ZIMBABWE

MINISTRY OF PRIMARY AND SECONDARY EDUCATION

PURE MATHEMATICS SYLLABUS

FORMS 5 - 6

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  - United Nations Educational Scientific and Cultural Organisation (UNESCO)
  - Representatives from higher and tertiary educational institutions

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1.0 PREAMBLE

1.1 Introduction

In developing the Form 5 to 6 Pure Mathematics syllabus, attention was paid to the need to provide continuity of pure mathematical concepts and lay foundations for further studies. It is meant for learners who have the ability and interest in studying Pure Mathematics. The two year learning phase will provide learners with opportunities to apply pure mathematical concepts, principles and skills in other learning areas.

The intention is to provide wider opportunities for learners who wish to acquire competences in scientifically and technologically based areas required for the national human capital development needs and enterprising activities in the 21st century. In learning Pure Mathematics, learners should be helped to acquire a variety of skills, knowledge and processes, and develop a positive attitude towards the learning area. These will enhance the ability to investigate and interpret numerical and spatial relationships as well as patterns that exist in mathematics and in the world in general. The syllabus also caters for learners with diverse needs to experience Pure Mathematics as relevant and worthwhile. It also desires to produce a learner with the ability to communicate mathematical ideas and information effectively.

1.2 Rationale

Pure Mathematics is the science of abstract concepts in the context of number, time, and space. It uses logic and reasoning to construct new mathematical structures by building on existing ones, and to discover new patterns within, and relationships among mathematical structures. Pure Mathematics is underpinned in abstraction and proof. Typically, the Pure Mathematician finds joy and fulfillment in the intrinsic value of her/his constructions and discoveries, with little or no regard to their applications in life. However, examples abound of instances where Pure Mathematics discoveries initially born and existing only in the abstract, have eventually been found to have important applications in life. These life examples are in the areas of science, technology and engineering, as well as finance, banking and commerce, among others. Given the Pure Mathematician's interest and ability in abstraction and pattern discovery, such a professional is increasingly in demand in such activities as meteorology, investment forecasting, and risk analysis. Thus teaching and learning Pure Mathematics should not be construed as a luxury, but a 21st Century necessity.

The teaching and learning process in Pure Mathematics at the Form 5 and 6 levels is also expected to enhance learners' confidence and sense of self fulfillment, interconnectedness and intellectual honesty, hence contributing to their growth in the acquisition of Unhu/ Ubuntu / Vumunhu values.

1.3 Summary of Content

The syllabus will cover the theoretical and practical aspects of Pure Mathematics. The learning area will cover: algebra, geometry and calculus.

1.4 Assumptions

The syllabus assumes that the learner has:

1.4.1 passed at least one of the following at form 4: Mathematics, Pure Mathematics and Additional Mathematics
1.4.2 interest in studying Pure Mathematics form 5 - 6

1.5 Cross cutting Themes

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

1.5.1 Business and financial literacy
1.5.2 Disaster and risk management
1.5.3 Collaboration
1.5.4 Environmental issues
1.5.5 Enterprise skills
1.5.6 HIV and AIDS
1.5.7 Unhu/Ubuntu/ Vumunhu
1.5.8 ICT
1.5.9 Gender

2.0 PRESENTATION OF SYLLABUS

The Pure Mathematics syllabus is a document covering Forms 5 and 6. It contains the preamble, aims, syllabus objectives, methodology and time allocation, syllabus topics, scope and sequence, competency matrix and assessment. The syllabus also suggests a list of resources that could be used during teaching and learning process.

3.0 AIMS

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

3.1 acquire enterprising skills through modelling, research and project based learning
3.2 develop the abilities to reason logically, to communicate mathematically, and to learn co-operatively and independently
3.3 develop an appreciation of the applicability, creativity and power of pure mathematics in solving a broad range of problems
3.4 understand the nature of Pure Mathematics and its relationship to other branches of mathematics and STEM in general.
3.5 appreciate the use of ICT tools in solving pure mathematical problems
3.6 engage, persevere, collaborate and show intellectual honesty in performing tasks in Pure Mathematics, in the spirit of Unhu/ Ubuntu/Vumunhu

4.0 SYLLABUS OBJECTIVES

By the end of the two year learning period, the learners should be able to:

