



Republic of Zambia

Ministry of Education, Science, Vocational Training and Early Education

Additional Mathematics Syllabus

Grades 10 to 12



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VISION

Quality, lifelong education for all which is accessible, inclusive and relevant to individual, national and global needs and value systems.

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PREFACE	i
Introduction	iii
Time and Period allocation	iv
Assessment Scheme	iv
Rationale	iv
General Outcomes	v
GRADE 10	1
General Outcomes	1
GRADE 11	4
General Outcomes	4
GRADE 12	8
General Outcomes	8
GRADES 10 to 12 ADDITIONAL MATHEMATICS SCOPE AND SEQUENCE	i

PREFACE

The syllabus was produced as a result of the Curriculum review process carried out by the Ministry of Education, Science, Vocational Training and Early Education under the auspices of the Curriculum Development Centre (CDC). The curriculum reform process started way back in 1999 when the Ministry of Education commissioned five (5) curriculum studies which were conducted by the University of Zambia. These studies were followed by a review of the lower and middle basic and primary teacher education curriculum. In 2005 the upper basic education National survey was conducted and information from learners, parents, teachers, school managers, educational administrators, tertiary institutions traditional leaders civic leaders and various stakeholders in education was collected to help design a relevant curriculum.

The recommendations provided by various stakeholders during the Upper Basic Education National survey of 2005 and National symposium on curriculum held in June 2009 guided the review process.

The review was necessitated by the need to provide an education system that would not only incorporate latest social, economic, technological and political developments but also equip learners with vital knowledge, skills and values that are necessary to contribute to the attainment of Vision 2030.

The syllabus has been reviewed in line with the Outcome Based Education principles which seek to link education to real life experiences that give learners skills to access, criticize analyse and practically apply knowledge that help them gain life skills. Its competences and general outcomes are the expected outcomes to be attained by the learners through the acquisition of knowledge, skills, techniques and values which are very important for the total development of the individual and the nation as a whole.

Effective implementation of Outcome Based Education requires that the following principles be observed: clarity of focus, Reflective designing, setting high expectations for all learners and appropriate opportunities.

It is my sincere hope that this Outcome Based syllabus will greatly improve the quality of education provided at Grade 10 to 12 level as defined and recommended in various policy documents including Educating Our Future`1996 and the `Zambia Education Curriculum Framework `2013.

Chishimba Nkocha
Permanent Secretary

MINISTRY OF EDUCATION,SCIENCE, VOCATIONAL TRAINING AND EARLY EDUCATION.

Acknowledgement

The syllabus presented here is a result of broad-based consultation involving several stakeholders within and outside the education system.

Many individuals, institutions and organizations were consulted to gather their views on the existing syllabus and to accord them an opportunity to make suggestions for the new syllabus. The Ministry of Education wishes to express heartfelt gratitude to all those who participated for their valuable contributions, which resulted in the development of this syllabus.

The Curriculum Development Centre worked closely with other sister departments and institutions to create this document. We sincerely thank the Directorate of Teacher Education and Specialized Services, the Directorate of Planning and Information, the Directorate of Human Resource and Administration, the Directorate of Open and Distance Education ,the Examinations Council of Zambia, the University of Zambia, schools and other institutions too numerous to mention, for their steadfast support.

We pay special tribute to co-operating partners especially JICA and UNICEF for rendering financial technical support in the production of the syllabus.

C.N.M Sakala (Mrs)

Director-Standard and Curriculum

MINISTRY OF EDUCATION, SCIENCE, VOCATIONAL TRAINING AND EARLY EDUCATION

Introduction

Suggested Teaching Methodology

- The syllabus encourages a learner-centred approach or pedagogy. This involves learners to learn Mathematics in context of multipart, comprehensive and practical problems. Under such learning situations learners may be put in groups and required to identify what they already know, what they need to know and how and where to access new information that may lead to resolution of the problem.
- The Problem-Based Learning (PBL) in mathematics may include the four core area specific outcomes, thinking process, skills and values with the aim of nurturing wise citizens who are responsible in decision-making for sustainable and responsible development.
- The role of the teacher may be that of a facilitator of learning who provides appropriate scaffolding of that process by asking probing questions, providing appropriate resources and leading class discussions as well as designing student's assessments. The strategy strives to transform the traditional teacher centred mathematics classroom situation into student centred environment completely where learners are allowed to construct new knowledge through, the specific outcomes learned, thinking processes such as communication, interconnections, reasoning, representations, problem solving and other similar ones: both mathematics and non-mathematical positive as well as universal values.
- The teaching of **Additional Mathematics** should expose learners to practical applications of mathematics in everyday life. Learners should be exposed to do more of practical work as much as necessary through contextual reference to the local environment.
- use of computer related software for mathematics should be encouraged and the teacher should encourage learners to use available mathematics software.
- Learners may be exposed to situation where they can provide assistance and support to their peer in learning groups. The opportunities may help to evaluate their peers and conduct self-assessment that helps them to shoulder responsibility for their learning.

