Mathematical Methods

2011 Assessment Report

Government
of South Australia

SACE
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MATHEMATICAL METHODS

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 ASSESSMENT

The moderators were generally impressed with the organisation and presentation of the school assessment pieces. Some teachers provided a cover sheet for each student folio in the sample, including a summary of the results for each assessment piece. This enabled the moderation team to quickly identify which assessment pieces each student had completed, and if materials were not in the folio, why they were not available (e.g. was the assessment task misplaced after marking or not submitted at all).

Assessment Type 1: Skills and Applications Tasks

It is important when designing a task that the questions range from routine to complex to give students the opportunity to perform at all levels of the performance standards, including the highest level. About 30% of questions should be set at a complex level. Note that providing multiple questions that test the same concept and setting questions about concepts that are outside the curriculum do not assist with confirming the levels of achievement.

During the moderation process it was found that when multiple classes had undertaken the same assessment task, it was important that there was evidence of consistent marking. This was particularly important when classes were enrolled in the same assessment group. The moderation team has to assume that a consistent understanding of the performance standards exists and has been applied consistently in the assessment of student work. A moderation shift may have been the result of only one class within an assessment group having results that could not be confirmed through the moderation process.

It was also very useful to see the mark allocations for each question in each assessment. This supported the students by indicating their areas of strength and weakness, and also provided evidence to the moderation team of how the students' grades were achieved by indicating how much of each question the students had responded to appropriately.

Assessment Type 2: Folio

At least one of the investigations given to students needs to provide an open-ended context with less direction, enabling students to show their ability to make decisions about modelling and problem-solving. This provides students with greater opportunities to achieve at the higher levels of the performance standards, particularly in the mathematical modelling and problem-solving assessment design criterion.

One of the crucial elements of a folio task is students' ability to communicate their understanding of their investigation topics. Students should use a report format for their folio tasks, beginning with an introduction that outlines the purpose and context of the investigation. The main body of the investigation should include evidence of appropriate application of the mathematical model or strategy, including collection or generation of data, mathematical calculations, and analysis and interpretation of the results (including any limitations of the model or strategy used). The conclusion should be in the context of the original problem and provide an evaluation of the result of the investigation. Appendices and a bibliography should be included where appropriate. More detailed information can be found on pages 32 and 33 of the subject outline and teachers and students should refer to this and to the description of the specific features at each grade in the performance standards.

Ensuring that the mathematical investigations within the folio are marked for accuracy is necessary for the moderation process, and supports the process of confirming teacher assessments. Marking any calculations for accuracy is also very important in assisting students to identify skills that they are applying accurately, and those that they need to review.

EXTERNAL ASSESSMENT

Assessment Component 3: Examination

The examination design is based on the key questions and key ideas outlined in the four topics and their subtopics listed in the subject outline. The examination consisted of a range of questions, some focusing on knowledge and routine skills and applications and others on analysis and interpretation. The skills and understandings developed through investigations were also assessed in the examination.

There were quite a few very impressive papers clearly demonstrating attention was paid throughout the year to giving responses within the context of the question.

It was pleasing to see the vast majority of students attempting and achieving some success in most questions. Routine skills and applications were generally well handled.

To enable students to proceed further through some questions, students were given results and asked to 'clearly show' how these results could be achieved. This task proved to be quite difficult for many students. This was particularly noticeable when students were asked to find the derivative of functions.

The majority of students displayed more than competent knowledge and understanding of the course content and concepts and relationships. A major concern continues to be student ability to deal with the interpretation of mathematical results and the reasonableness and possible limitations of interpreted results.

The sensible rounding of numbers was attended to by the majority of students. It was noticeable that some students do have difficulty rounding numbers. Marks were deducted from students if they persisted in providing responses that were not sensibly rounded.

The discerning use of electronic technology in the examination is encouraged. Students may use their calculator whenever they see an opportunity to do so. There is no need to indicate to the examiners when they have used their calculator. Too many students appeared to be reluctant to use their graphics calculators.

It is important to keep in mind that it is assumed that students have knowledge of subtopics from the Stage 1 course, and that the key ideas from these topics may be used in parts of questions. Full details of the subtopics that are assumed knowledge are detailed in the Stage 1 Mathematics subject outline on page 10.

