# Stage 2 Essential Mathematics Subject Assessment Advice

## Overview

Subject assessment advice, based on the previous year’s assessment cycle, gives 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, and the quality of student performance.

Teachers should refer to the subject outline for specifications on content and learning requirements, and to the subject operational information for operational matters and key dates.

# School Assessment

Assessment Type 1: Skills and Applications Tasks

Students complete four skills and applications tasks, including at least one skills and applications task from each of the non-examined topics. Skills and applications tasks are completed under the direct supervision of the teacher. The equivalent of one skills and applications task must be undertaken without the use of either a calculator or notes. In the remaining skills and applications tasks, electronic technology and up to one A4 sheet of handwritten notes (on one side only) may be used at the discretion of the teacher. Students must be given the opportunity to demonstrate evidence in both assessment design criteria (*Concepts and Techniques* and *Reasoning and Communication*), and where possible for each specific feature, at least once in the school assessment component.

Teachers are encouraged to access the support material document - ‘*Complexity Guide Essential Mathematics’* which is available on the website at the following link: <https://www.sace.sa.edu.au/web/essential-mathematics/stage-2/support-materials/subject-advice-and-strategies>. The complexity guide has been produced to support teachers to identify key questions and key concepts that provide the opportunity for complexity in questions.

The more successful responses commonly:

* provided a good balance between routine calculations/analysis (approximately 65%), complex calculations (approximately 30%) and complex interpretive questions (approximately 5%)
* included routine questions that were broken into distinct parts (scaffolding) and often (but not always) used prompts as starters such as “show…” and “using the Sine rule…”, but complex questions gave students the opportunity to choose a calculation method
* provided opportunity for students to use technology, particularly in both *Statistics* and *Investments and loans* (specific feature CT4)
* had questions set within a context which allowed students to appropriately interpret their mathematical results (specific feature RC1)
* gave opportunities for students to discuss the reasonableness of their calculations (specific feature RC2)
* displayed clear communication of the steps in solving problems (specific feature RC4), with correctly labelled calculations and correct units of measurement (specific feature RC3).

The less successful responses commonly:

* did not provide the students with enough complex problems to enable them to provide evidence of their ability to solve questions of a complex nature, or included too many complex questions making it hard for students to access the C grade band (specific feature CT2)
* included mostly questions that were very scaffolded, hence reducing the complexity of the task overall (specific feature CT2)
* included assessment of the measurement topic with questions containing only basic shapes, reducing the overall complexity of the task (specific feature CT2).
* lacked opportunities for students to provide evidence of good interpretation in the context of the question, rather providing opportunities for students to simply state results (specific feature RC1)
* provided limited opportunities to interpret, explain or justify (specific feature RC4)
* provided no, or limited evidence of calculations. In multiple mark questions where only final solutions are provided and the result is incorrect, marks for appropriate steps cannot be allocated. Teachers should encourage students to show appropriate steps in their mathematical calculations. (specific feature RC4)
* did not include at least one skills and applications task from each of the non-examined topics as specified in the subject outline.

Assessment Type 2: Folio

Students complete 3 folio tasks, where they investigate a mathematical problem based in an everyday or workplace context. Any topic not assessed in skills and applications should be assessed within a folio task. The subject of the mathematical problem may be derived from one or more topics. Each folio task, excluding bibliography and appendices if used, must be a maximum of 8 A4 pages if written (minimum font size 10), or the equivalent in multimodal form. Students must be given the opportunity to demonstrate all assessment design criteria at least once in the school assessment component.

The more successful responses commonly:

* addressed predictions in the *Statistics* topic (specific feature RC5)
* displayed evidence that teachers supported students in understanding where complexity could be found in the mathematical investigations that were undertaken ( correlation – removal of outliers, using equation of best fit, loans and investments – explicit use of technology, multiple changes at once, comparisons of investments or loan costs)
* were seen when open-ended tasks were used which allowed students to choose the path of their investigation and select their own ideas/figures/contexts to follow – providing individuality in responses and hence allowing for differentiation in the responses seen (specific feature CT3)
* had responses providing clear communication of the steps undertaken in the investigations – providing connections between the mathematical investigations which were easy to follow, and clearly identifiable (specific feature CT4)
* provided in-depth discussion of reasonableness and limitations that clearly linked to the context of the investigations, not just stating generic reasons (specific feature RC2)

The less successful responses commonly:

* limited opportunities to provide alternative investigations or changes to scenarios, limiting the opportunities for variations in the analysis (specific feature CT2)
* provided brief discussions with little or no reference to calculations (specific feature RC4)
* provided evidence of students creating and using unreliable models, particularly in *Statistics* where correlations investigations with a very weak relationship between the variables were used to make predictions. As a guide, an r2<0.7 is not sufficiently large to proceed with. Where students have not got the time to investigate new variables, they need to show a very clear understanding of the limitations of using a least squares regression line to make predictions when the relationship is so weak.
* focused on research for the task (e.g. costs of products needed to make something) rather than calculations showing the mathematical skills required
* were evident when tasks had very limited scope for further investigations, or included mathematical content that does not get beyond basic or routine levels. This was often evident in the Cubby House folio task where only basic shapes were used for the walls, windows and roof.
* did not adhere to the page limit, placing repetitive calculations in the main body and hence exceeding the page limit. Students should be encouraged to place repetitive calculations in the appendices, with an initial calculation providing evidence of the skill in the main body, and then the results of the calculations in the appendices placed in a table in the main body for comparison and discussion.

