Essential Mathematics subject report

2021 cohort

February 2022

Queensland Government

QCAA Queensland Curriculum & Assessment Authority

220639

For all Queensland schools

ISBN

Electronic version: 978-1-74378-183-8

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Contents

Introduction

Purpose

The annual subject report is an analysis of the previous year's full summative assessment cycle. This includes endorsement of summative internal assessment instruments, implementation of the common internal assessment (CIA) and outcomes from the Applied quality assurance (QA) process.

The report provides an overview of the key outcomes of one full teaching, learning and assessment cycle for each subject, including information about:

- the application of the syllabus objectives through the internal assessment design
- making judgments about internal assessment (IA)
- the patterns of student achievement in each subject for the assessment cycle.

It also provides advice to schools to promote continuous improvement, including through:

- identifying effective practices in the design and marking of valid, accessible and reliable assessment
- identifying areas for improvement and recommendations to enhance the design and marking of valid, accessible and reliable assessment instruments
- providing tangible examples of best practice where relevant, possible and appropriate.

Audience and use

This report should be read by school leaders, subject leaders and teachers to:

- inform teaching and learning and assessment preparation
- assist in assessment design practice
- assist in making assessment decisions
- help prepare students for the CIA.

The report is publicly available to promote transparency and accountability. Students, parents, community members and other education stakeholders can learn about the assessment practices and outcomes for Applied (Essential) subjects.

Report preparation

The report includes analyses of data and other information from endorsement and Applied QA processes. It also includes advice from the chief endorser and subject teachers, developed in consultation with and support from QCAA subject matter experts.

Subject data summary

Subject completion

Note: All data is correct as at 17 December 2021. Where percentages are provided, these are rounded to two decimal places and, therefore, may not add up to 100%.

Number of schools that offered the subject: 444.

Completion of units	Unit 1	Unit 2	Units 3 and 4
Number of students completed	18018	18275	16331

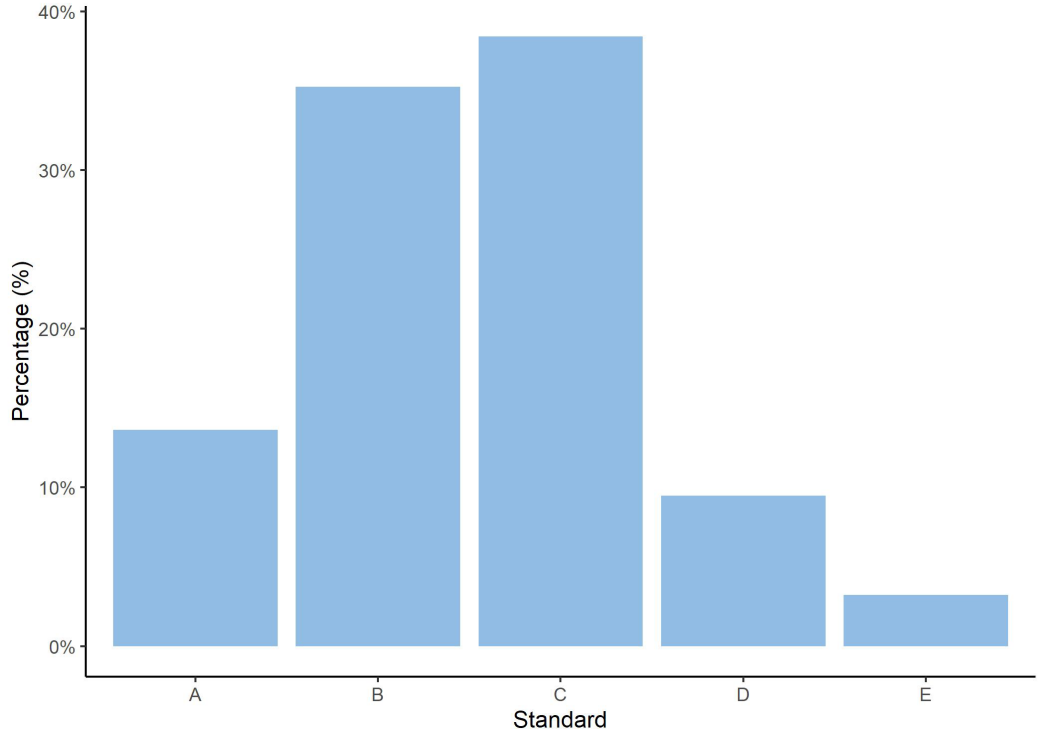
Units 1 and 2 results

Number of students	Satisfactory	Unsatisfactory
Unit 1	14955	3063
Unit 2	15378	2897