4.1 make use of a variety of mathematical skills (including graphing, proving, modelling, finding pattern and problem solving) in the learning and application of Pure Mathematics.
4.2 communicate pure mathematical ideas and information
4.3 produce imaginative and creative work arising from pure mathematical ideas
4.4 choose strategies to construct arguments and proofs in both concrete and abstract settings
4.5 construct and use mathematical models in solving problems in life
4.6 apply pure mathematical ideas in other branches of mathematics and STEM in general.
4.7 demonstrate perseverance, diligence, cooperation and intellectual honesty.
4.8 use ICT tools to solve pure mathematical problems.
4.9 conduct research projects including those related to enterprise

5.0 METHODOLOGY AND TIME ALLOCATION

5.1 Methodology

A constructivist based teaching and learning approach is recommended for the Form 5 and 6 Pure Mathematics Syllabus. The theoretical basis for this approach is that: in a conducive environment with appropriate stimuli, learners' capacity to build on their pre-requisite knowledge and create new mathematical knowledge is enhanced. A conducive environment in this context is one that encourages: creativity and originality; a free exchange of ideas and information; inclusivity and respect for each other's' views, regardless of personal circumstances (in terms of, for example: gender, appearance, disability and religious beliefs); collaboration and cooperation; intellectual honesty; diligence and persistence; and Unhu/ Ubuntu /Vumunhu. This is particularly important in a learning area like mathematics, given the negative attitudes associated with its teaching and learning.

Providing appropriate stimuli has to do with posing relevant challenges that excite learners, and help to make learning Pure Mathematics an enjoyable, fulfilling experience. Such challenges could be posed in the form of problems that encourage learners to create new (to them) mathematical knowledge/ideas in line with the teacher expectations and even beyond. New knowledge acquired in such a manner tends to be deep rooted and meaningful to learners, hence enhancing their ability to apply it within the learning area and in life. Definitely spoon feeding is not and cannot be an appropriate stimulus, as it does not help learners to develop critical thinking, creativity, and the ability to think outside the box, which are critical for self-reliance, national sustainable development and global competitiveness. Thus learners need to be active participants and decision makers in the pure mathematics teaching and learning process, with the teacher playing a facilitator role.
Pre-requisite knowledge and skills refers to what the learners should already know and can do, which can form a strong basis on which to construct the expected new knowledge. Thus the Pure Mathematics teacher needs to carefully analyse the new concepts and principles she/he intends to introduce, identify the relevant pre-requisite knowledge, assess to identify any gaps, and take appropriate steps to fill such gaps.
The following, is a list of teaching and learning methods that are consistent with, and supportive of the above approach:

5.1.1 Guided discovery
5.1.2 Group work
5.1.3 Interactive e-learning
5.1.4 Problem solving
5.1.5 Discussion
5.1.6 Modelling

5.2 Time Allocation

10 periods of 35 minutes each per week should be allocated. Learners are expected to participate in the following activities: -

- Mathematics Olympiads
- Mathematics and Science exhibitions
- Mathematics seminars
- Mathematical tours to tertiary and other institutions.

6.0 SYLLABUS TOPICS

The following topics will be covered from form 5 – 6:

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

7.0 SCOPE AND SEQUENCE

TOPIC 1: ALGEBRA

SUB TOPIC	FORM 5	FORM 6
Indices and proportionality	• Rational indices • General laws of indices • Direct, inverse, joint and partial variations	
Polynomials	• Polynomial operations • Quadratic operations • Factor and remainder theorems	
Identities, equations and inequalities	• Identities • Equations • Partial fractions • Inequalities	
Functions	• Logarithmic functions • Exponential functions	

	• Rational functions • Modulus functions	
Relations	• Relations • Domain, co-domain, and range • Functions • Types of functions (injective, bijective, surjective) • Inverse • Composite function	
Matrices		• Types of Matrices • Basic operation (up to 3 x 3) • Determinant and inverse • Systems of linear equations • Transformations
Mathematical induction		• Proof by Induction • Conjecture
Groups		• Binary operations • Basic properties of a group

TOPIC 2: GEOMETRY AND VECTORS

SUB TOPIC	FORM 5	FORM 6
Graphs and coordinate geometry	• Curve sketching • Coordinate geometry • Parametric equations	
Vectors (up to three dimensions)	• Vector notation • Vector operations • Types of vectors • Magnitude of a vector • Dot (scalar)product • Area of plane shapes	• Vector equation of a straight line • Equation of a plane • Cross product

