# 2018 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

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. The school set of assessments as a whole must give students the opportunity, at least once, to demonstrate each of the specific features in both assessment design criteria (Concepts and Techniques and Reasoning and Communication).

Note: in 2019 changes to the number of tasks in each assessment type will allow teachers a little more flexibility depending on their cohort of students, four ***or five*** skills and applications tasks and ***two or*** three folio tasks. Teachers are to refer to the Subject Outline for 2019 for further information, including impact on page limit.

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%)
* provided students the opportunity to compare two sets of data in *Statistic*s ensuring that complexity in the questions is appropriate (specific feature CT2)
* provided students the opportunity to answer ‘What if’ and ‘reasonableness’ questions in Investments and Loans by requiring students to investigate changes to variables (present values, payments, rates and time). (specific feature RC2)
* included routine questions that were broken into distinct parts (scaffolding) and often (but not always) used prompts as starters such as “show…” and “calculate”. Students can be prompted on the method required for solutions sometimes (e.g. use the Sine rule to”, however this removes complexity, and should not be common in a task. (specific feature CT3)
* provided opportunity for students to use technology, particularly in both *Statistics* and *Investments and Loans* (specific feature CT4)
* had questions set within a relevant context which allowed students to appropriately interpret their mathematical results (specific feature RC1)
* gave opportunities for students to discuss the reasonableness of their calculations across a variety of topics (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 where scaffolding within the problems limited students ability to access the A grade band (specific feature CT2)
* were seen when tasks were short, limiting students ability to demonstrate comprehensive knowledge and understanding of concepts and relationships (specific feature CT1)
* 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
* included tests straight off of the SACE site, these are there to help teachers with the exemplars of the standard, they should not be directly used as summative assessment
* combined two topics in one skills and applications task, making the task ‘exam like’ and requiring the students to retain a lot more content than.

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. The school set of assessments as a whole must give students the opportunity, at least once, to demonstrate each of the specific features in both assessment design criteria (Concepts and Techniques and Reasoning and Communication).

Note: in 2019 changes to the number of tasks in each assessment type will allow teachers a little more flexibility depending on their cohort of students, four ***or five*** skills and applications tasks and ***two or*** three folio tasks. Teachers are to refer to the Subject Outline for 2019 for further information, including impact on page limit.

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 with 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)
* were intuitive, and did not repetitively change variables unless it made sense to investigate that particular part of the problem further
* included repetitive calculations in the appendices, with an initial calculation providing evidence of the skill in the main body, and then the results of the additional calculations placed in the appendices included in a table (or other concise manner of presenting multiple results) in the main body for comparison and discussion.

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)
* were too short limiting students ability to demonstrate comprehensive knowledge and understanding of concepts and relationships (specific feature CT1)
* did not provide evidence of using technology when it was identified for assessment in the task. Using technology does not include typing up the folio task response or continually using an “online calculator” (specific feature CT4)
* were seen when tasks had scaffolding throughout all parts of the task. This limited the complexity of the overall set of tasks and therefore the student’s ability to ‘develop’ a model. (specific feature CT3)
* 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
* were evident when tasks had very limited scope for further investigations, or included mathematical content that did 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. The response then became a costing task which is not a part of the course content.

# External Assessment

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

### Examination markers aim to award marks for evidence of student understanding in responding to examination questions wherever possible, however, students should be advised not to cross out their responses or attempted responses to questions in the examination booklet, unless they are confident that no part of their response should be considered by the marker.

### If a student crosses out a response and then decides that it was the correct (or the most correct) answer, then the student should indicate clearly to the marker which part of their response should be considered. This could be done by circling or highlighting all or part of the response that the student want to be considered and write “please mark this work”. Students do not need to rewrite their answers in this case, unless the crossing out has rendered the response unreadable.

### Topic 2: Measurement

This section of the examination displayed varying levels of completion and success for students. Many students correctly answered Question 1, and it was among the most successfully responded to questions in the examination. Question 2 was attempted by most students with varying levels of success, and obtaining full marks for this question was challenging. Question 3 however, proved to be the most difficult for the majority of students. There was evidence that some students still do not know how to check that their calculator is in the degrees setting rather than the radians setting. It is important that students are aware of how to check and amend their settings for the Measurement section of the examination.

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

Question 1:

The more successful responses:

* Converted units accurately (i.e. 75cm to 0.75m).
* Demonstrated the working out required for part c (i).
* Rounded down appropriately in part c (iii) to provide a whole number answer for the maximum number of fish.

The less successful responses:

* Misinterpreted a (i) and calculated the perimeter of the entire garden, not just the pond perimeter.
* Used formulas for the areas of shapes, rather than perimeter.
* Did not show the working in parts c (i) and c (ii) when calculating the volume of water in the pond.
* Misunderstood how to convert in c (ii) (divided, instead of multiplied).

