General Mathematics subject report

2025 cohort

January 2026

Queensland Government | QCAA Queensland Curriculum & Assessment Authority

260029

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Contents

Introduction

The annual subject reports seek to identify strengths and opportunities for improvement of internal and external 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 judgments, and student responses to external assessment for General and General (Extension) 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:

- how schools have applied syllabus objectives in the design and marking of internal assessments
- how syllabus objectives have been applied in the marking of external 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, consider 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 internal and external assessment.

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

471
schools offered General Mathematics

9%
improvement in endorsed IA1 at Application 1

96.36%
of students received a C or higher

Subject data summary

Unit completion

The following data shows students who completed the General subject.

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 General Mathematics: 471.

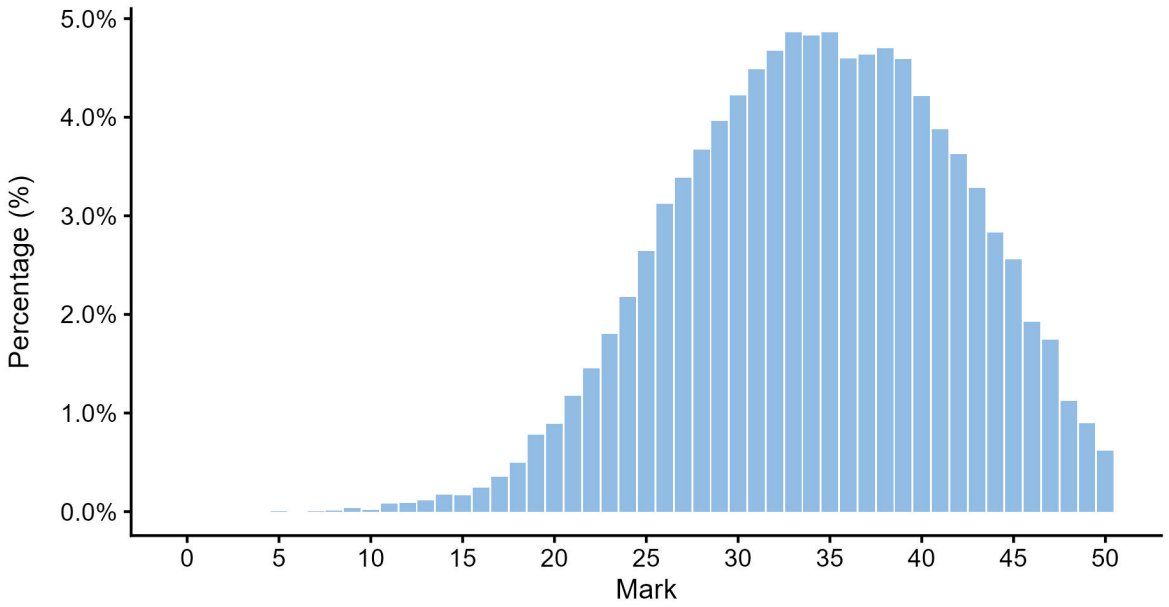
Completion of units	Unit 1	Unit 2	Units 3 and 4
Number of students completed	24,163	23,171	21,188

Units 1 and 2 results

Number of students	Unit 1	Unit 2
Satisfactory	21,036	20,181
Unsatisfactory	3,127	2,990

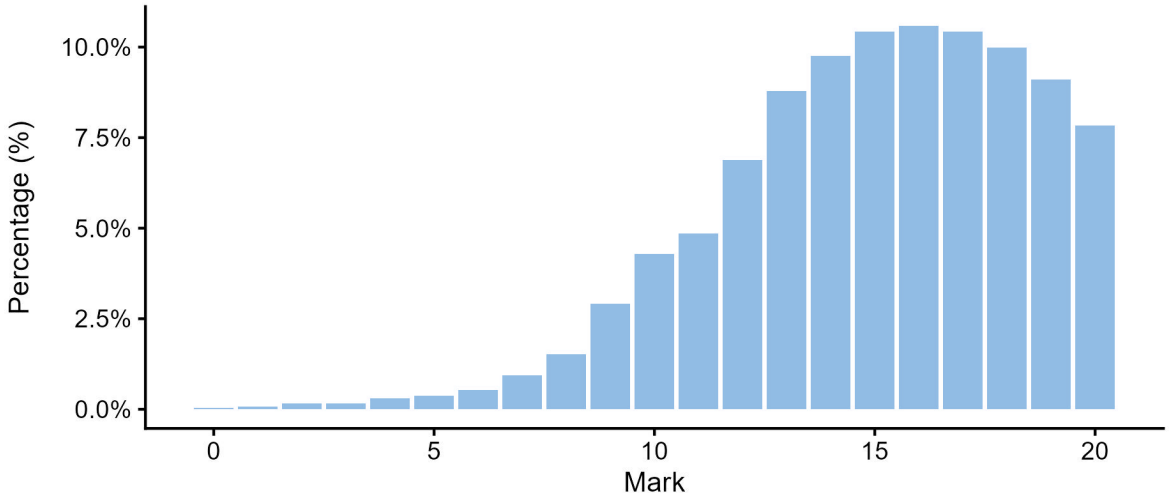
Units 3 and 4 internal assessment (IA) results

