Essential Mathematics subject report

2025 cohort

January 2026

Queensland Government
QCAA Queensland Curriculum & Assessment Authority

260028

For all Queensland schools

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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 2025 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 2026.

The report also includes information about:

- applying syllabus objectives in the design and marking of assessments
- patterns of student achievement
- important considerations to note related to the revised 2025 syllabus (where relevant).

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

505
schools offered Essential Mathematics

8%
improvement in endorsed IA1 at Application 1

94.51%
of students received a C or higher

Subject data summary

Subject completion

Note: All data is correct as at January 2026. 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: 505.

Completion of units	Unit 1	Unit 2	Units 3 and 4
Number of students completed	20,532	20,945	17,716

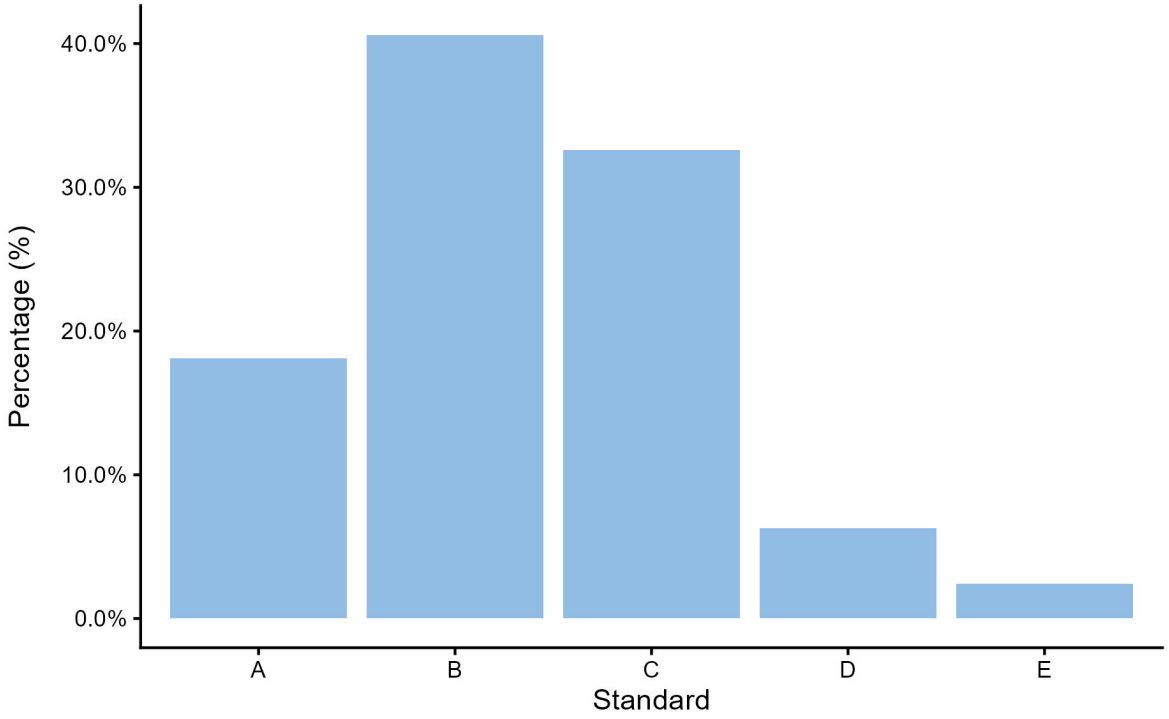
Units 1 and 2 results

Number of students	Unit 1	Unit 2
Satisfactory	17,972	18,658
Unsatisfactory	2,560	2,287

