Essential Mathematics subject report

2023 cohort

January 2024

Queensland Government | QCAA Queensland Curriculum & Assessment Authority

240028

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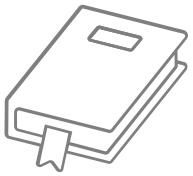
Contents

Introduction



Throughout 2023, schools and the Queensland Curriculum and Assessment Authority (QCAA) continued to improve outcomes for students in the Queensland Certificate of Education (QCE) system. These efforts were consolidated by the cumulative experience in teaching, learning and assessment of the current General, General (Extension), and Applied (Essential) senior syllabuses, and school engagement in QCAA endorsement and quality assurance (QA) processes and assessment marking. The current evaluation of the QCE system will further enhance understanding of the summative assessment cycle and will inform future QCAA subject reports.

The annual Applied (Essential) subject reports seek to identify strengths and opportunities for improvement of internal assessment processes for all Queensland schools. The 2023 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 this subject. 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 2024.

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 of best practice.

Schools are encouraged to reflect on the effective practices identified for each assessment, heed the recommendations for strengthening assessment design and explore the actual student work samples where 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.

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 highlights

475
schools offered Essential Mathematics

92.79%
of students completed 4 units

94.18%
of students received a C or higher

Subject data summary

Subject completion

Note: All data is correct as at January 2024. 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: 475.

Completion of units	Unit 1	Unit 2	Units 3 and 4
Number of students completed	18,964	19,040	17,597

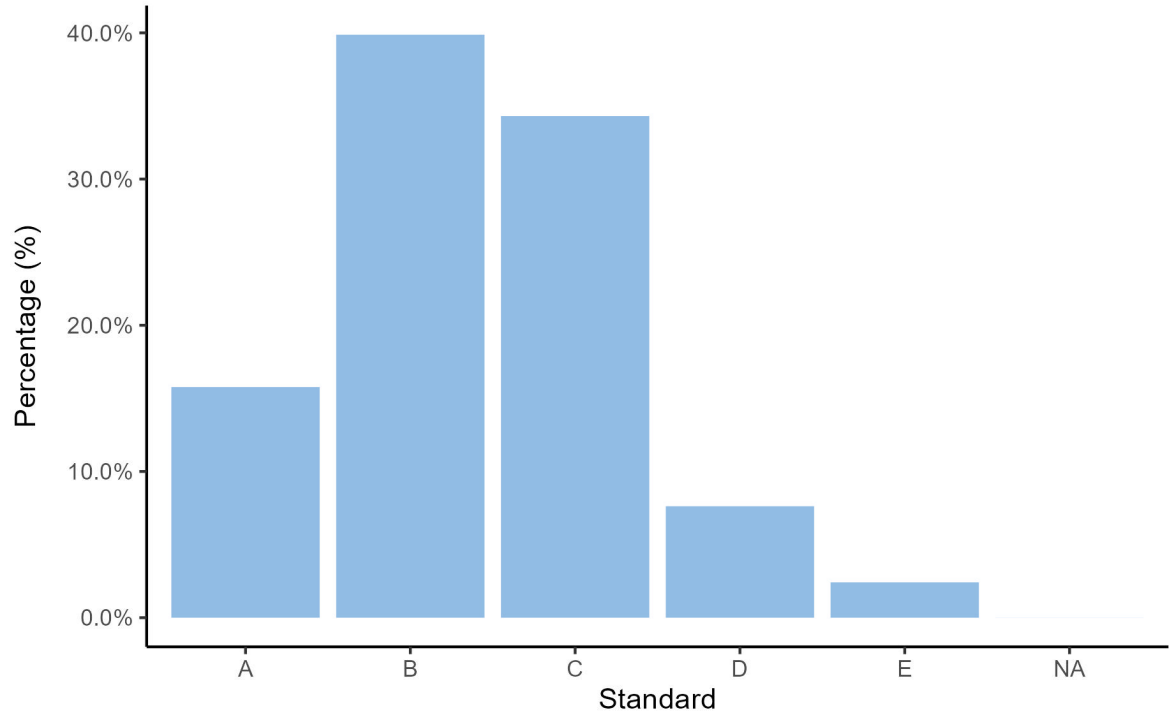
Units 1 and 2 results

Number of students	Satisfactory	Unsatisfactory
Unit 1	16,175	2,789
Unit 2	16,684	2,356

