Essential Mathematics subject report

2024 cohort

January 2025

Queensland Government | QCAA Queensland Curriculum & Assessment Authority

250028

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Contents

Introduction

The annual Applied (Essential) subject reports seek to identify strengths and opportunities for improvement of internal assessment processes for all Queensland schools. The 2024 subject report is the culmination of the partnership between schools and the QCAA. It addresses school-based assessment design, and student responses to assessment for Applied (Essential) subjects. In acknowledging effective practices and areas for refinement, it offers schools timely and evidence-based guidance to further develop student learning and assessment experiences for 2025.

The report also includes information about:

- applying syllabus objectives in the design and marking of assessments
- patterns of student achievement.

The report promotes continuous improvement by:

- identifying effective practices in the design and marking of valid, accessible and reliable assessments
- recommending where and how to enhance the design and marking of valid, accessible and reliable assessment instruments
- providing examples that demonstrate best practice.

Schools are encouraged to reflect on the effective practices identified for each assessment, heed the recommendations to strengthen assessment design and explore the authentic student work samples provided.

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 common internal assessment (CIA).

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

Subject highlights

499
schools offered Essential Mathematics

11,716
students completed 4 units

94.93%
of students received a C or higher

Subject data summary

Subject completion

Note: All data is correct as at January 2025. Where percentages are provided, these are rounded to two decimal places and, therefore, may not add up to 100%.

Number of schools that offered Essential Mathematics: 499.

Completion of units	Unit 1	Unit 2	Units 3 and 4
Number of students completed	18,964	19,041	18,759

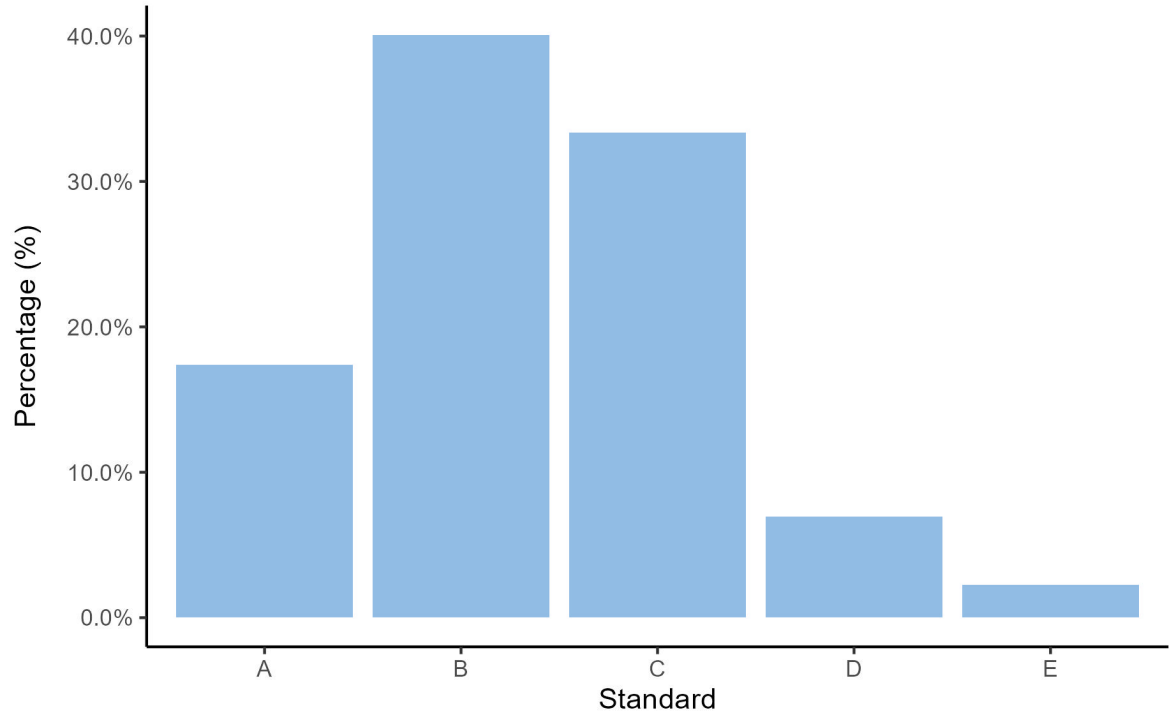
Units 1 and 2 results

Number of students	Satisfactory	Unsatisfactory
Unit 1	16,175	2,789
Unit 2	16,685	2,356