Units 3 and 4 internal assessment (IA) results

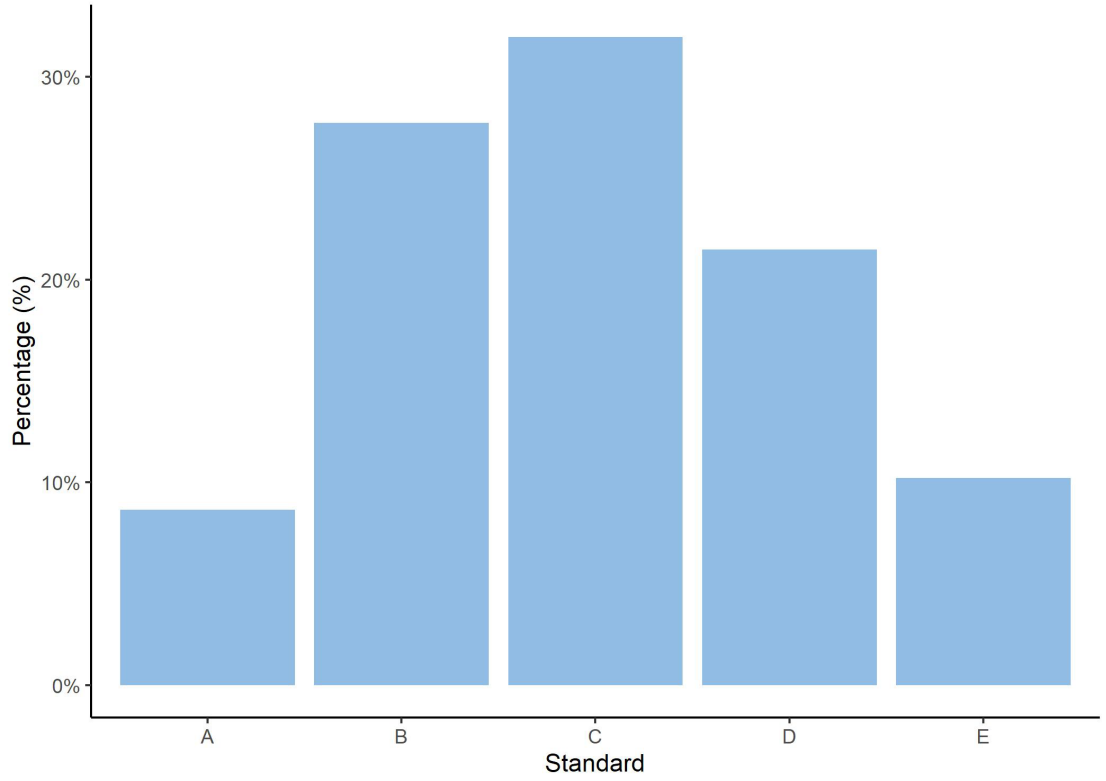
IA1 standards

IA1 total



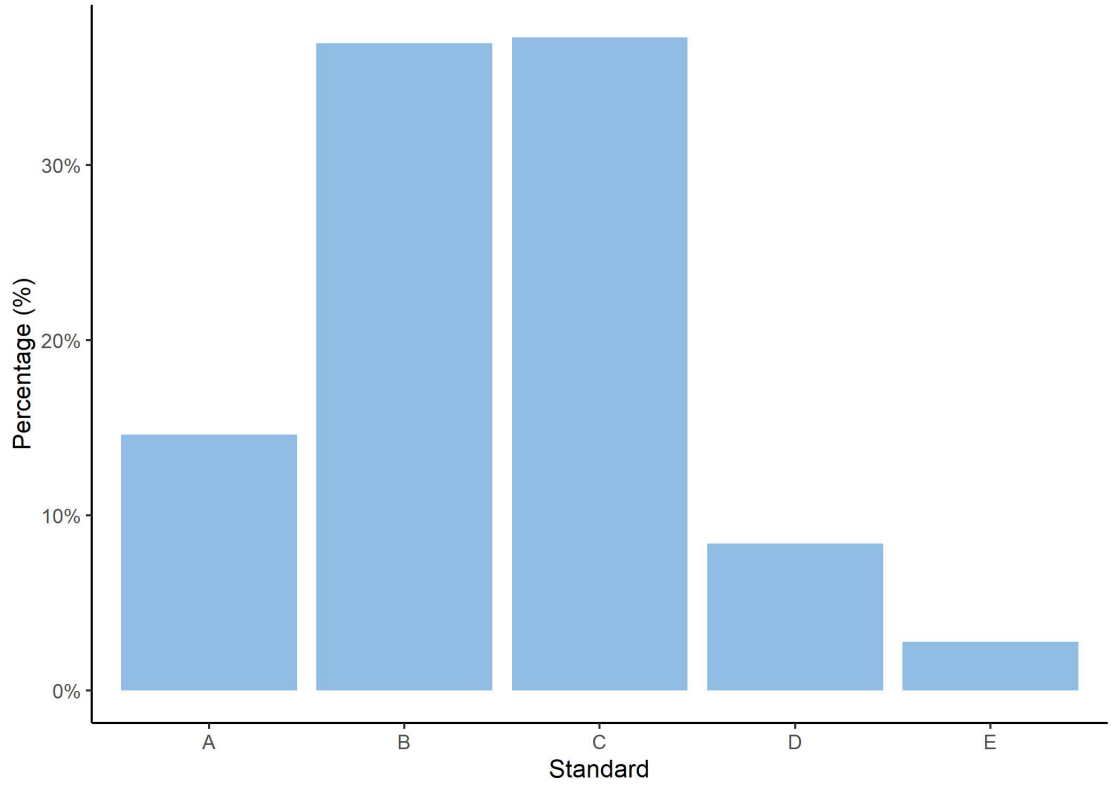
IA2 (CIA) standards

IA2 total



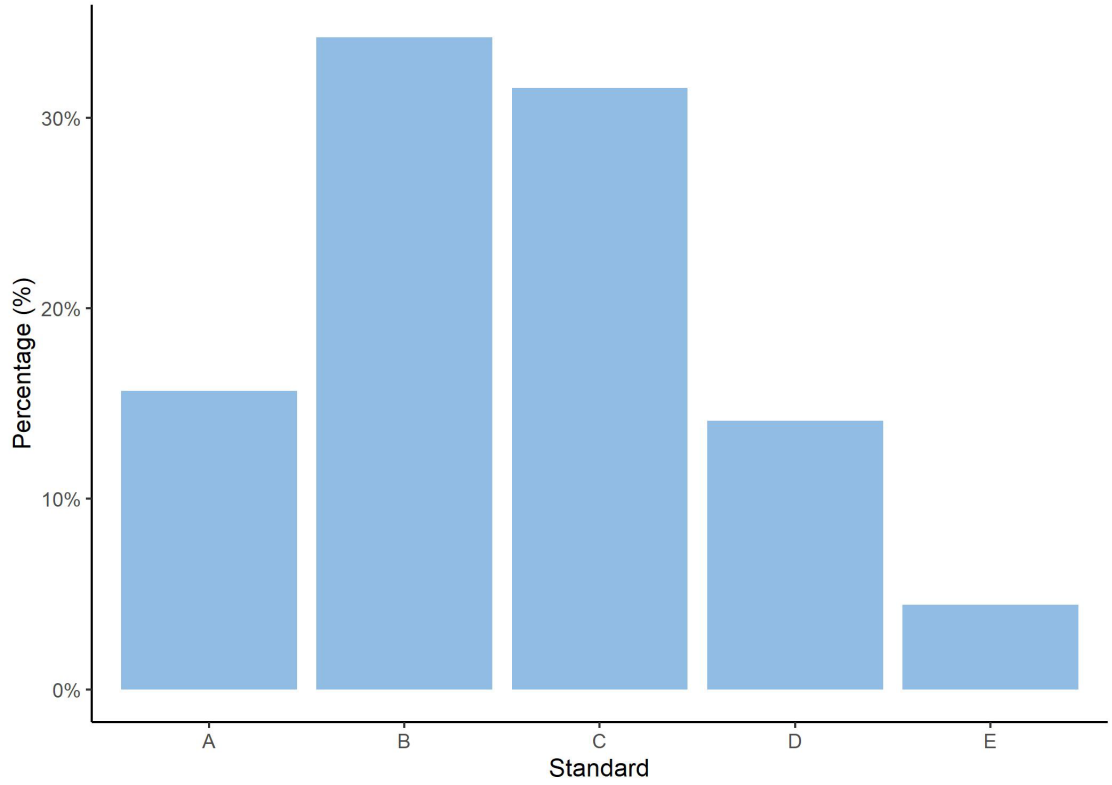
IA3 standards

IA3 total

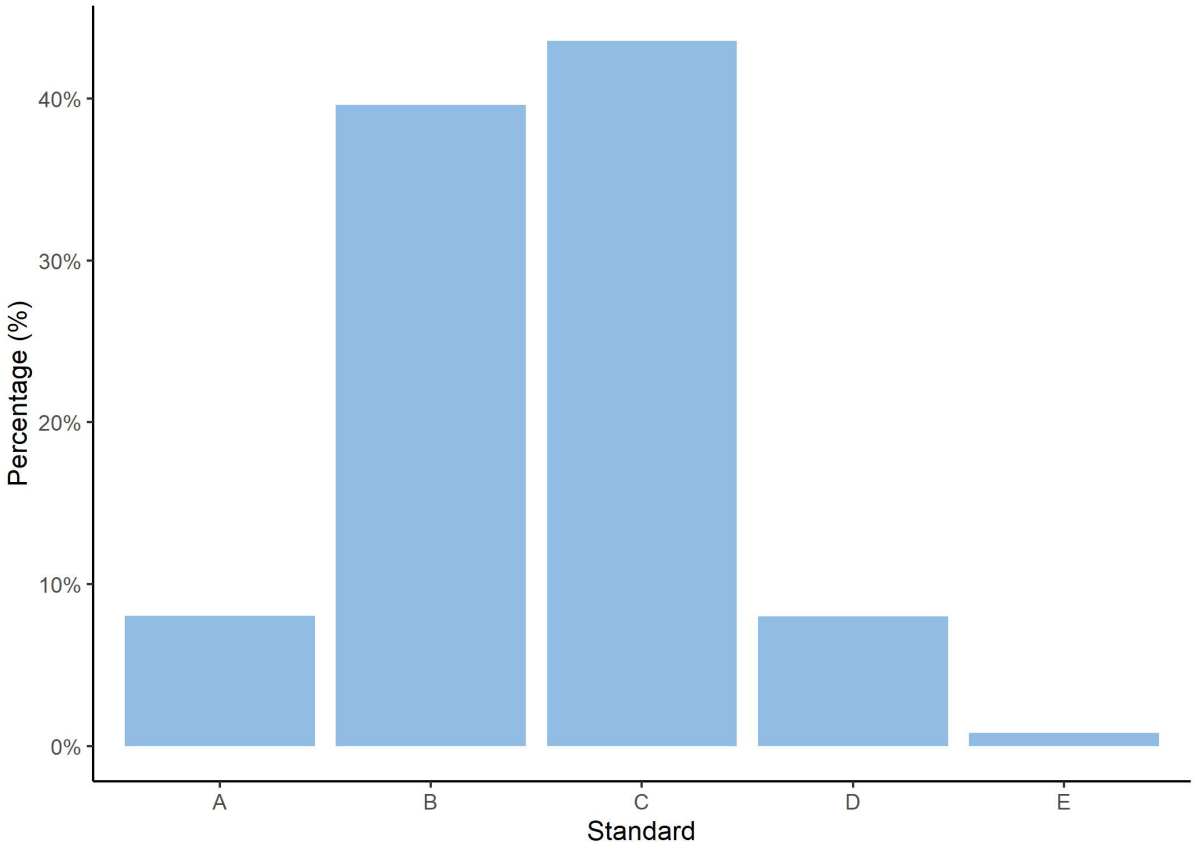


IA4 standards

IA4 total



Final subject results



Distribution of standards

The number of students who achieved each standard across the state is as follows.

Standard	A	B	C	D	E
Number of students	1311	6467	7113	1307	133

Internal assessment

The following information and advice pertain to the assessment design and assessment decisions for each IA in Units 3 and 4. These instruments have undergone quality assurance processes informed by the attributes of quality assessment (validity, accessibility and reliability).

Endorsement

Endorsement is the quality assurance process based on the attributes of validity and accessibility. These attributes are categorised further as priorities for assessment, and each priority can be further broken down into assessment practices.

Data presented in the Assessment design section identifies the reasons why IA instruments were not endorsed at Application 1, by the priority for assessments. An IA may have been identified more than once for a priority for assessment, e.g. it may have demonstrated a misalignment to both the subject matter and the assessment objective/s.

Refer to the quality assurance tools for detailed information about the assessment practices for each assessment instrument.

Percentage of instruments endorsed in Application 1

Number of instruments submitted	IA1	IA3	IA4
Total number of instruments	452	450	449
Percentage endorsed in Application 1	48%	58%	46%

Applied QA

Applied QA meetings occurred to provide feedback and advice to schools about the judgments of student work completed for Unit 3 (IA1 and CIA) and the quality of the school's submission. The feedback was provided to schools using the Quality assurance advice to school form. Schools used this advice to inform their judgments for IA3 and IA4.

Internal assessment 1 (IA1)

Problem-solving and modelling task

This problem-solving and modelling task must use subject matter from the Fundamental topic: Calculations and at least one of the following topics in Unit 3:

- Topic 1: Measurement
- Topic 2: Scales, plans and models
- Topic 3: Summarising and comparing data.

The problem-solving and modelling task is an assessment instrument where students provide a response to a mathematical investigative scenario or context. It requires students to respond with a range of understanding and skills, such as using mathematical language, appropriate calculations, tables of data, graphs and diagrams.