Time and Period allocation

Time allocation for this syllabus is will require at seven-40 minutes periods per week to complete.

Assessment Scheme

Continuous assessment will be emphasised by using various methods of testing according to topics and themes at various levels. The examinations council of Zambia will prepare detailed procedures on how continuous assessment will be conducted by the teachers. The Examinations Council will also develop examination syllabus to provide teachers with guidelines on the objectives to be tested. The scheme of assessment will consists of school based assessment and final examination that will be conducted by the Examinations Council of Zambia.

School based assessment will be in the form of tests. Tests will be in the form of diagnostic, aptitude, achievement, oral, practice, attitude and performance, exercises, assignments, discussions, investigation, project work etc. School based assessment shall contribute towards certification of all learners.

Rationale

Mathematics is an important tool for the development and improvement of a person's intellectual competence in logical reasoning, spatial visualization, analysis and abstract thought. When learners have acquired enough knowledge in mathematics they develop numeracy, reasoning, thinking skill and problem solving skills. Mathematics is very important not only in science and technology that is vital for the development of the country but also in everyday life and workplace. Mathematics would equip the learner to live in modern age of Science and technology and enable the learner to contribute to the social and economic development of the country and the world at large. Mathematics plays a vital role in the development of highly skilled and technologically based manpower. Mathematics also prepares and enhances the learners' prospect of employment and further education as it also plays a key role as a tool for other learning areas and subject. Mathematics relates to all subjects and provides necessary mathematical pre-requisites for further education. Other subjects in science and technology heavily depend on mathematics concepts. In order for Zambia to comfortably reach the 2010 millennium goals there has to be a deliberate emphasis on mathematics education.

Mathematics can also be an interesting subject as it can also be a subject of enjoyment and excitement. This offers learners and students an opportunity for creative work and moments of joy and pleasure. It is very interesting for students and indeed all learners when they discover ideas and insights that would help them pursue mathematics even outside school walls.

The study of mathematics will build up understanding and appreciation of basic mathematical concepts and computational skills in order to apply them in everyday life. Mathematics aims at developing clear mathematical thinking and expression in a learner and also develop ability to recognize problem and to solve them with related mathematical knowledge and skills.

Through the study of mathematics learners will develop ethical values necessary for accountability in financial matters. It will develop in them the skills of interpreting and financial information. It will help learners acquire skills for planning, budgeting and effective decision-making.

General Outcomes

- To build an understanding and appreciation of basic mathematical concepts and computational skills in order to apply them in everyday life.
- Through the study of mathematics learners will develop ethical values necessary for accountability in financial matters. It will develop in them the skills of interpreting and financial information. It will help learners acquire skills for planning, budgeting and effective decision-making.

GRADE 10

General Outcomes

- Provide clear mathematical **thinking** and expression in the learner
- Develop the learners' mathematical **knowledge and skills**
- Enrich the learners' **understanding** of mathematical concepts in order to facilitate further study of the discipline
- Build up an appreciation of mathematical concepts so that the learner can **apply** these for problem solving in everyday life.
- Enable the learner **Represent**, interpret and use data in a variety of forms

Key Competences

- Assimilate necessary mathematical concepts for use in everyday life such as environment and other related disciplines.
- Think mathematically and accurately in problem solving skills and apply these skills to formulate and solve mathematical and other related problems.
- Produce imaginative and creative work from mathematical concepts and ideas.
- Develop abilities and ideas drawn from mathematics to reason logically, communicate mathematically, and learn independently without too much supervision (self-discipline).
- Development positive attitudes towards mathematics and use it in other subjects such as science and technology.
- Apply mathematical tools such as information and communication technology in the learning of other subjects.
- Use mathematics for enjoyment and pleasure.
- Develop understanding of algebra, geometry, measurements and shapes.