Units 3 and 4 internal assessment (IA) results

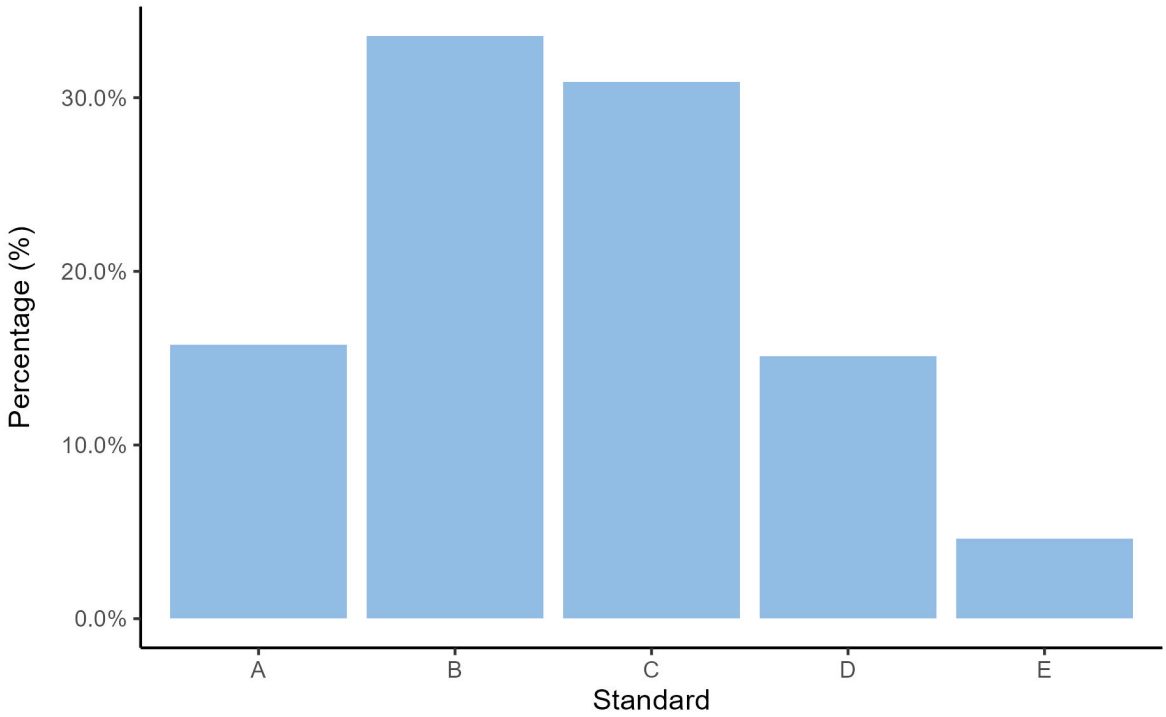
IA1 standards

IA1 total



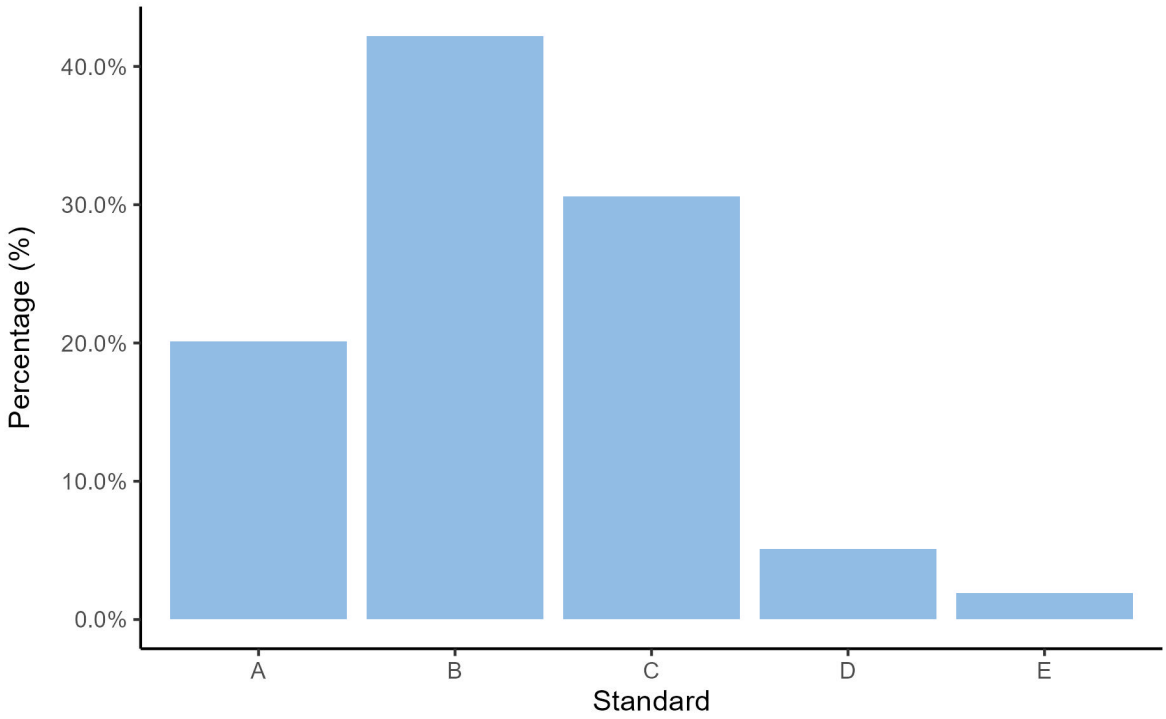
IA2 (CIA) standards

IA2 total



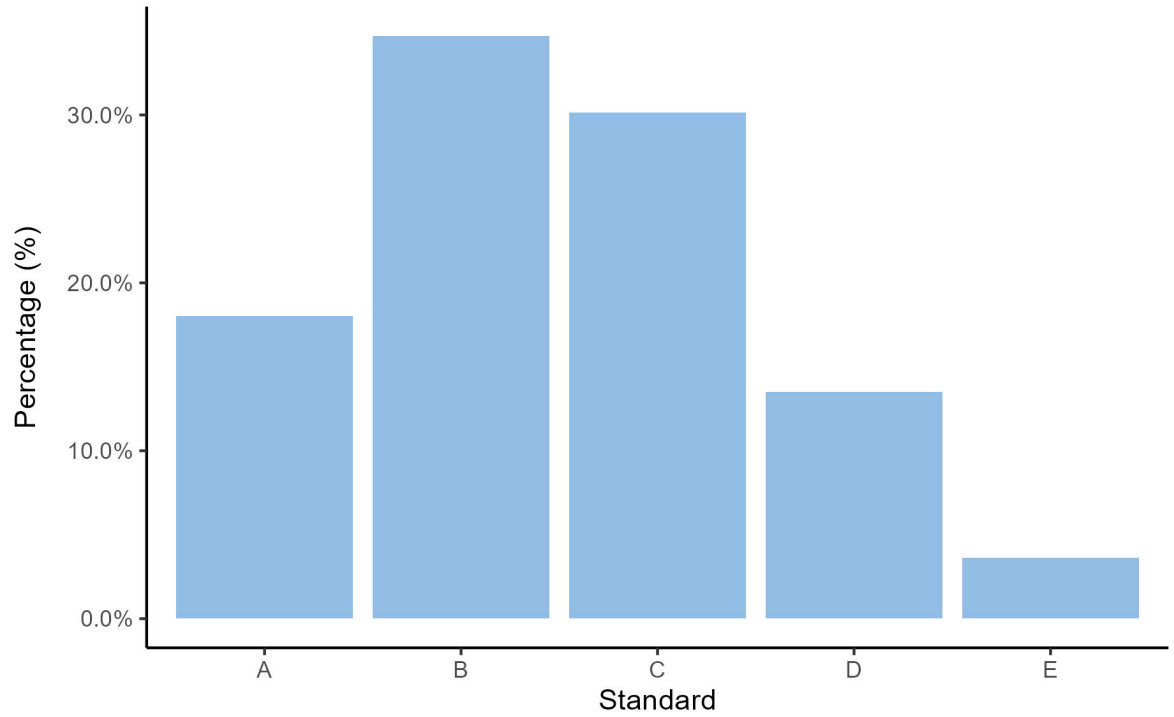
IA3 standards

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	2,441	8,485	6,882	881	70

Internal assessment

The following information and advice relate to the assessment design and assessment decisions for each internal assessment (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 assessment. 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 *QCE and QCIA policy and procedures handbook v6.0*, Section 9.5.