Units 3 and 4 internal assessment (IA) results

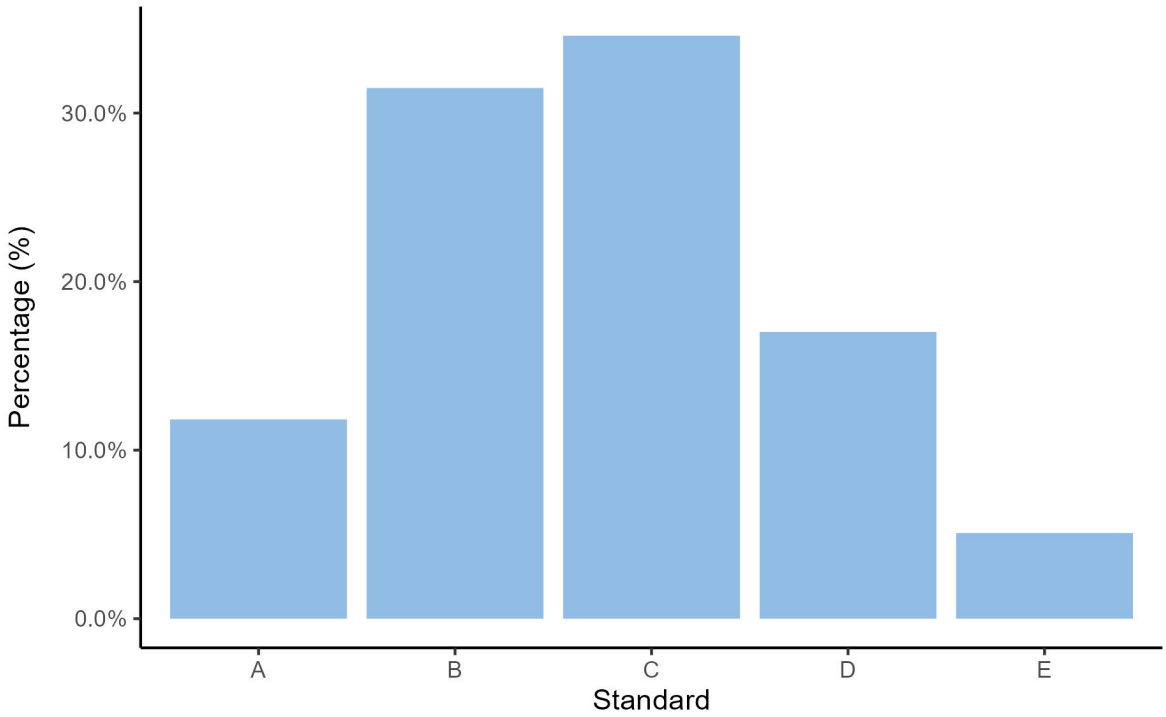
IA1 standards

IA1 total



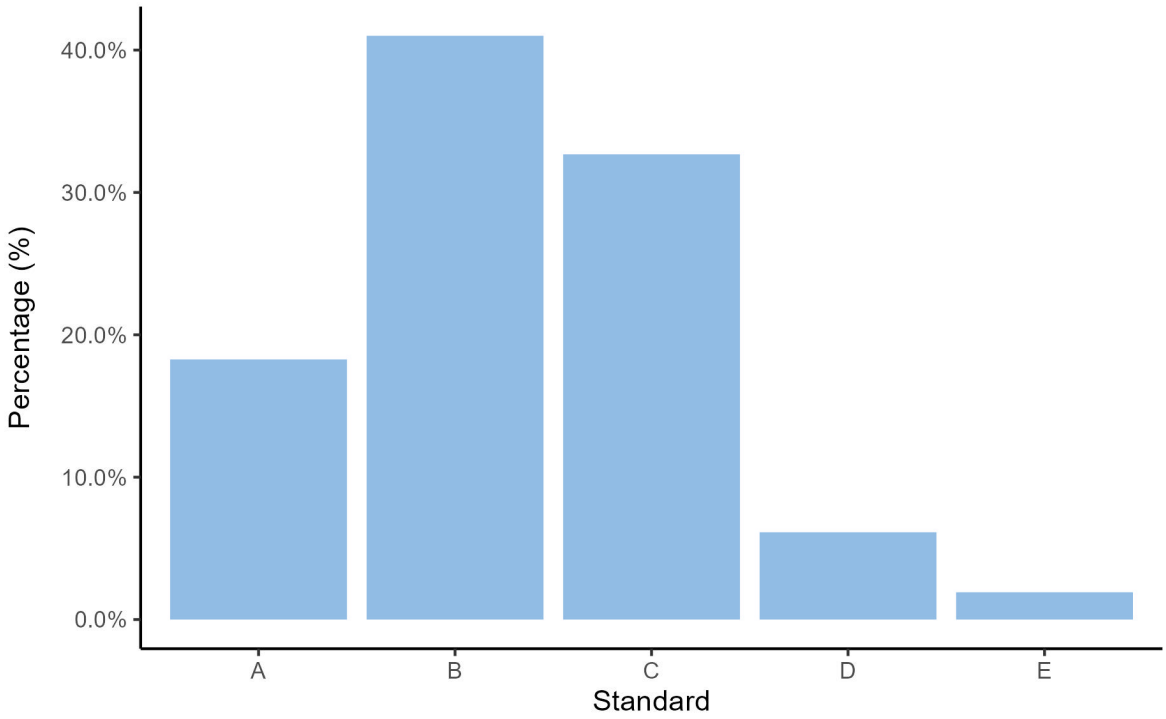
IA2 (CIA) standards

IA2 total



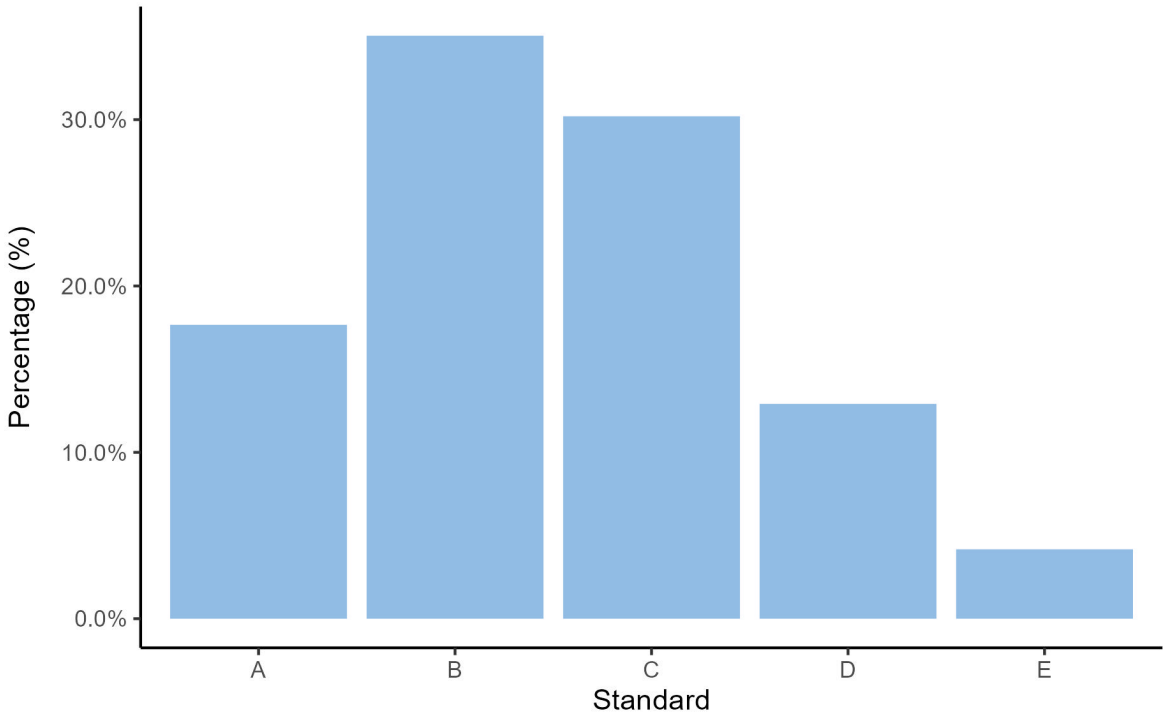
IA3 standards

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	1,956	7,750	6,867	942	82

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 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 *QCE and QCIA policy and procedures handbook v5.0*, Section 9.6.

Percentage of instruments endorsed in Application 1

Number of instruments submitted	IA1	IA3	IA4
Total number of instruments	487	486	486
Percentage endorsed in Application 1	46%	65%	37%

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 schools* form. Schools used this advice to inform their judgments for IA3 and IA4.

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 of time. Students will 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 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	70
Authentication	99
Authenticity	78
Item construction	35
Scope and scale	107

*Each priority might contain up to four assessment practices.

Total number of submissions: 487.

Effective practices

Validity priorities were effectively demonstrated in assessment instruments that:

- provided appropriate opportunities to elicit a unique response from authentic contexts that engaged the learning experiences of students, e.g. the task was adequately open-ended or provided individual sample datasets to enable students to make choices about how the data and mathematical techniques were used to solve the problem
- included relevant stimuli, e.g. a clear, detailed school map or floor plan and/or usable weblinks for appropriate online resources
- clearly indicated checkpoints to differentiate the submission of only one draft for feedback (see *QCE and QCIA policy and procedures handbook v5.0*, Section 8.2.5).

Practices to strengthen

It is recommended that assessment instruments:

- are of appropriate scope and scale by aligning specifically to Unit 3 subject matter for measurement, scales and data, e.g. require students to use the [complex] subject matter of representing composite figures as smaller regular shapes to investigate areas around the school that need upgrades
- are contextualised and include all assessable objectives. For this instrument, that could involve Objective 4: evaluate the reasonableness of solutions in relation to a scale drawing of a designated school area section rather than a complete school building plan with fit-outs or quantities of materials needed
- are not purely taken from problem-solving and modelling tasks in textbooks and sample assessments, which could compromise the authenticity of the student's work
- avoid heavily scaffolded steps or directed instructions that prevent students from taking an independent approach to problem-solving and modelling, e.g. frame scaffolding as generic prompts rather than a list of specific steps to guide students through the task.

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	17
Layout	9
Transparency	9

*Each priority might contain up to four assessment practices.

Total number of submissions: 487.

Effective practices

Accessibility priorities were effectively demonstrated in assessment instruments that:

- provided a clear, concise and consistent layout in the use of textual features (e.g. bullet points, grammar, spacing) and images