Approximately 1150 students sat the examination and the overall results were sound with the average score this year a little under 60%. This was slightly below the average of the previous few years.

Q. 1: The majority of students found this question to be a gentle lead-in to the paper. Part (a) was correctly answered by the vast majority of students and this led to the correct shading of the feasible region in part (b). Errors occurred in part (c) with some students unable to find the x-axis coordinate of point P. If a student is unable to solve $2x = 4 \times 30 - 95$ without using a calculator, there are many ways a graphics calculator can assist. In part (d) many students substituted in the incorrect coordinates. The best responses to this question included a statement such as 'the optimum value of M is 60 and this occurs when $x = 0$ and $y = 30$'.

Q. 2: This was a standard question for determining the average rate of change. Parts (a) and (b) were well answered. In part (c) students often struggled with the algebra and in part (e) the number of incorrect answers was disappointing as the correct solution can be easily obtained using most approved graphics calculators.

Q. 3: Quite a few students struggled with part (a). The multiplication of matrices was not handled as well as expected in this question.

Q. 4: This question was handled well by the majority of students. It was in this question that students were penalised for not giving their answers correct to three significant figures, resulting in many students losing 1 mark in part (c) (i). A whole number response was also expected in part (c) (ii).

Q. 5: This was another question where students who were adept at using their graphics calculator were at an advantage. Parts (b) (ii), (d) (iii), and (e) (ii) and (iii) required the students to give interpretations of the mathematical results within the context of the problem. Some students found this quite difficult.

With parts (d) (ii) and (e) (i), a significant number of students found $F(a)$ instead of solving $F(x) = a$. Approximately 25% of the students scored at least 16 out of the possible 18 marks for this question.

Q. 6: The graphing of the constraints in part (c) was pleasing although some students neglected to graph all constraints – especially those from parts (a) and (b). A function, not an expression, is required in part (d) (i), and the best responses to parts (d) (ii) and (e) gave an answer within the context of the question.

Q. 7: This question was not the ‘usual’ type of question on confidence intervals and the central limit theorem. Part (a) was handled well by students once they realised that at worst they were manipulating a formula from their formulae sheet. In part (b) students often substituted numbers into the formula rather than rearrange the formula. In part (c) (i) many students could not explain that the distribution of the sample means would be approximately normal because the sample size was sufficiently large.

Q. 8: It was evident that the student cohort struggled to recall Pythagoras’ theorem. The majority of the parts in this question were written so that if a student was not successful in part (a) he/she could pick up the question in part (b) and continue. The number of students who could not solve for x in (d) (ii) was disappointing. This question proved to be the most challenging for this cohort.

Q. 9: Part (b) was generally well done. There was a little confusion over the complement of $P(X \geq 3)$ and some students found difficulty connecting part (a) (iii) to the tree diagram in part (a) (i).

Q. 10: Students often were unable to provide correct explanations in part (a) displaying a lack of understanding of the graphical difference between $F(2)$ and $F'(2)$. Many students showed some understanding of what the graph in part (b) should look like. However the slope of the curve at $x = 2$ was often incorrect.

Q. 11: In part (a) students often commented on the pattern and scatter of the plot but did not refer to the size of the residual values. In part (c) students should use P and t as the variables and not y and x. Students were asked to show clearly the use of log laws. The step $e^{\ln P} = e^{-0.07485t+9.042}$ or similar should be included in student solutions.

Part (e) (i) was worth 2 marks and this should have alerted students to the need to use electronic technology in finding the time to the nearest year.

Q. 12: The development of the transition matrices and the matrix multiplications that were required in this question were confidently completed by the students. However interpretations of the various scenarios were not done well.

Q. 13: A similar question to part (a) has now been included in the examination three years in a row. Students should be able to determine when a function is defined. Finding the derivative of a logarithmic function proved difficult for many of the students and once again the interpretations given in response to part (d) (ii) were not clear or concise.

Q. 14: This proved to be a positive question for most students to end the exam with. Fifty-eight per cent of students scored 10 or more out of the 14 marks allocated. Using the product rule to find the derivative was done well – a good example of where less able students with a good reference sheet could pick up a few marks. The crucial line of $P/t = e^{-0.0416t+2.94}$, or similar, in part (c) was often missing and the interpretations given in response to part (e) (iii) were often not sufficiently concise.

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