TOPIC 3: SERIES AND SEQUENCES

SUB TOPIC	FORM 5	FORM 6
Sequences	• Sequences • Arithmetic and Geometric progressions	
Series	• Σ, n! and $\binom{n}{r}$ notation • Arithmetic and Geometric progressions • Binomial expansion	• Standard results • Method of differences • Maclaurin's series • Taylor's series

TOPIC 4: TRIGONOMETRY

SUB TOPIC	FORM 5	FORM 6
Plane Trigonometry	• Radians and degrees • Arc length • Sector area • Segments	
Trigonometrical Functions	• Graphs of Trigonometrical functions • Trigonometrical equations • Trigonometrical identities (excluding half angle identities)	

TOPIC 5: CALCULUS

SUB TOPIC	FORM 5	FORM 6
Differentiation	• First principles differentiation • Polynomials, rational functions, natural logarithms, exponentials, trigonometrical functions • Sums, differences, products, quotients and composites • Implicit and parametric • Gradient, tangents, normals, rates of change and stationary points	
Integration	• Indefinite Integral of Polynomials, Rational functions, exponentials (e^{ax+b}), Trigonometrical functions with standard integrals and those that can be reduced to standard integral • Integration by recognition, by parts and by substitution • Definite Integral • Application of integration to areas and volumes	
1^{st} Order Differential equations		• Rates of change • Separation of Variables • Solution by Integration

TOPIC 6: NUMERICAL METHODS

SUB TOPIC	FORM 5	FORM 6
Numerical Methods		• Errors • Iterative methods • Newton – Raphson method • Trapezium rule

TOPIC 7: COMPLEX NUMBERS

SUB TOPIC	FORM 5	FORM 6
Complex Numbers	• Parts of a complex number • Conjugate, modulus and argument • Operations • Argand diagram	• Equations (up to order 5) • Polar form $(r(\cos\theta + i\sin\theta) = re^{i\theta})$ • Loci • De Moivre's Theorem • n^{th} roots of unit

FORM FIVE (5) SYLLABUS

8.0 COMPETENCY MATRIX

8.1 COMPETENCY MATRIX: FORM 5 SYLLABUS

TOPIC 1: ALGEBRA

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT: {Skills, Knowledge, Attitudes}	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
Indices and proportionality	• state the laws of indices • use laws of indices to solve problems • solve problems involving direct, inverse, partial and joint variation	• Rational indices • General laws of indices • Direct, inverse, partial and joint variations	• Applying laws of indices to solve problems (including life problems) • Modelling situations involving variation and solving related problems	• ICT tools • Braille materials and equipment • Talking books or software • Relevant texts
Polynomials	• carry out polynomial operations of addition, subtraction, multiplication and division • complete the square of a quadratic polynomial • use the remainder and factor theorems	• Polynomial operations • Quadratic operations • Factor and remainder theorems	• Performing operations with polynomials • Completing the square and solving the related problems • Deriving factor and remainder theorems • Applying the factor and remainder theorems in solving problems	• ICT tools • Braille materials and equipment • Talking books or software • Relevant texts
Identities, equations and Inequalities	• distinguish between an equation and an identity • find unknown coefficients in polynomials using identities • solve simultaneous equations • decompose rational polynomials into partial fractions	• Identities • Equations • Partial fractions	• Discussing the difference between identities and equations • Finding unknown coefficients in polynomials using identities • Solving simultaneous equations (at least one is linear and at most one quadratic) • Expressing rational polynomials in partial fractions (including improper fractions)	• ICT tools • Braille materials and equipment • Talking books or software • Relevant texts