- avoided colloquial language, jargon and/or bias in the context of the task so the real-life investigative scenario was relevant and accessible to all students.

Practices to strengthen

It is recommended that assessment instruments:

- use relevant and concise mathematical, statistical and everyday language aligned with the syllabus and, in particular, the instrument-specific standards
- provide appropriate opportunities in the task to respond with a range of understanding and skills, e.g. using relevant tables of data, graphs and/or diagrams.

Additional advice

- The task must use relevant stimulus material involving the selected subject matter. It must also provide sufficient scope to allow students to address all the stages of the problem-solving and modelling approach as specified in Figure 4 in Syllabus section 1.2.4 and the characteristics of the instrument-specific standards.

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: 487

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 descriptors showed documentation of appropriate assumptions and relevant observations by providing supporting evidence for the stated assumptions and observations, e.g. decisive information, written references, citations
- the performance-level descriptors in the instrument-specific standards were accurately annotated, by the use of highlighting, circling or ticking or equivalent, to indicate the relevant characteristics that best matched the evidence in the student response
- the pattern of evidence across the four criteria was used to determine an overall grade, based on an on-balance judgment, not an individual grade for each criterion
- there was a clear distinction between simple and complex aspects of the problem by identifying mathematical concepts and techniques in the response to the Formulate and Solve criteria, e.g. [complex] subject matter, such as investigating the
  - suitability of measures of central tendency in various real-world contexts
  - effect of outliers on the mean and the median
  - real-world examples from the media illustrating inappropriate uses of measures of central tendency and spread
- for the Solve criterion, judgments matched to the A- or B-standard performance-level descriptors for the ‘accurate and/or appropriate use of technology’ must go beyond simple computation or word processing, as stipulated in the syllabus conditions.

Samples of effective practices

The following excerpts illustrate:

- the clear use of annotations on the instrument-specific standards to effectively show that the evidence in the student response has been appropriately aligned to the descriptors in each criterion and, on-balance, matched to an A-standard response despite some characteristics being matched to the B-standard performance-level descriptors (Excerpt 1)
- evidence of ‘documentation’ rather than ‘statement’ of relevant observations (Excerpt 2)

- the evidence in the response judged as accurately translating simple and complex aspects of the task (Excerpt 3)
- appropriate 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 (Excerpts 4–5)
- the evidence in a student response judged as having the use of mathematical reasoning to justify decisions made, and provision of supporting evidence to document relevant strengths and limitations of the solutions to be able to make an evaluation of the reasonableness of the solution (Excerpts 6–8)
- an alignment to the match of evidence for the correct use of appropriate vocabulary and conventions to develop a response, which is organised using a suitable introduction, body and conclusion (Excerpt 9).