Students must provide a response to a specific task or issue that is set in a context that highlights a real-life application of mathematics. The task requires students to use relevant stimulus material involving the selected subject matter. The task must have sufficient scope to allow students to address all the stages of the problem-solving and modelling approach. Technology must be used.

Assessment design

Validity

Validity in assessment design considers the extent to which an assessment item accurately measures what it is intended to measure and that the evidence of student learning collected from an assessment can be legitimately used for the purpose specified in the syllabus.

Reasons for non-endorsement by priority of assessment

Validity priority	Number of times priority was identified in decisions*
Alignment	107
Authentication	58
Authenticity	58
Item construction	30
Scope and scale	93

*Each priority might contain up to four assessment practices.

Total number of submissions: 452.

Effective practices

Validity priorities were effectively demonstrated in assessment instruments that:

- followed the conventions of item construction by providing a purposeful context that introduced the problem or scenario, separate to the task description, which clearly outlined the key requirements to complete the task
- provided students the opportunity to respond uniquely, using individualised values for key components of the task, or making choices about how to use data, or designing their own plan or model, e.g. students were provided individualised measurements, conditions or datasets
- featured meaningful, realistic contexts that provided an engaging learning experience for students, e.g. tasks that focused on a project in the school community provided an authentic learning experience
- used a range of authentication strategies, including a checkpoint for teachers to provide feedback on one draft, and checkpoints for monitoring student progress and establishing authorship.

Practices to strengthen

It is recommended that assessment instruments:

- align Unit 3 subject matter to the task and assessable objectives by focusing on measurement, scales, plans and models and/or summarising and comparing data, e.g. researching costings and producing a budget should not be a focus of the task
- are of an appropriate scale by refining the task so students can demonstrate all assessable objectives, while not having to address multiple components, e.g. all assessable objectives can be demonstrated by producing a scale drawing of a backyard with two distinct features rather than producing a scale drawing of a complete house plan including fixtures
- have sufficient scope for students to independently address all stages of the problem-solving and mathematical modelling approach by framing scaffolding as prompting questions that guide students to develop a response, rather than a list of instructions that links subject matter to task requirements, e.g. What simple and complex subject matter will you use to solve the problem? How will you use technology to develop your solution?