Question 2:

The more successful responses:

* Identified the useful information from the diagrams to use in their formula(s).
* Identified appropriate formula for problems requiring them to choose the method, and successfully used the formula provided in c(ii).
* Rounded answers appropriately.

The less successful responses:

* Incorrectly calculated the area instead of the circumference in part a.
* Incorrectly applied the trigometric ratios or used Pythagoras’ Theorem.
* Did not recognise that they could use the 266 m value provided in the question stem in part (b) to calculate c (i) when they did not get an answer which was approximately 266 m.
* Only stated an assumption and did not comment directly on the reasonableness of the answer in part c (ii).

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, and placed information given onto diagrams to support their understanding of the.

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.
* Did not use the values given in the questions stem.

### 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.

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

Question 4:

The more successful responses:

* Were able to accurately order the stem plot in part a.
* Were able to explain in detail a reason for their choice of statistical measure in part c (ii).
* Were able to both identify and justify the conclusion they drew to part c (iii).

The less successful responses:

* Could not explain (and justify) the conclusions they made in part c (ii) and (iii).

Question 5:

The more successful responses:

* Correctly identified the data points and understood what the scatter plot represented.
* Were able to explain a reason for the error in part c (ii), rather than a possible cause of data.
* Were able to accurately explain extrapolation in part d (iii).

The less successful responses:

* Did not correctly identify the dependent variable in the scenario.
* Did not identify the outlier in the scatter plot.
* Were not able to explain their answers to part 5 c (iii) and d (iii).

Question 6:

The more successful responses:

* Knew the types of surveys, and were able to identify limitations of the specific answer required.
* Were able to calculate percentages and round appropriately.
* Were able to identity and explain the answers to part e (i) and (ii).

The less successful responses:

* Identified the sampling method as stratified.
* Did not explain the answers to part e (i) and (ii).

### Topic 5: Investments and Loans

This section of the examination had varying levels of completion and success for students. Question 8 was the most accurately answered throughout the examination. Most students were able to correctly answer various sections of Questions 7, 9 and 10, 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.

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:

* Correctly identified the problem as one using simple interest.
* Were able to rearrange the I = PRT formula (or select the correct one from their notes).
* Were able to recognise that the time for c) needed to be divided by 12 (e.g. 5/12).

The less successful responses:

* Did not decimalise the 4.5% in part a).
* Used 0.5 as the time rather than 5/12 or 0.417.
* Identified the problem as a compound interest problem and therefore used the incorrect formula.

Question 8:

The more successful responses:

* Correctly identified the problem as a future value annuity and therefore used the correct inputs into the calculator.
* Used a calculator efficiently to find the answers to each question.
* Showed the calculator inputs allowing for marks to be earned even though their answer was not correct.
* Correctly identified the change in compounding period and amended their calculator inputs correctly.

The less successful responses:

* Did not identify the problem correctly as a future value annuity.
* 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 identified the values required for each question and where to input them in the TVM solver.
* Provided a response for a) (ii) that was focussed on the assumptions made in the mathematics affecting the reasonableness of the answer (e.g. assuming that the interest rate remained the same over 30 years or that the loan conditions such as fees and charges did not change).
* Used a calculator to find the answers to each calculation efficiently.
* Were successful in explaining the strategy that they identified in c (iii).

The less successful responses:

* Did not recognise the instruction ‘show that’ was asking for evidence of calculations in part a (i).
* Misinterpreted part a (ii) and provided responses that were not relevant to the mathematics and the assumptions that had to be made to carry out the calculation.
* Did not recognise that the $355000 was a PV not an FV in part c (i).
* Did not complete part c (i) by converting the months into years
* Incorrectly tried to use TVM to solve part c (ii).
* Did not show the calculator entries in their working out, and were therefore not able to be awarded partial marks for incorrect answers.
* Provided a list of strategies for part c (iii) but did not ‘explain’ any of them.

Question 10:

The more successful responses:

* Converted units accurately.
* Recognised that part a) was a compound interest problem, not an annuity.
* Knew a range of reasons for part e), and were able to explain them in detail. For example, responses indicating that the 12.34% interest rate was unlikely to be found (assuming that Lin Hao continues to pay $80 per fortnight), or alternatively, that his goal would be reasonable if he can make the repayments of $138, and has the $10000 saved).
* Were correct in their use of negatives in their inputs for parts b) and c).

The less successful responses:

* Struggled to use opposing signs effectively in entries into the graphics calculator. This likely led to an Invalid Setting message in part d).
* Did not show the calculator entries in their working out, and were therefore not able to be awarded partial marks for incorrect answers.