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

Excerpt 1

Instrument-specific standards (IA1): Problem-solving and modelling task

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
• statement of assumptions • statement of observations • translation of simple aspects of the problem by identifying mathematical concepts and techniques.	• use of simple procedures to make some progress towards a solution • application of simple mathematical concepts and techniques relevant to the task • use of technology.	• statement about the reasonableness of solutions • statement about strengths and/or limitations of the solution and/or model • statement about decisions made.	• use of some appropriate language and conventions to develop the response • adequate organisation of the response.	C
• statement of an assumption or an observation • translation of some simple aspects of the problem by identifying mathematical concepts and techniques.	• application of some simple procedures, mathematical concepts or techniques • superficial use of technology.	• statement about a decision and/or the reasonableness of a solution.	• use of everyday language to develop a response • basic organisation of the response.	D
• statement of an assumption, observation or translation of an aspect of the problem.	• inappropriate use of technology or procedures.	• inappropriate statement about a decision or the reasonableness of a solution.	• unclear and disjointed organisation of the response.	E

Essential Mathematics
Applied Senior Syllabus

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Excerpt 2

doc. obs

- It was observed that an above ground pool was more cost effective than an in-group pool when staying in the budget as the minimum price for a professionally installed pool was between $45,000 - $55,000, however the price for an above ground pool was $799. https://www.bunnings.com.au/bestway-5-49-x-2-74x-1-22m-above-ground-pool-power-steel-oval-pool-set_p0262780 (above ground pool)
  https://www.compasspools.com.au/101/how-much-does-a-pool-cost/ (in ground pool)
- It was observed that the 'plain grey concrete' was $75-85 per square metre and the 'exposed aggregate concrete' was $95-100 per square metre making the plain grey concrete the most cost-effective option.
  http://www.brisbaneconcreteservice.com/contact-us

Excerpt 3

2.3 Mathematical concepts and techniques

Linear measure	- Use metric units of length (mm, cm, m, km), their abbreviations, conversions between them, and appropriate levels of accuracy and choice of units
Area measure	- Use metric units of area (mm^2, cm^2, m^2, km^2) - Calculate areas of regular shapes - Calculate areas of composite figures by decomposing them into regular shapes
Interpret scale drawings	- Interpret commonly used symbols and abbreviations in scale drawings. - Find actual measurements from scale drawings. - Estimate and compare materials and costs using actual measurements from scale drawings
Creating scale drawings	- Understand and apply drawing conventions of scale drawings, including scales in ratio, clear indications of dimensions and clear labelling - Construct scale drawings by hand

accurate translation of maths

2

Excerpt 4

3.1 Concrete

As per the client's instructions, a concrete path (900mm x 100mm) has to surround the house: This ensured that the paths led into doorways for the most practical design. The path was broken into 8 sections by decomposing the path into regular shapes (rectangles). Then a formula was used to find the drawing to real scale of the concrete path by using 1:100 then measuring the length and width of the path (Appendix 1). After, the real-life measurement was converted from millimetres to metres and then used in to find the volume using the V = l x w x h formula. Once the volume was found for all 8 parts of the path, the sum of the entire path was found, while considering the area measure as this was how the company chosen applied the pricing policy (Appendix 2). To conclude, it was found that 4.2219m^3 of concrete was needed to create the concrete path, resulting in the total cost for the path come to $4221.90 for 'exposed aggregate concrete' being $95-$100 per m^3.

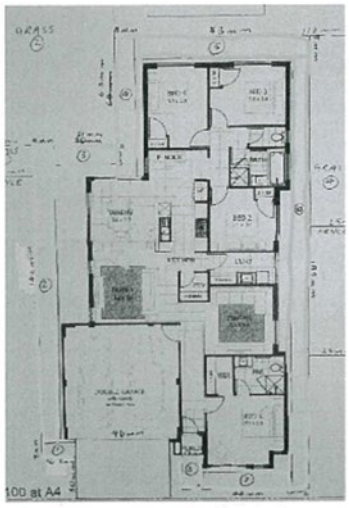
2.4 Use of Technology

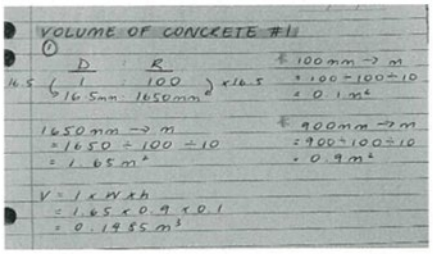
The technology used to develop the plan are:

- Google – used to find prices, suppliers, and materials.
- Calculator – used to find answers to formulas.
- Excel – use for repeated calculations.
- Microsoft Word – used to document the task.
- Ruler – to find the length/width of scale drawing.
- iPhone – to take photos of scale drawing.

=B2*C2*D2

B	C	D	E	F
ıgth in ters	Width in meters	Depth in meters	Volume cubic meters	Area meters
1.65	0.9	0.1	0.1485	1.48
1.46	0.9	0.1	0.1314	1.31