Units 3 and 4 internal assessment (IA) results

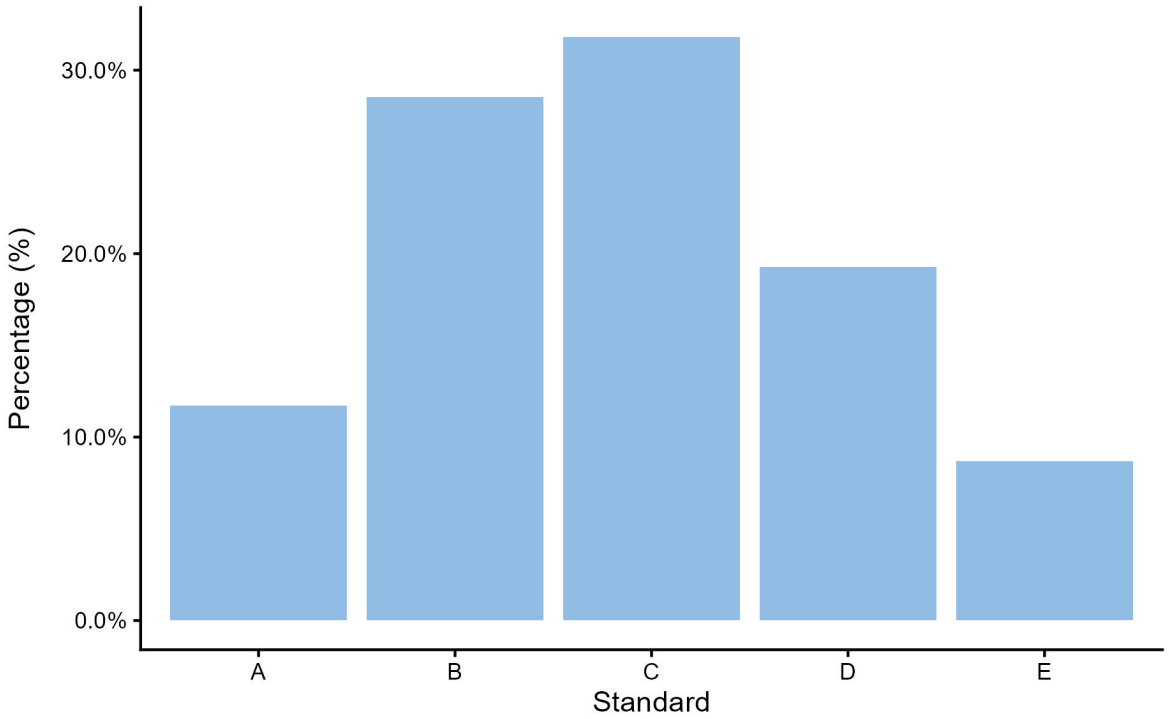
IA1 standards

IA1 total



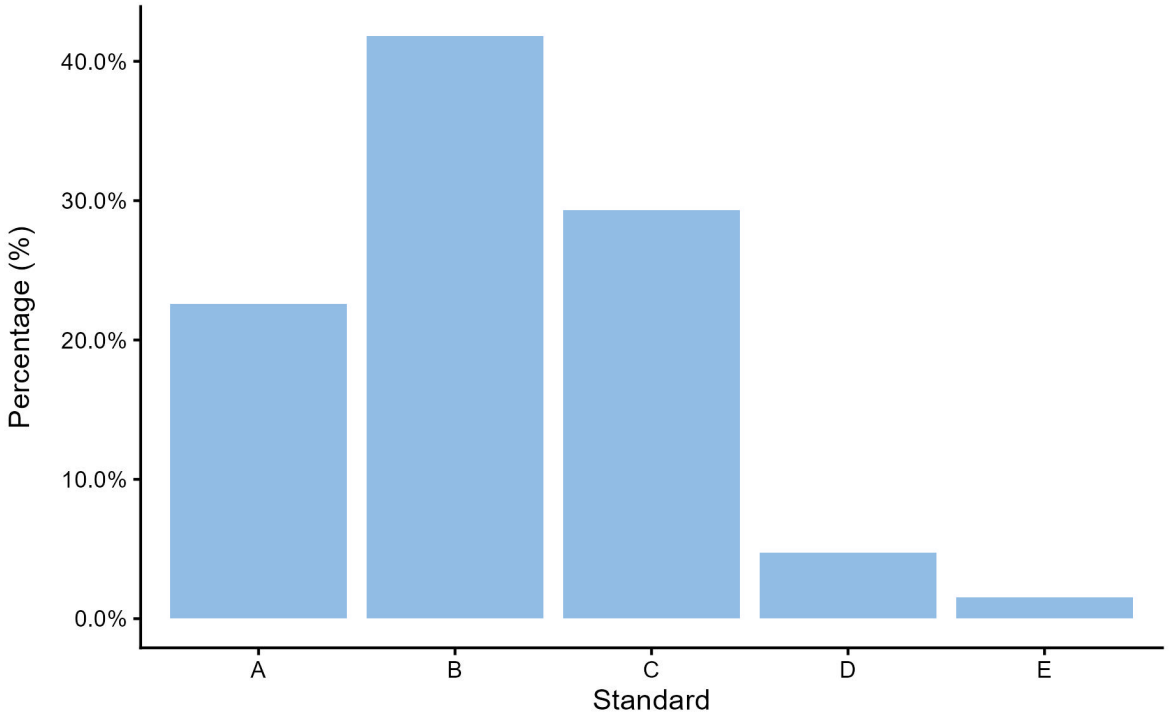
IA2 (CIA) standards

IA2 total



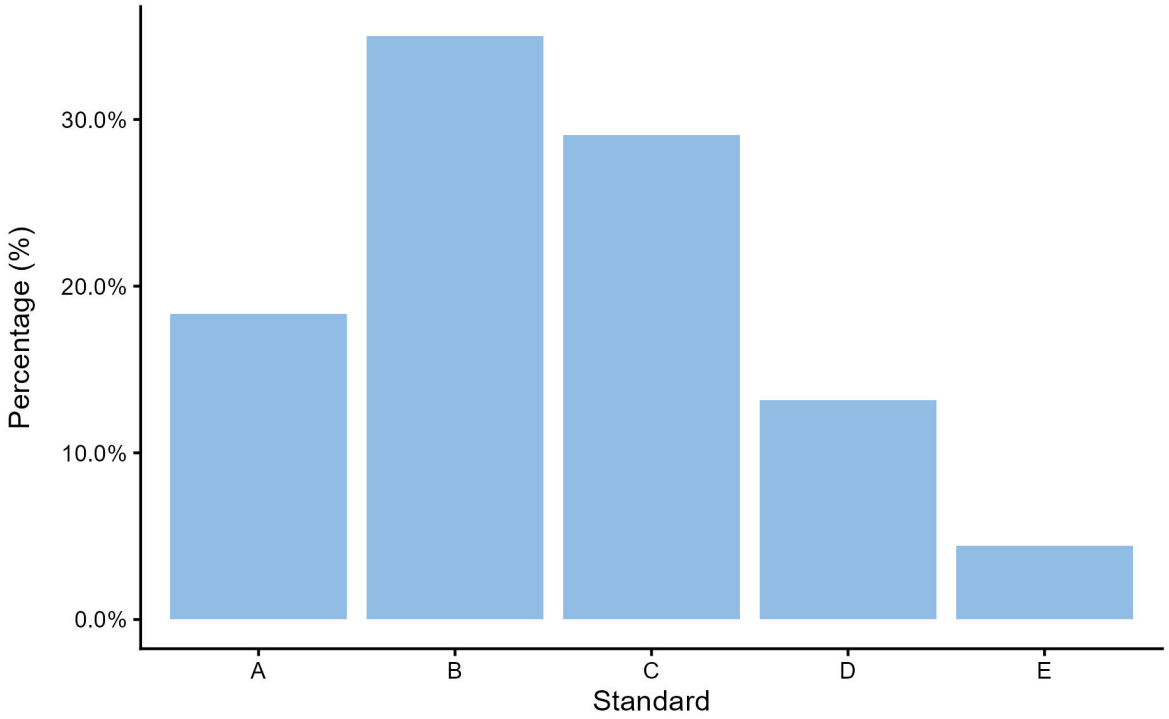
IA3 standards

IA3 total



IA4 standards

IA4 total



Final subject results

Distribution of standards

Number of students who achieved each standard across the state.

Standard	A	B	C	D	E
Number of students	2,256	7,787	6,701	923	49
Percentage of students	12.73	43.95	37.82	5.21	0.28

Internal assessment

This information and advice relate 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 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 v7.0*, Section 9.5.

Percentage of instruments endorsed in Application 1

Number of instruments submitted	IA1	IA3	IA4
Total number of instruments	509	513	512
Percentage endorsed in Application 1	70	69	49

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 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 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	61
Authentication	46
Authenticity	23
Item construction	19
Scope and scale	31

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
- clearly indicated checkpoints to differentiate between teacher progress checks and the submission of only one draft for feedback (see *QCE and QCIA policy and procedures handbook v7.0*, Section 8.2.5).

