



ZIMBABWE

MINISTRY OF PRIMARY AND SECONDARY EDUCATION

CURRICULUM DEVELOPMENT AND TECHNICAL SERVICES

PURE MATHEMATICS

SECONDARY SCHOOL LEVEL

FORM 3-6

2015-2022

TEACHER'S GUIDE

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1.0 ORGANISATION OF THE TEACHERS' GUIDE

This teachers' guide was designed taking into cognisance the need to guide you teachers in developing and employing teaching methods in Pure Mathematics. The guide draws from the Pure Mathematics syllabus. It also clarifies aspects contained in the syllabus. This guide assists the teacher to explore teaching strategies that help the learner to acquire necessary skills and competencies. As a teacher you should be able to go beyond this guide by reading relevant material. This Teachers' Guide is divided into two parts:

Part A - Critical Documents

- Curriculum Framework
- National syllabus
- School syllabus
- Scheme of work
- Lesson plan
- Progress records
- Learner Profile
- Attendance Register

Part B - Curriculum Delivery

- Content
- Objectives
- Methodology
- Teaching-learning materials
- Assessment and Evaluation
- Class Management
- Scope of the Guide

2.0 PART A: CRITICAL DOCUMENTS

Introduction

The critical documents assist you the teacher in handling the Pure Mathematics learning area. As a teacher you need to have the following critical documents in order to deliver the curriculum effectively. You should have the following:

- Curriculum Framework
- National Syllabus
- School syllabus
- Schemes of Work/Scheme Cum Plan
- Lesson Plans
- Learner Profile
- Records
- Register of Attendance

Rationale

The aim is to enable teachers to apply suitable teaching methods that allow learners to explore mathematical and scientific concepts as they are central to most facets of everyday life and enterprise skills. The learning area plays a pivotal role in Science, Technology, Engineering and Mathematics (STEM). The teachers` guide promotes problem solving, innovativeness, confidence, self-actualisation and classroom based research.

It is therefore important as a teacher to expose learners to mathematical and scientific knowledge. This enables learners to manipulate objects and interact with their environment.

Objectives

It is hoped that after going through this part, you will be able to:

- gain an insight into the philosophy of education underpinning the curriculum
- manage your class effectively
- mobilise the teaching and learning resources
- prepare engaging and appropriate teaching aids
- track the learner's progress during the learning process

UNIT 1

Curriculum for Primary and Secondary Education (2015-2022)

Introduction

This is a policy document that outlines underpinning principles, national philosophy, learning areas, the description and expectations of Ministry of Primary and Secondary Education (MOPSE) at policy level. It prescribes what the government expects you to deliver as you go about your duties. The Zimbabwe Curriculum framework sets out the common aims and objectives of the education system and the specific features of different education levels, thereby providing the basis for transparent relationships between schools, parents, and local communities. It also provides guidance to schools and education administrators in the organization, management and evaluation of the effectiveness of the school activities. Schools are encouraged to actively engage, as learning organisations, in providing diversified opportunities for all learners to develop the knowledge, key skills and attitudes defined in this framework. This framework is intended to be the main reference document informing the development of syllabuses, revision of syllabuses, development and use of learning resources and the creation of guidelines for in-service teacher training and support. This Curriculum Framework sets out what learners are expected to know, understand, value and be able to do as a result of their learning experiences in schools and non-formal education settings from Early Childhood Development (ECD) to secondary level. Its fundamental purpose is to provide a structure around which schools can build educational programmes that ensure learners achieve desired outcomes. This framework identifies learning areas for all learners. It is intended to guide schools and teachers, stakeholders and parents over the curriculum process in a rapidly changing environment.

