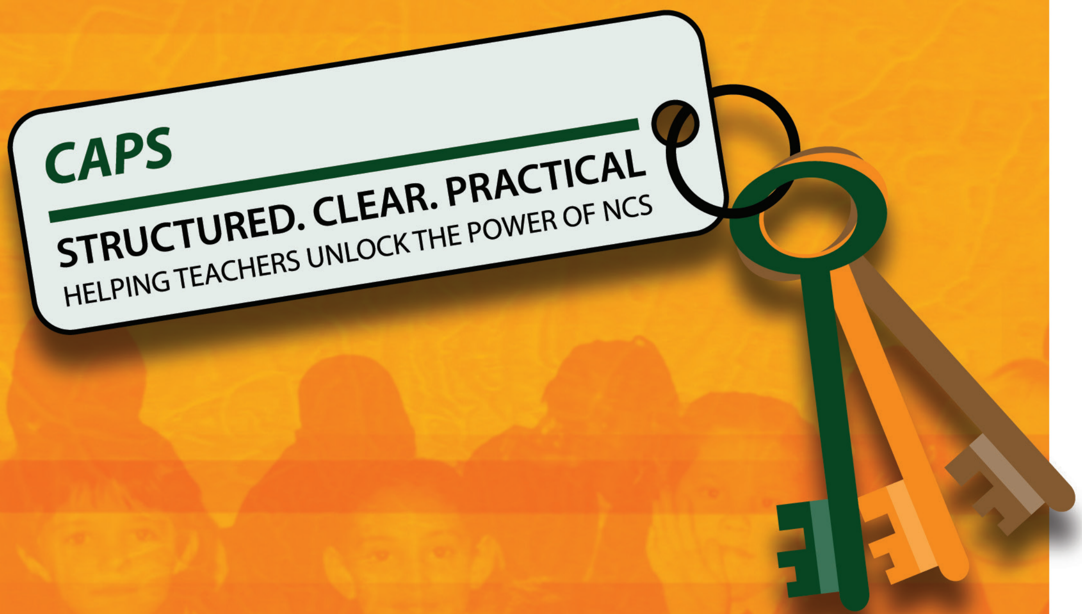
TECHNICAL MATHEMATICS

National Curriculum Statement (NCS)

Curriculum Assessment
Policy Statement



GRADES 10 – 12

basic education
Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

CURRICULUM AND ASSESSMENT POLICY STATEMENT (CAPS)

GRADES 10 – 12

TECHNICAL MATHEMATICS

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FOREWORD BY THE MINISTER

Our national curriculum is the culmination of our efforts over a period of seventeen years to transform the curriculum bequeathed to us by apartheid. From the start of democracy we have built our curriculum on the values that inspired our Constitution (Act 108 of 1996). The Preamble to the Constitution states that the aims of the Constitution are to:

- heal the divisions of the past and establish a society based on democratic values, social justice and fundamental human rights;
- improve the quality of life of all citizens and free the potential of each person;
- lay the foundations for a democratic and open society in which government is based on the will of the people and every citizen is equally protected by law; and
- build a united and democratic South Africa able to take its rightful place as a sovereign state in the family of nations.

Education and the curriculum have an important role to play in realising these aims.

In 1997 we introduced outcomes-based education to overcome the curricular divisions of the past, but the experience of implementation prompted a review in 2000. This led to the first curriculum revision: the *Revised National Curriculum Statement Grades R-9* and the *National Curriculum Statement Grades 10-12* (2002).

Ongoing implementation challenges resulted in another review in 2009 and we revised the *Revised National Curriculum Statement* (2002) to produce this document.

From 2012 the two 2002 curricula, for *Grades R-9* and *Grades 10-12* respectively, are combined in a single document and will simply be known as the *National Curriculum Statement Grades R-12.* The *National Curriculum Statement for Grades R-12* builds on the previous curriculum but also updates it and aims to provide clearer specification of what is to be taught and learnt on a term-by-term basis.

The *National Curriculum Statement Grades R-12* accordingly replaces the Subject Statements, Learning Programme Guidelines and Subject Assessment Guidelines with the

(a) Curriculum and Assessment Policy Statements (CAPS) for all approved subjects listed in this document;

(b) *National policy pertaining to the programme and promotion requirements of the National Curriculum Statement Grades R – 12*; and

(c) *National Protocol for Assessment Grades R – 12.*

MRS ANGIE MOTSHEKGA, MP

MINISTER OF BASIC EDUCATION

CONTENTS

SECTION 1

INTRODUCTION TO THE CURRICULUM AND ASSESSMENT POLICY STATEMENTS FOR TECHNICAL MATHEMATICS GRADE 10 - 12

TECHNICAL MATHEMATICS

1.1 Background

The *National Curriculum Statement Grades R – 12 (NCS)* stipulates policy on curriculum and assessment in the schooling sector. To improve its implementation, the National Curriculum Statement was amended, with the amendments coming into effect in January 2012. A single comprehensive National Curriculum and Assessment Policy Statement was developed for each subject to replace the old Subject Statements, Learning Programme Guidelines and Subject Assessment Guidelines in Grades R – 12.

The amended *National Curriculum and Assessment Policy Statements (January 2012) replace the National Curriculum Statements Grades R – 9 (2002) and the National Curriculum Statements Grades 10 – 12 (2004)*.

1.2 Overview

(a) The *National Curriculum Statement Grades R – 12 (January 2012)* represents a policy statement for learning and teaching in South African schools and comprises the following:

National Curriculum and Assessment Policy statements for each approved school subject as listed in the policy document, and the *National policy pertaining to the programme and promotion requirements of the National Curriculum Statement Grades R – 12,* which replaces the following policy documents:

- *(i)* *National Senior Certificate: A qualification at Level 4 on the National Qualifications Framework (NQF)*; and
- *(ii)* *An addendum to the policy document, the National Senior Certificate: A qualification at Level 4 on the National Qualifications Framework (NQF), for learners with special needs*, published in the *Government Gazette, No.29466* of 11 December 2006.

(b) The *National Curriculum Statement Grades R – 12 (January 2012)* should be read in conjunction with the *National Protocol for Assessment Grade R – 12*, which replaces the policy document, *An addendum to the policy document, the National Senior Certificate: A qualification at Level 4 on the National Qualifications Framework (NQF), for the National Protocol for Assessment Grade R – 12*, published in the *Government Gazette, No. 29467* of 11 December 2006.

(c) The Subject Statements, Learning Programme Guidelines and Subject Assessment Guidelines for Grades R – 9 and Grades 10 – 12 have been repealed and replaced by the *National Curriculum and Assessment Policy Statements for Grades R – 12 (January 2012)*.

(d) The sections on the Curriculum and Assessment Policy as discussed in Chapters 2, 3 and 4 of this document constitute the norms and standards of the *National Curriculum Statement Grades R – 12.* Therefore, in terms of *section 6A* of the *South African Schools Act, 1996 (Act No. 84 of 1996,)* this forms the basis on which the Minister of Basic Education will determine minimum outcomes and standards, as well as the processes and procedures for the assessment of learner achievement, that will apply in public and independent schools.

1.3 General Aims of the South African Curriculum

(a) The *National Curriculum Statement Grades R – 12* spells out what is regarded as knowledge, skills and values worth learning. It will ensure that children acquire and apply knowledge and skills in ways that are meaningful to their own lives. In this regard, the curriculum promotes the idea of grounding knowledge in local contexts, while being sensitive to global imperatives.

(b) The National Curriculum Statement Grades R – 12 serves the purposes of:

- equipping learners, irrespective of their socio-economic background, race, gender, physical ability or intellectual ability, with the knowledge, skills and values necessary for self-fulfilment, and meaningful participation in society as citizens of a free country;
- providing access to higher education;
- facilitating the transition of learners from education institutions to the workplace; and
- providing employers with a sufficient profile of a learner's competencies.

(c) The National Curriculum Statement Grades R – 12 is based on the following principles:

- social transformation: ensuring that the educational imbalances of the past are redressed, and that equal educational opportunities are provided for all sections of our population;
- active and critical learning: encouraging an active and critical approach to learning, rather than rote and uncritical learning of given truths;
- high knowledge and high skills: specifying the minimum standards of knowledge and skills to be achieved at each grade setting high, achievable standards in all subjects;
- progression: showing progression from simple to complex in the content and context of each grade;
- human rights, inclusivity, environmental and social justice: infusing the principles and practices of social and environmental justice and human rights as defined in the Constitution of the Republic of South Africa. (The National Curriculum Statement Grades 10 – 12 (General) is sensitive to issues of diversity such as poverty, inequality, race, gender, language, age, disability and other factors.)
- value of indigenous knowledge systems: acknowledging the rich history and heritage of this country as important contributors to nurturing the values contained in the Constitution; and
- credibility, quality and efficiency: providing an education that is comparable in quality, breadth and depth to those of other countries.

(d) The National Curriculum Statement Grades R – 12 aims to produce learners that are able to:

- identify and solve problems and make decisions using critical and creative thinking;
- work effectively as individuals and with others as members of a team;
- organise and manage themselves and their activities responsibly and efficiently;
- collect, analyse, organise and evaluate information critically;
- communicate effectively using visual, symbolic and/or language skills in various modes;
- use science and technology effectively and critically showing responsibility towards the environment and the health of others; and
- demonstrate an understanding of the world as a set of related systems by recognising that problem solving contexts do not exist in isolation.

(e) Inclusivity should be a central part of the organisation, planning and teaching at each school. This can only occur if all teachers have the capacity to recognise and address barriers to learning, and to plan for diversity. The key to managing inclusivity is to ensure that barriers are identified and addressed by all the relevant support structures within the school community, including teachers, district-based support teams, institutional-level support teams, parents and Special Schools as resource centres. To address barriers in the classroom, teachers should employ various curriculum differentiation strategies such as those contained in the Department of Basic Education's *Guidelines for Inclusive Teaching and Learning* (2010).

1.4 Time Allocation

1.4.1 Foundation Phase

(a) The instructional time for each subject in the Foundation Phase is indicated in the table below:

Subject	Time allocation per week (hours)
i. Languages (FAL and HL)	10 (11)
ii. Mathematics	7
iii. Life Skills	6 (7)
• Beginning Knowledge	1 (2)
• Creative Arts	2
• Physical Education	2
• Personal and Social Well-being	1

(b) Total instructional time for Grades R, 1 and 2 is 23 hours and for Grade 3 is 25 hours.

(c) To Languages 10 hours are allocated in Grades R – 2 and 11 hours in Grade 3. A maximum of 8 hours and a minimum of 7 hours are allocated to Home Language and a minimum of 2 hours and a maximum of 3 hours to First Additional Language in Grades R – 2. In Grade 3 a maximum of 8 hours and a minimum of 7 hours are allocated to Home Language and a minimum of 3 hours and a maximum of 4 hours to First Additional Language.

(d) To Life Skills Beginning Knowledge 1 hour is allocated in Grades R – 2 and 2 hours are allocated for Grade 3 as indicated by the hours in brackets.

1.4.2 Intermediate Phase

(a) The table below shows the subjects and instructional times allocated to each in the Intermediate Phase.