Practices to strengthen

It is recommended that assessment instruments:

- demonstrate appropriate scope and scale by requiring subject matter from Fundamental topic: Calculations, and at least one topic from Unit 3
- minimise scaffolding, e.g. allow students to demonstrate an independent approach to modelling and problem-solving by removing lists of steps or requirements
- provide students with the opportunity to meet all assessable objectives, such as evaluating the reasonableness of solutions (Objective 4) and justifying procedures and decisions using mathematical reasoning (Objective 5), e.g. by assessing results or explaining methods for a scale drawing or calculated area.

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	7
Layout	2
Transparency	6

Effective practices

Accessibility priorities were effectively demonstrated in assessment instruments that:

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

Practices to strengthen

There were no significant issues identified for improvement.

Additional advice

When developing an assessment instrument for this IA, it is essential to consider the following key differences between the 2019 and 2025 syllabuses:

- Unit 3 is now titled Measurement, scales and chance, reflecting the reorganisation of subject matter. Topic 3 is now titled Probability and relative frequencies (moved from Unit 4 Topic 2 in the 2019 syllabus).
- The duration of 5 weeks has been removed from the assessment conditions.
- The unit and assessment objectives have been revised to improve clarity, while maintaining the original intent and ensuring stronger alignment with the instrument-specific standards.
- Characteristics and descriptors within the four criteria in the instrument-specific standards have been revised, e.g. at the A grade for the Formulate criterion, the characteristic ‘documentation of appropriate assumptions’ has been revised to ‘justified statements of important assumptions’.

Assessment decisions

Reliability

Reliability refers to the extent to which the results of assessments are consistent, replicable and free from error.

Number of submissions received and reviewed: 493.

Effective practices

Reliable judgments were made using the instrument-specific standards for this IA when:

- for the Formulate criterion, evidence was matched to the A-standard performance level where the student response demonstrated accurate translation of all aspects of the problem by identifying relevant mathematical concepts and techniques that were specific to the problem, rather than a list of general definitions
- for the Solve criterion, evidence was matched to the A-standard performance level where the student response demonstrated accurate use of complex procedures to reach a valid solution, e.g. shown by annotating where the student had used complex procedures in their solution to determine the volume of an in-ground pool with a composite shape base.

Practices to strengthen

When making judgments for this IA for the 2025 syllabus, it is essential to consider the following key differences between the instrument-specific standards in the 2019 and 2025 syllabuses:

- In the 2025 syllabus, each descriptor describes a single characteristic that may be evidenced in a student response, while some descriptors in the 2019 syllabus contained several characteristics. Therefore, when the school makes a judgment on a characteristic in the revised syllabus, it must be the whole descriptor that is matched to the evidence available.

To further ensure reliable judgments are made using the instrument-specific standards for this IA, it is recommended that:

- for the Solve criterion, evidence is matched to the A- or B-standard performance-level descriptors for accurate and/or appropriate use of technology where it reflects applications beyond simple computation or word processing, as required by syllabus conditions
- teachers use the pattern of evidence across the four criteria to determine an overall grade, based on an on-balance judgment, not an individual grade for each criterion
- teachers and schools consult the following resources in the QCAA Portal
  - *Understanding General and Applied (Essential) syllabuses* in the Learning Hub application (app)
  - *Unpacking internal assessment terminology: Essential Mathematics IA1 — PSMT* in the Syllabuses app
  - the *Making judgments* webinar in the Syllabuses app.

Additional advice

Schools should:

- ensure teachers judge student achievement by aligning the evidence in student responses with the characteristics of the instrument-specific standards, and

- if the work clearly matches all the characteristics in the performance-level descriptors, award the grade of that performance level
- if the work matches characteristics from more than one performance-level descriptor, choose the performance level that on-balance fits, overall, the evidence found in the student work.

Samples

The following excerpt demonstrates discerning application of simple and complex mathematical concepts and techniques relevant to the task.

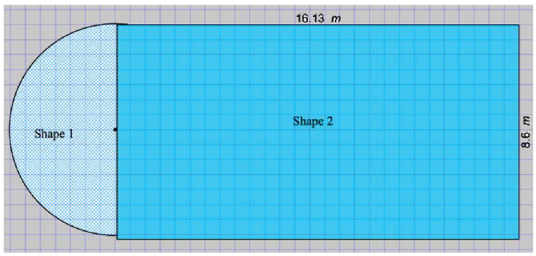
Note: The characteristic/s identified may not be the only time the characteristic/s occurred throughout a response.

Area calculation for proposed splash pad

$$Area = Length \times Width$$
$$= 28.71 \times 14.49$$
$$= 416.0079$$
$$\approx 416m^2$$
$$\therefore \text{the total area of the proposed splash pad is } 416m^2.$$

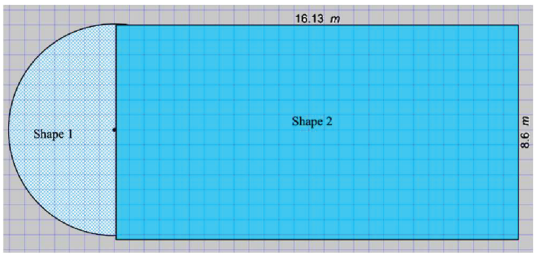
Area Calculations for Shape 1

$$Area = \frac{\pi r^2}{2}$$
$$= \frac{\pi \times 4.3^2}{2}$$
$$\approx 29.04m^2$$
$$\therefore \text{the total area of shape 1 is } 29.04m^2.$$



Area Calculation for Shape 2

$$Area = Length \times Width$$
$$= 16.13 \times 8.6$$
$$= 138.72m^2$$
$$\therefore \text{the total area of shape 2 is } 138.72m^2.$$



Total Area of Shapes

$$Total\ Area = Area\ of\ Shape\ 1 + Area\ of\ Shape\ 2$$
$$= 29.04 + 138.72$$
$$= 167.76\,m^2$$
$$\therefore \text{the total area of both shapes is } 167.76\,m^2$$

Note: This student response has been modified for clarity.

The following excerpt demonstrates evaluation of the reasonableness of solutions by considering the results, assumptions and observations. In some cases, arranging the assumptions and observations in a table can be an appropriate method.

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

4.3 Evaluating reasonableness by considering Assumptions

Assumptions	Reasonableness
The splash pad consists of composite shapes which may include a circle, square or rectangle.	Most real-world designs are based off composite and geometric shapes, as it allows for simple and precise measurements and calculations to be made (Anthony & Sylvan Pools, 2025).
The surface of the splash pad is made with a non-slip material.	Splash pads are constructed with non-slip surfaces preventing accidents and injuries, creating a safer environment for children (Bexley pools, n.d).

