SUBJECT ASSESSMENT GUIDELINES
Advanced Programme Mathematics
Grades 10 - 12

1. PURPOSE OF THE SUBJECT ASSESSMENT GUIDELINES

This document provides guidelines for assessment of a subject registered with the South African Qualifications Authority. The guidelines must be read in conjunction with the Unit Standards presented for a qualification at Level 4 on the National Qualifications Framework (NQF) and the relevant Range of the Unit Standard. The Subject Assessment Guidelines will be applicable for grades 10 and 11 from 1 January 2007 and for grade 12 from 2008.

Section 2 of this document provides general guidelines on assessment in schools and Section 3 provides more specific assessment guidelines for Advanced Programme Mathematics.

Together, these documents assist teachers in their teaching of Advanced Programme Mathematics. Teachers should also use every available opportunity to hone their capacity for assessment, including the creating, implementing, marking and recording of assessments.

2. ASSESSMENT WITHIN SCHOOLS

2.1 Introduction

Assessment is an integral part of teaching and learning. For this reason, assessment should be part of every lesson and teachers should plan assessment activities to complement learning activities. In addition, teachers should plan a formal Programme of Assessment. Together the informal daily assessment and the formal Programme of Assessment should be used to monitor learner progress through the school year.

Continuous assessment through informal daily assessment and the formal Programme of Assessment should be used to:

- develop learners' knowledge, skills and values
- assess learners' strengths and weaknesses
- provide additional support to learners
- revisit or revise certain sections of the curriculum and
- motivate and encourage learners.

In grades 10 and 11 all assessment of Advanced Programme Mathematics is internal. In grade 12 the formal Programme of Assessment which counts 25% is internally set and marked and externally moderated. The remaining 75% of the final mark for certification in grade 12 is externally set, marked and moderated.

2.2 Continuous assessment

Continuous assessment involves assessment activities that are undertaken throughout the year, using various kinds of assessment forms, methods and tools. In grades 10-12 continuous assessment comprises two different but related activities: informal daily assessment and a formal Programme of Assessment.

2.2.1 Daily assessment

The daily assessment tasks are the planned teaching and learning activities that take place in the subject classroom. Learner progress should be monitored during learning activities. This informal daily monitoring of progress can be done through question and answer sessions; short assessment tasks completed during the lesson by individuals, pairs or groups or homework exercises.

Individual learners, groups of learners or teachers can mark these assessment tasks. Self-assessment, peer assessment and group assessment actively involves learners in assessment. This is important as it allows learners to learn from and reflect on their own performance.

The results of the informal daily assessment tasks are not formally recorded unless the teacher wishes to do so. In such instances, a simple checklist may be used to record this assessment. However, teachers may use the learners' performance in these assessment tasks to provide verbal or written feedback to learners, the School Management Team and parents. This is particularly important if barriers to learning or poor levels of participation are encountered.

2.2.2 The internal Programme of Assessment for Grades 10, 11 and 12

In grades 10 and 11, the Programme of Assessment consists of tasks undertaken during the school year and an end-of-year examination. The requirements for the formal Programme of Assessment for grades 10 and 11 are summarised in table 3.2.1.

In grade 12, the Programme of Assessment consists of tasks undertaken during the school year and counts 25% of the final grade 12 mark. The other 75% is made up of an externally set examination. The requirements for the formal Programme of Assessment for grade 12 are summarised in table 3.3.1.

The marks achieved in each assessment task in the formal Programme of Assessment must be recorded and included in formal reports to parents and School Management Teams. In grades 10 and 11 these results will form part of the overall evaluation and assessment of the learner's performance. In grade 12, these marks will be submitted as the internal continuous assessment mark. Section 3 of this document provides details on the weighting of the tasks for promotion purposes.

In grades 10 and 11, two of the assessment tasks must be examinations and should be administered in mid-year and November. These examinations should take account of the requirements set out in Section 3 of this document. They should be carefully designed and weighted to cover all the Unit Standards of the subject. Two of the assessment tasks should be tests written under controlled conditions at a specified time.

The remainder of the assessment tasks should not be tests or examinations. They should be carefully designed tasks, which give learners opportunities to research and explore the subject in exciting and varied ways. Examples of assessment forms are presentations, projects, simulations, written reports, practical tasks, exhibitions and research projects. The most appropriate forms of assessment are set

out in table 3.2.2. Care should be taken to ensure that learners cover a variety of assessment forms in the three grades.

In grade 12, at least one of the assessment tasks for Advanced Programme Mathematics must be an examination administered in mid-year and/or September. These examinations should conform to the external requirements set out in Section 3 of this document. They should be carefully designed and weighted to cover all the Learning Outcomes of the subject. A further two of the assessment tasks should be tests written under controlled conditions at a specified time. The remainder of the assessment tasks should not be tests or examinations. They should be carefully designed tasks, which give learners opportunities to research and explore the subject in exciting and focused ways.

2.3 External assessment in grade 12

External assessment is only applicable to grade 12. The external examinations are set externally, administered at schools under conditions specified in the National policy on the conduct, administration and management of the assessment of the National Senior Certificate: A qualification at Level 4 on the National Qualifications Framework (NQF). In addition the scripts are marked externally and the results externally moderated.