Accessibility

Accessibility in assessment design ensures that no student or group of students is disadvantaged in their capacity to access an assessment.

Reasons for non-endorsement by priority of assessment

Accessibility priority	Number of times priority was identified in decisions*
Bias avoidance	12
Language	43
Layout	11
Transparency	18

*Each priority might contain up to four assessment practices.

Total number of submissions: 452.

Effective practices

Accessibility priorities were effectively demonstrated in assessment instruments that:

- provided a clear layout, e.g. use of dot points, spacing and images
- focused on a context relevant to the school community and students of Essential Mathematics
- used language reflected in the instrument-specific standards.

Practices to strengthen

It is recommended that assessment instruments:

- include clear, concise instructions and cues using language linked to the descriptors in the instrument-specific standards
- avoid repetition and contradictions in the context, task and scaffolding
- are free from spelling, grammatical and textual errors.

Assessment decisions

Reliability

Reliability is a judgment about the measurements of assessment. It refers to the extent to which the results of assessments are consistent, replicable and free from error.

Number of submissions received and reviewed: 433.

Effective practices

Accuracy and consistency of the application of the instrument-specific standards for this IA was most effective when:

- the performance-level descriptors for each criterion in the instrument-specific standards were clearly annotated to indicate the particular characteristics that best matched the evidence in the response. The pattern of evidence across the four criteria was then used to determine an overall on-balance grade, not a separate grade for each criterion
- there was correct distinction between simple and complex subject matter (as identified in the syllabus) when matching evidence in the response to the Formulate and Solve criteria characteristics for the translation and application of mathematical concepts and techniques, e.g. complex subject matter includes calculating areas of trapeziums, sectors and composite figures, and constructing scale drawings using software packages and by hand
- there was alignment between the characteristics annotated for the Communicate criterion and the qualities in student work regarding use of appropriate vocabulary and conventions to develop the response, and organisation of the response, including a suitable introduction, body and conclusion, e.g. responses matched to Standards A and B descriptors showed the use of
  - correct shape names and terms such as capacity, surface area, mean and outlier
  - superscripts to indicate correct units for quantities such as area and volume
  - headings and/or useful introductory sentences to logically structure sections of the response
- for the Evaluate and justify criterion, judgments matched to the Standard A performance-level descriptors took into account the use of mathematical reasoning and supporting evidence in the student response as an indication of evaluation, documentation and justification of (as

opposed to statements about) the reasonableness of solutions, strengths and limitations of the solution and/or model and decisions made.

Samples of effective practices

The following are excerpts from a response that illustrate the characteristics for the criteria at the standard indicated. The excerpts may provide evidence of more than one criterion. The characteristics identified may not be the only time the characteristics have occurred throughout a response.

This excerpt has been included:

- to demonstrate effective annotations on the instrument-specific standards that show the response to the endorsed task (to design a floor plan for a teenage retreat within specifications) was matched to Standard A descriptors in each criterion and has been graded as an A overall even though some characteristics were matched to a Standard B descriptor.

Instrument-Specific Standards (IA1): Problem-Solving and Modelling Task

Essential Mathematics

Formulate	Solve	Evaluate and Verify	Communicate	Grade
The student work has the following characteristics:				
• documentation of appropriate assumptions • accurate documentation of relevant observations • accurate translation of all simple and complex aspects of the problem by identifying mathematical concepts and techniques.	• accurate use of complex procedures to reach a valid solution • discerning application of simple and complex mathematical concepts and techniques relevant to the task • accurate and appropriate use of technology.	• evaluation of the reasonableness of solutions by considering the results, assumptions and observations • documentation of relevant strengths and limitations of the solution and/or model • justification of decisions made using mathematical reasoning.	• correct use of appropriate technical vocabulary, procedural vocabulary and conventions to develop the response. • coherent and concise organisation of the response, appropriate to the genre, including a suitable introduction, body and conclusion	A
• statements of appropriate assumptions • statements of relevant observations • translation of simple and complex aspects of the problem by identifying mathematical concepts and techniques.	• use of complex procedures to reach a reasonable solution • application of simple and complex mathematical concepts and techniques relevant to the task • appropriate use of technology.	• statements about the reasonableness of solutions by considering the context of the task • statements about relevant strengths and limitations of the solution and/or model • statements about decisions made relevant to the context of the task.	• use of technical vocabulary, procedural vocabulary and conventions to develop the response • organisation of the response, including a suitable introduction, body and conclusion.	B

This student response excerpt has been included:

- to show evidence in the response judged as accurately translating all simple and complex aspects of the problem.

Formulate Standard A

- accurate translation of all simple and complex aspects of the problem by identifying mathematical concepts and techniques

To respond to the task, the internet was first used to discover granny flat floor plans which could be altered to meet each task requirement. The adapted floor plan would then be produced as a complete scaled diagram using a scale of 1:50. To make the diagram complete, the floor plan contained dimensions of each room including the furnishings, fittings, doors and windows. The scaled diagrams were produced using AutoCAD 2021 to develop a high-quality and accurate floor plan.

Accurately translates task.

Flooring within the granny flat consists of both tiles and carpet. For each type of flooring, two local businesses were compared to determine the cheapest option. This had been calculated using Microsoft Excel's AutoSum feature.

These student response excerpts have been included:

- to demonstrate effective judgments about the accurate use of simple and complex procedures; discerning application of mathematical concepts and techniques relevant to the task; and accurate and appropriate use of technology
- to show how marking decisions matched evidence of the correct use of appropriate vocabulary and conventions to develop the response, which was organised using a suitable introduction, body and conclusion.