Objectives of the Curriculum:

The Curriculum was developed to:

- promote and cherish the Zimbabwean identity
- Prepare learners for life and work in a largely agro-based economy and an increasingly globalised and competitive environment.
- foster life-long learning in line with the opportunities and challenges of the knowledge society
- Prepare learners for participatory citizenship, peace and sustainable development
- Prepare and orient learners for participation, leadership and voluntary service

Key Elements

The Curriculum of Zimbabwe is made up of the following key elements:

- Background
- Principles and values guiding the curriculum
- Goals of the curriculum
- Learning areas
- Teaching and learning methods
- Assessment and learning
- Strategies for curriculum implementation
- The future

Unit 2

SYLLABUS INTERPRETATION

Introduction

Syllabus interpretation is the process of making sense out of the syllabus. Interpretation is about finding meaning. It is the process of unpacking the syllabus, analysing it and synthesising it.

Objectives

As a teacher you therefore need to be familiar with the two syllabuses, that is the national syllabus and the school syllabus. This will assist you in your lesson delivery.

Types of School syllabuses

National Syllabus

It is a policy document that outlines and specifies the learning area philosophy, aims and objectives, Learning/teaching concepts and content, suggested methodology and assessment criteria at every form level. As a teacher you should always have it and use it to guide you in your day to day teaching and learning activities.

Aims: general direction in which you should be guiding your learners (long term)

Objectives: learner behavior after treatment

Assessment objectives: examination oriented (what is to be tested)

Content: topics or aspects to be covered

Methodology: teaching approaches to achieve desired learning outcomes

Learner-centred approaches allow learners to practice skills learnt

Examination format: how learners will be assessed

School Syllabus

This must be drawn from the National Syllabus by reorganising content taking into account local factors. It is a breakdown of the national/official syllabus to suit the contextual environment into which the school is located but without changing the content of the national syllabus. This document is drafted at school level by the teachers.

Influenced by:

- Level of learner performance (knowledge they already have)
- Facilities and funds available
- Time allocation in the official syllabus
- Local conditions that affect the choice and sequencing of topics
- Supply of textbooks and other teaching materials
- Education technology
- Community influences

Structure of School Syllabus

- **Aims:** broad indication of what the learners should learn
- **Objectives:** learner behavior at the end of the teaching-learning experience
- (competencies)
- **Topics/Activities (Content)**
- **Methodology (Learner – Centred)**
- **Instructional Or Teaching Materials**
- **Assessment/Evaluation**

UNIT 3

SCHEMES OF WORK/ SCHEME CUM PLANS

SCHEME OF WORK (WEEKLY BREAKDOWN)

By the end of this unit, you should be able to:

- describe the essential components of a scheme plan
- develop a scheme plan
- explain the advantages of writing down your plan
- realise the merits of planning your lessons well in advance

Definition:

This is a document that you as a teacher should draw from the national and school syllabus. You should outline the objectives, activities, content, and methodologies. A scheme of work is therefore a plan of action, which should enable you to organize teaching activities ahead of time. It is a summarized forecast of work, which you consider adequate and appropriate for the class to cover within a given period from those topics, which are already set in the syllabus.

COMPONENTS

The components of a scheme of work include the following aspects:

- Level of learners: state the level (grade/form) of learners you are scheming for.
- Learning Area: indicate the learning area you are scheming for
- Week ending: the date should be clearly indicated
- Topic/Key concepts/Skills: topics should follow the order, which they are supposed to be taught, from simple to complex.

Objectives: each lesson should have objectives, which pinpoint the anticipated learning behaviour of the learners. The objectives must be stated in a manner that there is a measurable aspect manifested at the end of the lesson for example, learners should be able to conduct fire drills.