Guidelines for the external examinations are provided in Section 3.

2.4 Recording and reporting on the Programme of Assessment

The Programme of Assessment should be recorded in the teacher's portfolio of assessment. The following should be included in the teacher's portfolio:

- a contents page;
- the formal Programme of Assessment;
- the requirements of each of the assessment tasks;
- the tools used for assessment for each task; and
- record sheets for each class.

Teachers must report regularly and in a timely fashion to learners and parents on the progress of learners. Schools will determine the reporting mechanism but it could include written reports, parent-teacher interviews and parents' days. Schools are required to provide written reports to parents once per term on the Programme of Assessment using a formal reporting tool. This report must indicate the percentage achieved per subject and include the following seven-point scale.

Table 2.4: Seven-point reporting scale

RATING CODE	RATING	MARKS %
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

3. ADVANCED PROGRAMME MATHEMATICS

3.1 Introduction

Assessment in Advanced Programme Mathematics should focus on collecting reliable information regarding learners' advanced mathematical growth and competence. Although interesting and non-routine problems should form part of the assessment programme, it should also reflect the fact that the concepts, algorithms and heuristics in Advanced Programme Mathematics are abstract and complex in their own right and therefore should not be assessed at too high a level. The results of formal assessment must be reported using the 7-point scale in table 2.4.

The Learning Outcomes of the Advanced Programme Mathematics National Curriculum Statement have been divided into Core Learning Outcomes (LO 1: Calculus & 2: Algebra) and Elective Learning Outcomes (LO 3: Statistics, 4: Matrices and Graph Theory & 5: Modelling). Learners will be examined on LO 1 and 2 as well as a choice of one of LO 3, 4 or 5. In grade 12 Advanced Programme Mathematics will be examined in one compulsory examination.

3.2 Programme of Assessment in Grades 10 and 11

The Programme of Assessment for Advanced Programme Mathematics in grades 10 and 11 comprises six tasks that are internally assessed (school-based assessment). As indicated in table 1, the six tasks completed during the school year make up 25% of the total mark for Advanced Programme Mathematics, while the end-of-year examination makes up the remaining 75%. Cluster groups should support the implementation of the Programme of Assessment.

3.2.1 Annual assessment plan

Table one illustrates the forms of assessment, and the weighting, that must be used in the compilation of the learners' portfolios. The timing of the assessment items is left to the discretion of the teacher but should be ongoing and spread across the school year.
Table 3.2.1: Forms of assessment in an annual assessment plan for grades 10 and 11.

	Grade 10	**Grade 11**
	Weight (%)	**Weight (%)**
2 Investigations (15% each)	30	30
Mid-year Examination	40	40
2 Tests (15% each)	30	30
Portfolio mark	100	100
Portfolio mark (as % of promotion mark)	25	25
November Examinations	75	75
Promotion mark	100	100

The grade 10 and 11 portfolio components have been selected in such a way to produce at least 70% of the mark under controlled conditions and less than 30% of the mark under less controlled

conditions. The portfolio should be representative of both the compulsory and elective Learning Outcomes.

3.2.2 Examples of assessment tasks and tools

The completion of the learner's portfolio requires assessment tasks that provide the learner with the opportunity to demonstrate his or her mathematical competence. Although not expected within each task, collectively the assessment tasks should enable the teacher to differentiate between various levels of performance and learner competence. The most commonly used forms of assessment in Advanced Programme Mathematics are described in Table 2.

Table 3.2.2: Forms of assessment and suitable assessment tools

TESTS	Marking memorandum
EXAMS	Marking memorandum
INVESTIGATIONS	Rubric (including accuracy)
TUTORIALS	Class Tutorials - Marking memorandum Home Tutorials – Marking memorandum
PROJECT	Grade 12 portfolio item using Assessment Standards that can not be efficiently tested in an Examination • An instruction sheet should be given to the learners well in advance to allow enough time for research. • A class checklist to monitor the process helps learners stay on track with their project work • A rubric can be used for assessment of the project.

3.2.3 Examinations

The contents of the examinations should be in line with the curriculum document as determined by Independent Examination Board. Examinations in grades 10 and 11 should also include problem-solving questions in preparation for such questions in the grade 12 external examination. The end-of-year examination in grade 11 should be representative of the style, nature and complexity of the grade 12 external examination.

Table 3.2.3.1: Examination papers and times in Grades 10 and 11

	GRADE 10	GRADE 11
Mid-year	2 hours (100 marks)	2 hours (200 marks)
November	2 hours (100 marks)	3 hours (300 marks)

The central purpose of examinations is to differentiate between the seven levels of performance described in the introduction. To set a differentiated exam, it is recommended that teachers use the taxonomy in table 3.2.3.2. This taxonomy has four categories of mathematical task or question that ensures an assessment capable of differentiating learner performance. The 200 marks for the grade 11 mid-year examination and the 300 marks for the grade 11 November examination (table 3.2.31) are allocated generously. For example, important concepts, procedures, insights and applications should be allocated 2 marks each. Even the use of relatively simple ideas or procedures may be allocated a mark.