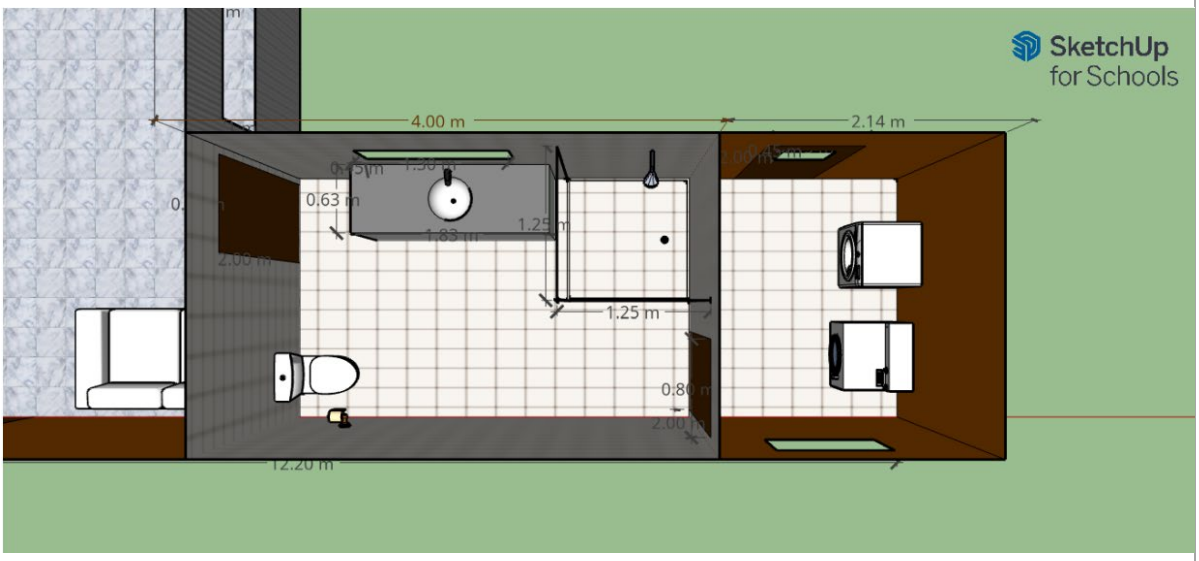
Scale calculation	
Drawing	Real
1	100
9mm	900mm

Section of path	Length in metres	Width in metres	Depth in metres	Volume cubic metres	Area metres squared
1	1.65	0.9	0.1	0.1485	1.485
2	1.46	0.9	0.1	0.1314	1.314
3	3.1	0.9	0.1	0.279	2.79
4	6.3	0.9	0.1	0.567	5.67
5	8.3	0.9	0.1	0.747	7.47
6	19.9	0.9	0.1	1.791	17.91
7	4.4	0.9	0.1	0.396	3.96
8	1.8	0.9	0.1	0.162	1.62
			Total	4.2219	42.219

discerning use of maths.

Section of path	Length in metres	Width in metres	Depth in metres	Volume cubic metres	Area metres squared
1	1.65	0.9	0.1	=B2*C2*D2	=B2*C2
2	1.46	0.9	0.1	=B3*C3*D3	1.314
3	3.1	0.9	0.1	=B4*C4*D4	2.79
4	6.3	0.9	0.1	=B5*C5*D5	5.67
5	8.3	0.9	0.1	=B6*C6*D6	7.47
6	19.9	0.9	0.1	=B7*C7*D7	17.91
7	4.4	0.9	0.1	=B8*C8*D8	3.96
8	1.8	0.9	0.1	=B9*C9*D9	1.62
			Total	=SUM(E2:E9)	=SUM(F2:F9)

Excerpt 5

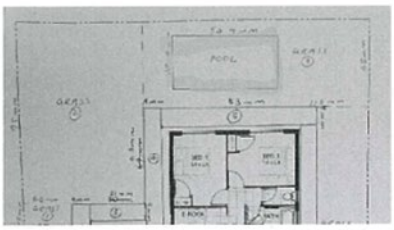


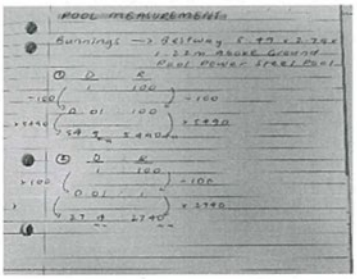
Excerpt 6

Justification of decision with mathematical reasoning.

3.5 Feature 1 – Pool

The first feature added was an above ground pool. After thorough research it was determined that an above ground pool was the most practical feature chosen in comparison to an underground pool to ensure the cost overall did not go over the budget as it was found an inground pool can cost between $45,000 - $55,000 ("How Much Does a Pool Cost? | Compass Pools Australia," 2018). Thus, the pool chosen was above ground costing $799 from Bunnings Warehouse, titled Bestway 5.49 x 2.74 x 1.22m (Appendix 5) above ground pool power steel oval pool set' ("Bestway 5.49 X 2.74 X 1.22m above Ground Pool Power Steel Oval Pool Set," 2022). It was decided that the most appropriate place for the pool to go was in the top right corner of the backyard as it is out of the walkway and not against the fence. The real measurements were taken from the website and converted to 1:100 scale to fit on the spreadsheet as seen below:





4.0 Evaluation considered results, observations & limitations

4.1 Reasonableness

It can be concluded that the requirements of the task were met. A suburban backyard was designed with the following features: a concrete pathway, driveway that leads to the road and a grassed area for activities while staying within the budget. An observation that was made about the budget being between $5000 and $75,000. This requirement was met. An assumption that was made prior to designing the task was that the prices would not increase after finding them online, however this is not realistic as prices would often change in real life. This limitation occurred when I was buying grass. The price was $12.50 when I first started this task, however it recently went on sale for cheaper to $11.90

Excerpt 7

Limitations:

- The sample size of 30 students could be argued that it is not enough students to portray the fairest, most reliable and accurate data results - this is because each grade will usually contain 100+ students, therefore leaving 70% of the people out of the equation

Excerpt 8

Meaning that the square prism has a greater surface area and volume taking up more room and using more materials to make. Design 1 is reasonable because it is low cost saving the business time and money as it is does not take up much space and a simple design compared to box 2 while still using the best materials to create the box all ten circular biscuits fit inside box 1 neatly without damaging.

Design 1 has many strengths compared to box 2 as it smaller taking up less room and materials therefore more can be stacked into a larger box for transport saving the company more money. Design 1 is a cylinder making it the same shape as the biscuits making it a better fit than the square box. Although there are some limitations of this design as they are a cylinder they cannot stack into a larger box without a small gap in between each packet.