FORM 3 SCHEMES OF WORK

Learning area: Pure Mathematics form 3

Aims

- acquire mathematical skills to solve problems related to industry and technology
- further develop mathematical concepts and skills for higher studies
- use mathematical skills in the context of more advanced techniques such as research
- apply Pure mathematics concepts and techniques in other learning areas
- develop an appreciation of the role of mathematics in personal, community and national development (Unhu/Ubuntu/Vumunhu)
- use I.C.T tools effectively to solve mathematical problems
- apply Pure mathematical skills and knowledge in relevant life situations
- enhance confidence, critical thinking, innovativeness, creativity and problem solving skills for sustainable development

WEEK ENDING	TOPIC/ CONTENT	OBJECTIVES	COMPETENCIES/ SKILLS/ KNOWLEDGE	MEDIA	S.O.M/ REFERENCES	METHODS/ACTIVITIES	EVALUATION
16/12/16	INDICES	<p>By the end of the lesson learners should be able to:</p> <ul style="list-style-type: none"> • define an index • use the laws of indices in algebraic application • solve equations involving indices 	<ul style="list-style-type: none"> • critical thinking • analytical thinking • problem solving 	<ul style="list-style-type: none"> • ICT tools(overhead projector and laptop to display laws of indices) • Work cards 	<ul style="list-style-type: none"> • Pure Mathematics National Syllabus page 13 • Pure Mathematics Pupils Book 3 page 61-63 	<ul style="list-style-type: none"> • Explaining the term index • Discussing the laws of indices • Demonstrating the use of indices • Solving equations involving indices in groups 	<p>Should show strength and weaknesses of methodology, and whether objectives were achieved. Map the way forward. This forms the basis for remedial work</p>

SCHEME –CUM PLAN: PURE MATHEMATICS

LEVEL FORM 3

Aim: Develop an ability to apply Pure Mathematics in life and other subjects, particularly Science and Technology.

Week ending	Topic/ Content	Objectives	Methodology and Activities	Competence s (skills, knowledge and attitudes)	References/ Source of material	Media/ Resources	Evaluation
16/12/16	INDICES Lesson 1 Definition Laws of indices	By the end of the lesson learners should be able to: <ul style="list-style-type: none"> define an index use the laws of indices to simplify algebraic expressions 	Introduction -Learners state examples of indices as asked by the teacher Step 1 :Brainstorming -on the laws of indices Step 2 Demonstration -learners demonstrate simplification of indices following examples done by the teacher Step 3 Individual work -learners write exercise on simplifying indices	<ul style="list-style-type: none"> critical thinking analytical thinking problem solving 	<ul style="list-style-type: none"> Pure Mathematics National Syllabus page 5 Pure Mathematics Pupils Book 3 page 61-63 	<ul style="list-style-type: none"> ICT tools(overhead projector and laptop to display laws of indices) Print media 	

Week ending	Topic/ Content	Objectives	Methodology and Activities	Competencies (skills, knowledge and attitudes)	References/ Source of material	Media/ Resources	Evaluation
			conclusion -summarising main points				
	Lesson 2 Equations	<ul style="list-style-type: none"> • solve equations involving indices 	<p>Introduction Recapping of the concepts of the previous lesson</p> <p>Step 1 :Discussion -class discussion on the laws of indices</p> <p>Step 2: Group work -on solving equations</p> <p>Step 3 : Demonstration Learners demonstrate solving equations</p> <p>Step 4 : individual work learners write exercise on solving equations</p>	<ul style="list-style-type: none"> • critical thinking • analytical thinking • problem solving 	<ul style="list-style-type: none"> • Pure Mathematics National Syllabus page 5 • Pure Mathematics Pupils Book 3 page 64 	<ul style="list-style-type: none"> • ICT tools (overhead projector and laptop to display laws of indices) • Work cards 	

Week ending	Topic/ Content	Objectives	Methodology and Activities	Competencies (skills, knowledge and attitudes)	References/ Source of material	Media/ Resources	Evaluation
			conclusion -revising selected questions				
	Lesson 3						
	Lesson 4						
	Lesson 5						

UNIT 4: LESSON PLANS

Definition

This is a detailed daily plan of what you intend to deliver during the lesson. This is to be used in the event of you having drawn a scheme of work rather than a scheme cum plan.