Percentage of instruments endorsed in Application 1

Number of instruments submitted	IA1	IA3	IA4
Total number of instruments	506	500	500
Percentage endorsed in Application 1	60	73	51

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 inform judgments for IA3 and IA4. The feedback was provided to schools using the *Quality assurance advice to schools* form.

Internal assessment 1 (IA1)

Problem-solving and modelling task

This assessment focuses on the interpretation, analysis and evaluation of ideas and information. It is an independent task responding to a particular situation or stimuli. While students may undertake some research in the writing of the problem-solving and modelling task, it is not the focus of this technique. This assessment occurs over an extended and defined period. Students will use class time and their own time to develop a response.

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.

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	101
Authentication	28
Authenticity	37
Item construction	27
Scope and scale	57

Effective practices

Validity priorities were effectively demonstrated in assessment instruments that:

- allowed for unique responses within an authentic context, e.g. the task included individualised sample datasets and/or was sufficiently open-ended, allowing students to decide how to use Unit 3 mathematical techniques in responding to the task
- provided clarity in the overview and framework of the task, but without explicit direction on methods and techniques to be used to develop the response
- instructed students to follow the syllabus approach to problem-solving and mathematical modelling
- clearly indicated checkpoints to differentiate the submission of only one draft for feedback (*QCE and QCIA policy and procedures handbook v6.0,* Section 8.2.5 Drafting).

Practices to strengthen

It is recommended that assessment instruments:

- are of appropriate scope and scale for students to respond using Unit 3 subject matter, e.g. students are provided with data or costings so that researching these is not a focus of the assessment
- provide students with the opportunity to respond to all assessable objectives, e.g. Objective 4: evaluate the reasonableness of solutions and Objective 5: justify procedures and decisions by explaining mathematical reasoning. For this instrument, the task could require students to evaluate the reasonableness of solutions and/or justify procedures and decisions in relation to a scale drawing or calculated area
- provide sufficient opportunity for the use of technology, appropriate to the task and school context.

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	15
Layout	2
Transparency	4

Effective practices

Accessibility priorities were effectively demonstrated in assessment instruments that:

- avoided specialist language, jargon and/or bias in the context of the task
- used relevant and legible stimulus, e.g. diagrams, data and images.

Practices to strengthen

There were no significant issues identified for improvement.

Additional advice

- When developing the IA1 task, schools are encouraged to consider expected elements in a student's response that demonstrate the characteristics outlined in the instrument-specific standards descriptors. This does not require teachers to write a full solution but will assist teachers to identify and provide relevant stimulus material required to complete the task and calibrate their expectations, e.g. annotated instrument-specific standards.
- Avoid heavily scaffolded steps or directed instructions in the task or stimulus that prevent students from taking an independent approach to problem-solving and modelling, e.g. instructing students to 'produce a hand-drawn scale drawing' could provide too much guidance or scaffolding.

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: 484.

Effective practices

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

- for the Formulate criterion, judgments matched to the A-standard performance level were made where the student's response included documentation of appropriate assumptions and relevant observations by providing supporting evidence for stated assumptions and observations, e.g. decisive information, written references, citations
- an on-balance judgment was used to determine the grade for student responses that demonstrated characteristics from more than one performance level
- appropriate judgments about accurate use of simple and complex aspects of the task were documented by the school at relevant points on student responses.

Practices to strengthen

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

- the pattern of evidence across the four criteria be used to determine an overall grade, based on an on-balance judgment, not an individual grade for each criterion
- teacher annotations (e.g. highlighting, circling, ticking) indicate the relevant characteristics that best match evidence in the student response
- decisions for the Solve criterion, when aligned with A- or B-standard performance-level descriptors for accurate and/or appropriate use of technology should reflect applications beyond simple computation or word processing, as required by syllabus conditions
- decisions for the Evaluate and verify criterion, when aligned to the A-standard performance-level descriptors for documentation and justification should include mathematical reasoning and supporting evidence.

Samples

The following excerpt illustrates evidence of accurate documentation of relevant observations and documentation of appropriate assumptions by providing supporting evidence, including information relevant to the context of the task.

Note: The characteristic/s identified may not be the only time the characteristic/s occurred throughout a response.

Observations & Assumptions

Observations	Reasoning
There is no limit to the layout or the placement of the features within the garden	The neighbours only request for a design within the area of their backyard with 3 of the features.
The garden is not made to be practical, but aesthetically pleasing	Within the context, the neighbours had requested as such for their preferred backyard
Children or pets were not mentioned within the context	The context gave constraints and suggestions but did not instruct of any suggestions for pets or children, as such the garden will be developed with thoughts in case the neighbours get either in the future.
Assumptions	**Reasoning**
The construction of the garden will be undertaken as a DIY project	No additional labour costs taken from the budget
A 10% additional purchase of all materials will be added to their final costs	When undergoing construction, if materials are damaged due to weather or other reasons such as inexperienced handling and such, replacements will be needed.
There will be little to no transportation, or import fees.	The context had said that the neighbours had sourced all materials form within the Brisbane region.
We are allowed to add more materials to the list as long as we remain under budget	There is an additional space under the Decking resource that is empty, this can be reasoned to say that the list is not full and so the designer can add more.