GRADE 10

TOPIC	SUB-TOPIC	SPECIFIC OUTCOMES	KNOWLEDGE	SKILLS	VALUES
10.1 COORDINATE GEOMETRY	10.1.1 Distance of a straight line 10.1.2 Mid-point of a line 10.1.3 Equation of a straight line. 10.1.4 Parallel and perpendicular lines. 10.1.5 Area of rectilinear figures	10.3.1.1 Find length of line segment given two points. 10.3.1.2 Find mid-point of two points. 10.3.1.3 Find the gradient and equation of a straight line. 10.3.1.4 Plot a line of the form $y = mx + c$. 10.3.1.5 Solve problems involving parallel and perpendicular lines. 10.3.1.6 Solve problems involving area.	<ul style="list-style-type: none"> Calculating the distance between two points. Calculating the coordinates of the mid-point Finding Equation of a straight line (gradient - intercept form, two point form / double intercept form) Drawing graphs of the form $y = mx + c$. Solving problems using gradients of Parallel and Perpendicular lines. Finding Coordinates of points of Intersection Finding Collinear points Finding Area of Rectilinear figures 	<ul style="list-style-type: none"> Computation of the distance between two points Interpretation of gradient, intercept and Collinear points. Problem solving involving area. 	<ul style="list-style-type: none"> Appreciation of coordinate geometry in real life
10.2 SYSTEMS OF EQUATIONS	10.2.1 Linear and Quadratic equations 10.2.2 Equations with three variables.	10.2.2.1 Solve systems of equations with one linear and one quadratic. 10.1.2.1 Solve linear systems of equations with three variables.	<ul style="list-style-type: none"> Solving simultaneous equations (one linear and one quadratic.) Solving linear equations with three variables (elimination, substitution and matrix methods). 	<ul style="list-style-type: none"> Computation of systems of equations 	<ul style="list-style-type: none"> Appreciation of systems of equations Decisiveness in selecting appropriate computation method
10.3 FUNCTIONS	10.3.1 Notation of functions. 10.3.2 Inverse function. 10.3.3 Graphs of functions 10.3.4 Composite functions. 10.3.5 Graphs of	10.3.1.1 Describe function, domain, co-domain and range. 10.3.1.2 Find domain, co-domain and range of functions. 10.3.1.3 Evaluate modulus of a function 10.2.3.1 Find inverse of a function 10.2.3.2 Sketch the graph of a function and its inverse.	<ul style="list-style-type: none"> Describing Function, Domain, Range and Co-domain. (Sets of ordered pairs.) Finding domain, co-domain and range of one- to- one function and its inverse. 	<ul style="list-style-type: none"> Representation of functions. Sketching graphs of functions and their inverses. Computation of images of 	<ul style="list-style-type: none"> Appreciation of graphs of functions. Awareness of notation of functions

TOPIC	SUB-TOPIC	SPECIFIC OUTCOMES	KNOWLEDGE	SKILLS	VALUES
	quadratic functions 10.3.6 Quadratic inequalities	10.3.1.4 Find composite functions 10.3.1.5 Sketch quadratic functions 10.1.2.1 Solve quadratic equations 10.1.2.2 Solve quadratic problems involving Inequalities and inequations. 10.3.1.6 Apply quadratic equations to solve real life problems 10.3.1.7 Apply quadratic inequalities to solve real life problems	<ul style="list-style-type: none"> • Drawing graphs of a function, and it's inverse. • Modulus/absolute value • Finding images under composite functions $g[f(x)]$ • Completing the square and graphical method • Understanding and applying the discriminant • Finding maximum and Minimum turning points • Domain and range of quadratic inequalities • Application of quadratic equations to real life problems. 	functions and domains	
10.4 CIRCULAR MEASURES	10.4.1 Radian measures 10.4.2 Arc length 10.4.3 Area of a sector	10.4.1.1 Describe a Radian. 10.4.1.2 Convert radians to degrees and vice-versa. 10.4.2.1 Calculate arc length. 10.4.3.1 Calculate area of a sector.	<ul style="list-style-type: none"> • Describing Radians as circular measures • Relationship between radians and degrees • Converting radians to degrees and vice-versa • Sub units of circular measures ; (e.g. Minutes, $\frac{\pi}{2}$) • Circumference and centre of circle • Calculating Arc length, chord, segment, diameter, radius, area of sector • Area of a triangle using $\frac{1}{2}ab \sin \theta$, where θ is the included angle in radians 	<ul style="list-style-type: none"> • Relating radians and degrees • Conversion of radians to degrees and vice-versa. • Computation of arc length, chord, segment, diameter, radius, and area of sector. 	<ul style="list-style-type: none"> • Appreciation of circular measures. • Awareness of relationship between radians and degrees
10.5 TRIGONOMETR	10.3.1 Six	10.3.1.1 Describe the six	<ul style="list-style-type: none"> • The six trigonometric 	<ul style="list-style-type: none"> • Relating the six 	<ul style="list-style-type: none"> • Curiosity in using