	• use the discriminant to determine the number of real roots of quadratic equations • solve problems involving the use of the discriminant • solve polynomial equations using the factor theorem • solve problems using factor and remainder theorems • solve inequalities	• Inequalities	• Determining the number of real roots of quadratic equations using the discriminant • Solving problems using the discriminant • Stating and using factor and remainder theorems to solve equations • Solving problems involving inequalities (including rational inequalities) • Modelling situations involving equations and inequalities and solving related problems •	
Functions	• define the function as a mapping • sketch simple graphs of functions for a given domain • explain exponential growth and decay • solve equation of the form $a^x = b$, using logarithms • solve inequalities of the form $a^x \leq b$, or $a^x \geq b$, using logarithms • use logarithms to transform a given relationship to a linear form • describe the meaning of absolute value notation • solve equations and inequalities involving the absolute value	• Logarithmic functions • Exponential functions • Rational functions • Modulus functions	• Discussing the function as a mapping • Sketching simple graphs of functions • Discussing examples of exponential growth and decay in life • Modelling situations to solve problems involving exponential growth and decay • Solving equations and inequalities using logarithms • Transforming given relationships to linear form to find unknown constants (including sketching linear graphs) • Modelling situations to solve problems involving the use of logarithms • Discussing the absolute value notation	• ICT tools • Braille materials and equipment • Talking books or software • Relevant texts

			• Solving equations and inequalities involving the modulus function	
Relations	• define a relation • define domain, co-domain and range • describe types of relations • define a function • distinguish among the following types of functions: one to one/injective, bijective and surjective • find the inverse of a given function • illustrate in graphical terms the relation between a one to one function and its inverse • illustrate relationship amongst the graphs of $y = f(x)$ and $y = \|f(x)\|$ $y = af(x)$, $y = f(x) + a$, $y = f(x + a)$, $y = f(ax)$ and $y = af(x + b)$ • find composite functions	• Relations • Domain, co-domain, and range • Functions • Types of function (injective, bijective, surjective) • Inverse • Composite function	• Discussing relations, domain, co-domain and range • Describing types of relations • Defining a function • Discussing differences among the following types of functions: injective, bijective and surjective • Finding the inverse of a given function • Illustrating in graphical terms the relation between a one to one function and its inverse • Illustrating relationship amongst the graphs of $y = f(x)$ and $y = \|f(x)\|$ $y = af(x)$, $y = f(x) + a$, $y = f(x + a)$, $y = f(ax)$ and $y = af(x + b)$ • Finding composite functions • Modelling situations involving relations and solving related problems	• ICT tools • Braille materials and equipment • Talking books or software • Relevant texts

TOPIC 2: GEOMETRY AND VECTORS

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT: {Skills, Knowledge, Attitudes}	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 and inequalities 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 • define a curve using parametric equations	• Curve sketching • Coordinate geometry • 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 and inequalities 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) • Reducing equations to appropriate linear form in solving problems (such as $y = ax^2 + b$ when y is plotted against x^2) • Finding equations of circles • Defining a curve using parametric equations	• ICT tools • Braille materials and equipment • Talking books or software • Relevant texts
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	• Vector notation • Vector operations • Types of vectors	• Discussing the use of position and free vectors in life • Carrying out vector operations • Using unit, displacement and position vectors to solve problems	• ICT tools • Braille materials and equipment • Talking books or software • Relevant texts

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT: (Skills, Knowledge, Attitudes)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
	and of $(1 + x)^n$, where n is a rational number and $\|x\| < 1$ • solve problems involving series		$(a + b)^n$ 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	

TOPIC 3: SERIES AND SEQUENCES

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT: (Skills, Knowledge, Attitudes)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
Sequences	• define a sequence • use sequence definitions such as $U_n = n^2$ and $U_{n+1} = 2U_n$ to calculate successive terms • distinguish among periodic, oscillating, converging, and diverging sequences • define arithmetic and geometric progressions • find the general terms and other terms of arithmetic and geometric progressions • 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 $U_n = n^2$ and $U_{n+1} = 2U_n$ • Discussing the behaviour of periodic, oscillating, converging, and diverging sequences • Discussing examples of arithmetic and geometric progressions • Finding the general terms and other terms of arithmetic and geometric progressions • Representing life phenomena using mathematical models involving sequences and exploring their applications in life	• ICT tools • Braille materials and equipment • Talking books or software • Relevant texts
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 positive integer,	• Σ, n! and $\binom{n}{r}$ notation • Arithmetic and geometric progressions • Binomial expansion	• Using the Σ, n! and $\binom{n}{r}$ notation to solve problems • Computing the sum of given arithmetic and geometric terms • Finding sum to infinity of given converging geometric series • Expanding expressions of	• ICT tools • Braille materials and equipment • Talking books or software • Relevant texts