The following excerpt illustrates the accurate and appropriate use of technology as the student has provided a summary of how technology was used and evidence of the equations used for spreadsheeting. Teacher judgments also indicate accurate use of complex procedures and application of [complex] mathematical concepts and techniques relevant to the task.

Note: The characteristic/s identified may not be the only time the characteristic/s occurred throughout a response.

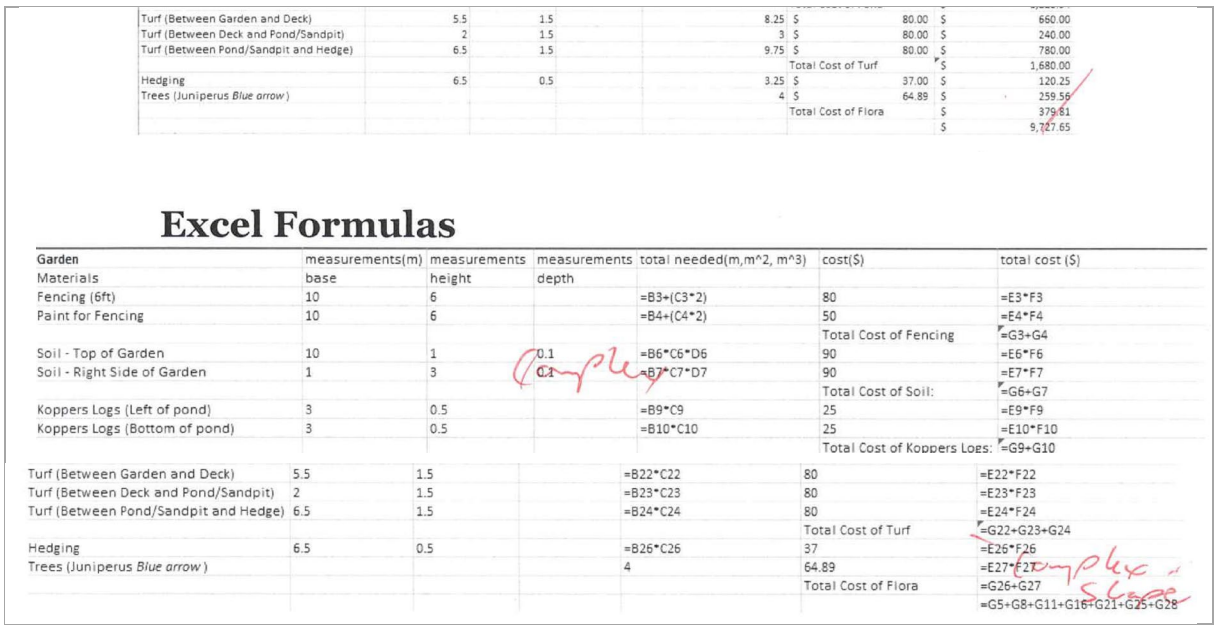
Method

To complete this assignment, Excel will be used to handle both the calculations and the listings of the number of materials along with total price of the materials. There will also be a small section of calculations done by hand. Included, there will also be a handwritten draft that estimates the placement and the area of all the respective backyard features and then that draft will be transformed into a proper schematic, either through the use of REVIT, a 3D construction program, or through the use of Word – sizing of the picture format to achieve an accurate schematic. The latter was used (See appendix 1.3)

Calculations

Excel Solutions

Garden	measurements(m)	measurements	measurements	total needed(m,m^2, m^3)	cost($)	total cost ($)
Materials	base	height	depth			
Fencing (6ft)	10	6		22	$ 80.00	$ 1,760.00
Paint for Fencing	10	6		22	$ 50.00	$ 1,100.00
					Total Cost of Fencing	$ 2,860.00
Soil - Top of Garden	10	1	0.1	1	$ 90.00	$ 90.00
Soil - Right Side of Garden	1	3	0.1	0.3	$ 90.00	$ 27.00
					Total Cost of Soil:	$ 117.00
Koppers Logs (Left of pond)	3	0.5		1.5	$ 25.00	$ 37.50
Koppers Logs (Bottom of pond)	3	0.5		1.5	$ 25.00	$ 37.50
					Total Cost of Koppers Logs:	$ 75.00



Turf (Between Garden and Deck)	5.5	1.5	8.25	$ 80.00	$ 660.00
Turf (Between Deck and Pond/Sandpit)	2	1.5	3	$ 80.00	$ 240.00
Turf (Between Pond/Sandpit and Hedge)	6.5	1.5	9.75	$ 80.00	$ 780.00
				Total Cost of Turf	$ 1,680.00
Hedging	6.5	0.5	3.25	$ 37.00	$ 120.25
Trees (Juniperus *Blue arrow*)			4	$ 64.89	$ 259.56
				Total Cost of Flora	$ 379.81
					$ 9,727.65

Excel Formulas

Garden	measurements(m)	measurements	measurements	total needed(m,m^2, m^3)	cost($)	total cost ($)
Materials	base	height	depth			
Fencing (6ft)	10	6		=B3+(C3*2)	80	=E3*F3
Paint for Fencing	10	6		=B4+(C4*2)	50	=E4*F4
					Total Cost of Fencing	=G3+G4
Soil - Top of Garden	10	1	0.1	=B6*C6*D6	90	=E6*F6
Soil - Right Side of Garden	1	3	0.1	=B7*C7*D7	90	=E7*F7
					Total Cost of Soil:	=G6+G7
Koppers Logs (Left of pond)	3	0.5		=B9*C9	25	=E9*F9
Koppers Logs (Bottom of pond)	3	0.5		=B10*C10	25	=E10*F10
					Total Cost of Koppers Logs:	=G9+G10
Turf (Between Garden and Deck)	5.5	1.5		=B22*C22	80	=E22*F22
Turf (Between Deck and Pond/Sandpit)	2	1.5		=B23*C23	80	=E23*F23
Turf (Between Pond/Sandpit and Hedge)	6.5	1.5		=B24*C24	80	=E24*F24
					Total Cost of Turf	=G22+G23+G24
Hedging	6.5	0.5		=B26*C26	37	=E26*F26
Trees (Juniperus *Blue arrow*)				4	64.89	=E27*F27
					Total Cost of Flora	=G26+G27
						=G5+G8+G11+G16+G21+G25+G28

The following excerpt illustrates the use of mathematical reasoning to justify decisions made as well as the provision of supporting evidence to document relevant strengths and limitations of the solutions to make an evaluation of the reasonableness of the solution. It demonstrates how the student referenced results, assumptions, and observations throughout their evaluation of the solution. The excerpt also illustrates coherent and concise organisation of the response appropriate to the genre, including a suitable conclusion.