Solve Standard A

- accurate use of complex procedures to reach a valid solution
- discerning application of simple and complex mathematical concepts and techniques relevant to the task
- accurate and appropriate use of technology

Communicate Standard A

- correct use of appropriate technical vocabulary, procedural vocabulary and conventions to develop the response

Standard B

- organisation of the response, including a suitable introduction, body and conclusion

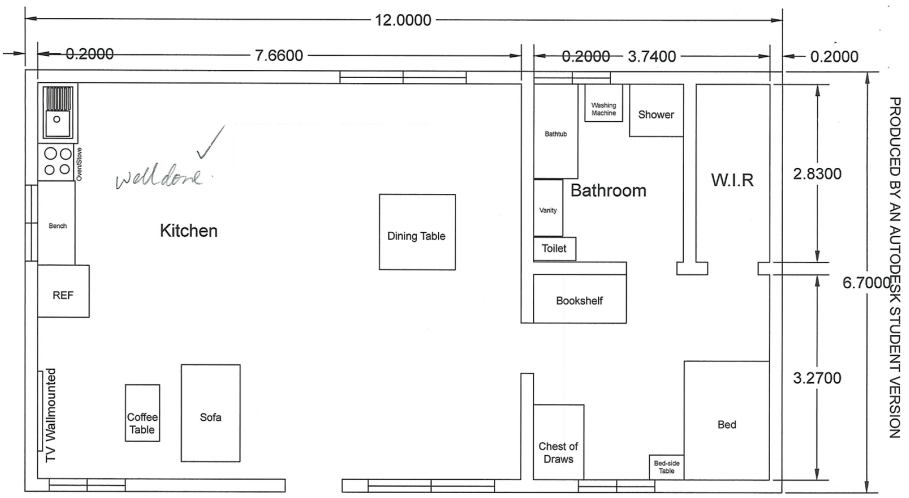
Excerpt 1

Body technology

An online area calculator was used to determine the dimensions of the granny flat. The area of the granny flat is 80.4m^2. The dimensions of the granny flat 12 x 6.7m This choice was made as it was desirable to avoid using the common dimensions of 10 x 8m. justifies

12 x 6.7m is ideal as it meets the area requirements of 80m^2 while avoiding sacrificing too much width. For example, it would be possible to use 16 x 5m as the chosen dimensions although, however having a length of 16m would increase the change of making the design unable to fit in the family's backyard. The scale of 1:50 was used to draw a scale diagram of the Granny Flat where 1 cm on paper represents 50 cm of actual distance. The Length of the granny flat is 12 m long and had been reduced to an 24 cm line on the page. The dimensions of 12 x 6.7m will then be reduced to 24 x 13.4cm. The area will be reduced to 321.6cm^2. The

Excerpt 2



well done

Excerpt 3

	D	E	F	G	H
	Area / Unit (m²)	Retail Price / m² ($)	EXACT Floor Space (m²)	Rounded Floor Space (m²)	Leftover Material (m2)
	15.75	$54.48	15.8603	16	0.1397
	1	$35.70	15.8603	16	0.1397
	1	$57.70	55.3061	56	0.6939
	1	$49.95	55.3061	56	0.6939

Savings per m² ($)	Total Cost	Total Savings
$18.78	$571.20	$300.42
$7.75	$2,797.20	$434.00

Complex use of Technology

	Excerpt 4 Conclusion The purpose of the task was to design a granny flat for a teenage retreat. The granny flat must contain a single bedroom, en-suite, self-contained kitchen and living area and have a gross floor area (GFA) of 80m^2. The task response has met each requirement. The criteria listed in the assumptions and observations have also been met. Throughout the task, finalised sketches have been produced which have been provided to the family, the gross floor area (GFA) is near 80m^2 and will likely fit in the backyard of the family's house. Legislative requirements from the Building Code of Australia has been followed for window size recommendations and the building can commence following the assumption that the family and city council have approved the design. Prices should remain the same as it is assumed that tile and carpet prices will not change following the completion of the report. A complete list of furnishings and fittings used in the sketches have been provided in the appendices of the report so they can be chosen when furnishing the granny flat.

These student response excerpts have been included:

- to show evidence in the response judged as being the use of mathematical reasoning to justify decisions made, and provision of supporting evidence to document relevant strengths and limitations of the solutions and/or model and evaluate the reasonableness of solutions.

Evaluate and verify Standard A • evaluation of the reasonableness of solutions by considering the results, assumptions and observations • documentation of relevant strengths and limitations of the solution and/or model • justification of decisions made using mathematical reasoning	**Excerpt 1** The dimensions of the bathroom are 2.37 x 2.83m. The area of the bathroom is 6.66m^2 and the perimeter is 10.04m. The bathroom contains a shower (85 x 83cm), bathtub (70 x 150 cm), washing machine (60 x 59cm), vanity (90 x 46cm) and a toilet seat (37 x 46cm). After fitting the bathroom, 3.77m^2 of floor space remains. According to the Building Code of Australia, a bathroom window must occupy a minimum of 5% of the floor space. This allows for a window with a frame size of 1372 x 970cm to be installed while also meeting any relevant legislative requirements. **Excerpt 2** The gross floor area (GFA) of the granny flat is near 80m^2 meaning it will likely fit in the backyard. The choice of dimensions (12 x 6.7m) are beneficial as it provides a comfortable amount of space in both length and width. While it would be possible to use 20 x 4m, it would be unreasonable. **Excerpt 3** The family had specified that the granny flat is to have a gross floor area (GFA) of 80m2. The dimensions used in this response contain a GFA of 80.4m^2. This should be insignificant as it is unlikely that the backyard will be unable to contain the slight increase in size. The family had not provided elevation specifications. As such, all that can be provided is are the sketches of the floor plan. If these details had been provided, a more complete sketch could be produced along with rendered 3D models.

Practices to strengthen

To further ensure accuracy and consistency of the application of the instrument-specific standards for this IA, it is recommended that:

- within the Formulate criterion, a clear distinction is made between ‘documentation’ and ‘statement’, and ‘assumptions’ and ‘observations’ when making judgments
  - clear demonstration of the ‘documentation of appropriate assumptions’ should include assumptions related to the student's model/solution and evidence to support the assumptions. This could be in the form of a reference or identification of historical data relating to the topic, or by providing coherent reasoning for why an assumption is necessary, its likely effect on the model/solution, and/or the impact of not making the assumption.
  - clear demonstration of ‘accurate documentation of relevant observations’ should provide evidence to support observations (information/data) used in a student's model/solution, such as explaining how the observations were collected, the source of the observations, what made the observations valid and reliable, or identifying a specific feature of an observation that made it relevant to the model/solution, e.g. while the Queensland Development Code (QDC) specifies the minimum requirements for a double garage to be 5.70m wide x 6.00m deep, a 7m by 7m garage will be incorporated into the plan to allow for additional storage and room for the family’s car doors to be opened fully for easy access.

Additional advice

- Make judgments using the instrument-specific standards from the syllabus by annotating (highlighting, ticking, crossing out) each characteristic to accurately reflect its match to qualities in the student response, e.g. annotations may highlight the Standard A descriptor for ‘justification of decisions’ because supporting evidence was used and cross out the Standard C descriptor for ‘statement about strengths/and/or limitations of the solution’ because none were provided. This provides feedback to students to enable them to improve.
- Use the pattern of evidence in the annotated standards to determine one on-balance grade. Do not alter the wording of the instrument-specific standards, assign marks to arrive at an overall result, or determine a grade for each criterion. Only one result is entered into Student Management.
- Make judgments on only the permissible word length and page count required by the syllabus. If a submitted response exceeds the syllabus conditions and redaction has not occurred before a judgment is made, teachers mark only the evidence in the student response that meets the assessment conditions for response length. Annotate the response to indicate the evidence used to determine the grade and indicate this on the appropriate criteria on the instrument-specific standards.