Subject	Time allocation per week (hours)
i. Home Language	6
ii. First Additional Language	5
iii. Mathematics	6
iv. Science and Technology	3.5
v. Social Sciences	3
vi. Life Skills	4
vii. Creative Arts	1.5
viii. Physical Education	1.5
ix. Religious Studies	1

1.4.3 Senior Phase

(a) The instructional time for each subject in the Senior Phase is allocated as follows:

Subject	Time allocation per week (hours)
i. Home Language	5
ii. First Additional Language	4
iii. Mathematics	4.5
iv. Natural Sciences	3
v. Social Sciences	3
vi. Technology	2
vii. Economic Management Sciences	2
viii. Life Orientation	2
ix. Arts and Culture	2

1.4.4 Grades 10 – 12

(a) The instructional time for each subject in Grades 10 – 12 is allocated as follows:

Subject	Time allocation per week (hours)
i. Home Language	4.5
ii. First Additional Language	4.5
iii. Mathematics	4.5
iv. Technical Mathematics	4.5
v. Mathematical Literacy	4.5
vi. Life Orientation	2
vii. Three Electives	12 (3x4h)

The allocated time per week may be utilised only for the minimum number of required NCS subjects as specified above, and may not be used for any additional subjects added to the list of minimum subjects. Should a learner wish to offer additional subjects, additional time has to be allocated in order to offer these subjects.

Section 2

Curriculum and Assessment Policy Statement (CAPS)

FET TECHNICAL MATHEMATICS

Introduction

In Section 2, the Further Education and Training (FET) Phase Technical Mathematics CAPS provides teachers with a definition of Technical Mathematics, specific aims, specific skills focus of content areas, and the weighting of content areas.

2.1 What is Technical Mathematics?

Mathematics is a universal science language that makes use of symbols and notations for describing numerical, geometric and graphical relationships. It is a human activity that involves observing, representing and investigating patterns and qualitative relationships in physical and social phenomena and between mathematical objects themselves. It helps to develop mental processes that enhance logical and critical thinking, accuracy and problem solving that will contribute in decision-making.

Mathematical problem solving enables us to understand the world (physical, social and economic) around us, and, most of all, teaches us to think creatively. The aim of Technical Mathematics is to apply the Science of Mathematics to the Technical field where the emphasis is on APPLICATION andnot on abstract ideas.

2.2 Specific Aims of Technical Mathematics

1. To apply mathematical principles.

2. To develop fluency in computation skills **with the usage of calculators**.

3. Mathematical modelling is an important focal point of the curriculum. Real life **technical problems** should be incorporated into all sections whenever appropriate. Examples used should be realistic and not contrived. Contextual problems should include issues relating to health, social, economic, cultural, scientific, political and environmental issues whenever possible.

4. To provide the opportunity to develop in learners the ability to be methodical, to generalize and to be skilful users of the Science of Mathematics.

5. To be able to understand and work with the number system.

6. To promote accessibility of **Mathematical content to all learners**. This could be achieved by catering for learners with different needs, e.g. TECHNICAL NEEDS.

7. To develop problem-solving and cognitive skills. Teaching should not be limited to **“how”** but should rather feature the **“when”** and **“why”** of problem types.

8. To provide learners at Technical schools an alternative and value adding substitute to Mathematical Literacy.

9. To support and sustain technical subjects at Technical schools.

10. Technical Mathematics can only be taken by learners offering a Technical subject (mechanical, civil and electrical engineering).

11. To provide a vocational route aligned with the expectations of labour in order to ensure direct access to learnership/apprenticeship.

12. To create the opportunity for learners to further their studies at FET Colleges at an entrance level of N-4 and thus creating an alternative route to access other HEIs.

2.3 Specific Skills

To develop essential mathematical skills the learner should:

- develop the correct use of the language of Mathematics;
- use mathematical process skills to identify and solve problems.
- use spatial skills and properties of shapes and objects to identify, pose and solve problems creatively and critically;
- participate as responsible citizens in the technical environment locally, as well as in national and global communities; and
- communicate appropriately by using descriptions in words, graphs, symbols, tables and diagrams.

2.4 Focus of Content Areas

Technical Mathematics in the FET Phase covers ten main content areas. Each content area contributes towards the acquisition of the specific skills.

The table below shows the main topics in the FET Phase.

1.	**Number system**
2.	**Functions and graphs**
3.	**Finance, growth and decay**
4.	**Algebra**
5.	**Differential Calculus**
6.	**Euclidean Geometry**
7.	**Mensuration**
8.	**Circles, angles and angular movement**
9.	**Analytical Geometry**
10.	**Trigonometry**

Main topics for Technical Mathematics:

2.5 Weighting of Content Areas

The weighting of Technical Mathematics content areas serves two primary purposes: *firstly* the weighting gives guidance on the amount of time needed to address adequately the content within each content area; *secondly* the weighting gives guidance on the spread of content in the examination (especially end of the year summative assessment).

Weighting of Content Areas			
Description	**Grade 10**	**Grade 11**	**Grade 12**
PAPER 1			
Algebra (Expressions, equations and inequalities including nature of roots in Grades 11 & 12)	60 ± 3	90 ± 3	50 ± 3
Functions & Graphs (excluding trig. functions)	25 ± 3	45 ± 3	35 ± 3
Finance, growth and decay	15 ± 3	15 ± 3	15 ± 3
Differential Calculus and Integration			50 ± 3
TOTAL	**100**	**150**	**150**
PAPER 2 :			
Description	**Grade 10**	**Grade 11**	**Grade 12**
Analytical Geometry	15 ± 3	25 ± 3	25 ± 3
Trigonometry (including trig. functions)	40 ± 3	50 ± 3	50 ± 3
Euclidean Geometry	30 ± 3	40 ± 3	40 ± 3
Mensuration, circles, angles and angular movement	15 ± 3	35 ± 3	35 ± 3
TOTAL	**100**	**150**	**150**

2.6 Technical Mathematics in the FET

The subject Technical Mathematics in the Further Education and Training Phase forms the link between the Senior Phase and the Higher Education band. All learners passing through this phase acquire a functioning knowledge of Technical Mathematics that empowers them to make sense of their Technical field of study and their place in society. It ensures access to an extended study of the technical mathematical sciences and a variety of technical career paths.

In the FET Phase, learners should be exposed to technical mathematical experiences that give them many opportunities to develop their mathematical reasoning and creative skills in preparation for more applied mathematics in HEIs or in-job training.

Section 3

Curriculum and Assessment Policy Statement (CAPS)
FET TECHNICAL MATHEMATICS Content Specification and Clarification

Introduction

Section 3 provides teachers with:

- Specification of content to show progression
- Clarification of content with teaching guidelines
- Allocation of time

3.1 Specification of Content to show Progression

The specification of content shows progression in terms of concepts and skills from Grade 10 to 12 for each content area. However, in certain topics the concepts and skills are similar in two or three successive grades. The clarification of content gives guidelines on how progression should be addressed in these cases. The specification of content should therefore be read in conjunction with the clarification of content.

3.1.1 *Overview of topics*

	Grade 10		Grade 11		Grade 12
1. NUMBER SYSTEM					
•	(a) Identify rational numbers and convert terminating or recurring decimals into the form $\frac{a}{b}$ where $a, b \in Z$ and $b \neq 0$. (b) Understand that simple surds are not rational.	•	Take note that numbers exist other than those on the real number line, the so-called non-real numbers. It is possible to square certain non-real numbers and obtain negative real numbers as answers. Binary numbers should be known.	•	There are numbers other than those studied in earlier grades called imaginary numbers and complex numbers. Add, subtract, divide, multiply and simplify imaginary numbers and complex numbers. Solve equations involving complex numbers.
2. FUNCTIONS					
•	Work with relationships between variables in terms of numerical, graphical, verbal and symbolic representations of functions and convert flexibly between these representations (tables, graphs, words and formulae). Include linear and some quadratic polynomial functions, exponential functions and some rational functions.	•	Extend Grade 10 work on the relationships between variables in terms of numerical, graphical, verbal and symbolic representations of functions and convert flexibly between these representations (tables, graphs, words and formulae). Include linear and quadratic polynomial functions, exponential functions andsome rational functions.		Introduce a more formal definition of a function and extend Grade 11 work on the relationships between variables in terms of numerical, graphical, verbal and symbolic representations of functions and convert flexibly between these representations (tables, graphs, words and formulae). Include linear, quadratic and some cubic polynomial functions, exponential and some rational functions.
•	Generate as many graphs as necessary, initially by means of point-by-point plotting, to make and test conjectures and hence generalise the effect of the parameter which results in a vertical shift and that which results in a vertical stretch and/or a reflection about the x-axis.	•	Generate as many graphs as necessary, initially by means of point-by-point plotting, to make and test conjectures and hence generalise the effects of the parameter which results in a horizontal shift and that which results in a horizontal stretch and/or reflection about the *y*-axis.	•	Revise work studied in earlier grades.
•	Problem solving and graph work involving the prescribed functions.	•	Problem solving and graph work involving the prescribed functions. Average gradient between two points.	•	Problem solving and graph work involving the prescribed functions.

3. FINANCE, GROWTH AND DECAY					
•	Use simple and compound growth formulae $A = P(1+in)$ and $A = P(1+i)^n$ to solve problems (including interest, hire purchase, inflation, population growth and other real life problems).	•	Use simple and compound growth/decay formulae $A = P(1+in)$ and $A = P(1+i)^n$ to solve problems (including interest, hire purchase, inflation, population growth and other real life problems).	•	Strengthen the Grade 11 work.
•	The implications of fluctuating foreign exchange rates.	•	The effect of different periods of compounding growth and decay (including effective and nominal interest rates).	•	Critically analyse different loan options.
4. ALGEBRA					
•	(a) Simplify expressions using the laws of exponents for integral exponents. (b) Establish between which two integers a given simple surd lies. (c) Round real numbers to an appropriate degree of accuracy (to a given number of decimal digits). (d) Revise scientific notation.	•	(a) Apply the laws of exponents to expressions involving rational exponents. (b) Add, subtract, multiply and divide simple surds. (c) Demonstrate an understanding of the definition of a logarithm and any laws needed to solve real life problems.	•	Apply any law of logarithm to solve real life problems.
•	Manipulate algebraic expressions by: • multiplying a binomial by a trinomial; • factorising common factor (revision); • factorising by grouping in pairs; • factorising trinomials; • factorising difference of two squares (revision); • factorising the difference and sums of two cubes; and • simplifying, adding, subtracting, multiplying and division of algebraic fractions with numerators and denominators limited to the polynomials covered in factorisation.	•	Revise factorisation from Grade 10.	•	• Take note and understand the Remainder and Factor Theorems for polynomials up to the third degree (proofs of the Remainder and Factor theorems will not be examined). • Factorise third-degree polynomials (including examples which require the Factor Theorem).