Note: The characteristic/s identified may not be the only time the characteristic/s occurred throughout a response.

Reasonableness & Justification

According to Architectural Digest, an American home décor and backyard magazine with over 40,000 subscriptions, recommended a renovation cost of a background to be $20,000 USD, which is ~$30,000 AUD. The budget given by the neighbours in this situation, was $20,000 AUD, which is ~$13,000 USD, 65% cheaper than the suggested budget. However, in both cases, the proposed final cost still comes quite a bit under budget. As such, the reasonableness of the design cannot be questioned as the suggested backyard maintains a good sense of aesthetics, providing a pond, sandpit, deck, firepit and garden, 5 of the 8 suggested features within a fairly large backyard, while remaining cheap.

Conclusion

Off the requested criteria for the design from the Neighbours, those being that the backyard must be fenced off, their must be at least 3 features and that the backyard must be aesthetically pleasing. I believe that I have successfully fulfilled all three criteria. The backyard is fenced off with hedges to manipulate the feel of the garden and make it aesthetically pleasing along with 5 of the 8 backyard features. The deck has an inlaid fire pit, the sand pit is surrounding a pool with a garden on the top and right of the backyard that also contributes to the aesthetics. All in all, I believe I have delivered a sufficient enough design that is both cheap, using just over half the budget, aesthetically pleasing, making the garden feel contained rather than constrained, with enough space for various miscellaneous activities.

The following excerpt illustrates an example of 'documentation' rather than 'statement' for both relevant strengths and limitations of the solution and/or model. The student has demonstrated consideration of the strengths and limitations of the solution, the relevance to the context of the task, whether the solution fulfilled the intended purpose, and how the solution links to the real world.

Note: The characteristic/s identified may not be the only time the characteristic/s occurred throughout a response.

Strengths & Limitations

Strengths	Effects
Nice to look at and a good environment to entertain guests	Able to host more parties or gatherings if the neighbours are a social butterfly and it also provides a calming environment for after the stressful day
Good amount area for plant life and enough space in the pond for a small ecosystem	Adds to the character of the garden as well as the aesthetics, and if wanted, enough room for a small vegetable or fruit patch
The deck area has a view of the whole backyard which guarantees a whole view of where a child or pet might play	Allows parents to keep a watchful eye on what their children are doing and also keep an eye on whatever pets or pests might appear

Limitations	Effects
There is not much open space for playing games that require a lot of space	When inviting friends or family over, you would not be able to play cricket, soccer or frisbee. This could prevent the making of memories
No space for a pool or any other large renovations such as a shed or a storage shack	Gardening tools or power tools such as a mower or drill, would have to be stored in a separate area, which depending on where, could be an annoyance or a detriment to the motivation to maintain the garden
Slow construction due to the Do-It-Yourself nature	Not a lot of people, and thus cannot work on multiple parts of the garden at once, leading to slow construction, including massive delays for small problems.
If someone else was to use this budget and did not want to DIY it, there is no inclusion of labour costs	This problem could exponentially inflate the cost far past the dedicated amount, due to weather, transport fees and hazard pay should accident ever occur.

Additional advice

- Teachers make judgments about student achievement by matching the evidence in the student responses to the characteristics of the instrument-specific standards and then make an on-balance decision when awarding the grade. It is recommended that teachers and schools refer to Understanding General and Applied (Essential) syllabuses in the Learning Hub application (app) on the QCAA Portal and the Making judgments webinar in the Syllabus app.

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. The CIA is not privileged over the school-developed summative assessment.

Assessment design

The assessment instrument was designed using the specifications, conditions and assessment objectives described in the Summative internal assessment 2: Common internal assessment section of the syllabus.

The examination consisted of one paper with two parts: simple (Part A) with 9 short response items (40 marks) and complex (Part B) with two short response items (10 marks).

The examination assessed subject matter from Unit 3. Questions were derived from the context of all Unit 3 topics.

The assessment required students to respond to short response items.

Assessment decisions

Assessment decisions are made by teachers matching student responses to the common internal assessment marking guide (CIAMG).

Effective practices

Overall, students responded well when they:

- correctly selected the appropriate formula to use, when required
- justified solutions using appropriate mathematical language, where applicable
- responded to questions worth more than one mark by providing mathematical reasoning and/or working to support answers.

Practices to strengthen

When preparing students for the CIA, it is recommended that teachers:

- participate in the QCAA webinar *Common Internal Assessment: Essential Mathematics* prior to implementing the Essential Mathematics CIA
- refer to the *Common internal assessment: Guidelines for administration* and information in the CIA Teacher pack for instructions and advice
- provide students with opportunities to engage with the relevant Unit 3 subject matter assessed in, and experience the types of questions used within, the CIA. (See past papers in the Units 3 and 4 Resources section of the Syllabuses app.)

Samples

Short response

Phase 2, Question 4

The following excerpt relates to Question 4 from Phase 2 of the CIA. It required students to interpret and estimate a mass given on a diagram of a scale, convert a mass from tonnes to kilograms, then solve a practical problem requiring basic number operations.