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT: (Skills, Knowledge, Attitudes)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
	and of $(1 + x)^n$, where n is a rational number and $\|x\| < 1$ • solve problems involving series		$(a + b)^n$ 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	

TOPIC 4: TRIGONOMETRY

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT: {Skills, Knowledge, Attitudes}	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
Plane Trigonometry	• distinguish between radians and degrees • convert degrees to radians and vice versa • calculate arc length and sector area • solve problems involving lengths of arcs, areas of sectors and segments • use small angle approximation for sin x, cos x and tan x	• Radians and degrees • Arc length • Sector area • Segments	• Discussing the concept of radians and degrees, 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 sectors and segments • Recalling and using small angle approximation for sin x, cos x and tan x	• ICT tools • Braille materials and equipment • Talking books or software • Relevant texts
Trigonometrical Functions	• sketch the graphs of trigonometrical functions transform the graphs of trigonometrical functions • sketch graphs of inverse trigonometrical relations • solve trigonometrical equations • prove trigonometrical identities • solve problems using trigonometrical identities	• Graphs of Trigonometrical functions • Trigonometrical equations • Trigonometrical identities (excluding half angle identities)	• Sketching and transforming the graphs of trigonometrical functions • Sketching and transforming graphs of inverse trigonometrical relations • 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

TOPIC 5: CALCULUS

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT: {Skills, Knowledge, Attitudes}	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
Differentiation	• differentiate from first principles excluding logarithmic and exponential functions • differentiate polynomials, rational functions, natural logarithms, exponentials and trigonometrical functions • differentiate sums, differences, products, quotients and composite functions • carry out implicit and parametric differentiation • locate stationary points • distinguish between maxima, minima and point of inflexion • solve problems involving differentiation	• First principles differentiation • Polynomials, rational functions, natural logarithms, exponentials, trigonometrical functions • Sums, differences, products, quotients and composites • Implicit and parametric • Gradient, tangents, normal, rates of change and stationary points	• Differentiating from first principles: polynomials, rational functions, trigonometrical functions excluding logarithmic and exponential functions • Differentiating polynomials, rational functions, natural logarithms, exponentials and trigonometrical functions • Differentiating sums, differences, products, quotients and composite functions • Carrying out implicit and parametric differentiation • Locating stationary points and distinguishing between maxima, minima and point of inflexion • Solving problems involving differentiation • Representing life phenomena using mathematical models involving differentiation and exploring their applications in life	• ICT tools • Braille materials and equipment • Talking books or software • Relevant texts
Integration	• integrate polynomials, rational functions, exponentials, trigonometrical functions	• Indefinite Integral of Polynomials, Rational functions, exponentials (e^{ax+b}), trigonometrical functions with standard integrals and those that	• Finding Integrals of polynomials, rational functions, exponentials and trigonometrical functions	• ICT tools • Braille materials and equipment • Talking books or software

	• integrate by recognition, by substitution and by parts • evaluate definite integrals • find areas and volumes	can be reduced to standard integral • Integration by recognition, parts and substitution • Definite Integral • Application of integration to areas and volumes	• Integrating by recognition, by substitution and by parts • Evaluating definite integrals • Applying integration to find areas and volumes • Representing life phenomena using mathematical models involving integration and exploring their applications in life	• Relevant texts

TOPIC 6: NUMERICAL METHODS: *to be covered in form six*

TOPIC 7: COMPLEX NUMBERS

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT: {Skills, Knowledge, Attitudes}	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
Complex Numbers	• find the conjugates, moduli and arguments of complex numbers • carry out operations with complex numbers • represent complex numbers on an Argand diagram • Interprete geometric effects of: - conjugating a complex number - adding, subtracting, multiplying and dividing complex numbers	• Parts of a complex number • Conjugate, modulus and argument • Operations • Argand diagram	• Finding conjugates, modulus and argument of complex numbers • Adding, subtracting, multiplying and dividing complex numbers • Representing complex numbers on an Argand diagram • Interpreting geometric effects of: - conjugating a complex number - adding, subtracting, multiplying and dividing complex numbers	• ICT tools • Braille materials and equipment • Talking books or software • Relevant texts •