Components of a lesson plan

A lesson plan is made up of the following components:

- Date
- form
- Time
- Learning area
- Topic/content
- Sub-topic
- SOM
- Teaching and learning aids
- Number of learners
- Assumed knowledge
- Lesson objectives
- Lesson steps
- Evaluation

Example of a lesson plan

The following is an example of a lesson plan drawn from the scheme of work above.

Detailed Lesson Plan

Date :	15 December 2016
Form :	3
Time:	11.30 -12.00
Learning Area	Pure Mathematics forms 3-4
Topic/Content:	Indices
Sub-Topic:	Laws of Indices
S.O.M:	Pure Mathematics forms 3-4 National Syllabus page 13
Teaching and learning aids:	ICT tools (overhead projector and laptop), work cards
Number of learners:	45
Assumed Knowledge:	Learners are able to state examples of Indices

Lesson Objectives

By the end of the lesson, learners should be able to:

- state the laws of indices
- use laws of indices to simplify algebraic expressions
- solve equations involving indices

INTRODUCTION: Learners state examples of indices

Stage 1: Learners discuss the laws of indices

Stage 2: Learners, demonstrate how to simplify algebraic expressions.

Stage 3: Learners solve equations involving indices in groups.

Stage 4: individual written work on solving indices equations

Conclusion: learners and the teacher summarises the lesson by highlighting main points

LESSON EVALUATION:

Strength:

.....

.....

.....

Weaknesses:

.....

.....

.....

Way forward:

.....

.....

.....

Unit 5

RECORD KEEPING

Records are critical documents about the teaching – learning process, which you must keep as a teacher

They include:

- Syllabuses (National and School)
- Staff and pupil details
- Examination documents
- Mark lists
- Stock control registers

OBJECTIVES

By the end of this unit, you should be able to:

- identify the various records you are expected to keep
- prepare accurate records
- Interpret information from records to promote learning
- Maintain and keep records safely
- Appreciate the need to update records regularly

TYPES OF RECORDS

- Official syllabuses
- School syllabuses
- Records of staff details
- Records of learner details
- Supervision records
- Files, circulars, handouts, past exam papers
- Minutes of meetings
- Inventory of resource materials
- Stock control registers
- Learner Profiles
- Attendance Register

CONCLUSION

Effective teaching and learning requires you to have all the critical documents and to use them as required. You need to scheme, plan and prepare for your lessons well in advance. Furthermore, you need to familiarize yourself with the Ministry Of Primary and Secondary Education's Curriculum Framework.

3.0 PART B: CURRICULUM DELIVERY

Introduction

This section comprises of the content, Objectives, Methodology, Teaching-learning materials, Class management and Evaluation

RATIONALE

In its socio-economic transformation agenda, Zimbabwe has embarked on an Industrialisation development process, where high mathematical skills are a prerequisite. It is therefore, important to provide a sound grounding for development and improvement of the learner's intellectual competencies in logical reasoning, spatial visualisation, analytical and abstract thinking. This will form the basis for creative thinkers, innovators and inventors. Pure Mathematics optimises the potential of the mathematically gifted learners through exposure to more challenging practical life problems that require practical solutions. The thrust is to provide wider opportunities for the mathematically gifted learners who desire to undertake technologically and industrially related careers such as actuarial sciences, architecture, engineering and other scientific research activities. Sound knowledge of mathematics enables learners to develop skills such as accuracy, research and analytical competencies essential for life and sustainable development.