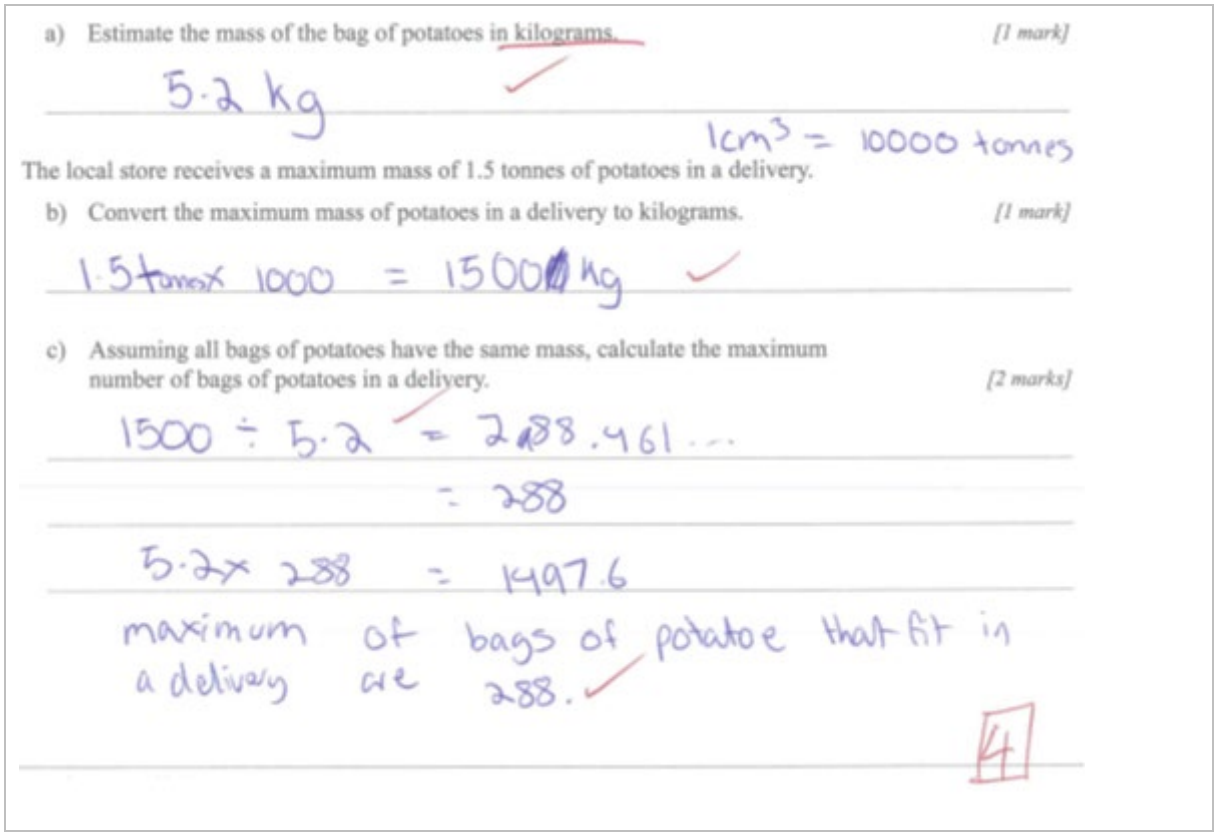
Effective student responses:

- accurately estimated the mass in kilograms
- converted the maximum mass from tonnes to kilograms
- calculated the maximum number of bags by applying a conversion rate
- used appropriate units of measure based on the context of each part of the question
- included clear communication of mathematical concepts and techniques.

This excerpt has been included:

- to show how teacher feedback has been provided in the marked response by
  - underlining the words in Part A of the question (i.e. ‘in kilograms’)
  - writing the total marks at the bottom of the question.

Note: The characteristic/s identified may not be the only time the characteristic/s occurred throughout a response.


a) Estimate the mass of the bag of potatoes in kilograms. [1 mark]

5.2 kg ✓

$1cm^3 = 10000$ tonnes

The local store receives a maximum mass of 1.5 tonnes of potatoes in a delivery.

b) Convert the maximum mass of potatoes in a delivery to kilograms. [1 mark]

1.5 tonnes × 1000 = 1500 kg ✓

c) Assuming all bags of potatoes have the same mass, calculate the maximum number of bags of potatoes in a delivery. [2 marks]

1500 ÷ 5.2 = 288.461...