TOPIC	SUB-TOPIC	SPECIFIC OUTCOMES	KNOWLEDGE	SKILLS	VALUES
IC FUNCTIONS	trigonometric functions 10.3.2 Special Angles (30° , 45° and 60°) 10.3.3 Graphs of sine, cosine and tangent functions 10.3.3 Modulus of trigonometric functions. 10.3.4 Trigonometric equations 10.3.5 Trigonometric Identities	trigonometric functions. 10.3.2 Find the trigonometric ratios of 30° , 45° and 60° from a right angled triangle. 10.3.2.1 Describe the relationship between angles in the four quadrants and trigonometric functions 10.3.3.1 Draw graphs of sine, cosine and tangent functions of the form $b\sin kA$, $b\cos kA$, $b\tan kA$ where $b \neq 0$, 10.3.5.1 Solve trigonometric functions involving modulus. 10.3.2.2 Draw graphs of modulus trigonometric functions. 10.3.6.1 Solve simple Trigonometric equation involving the six Trigonometric functions 10.3.4.2 Solve equations involving compound and multiple angles. 10.3.7.1 Prove identities.	functions and their relationships • Finding the trigonometric ratios of 30° , 45° and 60° from a right angled triangle. • Relationship between angle and trigonometric functions in the four quadrants. • Graphs of sine, cosine and tangent curves • Use of formulae $\sin(A \pm B)$. • Applying trigonometric functions in solving Trigonometric equations ; $\tan A = \frac{\sin A}{\cos A} \text{ and}$ $\cot A = \frac{\cos A}{\sin A}$ $\sin^2 A + \cos^2 A = 1$ $\sec^2 A = 1 + \tan^2 A$ • $\operatorname{cosec} A = 1 + \cot^2 A$ • Equations of the form $a\cos\theta + b\sin\theta = c$ • Proving Identities	trigonometric functions. • Substitution of trigonometric identities into trigonometric equations. • Drawing graphs of sine, cosine and tangent functions. • Application of trigonometric Identities.	trigonometry identities. • Appreciation of trigonometry. • Awareness of trigonometric identities
10.6 PERMUTATIONS AND COMBINATIONS	10.6.1 Permutations 10.6.2 Combinations 10.6.2 Factorials	10.6.1.1 Describe permutations and combinations 10.6.1.2 Calculate permutations and combinations of 'n' items 10.6.2.1 Calculate 'n factorial' (n!). 10.6.2.2 Solve problems on linear arrangement and selection	• Describing Permutation and Combination • Calculating permutations and combinations of 'n' items • Factorial; n factorial (n!) where $n \in \mathbb{W}$. • Permutations and combinations of n items	• Interpretation of permutations and Combinations • Computation of permutations and combinations of 'n' items.	• Appreciation of permutations and combinations. • Logical thinking in solving permutations and combinations

TOPIC	SUB-TOPIC	SPECIFIC OUTCOMES	KNOWLEDGE	SKILLS	VALUES
			take r at a time • Solving problems on linear arrangement and selection		
10.7 BINOMIAL THEOREM	10.7.1 Binomial expressions	10.7.1.1 Explain the meaning of Binomial. 10.7.1.1 Expand expressions using Pascal's Triangle and Binomial theorem. 10.7.1.2 Solve problems involving Binomial Theorem	• Explaining the meaning of the Binomial theorem • Describing Pascal's triangle • Expansion of expressions of the form $(a \pm b)^n$ using Pascal triangle and Binomial theorem	• Interpretation of binomials. • Computation of Binomials. • Extrapolation of expressions using Pascal's Triangle and Binomial theorem.	• Appreciation of Binomial theorem. • Inquisitiveness in using the Binomial theorem. • Perseverance in solving problems involving Binomial Theorem.