The Pure Mathematics forms 3-4 syllabus enables learners to develop skills in:

- Problem solving
- Critical thinking
- Decision making
- Leadership
- Self-management
- Communication
- Technology and innovation
- Enterprise

CROSS CUTTING THEMES

In order to foster competence development for further studies, life and work, the teaching and learning of Pure Mathematics for forms 3 - 4 should integrate the following cross cutting themes:

- Business and financial literacy
- Disaster and risk management
- Communication and team building
- Problem solving of environmental issues
- Inclusivity
- Enterprise skills
- Cultural Diversity
- ICT
- HIV & AIDS

3.1 OBJECTIVES

By the end of this unit, you should be able to:

- select appropriate teaching methods for your lessons
- use a variety of learner-centred approaches
- plan and organise study tours
- help pupils carry-out projects or experiments

3.2 CONTENT

The guide covers the following aspects:

- Syllabus interpretation
- Content
- Methodology
- Teaching-learning materials
- Class management
- Record keeping
- Evaluation

3.3 METHODOLOGY

As a teacher it is important for you to use problem-solving and learner-centred approaches:

- You are the facilitator
- The learner is the doer

OBJECTIVES

By the end of this unit, you should be able to:

- select appropriate teaching methods for your lessons
- use a variety of learner-centred approaches
- plan and organise study tours
- help pupils carry-out projects or experiments

Teaching methods can be grouped under three main categories:

- Cognitive development methods
- Affective development methods
- Psychomotor development methods

a) **Cognitive development methods**

These are mainly:

- Discussion Method
- Questioning/Socratic Method
- Team Teaching Method
- Talk Chalk/Recitation Method
- Field Trip/Educational tours Method
- Team Teaching Method
- Question and Answer

b) Affective development methods

- Modelling Method
- Simulation Method
- Dramatic Method
- Simulation Games
- Role-Playing Method
- Gallery walk
- Observation
- Lecture

c) Psychomotor development methods

These are more learner activity based and heuristic

- Inquiry Method
- Interactive e-learning
- Discovery Method
- Process Approach Method
- Demonstration Method
- Laboratory/Experimentation Method
- Programmed Learning Method
- Dalton Plan/Assignment Method
- Project Method, case studies
- Microteaching Method
- Mastery Learning
- Song and dance
- Your subject matter should determine the most suitable teaching method/methods to use.
- The instructional objectives to be achieved by the end of the lesson also determine the choice of teaching methods.
- You must be very familiar with the teaching methods you want to use and be convinced they are the most appropriate for that lesson.
- You must consider the age, interest, level of development of the learners and ensure that all learners will benefit from the method you have chosen.
- You must consider time in relation to the methods chosen.
- You should consider the environment and the size of the class in settling for methods to employ.

3.4 INSTRUCTIONAL (TEACHING-LEARNING) AIDS

- help learners to learn better and faster
- capture learners' interest
- create virtual reality

OBJECTIVES

By the end of this unit, you should be able to:

- select appropriate instructional aids
- make good quality aids from available resources
- use instructional aids effectively
- Design meaningful and effective instructional aids

TYPES OF INSTRUCTIONAL-LEARNING AIDS:

The following are some of the learning aids you can use as a teacher:

- charts,
- chalkboard,
- whiteboard,
- computers,
- slides,
- films,
- videos,
- flannel
- graph,
- textbooks

3.5 ASSESSMENT AND EVALUATION

- Measuring the success of teaching in terms of teacher and learner performance
- Provides feedback on the acquisition of knowledge, skills and attitudes by learners

OBJECTIVES

By the end of this unit, you should be able to:

- evaluate both your work and that of the learners
- identify the essential evaluation methods that you can use
- prepare marking schemes for the various activities or projects

METHODS OF EVALUATION

- Tests and exercises
- Projects
- Examinations
- Assignments

3.6 CLASS MANAGEMENT

Process of planning, organising, leading and controlling class activities to facilitate learning

OBJECTIVES

By the end of this unit, you should be able to:

- create an effective learning environment
- motivate the learners
- maintain discipline
- supervise class activities

ORGANISATIONAL SKILLS FOR EFFECTIVE LEARNING

Classroom organisation which covers:

- physical environment
- emotional environment
- grouping the learners
- class control and discipline
- supervision

PHYSICAL ENVIRONMENT

- Classroom to be clean, tidy and airy
- Safety considerations when arranging furniture
- Teaching aids to be visible to learners