4. ALGEBRA					
•	Solve: • linear equations; • quadratic equations by factorisation; • literal equations (changing the subject of formula); • exponential equations (accepting that the laws of exponents hold for real exponents and solutions are not necessarily integral or even rational); • linear inequalities in one variable and illustrate the solution graphically; and • linear equations in two variables simultaneously (algebraically and graphically).	•	Solve: • quadratic equations (by factorisation and by using the quadratic formula); • equations in two unknowns, one of which is linear the other quadratic, algebraically or graphically. • Explore the nature of roots through the value of $b^2 - 4ac$.	•	• Determine the nature of roots and the conditions for which the roots are real, non-real, equal, unequal, rational and irrational.
5. DIFFERENTIAL CALCULUS AND INTEGRATION					
•		•		•	(a) An intuitive understanding of the concept of a limit. (b) Differentiation of specified functions from first principles. (c) Use of the specified rules of differentiation. (d) The equations of tangents to graphs. (e) The ability to sketch graphs of cubic functions. (f) Practical problems involving optimisation and rates of change (including the calculus of motion). (g) Basic integration.

6. EUCLIDEAN GEOMETRY					
•	(a) Revise basic results established in earlier grades. (b) Investigate and form conjectures about the properties of special triangles (scalene, isosceles, equilateral and right-angled triangle) and quadrilaterals. (c) Investigate alternative (but equivalent) definitions of various polygons (including the scalene, isosceles, equilateral and right-angled triangle, the kite, parallelogram, rectangle, rhombus, square and trapezium). (d) Application of the theorem of Pythagoras.	•	(a) Investigate theorems of the geometry of circles assuming results from earlier grades, together with one other result concerning tangents and radii of circles. (b) Solve circle geometry problems, providing reasons for statements when required.	•	(a) Revise the concept of similarity and proportionality. (b) Apply proportionality in triangles. (c) Apply mid-point theorem.
7. MENSURATION					
•	Conversion of units, square units and cubic units.	•	(a) Solve problems involving volume and surface area of solids studied in earlier grades and combinations of those objects to form more complex shaped solids. (b) Determine the area of an irregular figure using Mid-ordinate Rule.	•	Revise work studied in earlier Grades.
8. CIRCLES, ANGLES AND ANGULAR MOVEMENT					
•	• Define a radian. • Converting degrees to radians and vice versa.	•	• Angles and arcs • Degrees and radians • Sectors and segments • Angular and circumferential velocity.	•	
9. ANALYTICAL GEOMETRY					
•	Represent geometric figures in a Cartesian co-ordinate system, and derive and apply, for any two points $(x_1;y_1)$ and $(x_2;y_2)$ a formula for calculating: • the distance between the two points; • the gradient of the line segment joining the points; • the co-ordinates of the mid-point of the line segment joining the points; and • the equation of a straight line joining the two points.	•	Use a Cartesian co-ordinate system to determine: • the equation of a line through two given points; • the equation of a line through one point and parallel or perpendicular to a given line; and • the angle of inclination of a line.	•	Use a two-dimensional Cartesian co-ordinate system to determine: • the equation of a circle with centre at the origin (centre is (0;0)); • the equation of a tangent to a circle at a given point on the circle; and • point/s of intersection of a circle and a straight line.

10. TRIGONOMETRY					
•	(a) Definitions of the trigonometric functions $\sin\theta$, $\cos\theta$ and $\tan\theta$ in $\text{right}-\text{angled}$ triangles .Take note that there are special names for the reciprocals of the trigonometric functions $\cos ec\theta = \frac{1}{\sin\theta}$; $\sec\theta = \frac{1}{\cos\theta}$ and $\cot\theta = \frac{1}{\tan\theta}$. (b) Extend the definitions of $\sin\theta, \cos\theta$ and $\tan\theta$ to $0° \le \theta \le 360°$ and calculate trigonometric ratios. (c) Simplification of trigonometric expressions/ equations by making use of a calculator. (d) Solve simple trigonometric equations for angles between 0^0 and 90^0.	•	(a) Use the identities: $\tan\theta = \frac{\sin\theta}{\cos\theta}$, $\sin^2\theta + \cos^2\theta = 1$, $1 + \tan^2\theta = \sec^2\theta$, and $\cot^2\theta + 1 = \cos ec^2\theta$. (b) Reduction formulae, $(180° \pm \theta)$ and $(360° \pm \theta)$. (c) Determine the solutions of trigonometric equations for $0° \le \theta \le 360°$. (d) Apply sine, cosine and area rules (proofs of these rules will not be examined).	•	• Apply trigonometric identities studied in earlier grades to prove that left hand side equals to right hand side.
•	Solve problems in two dimensions by using the above trigonometric functions and by constructing and interpreting geometric and trigonometric models.	•	Solve problems in two dimensions by using sine, cosine and area rule.	•	Solve problems in two and three dimensions by constructing and interpreting geometric and trigonometric models. Only angles and numerical distances/lengths should be used.
•	Draw the graphs of $y = \sin\theta$, $y = \cos\theta$ and $y = \tan\theta$.	•	The effects of the parameters on the graphs defined by $y = \sin k\theta$, $y = \cos k\theta$ and $y = \tan k\theta$. The effects of p on the graphs of $y = \sin(\theta + p)$, $y = \cos(\theta + p)$ and $y = \tan(\theta + p)$. One parameter should be tested at a given time if examining horizontal shift.	•	Revise work studied in earlier grades.
			Rotating vectors (sine and cosine curves only).		

3.2 Content Clarification with teaching guidelines

In Section 3, content clarification includes:

  - Teaching guidelines
  - Sequencing of topics per term
  - Pacing of topics over the year

- Each content area has been broken down into topics. The sequencing of topics within terms gives an idea of how content areas can be spread and re-visited throughout the year.
- The examples discussed in the Clarification Column in the annual teaching plan which follows are by no means a complete representation of all the material to be covered in the curriculum. They only serve as an indication of some questions on the topic at different cognitive levels. Text books and other resources should be consulted for a complete treatment of all the material.
- The order of topics is not prescriptive, but ensures that in the first two terms, more than six topics are covered/ taught so that assessment is balanced between paper 1 and 2.

3.2.1 *Allocation of Teaching Time*

Time allocation for Technical Mathematics: 4 hours and 30 minutes, e.g. six forty-five-minute periods per week in Grades 10, 11 and 12.

Terms	Grade 10		Grade 11		Grade 12	
		No. of weeks		**No. of weeks**		**No. of weeks**
Term 1	Introduction Number systems Exponents Mensuration Algebraic Expressions	2 3 2 1 3	Exponents and surds Logarithms Equations and inequalities (including nature of roots) Analytical Geometry	3 2 4 2	Complex numbers Polynomials Differential Calculus	3 2 6
Term 2	Algebraic Expressions Equations and inequalities Trigonometry MID-YEAR EXAMS	2 3 3 3	Functions and graphs Euclidean Geometry MID-YEAR EXAMS	4 4 3	Integration Analytical Geometry Euclidean Geometry MID-YEAR EXAMS	3 2 3 3
Term 3	Trigonometry Functions and graphs Euclidean Geometry Analytical Geometry	2 3 4 1	Circles, angles and angular movement Trigonometry Finance, growth and decay	4 4 2	Euclidean Geometry Trigonometry Revision TRIAL EXAMS	2 3 1 4
Term 4	Analytical Geometry Circles, angles and angular movement Finance and growth Revision EXAMS	1 1 2 2 3	Mensuration Revision EXAMS	3 3 3	Revision EXAMS	3 5

The detail which follows includes examples and numerical references to the Overview.

MATHEMATICS: GRADE 10 PACE SETTER

Term 1	TERM 1										
Weeks	**WEEK 1**	**WEEK 2**	**WEEK 3**	**WEEK 4**	**WEEK 5**	**WEEK 6**	**WEEK 7**	**WEEK 8**	**WEEK 9**	**WEEK 10**	**WEEK 11**
Topics	Introduction		Number systems			Exponents		Mensuration	Algebraic Expressions		
Assessment	Investigation or project							Test			
Date completed											

Term 2	TERM 2										
Weeks	**WEEK 1**	**WEEK 2**	**WEEK 3**	**WEEK 4**	**WEEK 5**	**WEEK 6**	**WEEK 7**	**WEEK 8**	**WEEK 9**	**WEEK 10**	**WEEK 11**
Topics	Algebraic Expressions		Equations and Inequalities			Trigonometry					
Assessment	Assignment / Test								MID-YEAR EXAMINATION		
Date completed											

Term 3	TERM 3									
Weeks	**WEEK 1**	**WEEK 2**	**WEEK 3**	**WEEK 4**	**WEEK 5**	**WEEK 6**	**WEEK 7**	**WEEK 8**	**WEEK 9**	**WEEK 10**
Topics	Trigonometry		Functions and graphs			Euclidean Geometry				Analytical Geometry
Assessment	Test						Test			
Date completed										

Term 4	TERM 4										Paper 1: 2 hours		Paper 2: 2 hours	
Weeks	**WEEK 1**	**WEEK 2**	**WEEK 3**	**WEEK 4**	**WEEK 5**	**WEEK 6**	**WEEK 7**	**WEEK 8**	**WEEK 9**	**WEEK 10**	Algebraic expressions and equations (including inequalities and exponents)	60	Euclidean Geometry	30
Topics	Analytical Geometry	Circles, angles and angular movement	Finance and growth		Revision					Admin	Finance and growth	15	Analytical Geometry	15
													Trigonometry	40
													Mensuration, circles, angles and angular movement	15
Assessment	Test						Examinations				Functions and graphs (excluding trig. functions)	25		
Date completed											Total marks	100	Total marks	100

3.2.2 Sequencing and Pacing of Topics

	MATHEMATICS: GRADE 11 PACE SETTER										
Term 1	**TERM 1**										
Weeks	**WEEK 1**	**WEEK 2**	**WEEK 3**	**WEEK 4**	**WEEK 5**	**WEEK 6**	**WEEK 7**	**WEEK 8**	**WEEK 9**	**WEEK 10**	**WEEK 11**
Topics	Exponents and surds			Logarithms		Equations and inequalities			Nature of roots	Analytical Geometry	
Assessment	Investigation or project						Test				
Date completed											
Term 2	**TERM 2**										
Weeks	**WEEK 1**	**WEEK 2**	**WEEK 3**	**WEEK 4**	**WEEK 5**	**WEEK 6**	**WEEK 7**	**WEEK 8**	**WEEK 9**	**WEEK 10**	**WEEK 11**
Topics	Functions and graphs				Euclidean Geometry Trigonometry						
Assessment	Assignment / Test								MID-YEAR EXAMINATION		
Date completed											
Term 3	**TERM 3**										
Weeks	**WEEK 1**	**WEEK 2**	**WEEK 3**	**WEEK 4**	**WEEK 5**	**WEEK 6**	**WEEK 7**	**WEEK 8**	**WEEK 9**	**WEEK 10**	
Topics	Circles, angles and angular movement				Trigonometry				Finance, growth and decay		
Assessment	Test					Test					
Date completed											

Term 4	**TERM 4**										Paper 1: 3 hours		Paper 2: 3 hours	
Weeks	**WEEK 1**	**WEEK 2**	**WEEK 3**	**WEEK 4**	**WEEK 5**	**WEEK 6**	**WEEK 7**	**WEEK 8**	**WEEK 9**	**WEEK 10**	Algebraic expressions, equations, inequalities and nature of roots Functions and graphs (excluding trig. functions) Finance, growth and decay	90 45 15	Euclidean Geometry Analytical Geometry Trigonometry and Mensuration, circles, angles and angular movement	40 25 50 35
Topics	Mensuration			Revision			FINAL EXAMINATION			Admin				
Assessment	Test													
Date completed											Total marks	150	Total marks	150