FORM SIX (6) SYLLABUS

8.2 COMPETENCY MATRIX: FORM 6 SYLLABUS

TOPIC 1: ALGEBRA

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT: {Skills, Knowledge, Attitudes}	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
Matrices	• identify null matrix, identity matrix, singular and non-singular matrix • carry out basic operations of matrices • calculate determinant of a square matrix (up to 3 x 3) • find inverse of a 3 x 3 non- singular matrix • apply the result $(AB)^{-1}= B^{-1}A^{-1}$ for non-singular matrices to solve problems • construct 2 x 2 matrices to represent enlargement, rotation, reflection, stretch and shear transformations • use a 2 x 2 matrix to represent certain geometrical transformation in the x – y plane • use the composite transformation AB and A^n in problem solving • derive the relationship between the area scale-factor of a transformation and the determinant of the corresponding matrix	• Types of matrices • Basic operation (up to 3 x 3) • Determinant and inverse • Systems of linear equations • Transformations	• Discussing null matrix, identity matrix, singular and non-singular matrix • Adding, subtracting and multiplying matrices • Calculating determinant of a square matrix (up to 3 x 3) • Finding inverse of 3 x 3 non- singular matrices • Using the result $(AB)^{-1}= B^{-1}A^{-1}$ for non-singular matrices to solve problems • Constructing 2 x 2 matrices to represent enlargement, rotation, reflection, stretch and shear transformations • Using a 2 x 2 matrix to represent certain geometrical transformations in the x – y plane • Using the composite transformation AB and A^n in problem solving • Deriving and discussing the relationship between the area scale-factor of a transformation and the	• ICT tools • Braille materials and equipment • Talking books or software • Relevant texts

	• solve simultaneous equations in 2 or 3 unknowns by reducing them to the matrix equation of the form (A**X** =**b**)		determinant of the corresponding matrix • Solving simultaneous equations in 2 or 3 unknowns by reducing them to the matrix equation form (A**x** =**b**) • Representing life phenomena using mathematical models involving matrices and exploring their applications in life	
Mathematical Induction	• describe the process of mathematical induction • prove by mathematical induction to establish a given result • use the strategy of conducting limited trials to formulate a conjecture and prove it by the method of induction	• Proof by Induction • Conjecture	• Discussing the processes of mathematical induction • Proving by mathematical induction to establish given results • Using the strategy of conducting limited trials to formulate conjecture and proving it by the method of induction	• ICT tools • Braille materials and equipment • Talking books or software • Relevant texts • •
Groups	• define a binary operation • define closure, commutation, association, distribution, identity and inverse element • define a group • use the basic properties to show that a given structure is, or is not, a group • solve problems involving binary operations and properties of a group	• Binary operations • Basic properties of a group	• Defining a binary operation • Discussing closure, commutation, association, distribution, identity and inverse element • Discussing a group • Using the basic properties to show that a given structure is, or is not, a group • Solving problems involving binary operations and properties of a group	• ICT tools • Braille materials and equipment • Talking books or software • Relevant texts •

TOPIC 2: GEOMETRY AND VECTORS

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT: {Skills, Knowledge, Attitudes}	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
Vectors (up to three dimensions)	• find vector and Cartesian equations of a straight line in 3D • find the cross product of given vectors • use cross product to find area of plane shapes • find vector, parametric and Cartesian equations of a plane • find the angle between a line and a plane, two lines and two planes • determine whether two lines are parallel, intersecting or skewed • determine whether two lines intersect • find the perpendicular distance from a point to a straight line and the coordinates of the foot of the perpendicular • determine whether a line lies in, is parallel to or intersects a plane • find the point of intersection of a line and a plane • find the line of intersection of two planes • find the perpendicular distance from a point to a plane • solve problems involving lines and planes	• Vector equation of a straight line • Equation of a plane • Cross product	• Finding vector and Cartesian equations of a straight line in 3D • Finding the cross product of given vectors • Using cross product to find area of plane shapes • Finding vector, parametric and Cartesian equations of a plane • Finding the angle between a line and a plane, two lines and two planes • Determining whether two lines are parallel, intersecting or skewed • Determining whether two lines intersect • Finding the perpendicular distance from a point to a straight line and the coordinates of the foot of the perpendicular • Determining whether a line lies in, is parallel to or intersects a plane • Finding the point of intersection of a line and a plane • Finding the line of intersection of two planes • Finding the perpendicular distance from a point to a plane • Solving problems involving lines and planes	• ICT tools • Braille materials and equipment • Talking books or software • Relevant texts