4.4 Evaluating reasonableness by considering Observations

Observations	Reasonableness
The selected WPE was Leo the Lion. The dimensions are 2.05m in length and 0.91m in width.	This aligns with the needs of the ELC, and fits within the proposed area and allows for the correct measurements to be made.
The depth of the pool is 25cm.	Provides a safe and shallow water level for young children, also allows for correct measurements to be made for splash pad (Adelaide Hills Recreation Centre, n.d).

Note: WPE refers to Wet Play Equipment. ELC refers to Early Learning Centre.

The following excerpt demonstrates accurate and appropriate use of technology and the accurate translation of all simple and complex aspects of the problem by identifying mathematical concepts and techniques. Arranging the mathematical concepts and relevant spreadsheet formulas in a table can be an appropriate method.

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

Mathematical Concepts and Techniques:

This table shows the formula's and where the formulas are in the spreadsheet. I will be using Excel to make all my graphs and to do my calculations for me.

Formula Description	Formula	Spreadsheet
Mean	$\bar{x} = \frac{sum\ of\ all\ data\ values}{number\ of\ data\ values}$	=AVERAGE(B2:B32)
Mode	Most common	=MODE(B2:B32)
Median	The middle of a data set	=MEDIAN(B2:B32)
Range – Spread of all the data	$range = highest - lowest$	=B44-B40
IQR – Spread of the middle half of the data	$IQR = Q3 - Q1$	=B43-B41
SD – Standard Deviation		=STDEV.S(B2:B32)
Five Number Summary		=QUARTILE(B2:B32,0) =QUARTILE(B2:B32,1) =QUARTILE(B2:B32,2) =QUARTILE(B2:B13,3) =QUARTILE(B2:B32,4)

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) consisted of nine short response items (40 marks)
- complex (Part B) consisted of two short response items (10 marks).

The examination assessed subject matter from Unit 3. Questions were derived from the context of measurement, scales and data and the Fundamental topic: Calculations.

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 when they:

- used the response space associated with the question, where required
- provided a logical flow in their response, including appropriate mathematical conventions where appropriate
- 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:

- take part 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*, available from the Noticeboard in the QCAA Portal
- review the information in the CIA teacher pack.

Additional advice

Schools should:

- provide opportunities for students to engage with the relevant Unit 3 subject matter and experience the types of questions used in the CIA (see past papers in the Units 3 and 4 resources section of the Syllabuses app)
- ensure they are familiar with the revised subject matter order in the 2025 syllabus, specifically that
  - Unit 3 is now titled Measurement, scales and chance, reflecting the reorganisation of subject matter
  - Topic 3 is now titled Probability and relative frequencies, moved from Unit 4 Topic 2 in the 2019 syllabus.

Samples

Short response

Question 1 from Phase 2

This question required students to determine the unknown width of a rectangular frame using Pythagoras' theorem, then to calculate the perimeter of the rectangular frame.

Effective student responses:

- correctly applied Pythagoras' theorem to find the width of an unknown side
- appropriately rounded the width to the nearest centimetre as per the prompting in Question 1a)
- included appropriate units for both answers.

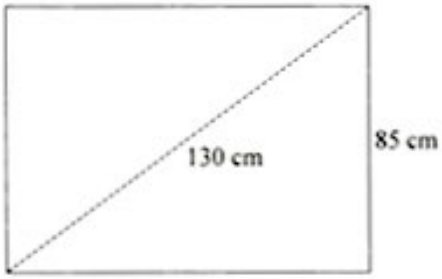
This excerpt has been included:

- to demonstrate the logical sequence and correct use of mathematical conventions in the response
- to show the school's effective method of
  - indicating where follow-through marks have been applied for the third mark of Question 1b)
  - clearly showing the total allocated marks for Question 1.

QUESTION 1 (6 marks) 5

A builder is constructing a rectangular frame with a diagonal brace, as shown.

Not to scale



a) Use Pythagoras' theorem to calculate the width of the frame, rounded to the nearest centimetre. *[3 marks]*

$c^2 = a^2 + b^2$ ✓

$a^2 = c^2 - b^2$

$a = \sqrt{130^2 - 85^2}$ ✓

$a = 98.861577 86$

$\approx 98\text{cm}$ ✓

b) Calculate the perimeter of the rectangular frame in metres. *[3 marks]*

perimeter = sum of all sides ✓

= L x 2 + W x 2 + Diagonal brace

= 98 x 2 + 85 x 2 + 130

= 496 cm ÷ 100 ✗

= 4.96m ✓FTE

Question 6 from Phase 2

Questions 6a) and 6b) required students to estimate the volume of a cylindrical storage tank using leading-digit approximation, then determine the approximate mass of animal feed in the storage tank.

Effective student responses:

- provided mathematical reasoning or working to support the answer
- used the conversion 800 kg/m^3 to determine the approximate mass
- included m^3 as the unit in Question 6a) and kg as the unit in Question 6b).

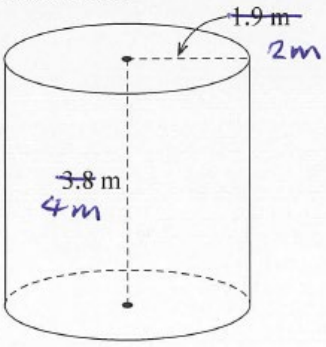
This excerpt has been included:

- to show an appropriate method for indicating use of leading-digit approximation
- to demonstrate an effective method for crossing out an incorrect response
- to provide an example of teacher annotations that clearly show 2 marks were allocated for Question 6a) and 1 mark was allocated for Question 6b).

QUESTION 6 (5 marks)

A farmer stores animal feed in storage tanks with the internal dimensions shown.

Not to scale



a) Use leading-digit approximation to estimate the volume of the storage tank, rounded to the nearest cubic metre. *[2 marks]*

$V = \pi r^2 \times h$

$= \pi \times 2^2 \times 4$ ✓

$= 50.26$ ✓

$= 50cm^3$ ~~$50m^3$~~

Animal feed weighs approximately 800 kilograms per cubic metre (kg/m^3).

b) Determine the approximate mass of animal feed in a full storage tank in kilograms. *[1 mark]*

800 kg/p m^3

50×800 ✓

$= 40\,000$ kg

Question 11 from Phase 2

This question required students to evaluate the appropriateness of a claim by determining unknown distances using the dimensions in a provided diagram.