EMOTIONAL ENVIRONMENT

- Be firm, warm and pleasant
- Set the right tone
- Tell learners what behaviour you expect

GROUPING

- Learners may be grouped according to needs, abilities, problems but not sex
- Promote sharing of ideas among learners

CLASS CONTROL AND DISCIPLINE

- Know the schools policy on discipline
- Be firm and fair
- Punishment should be corrective
- Acknowledge good behavior
- Make use of prefects and class monitors
- Create an atmosphere of trust and honesty
- Aim for intrinsic discipline

MOTIVATION

- Make learners feel important
- Recognise and reward excellence
- Be a role model in terms of your demeanour

SUPERVISION

- Check learners` work in order to guide and correct them
- Areas that require supervision include practical work, written work, discussions, group work and field trips

UNIT 6

SCOPE OF THE GUIDE

SYLLABUS TOPICS

It is important for you as an Pure Mathematics teacher to know the topics that are covered and how they are listed according to levels as shall be revealed below. You should also be able to state the objectives, methods, teaching and learning materials, records and evaluation techniques for each topic.

Pure Mathematics forms 3-4 learning area has 13 broad topics as stipulated below. The following topics will be covered from Form 3 - 4

Pure Mathematics

- Indices and irrational numbers
- Polynomials
- Identities, equations and inequalities
- Graphs and coordinate geometry
- vectors
- Functions
- Sequences
- Binomial expansions
- Trigonometry
- Logarithmic and Exponential functions
- Differentiation
- Integration
- Numerical methods

The following topics will be covered from Form 5 - 6

Pure Mathematics

- Algebra
- Geometry and vectors
- Series and sequences
- Trigonometry
- Calculus
- Numerical methods
- Complex numbers

Topic

Plane trigonometry

Objectives (learner – behaviour)

By the end of the unit learners should be able to:

- define a radian
- use the correct radian notation
- convert degrees to radians and radians to degrees
- find the length of an arc

- find area of a sector and a segment
- solve problems involving length of arcs, areas of sectors and segments

Sub topics

- radians
- length of an arc
- area of sector
- area of a segment

ACTIVITIES

- Discussing radians and degrees and their relationship
- Using the correct radian notation
- Converting degrees to radians and radians to degrees
- Deriving and using the formulae for length of an arc
- Deriving and using the formulae for the area of a sector and segment
- Solving problems involving length of arcs, areas of sectors and segments

METHODOLOGY (learner - centredness)

- Project based learning
- Educational tours
- E-learning
- Collections
- Demonstrations
- Resource person(s)

TEACHING-LEARNING AIDS

- ICT Tools
- Local environment
- Audio and Visual Materials
- Educational tours
- Geo board
- Geometrical instruments
- Braille materials and equipment
- Talking books

Evaluation

Should show strength and weaknesses of methodology, and whether objectives were achieved. Map the way forward. This forms the basis for remedial work.

Topics to be covered

Form 3	FORM 4	FORM 5	Form 6
Indices		Indices and proportionality	Matrices
Irrational numbers		Polynomials	Mathematical induction
Polynomials	Polynomials	Identities, equations and inequalities	Groups
Identities and equations	Identities and equations	Functions	
Inequalities		Relations	
Graphs	Graphs	Graphs and coordinate geometry	
Coordinate geometry		Vectors up to three dimensions	Vectors up to three dimensions
Vectors in two dimensions	Vectors in two dimensions	Sequences	
Functions	Functions	Series	Series
sequences	sequences	Plane trigonometry	
	Binomial expansion	Trigonometrical functions	
Plane trigonometry	Plane trigonometry	Differentiation	First order differential equations
Trigonometrical functions	Trigonometrical functions	Integration	Numerical methods
Logarithms	Logarithms	Complex numbers	Complex numbers
	Exponential functions		
Differentiation	Differentiation		
Integration	Integration		

CONCLUSION

This guide is not there to kill your innovativeness but just assist you as you embark teaching this new learning area. Any contributions that will improve our Teachers' Guide are welcomed. Just forward those contributions to Curriculum Development and Technical Services. If there are any teachers who are interest in writing these teachers' guides please just let us know so that we can make the necessary arrangements.