Excerpt 9

To improve the overall model, I can make the size of Design 1 smaller so that the biscuits do not move around in transport and perhaps damage them, also creating more space to transport the biscuits. Also, create a re sealable lid for the customers to preserve the biscuits.

Conclusion:

In conclusion the task as a new chief designer in a biscuit company was to create a proposal of a new high-quality biscuit and a box to hold ten of the biscuits. During the designing process a circular biscuit was designed along with a cylinder as it was proven better than box 2 which was a square prism this is because the cylinder box takes up less room while still fitting the biscuits neatly stacked on top of each other. This proposal will stand up to our company's standards and needs.

Practices to strengthen

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

- when making judgments in the Evaluate and verify criterion, a clear distinction is made between 'documentation' versus 'statement'. In this criterion, clear demonstration of
  - the 'documentation of relevant strengths and limitations' versus 'statements about relevant strengths and limitations' should include strengths and limitations related to the student's solution with supporting evidence, e.g. this could be in the form of a reference or identification of historical data relating to the task
  - 'evaluation of the reasonableness of solutions by considering the results, assumptions and observations' should examine the implications of the results, assumptions and observations to determine the merit or significance of a student's solution, based on the task requirements.

Additional advice

- Make judgments on only the allowable page count and word length, as outlined in the syllabus conditions (Syllabus section 4.7.1). If a submitted student response exceeds the syllabus conditions, and redaction or some other school assessment strategy has not occurred before an overall judgment is made, clearly annotate the student work to explain how the school policy on managing excessive word length / page count has been applied (*QCE and QCIA policy and procedure handbook v5.0*, Section 8.2.6).
- Make judgments, using the instrument-specific standards, by clearly annotating (e.g. highlighting, ticking, circling or crossing out) each characteristic to show how it matches the qualities in the student response. As an example, it could involve highlighting the Standard A descriptor for 'justification of decisions' because supporting evidence was used and crossing out the Standard C descriptor for 'statement about strengths and/or limitations of the solution' because this was not provided. Such annotations provide useful feedback to students to assist them to refine their next problem-solving and modelling response. See the *Making exit judgments* factsheet in the Resources section of the Syllabuses application (app) in the QCAA Portal.
- Use the pattern of evidence in the annotated instrument-specific standards to determine an on-balance grade, but do not
  - alter the wording of the instrument-specific standards (*QCE and QCIA policy and procedures handbook v5.0*, Section 7.3.2)
  - determine individual grades for each criterion
  - assign marks to arrive at an overall grade.

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 nine 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 markers matching student responses to the common internal assessment marking guide (CIAMG).

Effective practices

Overall, students responded well to:

- the scaffolded parts of simple familiar and complex familiar questions to demonstrate that all of the information to solve these problems is identifiable, i.e.
  - the required procedure is clear from the way the question is posed, or
  - in a context that has been a focus of prior learning.

Samples of effective practices

Short response

The following excerpt is Question 7a) and c) from Part A (Phase 2). It required students to calculate the volume of space within a pie shell. It required students to integrate the Fundamental topic: Calculations by applying approximation strategies to calculate the number of pie shells.

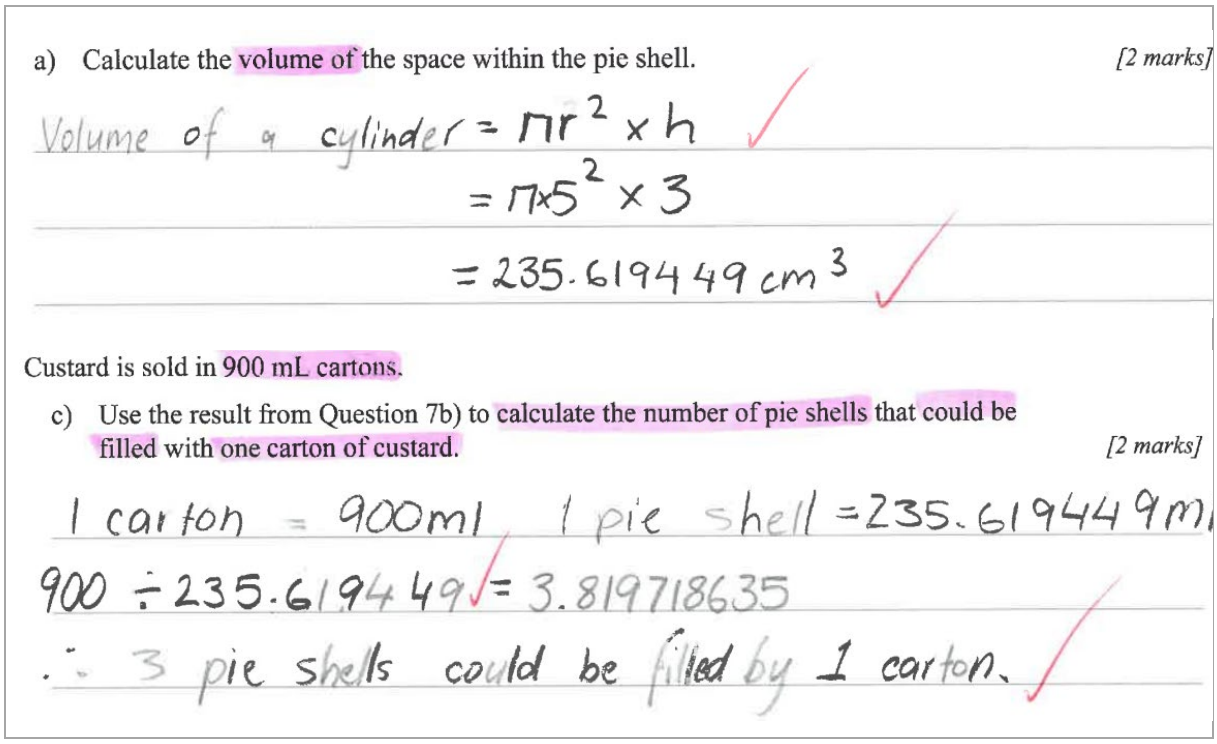
Effective student responses:

- recalled an appropriate rule
- calculated volume, including units
- used appropriate strategies
- calculated the number of pie shells.