Internal assessment 2 (CIA)

Common internal assessment (CIA)

The CIA is common to all schools and is developed by the QCAA. Schools are able to administer this assessment during the CIA phase chosen by the school in Unit 3 once it has been provided by the QCAA. It is administered flexibly under supervised conditions and is marked by the school according to a QCAA-developed common marking scheme.

Assessment design

The assessment instrument was designed using the specifications, conditions and assessment objectives described in the summative CIA section of the syllabus. The examination consisted of two parts:

- Part A consisted of 9 short response items (simple familiar) (40 marks)
- Part B consisted of 2 short response items (complex familiar and complex unfamiliar) (10 marks).

The examination assessed subject matter from Unit 3.

The assessment required students to respond to short response items.

Assessment decisions

Reliability

Reliability is a judgment about the measurements of assessment. It refers to the extent to which the results of assessments are consistent, replicable and free from error.

Number of submissions received and reviewed: 433

Effective practices

Overall, students responded well to:

- simple familiar questions by selecting, recalling and using facts, rules, definitions and procedures and communicating using mathematical, statistical and everyday language and conventions
- the scaffolded parts of simple familiar and complex familiar problems requiring comprehension of and application of mathematical concepts and techniques to solve problems
- the instrument by attempting the full range of questions across all Unit 3 topics, following task instructions to show mathematical reasoning and/or working to support answers to questions worth more than one mark, and writing plausible responses in the provided spaces in the Question and response book.

Accuracy and consistency of the application of the CIA marking guide was most effective when:

- for every awarded mark, there was evidence in the student's response matching the explicit '[1 mark]' allocation statement in 'The response' column; otherwise, the mark was not awarded

- the provided sample responses and notes were used to assist the marker in making a decision but were not considered as the definitive marking tool for an 'expected' response
- follow through (FT) marks were awarded, where indicated in the notes as allowed due to error/s in prior working, and where the part of the response being awarded the FT mark still demonstrated correct conceptual understanding or skill
- annotations on student responses directly aligned to the allocation of marks in the CIA marking guide to provide feedback to students for where and why the mark was awarded and to clearly identify the number of marks awarded for each part of each question.

Samples of effective practices

The following are excerpts from responses that illustrate the characteristics for the criterion at the performance standard indicated. The excerpts may provide evidence of more than one criterion. The characteristics identified may not be the only time the characteristics have occurred throughout a response.

Item: Questions 6c) and 6d) — Part A, CIA 2021 Phase 4

Assessment objectives: 1, 2 and 3 — simple familiar

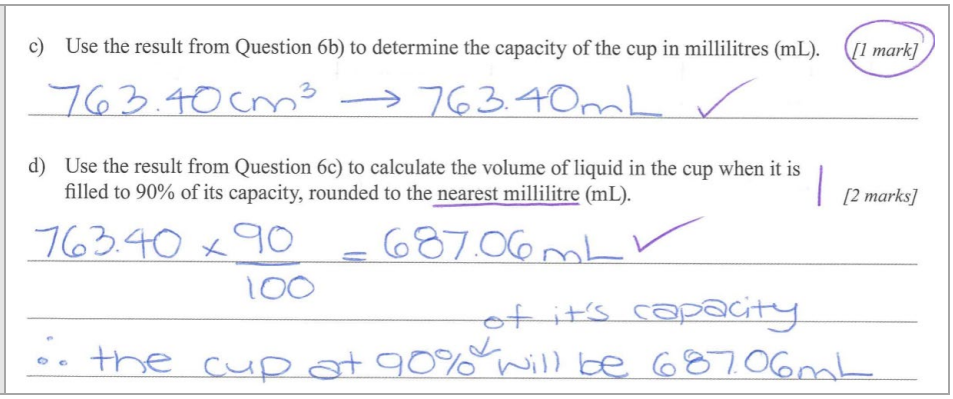
These parts of this question required students to convert between units of volume and capacity, and to apply percentage and rounding strategies.

Effective student responses:

- converted cubic centimetres to millilitres
- calculated 90% capacity
- rounded volume to nearest millilitre.

This student response excerpt has been included:

- to demonstrate the use of a tick to indicate the location of each part of the response that matches the marking guide (unit conversion and 90% calculation)
- to show the feedback the teacher provided by underlining words in the question instruction (nearest millilitre) that were not addressed in the student's response
- to demonstrate how the teacher has clearly indicated that answer c) is awarded the 1 allocated mark and that answer d) is awarded 1 of the possible 2 marks.

Foundational knowledge and problem-solving (2 of a possible 3 marks)	

Item: Question 4 — Part A, CIA 2021 Phase 2

Assessment objectives: 1, 2 and 3 — simple familiar

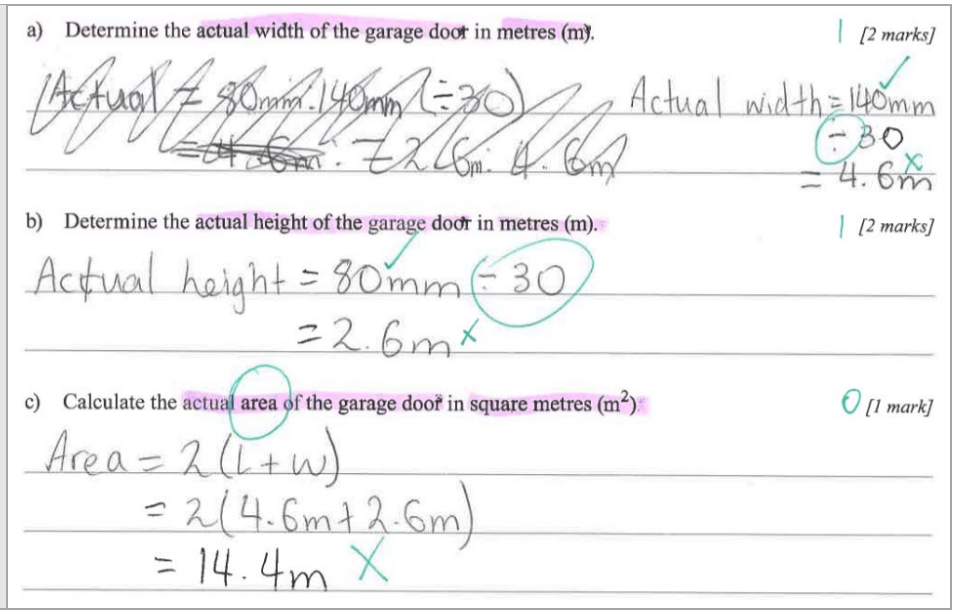
This question required students to find actual measurements from a scale drawing and calculate the area of a rectangle.