GRADE 11

<p>General Outcomes</p> <ul style="list-style-type: none"> • Provide clear mathematical thinking and expression in the learner • Develop the learners' mathematical knowledge and skills • Enrich the learners' understanding of mathematical concepts in order to facilitate further study of the discipline • Build up an appreciation of mathematical concepts so that the learner can apply these for problem solving in everyday life. • Enable the learner Represent, interpret and use data in a variety of forms 	<p>Key Competences</p> <ul style="list-style-type: none"> • Assimilate necessary mathematical concepts for use in everyday life such as environment and other related disciplines. • Think mathematically and accurately in problem solving skills and apply these skills to formulate and solve mathematical and other related problems. • Produce imaginative and creative work from mathematical concepts and ideas. • Develop abilities and ideas drawn from mathematics to reason logically, communicate mathematically, and learn independently without too much supervision (self-discipline). • Development positive attitudes towards mathematics and use it in other subjects such as science and technology. • Apply mathematical tools such as information and communication technology in the learning of other subjects. • Use mathematics for enjoyment and pleasure. • Develop understanding of algebra, geometry, measurements and shapes.
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GRADE 11

TOPIC	SUB TOPIC	OUTCOMES	KNOWLEDGE	SKILLS	VALUES
11.1 REMAINDER AND FACTOR THEOREM	11.1.1 Remainder theorem 11.1.2 Factor theorem 11.1.3 Polynomial equations	11.2.1.1 Explain the remainder theorem 11.2.1.2 Use theorem to find quotient and remainder 11.2.2.1 Find factors of a polynomial. 11.1.3.1 Solve polynomial equations.	<ul style="list-style-type: none"> remainder theorem Quotient and Remainder (when a polynomial is divided by $ax+b$. where a and b are integers) Finding Factors of polynomials using factor theorem Identical polynomials Solving polynomial equations 	<ul style="list-style-type: none"> Identification of polynomials. Interpretation of the remainder and factor theorems. Computation of polynomial equations. 	<ul style="list-style-type: none"> Awareness of remainder and factor theorems. Logical thinking in solving polynomials using remainder or factor theorems.
11.2 EXPONENTS AND LOGARITHMIC FUNCTIONS	11.3.1 Exponents 11.3.2 Logarithms	12 Sketch the graph of logarithmic functions. 13 Express exponential function as a logarithmic function and vice versa. 14 Sketch graphs of $y = \log a^x$. 15 Apply laws of indices and logarithms to solve problems.	<ul style="list-style-type: none"> Graphs of the form $y = a^x$ and $y = \log a^x$, $y = e^x$ where $a > 0$, $a \neq -1$ Expressing exponential function as a logarithmic function and vice versa Sketching graphs ($y = \log a^x$ where $a > 0$, $a \neq -1$ and graph of $y = \ln x$) Applying laws of indices and logarithms to solve problems 	<ul style="list-style-type: none"> Presentation of exponents and logarithms. Sketching graphs of exponents and logarithms Application of laws of indices and logarithms to solve problems. 	<ul style="list-style-type: none"> Awareness of exponential and logarithmic functions. Appreciation of exponential functions as logarithmic functions.
11.3 ARITHMETIC AND GEOMETRIC EXPRESSIONS	11.1 Introduction to Arithmetic and Geometric progression 11.2 The n^{th} term of an arithmetic progression. 11 The arithmetic mean. 12 The sum of an A.P. 13 The n^{th} term of a geometric	16 Generate Arithmetic sequence and Geometric series 17 Find the n^{th} term of an Arithmetic progression and Geometric progression. 18 Find the number of terms of an arithmetic progression and Geometric progression. 19 Find the arithmetic and Geometric means.	<ul style="list-style-type: none"> Generating Arithmetic sequence and Geometric series Finding the n^{th} term of an Arithmetic progression and Geometric progression. Finding the number of terms of an arithmetic progression and Geometric progression. Finding the arithmetic and Geometric means. 	<ul style="list-style-type: none"> Generation of Arithmetic sequence and Geometric series. Representation of the n^{th} term of an arithmetic and geometric progression. Computation of the arithmetic and geometric mean and sum. 	<ul style="list-style-type: none"> Curiosity in generating series Logical thinking in solving problems involving arithmetic and geometric progressions. Appreciating patterns formed by arithmetic and geometric progressions

