basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

MATHEMATICS

EXAMINATION GUIDELINES

GRADE 10

2015

These guidelines consist of 11 pages.

CONTENTS Page

1. INTRODUCTION

The Curriculum and Assessment Policy Statement (CAPS) for Mathematics outlines the nature and purpose of the subject Mathematics. This guides the philosophy underlying the teaching and assessment of the subject in Grade 10.

The purpose of these Examination Guidelines is to:

- Provide clarity on the depth and scope of the content to be assessed in the Grade 10 common/national examination in Mathematics.
- Assist teachers to adequately prepare learners for the examinations.

This document deals with the final Grade 10 examinations. It does not deal in any depth with the School-Based Assessment (SBA).

These Examination Guidelines should be read in conjunction with:

- *The National Curriculum Statement (NCS) Curriculum and Assessment Policy Statement (CAPS):* Mathematics
- The National Protocol of Assessment: *An addendum to the policy document, the National Senior Certificate: A qualification at Level 4 on the National Qualifications Framework (NQF), regarding the National Protocol for Assessment (Grades R–12)*
- The national policy pertaining to the programme and promotion requirements of the National Curriculum Statement, Grades R–12

Included in this document is a list of Euclidean Geometry reasons which should be used as a guideline when teaching learners Euclidean Geometry.

2. ASSESSMENT IN GRADE 10

All candidates will write two external papers, as prescribed.

2.1 Format of question papers for Grade 10

Paper	Topics	Duration	Total	Date	Marking
1	Patterns and Sequences Finance and Growth Functions and Graphs Algebra, Equations and Inequalities Probability	2 hours	100	October/November	Internally
2	Euclidean Geometry and Measurement Analytical Geometry Statistics Trigonometry	2 hours	100	October/November	Internally

Questions in both Papers 1 and 2 will assess performance at different cognitive levels with an emphasis on process skills, critical thinking, scientific reasoning and strategies to investigate and solve problems in a variety of contexts.

2.2 Weighting of cognitive levels

Papers 1 and 2 will include questions across four cognitive levels. The distribution of cognitive levels in the papers is given below.

Cognitive level	Description of skills to be demonstrated	Weighting	Approximate number of marks in a 100-mark paper
Knowledge	• Recall • Use of the correct formula (no changing of the subject) • Use of mathematical facts • Appropriate use of mathematical vocabulary • Algorithms • Estimation and appropriate rounding of numbers	20%	20 marks
Routine Procedures	• Proofs of prescribed theorems and derivation of formulae • 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	35%	35 marks
Complex Procedures	• 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 • Learners are expected to solve problems by integrating different topics.	30%	30 marks
Problem Solving	• Non-routine problems (which are not necessarily difficult) • Problems are mainly unfamiliar • Higher-order reasoning and processes are involved • Might require the ability to break the problem down into its constituent parts • Interpreting and extrapolating from solutions obtained by solving problems based in unfamiliar contexts.	15%	15 marks

3. ELABORATION OF CONTENT/TOPICS

The purpose of the clarification of the topics is to give guidance to the teacher in terms of depth of content necessary for examination purposes. Integration of topics is encouraged as learners should understand Mathematics as a holistic discipline. Thus questions integrating various topics can be asked.

FUNCTIONS

1. Candidates must be able to use and interpret functional notation. In the teaching process learners must be able to understand how $f(x)$ has been transformed to generate $-f(x)$, $f(x)+a$ and $af(x)$ where $a \in R$.
2. Trigonometric functions will ONLY be examined in Paper 2.
3. Not more than two transformations will be applied to a function simultaneously.

NUMBER PATTERNS

1. The general term of the linear pattern should be obtained by intuitive processes or by using methods similar to those used in obtaining the equation of a linear function. The formula $T_n = a + (n-1)d$, as discussed in Grade 12, should not be used in Grade 10.
2. Recursive patterns will not be examined explicitly.
3. Non-linear number patterns may be examined. These will be considered problem solving and should not be taught explicitly at the Grade 10 level.

FINANCE AND GROWTH

1. In the case of compound interest, the compounding period will be 'annual' only.
2. With the exception of calculating *n* in the formula: $A = P(1+i)^n$, candidates are expected to calculate the value of any of the other variables.
3. Hire purchase should be seen as an application of simple interest charged in advance.
4. Inflation is defined as year-on-year growth and should therefore be viewed as an application of compound growth.
5. Cognisance is made of the fact that the exchange rate fluctuates several times in a day. In the contexts of petrol price, exports and overseas travel, it will be assumed that the exchange rate quoted will be an average rate over a given time period.

ALGEBRA

1. Simplification of algebraic fractions using factorisation of linear, quadratic and cubic denominators is examinable. In the case of cubic denominators, these will be limited to the sum and the difference of two cubes.
2. Equations with fractions where the denominators are linear, quadratic or cubic are examinable.
3. Word problems involving linear, quadratic or simultaneous linear equations are examinable.

