derive the equations of motion of a particle with constant acceleration in a straight line	• Displacement – time and velocity time graphs • Equation of motion for constant linear acceleration	• Using differentiation and integration with respect to time to solve simple problems concerning displacement, velocity and acceleration • Sketching the graphs of: ➢ (x-t) ➢ (s-t) ➢ (v-t) ➢ (a-t) • Interpreting the (x-t), (s-t), (v-t) and (a-t) graphs	• ICT tools • Geo-board • Environment • Relevant texts • Talking books • Braille materials

SUB TOPIC	OBJECTIVES Pupils should be able to:	CONTENT (Skills, attitudes, values and knowledge)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
			• Deriving the equations of motion of a particle with constant acceleration in a straight line	
Application of Kinematics of Motion in a straight line	• use the equations of motion of a particle with constant acceleration in a straight line to solve kinematics problems	• Vertical motion under gravity • Motion with constant velocity	• Using the equations of motion of a particle with constant acceleration in a straight line to solve kinematics problems	• ICT tools • Geo-board • Environment • Relevant texts • Talking books • Braille materials

8.2.11 TOPIC 11: Newton's Laws of motion

SUB TOPIC	OBJECTIVES Pupils should be able to:	CONTENT (Skills, attitudes, values and knowledge)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
Newton's Laws of motion	• state Newton's laws of motion • apply Newton's laws of motion to solve problems involving linear motion of a body of constant mass moving under the action of constant forces	• Newton 's laws of motion • Motion caused by a set of forces	• Discussing Newton's laws of motion • Applying Newton's laws of motion to solve problems involving linear motion of a body of	• ICT tools, • Relevant texts • Braille material and equipment • Environment • Pulley systems

SUB TOPIC	OBJECTIVES Pupils should be able to:	CONTENT (Skills, attitudes, values and knowledge)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
			constant mass moving under the action of constant forces	
Application of Newton's Laws	• solve problems using the relationship between mass and weight • solve problems involving the motion of two particles, connected by a light inextensible string which may pass over a fixed, smooth, light pulley or peg • model the motion of a body moving vertically or on an inclined plane as motion with constant acceleration	• Concept of mass and weight • Motion of connected objects	• Solving problems using the relationship between mass and weight • Solving problems involving the motion of two particles, connected by a light inextensible string which may pass over a fixed, smooth, light pulley or peg • Modelling the motion of a body moving vertically or on an inclined plane as motion with constant acceleration	• ICT tools, • Relevant texts • Braille material and equipment • Environment • Pulley systems

8.2.12 TOPIC 12: Motion of a projectile

SUB TOPIC	OBJECTIVES Pupils should be able to:	CONTENT (Skills, attitudes, values and knowledge)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
• Projectile Motion	• define projectile motion • model the motion of a projectile as a particle moving with constant acceleration • explain the relationship between velocity and displacement in projectile motion	• Motion of a projectile • Velocity and displacement	• Defining key concepts of a projectile • Explaining the concept of projectile motion • Modelling the motion of a projectile as a particle moving with constant acceleration • Explaining the relationship between velocity and displacement in projectile motion	• Relevant texts • ICT tools • Environment • Braille material and equipment
• Projectile Motion Analysis	• find the magnitude and direction of velocity of a particle at a given time and position • solve problems involving range on horizontal plane	• Range on horizontal plane • Greatest height • Maximum range	• Finding the magnitude and direction of velocity of a particle at a given time and position	• Relevant texts • ICT tools • Environment • Braille material and equipment • Bouncing ball • Stroboscope

SUB TOPIC	OBJECTIVES Pupils should be able to:	CONTENT (Skills, attitudes, values and knowledge)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
	• determine the displacement (range and maximum height) of a projectile		• Solving problems involving range on a horizontal plane • Applying horizontal and vertical equations of motion in solving problems on the motion of a projectile • Deriving formulae for greatest height and maximum range	
• Projectile trajectory modelling	• derive the Cartesian equation of a trajectory of a projectile • solve problems involving projectile motion using the Cartesian equation	• Cartesian equation of a trajectory of a projectile	• Discussing the interdependence of velocity and displacement in determining a projectile's path • Deriving the Cartesian equation of a trajectory of a projectile • Solving problems using Cartesian equation of a trajectory of a projectile	• Relevant texts • ICT tools • Environment • Braille material and equipment • Tennis ball

STATISTICS

8.2.13 TOPIC 13: Representation of data

SUB TOPIC	OBJECTIVES Pupils should be able to:	CONTENT (Skills, attitudes, values and knowledge)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
Data collection	• describe the different methods of data collection • design data collection instruments • gather data using appropriate method	• Data collection methods • Data collection instruments • Data types	• Discussing different methods of collecting data • Designing data collecting instruments • Collecting data using designed instruments • Conducting field trips to collect data	• ICT tools • Environment • Relevant texts • Braille materials and equipment • Indigenous Knowledge Systems (IKS) • Data collection instruments
Data presentation	• organise data into tabular or diagrammatic form • construct statistical graphs and charts • interpret statistical graphs and charts • outline advantages and disadvantages of data presentation methods	• Histograms • Stem and leaf diagrams • Box and whisker diagrams • Cumulative frequency curve	• Discussing data presentation methods • Categorizing data into tabular or diagrammatic form • Drawing statistical graphs and charts • Interpreting statistical graphs and charts	• ICT tools • Environment • Relevant texts • Braille materials and Equipment