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT: {Skills, Knowledge, Attitudes}	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
			• Representing life phenomena using mathematical models involving vectors and exploring their applications in life	

TOPIC 3 SERIES AND SEQUENCES

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT: {Skills, Knowledge, Attitudes}	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
Series	• use standard results for Σr, Σr^2 and Σr^3 to find related sums • use the method of differences to obtain the sum of finite series • use Taylor's and Maclaurin's series for approximation • solve problems involving method of differences as well as Taylor's and Maclaurin's series	• Standard results • Method of differences • Maclaurin's series • Taylor's series	• Finding related sums using standard results for Σr, Σr^2 and Σr^3 • Obtaining the sum of finite series using the method of differences • Using Taylor's and Maclaurin's series for approximation • Solving problems involving method of differences as well as Taylor's and Maclaurin's series • Representing life phenomena using mathematical models involving series and exploring their applications in life	• ICT tools • Braille materials and equipment • Talking books or software • Relevant texts •

TOPIC 4: TRIGONOMETRY: *covered in form five*

TOPIC 5: CALCULUS

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT: {Skills, Knowledge, Attitudes}	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
1st Order Differential equations	• formulate a statement involving a rate of change as a differential equation • solve differential equations by integration in the case where variables are separable • sketch typical examples of a family of curves representing a general solution of a differential equation • find a particular solution of a differential equation given initial conditions • solve problems involving 1st order differential equation	• Rates of change • Separation of Variables • Solution by Integration	• Formulating statements involving rates of change as differential equations • Solving differential equations by integration in the case where variables are separable • Sketching typical examples of a family of curves representing a general solution of a differential equation • Finding particular solutions of differential equations given initial conditions • Solving problems involving 1st order differential equations • Representing life phenomena using mathematical models involving 1st order differential equations and exploring their applications in life	• ICT tools • Braille materials and equipment • Talking books or software • Relevant texts •

TOPIC 6: NUMERICAL METHODS

SUB TOPIC	OBJECTIVES **Learners should be able to:**	CONTENT: {Skills, Knowledge, Attitudes}	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
Numerical Methods	• define error • distinguish between absolute error and relative error • estimate errors in calculation including the use of $\partial y \approx \frac{dy}{dx}\partial x$ • approximate the root of an equation by graphical means or sign change • derive a converging iterative formula for solving a given equation • solve the equation using iterative procedure • derive the Newton – Raphson formula • solve equations using the Newton – Raphson method • recognise cases where the iterative method may fail to converge to the required root • solve problems involving the use of iterative procedures in root finding • derive the trapezium rule • estimate the area under a curve using the trapezium rule	• Errors • Iterative methods • Newton – Raphson method • Trapezium rule	• Defining error • Distinguishing between absolute error and relative error • Estimating errors in calculations including the use of $\partial y \approx \frac{dy}{dx}\partial x$ • Approximating the root of an equation by graphical means or sign change • Deriving a converging iterative formula for solving a given equation • Solving equations using iterative procedure • Deriving the Newton – Raphson formula • Solving equations using the Newton – Raphson method • Recognising cases where the iterative method may fail to converge to the required root • Solving problems involving the use of iterative procedures in root finding • Deriving the trapezium rule • Estimating the area under a curve using the trapezium rule	• ICT tools • Braille materials and equipment • Talking books or software • Relevant texts

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT: {Skills, Knowledge, Attitudes}	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
	• explain how to set bounds for the area under the curve using rectangle or trapezia • solve problems involving the trapezium rule		• Explaining how to set bounds for the area under the curve using rectangle or trapezia • Solving problems involving the trapezium rule • Representing life phenomena using mathematical models involving numerical methods and exploring their applications in life	