PROBABILITY

1. Venn diagrams will be restricted to a maximum of two events that may or may not have an intersection.

EUCLIDEAN GEOMETRY & MEASUREMENT

1. Measurement can, in the main, be tested in the context of Trigonometry and Euclidean Geometry. This does not preclude measurement being tested in other sections.
2. Composite shapes could be formed by combining a maximum of TWO shapes prescribed in the curriculum.
3. Candidates must know the formulae for the surface area and volume of the right prisms.
4. If a question is based on the surface area and/or volume of a cone, sphere and/or pyramid, a list of the relevant formulae will be provided in that question. Candidates will be expected to select the correct formula from this list.
5. Although the curriculum requires candidates to revise the similarity and congruence of triangles, emphasis should be placed on the congruence of triangles, as this is vital in solving geometry riders in Grade 10.
6. Candidates must take note of the hierarchy in the definitions of the special quadrilaterals. In this regard, candidates must refrain from applying the properties of a quadrilateral that is defined higher in the development hierarchy to a quadrilateral that is defined lower in the hierarchy. For example candidates may not apply the properties of a rhombus to a parallelogram. However, it is acceptable for candidates to apply the properties of a parallelogram to a rhombus.
7. Candidates must know the formulae for the area of the different quadrilaterals.
8. The following proofs of theorems are examinable:
   - The opposite sides and angles of a parallelogram are equal
   - The diagonals of a parallelogram bisect each other
   - If one pair of opposite sides of a quadrilateral are equal and parallel the quadrilateral is a parallelogram
   - The diagonals of a rectangle are equal
   - The diagonals of a rhombus bisect each other at right angles and bisect the interior angles of the rhombus
   - The line segment joining the midpoints of two sides of a triangle is parallel to the third side and equal to half the length of the third side
9. Converses and corollaries derived from the theorems and axioms that are necessary in solving riders:
   - If the opposite sides of a quadrilateral are equal then the quadrilateral is a parallelogram
   - If the opposite angles of a quadrilateral are equal then the quadrilateral is a parallelogram
   - If the diagonals of a quadrilateral bisect each other the quadrilateral is a parallelogram
   - One pair of opposites angles of a kite are equal
   - A diagonal of a kite bisects the other diagonal at right angles
   - The diagonal between the equal sides of a kite bisects the angles at the vertices and is a line of symmetry
   - Triangles (or parallelograms) having the same base (or equal bases) and lying between the same two parallel lines have equal area
   - If triangles (or parallelograms) lying on the same base (or equal bases) and on the same side thereof have equal areas, they lie between the same two parallel lines
   - The line passing through the midpoint of one side of a triangle, parallel to another side, bisects the third side
10. Concurrency theory is excluded.

TRIGONOMETRY

1. The reciprocal ratios cosec θ, sec θ and cot θ will be explicitly tested in all aspects: definitions, function values and equations.
2. While the focus of trigonometric graphs is on the relationships, the characteristics of the graphs will also be examined.

ANALYTICAL GEOMETRY

1. Prove the properties of polygons by using analytical methods.
2. The concept of collinearity must be understood.
3. Candidates are expected to be able to integrate Euclidean Geometry axioms and theorems into Analytical Geometry problems.
4. Concepts involved with concurrency will not be examined.

STATISTICS

1. Candidates should be encouraged to use their calculators to calculate the mean for ungrouped and grouped data.
2. Candidates should be able to manually identify the quartiles from the set of data. Whilst formulae are available to identify the position of the quartiles in data sets, these should only be used in very large data sets.
3. Candidates are expected to identify outliers intuitively in the box and whisker diagram.
   In the case of the box and whisker diagram, observations that lie outside the interval (lower quartile – 1,5 IQR ; upper quartile + 1,5 IQR), are considered to be outliers. However, candidates will not be penalised if they do not use this formula in identifying outliers.

4. ACCEPTABLE REASONS: EUCLIDEAN GEOMETRY

In order to have some kind of uniformity, the use of the following shortened versions of the theorem statements is encouraged.