ANNEXURE 1**SYLLABUS SCOPE AND SEQUENCE****TOPIC 1: INDICES AND IRRATIONAL NUMBERS**

SUB TOPIC	FORM 3	FORM 4
Indices	<ul style="list-style-type: none"> Laws of indices Equations involving indices 	
Irrational numbers	<ul style="list-style-type: none"> Surds 	

TOPIC 2: POLYNOMIALS

SUB TOPIC	FORM 3	FORM 4
<ul style="list-style-type: none"> Polynomials 	<ul style="list-style-type: none"> Components of polynomials Addition Subtraction Partial fractions 	<ul style="list-style-type: none"> Multiplication Division Factor Theorem Solving equations

TOPIC 3: IDENTITIES, EQUATIONS AND INEQUALITIES

SUB TOPIC	FORM 3	FORM 4
Identities and equations	<ul style="list-style-type: none"> Definition of identity Unknown coefficients Equations 	<ul style="list-style-type: none"> Completing the square Simultaneous equations
Inequalities	<ul style="list-style-type: none"> Quadratic inequalities Cubic inequalities 	

TOPIC 4: GRAPHS AND COORDINATE GEOMETRY

SUB TOPIC	FORM 3	FORM 4
Graphs	<ul style="list-style-type: none"> Straight line graphs Gradient of a line segment 	<ul style="list-style-type: none"> Graphs of $y = kx^n$
Coordinate geometry	<ul style="list-style-type: none"> Distance between two points Coordinates of the mid-point 	

TOPIC 5: VECTORS

SUB TOPIC	FORM 3	FORM 4
Vectors in three dimensions	<ul style="list-style-type: none"> • Types of vectors • Vector operations 	<ul style="list-style-type: none"> • Unit vectors • Scalar product • Vector properties of plane shapes • Areas of triangles and parallelograms

TOPIC 6: FUNCTIONS

SUB TOPIC	FORM 3	FORM 4
Functions	<ul style="list-style-type: none"> • Definition of a function • Domain and range • Composite function 	<ul style="list-style-type: none"> • One-one function • Inverse of a function • Graphs of functions

TOPIC 7: SEQUENCES

SUB TOPIC	FORM 3	FORM 4
Sequences	<ul style="list-style-type: none"> • Definition of a sequence • Examples of sequences 	<ul style="list-style-type: none"> • Arithmetic progression • Geometric progression

TOPIC 8: BINOMIAL EXPANSION

SUB TOPIC	FORM 3	FORM 4
Binomial expansion		<ul style="list-style-type: none"> • Pascal's Triangle • Expansion of $(a + b)^n$ where n is a positive integer

TOPIC 9: TRIGONOMETRY

SUB TOPIC	FORM 3	FORM 4
Plane Trigonometry	<ul style="list-style-type: none"> Sine and cosine rules Area of a triangle 	<ul style="list-style-type: none"> Radians Length of an arc Area of a sector Area of a segment
Trigonometrical functions	<ul style="list-style-type: none"> Trigonometrical functions for angles of any size Exact values of sine, cosine and tangent of special angles 	<ul style="list-style-type: none"> Equations

TOPIC 10: LOGARITHMIC AND EXPONENTIAL FUNCTIONS

SUB TOPIC	FORM 3	FORM 4
Logarithms	<ul style="list-style-type: none"> Laws of logarithms Logarithms and indices 	<ul style="list-style-type: none"> Natural logarithms Equations of the form $a^x = b$
Exponential functions		<ul style="list-style-type: none"> Exponential growth and decay