SUB TOPIC	OBJECTIVES Pupils should be able to:	CONTENT (Skills, attitudes, values and knowledge)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
Measures of central tendency (Grouped and ungrouped data)	• define the measures of central tendency • Calculate the measures of central tendency • Interpret the measures of central tendency • apply the measures of central tendency in solving problems	• Mean, mode and median	• Discussing the measures of central tendency • Explaining the advantages and disadvantages of the measures of central tendency • Computing the measures of central tendency • Solving problems involving measures of central tendency	• ICT tools • Environment • Relevant texts • Braille materials and equipment
Measures of dispersion (Grouped and ungrouped data)	• define the measures of dispersion • calculate the measures of dispersion • interpret the measures of dispersion • apply the measures of dispersion in solving problems	• Range • Quartiles and percentiles • Variance and Standard deviation	• Discussing the measures of dispersion • Explaining the advantages and disadvantages of the measures of dispersion • Computing the measures of dispersion • Solving problems involving the measures of dispersion	• ICT tools • Environment • Relevant texts • Braille materials and equipment

8.2.14 TOPIC 14: Probability

SUB TOPIC	OBJECTIVES Pupils should be able to:	CONTENT (Skills, attitudes, values and knowledge)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
Probability fundamentals	• define probability key terms	• Probability key terms	• Explaining the meanings of probability key terms • Discussing the importance of probability in life	• ICT tools • Environment • Relevant texts • Braille materials and equipment
Types of Events	• calculate probabilities of combined events	• Independent • Mutually exclusive • Exhaustive	• Computing probabilities of a variety of events	• ICT tools • Environment • Relevant texts • Braille materials and equipment
Probability Tools	• use Venn diagrams to solve problems • use outcome tables to solve problems • use tree diagrams to solve problems	• Venn diagrams • Outcome tables • Tree diagrams	• Solving problems using Venn diagrams • Solving problems using outcome tables • Solving problems using tree diagrams	• ICT tools • Environment • Relevant texts • Braille materials and equipment
Conditional Probability	• solve problems involving conditional probability	• Conditional probability (excluding Bayes' theorem)	• Applying conditional probability concepts in solving problems	• ICT tools • Environment • Relevant texts • Braille materials and equipment

8.2.15 TOPIC 15: Discrete random variables

SUB TOPIC	OBJECTIVES Pupils should be able to:	CONTENT (Skills, attitudes, values and knowledge)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
Discrete random variables	• define a discrete random variable • construct a discrete probability distribution table • define expectation, variance and standard deviation • calculate expectation, variance and standard deviation • find the probabilities of a discrete random variable	• Discrete random variable • Discrete probability distributions • Expectation • Variance • Standard deviation	• Discussing discrete random variables • Constructing a probability distribution table • Defining expectation, variance and standard deviation • Calculating expectation, variance and standard deviation • Finding the probabilities of a discrete random variable	• ICT tools • Environment • Relevant texts • Braille materials and equipment
Special discrete probability distributions	• outline the characteristics of each distribution • calculate expectation, variance and standard deviation for each distribution • find the probabilities for each distribution	• Uniform • Binomial • Geometric • Poisson	• Discussing the characteristics of each distribution • Calculating expectation, variance and standard deviation for each distribution • Finding the probabilities for each distribution	• ICT tools • Environment • Relevant texts • Braille materials and equipment

8.2.16 TOPIC 16: Continuous Random Variables

SUB TOPIC	OBJECTIVES Pupils should be able to:	CONTENT (Skills, attitudes, values and knowledge)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
Continuous Random Variables	• use the probability density functions and cumulative distribution functions to calculate probabilities • calculate mean, mode and median • compute quartiles and percentiles • calculate variance and standard deviation • solve problems involving probability density function and cumulative distribution function	• Probability density function (pdf) • Cumulative distribution function (cdf) • Mean, mode, median • Quartiles and percentiles • Variance and standard deviation	• Discussing the difference between a discrete random variable and a continuous random variable • Discussing the significance of probability density function and cumulative distribution function of a continuous random variable • Computing probabilities using both pdf and cdf • Calculating mean, mode, median, quartiles and percentiles, variance and standard deviation • Solving problems involving pdf and cdf	• ICT tools • Environment • Relevant texts • Braille materials and equipment
Special Continuous	• explain the characteristics of a normal distribution curve	• Normal distribution	• Discussing the characteristics of a	• ICT tools • Environment