THEOREM STATEMENT	ACCEPTABLE REASON(S)
LINES	
The adjacent angles on a straight line are supplementary.	∠s on a str line
If the adjacent angles are supplementary, the outer arms of these angles form a straight line.	adj ∠s supp
The adjacent angles in a revolution add up to 360°.	∠s around a pt **OR** ∠s in a rev
Vertically opposite angles are equal.	vert opp ∠s =
If AB || CD, then the alternate angles are equal.	alt ∠s; AB || CD
If AB || CD, then the corresponding angles are equal.	corresp ∠s; AB || CD
If AB || CD, then the co-interior angles are supplementary.	co-int ∠s; AB || CD
If the alternate angles between two lines are equal, then the lines are parallel.	alt ∠s =
If the corresponding angles between two lines are equal, then the lines are parallel.	corresp ∠s =
If the co-interior angles between two lines are supplementary, then the lines are parallel.	co-int ∠s supp
TRIANGLES	
The interior angles of a triangle are supplementary.	∠ sum in Δ **OR** sum of ∠s in Δ **OR** int ∠s Δ
The exterior angle of a triangle is equal to the sum of the interior opposite angles.	ext ∠ of Δ
The angles opposite the equal sides in an isosceles triangle are equal.	∠s opp equal sides
The sides opposite the equal angles in an isosceles triangle are equal.	sides opp equal ∠s
In a right-angled triangle, the square of the hypotenuse is equal to the sum of the squares of the other two sides.	Pythagoras **OR** Theorem of Pythagoras
If the square of the longest side in a triangle is equal to the sum of the squares of the other two sides, then the triangle is right-angled.	converse Pythagoras **OR** converse Theorem of Pythagoras
If three sides of one triangle are respectively equal to three sides of another triangle, the triangles are congruent.	SSS
If two sides and an included angle of one triangle are respectively equal to two sides and an included angle of another triangle, the triangles are congruent.	SAS **OR** S∠S
If two angles and one side of one triangle are respectively equal to two angles and the corresponding side in another triangle, the triangles are congruent.	AAS **OR** ∠∠S
If in two right-angled triangles, the hypotenuse and one side of one triangle are respectively equal to the hypotenuse and one side of the other, the triangles are congruent	RHS **OR** 90°HS
The line segment joining the midpoints of two sides of a triangle is parallel to the third side and equal to half the length of the third side	midpt Theorem

THEOREM STATEMENT	ACCEPTABLE REASON(S)
The line drawn from the midpoint of one side of a triangle, parallel to another side, bisects the third side.	line through midpt || to 2nd side
If two triangles are equiangular, then the corresponding sides are in proportion (and consequently the triangles are similar).	||| Δs **OR** equiangular Δs
If the corresponding sides of two triangles are proportional, then the triangles are equiangular (and consequently the triangles are similar).	sides of Δ in prop
If triangles (or parallelograms) are on the same base (or on bases of equal length) and between the same two parallel lines, then the triangles (or parallelograms) have equal areas.	same base; same height **OR** equal bases; equal height
QUADRILATERALS	
The interior angles of a quadrilateral add up to 360°.	sum of ∠s in quad
The opposite sides of a parallelogram are parallel.	opp sides of ||m
If the opposite sides of a quadrilateral are parallel, then the quadrilateral is a parallelogram.	opp sides of quad are ||
The opposite sides of a parallelogram are equal in length.	opp sides of ||m
If the opposite sides of a quadrilateral are equal, then the quadrilateral is a parallelogram.	opp sides of quad are = **OR** converse opp sides of a parm
The opposite angles of a parallelogram are equal.	opp ∠s of ||m
If the opposite angles of a quadrilateral are equal then the quadrilateral is a parallelogram.	opp ∠s of quad are = **OR** converse opp angles of a parm
The diagonals of a parallelogram bisect each other.	diag of ||m
If the diagonals of a quadrilateral bisect each other, then the quadrilateral is a parallelogram.	diags of quad bisect each other **OR** converse diags of a parm
If one pair of opposite sides of a quadrilateral is equal and parallel, then the quadrilateral is a parallelogram.	pair of opp sides = and ||
The diagonals of a parallelogram bisect its area.	diag bisect area of ||m
The diagonals of a rhombus bisect at right angles.	diags of rhombus
The diagonals of a rhombus bisect the interior angles.	diags of rhombus
All four sides of a rhombus are equal in length.	sides of rhombus
All four sides of a square are equal in length.	sides of square
The diagonals of a rectangle are equal in length.	diags of rect
The diagonals of a kite intersect at right-angles.	diags of kite
A diagonal of a kite bisects the other diagonal.	diag of kite
A diagonal of a kite bisects the opposite angles	diag of kite

5. GENERAL GUIDELINES FOR MARKING

- If a learner makes more than one attempt at answering a question and does not cancel any of the attempts, only the first attempt will be marked irrespective of which of the attempt(s) may be the correct answer.
- Consistent accuracy marking regarding calculations will be followed in the following cases:
  - **Subquestion to subquestion:** When a certain variable is incorrectly calculated in one subquestion and needs to be substituted into another subquestion, **full marks can be** awarded for the subsequent subquestions provided the methods used are correct and the calculations are correct.
  - Assuming values/answers in order to solve a problem is unacceptable.

6. CONCLUSION

This Examination Guidelines document is meant to articulate the assessment aspirations espoused in the CAPS document. It is therefore not a substitute for the CAPS document which educators should teach to.

Qualitative curriculum coverage as enunciated in the CAPS cannot be over-emphasised.