TOPIC 7: COMPLEX NUMBERS

SUB TOPIC	OBJECTIVES Learners should be able to:	CONTENT: {Skills, Knowledge, Attitudes}	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
Complex Numbers	• solve polynomial equations with at least one pair of non- real roots • express complex numbers in polar form • carry out operations of complex numbers expressed in polar form • illustrate equations and inequalities involving complex numbers by means of loci in an Argand diagram • derive the deMoivre's Theorem • prove the deMoivre's Theorem • prove trigonometrical identities using deMoivre's Theorem • solve equations using the deMoivre's Theorem • solve problems involving complex numbers	• Equations (up to order 5) • Polar form $(r(\cos\theta + i\sin\theta) = re^{i\theta})$ • Loci • deMoivre's Theorem • n^{th} roots of unit	• Solving polynomial equations with at least one pair of non- real roots • Expressing complex numbers in polar form • Dividing and multiplying complex numbers expressed in polar form • Illustrating equations and inequalities involving complex numbers by means of loci in an Argand diagram • Deriving and discussing the deMoivre's Theorem • Proving the deMoivre's Theorem • Proving trigonometrical identities using deMoivre's Theorem • Solving equations using the deMoivre's Theorem • Solving problems involving complex numbers • Representing life phenomena using mathematical models involving complex numbers and exploring their applications in life	• ICT tools • Braille materials and equipment • Talking books or software • Relevant texts

9.0 ASSESSMENT

9.1 Assessment Objectives

The assessment will test candidate's ability to:

9.1.1 use mathematical symbols, terms and definitions appropriately
9.1.2 sketch graphs accurately
9.1.3 use appropriate formulae, algorithms and strategies to solve routine and non-routine problems in Pure Mathematics
9.1.4 solve problems in Pure Mathematics systematically
9.1.5 apply mathematical reasoning and communicate mathematical ideas clearly
9.1.6 conduct mathematical proofs in the expected manner
9.1.7 construct and use appropriate mathematical models for a given life situation
9.1.8 conduct research projects (including those related to enterprise) accurately and systematically.

9.2 Scheme of Assessment

Form 5 - 6 Pure Mathematics assessment will be based on 30% continuous assessment and 70% summative assessment.
The syllabus' scheme of assessment caters for all learners. Arrangements, accommodations and modifications must be visible in both continuous and summative assessments to enable candidates with special needs to access assessments and receive accurate performance measurement of their abilities. Access arrangements must neither give these candidates an undue advantage over others nor compromise the standards being assessed.
Candidates who are unable to access the assessments of any component or part of component due to disability (transitory or permanent) may be eligible to receive an award based on the assessment they would have taken.

a) Continuous Assessment

Continuous assessment for Form 5 – 6 will consists of topic tasks, written tests, end of term examinations, project and profiling to measure soft skills.

i. Topic Tasks
These are activities that teachers use in their day to day teaching. These should include practical activities, assignments and group work activities.

ii. Written Tests
These are tests set by the teacher to assess the concepts covered during a given period of up to a month. The tests should consist of short structured questions as well as long structured questions.

iii. End of term examinations
These are comprehensive tests of the whole term's or year's work. These can be set at school, district or provincial level.
iv. Project
This should be done from term two to term five.
Summary of Continuous Assessment Tasks
From term two to five, candidates are expected to have done the following recorded tasks:
- 1 Topic task per term
- 2 Written tests per term
- 1 End of term test per term
- 1 Project in five terms

Detailed Continuous Assessment Tasks Table

Summary of Continuous Assessment Tasks

From term two to five, candidates are expected to have done the following recorded tasks:

- 1 Topic task per term
- 2 Written tests per term
- 1 End of term test per term
- 1 Project in five terms

Detailed Continuous Assessment Tasks Table

Term	Number of Topic Tasks	Number of Written Tests	Number of End of Term Tests	Project	Total
2	1	2	1	1	
3	1	2	1		
4	1	2	1		
5	1	2	1		
Weighting	25%	25%	25%	25%	100%
Actual Weight	7.5%	7.5%	7.5%	7.5%	30%

Specification Grid for Continuous Assessment

Component Skills	Topic Tasks	Written Tests	End of Term	Project
Skill 1 Knowledge Comprehensive	50%	50%	50%	20%
Skill 2 Application	40%	40%	40%	40%
Analysis				
Skill 3 Synthesis Evaluation	10%	10%	10%	40%
Total	**100%**	**100%**	**100%**	**100%**
Actual weighting	**7.5%**	**7.5%**	**7.5%**	**7.5%**

9.3 Assessment model

Learners will be assessed using both continuous and summative assessments