MATHEMATICS: GRADE 12 PACE SETTER

Term 1	TERM 1										
Weeks	**WEEK 1**	**WEEK 2**	**WEEK 3**	**WEEK 4**	**WEEK 5**	**WEEK 6**	**WEEK 7**	**WEEK 8**	**WEEK 9**	**WEEK 10**	**WEEK 11**
Topics	Complex numbers			Functions: Polynomials		Differential Calculus					
Assessment	Test				Investigation or project			Assignment / Test			
Date completed											

Term 2	TERM 2										
Weeks	**WEEK 1**	**WEEK 2**	**WEEK 3**	**WEEK 4**	**WEEK 5**	**WEEK 6**	**WEEK 7**	**WEEK 8**	**WEEK 9**	**WEEK 10**	**WEEK 11**
Topics	Integration			Analytical Geometry		Euclidean Geometry					
Assessment	Test								MID-YEAR EXAMINATION		
Date completed											

Term 3	TERM 3									
Weeks	**WEEK 1**	**WEEK 2**	**WEEK 3**	**WEEK 4**	**WEEK 5**	**WEEK 6**	**WEEK 7**	**WEEK 8**	**WEEK 9**	**WEEK 10**
Topics	Euclidean Geometry		Trigonometry			Revision				
Assessment	Test							**TRIAL EXAMINATION**		
Date completed										

Term 4	TERM 4										Paper 1: 3 hours		Paper 2: 3 hours	
	WEEK 1	**WEEK 2**	**WEEK 3**	**WEEK 4**	**WEEK 5**	**WEEK 6**	**WEEK 7**	**WEEK 8**	**WEEK 9**	**WEEK 10**	Algebraic expressions and equations (and inequalities, logs and complex numbers) Functions and graphs (excluding trig. functions) Finance, growth and decay Differential Calculus and integration	50 35 15 50	Euclidean Geometry Analytical Geometry Trigonometry and Mensuration, circles, angles and angular movement	40 25 50 35
	Revision		FINAL EXAMINATION							Admin				
Date completed											Total marks	150	Total marks	150

3.2.3 *Topic allocation per term and clarification*

GRADE 10: TERM 1			
Weeks	**Topic**	**Curriculum statement**	**Clarification**
			Where an example is given, the cognitive demand is suggested: knowledge (K), routine procedure (R), complex procedure (C) or problem-solving (P).
2	**Introduction**	Mathematical language and concepts used in previous years are revised.	All basic algebra must be revised.
3	**Number systems**	• Understand that real numbers can be natural, whole, integers, rational, irrational. • Introduce binary and complex numbers. • Round real numbers off to a significant/appropriate degree of accuracy. • Convert rational numbers into decimal numbers and vice versa. • Determine between which two integers a given simple surd lies. • Set builder notation, interval notation and number lines.	• Use real numbers as the set of points and explain each set of numbers on a line. (Natural, whole, integers, rational, irrational). • Deal with imaginary, binary and complex numbers • Binary numbers – basic operations including addition, subtraction, multiplication and division of whole numbers) • Complex numbers – define only • Learners must be able to round off to one, two or three decimals. Binary numbers system consists of two numbers, namely 0 and 1. Examples: 1. $111=(1\times 2^2)+(1\times 2^1)+1=7$ (R) 2. $\begin{array}{r} 111 \\ +101 \\ \hline 1100 \\ \hline \end{array}$ (R)
2	**Exponents**	1. Revise laws of exponents studied in Grade 9 where $x, y > 0$ and $m, n \in Z$. • $x^m \times x^n = x^{m+n}$ • $x^m \div x^n = x^{m-n}$ • $(x^m)^n = x^{mn}$ • $x^m \times y^m = (xy)^m$ Also by definition: • $x^{-n} = \frac{1}{x^n}$, $x \neq 0$, and $x^0 = 1$, $x \neq 0$. 2. Use the laws of exponents to simplify expressions and solve easy exponential equations (the exponents may only be whole numbers). 3. Revise scientific notation.	Comment: Revise prime base numbers and prime factorisation Examples: 1. $2^2 \times 2^3$ (K) 2. $\frac{9^{x+1}}{3^{x-1}}$ (R) Solve for x: 3. $3^x = 27$ (K) 4. $6^x = 36$ (K) Comment: Make sure to do examples of very big and very small numbers.
1	**Mensuration**	1. Conversion of units and square units and cubic units. **All conversions should be done both ways.** 2. Applications in technical fields.	• Units of length: (mm, cm, m, km) e.g. 1000m = 1km • Units of area: (mm^2, cm^2, m^2) e.g. 1 m^2 = 1 000 000 mm^2 • Units of volume: (ml = cm^3, m^3, dm^3 = 1l). • Typical practical examples on the learners' level should be introduced.

GRADE 10: TERM 1			
Weeks	**Topic**	**Curriculum statement**	**Clarification**
			Where an example is given, the cognitive demand is suggested: knowledge (K), routine procedure (R), complex procedure (C) or problem-solving (P).
3	**Algebraic expressions**	1. Revise notation (interval, set builder, number line, sets). 2. Adding and subtracting of algebraic terms. 3. Multiplication of a binomial by a binomial. 4. Multiplication of a binomial by a trinomial. 5. Determine the HCF and LCM of not more than three numerical or monomial algebraic expressions by making use of factorisation. 6. Factorisation of the following types: • common factors • grouping in pairs • difference of two squares • addition/subtraction of two cubes • trinomials	Examples 1. Subtract $4a+8b$ from $5a+10b$ (K) Remove brackets 2. $(x+2)(x-2)=$ (K) 3. $(4x-5y)^2=$ (K) 4. $(x-y)(2x-3y)=$ (K) 5. $(2a+3)(a^2-2a-1)=$ (R) Factorise 6. $2x^2y+4xy^2-6xy$ (K) 7. $ab+ac-2b-2c$ (R) 8. $2a^2-8b^2$ (K) 9. x^3-8y^3 (R) 10. x^2-7x-8 (R)

Assessment Term 1:

1. Investigation or project (only one project or one investigation a year) (at least 50 marks)

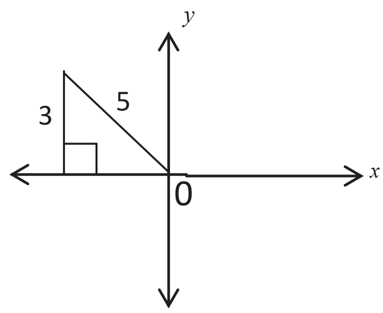
Example of an investigation:

Imagine a cube of white wood which is dipped into red paint so that the surface is red, but the inside still white. If one cut is made, parallel to each face of the cube (and through the centre of the cube), then there will be 8 smaller cubes. Each of the smaller cubes will have 3 red faces and 3 white faces. Investigate the number of smaller cubes which will have 3, 2, 1 and 0 red faces if 2/3/4/…/*n* equally spaced cuts are made parallel to each face. This task provides the opportunity to investigate, tabulate results, make conjectures and justify or prove them.

2. Test (at least 50 marks and 1 hour). Make sure all topics are tested.

Care needs to be taken to set questions on all four cognitive levels: approximately 20% knowledge, approximately 35% routine procedures, 30% complex procedures and 15% problem-solving.

GRADE 10: TERM 2			
Weeks	**Topic**	**Curriculum statement**	**Clarification**
			Where an example is given, the cognitive demand is suggested: knowledge (K), routine procedure (R), complex procedure (C) or problem-solving (P).
2	**Algebraic Expressions (continue)**	7. Do addition, subtraction, multiplication and division of algebraic fractions using factorisation (numerators and denominators should be limited to the polynomials covered in factorisation).	Simplify 11. $\frac{x^2y+xy^2}{bx+by}\times\frac{x^2+xy-bx-by}{xy}$ (R) 12. $\frac{a-3}{a^2+3a+2}+\frac{4}{a+1}-\frac{5}{a^2-4}$ (R)
3	**Equations and Inequalities**	1.1 Revise notation (interval, set builder, number line, sets). 1.2 Solve linear equations. 1.3 Solve equation with fractions. 2. Solve quadratic equations by factorisation 3. Solve simultaneous linear equations with two variables 4.1 Do basic Grade 8 & 9 word problems. 4.2 Solve word problems involving linear, quadratic or simultaneous linear equations. 5. Solve simple linear inequalities (and show solution graphically). 6. Manipulation of formulae (technical related).	**Examples** Solve for x: 1. $3x+4=8$ (K) 2. $\frac{x-3}{3x+1}=2$ (R) 3. $x^2-4x+2=0$ (K) Solve for x and y: 4. $3x+y=4$ and $2x+y=6$ (R) 5. $v=u+at$ (Change the subject of the formula to a) (R) 6. $E=\frac{1}{2}mv^2$ (Change the subject of the formula to v) (R)

GRADE 10: TERM 2			
Weeks	**Topic**	**Curriculum statement**	**Clarification**
			Where an example is given, the cognitive demand is suggested: knowledge (K), routine procedure (R), complex procedure (C) or problem-solving (P).
3	**Trigonometry**	1. Know definitions of the trigonometric ratios sin θ, $\cos\theta$ and tan θ, using right-angled triangles for $0° \leq \theta \leq 360°$. 2. Introduce the reciprocals of the 3basic trigonometric ratios, sin θ, $\cos\theta$ and tan θ : $\operatorname{cosec}\theta = \frac{1}{\sin\theta}$, $\sec\theta = \frac{1}{\cos\theta}$ and $\cot\theta = \frac{1}{\tan\theta}$. 3. Trigonometric ratios in each of the quadrants are calculated where one ratio in the quadrant is given by making use of diagrams. 4. Practise the use of a calculator for questions applicable to trigonometry. 5. Solve simple trigonometric equations for angles between 0^0 and 90^0. 6. Solve two-dimensional problems involving right-angled triangles. 7. Trigonometry graphs • $y = a\sin\theta$, $y = a\cos\theta$ and $y = a\tan\theta$ for $0° \leq \theta \leq 360°$. • $y = a\sin\theta + q$ and $y = a\cos\theta + q$ for $0° \leq \theta \leq 360°$.	1. Determine the values of $\cos\theta$ and $\tan\theta$ if $\sin\theta = \frac{3}{5}$ and $90° \leq \theta \leq 360°$. (C)  Making use of Pythagoras' theorem. 2. Draw the graph of $y = 3\sin\theta$ for $0° \leq \theta \leq 360°$ by making the use of a table, point by point plotting and identify the following: • asymptotes • axes of symmetry • the domain and range. (C) Note: • It is very important to be able to read off values from the graph. • Investigate the effect of a and q on the graph.
3	**Mid-year examinations**		

Assessment Term 2:
1. <u>Assignment / test</u> (at least 50 marks). **Note that the weight of a test is equal to the weight of an assignment**.
2. <u>Mid-year examination</u> (at least 100 marks)
   One paper of 2 hours (100 marks) **or** Two papers - one, 1 hour (50 marks) and the other, 1 hour (50 marks)