= 288

5.2 × 288 = 1497.6

maximum of bags of potatoe that fit in a delivery are 288. ✓

4

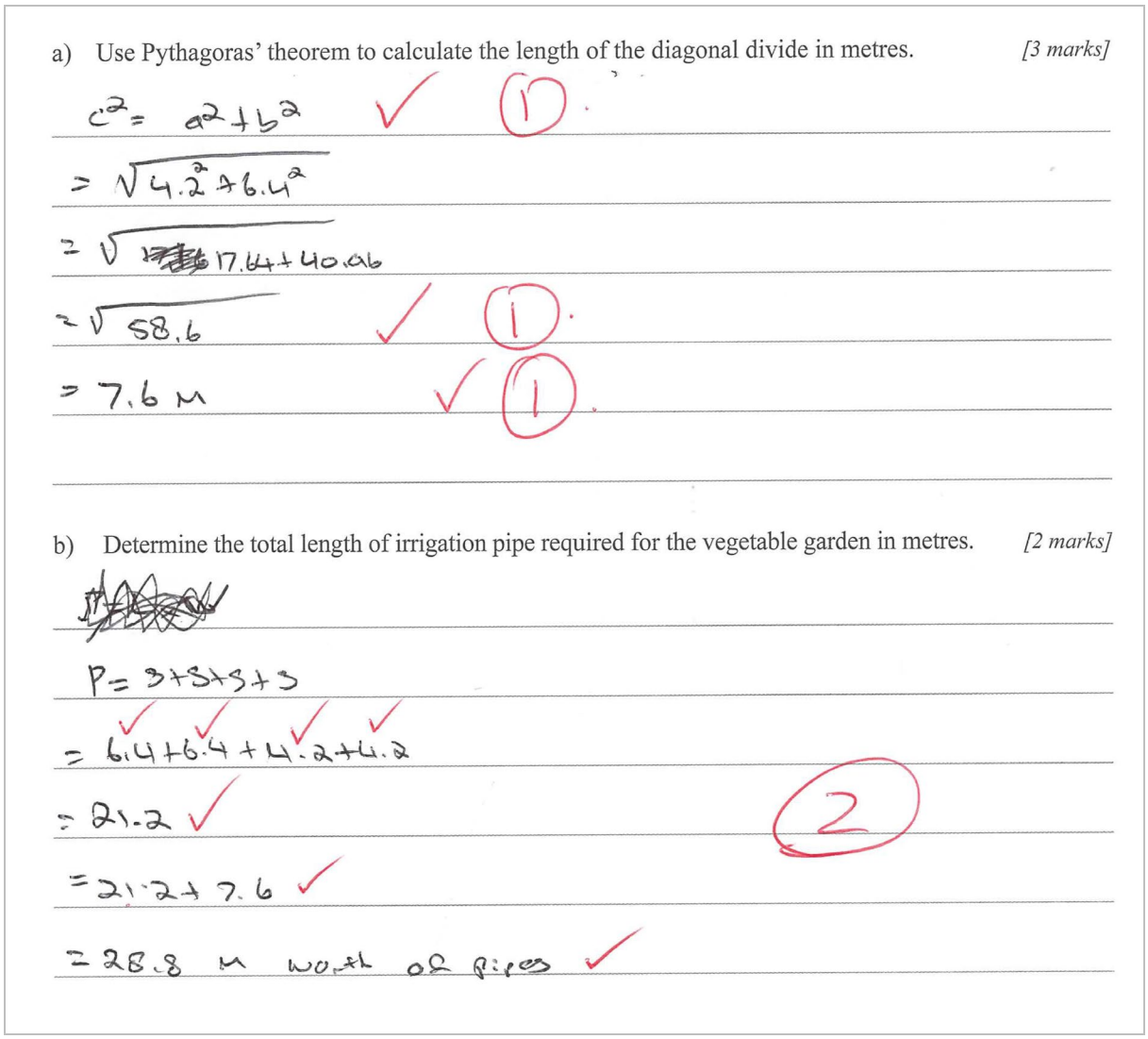
Phase 2, Question 9

The following excerpt relates to Question 9 from Phase 2. It required students to determine the length of the hypotenuse of a right-angled triangle, then determine the total length of irrigation pipe required.

Effective student responses:

- applied a relevant strategy to
  - calculate the length of the hypotenuse
  - determine the total length of pipe required.

This excerpt has been included to show where the teacher has allocated the third mark in Question 9a) by considering the Notes column in the CIAMG that states 'Accept appropriate rounding'.



a) Use Pythagoras' theorem to calculate the length of the diagonal divide in metres. *[3 marks]*

$c^2 = a^2 + b^2$ ✓ (1)

$= \sqrt{4.2^2 + 6.4^2}$

$= \sqrt{17.64 + 40.96}$

$= \sqrt{58.6}$ ✓ (1)

$= 7.6$ m ✓ (1)

b) Determine the total length of irrigation pipe required for the vegetable garden in metres. *[2 marks]*

$P = 3 + 3 + 3 + 3$

$= 6.4 + 6.4 + 4.2 + 4.2$ ✓ ✓ ✓ ✓

$= 21.2$ ✓ (2)

$= 21.2 + 7.6$ ✓

$= 28.8$ m worth of pipes ✓

Phase 1, Question 4

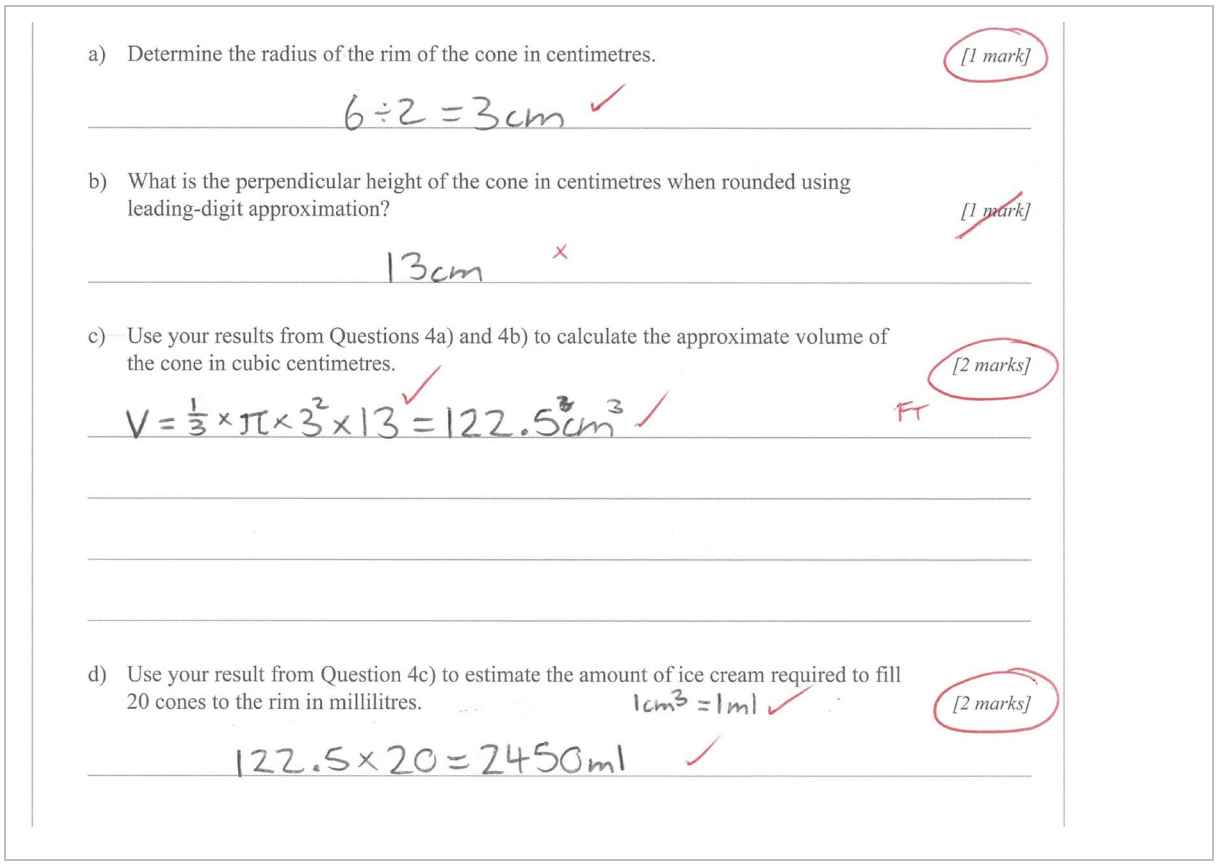
The following excerpt relates to Question 4 from Phase 1. It required students to determine and use the approximate volume of a cone to solve a practical problem.

