# Mathematics Pathways

2011 Assessment Report

Government of South Australia

SACE Board of SA

# MATHEMATICS PATHWAYS

# 2011 ASSESSMENT REPORT

## OVERVIEW

Assessment reports give an overview of how students performed in their school and external assessments in relation to the learning requirements, assessment design criteria, and performance standards set out in the relevant subject outline. They provide information and advice regarding the assessment types, the application of the performance standards in school and external assessments, the quality of student performance, and any relevant statistical information.

## SCHOOL-BASED ASSESSMENT

### Assessment Type 1: Skills and Applications Tasks

This assessment type required students to complete at least five tasks under supervision for the 20-credit course. Most teachers gave written tests, with the main focus on application of knowledge and understanding, and minor focus on modelling and communication.

Most skills and applications tasks were well-constructed, with a mixture of routine and complex questions. Simple routine and scaffolded questions were used to guide students through to a pass result. These were balanced with complex questions that contained several sequenced steps and no scaffolding, and allowed students to achieve a pass at A and B levels.

The best responses were those where the students discussed and drew conclusions based on their calculations, rather than making general comments about reasonableness, assumptions and limitations without doing the calculations. Comparison of two sets of statistical data, for example, gave an opportunity for depth of discussion and the drawing of their own conclusions. The most popular topics were Applied Geometry, Mathematics and Small Business, Investments and Loans, and Statistics. Other topics included Optimisation, Matrices, Share Investments and Probability. Content in Mathematics Pathways is more flexible than in Mathematical Applications, but most topics chosen appeared to adhere closely to the topics in Mathematical Applications. If variations are made – for example additional coverage of formulae from areas other than Applied Geometry – there is still the expectation that the work will be of Stage 2 standard.

### Assessment Type 2: Folio

The quality of folio work was variable. To achieve at the highest level on the Mathematical Knowledge and Skills and Their Application performance standards, students needed to show evidence of completely correct, complex calculations of a

Stage 2 standard. Students needed to be provided with the opportunity to develop or select a model (process, graph, spreadsheet or formula) with little or no instruction or scaffolding in the question. This model could then be used to solve problems, with changing parameters, where appropriate. The best folio tasks provided the opportunity for students to produce individual results, interpret them, and make predictions on them. This is to be preferred rather than having the whole class work with the same figures or measurements and answering short general discussion questions. Students are able to achieve at the higher standards when their analysis and discussion includes the quotation of more figures from their own calculations as evidence to back up general points.

Incomplete folio work and non-submission of a task had an impact on the assessment of student performance, and generally led to a lower grade overall for the folio. Because the subject outline requires the grade for the Folio to be based on the at least two investigations, if one was missing, there was an impact on the overall grade, particularly if the omitted task was the major open-ended investigation.

## EXTERNAL ASSESSMENT

## Assessment Type 3: Investigation

The connected questions set for the external investigations came from all topics. The most popular choices were Mathematics and Small Business, Investments and Loans, and Applied Geometry – often combined under a theme or series of connected problems. Investigations centred on Matrices and Share Investments were chosen less frequently. The option of seeking advice on the external investigation draft was used by more than half of the schools. In general these schools accepted and acted on the advice given.

### Mathematical Knowledge and Skills and Their Application

In general, students were able to clearly display their level of knowledge and application where the task design allowed for their discernment, and for the choice of the most appropriate algorithms. Of concern was the significant proportion of students with very limited knowledge.

To be successful in this subject at Stage 2 level, learners to show a significant development from Stage 1 knowledge and application. A significant number of students were not able to complete routine calculation problems of a standard much lower than Stage 2.

### Mathematical Modelling and Problem-Solving

Successful students had been explicitly taught how to apply problem-solving methods and analyse with reference to calculations in their mathematical models. It was apparent that many students with reasonable knowledge, skills, and application abilities had little awareness of the appropriate way to respond to analysis and reflection problems.