GRADE 10: TERM 3			
Weeks	**Topic**	**Curriculum statement**	**Clarification**
			Where an example is given, the cognitive demand is suggested: knowledge (K), routine procedure (R), complex procedure (C) or problem-solving (P).
1	**Analytical Geometry**	Represent geometric figures on a Cartesian co-ordinate system. Apply for any two points $(x_1; y_1)$ and $(x_2; y_2)$ formulae for determining the: 1. distance between the two points; 2. gradient of the line segment connecting the two points (and from that identify parallel and perpendicular lines); 3. coordinates of the mid-point of the line segment joining the two points; and 4. the equation of a straight line passing through two points. $y = mx + c$	**Example**: Consider the points P(2 ; 5) and Q(-3 ; 1) in the Cartesian plane. (R) 1.1 Calculate the distance PQ. 1.2 Find the gradient of PQ. 1.3 Find the mid-point of PQ. 1.4 Determine the equation of PQ.
3	**Functions and Graphs**	1. Functional notation 2. Generate graphs by means of point-by-point plotting supported by available technology. 3. Drawing of the following functions: • Linear function: $y = mx + c$ (revise) • Quadratic: $y = ax^2 + q$ • Hyperbola: $y = \frac{a}{x}$ • Exponential: $y = ab^x$ where $b \neq 1$ and $b > 0$ **Note**: $a, b, c, m, p, q \in \mathbb{R}$ $a = \pm 1$ for parabola graphs only.	Investigate the way (unique) output values depend on how the input values vary. The terms independent (input) and dependent (output) variables might be useful. Draw the parabola $y = ax^2 + q$ for $a = \pm 1$ only. Use the table method only. Identify the following characteristics: ◦ y-intercept ◦ x-intercepts ◦ the turning points ◦ axes of symmetry ◦ the roots of the parabola (x-intercepts) ◦ the domain (input values) and range (output values) ◦ Very important to be able to read off values from the graphs. ◦ Investigate the effect of q on the graph. ◦ asymptotes where applicable **NOTE: Use this approach to engage with all the other graphs.**

GRADE 10: TERM 3			
Weeks	**Topic**	**Curriculum statement**	**Clarification**
			Where an example is given, the cognitive demand is suggested: knowledge (K), routine procedure (R), complex procedure (C) or problem-solving (P).
4	**Euclidean Geometry**	1. Revise basic geometry done in Grades 8 and 9. Lines and parallel lines, angles, triangles congruency and similarity. 2. Apply the properties of line segments joining the mid-points of two sides of a triangle. Do practical problems. 3. Know the features of the following special quadrilaterals: the kite, parallelogram, rectangle, rhombus, square and trapezium (apply to practical problems). 4. Pythagoras' theorem • Calculate the unknown side of a right-angled triangle.	No formal proves are required, only calculation of unknowns. Know the properties of the following kinds of triangles • scalene • isosceles triangle • equiangular triangle **Congruency:** Investigate the conditions for two triangles to be congruent: • 3 sides • side, angle side • angle, angle, corresponding side • right angle, hypotenuse and side **Similarity:** Investigate the condition for two triangles to be similar: • Give drawings of similar triangles, write down the corresponding angles and calculate the ratio of the corresponding sides. Investigate: line segment joining the mid-points of two sides of a triangle is parallel to the third side and half of the length of the third side. Investigate and make conjectures about the properties of the sides, angles and diagonals of these quadrilaterals. Calculation of one unknown side of a right-angled triangle, using Pythagoras' theorem.
Assessment Term 3: Two (2) tests (at least 50 marks and 1 hour) covering all topics in approximately the ratio of the allocated teaching time.			

GRADE 10: TERM 4			
Weeks	**Topic**	**Curriculum statement**	**Clarification**
			Where an example is given, the cognitive demand is suggested: knowledge (K), routine procedure (R), complex procedure (C) or problem-solving (P).
1	**Analytical Geometry**	Continuation from term 3.	
1	**Circles, angles and angular movement**	1. Define a radian 2. Indicate the relationship between degrees and radians, convert radians to degrees or degrees to radians, convert degrees and minutes to radians and radians to degrees and minutes.	**Example:** (K) • Revise circle terminology: chord, secant, segment, sector, diameter, radius, arc, etc. • Rediscover unique ratio between circumference and diameter represented by π. • Show that any circle $360^\circ = 2\pi$ radians and consequently that $360^\circ = 6{,}283$ radians and that 1 radian $57{,}3^\circ$. • Revise degrees, minutes and seconds. • Learners should know to convert radians to degrees and to convert degrees to radians. • Examples should include the following: convert degrees to radians: $213^\circ; 133{,}3^\circ; 300{,}12'; 110{,}24'6''$ etc. • convert radians to degrees: 1,5 rad; 65,98 rad; 16,25 rad; etc. (K) (answers in degrees, minutes and seconds). • Practical application in the technical field: ◦ Calculate the angle in radians through which a pulley with a diameter of 0,6m will rotate if a length of belt of 120m passes over the pulley. ◦ A road wheel with a diameter of 560mm turns through an angle of 150°. Calculate the distance moved by a point on the tyre tread of the wheel. (C) • Also ensure the following are covered : (R) ◦ Add $\pi + \frac{\pi}{4} + \frac{2\pi}{3}$ radians and covert to degrees. ◦ Simplify: $\sin 90^\circ + \cos 0^\circ + \cos\frac{\pi}{2} + \sin\pi$ ◦ Calculate $\sin\frac{\pi}{2} + \cos\frac{\pi}{4}$ ◦ Determine the value of the following: $\sin^{-1} 0{,}5 + \cos^{-1} 0{,}866 + \tan^{-1} 0{,}577$ (answer in radians).

GRADE 10: TERM 4			
Weeks	**Topic**	**Curriculum statement**	**Clarification**
			Where an example is given, the cognitive demand is suggested: knowledge (K), routine procedure (R), complex procedure (C) or problem-solving (P).
2	**Finance and growth**	Use the simple and compound growth formulae $A = P(1+in)$ and $A = P(1+i)^n$ to solve problems, including interest, hire purchase, inflation, population growth and other real life problems. Understand the implication of fluctuating foreign exchange rates (e.g. on the petrol price, imports, exports, overseas travel).	
2	**Revision**		
Assessment Term 4: 1. Test (at least 50 marks) 2. Examination Paper 1: 2 hours (100 marks) made up as follows: 60 ± 3 on algebraic expressions, equations, inequalities and exponents, 25 ± 3 on functions and graphs (trig. functions will be examined in paper 2) and 15 ± 3 on finance and growth. Paper 2: 2 hours (100 marks) made up as follows: 40 ± 3 on trigonometry, 15 ± 3 on Analytical Geometry, 30 ± 3 on Euclidean Geometry and 15 ± 3 on mensuration, circles, angles and angular movement.			

GRADE 11: TERM 1			
Weeks	**Topic**	**Curriculum statement**	**Clarification**
			Where an example is given, the cognitive demand is suggested: knowledge (K), routine procedure (R), complex procedure (C) or problem-solving (P).
3	**Exponents and surds**	1. Simplify expressions and solve equations using the laws of exponents for rational exponents where $x^{\frac{p}{q}} = \sqrt[q]{x^p}$; $x > 0; q > 0$ 2. Add, subtract, multiply and divide simple surds. 3. Solve exponential equations.	**Example**: Without the use of a calculator, 1. Determine the value of $9^{\frac{3}{2}}$.(K) 2. Simplify: $(3+\sqrt{2})(3-\sqrt{2})$.(R) 3. Revise Grade 10 exponential equations. 4. Revise all exponential laws from Grade 10. Examples should include but not be limited to 5. $\frac{\sqrt[3]{8x^6}}{\sqrt{16x^2+9x^2}}$ (R) 6. $\frac{5^3 \times \sqrt[3]{\frac{625}{5}}}{125 \times 5} + \sqrt[3]{8^{-2}}$ (C) Solve: 7. $4x^{\frac{5}{2}} = 128$ (R) 8. $25^{2x} = 5^{x-3}$ (R) 9. Practical examples from the technical field must be included e.g. The formula $C = \frac{Q}{V}$ is given with $Q = 6 \times 10^{-4}$ C and $V = 200\ volt$. Determine C without using a calculator. (R)
2	**Logarithms**	Laws of logarithms • $\log_a xy = \log_a x + \log_a y$ • $\log_a xy = \log_a x + \log_a y$ • $\log_a \frac{x}{y} = \log_a x - \log_a y$ • $\log_a x^n = n \log_a x$ • Simplify applying the law: $\log_a b = \frac{\log_c b}{\log_c a}$ • Solving of logarithmic equations.	1. Explain relationship between logs and exponents and show conversion from log-form to exponential form and vice versa. 2. Application of laws of logarithms: - Simplify without the aid of a calculator: 2.1 $\frac{\log 343}{\log 49}$ (R) 2.2 $\frac{\log 4 + \log 25}{\log 0{,}01}$ 2.3 $\log 6 + 2\log 20 - \log 3 - 3\log 2$ (R) - Prove: 2.4 $\frac{\log_x 64 + \log_x 4 - \log_x 8}{\log_x 1024} = \frac{1}{2}$ (C) - Simplify: 2.5 $\log_{32} 64$ 3. Show application of logs to solve $5^x = 3$ 4. Solving of log equations limited to the following: 4.1 $\log_2 \frac{1}{8} = x$ (K) 4.2 $2\log x + 2 = \log 900$ (K) 4.3 $\log_2(x+3) + \log_2(x-4) = 3$ (K)

GRADE 11: TERM 1			
Weeks	**Topic**	**Curriculum statement**	**Clarification**
			Where an example is given, the cognitive demand is suggested: knowledge (K), routine procedure (R), complex procedure (C) or problem-solving (P).
4	**Equations**	1. Solve quadratic equations by means of: 1.1 Factorisation 1.2 Quadratic formula. 2. Quadratic inequalities (interpret solutions graphically). 3. Determine the nature of roots and the conditions for which the roots are real, non-real, equal, unequal, rational and irrational. 4. Equations in two unknowns, one of which is linear and the other quadratic. 5. Word problems. 6. Manipulating formulae (Make a variable the subject of the formula).	• When explaining the quadratic formula it is important to show where it comes from although learners **do not** need to know the proof. • Use the formula to introduce the discriminant and how it determines the nature of the roots. • Show by means of sketches how the discriminant affects the parabola. • Learners should only be able to apply the quadratic formula and to derive from $b^2 - 4a$ the nature of the roots. • Word problems should focus and be related to the technical field and should include examples similar to the following: **e.g**. The length of a rectangle is 4m longer than the breadth. Determine the measurements of the rectangle if the area equals 621m^2. • With manipulation of formulae the fundamentals of changing of the subject should be emphasized and consolidated. • All related formulae from the technical fields should be covered.
2	**Analytical Geometry**	1. Revise to find the equation of a line through two given points; Determine: 2. the equation of a line through one point and parallel or perpendicular to a given line; and 3. the inclination (θ) of a line, where $m = \tan\theta$ is the gradient of the line and $0° \leq \theta \leq 180°$	1. Revision of linear equation from Grade 10. 2. Showing the influence of the gradient and consequently the relationship when lines are parallel and perpendicular. 3. Example: Given $A(-2;4)$, $B(2;6)$ and $C(3;-2)$ Determine: 3.1 Equation of line passing through point C and parallel to line AC. (R) 3.2 Equation of line passing through point B and perpendicular to line AC. (R) 4. Example: A ladder leans against a straight line wall defined by $y = 2x + 4$. 4.1 Determine the length of a ladder. (P) 4.2 How far it reaches up the wall and the ladder's inclination with the floor. (C)
Assessment Term 1: 1. An investigation or a project (a maximum of one project in a year) (at least 50 marks) 2. Test (at least 50 marks). Make sure all topics are tested. Care needs to be taken to ask questions on all four cognitive levels: approximately 20% knowledge, approximately 35% routine procedures, 30% complex procedures and 15% problem-solving.			