Effective student responses:

- used an appropriate strategy to determine the missing vertical and horizontal distances
- provided mathematical reasoning to justify the decision on the appropriateness of the claim.

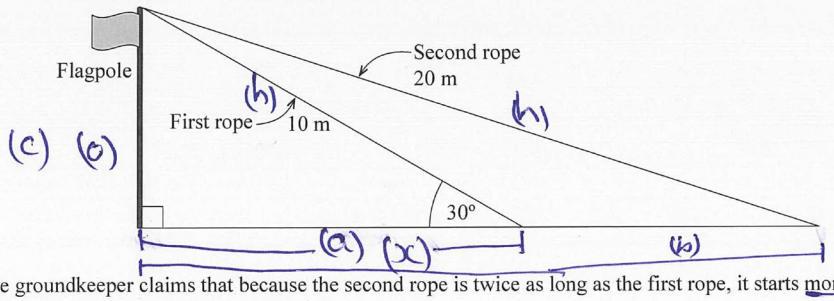
This excerpt has been included:

- to show the logical organisation of a response, including clear flow of the solution using appropriate mathematical terminology, symbols, conventions and representations
- to demonstrate appropriate rounding and use of units relevant to the context of the question.

QUESTION 11 (5 marks)

A flagpole is supported by two ropes, as shown.

Not to scale



The groundkeeper claims that because the second rope is twice as long as the first rope, it starts more than twice as far away from the flagpole.

Determine if the groundkeeper's claim is appropriate. Provide mathematical reasoning in your justification.

$\cos = \frac{a}{h}$

$= \frac{x}{10}$

$= \cos(30) \times 10$

$= x = 8.66\text{ m}$ ✓

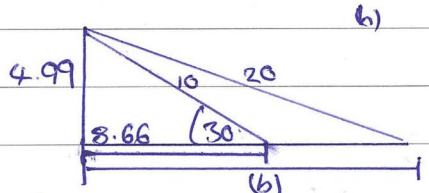
$\frac{o}{a} = \tan$

$\tan = \frac{o}{a}$

$= \frac{c}{8.66}$

$\tan(30) \times 8.66$

$c = 4.99$ ✓



(a)

$\cos = \frac{a}{h}$ ✓

$c^2 = a^2 + b^2$

$b^2 = c^2 - a^2$

$= 20^2 - 4.99^2$

$= \sqrt{375.09}$

$b = 19.37\text{ m}$ ✓

8.66×2

$= 17.32\text{ m}$

19.37m

The groundkeepers claim is ~~not~~ appropiate, although the second rope is twice as long as the first rope, it ~~is not~~ does start more than twice as far away than the flag pole. ✓

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 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	62
Authentication	33
Authenticity	23
Item construction	21
Scope and scale	46

Effective practices

Validity priorities were effectively demonstrated in assessment instruments that:

- explicitly identified the relevant topic/s from which students were required to independently select subject matter to solve the problem, ensuring consistency between the assessment requirements and curriculum content
- provided relevant and appropriate stimulus material that was readily accessible, e.g. a list of loan options or rental properties
- provided opportunities for students to identify observations and assumptions outside those detailed on the task sheet.

Practices to strengthen

It is recommended that assessment instruments:

- avoid heavily scaffolded steps or directed instructions in the task and stimulus materials, supporting students to take an independent approach to problem-solving and mathematical modelling. For instance, rather than prescribing specific techniques or step-by-step procedures, the task encourages individualised decision-making through open guidance (e.g. referencing syllabus content) without providing detailed instructions
- provide sufficient opportunity for the use of technology, appropriate to the task and school context, e.g. spreadsheeting, online calculators
- 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.

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	0
Language	9
Layout	2
Transparency	3

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

It is recommended that assessment instruments:

- provide clear instructions and cues that align with the unit objectives and instrument-specific standards, e.g. ‘use simple and complex mathematical procedures’.

Additional advice

When developing an assessment instrument for this IA, it is essential to consider the following key differences between the 2019 and 2025 syllabuses:

- Subject matter has been reorganised in the 2025 syllabus. Unit 4 is now titled Graphs, data and loans, reflecting the reorganisation of subject matter. Topic 2 is now titled Summarising and comparing data, moved from Unit 3 Topic 3 in the 2019 syllabus.
- The unit and assessment objectives have been revised to improve clarity, while maintaining the original intent and ensuring stronger alignment with the instrument-specific standards.

- Characteristics and descriptors within the four criteria in the instrument-specific standards have been revised, e.g. at the A grade for the Communicate criterion, the characteristic ‘coherent and concise organisation of the response, appropriate to the genre, including a suitable introduction, body and conclusion’ has been revised to ‘logical organisation of the response, which can be read independently of the task sheet’.

Assessment decisions

Reliability

Reliability refers to the extent to which the results of assessments are consistent, replicable and free from error.

Effective practices

Reliable judgments were made using the instrument-specific standards for this IA when:

- teacher annotations (e.g. highlighting, circling, ticking) indicated 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
- for the Evaluate and verify criterion, evidence was matched to the A-standard performance level where the response evaluated the reasonableness of the solution by interpreting results and referring to previously identified assumptions and observations
- for the Communicate criterion, evidence was matched to the A-standard performance level where the response included an introduction relevant to the task and a conclusion that responded to the problem that had been solved.

Practices to strengthen

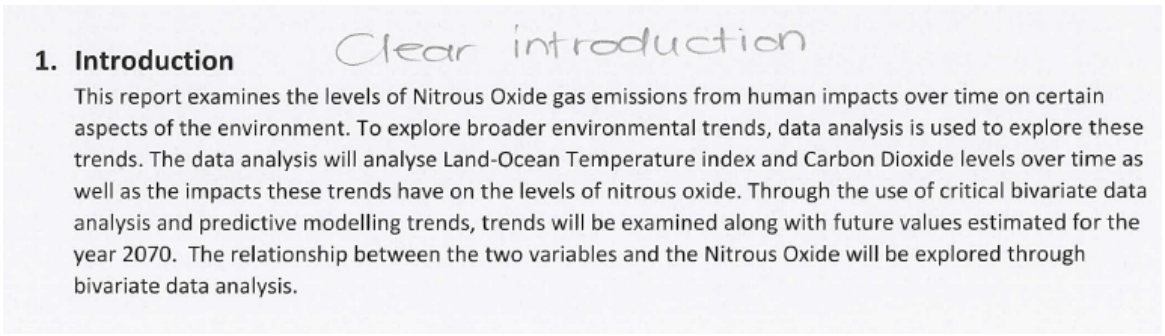
When making judgments for this IA for the 2025 syllabus, it is essential to consider the following key differences between the instrument-specific standards in the 2019 and 2025 syllabuses:

- For the Evaluate criterion in the 2025 syllabus, the A- and B-grade performance levels each have five descriptors. This has been revised from three descriptors for the Evaluate and verify criterion in the 2019 syllabus.
- For the Communicate criterion in the 2025 syllabus, the A-, B- and C-grade performance levels each have three descriptors, revised from two descriptors in the 2019 syllabus.