TOPIC	SUB TOPIC	OUTCOMES	KNOWLEDGE	SKILLS	VALUES
	<p>14 progression. The geometric mean.</p> <p>15 The sum of a G.P.</p>	<p>20 Find the sum of n terms of an arithmetic progression.</p> <p>21 Find the n^{th} term of a Geometric progression.</p> <p>22 Find the Geometric mean of two numbers.</p> <p>23 Find the sum of a given number of terms in a G.P.</p> <p>24 Find the sum to infinity of a G.P.</p>	<ul style="list-style-type: none"> • Finding the sum of n terms of an arithmetic progression. • Finding the n^{th} term of a Geometric progression. • Finding the Geometric mean of two numbers. • Finding the sum of a given number of terms in a G.P. • Finding the sum to infinity of a G.P. 		
11.5DIFFERENTIATION	<p>11.5.1 The derived function</p> <p>11.5.2 Application of the derived function.</p>	<p>12 Find the derivative of a polynomial ($f'(x)$ or $\frac{dy}{dx}$).</p> <p>13 Find the derivative of a sum of functions or of composite functions.</p> <p>14 Find derivative of gradient,</p> <p>15 Tangents, normal and stationary points.</p> <p>16 Calculate maxima and minima</p> <p>17 Differentiate exponential functions</p> <p>18 Differentiate trigonometric functions</p>	<ul style="list-style-type: none"> • Finding the derivative of a polynomial using the product rule, the quotient rule and chain rule. • The second derivative • Nature of a stationary point (turning points and points of inflection) • Increasing and decreasing functions • Maxima and minima • Velocity and acceleration, Rate of change, small increments 	<ul style="list-style-type: none"> • Identification of differentiation rules. • Interpretation of gradient, tangents, normal and stationary points • Application of the derived function.. 	<ul style="list-style-type: none"> • Awareness of differentiation rules. • Logical thinking in differentiating the derived functions.
11.6INTEGRATION	<p>11.6.1 Introduction to Integration</p> <p>11.6.2 Indefinite and definite integrals</p> <p>11.6.3 Area</p>	<p>12 Integrate terms of integer powers and their sum (excluding $\frac{1}{x}$ or x^{-1}).</p> <p>13 Integrate polynomials with fractional powers.</p> <p>14 Find indefinite and definite integrals.</p> <p>15 Find areas between two curves.</p> <p>16 Find area bounded by</p>	<ul style="list-style-type: none"> • Relating integration to differentiation • Integrating terms of integer powers and their sum (excluding $\frac{1}{x}$ or x^{-1}) • Integrating polynomials with fractional powers • Finding definite and indefinite integrals • Finding Area under a curve 	<ul style="list-style-type: none"> • Interpretation of indefinite and definite integrals. • Determination of area bounded by curves of polynomials • Application of integration to calculate area 	<ul style="list-style-type: none"> • Curiosity in exploration of indefinite and definite integrals. • Logical thinking in calculating area bounded by curves of polynomials

TOPIC	SUB TOPIC	OUTCOMES	KNOWLEDGE	SKILLS	VALUES
		curves of polynomials.	<ul style="list-style-type: none"> Finding Area bounded by two curves Finding Area bounded by curves of polynomials 		
	11.6.4 Volume of solids of revolution	12 Find volume formed when curve is rotated through 360° (for both x and y axes).	<ul style="list-style-type: none"> Finding volume formed when curve is rotated through 360° (for both x and y axes) 	<ul style="list-style-type: none"> Computation of volume of solids of revolution. Perception of revolution of two dimensional shapes 	<ul style="list-style-type: none"> Logical thinking in finding volume formed when the curve is rotated through 360 degrees
	24.6.5 Velocity and acceleration	11.6.5.1 Find area of the region under velocity – time graph and acceleration time graph. 11.6.5.1 Solve problem involving velocity and acceleration.	<ul style="list-style-type: none"> Finding area of the region under velocity – time graph and acceleration time graph. Solving problem involving velocity and acceleration Displacement Rate of change 	<ul style="list-style-type: none"> Interpretation of velocity and acceleration time graphs. Computation of velocity-acceleration related problems 	<ul style="list-style-type: none"> Accuracy in finding velocity and acceleration.