GRADE 11: TERM 2			
Weeks	**Topic**	**Curriculum statement**	**Clarification**
			Where an example is given, the cognitive demand is suggested: knowledge (K), routine procedure (R), complex procedure (C) or problem-solving (P).
4	**Functions and graphs**	1. Revise the effect of the parameters and *q* on the graphs. a is not restricted to $\pm$ 1 Investigate the effect of *p* on the graphs of the functions defined by: 1.1. $y = f(x) = a(x+p)^2 + q$ 1.2. $y = f(x) = ax^2 + bx + c$ 1.3. $y = \frac{a}{x} + q$ 1.4. $y = a.f(x) = a.b^x + q$, $b > 0$ and $b \neq 1$ 2. $x^2 + y^2 = r^2$ $y = \pm\sqrt{r^2 - x^2}$ $y = +\sqrt{r^2 - x^2}$ $y = -\sqrt{r^2 - x^2}$	**Comment:** • Learners should gain confidence and get a grasp of graphs from tabling and dotting and joining points to draw the graphs. • They should understand the influence of variables on the form and calculate critical points to draw graphs. • The concept of asymptotes should be clear. • They should be able to deduce the equations when critical points are given. • Analyse the information from graphs (graphs given).

GRADE 11: TERM 2			
Weeks	**Topic**	**Curriculum statement**	**Clarification**
			Where an example is given, the cognitive demand is suggested: knowledge (K), routine procedure (R), complex procedure (C) or problem-solving (P).
4	**Euclidean Geometry**	Accept results established in earlier grades as axioms and also that a tangent to a circle is perpendicular to the radius, drawn to the point of contact. Then investigate and apply the theorems of the geometry of circles: • The line drawn from the centre of a circle perpendicular to a chord bisects the chord; • The perpendicular bisector of a chord passes through the centre of the circle; • The angle subtended by an arc at the centre of a circle is double the size of the angle subtended by the same arc at the circle (on the same side of the chord as the centre); • Angles subtended by a chord of the circle, on the same side of the chord, are equal; • The opposite angles of a cyclic quadrilateral are supplementary; • Exterior angle of cyclic quad. is equal to opposite interior angle; • Two tangents drawn to a circle from the same point outside the circle are equal in length; • Radius is perpendicular to the tangent; and • The angle between the tangent to a circle and the chord drawn from the point of contact is equal to the angle in the alternate segment.	**Comments:** Proofs of theorems and their converses will not be examined. But proofs of theorems and their converses will applied in solving riders. The focus of all questions will be on applications and calculations. Make use of problems taken from the technical fields.
3	**Mid-year examinations**		

Assessment Term 2:
1. Assignment / test (at least 50 marks)
2. Mid-year examination (at least 200 marks)

Paper 1: 2 hours (100 marks made up as follows: General algebra (35 ± 3), equations, inequalities and nature of roots (40 ± 3), function and graphs (25 ± 3).

Paper 2: 2 hours (100 marks made up as follows: Analytical Geometry (40 ± 3) and Euclidean Geometry (60 ± 3).

GRADE 11: TERM 3			
Weeks	**Topic**	**Curriculum statement**	**Clarification**
			Where an example is given, the cognitive demand is suggested: knowledge (K), routine procedure (R), complex procedure (C) or problem-solving (P).
4	**Circles, angles and angular movement**	1. Circle 1.1 $x^2 + y^2 = r^2$, with centre (0;0) only 1.2 Angles and arcs 1.3 Degrees and radians 1.4 Sectors and segments 2. Angular and circumferential/peripheral velocity	Pay attention to the following: diameter, radius, chord, segment, arc,secant, tangent. 1.1 If a point on a circumference is given, how to determine r and the equation of the circle? 1.2 What is an arc, central angle, inscribed angle? 1.3 A radian is the angle at the centre of a circle subtended by an arc of the same length as the radius. Complete revolution: 360^0 = 2π radians; 180^0 = π radians • If an arc of length *s* is intercepted by a central angle θ (in radians) the angle subtended will be equal to the arc divided by the radius. $\theta = \frac{s}{r}$. • If s = r then θ = 1 radian. • Convert degrees to radians and vice versa. <u>Convert 2 radians to degrees</u> $\pi\, rad = 180°$ 1 rad = $\frac{180°}{\pi}$ 2 rad = $2 \times \frac{180°}{\pi}$ = $114{,}59^0$ <u>Convert $52{,}6^0$ to radians</u> $1° = \frac{\pi}{180°} rad$ $52{,}6^0$ = $52{,}6° \times \frac{\pi}{180°}$ = 0, 918 rad 1.3 A sector of a circle is a plane figure bounded by an arc and two radii. Area of a sector = $\frac{rs}{2} = \frac{r^2\theta}{2}$ $= r$ = radius; s = arc length and θ = central angle in radians. • A segment of a circle is the area bounded by an arc and a chord. The relation between the diameter of a circle, a chord and the height of the segment formed by the chord, can be set out in the formula

GRADE 11: TERM 3			
Weeks	**Topic**	**Curriculum statement**	**Clarification**
			Where an example is given, the cognitive demand is suggested: knowledge (K), routine procedure (R), complex procedure (C) or problem-solving (P).
			$h^2 - 4dh + x^2 = 0$; h = height of segment; d = diameter of circle; h = length of chord. 2. Angular velocity (omega) ω can be determined by multiplying the radians in one revolution (2π) with the revolutions per second (n) $\omega = 2\pi$ n= 360^0 n Circumferential velocity is the linear velocity of a point on the circumference $v = \pi D n$ with D the diameter, n is the rotation frequency
4	**Trigonometry**	1. Revise the trig ratios in the solving of right-angle triangle in all 4 quadrants (Grade 10). 2. Apply the sine, cosine and area rules. 3. Solve problems in two dimensions using the sine, cosine and area rules 4. Draw the graphs of the functions defined by $y = k\sin x$, $y = k\cos x$, $y = \sin(kx)$, $y = \cos(kx)$ and $y = \tan x$. 5. Draw the graphs of the functions defined by $y = \sin(x + p)$ and $y = \cos(x + p)$ 6. Rotating vectors Developing the sine and cosine curve. 7. Trigonometric equations. 8. Introduce identities and apply $\tan\theta = \dfrac{\sin\theta}{\cos\theta}$, $\sin^2\theta + \cos^2\theta = 1$, $1 + \tan^2\theta = \sec^2\theta$ and $\cot^2\theta + 1 = \operatorname{cosec}^2\theta$.	**Comment:** No proofs of the sine, cosine and area rules are required. Apply only with actual numbers, no variables. (Acute- and obtuse-angled triangles) • Learners must be able to draw all mentioned graphs and also be able to deduct important information from given sketches. • One parameter should be tested at a given time when examining horizontal shifts • Rotating vectors should be done on graph paper. • Determine the solutions of equations for $\theta \in [0°; 360°]$ • Limited to routine procedures. • Reduction formulae, $(180° \pm \theta)$ and $(360° \pm \theta)$. • Examples related to the use of identities limited to routine procedures.

GRADE 11: TERM 3			
Weeks	**Topic**	**Curriculum statement**	**Clarification**
			Where an example is given, the cognitive demand is suggested: knowledge (K), routine procedure (R), complex procedure (C) or problem-solving (P).
2	**Finance, growth and decay**	1. Use simple and compound decay formulae: $A = P(1 + in)$ and $A = P(1 - i)^n$ to solve problems (including straight line depreciation and depreciation on a reducing balance). 2. The effect of different periods of compound growth and decay, including nominal and effective interest rates.	**Examples**: 1. The value of a piece of equipment depreciates from R10 000 to R5 000 in four years. What is the rate of depreciation if calculated on the: 1.1 straight line method?; and (R) 1.2 reducing balance? (C) 2. Which is the better investment over a year or longer: 10,5% p.a. compounded daily or 10,55% p.a. compounded monthly? (R) **Comments**: The use of a timeline to solve problems is a useful technique. 3. R50 000 is invested in an account which offers 8% p.a. interest compounded quarterly for the first 18 months. The interest then changes to 6% p.a. compounded monthly. Two years after the money is invested, R10 000 is withdrawn. How much will be in the account after 4 years? (C) **Comment**: Stress the importance of not working with rounded answers, but of using the maximum accuracy afforded by the calculator right to the final answer when rounding might be appropriate.
3	**Mid-year examinations**		

Assessment Term 3:
Two (2) tests (at least 50 marks per test and 1 hour) covering all topics in approximately the ratio of the allocated teaching time.

GRADE 11: TERM 4			
Weeks	**Topic**	**Curriculum statement**	**Clarification**
			Where an example is given, the cognitive demand is suggested: knowledge (K), routine procedure (R), complex procedure (C) or problem-solving (P).
3	**Mensuration**	1. Surface area and volume of right prisms, cylinders, pyramids, cones and spheres, and combinations of these geometric objects. 2. The effect on volume and surface area when multiplying any dimension by factor k. 3. Determine the area of an irregular figure using mid-ordinate rule.	1. Surface Area = 2 $\times$ area of base + circumference of base $\times$ height(for closed right-angled prism) Surface Area = area of base + circumference of base $\times$ height (for open right angled prism) Volume = area of base $\times$ height 2. What is the effect if some of the measurements are multiplied by a factor k? 3. Using the mid-ordinate rule: $A_T = a(m_1 + m_2 + m_3 + .. + m_n)$ where $m_1 = \frac{o_1 + o_2}{2}$ etc. and n = number of ordinates
3	**Revision**		
3	**Examinations**		

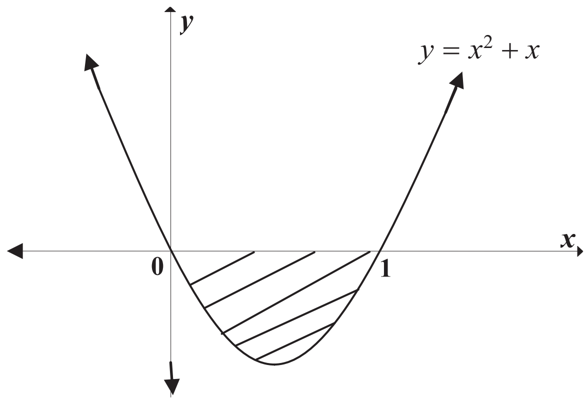
Assessment Term 4:
1. Test (at least 50 marks)
2. Examination (300 marks)

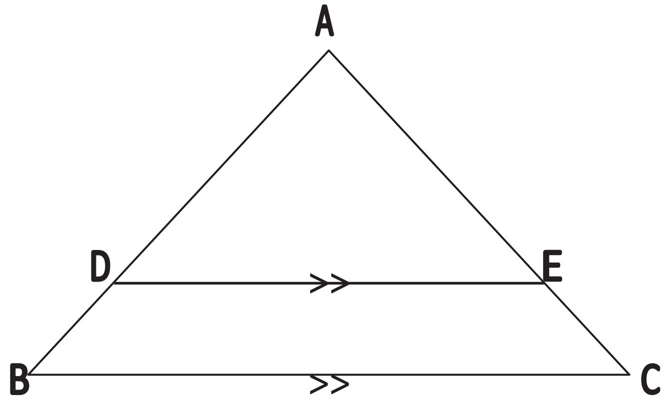
Paper 1: 3 hours (150 marks made up as follows: (90 ± 3) on algebraic expressions, equations, inequalities and nature of roots, (45 ± 3) on functions and graphs (excluding trigonometric functions) and (15 ± 3) on finance growth and decay.
Paper 2: 3 hours (150 marks made up as follows: (50 ± 3) on trigonometry (including trigonometric functions), (25 ± 3) on Analytical Geometry, (40 ± 3) on Euclidean Geometry, (35 ± 3) on Mensuration, circles, angles and angular movement.