In many investigations, tasks were heavily scaffolded throughout and thus gave little opportunity for students to show their problem-solving skills or their ability to critically analyse a situation, or the need to make a decision. When the series of questions left little or no scope for student choice, it meant there was limited opportunity for analysis, reflection, or the need to draw a conclusion from the evidence.

### Communication of Mathematical Information

The majority of students made a genuine attempt to communicate the results of their work, and draw a meaningful conclusion (based on their calculations throughout the investigation) in relation to the problem posed. However, many students showed limited working and reflection on the significance of results. In this situation, as well as demonstrating poor communication, the possibility of a careless error is difficult to judge.

Students need to be encouraged to communicate the mathematical processes they have used, as well as making their answers clear. They also need to explain the significance of their result in the context of the question. Evidence of the reasonableness of results, in the context of the question, is taken into account especially where students acknowledge that they have made an error and attempt to explain the effect.

Students often provided basic definitions instead of explaining the significance of a feature. For example, when students were asked to explain the significance of an outlier they gave a definition rather than referring to calculations that showed how the mean and range were distorted.

### Task design

Well-designed investigations began with a significant problem to be investigated, and included guidance that moved from some scaffolding to more open-ended questions. The linked questions were logical in their progression, with response space provided for students to use throughout the task.

External marking was supported by accurate, comprehensive, well set-out solutions on the final task.

Markers felt that up to 50% of external investigations that were submitted would have taken less than the required full 3 hours, and that the tasks provided insufficient complexity and range of concepts.

A good task design reduced the likelihood of the student following an error through a series of questions. For example, after an open-ended question, if a value is provided for further related questions, an error is not carried.

## OPERATIONAL ADVICE

Mathematics Pathways is a very flexible course, but teachers do need to notify the SACE Board of any changes to their original assessment plan by using the Learning and Assessment Plan addendum.

The packaging and presentation of materials for moderation was generally satisfactory and moderators appreciated teachers' efforts to follow instructions. However, there are a few suggestions which would support the moderators to confirm teachers' decisions. Clearly marked work for all skills and applications tasks and folio tasks is essential. Provision of solutions supplied is very strongly recommended.

The instructions in the Mathematics Learning Area Manual regarding the presentation of student materials should be adhered to. Each student's work should be placed in a separate bag. It should not be submitted in hard-covered folders. Within each individual student bag it is helpful to include a Cover Sheet with a summary of all the individual task grades, and also to separate the tasks into the two Assessment Types: Type 1: Skills and Applications Tasks, and Type 2: Folio. Original marked student work for moderation should be submitted, not photocopies. Student grades need to be checked so that the grade awarded on their submitted materials matches the grade on the official results sheet. The SACE Board needs to be notified in writing by the Principal of any late changes to the official result sheet. All student work for the students who are in the selected sample needs to be sent in for moderation. If any assessed student work is missing or a student received special provisions in school assessment, the SACE Board Variations to Materials form must be included with details about what is missing and why.

## GENERAL COMMENT

For the first year of a new subject, teachers are to be commended on the standard of courses delivered to meet different student pathways. It appears that the courses with a more homogeneous group of students (for example, those with an interest in a particular trade) could include tasks with slightly less content and context but with greater depth; whereas courses for a wider variety of student needs could be more general. Most teachers found that to maintain an appropriate Stage 2 standard, it was safest to include at least some Mathematical Applications course content in each assessment task. The Mathematical Applications examination checklists which can be found in the Maths Applications support materials on the SACE website are a valuable tool for constructing skills and applications tasks with an appropriate mix of routine and complex problems.

Moderators were able to confirm the majority of teacher assessments. Teachers are encouraged to regularly check the SACE website as more support materials become available enabling the quality of tasks and student performance to continue to improve.

Students with TAFE and employment demands are being catered for in this new subject because of its reduced number of assessment tasks. However, the challenge for next year is to increase the quality of student responses particularly at the higher levels by encouraging teachers to set more complex questions in tests, and to give students more explicit teaching and the opportunity to provide evidence at the highest possible level in the development of mathematical models and interpretive responses in their folio tasks.

Mathematics Pathways
Chief Assessor