Assessment Type 3: Examination

Students undertake one 2-hour examination in which they answer questions on three specified topics from the Subject Outline. The topics that are specified for examination are:

Topic 2: Measurement Topic 4: Statistics Topic 5: Investments and loans

**Topic 2: Measurement**

This section of the examination displayed varying levels of completion and success for students. Most students correctly answered Questions 1 and 2, and these were among the most successfully responded to questions in the examination. Question 3 however, proved to be challenging for the majority of students.

Overall it was the second highest scoring section of the examination for the student cohort.

Question 1:

The more successful responses:

* Converted units accurately
* Demonstrated the working out required for question c (i)
* Rounded appropriately in question c (ii)

The less successful responses:

* Did not show the working for calculating the volume in question c (i)

Note: In an examination questions set with a ‘show that’ stem such as c (i) provide students who cannot successfully show the calculation themselves with the figure to proceed onto the next calculation. Students should be encouraged to use this examination strategy when needed.

Question 2:

The more successful responses:

* Identified the useful information from the diagrams to use in their formula(s)
* Were able to explain their mathematical understanding in question c (ii) and question 2 d (ii)

The less successful responses:

* Attempted to carry out the area calculation in question 2 a using two triangles
* Incorrectly used the formula for a trapezium in Question 2 b
* Incorrectly identified the measurements for use in Question 2 d (i)
* Did not use their calculators correctly, struggling with the use of brackets for calculations in Question 2 b and Question 2 d (i)

Question 3:

The more successful responses:

* Identified the appropriate formula(s) to use for each part of the question
* Selected only the useful and required information for each part of the question

The less successful responses:

* Did not recognise the shapes and formula to be used throughout the entire question
* Could not distinguish between right-angled and non-right-angled triangles throughout the question
* Selected and applied formulae incorrectly

**Topic 4: Statistics**

This section of the examination had high levels of completion and success for most students. Questions 5 and 6 demonstrated that students could use data in a range of ways and interpret the results with reasonable accuracy. Question 4 proved to be challenging for the majority of students, particularly with the concept of interpolation and extrapolation.

Statistics was the highest scoring section of the examination for the student cohort.

Question 4:

The more successful responses:

* Were able to identify and plot information on the scatter plot
* Were able to accurately calculate the coefficient of determination (r2)
* Were able to successfully use the regression equation to interpolate and extrapolate values

The less successful responses:

* Did not accurately describe the relationship of the data for question 4 b
* Some students recalculated the coefficient of determination (r2) in question 4 c (iii) instead of answering the question
* Could not explain (and justify) the reasonableness of their interpolation calculation in question 4 e

Question 5:

The more successful responses:

* Provided two distinct reasons for possible bias in question 5 a
* Were able to identify possible advantages and disadvantages of a sampling method in question 5 b (i) and (ii)
* Identified the use of stratified sampling in question 5 d and 5 e, using the formula correctly
* Identified the context of the question and rounded their answers to whole numbers (as they were calculating a number of people from a population)

The less successful responses:

* Did not provide two distinct reasons of possible bias in question 5 a (often repeating the same reason in a slightly different way)
* Did not identify the use of a sample size of 2000 in 5 d, and instead used the total population figure of 31 000
* Did not round their answers to whole numbers

Question 6:

The more successful responses:

* Used a calculator to efficiently complete the five number summary in question 6 (a)
* Accurately created a box and whisker plot, using labels and values
* Were able to interpret the data provided and accurately answer question 6 c (all parts) and d (all parts)

The less successful responses:

* Did not interpret the statements provided in question 6 c (i), (ii) and (iii)
* Did not necessarily use the data (used prior knowledge) as evidence for answering question 6 d (i) and (ii)

**Topic 5: Investments and Loans**

This section of the examination had varying levels of completion and success for students. Question 7 was the most accurately answered throughout the examination. Most students were able to correctly answer various sections of Questions 8 and 9, however, common errors in the input of values into the graphics calculator restricted the overall achievement. Question 10 was the least attempted question throughout the examination, evidence that many students ran out of time to complete it or were not able to complete it.

Students should be encouraged to ensure they show their graphics calculator entries, allowing them to obtain partial marks if their final answer is incorrect. Completing these calculations manually is time consuming under examinations conditions and not recommended.

Question 7:

The more successful responses:

* Used the correct formula

The less successful responses:

* Had errors with P/Y, C/Y and N
* Did not understand the concept of after-tax return

Question 8:

The more successful responses:

* Used the correct formula
* Understood and applied the term ‘flat interest rate’ (or simple interest)
* Used a calculator to find the answers to each question

The less successful responses:

* Did not understand and apply the flat interest rate (instead they carried out a compound interest calculation)
* Did not show the calculator entries in their working out, and were therefore not able to be awarded partial marks for incorrect answers

Question 9:

The more successful responses:

* Correctly interpreted each question
* Correctly identified the values required for each question
* Used the correct formula
* Used a calculator to find the answers to each calculation efficiently

The less successful responses:

* Misinterpreted question 9 a as requiring more than just the number of repayments
* Incorrectly using Fv when finding answers
* Incorrectly answered question 9 c by multiplying the repayments, rather than using TVM
* Incorrectly answered question 9 d (i) by using TVM and then were confused by the answer
* Incorrectly used TVM, often with errors in N or P/Y
* Did not show the calculator entries in their working out, and were therefore not able to be awarded partial marks for incorrect answers.

Question 10:

The more successful responses:

* Converted units accurately
* Demonstrated the working out required for question c (i)
* Provided an answer to question 10 b (ii) related to increasing payments made

The less successful responses:

* Did not convert the answer for question 10 a into years
* Struggled to use opposing signs effectively in entries into graphics calculator
* Did not show the calculator entries in their working out, and were therefore not able to be awarded partial marks for incorrect answers
* Used superficial reasons when answering question 10 (ii)