GRADE 12: TERM 1			
Weeks	**Topic**	**Curriculum statement**	**Clarification**
			Where an example is given, the cognitive demand is suggested: knowledge (K), routine procedure (R), complex procedure (C) or problem-solving (P).
3	**Complex numbers**	• Define a complex number, $\mathbb{C}, z = a + bi$. • Learners should know: ◦ the conjugate of $z = a + bi \cdot$ ◦ imaginary numbers, $i^2 = -1$. ◦ how to add, subtract, divide and multiply complex numbers. ◦ represent complex numbers in the Argand diagram. ◦ argument of z. ◦ trigonometric (polar) form of complex numbers. • Solve equations with complex numbers with two variables.	Simplify : 1. $\sqrt{-16} + \sqrt{-4} - \sqrt{-1}$ (R) 2. $\sqrt{-16} - \sqrt{-5}$ (K) 3. $\frac{\sqrt{-4}.\sqrt{-12}}{\sqrt{-6}}$ (R) 4. $2 - 3i + i - 1 - 5i$ (K) 5. $(3-2i)(i-1)$ (K) Solve for x and y : 6. $2x - 15i = 3 + 5yi$ (R)
2	**Polynomials**	Factorise third-degree polynomials. Apply the Remainder and Factor Theorems to polynomials of the third degree (no proofs are required). Long division method can also be used.	Revise functional notation. Any method may be used to factorise third degree polynomials but it should include examples which require the Factor Theorem. **Example:** Solve for $x : x^3 + 8x^2 + 17x + 10 = 0$ (R)

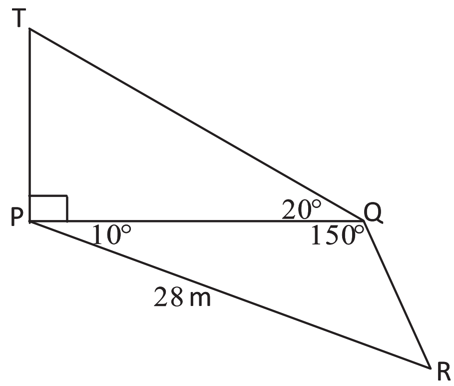
GRADE 12: TERM 1			
Weeks	**Topic**	**Curriculum statement**	**Clarification**
			Where an example is given, the cognitive demand is suggested: knowledge (K), routine procedure (R), complex procedure (C) or problem-solving (P).
6	**Differential Calculus**	1. An intuitive understanding of the limit concept, in the context of approximating the rate of change or gradient of a function at a point. 2. Determine the average gradient of a curve between two points. $m = \frac{f(x+h)-f(x)}{h}$ 3. Determine the gradient of a tangent to a graph, which is also the gradient of the graph at that point. Introduce the limit-principle by shifting the secant until it becomes a tangent. 4. By using first principals for $f'(x) = \lim_{h \to 0} \frac{f(x+h)-f(x)}{h}$ for $f(x)=k$, $f(x)=ax$ and $f(x)=ax+b$ 5. Use the rule $\frac{d}{dx}(ax^n) = anx^{n-1}$ for $n \in \mathbb{R}$ 6. Find equations of tangents to graphs of functions 7. Sketch graphs of cubic polynomial functions using differentiation to determine the co-ordinate of stationary points. Also, determine the x- intercepts of the graph using the factor theorem and other techniques. 8. Solve practical problems concerning optimisation and rates of change, including calculus of motion.	**Comment:** Differentiation from first principles will be examined on any of the types described in 3.1. Understand that the following notations mean the same $D_x, \frac{d}{dx}, f'(x)$ Examples: 1. In each of the following cases, find the derivative of $f(x)$ at the point where $x=-1$, using the definition of the derivative: 1.1 $f(x)=x^2$ (R) 1.2 $f(x)=x^2+2$ (R) 2. Sketch the graph defined by $y=-x^3+4x^2-x$ by: 2.1 finding the intercepts with the axes; 2.2 finding maxima, minima. (C) On word problems the diagram with all the measurements must be given. Guide the learners through the question with subsections. Refer to displacement formulae like $s = u + \frac{1}{2}at^2$. Very simple problems. Refer to practical application in the technical field.

Assessment Term 1:
1. Test (at least 50 marks).
2. Investigation or project.
3. Test (at least 50 marks) or Assignment (at least 50 marks).

GRADE 12: TERM 2			
Weeks	**Topic**	**Curriculum statement**	**Clarification**
			Where an example is given, the cognitive demand is suggested: knowledge (K), routine procedure (R), complex procedure (C) or problem-solving (P).
3	**Integration**	Introduce integration. 1. Understand the concept of integration as a summation function (definite integral) and as converse of differentiation (indefinite integral). 2. Apply standard forms of integrals as a converse of differentiation. 3. Integrate the following functions: 3.1 $kx^n,\ \ n \in \mathbb{R}$ with $n \neq -1$ 3.2 $\frac{k}{x}$ and ka^{nx} with $a \geq 0\ ,\ \ k\,,a \in$ R 4. Integrate polynomials consisting of terms of the above forms (3.1 and 3.2). 5. Apply integration to determine the magnitude of an area included by a curve and the x-axis or by a curve, the x-axis and the ordinates $x = a$ and $x = b$ where $a, b \in Z.$	Examples 1. Calculate the values of 1.1 $\int_0^1 x dx$. (K) 1.2 $\int_1^2 (x^3 + 2x^2 - 3)dx.$ (R) Determine the area included by the curve of $y = x^2 + x$ and the x-axis. (C) 
2	**Analytical Geometry**	1. The equation $x^2 + y^2 = r^2$ defines a circle with radius r and centre (0; 0). 2. Find the equation of the circle when the radius is given or a point on the circle is given. Only circles with the origin as centre. 3. Determination of the equation of a tangent to a given circle. (Gradient or point of contact is given). 4. Find the points of intersection of the circle and a given straight line. 5. Plotting of the graph of ellipse, $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$	**Examples:** 1.1 Determine the equation of the circle passing through the point (2; 4) with centre at the origin. (R) 1.2 Hence determine the equation of the tangent to the circle at the point (2; 4). (R) 1.3 Hence determine the points of intersection of the circle and the line with the equation $y = x + 2$. (R)

3	**Euclidean Geometry**	1. Revise earlier work on the necessary and sufficient conditions for polygons to be similar. 2. Introduce and apply the following theorems: • that a line drawn parallel to one side of a triangle divides the other two sides proportionally; • that equiangular triangles are similar; and • that triangles with sides in proportion are similar.	**Example:** The examples must be very easy. Only with one unknown used once. Start with problems like $\frac{3}{10}=\frac{x}{20}$ **Example:**  In ΔABC, $AB=8$, $AC=5$ and $BC=6$. D is a point AB so that $AD=4$. E is a point on AC so that DE is parallel to BC. Find the lengths of DE and AE. (R)
3	**Mid-year examinations**		

Assessment Term 2:
1. Test (at least 50 marks)
2. Mid-year examination (300 marks)
   Paper 1: 3 hours , 150 marks.
   Paper 2: 3 hours , 150 marks.

GRADE 12: TERM 3			
Weeks	**Topic**	**Curriculum statement**	**Clarification**
			Where an example is given, the cognitive demand is suggested: knowledge (K), routine procedure (R), complex procedure (C) or problem-solving (P).
2	**Euclidean Geometry**	Continuation from term 2.	
3	**Trigonometry**	1. Solve problems in two and three dimensions. 2. Measurements must always be given for angles and lengths of sides.	 TP is a tower. Its foot, *P,* and the points *Q* and *R* are on the same horizontal plane. From *Q* the angle of elevation to the top of the building is $20°$. Furthermore, $P\hat{Q}R = 150°$, $Q\hat{P}R = 10°$ and the distance between *P* and *R* is 28m. Find the height of the tower, TP. (C)
2	**Revision**	Revision	
3	**Trial Exam**		

Assessment Term 3:
1. Assignment / test (at least 50 marks)
2. Trial examination

Paper 1: 150 marks: 3 hours

Algebraic expressions, equations, and inequalities (nature of roots, logs and complex numbers) (50 ± 3), Functions and graphs (35 ± 3), Finance, growth and decay (15 ± 3) and Differential Calculus and Integration (50 ± 3).

Paper 2: 150 marks: 3 hours

Analytical Geometry (25 ± 3), Trigonometry (50 ± 3), Euclidean Geometry (40 ± 3) and Mensuration, circles, angles and angular movement (35 ± 3)

GRADE 12: TERM 4			
Weeks	**Topic**	**Curriculum statement**	**Clarification**
			Where an example is given, the cognitive demand is suggested: knowledge (K), routine procedure (R), complex procedure (C) or problem-solving (P).
3	**Revision**	Revision	

Assessment Term 4:
Final examination:

Paper 1: 150 marks: 3 hours

Algebraic expressions, equations and inequalities (nature of roots, logs and complex numbers) 50 ± 3
Functions and graphs 35 ± 3
Finance, growth and decay 15 ± 3
Differential Calculus and Integration 50 ± 3

Paper 2: 150 marks: 3 hours

Analytical Geometry 25 ± 3
Trigonometry 50 ± 3
Euclidean Geometry 40 ± 3
Mensuration, circles, angles and angular movement 35 ± 3

Section 4

Curriculum and Assessment Policy Statement (CAPS)

FET TECHNICAL MATHEMATICS ASSESSMENT GUIDELINES

4.1 INTRODUCTION

Assessment is a continuous planned process of identifying, gathering and interpreting information about the performance of learners, using various forms of assessment. It involves four steps: generating and collecting evidence of achievement; evaluating this evidence; recording the findings; and using this information to understand and assist in the learner's development to improve the process of learning and teaching.

Assessment should be both informal (Assessment for Learning) and formal (Assessment of Learning). In both cases regular feedback should be provided to learners to enhance the learning experience.