Samples

The following excerpt demonstrates coherent and concise organisation of the response, appropriate to the genre, through the inclusion of a suitable introduction that can be read independently of the task sheet.

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

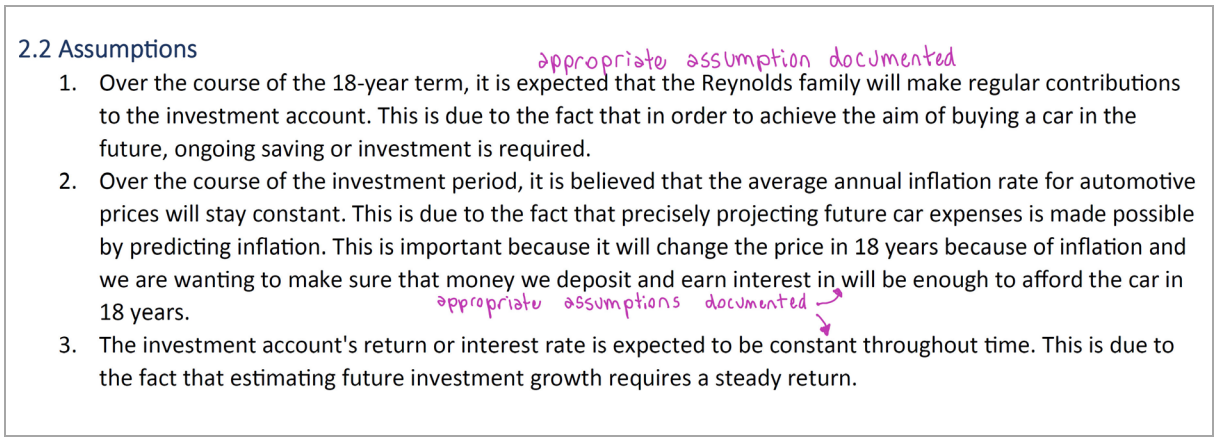


1. **Introduction** Clear introduction

This report examines the levels of Nitrous Oxide gas emissions from human impacts over time on certain aspects of the environment. To explore broader environmental trends, data analysis is used to explore these trends. The data analysis will analyse Land-Ocean Temperature index and Carbon Dioxide levels over time as well as the impacts these trends have on the levels of nitrous oxide. Through the use of critical bivariate data analysis and predictive modelling trends, trends will be examined along with future values estimated for the year 2070. The relationship between the two variables and the Nitrous Oxide will be explored through bivariate data analysis.

The following excerpt illustrates documentation of appropriate assumptions relevant to the problem by providing explanations to support the inclusion of each point. Teacher annotations identify where the response has demonstrated the characteristic 'documentation of appropriate assumptions' in the Formulate criterion.

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



2.2 Assumptions

appropriate assumption documented

1. Over the course of the 18-year term, it is expected that the Reynolds family will make regular contributions to the investment account. This is due to the fact that in order to achieve the aim of buying a car in the future, ongoing saving or investment is required.
2. Over the course of the investment period, it is believed that the average annual inflation rate for automotive prices will stay constant. This is due to the fact that precisely projecting future car expenses is made possible by predicting inflation. This is important because it will change the price in 18 years because of inflation and we are wanting to make sure that money we deposit and earn interest in will be enough to afford the car in 18 years.

appropriate assumptions documented

3. The investment account's return or interest rate is expected to be constant throughout time. This is due to the fact that estimating future investment growth requires a steady return.

The following excerpt illustrates evidence of accurate and appropriate use of technology relevant to the context of the task. This includes screenshots of the spreadsheet, equations used in the spreadsheet software, and a graph to represent the data generated in the spreadsheet.

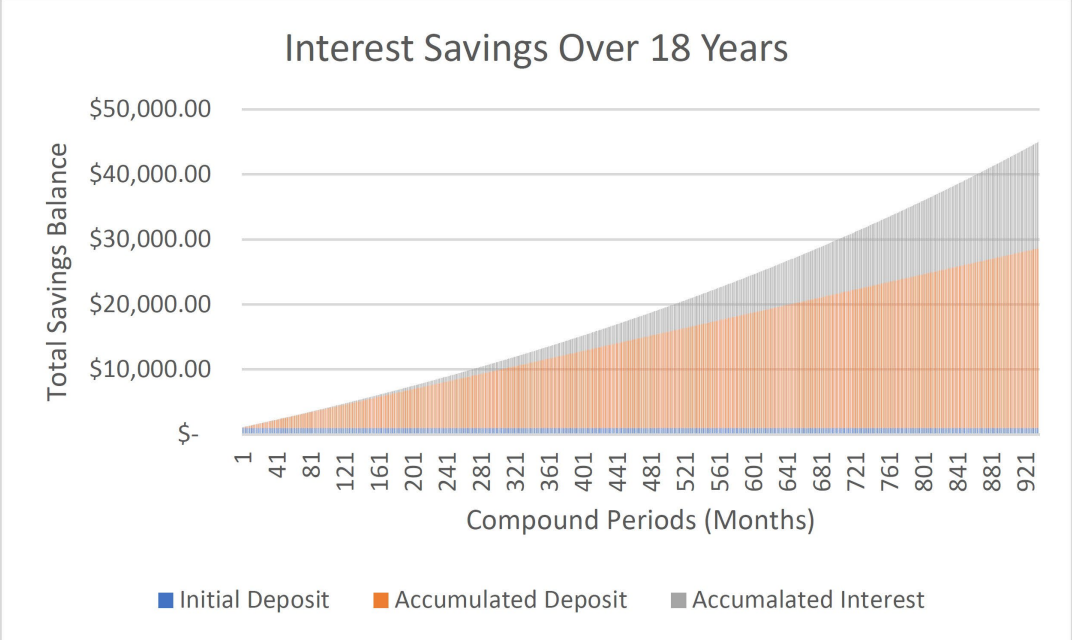
Note: The characteristic/s identified may not be the only time the characteristic/s occurred throughout a response.