Effective student responses:

- measured the width and height from the scale drawing within the ± 2 mm allowance stated in the marking guide notes
- applied a 1:30 scale and converted to metres
- calculated the rectangular area.

This student response excerpt has been included:

- to demonstrate the use of ticks to indicate the location of each correct part of the response (width and height measurements from scale drawing) and the use of crosses to indicate parts of the response that do not match the marking guide
- to show the feedback the teacher provided by circling the part of the response (÷ 30) and question instruction (area) that were not correctly demonstrated in the student's response
- to demonstrate how the teacher has clearly indicated that answers a) and b) are each awarded 1 of the possible 2 marks, and a mark of '0' is clearly recorded for answer c) because the response does not match the mark allocation descriptors in the marking guide
- as it provides evidence that students were aware that questions worth more than 1 mark required mathematical reasoning and/or working to be shown to support answers, and to cancel any incorrect response if students make a mistake and wish an alternative response to be marked.

Foundational knowledge and problem-solving (2 of a possible 5 marks)	

Item: Question 2 — Part A, CIA 2021 Phase 4

Assessment objectives: 1, 2, 3 and 6 — simple familiar

This question required students to estimate a value from a diagram showing a mass scale and apply calculation and rounding strategies to determine a maximum number within a constraint.

Effective student responses:

- used the diagram of a mass scale to estimate the mass of the full bucket of sand in the range of 8.2 kg to 8.3 kg
- used subtraction to calculate the mass of sand in the full bucket
- used multiplication or division to calculate the number of buckets of sand that can be safely moved in a wheelbarrow
- rounded down to a whole number for the maximum number of buckets.

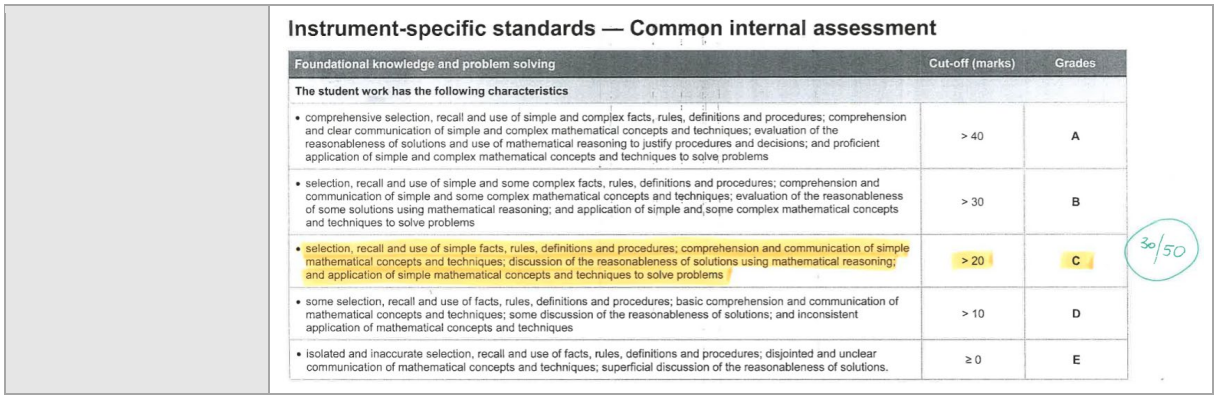
This student response excerpt has been included:

- to demonstrate how the teacher has clearly recorded '0' marks for answer a) because the response does not match the mark allocation descriptors in the marking guide
- to show that follow through (FT) marks, allowed in the marking guide due to error/s in prior working, were appropriately awarded in answer b) where the student used an incorrect value (8.5) from answer a) but demonstrated correct conceptual understanding and skill to calculate a maximum number of full buckets of sand by dividing and rounding down to a whole number
- to demonstrate the importance of clearly recording the number of marks awarded for each part of each question and not relying on counting ticks to total the marks. The teacher has used a circle to clearly indicate that answer b) is awarded 2 marks, which is the accurate number of marks when the response is matched to the mark allocation descriptors in the marking guide. Even though only one tick is shown on the response for the calculation, the value in the written statement is correctly rounded down to a whole number.

Foundational knowledge and problem-solving (2 of a possible 4 marks)	a) An empty bucket has a mass of one kilogram (kg). How many kilograms (kg) of sand are in one full bucket? 0 *[2 marks]* 8.5 kg of sand are in one full bucket X A person can safely move up to 80 kilograms (kg) of sand in the wheelbarrow. b) Use the result from Question 2a) to calculate the maximum number of full buckets of sand that can safely be moved in the wheelbarrow. *[2 marks]* 80 ÷ 8.5 = 9.4 ✓ ∴ the max number of full buckets is 9

This excerpt has been included:

- to demonstrate the correct application of the mark cut-offs in the instrument-specific standards to determine the correct grade allocation. The total mark of 30 out of 50 marks is written clearly on the standards and the correct corresponding mark cut-off and grade are clearly highlighted. The awarded total of 30 marks is greater than 20 marks but not greater than 30 marks and so the response is awarded a C grade. The descriptors have not been used to determine the grade but may have been highlighted (this is optional) to provide feedback to the student.



Instrument-specific standards — Common internal assessment

Foundational knowledge and problem solving	Cut-off (marks)	Grades
The student work has the following characteristics		
• comprehensive selection, recall and use of simple and complex facts, rules, definitions and procedures; comprehension and clear communication of simple and complex mathematical concepts and techniques; evaluation of the reasonableness of solutions and use of mathematical reasoning to justify procedures and decisions; and proficient application of simple and complex mathematical concepts and techniques to solve problems	> 40	A
• selection, recall and use of simple and some complex facts, rules, definitions and procedures; comprehension and communication of simple and some complex mathematical concepts and techniques; evaluation of the reasonableness of some solutions using mathematical reasoning; and application of simple and some complex mathematical concepts and techniques to solve problems	> 30	B
• selection, recall and use of simple facts, rules, definitions and procedures; comprehension and communication of simple mathematical concepts and techniques; discussion of the reasonableness of solutions using mathematical reasoning; and application of simple mathematical concepts and techniques to solve problems	> 20	C
• some selection, recall and use of facts, rules, definitions and procedures; basic comprehension and communication of mathematical concepts and techniques; some discussion of the reasonableness of solutions; and inconsistent application of mathematical concepts and techniques	> 10	D
• isolated and inaccurate selection, recall and use of facts, rules, definitions and procedures; disjointed and unclear communication of mathematical concepts and techniques; superficial discussion of the reasonableness of solutions.	≥ 0	E

30/50

Practices to strengthen

To further ensure accuracy and consistency of the application of the ISMG for this IA, it is recommended that:

- for each part of each question, teachers record near the response space the number of awarded marks. Where the response does not meet any of the descriptors for a question, a mark of '0' is recorded, and where no response to a question has been made, a mark of 'N' is recorded. This provides clarity for students and reviewers and enables accurate totalling of the marks achieved for the assessment
- teachers award only whole marks as described in the CIA marking guide, not half-marks, and that the awarded marks are totalled correctly to a mark out of 50
- the correct grade is determined because the total mark, regardless of the level of difficulty of questions in which marks are achieved, is greater than (>) the mark cut-off in the instrument-specific standards table in the CIA marking guide, e.g. to be correctly awarded an A grade, the marked response needs to total to greater than 40 marks. A result totalling exactly 40 marks is awarded a B grade
- the descriptors in the instrument-specific standards are not used to make or adjust the A–E judgment as these are provided as an indication (only) of the characteristics typically demonstrated in a response at each grade, which may be used to provide feedback to students.