TOPIC 11: DIFFERENTIATION

TOPIC	FORM 3	FORM 4
Differentiation	<ul style="list-style-type: none"> Gradient of a curve at a point Derived function of the form ax^n Derivative of a sum 	<ul style="list-style-type: none"> Application of differentiation to gradients, tangents and normals, stationary points, rates of change, velocity and acceleration

TOPIC 12: INTEGRATION

SUB TOPIC	FORM 3	FORM 4
Integration	<ul style="list-style-type: none"> Indefinite integration as the reverse process of differentiation Integration of functions of the form ax^n Integration of a polynomial 	<ul style="list-style-type: none"> Area Volume

TOPIC 13: NUMERICAL METHODS

SUB TOPIC	FORM 3	FORM 4
Numerical methods		<ul style="list-style-type: none"> • Simple iterative procedures • Newton-Raphson method • Trapezium Rule

TOPIC	FORM 5	FORM 6
Indices and proportionality	<ul style="list-style-type: none"> • Rational indices • General laws of indices • Direct, inverse, joint and partial variations 	
Polynomials	<ul style="list-style-type: none"> • Polynomial operations • Quadratic operations • Factor and remainder theorems 	
Identities , Equations and Inequalities	<ul style="list-style-type: none"> • Identities • Equations • Partial fractions • Inequalities 	
Functions	<ul style="list-style-type: none"> • Logarithmic functions • Exponential functions • Rational functions • Modulus functions 	
Relations	<ul style="list-style-type: none"> • Relation • Domain, co-domain, and range • Functions • Types of function (injective, bijective, surjective) • Inverse • Composite function 	
Matrices		<ul style="list-style-type: none"> • Basic operation (up to 3 x 3) • Determinant and inverse • Systems of linear equations • Transformations
Mathematical Induction		<ul style="list-style-type: none"> • Proof by Induction
Groups		<ul style="list-style-type: none"> • Binary operations • Basic properties of a group

TOPIC 2: GEOMETRY AND VECTORS

TOPIC	FORM 5	FORM 6
<ul style="list-style-type: none"> Graphs and Coordinate geometry 	<ul style="list-style-type: none"> Curve sketching Coordinate geometry Parametric equations 	
<ul style="list-style-type: none"> Vectors (up to three dimensions) 	<ul style="list-style-type: none"> Vector notation Vector operations Types of vectors Magnitude of a vector Dot (scalar) product Area of plane shapes 	<ul style="list-style-type: none"> Vector equation of a straight line Equation of a plane Cross product

TOPIC 3: SERIES AND SEQUENCES

TOPIC	FORM 5	FORM 6
Sequence	<ul style="list-style-type: none"> Sequences Arithmetic and Geometric progressions 	
Series	<ul style="list-style-type: none"> Σ, $n!$ and $\binom{n}{r}$ notation Arithmetic and Geometric progressions Binomial expansion 	<ul style="list-style-type: none"> Standard results Method of differences Maclaurin's series Taylor's series

TOPIC 4: TRIGONOMETRY

TOPIC	FORM 5	FORM 6
Plane Trigonometry	<ul style="list-style-type: none"> Radians and degrees Arc length Sector area Segments 	
Trigonometrical Functions	<ul style="list-style-type: none"> Graphs of Trigonometrical functions Trigonometrical equations Trigonometrical identities (excluding half angle identities) 	

TOPIC 5: CALCULUS

TOPIC	FORM 5	FORM 6
Differentiation	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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		<ul style="list-style-type: none"> • Rates of change • Separation of Variables • Solution by Integration

TOPIC 6: NUMERICAL METHODS

TOPIC	FORM 5	FORM 6
Numerical Methods		<ul style="list-style-type: none"> • Errors • Iterative methods • Newton – Raphson method • Trapezium rule

TOPIC 7: COMPLEX NUMBERS

TOPIC	FORM 5	FORM 6
Complex Numbers	<ul style="list-style-type: none">• Parts of a complex number• Conjugate, modulus and argument• Operations• Argand diagram	<ul style="list-style-type: none">• 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