This excerpt has been included:

- to demonstrate the use of ticks to indicate the location of each part of the response that matches the marking guide, i.e.
  - recall of an appropriate rule and/or substitution into an appropriate rule
  - calculation of the volume, including the units.

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


a) Calculate the volume of the space within the pie shell. *[2 marks]*

Volume of a cylinder = $\pi r^2 \times h$ ✓

$= \pi \times 5^2 \times 3$

$= 235.619449\ cm^3$ ✓

Custard is sold in 900 mL cartons.

c) Use the result from Question 7b) to calculate the number of pie shells that could be filled with one carton of custard. *[2 marks]*

1 carton = 900ml 1 pie shell = 235.619449ml

$900 \div 235.619449$ ✓ $= 3.819718635$

∴ 3 pie shells could be filled by 1 carton. ✓

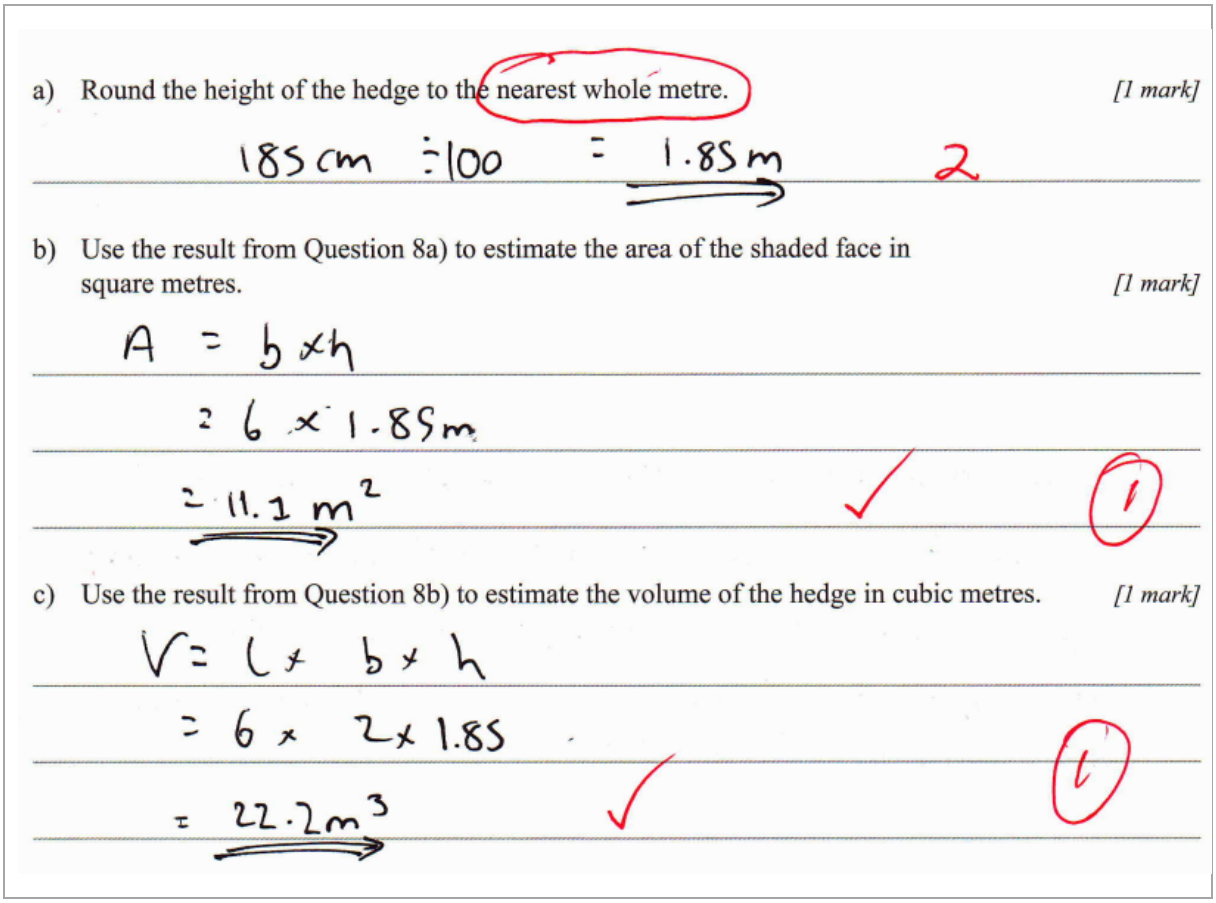
The following excerpt is Question 8 from Part A (Phase 2). It required students to apply a rounding strategy to estimate the area and volume of a long rectangular hedge.

Effective student responses:

- rounded the height of the hedge
- estimated the area of the shaded face
- estimated the volume of the hedge.