Although assessment guidelines are included in the Annual Teaching Plan at the end of each term, the following general principles apply:

1. Tests and examinations are assessed using a marking memorandum.

2. Assignments are generally extended pieces of work completed at home. They can be collections of past examination questions, but should focus on the more demanding aspects as any resource material can be used, which is not the case when a task is done in class under strict supervision.

3. At most one project or assignment should be set in a year. The assessment criteria need to be clearly indicated on the project specification. The focus should be on the mathematics involved and not on duplicated pictures and regurgitation of facts from reference material. The collection and display of real data, followed by deductions that can be substantiated from the data, constitute good projects.

4. Investigations are set to develop the skills of systematic investigation into special cases with a view to observing general trends, making conjectures and proving them. To avoid having to assess work which is copied without understanding, it is recommended that while the initial investigation can be done at home, the final write up should be done in class, under supervision, without access to any notes. Investigations are marked using rubrics which can be specific to the task, or generic, listing the number of marks awarded for each skill:

- 40% for communicating individual ideas and discoveries, assuming the reader has not come across the text before. The appropriate use of diagrams and tables will enhance the investigation;
- 35% for the effective consideration of special cases;
- 20% for generalising, making conjectures and proving or disproving these conjectures; and
- 5% for presentation: neatness and visual impact.

4.2 INFORMAL OR DAILY ASSESSMENT

The aim of assessment for learning is to continually collect information on a learner's achievement that can be used to improve individual learning.

Informal assessment involves daily monitoring of a learner's progress. This can be done through

observations, discussions, practical demonstrations, learner-teacher conferences, informal classroom interactions, etc, although informal assessment may be as simple as stopping during the lesson to observe learners or to discuss with learners how learning is progressing. Informal assessment should be used to provide feedback to the learners and to inform planning for teaching, and it need not be recorded. This should however not be seen as separate from learning activities taking place in the classroom. Learners or teachers can evaluate these tasks.

Self-assessment and peer assessment actively involve learners in assessment. Both are important as these allow learners to learn from and reflect on their own performance. Results of the informal daily assessment activities are not formally recorded, unless the teacher wishes to do so. The results of daily assessment tasks are not taken into account for promotion and/or certification purposes.

4.3 FORMAL ASSESSMENT

All assessment tasks that make up a formal programme of assessment for the year are regarded as Formal Assessment. Formal Assessment tasks are marked and formally recorded by the teacher for progress and certification purposes. All Formal Assessment tasks are subject to moderation for the purpose of quality assurance.

Formal assessments provide teachers with a systematic way of evaluating how well learners are

progressing in a grade and/or in a particular subject. Examples of formal assessments include tests, examinations, practical tasks, projects, oral presentations, demonstrations, performances, etc. Formal Assessment tasks form part of a year-long formal Programme of Assessment in each grade and subject.

Formal assessments in Mathematics include tests, a June examination, a trial examination (for Grade 12), a project or an investigation.

The forms of assessment used should be age- and developmental-level appropriate. The design of these tasks should cover the content of the subject and include a variety of activities designed to achieve the objectives of the subject.

Formal assessments need to accommodate a range of cognitive levels and abilities of learners as shown below:

4.4 PROGRAMME OF ASSESSMENT

The four cognitive levels used to guide all assessment tasks are based on those suggested in the TIMSS study of 1999. Descriptors for each level and the approximate percentages of tasks, tests and examinations which should be at each level are given below:

Cognitive levels	Description of skills to be demonstrated	Examples
Knowledge **20%**	• Straight recall • Identification of correct formula on the information sheet (no changing of the subject) • Use of mathematical facts • Appropriate use of mathematical vocabulary	1. Write down the domain of the function $y=f\left(x\right)=\frac{3}{x}+2$ (Grade 10) 2. The angle $A\hat{O}B$ subtended by arc AB at the centre O of a circle ....
Routine Procedures **35%**	• Estimation and appropriate rounding of numbers • Proofs of prescribed theorems and derivation of formulae • Identification and direct use of correct formula on the information sheet (no changing of the subject) • Perform well-known procedures • Simple applications and calculations which might involve few steps • Derivation from given information may be involved • Identification and use (after changing the subject) of correct formula • Generally similar to those encountered in class	1. Solve for $x: x^2-5x=14$ (Grade 10) 2. Determine the general solution of the equation $2\sin(x-30°)+1=0$(Grade 11) 3. Prove that the angle $A\hat{O}B$ subtended by arc AB at the centre O of a circle is double the size of the angle $A\hat{C}B$ which the same arc subtends at the circle. (Grade 11)
Complex Procedures **30%**	• Problems involve complex calculations and/or higher order reasoning • There is often not an obvious route to the solution • Problems need not be based on a real world context • Could involve making significant connections between different representations • Require conceptual understanding	1. What is the average speed covered on a round trip to andfrom a destination if the average speed going to the destination is $100km/h$ and the average speed for the return journey is $80km/h$? (Grade 11) 2. Differentiate $\frac{(x+2)^2}{\sqrt{x}}$ with respect to x. (Grade 12)
Problem Solving **15%**	• Non-routine problems (which are not necessarily difficult) • Higher order reasoning and processes are involved • Might require the ability to break the problem down into its constituent parts	Suppose a piece of wire could be tied tightly around the earth at the equator. Imagine that this wire is then lengthened by exactly one metre and held so that it is still around the earth at the equator. Would a mouse be able to crawl between the wire and the earth? Why or why not? (Any grade)

The Programme of Assessment is designed to set formal assessment tasks in all subjects in a school throughout the year.

(a) **Number of Assessment Tasks and Weighting:**

Learners are expected to have seven (7) formal assessment tasks for their school-based assessment (SBA). The number of tasks and their weighting are listed below:

TASKS		GRADE 10		GRADE 11		GRADE 12	
		WEIGHT (%)	**TASKS**	**WEIGHT (%)**	**TASKS**	**WEIGHT (%)**	
School-based Assessment	Term 1	**Project or Investigation Test**	**20 10**	**Project or Investigation Test**	**20 10**	**Test Project or Investigation Assignment / Test**	**10 20 10**
	Term 2	**Assignment or Test Mid-year Exam**	**10 30**	**Assignment or Test Mid-year Exam**	**10 30**	**Test Mid-year Exam**	**10 15**
	Term 3	**Test Test**	**10 10**	**Test Test**	**10 10**	**Test Trial Exam**	**10 25**
	Term 4	**Test**	**10**	**Test**	**10**		
School-based Assessment mark			**100**		**100**		**100**
School-based Assessment mark (as % of promotion mark)			**25%**		**25%**		**25%**
End-of-year examinations			**75%**		**75%**		
Promotion mark			**100%**		**100%**		

Note:

- Although the project/investigation is indicated in the first term, it could be scheduled in term 2. Only **ONE** project/investigation should be set per year.
- Tests should be at least ONE hour long and count at least 50 marks.
- Project or investigation must contribute 25% of term 1 marks while the test marks contribute 75% of the term 1 marks. The same weighting of 25% should apply in cases where a project/investigation is in term 2.
- The combination (25% and 75%) of the marks must appear in the learner's report.
- Graphic and non-programmable calculators are not allowed (for example, calculators which factorise $a^2 - b^2 = (a-b)(a+b)$, or find roots of equations). Calculators should only be used to perform standard numerical computations and to verify calculations by hand.
- **Formula sheet MUST NOT be provided for tests and final examinations in Grades 10 and 11. Learners can be with formula sheet in Grade 12 for tests and examinations.**
- **Trigonometric functions and graphs will be examined in paper 2.**

(b) **Examinations:**

In Grades 10, 11 and 12, 25% of the final promotion mark is a year mark and 75% is an examination mark.

All assessments in Grades 10 and 11 are internal while in Grade 12 the 25% year mark assessment is internally set and marked but externally moderated and the 75% examination is externally set, marked and moderated.

Mark distribution for Technical Mathematics NCS end-of-year papers: Grades 10 - 12			
Description	**Grade 10**	**Grade 11**	**Grade. 12**
PAPER 1:			
Algebra (Expressions, equations and inequalities including nature of roots in Grades 11 & 12)	60 ± 3	90 ± 3	50 ± 3
Functions & Graphs	25 ± 3	45 ± 3	35 ± 3
Finance, growth and decay	15 ± 3	15 ± 3	15 ± 3
Differential Calculus and Integration			50 ± 3
TOTAL	**100**	**150**	**150**
PAPER 2 : Grades 11 and 12: theorems and/or trigonometric proofs: maximum 12 marks			
Description	**Grade 10**	**Grade 11**	**Grade 12**
Analytical Geometry	15 ± 3	25 ± 3	25 ± 3
Trigonometry	40 ± 3	50 ± 3	50 ± 3
Euclidean Geometry	30 ± 3	40 ± 3	40 ± 3
Mensuration and circles, angles and angular movement	15 ± 3	35 ± 3	35 ± 3
TOTAL	**100**	**150**	**150**
Note: • Modelling as a process should be included in all papers, thus contextual questions can be set on any topic. • Questions will not necessarily be compartmentalised in sections, as this table indicates. Various topics can be integrated in the same question. • **Formula sheet must not be provided for tests and for final examinations in Grades 10 and 11 BUT for Grade 12 formula sheet can be provided for tests and examinations.** • **Trigonometric functions and graphs will be examined in paper 2.**			

4.5 RECORDING AND REPORTING

- Recording is a process in which the teacher is able to document the level of a learner's performance in a specific assessment task.
- It indicates learner progress towards the achievement of the knowledge as prescribed in the Curriculum and Assessment Policy Statements.
- Records of learner performance should provide evidence of the learner's conceptual progression within a grade and her/his readiness to progress or to be promoted to the next grade.
- Records of learner performance should also be used to monitor the progress made by teachers and learners in the teaching and learning process.
- Reporting is a process of communicating learner performance to learners, parents, schools and other stakeholders. Learner performance can be reported in a number of ways.
- These include report cards, parents' meetings, school visitation days, parent-teacher conferences, phone calls, letters, class or school newsletters, etc.
- Teachers in all grades report percentages for the subject. Seven levels of competence have been described for each subject listed for Grades R – 12. The individual achievement levels and their corresponding percentage bands are shown in the Table below.

CODES AND PERCENTAGES FOR RECORDING AND REPORTING

RATING CODE	DESCRIPTION OF COMPETENCE	PERCENTAGE
7	Outstanding achievement	80 – 100
6	Meritorious achievement	70 – 79
5	Substantial achievement	60 – 69
4	Adequate achievement	50 – 59
3	Moderate achievement	40 – 49
2	Elementary achievement	30 – 39
1	Not achieved	0 – 29

Note: The seven-point scale should have clear descriptors that give detailed information for each level. Teachers will record actual marks for the task on a record sheet; and indicate percentages for each subject on the learners' report cards.

4.6 MODERATION OF ASSESSMENT

Moderation refers to the process which ensures that the assessment tasks are fair, valid and reliable.

Moderation should be implemented at school, district, provincial and national levels. Comprehensive and appropriate moderation practices must be in place to ensure quality assurance for all subject assessments.

4.7 GENERAL

This document should be read in conjunction with:

4.7.1 *National policy pertaining to the programme and promotion requirements of the National Curriculum Statement Grades R – 12**; and***

4.7.2 ***The policy document,*** *National Protocol for Assessment Grades R – 12.*