	A	B	C	D	E	F	G	H
1	Starting Balance	$ 1,000.00						
2	Inerest Rate, % (p.a)	5						
3	Deposit	$ 29.50						
4	Legth of Inverstment (years)	18						
5	Compounding Periods per year	52						
6	Total Priods	936						
7								
8	Period	Balance	Regular Saving	Inerest	Saving Balance	Initial Deposit	Accumulated Deposit	Accumulated Interest
9	1	$ 1,000.00	$ 29.50	$ 0.96	$ 1,030.46	$ 1,000.00	$ 29.50	$ 0.96
10	2	$ 1,030.46	$ 29.50	$ 0.99	$ 1,060.95	$ 1,000.00	$ 59.00	$ 1.95
11	3	$ 1,060.95	$ 29.50	$ 1.02	$ 1,091.47	$ 1,000.00	$ 88.50	$ 2.97
12	4	$ 1,091.47	$ 29.50	$ 1.05	$ 1,122.02	$ 1,000.00	$ 118.00	$ 4.02
13	5	$ 1,122.02	$ 29.50	$ 1.08	$ 1,152.60	$ 1,000.00	$ 147.50	$ 5.10
940	932	$ 43,007.70	$ 29.50	$ 41.35	$ 43,078.55	$ 1,000.00	$ 27,494.00	$ 16,178.38
941	933	$ 43,078.55	$ 29.50	$ 41.42	$ 43,149.48	$ 1,000.00	$ 27,523.50	$ 16,219.80
942	934	$ 43,149.48	$ 29.50	$ 41.49	$ 43,220.47	$ 1,000.00	$ 27,553.00	$ 16,261.29
943	935	$ 43,220.47	$ 29.50	$ 41.56	$ 43,291.52	$ 1,000.00	$ 27,582.50	$ 16,302.85
944	936	$ 43,291.52	$ 29.50	$ 41.63	$ 43,362.65	$ 1,000.00	$ 27,612.00	$ 16,344.48
945	Total	$ 43,362.65						

Excel Calculator Formulas

	A	B	C	D	E	F	G	H
1	Starting Balance	1000						
2	Inerest Rate, % (p.a)	5						
3	Deposit	29.5						
4	Legth of Inverstment (years)	18						
5	Compounding Periods per year	52						
6	Total Priods	=B4*B5						
7								
8	Period	Balance	Regular Saving	Inerest	Saving Balance	Initial Deposit	Accumulated Deposit	Accumulated Interest
9	1	=B1	=$B$3	=B9*$B$2/100*1/52	=B9+C9+D9	=$B$9	=$C$9*A9	=$D$9
10	2	=E9	=$B$3	=B10*$B$2/100*1/52	=B10+C10+D10	=$B$9	=$C$9*A10	=H9+D10
11	3	=E10	=$B$3	=B11*$B$2/100*1/52	=B11+C11+D11	=$B$9	=$C$9*A11	=H10+D11
12	4	=E11	=$B$3	=B12*$B$2/100*1/52	=B12+C12+D12	=$B$9	=$C$9*A12	=H11+D12
13	5	=E12	=$B$3	=B13*$B$2/100*1/52	=B13+C13+D13	=$B$9	=$C$9*A13	=H12+D13
940	932	=E939	=$B$3	=B940*$B$2/100*1/52	=B940+C940+D940	=$B$9	=$C$9*A940	=H939+D940
941	933	=E940	=$B$3	=B941*$B$2/100*1/52	=B941+C941+D941	=$B$9	=$C$9*A941	=H940+D941
942	934	=E941	=$B$3	=B942*$B$2/100*1/52	=B942+C942+D942	=$B$9	=$C$9*A942	=H941+D942
943	935	=E942	=$B$3	=B943*$B$2/100*1/52	=B943+C943+D943	=$B$9	=$C$9*A943	=H942+D943
944	936	=E943	=$B$3	=B944*$B$2/100*1/52	=B944+C944+D944	=$B$9	=$C$9*A944	=H943+D944
945	Total	=E944						

Excel Calculator Graph



The following excerpt illustrates the correct use of appropriate conventions to develop the response. Appropriate conventions can include acknowledging sources in an appropriate manner.

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

Observation	Reference	Impact
Nitrous oxide gas emissions occur from Human Activity.	(NASA, 2024)	With the increased human activity, the nitrous oxide levels will continue to increase due to human activities. Due to the constant human activities, Nitrous Oxide levels will continue to rise and will not impact the linear model.
Nitrous Oxide gas emissions is more effective in trapping heat than carbon dioxide.	(Overview of Greenhouse Gases, 2025)	Nitrous oxide levels trap heat in the Earth's atmosphere 200 to 300 more effectively then Carbon Dioxide. Keeping the atmosphere around the Earth warmer/hotter for longer.

2.2 **Assumptions**

Assumption	Reference	Impact
It can be assumed that the increase of land-ocean temperature is due to farming		Human activities will remain constant to predict future values with linear model
Data is accurate	(Team, 2023)	Accurate data will lead to accurate future prediction
No natural disasters		So that it doesn't influence the linear model or change it to an exponential model

Internal assessment 4 (IA4)

Examination

This assessment is a supervised examination in two parts: simple (Part A) and complex (Part B). This 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	242
Authentication	0
Authenticity	5
Item construction	24
Scope and scale	84

Effective practices

Validity priorities were effectively demonstrated in assessment instruments that:

- provided opportunities for students to address all assessable objectives, particularly Objective 4: Evaluate the reasonableness of solutions and Objective 5: Justify procedures and decisions by explaining mathematical reasoning
- did not over-scaffold complex unfamiliar questions by making all information required to respond to the question immediately identifiable.

Practices to strengthen

It is recommended that assessment instruments:

- use language that aligns with the assessable objectives and instrument-specific standards, e.g. ‘describe the association between variables’ rather than ‘describe the relationship between variables’ when assessing simple subject matter
- only assess subject matter specified in the syllabus, e.g. constructing a scatterplot is not included in the 2019 syllabus subject matter
- allocate simple familiar marks only to questions addressing simple subject matter
- include [complex] subject matter in all complex familiar and complex unfamiliar questions, e.g. determining the future value of a compound loan with rests other than annual is considered [complex] 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	5
Language	23
Layout	2
Transparency	6

Effective practices

Accessibility priorities were effectively demonstrated in assessment instruments that:

- were free from textual and typographical errors such as grammar, spelling and formatting inconsistencies, e.g. contained clear and consistent labelling of parts of questions
- where relevant, provided adequate space for each question and/or extra space, grids or tables at the end of the examination, with no overflow of working space from one page to the next.