GRADE 12

General Outcomes

- Provide clear mathematical **thinking** and expression in the learner
- Develop the learners' mathematical **knowledge and skills**
- Enrich the learners' **understanding** of mathematical concepts in order to facilitate further study of the discipline
- Build up an appreciation of mathematical concepts so that the learner can **apply** these for problem solving in everyday life.
- Enable the learner **Represent**, interpret and use data in a variety of forms

Key Competences

- Assimilate necessary mathematical concepts for use in everyday life such as environment and other related disciplines.
- Think mathematically and accurately in problem solving skills and apply these skills to formulate and solve mathematical and other related problems.
- Produce imaginative and creative work from mathematical concepts and ideas.
- Develop abilities and ideas drawn from mathematics to reason logically, communicate mathematically, and learn independently without too much supervision (self-discipline).
- Development positive attitudes towards mathematics and use it in other subjects such as science and technology.
- Apply mathematical tools such as information and communication technology in the learning of other subjects.
- Use mathematics for enjoyment and pleasure.
- Develop understanding of algebra, geometry, measurements and shapes.

GRADE 12

TOPIC	SUB-TOPIC	SPECIFIC OUTCOMES	KNOWLEDGE	SKILLS	VALUES
12.1 VECTORS IN TWO DIMENSIONS	12.1.1 Vectors	11 Define a vector. 12 Use notation \underline{a} , AB, a_i+b_j 13 Add and subtract vectors. 14 Multiply vectors by scalar. 15 Find position vector of a point. 16 Apply position vectors in calculations. 17 Find unit vector. 18 Use (scalar) product of two vectors. 19 Use dot product to find angles between two vectors. 20 Define properties of scalars, such as when $\underline{a} \cdot \underline{b} = 0$, 21 Vector equation of a straight line	<ul style="list-style-type: none"> Defining a vector. Using notation \underline{a}, AB, a_i+b_j Adding and subtracting vectors. Multiplying vectors by scalar. Finding position vector of a point. Applying position vectors in calculations. Finding unit vector. Using (scalar) product of two vectors. Using dot product to find angles between two vectors. Define properties of scalars, such as when $\underline{a} \cdot \underline{b} = 0$, Define Vector equation of a straight line 	<ul style="list-style-type: none"> Identification of vectors in two dimensions. Interpretation of vectors in two dimensions. Computation of vector in two dimensions. 	<ul style="list-style-type: none"> Appreciation of vectors in two dimensions. Logical thinking in calculating vector in two dimension
12.2 STATISTICS	25 Measure of dispersion	26 Make cumulative frequency tables. 27 Draw cumulative frequency curves. 28 Find range, quartiles, percentiles and inter-quartile range. 29 Calculate mean, variance and standard deviation.	<ul style="list-style-type: none"> Statistical presentations (cumulative frequency tables, cumulative frequency curves) . Discrete and random variables Finding range, quartiles, percentiles and inter-quartile range. Calculating mean, variance and standard deviation. 	<ul style="list-style-type: none"> Presentation of cumulative table and cumulative frequency curves Computation of measure dispersion. Application of measures of dispersion in real life 	<ul style="list-style-type: none"> Appreciation of measure of dispersion. Accuracy in computation of measures of dispersion.

GRADES 10 to 12 ADDITIONAL MATHEMATICS SCOPE AND SEQUENCE

The table below shows the coverage of the syllabus in Additional Mathematics from Grades 10 to 12. It is important for a teacher to refer to this table from time to time to know the knowledge that the learners already have or need to have at various levels of learning of the subject.

TOPIC	SPECIFIC OUTCOMES		
	GRADE 10	GRADE 11	GRADE 12
<ul style="list-style-type: none"> ALGEBRA 	○	<ul style="list-style-type: none"> Explain the remainder theorem Use theorem to find quotient and remainder Find factors of a polynomial. Solve polynomial equations. 	<ul style="list-style-type: none"> Define a vector. Use notation \underline{a}, AB, $ai+bj$ Add and subtract vectors. Multiply vectors by scalar. Find position vector of a point. Apply position vectors in calculations. Find unit vector. Use (scalar) product of two vectors. Use dot product to find angles between two vectors. Define properties of scalars, such as when $\underline{a} \bullet \underline{b} = 0$, Vector equation of a straight line
	<ul style="list-style-type: none"> Solve systems of equations with one linear and one quadratic. Solve linear systems of equations with three variables. 	•	•