Effective student responses:

- determined the radius using the given diameter
- correctly applied leading-digit approximation for the given perpendicular height
- calculated the approximate volume of the cone
- responded to questions worth more than one mark by providing mathematical reasoning and/or working to support answers.

This excerpt has been included:

- to show how teacher feedback has been provided by
  - using ticks in Question 4c) to indicate the location of each part of the response that matches the CIA marking guide, i.e. apply relevant strategy and calculate approximate volume
  - annotating where follow-through (FT) marks in Question 4c) have been awarded based on the incorrect answer provided in the response to Question 4b).



a) Determine the radius of the rim of the cone in centimetres. [1 mark]

$6 \div 2 = 3\text{cm}$ ✓

b) What is the perpendicular height of the cone in centimetres when rounded using leading-digit approximation? [1 mark]

13cm ×

c) Use your results from Questions 4a) and 4b) to calculate the approximate volume of the cone in cubic centimetres. [2 marks]

$V = \frac{1}{3} \times \pi \times 3^2 \times 13 = 122.5\text{cm}^3$ ✓ ✓ FT

d) Use your result from Question 4c) to estimate the amount of ice cream required to fill 20 cones to the rim in millilitres. [2 marks]

$1\text{cm}^3 = 1\text{ml}$ ✓

$122.5 \times 20 = 2450\text{ml}$ ✓

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 teacher has annotated the instrument-specific standards clearly, by writing the total mark of 47 and circling the correct grade. The design of the CIA ensures that the characteristics of the instrument-specific standards describe the typical evidence in a student response, therefore only the mark cut-off is used to determine the grade, but characteristic highlighting may be used 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

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Additional advice

- To ensure the accuracy of judgments, schools are advised to apply internal quality assurance processes to check marking decisions, raw mark totals, and the application of cut-off marks to allocate the grade.

Internal assessment 3 (IA3)

Problem-solving and modelling task

This assessment focuses on the interpretation, analysis and evaluation of ideas and information. It is an independent task responding to a particular situation or stimuli. While students may undertake some research in the writing of the problem-solving and modelling task, it is not the focus of this technique. This assessment occurs over an extended and defined period. Students use class time and their own time to develop a response.

The 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.

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	56
Authentication	24
Authenticity	28
Item construction	8
Scope and scale	51

Effective practices

Validity priorities were effectively demonstrated in assessment instruments that:

- provided opportunity for students to use technology across the range of standards, e.g. complete calculations using spreadsheets or an online calculator
- allowed students to develop a unique response using provided information, e.g. to calculate an amount of money for a task related to savings and/or loans
- instructed students to follow the syllabus approach to problem-solving and mathematical modelling and provided appropriate stimulus material that was readily accessible, e.g. a given list of loan options or rental properties.

Practices to strengthen

It is recommended that assessment instruments:

- provide tasks that focus on the use of Unit 4 subject matter, with any stimulus material critical to the task being provided to students so that research is not a major focus
- avoid heavily scaffolded steps or directed instructions that prevent students from taking an independent approach to problem-solving and mathematical modelling, e.g. instructing students to 'use mathematical concepts and techniques from Unit 4 Topic 1', is preferable to providing a list of steps outlining the techniques for bivariate graphing.

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	3
Language	11
Layout	1
Transparency	1

Effective practices

Accessibility priorities were effectively demonstrated in assessment instruments that:

- provided a purposeful and meaningful context that featured a real-world application of mathematics relevant to students
- used clear and contextually appropriate language and other textual features, e.g. correct spelling and grammar, appropriately labelled tables and graphs.

Practices to strengthen

There were no significant issues identified for improvement.

Additional advice

- Schools are encouraged to use the **Print preview** function within the Endorsement app in the QCAA Portal to check for appropriate page breaks and other textual and formatting features.

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.

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	147
Authentication	0
Authenticity	3
Item construction	35
Scope and scale	92

Effective practices

Validity priorities were effectively demonstrated in assessment instruments that:

- provided questions with authentic, relevant and real-world contexts, where appropriate, e.g. required students to: plot spending trends over time; describe the relationship between average hours of sleep per week and age
- provided relevant, error-free stimulus, e.g. grids, tables and diagrams that were free from mathematical errors.

Practices to strengthen

It is recommended that assessment instruments:

- use language that aligns with the assessment objectives and instrument-specific standards, e.g. ‘describe the association between variables’, rather than ‘describe the correlation between variables’, when assessing simple subject matter
- provide opportunities in the examination to address all assessment objectives, e.g. Objective 4: evaluate the reasonableness of solutions, and Objective 5: justify procedures and decisions by explaining mathematical reasoning
- allocate marks to simple familiar questions addressing simple subject matter and ensure that marks are not allocated to complex questions that require students to use simple subject matter.

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	11
Language	32
Layout	2
Transparency	6

Effective practices

Accessibility priorities were effectively demonstrated in assessment instruments that:

- were free of textual and typographical errors
- provided adequate space for each question response and/or extra space at the end of the examination with blank grids, tables or axes, where appropriate.

Practices to strengthen

It is recommended that assessment instruments:

- provide clear and consistent cues aligned to the specified degree of difficulty and expected response for the questions, e.g. ‘use the sample space provided to calculate the probability of rolling a number greater than 10’
- avoid the use of specialist or colloquial language
- contain adequate allocated time and space for each question, and that questions are assigned the appropriate degree of difficulty.

Additional advice

- It is recommended that teachers watch the Maths moments videos *Teacher training for Applied (Essential) Mathematics: Writing examinations* before developing this assessment. (See the Units 3 and 4 Resources section of the Syllabuses app in the QCAA Portal.)
- Ensure that the correct marking scheme is uploaded and is consistent with the assessment instrument.