SUB TOPIC	OBJECTIVES Pupils should be able to:	CONTENT (Skills, attitudes, values and knowledge)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
Probability Distribution (Normal Distribution)	• standardize a random variable • use the standard normal tables to obtain probabilities • approximate the binomial distribution using the normal distribution • use a normal distribution to solve life problems	• Standard normal table • Continuity correction • Normal distribution approximation to binomial distribution	normal distribution curve, giving life examples • Standardizing random variables • Obtaining probabilities using standard normal tables • Approximating the binomial using the normal distribution	• Relevant texts • Braille materials and equipment

9.0 ASSESSMENT

Mathematics learning area at upper secondary level (Form 5-6) shall be assessed through School Based Continuous Assessment (SBCA) and Summative Assessment (SA). These assessments shall be guided by the principles of inclusivity, practicability, authenticity, transparency, flexibility, validity and reliability. These principles are crucial for creating a supportive and effective learning environment that fosters growth and development in learners at upper secondary level. In addition to SBCA and SA those aspects that cannot be assessed through the continuous and summative modes will be assessed through learner profiling. The aspect to be profiled will include soft skills among others. Arrangements, accommodations and modifications must be visible to enable candidates with special needs to access assessments. This section covers the assessment objectives, the assessment model, the scheme of assessment, and the specifications for continuous assessment.

9.1 Assessment Objectives

Learners will be assessed on their ability to: -

9.1.1use mathematical symbols, terms and definitions appropriately

9.1.2 sketch and interpret graphs accurately

9.1.3 employ appropriate formulae, algorithms and strategies to solve problems in familiar and less familiar contexts

9.1.4 solve problems in Pure Mathematics, Mechanics and Statistics systematically

9.1.5 apply mathematical reasoning and communicate mathematical ideas clearly

9.1.6 conduct mathematical proofs rigorously

9.1.7 make effective use of a variety of ICT tools in solving problems

9.1.8 construct appropriate mathematical models for use in a given life situation

9.1.9 carry out research projects including those related to enterprise

9.1.10 draw inferences through correct manipulation of data.

9.1.11 utilise data correctly for planning and decision-making purposes

9.1.12 develop mathematical arguments through appropriate use of precise statements, logical deduction, inference and manipulation of mathematical expressions

9.1.13 evaluate mathematical models including an appreciation of the assumptions made and interpret, justify and present the result from a mathematical analysis in a form relevant to the original problem

9.2 Scheme of Assessment

Learners at upper secondary level will be assessed using both School Based Continuous Assessment and Summative Assessment. From form 5 - 6, learners will do a school-based project per form, per year and per learning area which will contribute 20% to the end of term and year mark. Public examination candidates at secondary level are expected to complete 2 school-based projects per learning area at form 5 and 6 level, which will contribute 20% to the final mark at form 6.

FORM OFASSESSMENT	WEIGHTING
School Based Continuous Assessment	20%
Summative Assessment	80%
Total	100%

9.3: School – Based Project: Continuous Assessment Scheme

The Table given below shows the Learning and Assessment Scheme for the School Based Project.

Project Execution Stages	Description	Timelines	Marks
1	Problem Identification	January	5
2	Investigation of related ideas to the problem/innovation	February	10
3	Generation of possible solutions	March	10
4	Selecting the most suitable solution	April-May	5
5	Refinement of selected solution	June	5
6	Presentation of the final solution	July	10
7	Evaluation of the solution and Recommendations	August-September	5
	TOTAL		**50**

The learning and assessment scheme shows the stages that shall be executed by pupils and the timeline at which each stage shall be carried out. Possible marks, totalling 50, are highlighted to indicate how much can be allocated.

9.4 Summative Assessment

Summative assessment consists of two (2) papers of equal weighting

Description of the papers
Paper 1: Pure Mathematics
Duration: 3 hours

The paper consists of two sections, Section A and Section B.

Section A (60 marks): This section consists of 15 short structured questions. Candidates are expected to answer all questions.

Section B (60 marks): This section has seven (7) long questions. Candidates are expected to answer any 5 questions each of which carries twelve (12) marks.

Paper 2: Statistics and Mechanics
Duration: 3 hours

This paper consists of three sections A, B and C. The questions are set to cover all topics in Statistics and Mechanics. Candidates are expected to answer all questions in section A and a **total** of **five** questions from sections B and C (taking **two** questions from section B and **two** questions from section C and **one** more question from either section B or C).

Section A (40 marks)
This section consists of ***ten*** short structured questions and candidates are expected to answer all questions

Mechanics **(20 marks): five** compulsory questions
Statistics **(20 marks): five** compulsory questions

Section B: Mechanics
This section has **five (5**) long questions, each carrying sixteen (16) marks. Candidates are expected to answer two or three questions

Section C: Statistics
This section has **five (5)** long questions, each carrying sixteen (16) marks. Candidates are expected to answer two or three questions.

NB: Candidates are expected to attempt five questions from sections B and C

9.5 Specification Grid

Skill	**Paper 1**	**Paper 2**
Knowledge	40%	40%
Application and Analysis	40%	40%
Problem solving	20%	20%
TOTAL	**100%**	**100%**