Internal assessment 3 (IA3)

Problem-solving and modelling task

This problem-solving and modelling task must use subject matter from the Fundamental topic: Calculations and at least one of the following topics in Unit 4:

- Topic 1: Bivariate graphs
- Topic 2: Probability and relative frequencies
- Topic 3: Loans and compound interest.

The problem-solving and modelling task is an assessment instrument where students provide a response to a mathematical investigative scenario or context. It requires students to respond with a range of understanding and skills, such as using mathematical language, appropriate calculations, tables of data, graphs and diagrams.

Students must provide a response to a specific task or issue that is set in a context that highlights a real-life application of mathematics. The task requires students to use relevant stimulus material involving the selected subject matter and must have sufficient scope to allow students to address all the stages of the problem-solving and modelling approach. Technology must be used.

Assessment design

Validity

Validity in assessment design considers the extent to which an assessment item accurately measures what it is intended to measure and that the evidence of student learning collected from an assessment can be legitimately used for the purpose specified in the syllabus.

Reasons for non-endorsement by priority of assessment

Validity priority	Number of times priority was identified in decisions*
Alignment	103
Authentication	27
Authenticity	46
Item construction	21
Scope and scale	62

*Each priority might contain up to four assessment practices.

Total number of submissions: 450.

Effective practices

Validity priorities were effectively demonstrated in assessment instruments that:

- provided authentic contexts that were relevant and engaging for the students, e.g. comparing car loan options to make a recommendation or investigating if reaction time determined the success of other physical abilities

- used a range of authentication strategies, including a checkpoint for teachers to provide feedback on one draft, and checkpoints for monitoring student progress and establishing authorship.

Practices to strengthen

It is recommended that assessment instruments:

- have sufficient scope for students to independently address all stages of the problem-solving and mathematical modelling approach by framing scaffolding as prompting questions that guide students to develop a response, rather than a list of instructions that links subject matter to task requirements
- provide opportunities for students to respond to a specific task or issue set in a context that highlights a real-life application of mathematics, e.g. a task comparing two loan options requires a purpose, such as making a recommendation, or a report could be developed to inform a hypothetical case study.

Accessibility

Accessibility in assessment design ensures that no student or group of students is disadvantaged in their capacity to access an assessment.

Reasons for non-endorsement by priority of assessment

Accessibility priority	Number of times priority was identified in decisions*
Bias avoidance	4
Language	38
Layout	5
Transparency	12

*Each priority might contain up to four assessment practices.

Total number of submissions: 450.

Effective practices

Accessibility priorities were effectively demonstrated in assessment instruments that:

- provided a clear layout, e.g. use of dot points, spacing and images
- focused on a context relevant to the school community and students of Essential Mathematics
- used language reflected in the instrument-specific standards.

Practices to strengthen

It is recommended that assessment instruments:

- include clear, concise instructions and cues using language linked to the descriptors in the instrument-specific standards
- avoid repetition and contradictions in the context, task and scaffolding
- are free from spelling, grammatical and textual errors.

Internal assessment 4 (IA4)

Examination — short response

This assessment is a supervised examination in two parts: simple (Part A) and complex (Part B). The examination assesses the application of a range of cognitions to a number of items, drawn from all Unit 4 topics. Student responses must be completed individually, under supervised conditions and in a set timeframe.

The examination representatively samples subject matter from all Unit 4 topics. Where relevant, the focus of this assessment should be on subject matter not assessed in the problem-solving and modelling task.

The percentage allocation of marks must match the degree of difficulty specifications: ~80% simple familiar, ~10% complex familiar, ~10% complex unfamiliar.

Assessment design

Validity

Validity in assessment design considers the extent to which an assessment item accurately measures what it is intended to measure and that the evidence of student learning collected from an assessment can be legitimately used for the purpose specified in the syllabus.

Reasons for non-endorsement by priority of assessment

Validity priority	Number of times priority was identified in decisions*
Alignment	176
Authentication	0
Authenticity	6
Item construction	16
Scope and scale	181

*Each priority might contain up to four assessment practices.

Total number of submissions: 449.

Effective practices

Validity priorities were effectively demonstrated in assessment instruments that:

- provided questions with contexts that were authentic and engaging, e.g. providing screenshots of online calculators to fill in or probability scenarios relevant to adolescent interests
- provided questions that were free from mathematical errors and unnecessary stimulus, e.g. it is not necessary to include images of currency for a question related to compound interest.

Practices to strengthen

It is recommended that assessment instruments:

- align with the subject matter in Unit 4, e.g. create questions directly from the subject matter by ensuring the cognition and concept are assessed
- use only simple subject matter for questions assigned simple familiar marks, and complex subject matter for questions assigned complex familiar or complex unfamiliar marks, as specified in the syllabus
- provide explicit opportunities for students to demonstrate assessment objective 4: 'Evaluate the reasonableness of solutions'
- are of an appropriate scope and scale by containing a reasonable number of questions that representatively sample subject matter from all Unit 4 topics such that students can complete the examination within the specified conditions.

Accessibility

Accessibility in assessment design ensures that no student or group of students is disadvantaged in their capacity to access an assessment.

Reasons for non-endorsement by priority of assessment

Accessibility priority	Number of times priority was identified in decisions*
Bias avoidance	7
Language	42
Layout	12
Transparency	13

*Each priority might contain up to four assessment practices.

Total number of submissions: 449.

Effective practices

Accessibility priorities were effectively demonstrated in assessment instruments that:

- considered the layout of each question and provided sufficient space for re-attempts, e.g. providing multiple cartesian planes or images for students to use if they made a significant error on their first attempt
- avoided bias by including key information in questions and utilising contexts that did not require specialist knowledge to access the problem.

Practices to strengthen

It is recommended that assessment instruments:

- phrase questions in context using clear and concise language, avoiding specialist language and superfluous information, e.g. information that is not necessary to solving the problem should not be included for the sake of building context
- are free from spelling, grammatical and textual errors.