This excerpt has been included:

- to show the feedback the teacher provided by circling the words in the question instruction (i.e. 'to the nearest whole number') that was not addressed in the student response
- to demonstrate the use of ticks to indicate the location of each part of the response that matches the marking guide, i.e.
  - recall of appropriate rule and/or substitution into appropriate rule
  - estimations of the area and volume
- to demonstrate the use of follow-through (FT) marks in Q8 b) and c) based on the incorrect answer in Q8 a).


a) Round the height of the hedge to the nearest whole metre. *[1 mark]*

185 cm ÷ 100 = 1.85 m 2

b) Use the result from Question 8a) to estimate the area of the shaded face in square metres. *[1 mark]*

A = b × h

= 6 × 1.85 m

= 11.1 m^2 ✓ 1

c) Use the result from Question 8b) to estimate the volume of the hedge in cubic metres. *[1 mark]*

V = l × b × h

= 6 × 2 × 1.85

= 22.2 m^3 ✓ 1

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 perfect mark of 50 is clearly written on the student response together with the correct grade clearly annotated, even though the corresponding mark cut-off was not annotated. While the descriptors have not been used to determine the overall grade, they 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	50 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

Practices to strengthen

It is recommended that when preparing students for the CIA, teachers consider:

- reviewing past and mock CIAs to allow students to gain some familiarity with the type of questions in terms of the degree of difficulty, e.g. differences between simple familiar, complex familiar and complex unfamiliar questions
- reviewing past and mock CIAs to allow students to gain familiarity with the allocation of marks and particular formatting of certain questions, e.g. a 1-mark question may only require one-word or one-number responses, but questions worth more than one mark require mathematical reasoning and/or working to be shown to support answers
- encouraging students to attempt to respond to all questions rather than leaving them blank, e.g. stating relevant formulas based on the information contained in the questions could be awarded 1 mark.

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 of time. Students will 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	68
Authentication	25
Authenticity	43
Item construction	26
Scope and scale	53

*Each priority might contain up to four assessment practices.

Total number of submissions: 486.

Effective practices

Validity priorities were effectively demonstrated in assessment instruments that:

- followed conventions for item construction by providing up-to-date stimuli
- identified the topic/s relevant to the task
- clearly differentiated the draft checkpoint from progress checkpoints.

Practices to strengthen

It is recommended that assessment instruments:

- align the task to Unit 4 subject matter and assessment specifications, ensuring opportunity for students to demonstrate simple and [complex] subject matter
- are within the scope and scale of information, knowledge and skills required to complete the task appropriate for the syllabus conditions, e.g. avoiding the use of complex financial concepts and formulas.

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	15
Layout	6
Transparency	8

*Each priority might contain up to four assessment practices.

Total number of submissions: 486.

Effective practices

Accessibility priorities were effectively demonstrated in assessment instruments that:

- provided a purposeful and relevant context scenario that highlights a real-life application of mathematics relevant to the students
- avoided language and bias issues
- provided a clear and consistent layout, e.g. ensured tables and/or graphs were not broken up or split across pages.

Practices to strengthen

It is recommended that assessment instruments:

- use appropriate mathematical language and terminology aligned with the problem-solving and mathematical modelling approach and syllabus specifications.

Additional advice

- Ensure tasks are developed with a contextual problem to be solved using the Fundamental topic: Calculations and Unit 4 subject matter.
- Provide tasks that are accessible and relevant for young people in their local context, making sure to avoid any language and/or bias issues.
- To elicit a unique student response with an independent approach for problem-solving and modelling, avoid explicit or step-by-step scaffolding within the task.

- Provide a purposeful context that highlights a real-life application of mathematics, e.g. comparing loans in the context of purchasing a vehicle or setting up a business.

Internal assessment 4 (IA4)

Examination — short response

This assessment is a supervised examination. 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	133
Authentication	0
Authenticity	15
Item construction	120
Scope and scale	158

*Each priority might contain up to four assessment practices.

Total number of submissions: 486.

Effective practices

Validity priorities were effectively demonstrated in assessment instruments that:

- ensured opportunities in the examination to address all assessable objectives, particularly Objective 4: evaluate the reasonableness of solutions
- provided questions with an authentic, relevant, real-world context, e.g. data from a survey on shopping preferences to determine probability, plotting business earnings on a Cartesian plane
- ensured opportunities to representatively sample Unit 4 subject matter across the three topics and the Fundamental topic.

Practices to strengthen

It is recommended that assessment instruments:

- align with Unit 4 topics and sub-topics by wording questions to specifically address the syllabus subject matter, e.g. describe the association between two numerical variables in terms of strength, rather than how strong the relationship is
- allocate simple familiar marks to questions with simple subject matter only, e.g. the simple subject matter ‘find the line of best fit by eye’ should be allocated simple familiar marks only.

The ‘use the line of best fit to make predictions, both by interpolation and extrapolation’ is considered [complex] subject matter and should not be allocated simple familiar marks

- allocate complex marks to questions with [complex] subject matter. Repeating the simple subject matter for questions (such as ‘construct a sample space for an experiment’ then ‘use a sample space to determine the probability of outcomes for an experiment’) does not align with the required complex familiar and complex unfamiliar degrees of difficulty (Syllabus section 5.7.2).

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	8
Language	32
Layout	9
Transparency	20

*Each priority might contain up to four assessment practices.

Total number of submissions: 486.

Effective practices

Accessibility priorities were effectively demonstrated in assessment instruments that:

- considered the layout of each question so that response space was adequate and allowed for multiple attempts, if required
- avoided bias by using contexts that did not require specialist knowledge or understanding, e.g. avoided the use of terms such as ‘complement’, ‘expected number’ and/or constructing and using two-way frequency tables to determine the outcomes and the probabilities for experiments.

Practices to strengthen

It is recommended that assessment instruments:

- use clear instructions and diagrams, correct textual features and appropriate language, e.g. use consistent and clear textual features, diagrams and appropriate language to provide cues that align with the requirements of the instrument and the required response for the question
- provide clear and consistent cues aligned to the specified degree of difficulty and expected response for the question, i.e. avoid including information that is not needed to solve the problem
- avoid the use of specialised or colloquial language.

Additional advice

- Ensure that every item is contextualised according to syllabus specifications, has adequate time allocated, and is assigned the appropriate degree of difficulty (Syllabus section 5.7.2).

- Schools should ensure the marking scheme matches the examined subject matter by having teachers work through the examination before submission.
- It is recommended that teachers watch the Units 3 and 4 Maths moments videos accessible via the Resources section in the Syllabuses app in the QCAA Portal to provide training and support for writing examinations.