<ul style="list-style-type: none"> • FUNCTIONS 	<ul style="list-style-type: none"> • Describe function, domain, co-domain and range. • Find domain, co-domain and range of functions. • Evaluate modulus of a function • Find inverse of a function • Sketch the graph of a function and its inverse. • Find composite functions • Sketch quadratic functions • Solve quadratic equations • Solve quadratic problems involving Inequalities and inequations. • Apply quadratic equations to solve real life problems • Apply quadratic inequalities to solve real life problems 	<ul style="list-style-type: none"> • 	<ul style="list-style-type: none"> •
	<ul style="list-style-type: none"> • 	<ul style="list-style-type: none"> • Find the derivative of a polynomial ($f'(x)$ or $\frac{dy}{dx}$). • Find the derivative of a sum of functions or of composite functions. • Find derivative of gradient, • Tangents, normal and stationary points. • Calculate maxima and minima • Differentiate exponential functions • Differentiate trigonometric functions 	<ul style="list-style-type: none"> •
	<ul style="list-style-type: none"> • 	<ul style="list-style-type: none"> • Integrate terms of integer powers and their sum (excluding $\frac{1}{x}$ or x^{-1}). • Integrate polynomials with fractional powers. • Find indefinite and definite integrals. • Find areas between two curves. • Find area bounded by curves of polynomials. 	<ul style="list-style-type: none"> •

	<ul style="list-style-type: none"> • Describe the six trigonometric functions. ▪ Find the trigonometric ratios of 30°, 45° and 60° from a right angled triangle. • Describe the relationship between angles in the four quadrants and trigonometric functions • Draw graphs of sine, cosine and tangent functions of the form $b\sin kA$, $b\cos kA$, $b\tan kA$ where $b \neq 0$, • Solve trigonometric functions involving modulus. • Draw graphs of modulus trigonometric functions. • Solve simple Trigonometric equation involving the six Trigonometric functions • Solve equations involving compound and multiple angles. • Prove identities. 	<ul style="list-style-type: none"> • 	<ul style="list-style-type: none"> •
	<ul style="list-style-type: none"> • 	<ul style="list-style-type: none"> • Find volume formed when curve is rotated through 360° (for both x and y axes). 	<ul style="list-style-type: none"> •
<ul style="list-style-type: none"> • GEOMETRY 	<ul style="list-style-type: none"> • Find length of line segment given two points. • Find mid-point of two points. • Find the gradient and equation of a straight line. • Plot a line of the form $y = mx + c$. • Solve problems involving parallel and perpendicular lines. • Solve problems involving area. 	<ul style="list-style-type: none"> • 	<ul style="list-style-type: none"> •

	<ul style="list-style-type: none"> • Describe a Radian. • Convert radians to degrees and vice-versa. • Calculate arc length. • Calculate area of a sector. 	•	•
• MEASURES	•	<ul style="list-style-type: none"> • Find area of the region under velocity – time graph and acceleration time graph. • Solve problem involving velocity and acceleration. 	•
• NUMBERS AND CALCULATIONS	•	<ul style="list-style-type: none"> • Sketch the graph of logarithmic functions. • Express exponential function as a logarithmic function and vice versa. • Sketch graphs of $y = \log a^x$. • Apply laws of indices and logarithms to solve problems. 	•
	•	<ul style="list-style-type: none"> • Generate Arithmetic sequence and Geometric series • Find the n^{th} term of an Arithmetic progression and Geometric progression. • Find the number of terms of an arithmetic progression and Geometric progression. • Find the arithmetic and Geometric means. • Find the sum of n terms of an arithmetic progression. • Find the n^{th} term of a Geometric progression. • Find the Geometric mean of two numbers. • Find the sum of a given number of terms in a G.P. • Find the sum to infinity of a G.P. 	•

	<ul style="list-style-type: none"> • Describe permutations and combinations • Calculate permutations and combinations of 'n' items • Calculate 'n factorial' (n!). • Solve problems on linear arrangement and selection 	•	•
	<ul style="list-style-type: none"> • Explain the meaning of Binomial. • Expand expressions using Pascal's Triangle and Binomial theorem. • Solve problems involving Binomial Theorem 	•	•
• STATISTICS	•	•	<ul style="list-style-type: none"> • Make cumulative frequency tables. • Draw cumulative frequency curves. • Find range, quartiles, percentiles and inter-quartile range. • Calculate mean, variance and standard deviation.