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 question, e.g. Use the given formula to complete the table of values.

Additional advice

When developing an assessment instrument for this IA, it is essential to consider the following key differences between the 2019 and 2025 syllabuses:

- Statistical concepts have been moved into Unit 4, which must be reflected in stimulus and question design.
- The phrasing of the unit objectives and assessment objectives has been revised.

Assessment decisions

Reliability

Reliability refers to the extent to which the results of assessments are consistent, replicable and free from error.

Effective practices

Reliable judgments were made using the instrument-specific standards for this IA when:

- the student response was annotated to clearly indicate where marks matching the school's marking scheme were allocated
- teacher annotations clearly identified where follow-through marks had been applied.

Practices to strengthen

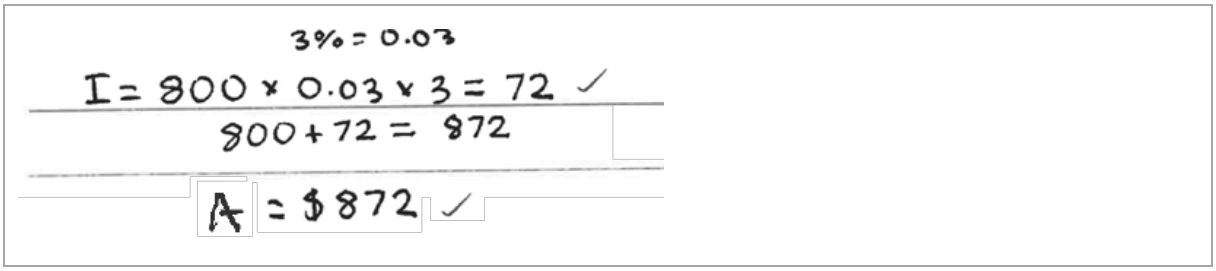
To further ensure reliable judgments are made using the instrument-specific standards for this IA, it is recommended that:

- schools apply internal quality assurance processes to check marking decisions, raw mark totals and percentages, and the application of cut-off percentages to allocate grades.

Samples

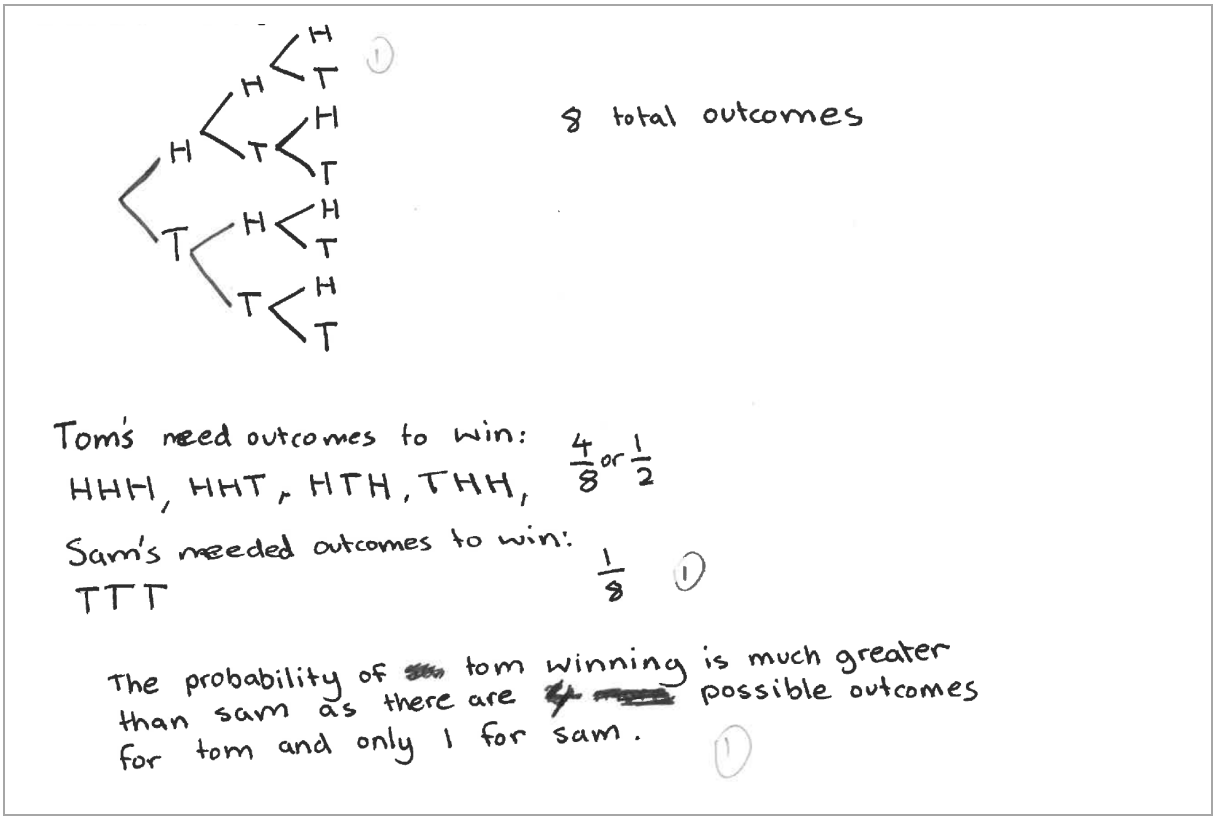
The following excerpt illustrates the allocation of marks for a simple interest problem: 2 marks in total, with 1 mark allocated for demonstrating an appropriate method and 1 mark for the correct answer, consistent with the school's marking scheme.

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



The following excerpt demonstrates use of a tree diagram to construct the sample space, then use of the sample space to answer the question. The response is well organised, flows clearly, and uses mathematical reasoning to justify the decision. Teacher annotations identify where each of the marks has been allocated.

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



The following excerpt demonstrates appropriate application of the Fundamental topic: Calculations within a complex question, where the results for quarterly and monthly total amounts have been appropriately rounded given the context of the task. The response also provides mathematical reasoning to support the decision made.

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