Table 3.2.3.2: Taxonomical differentiation of question in examinations and tests

Category	Knowing	Performing Routine Procedures	Performing Complex Procedures	Solving problems
Weight (%)	**10–20%**	**40–50%**	**20–30%**	**5–10%**

3.3 Assessment in Grade 12

3.3.1 Annual internal assessment plan

Table 4 illustrates the forms of assessment, and their weighting, that must be used in the compilation of the learners' grade 12 portfolios. The timing of the assessment items is left to the discretion of the teacher but should be ongoing and spread across the school year.

Table 3.3.1: Forms of assessment in the annual internal assessment plan for Grade 12.

	Portfolio Component	Weight (%)
Project		20
2 Tests (10% each)		20
2 Examinations	Mid-year or Grade 11 (Nov)	20
	Prelim	40
Portfolio mark		100

3.3.2 Elective Learning Outcome Project

In each of the Elective Learning Outcomes there is an Assessment Standard that lends itself to a project rather than examination under timed conditions. Consequently, grade 12 learners will be expected to complete a research project on one aspect of the Elective Learning Outcome presented for examination in the grade 12 external examination.

It is recommended that the following Assessment Standards be assessed in the form of a project:

Learning Outcome	Assessment Standard
LO 3: Statistics	12.3.1 Use the least-squares method to calculate a (real world) predictive linear regression function OR 12.3.2 Apply the Normal distribution model to a sample to estimate a population mean or proportion, using statistical tables to deal with various confidence levels.
LO 4: Mathematical modelling	12.4.1 Model simple population growth and decay problems using a discrete two species Lotka-Volterra predator-prey population model written in difference equation form $R_{n+1} = R_n + a.R_n - b.R_n.F_n$ $F_{n+1} = F_n + e.b.R_n.F_n - c.F_n$ Evaluate a realistic population scenario and apply the most suitable model for a given scenario.

Learning Outcome	Assessment Standard
LO 5: Matrices and Graph Theory	12.5.2 Solve simple travelling salesman problems using graphs and matrices applied to innovative algorithms in the literature.

3.3.3 External assessment

The certification process of Advanced Programme Mathematics includes a formal external assessment at the end of grade 12. The external Advanced Programme Mathematics examination will assess the Assessment Standards of grades 11 and 12 while assuming that learners have achieved the grade 10 Assessment Standards. The examination will consist of one 3-hour examination paper. The structure, time allocation and marks of the grade 12 examination are illustrated in table 5 and 6 below.

Table 3.3.3.1: Grade 12 examination mark allocation

Learning Outcome	Marks	Time
1	120 – 160	80 – 90 min
2	60 – 80	30 – 40 min
Elective	100	60 min
Total	300	3 hours

This includes approximately 10% application or problem solving.

The Assessment Standards of the National Senior Certificate Mathematics examinations will be structured in line with the weightings indicated in Table 3.6. The level of complexity of the mathematical questions in the examinations will be in line with the taxonomical categories given in Table 3.7. Table 3.7 is more fully elaborated with examples in Appendix 3.

Table 3.3.3.2: Suggested distribution of marks for Core Learning Outcomes in grade 12 external examination

LO	Topic	Mark distribution
1	Functions and limits	10 – 30
	Trigonometry	10 – 30
	Differentiation	20 – 40
	Integration	20 – 40
	Drawing functions	20 – 30
	Applications (Max / min; Rates of change; Volume and area)	20 – 30
	Total	120 – 160
2	Real and Complex roots	10 – 20
	Exponents and logarithms	20 – 30
	Absolute Value	20 – 30
	Induction	10 – 20
	Total	60 – 80

Table 3.3.3.3: Suggested distribution of marks for Core Learning Outcomes in grade 12 external examination

LO	Topic	Minimum percentage
3	Probability	40 – 60%
	Descriptive statistics	40 – 60%
	Total	100 marks
4	Graph theory	40 – 60%
	Matrices	40 – 60%
	Total	100 marks
5	Financial models	40 – 60%
	Recursive models	40 – 60%
	Total	100 marks

3.4 Promotion

A learner must achieve a minimum of 40% (Level 3: Moderate achievement) in Advanced Programme Mathematics for promotion at the end of Grades 10 and 11 and for certification at the end of Grade 12.

3.5 Moderation of internal assessment

Moderation of assessment tasks will take place at schools in grades 10, 11 and 12. In addition, moderation of assessment in grade 12 will also take place within clusters and at the IEB.

School moderation

The Programme of Assessment should be submitted to the head of department or subject head and School Management Team before the start of the academic year together with a Learning Programme for moderation purposes. Each task that will be used for the Programme of Assessment should be submitted to the head of department or subject head for moderation before the learners are given the work to do. The teacher and learner portfolios should be moderated at least once per term by the head of department, subject head, or his or her delegate.

Cluster and IEB moderation

Teacher portfolios and a sample of learner portfolios will be moderated by the cluster coordinators. A further sample of the greater of 10% or 5 students will be moderated by the IEB.