Total marks for IA

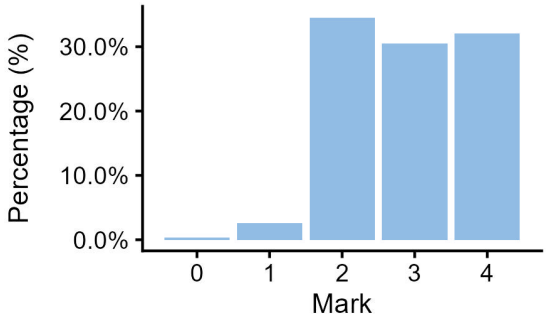


IA1 marks

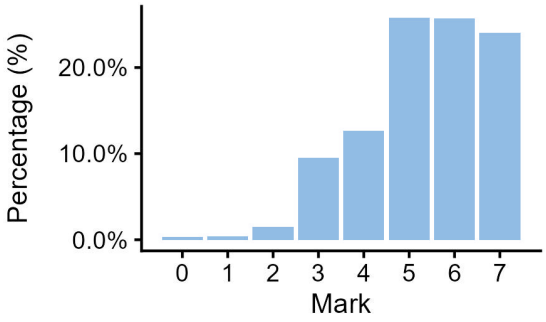
IA1 total



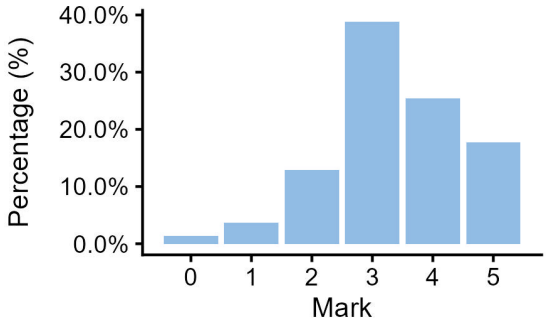
IA1 Criterion: Formulate



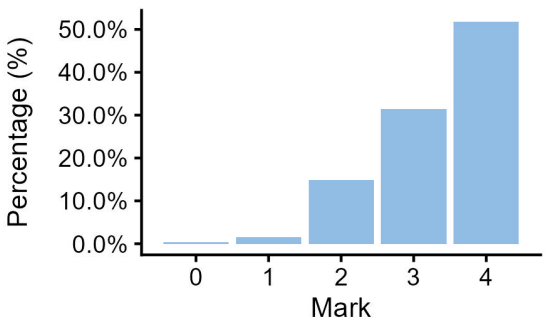
IA1 Criterion: Solve



IA1 Criterion: Evaluate and verify

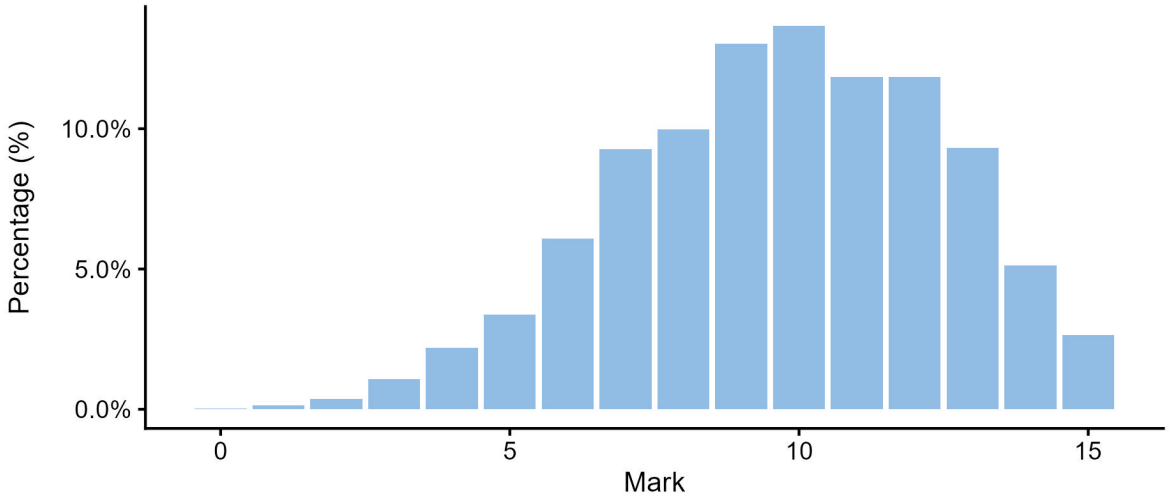


IA1 Criterion: Communicate

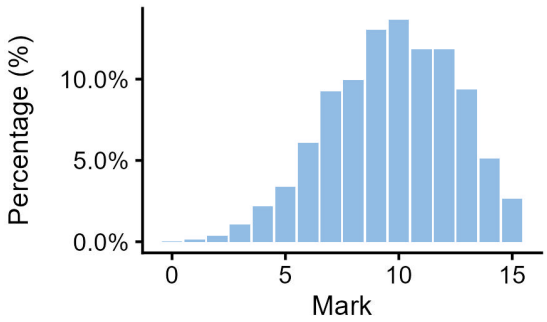


IA2 marks

IA2 total

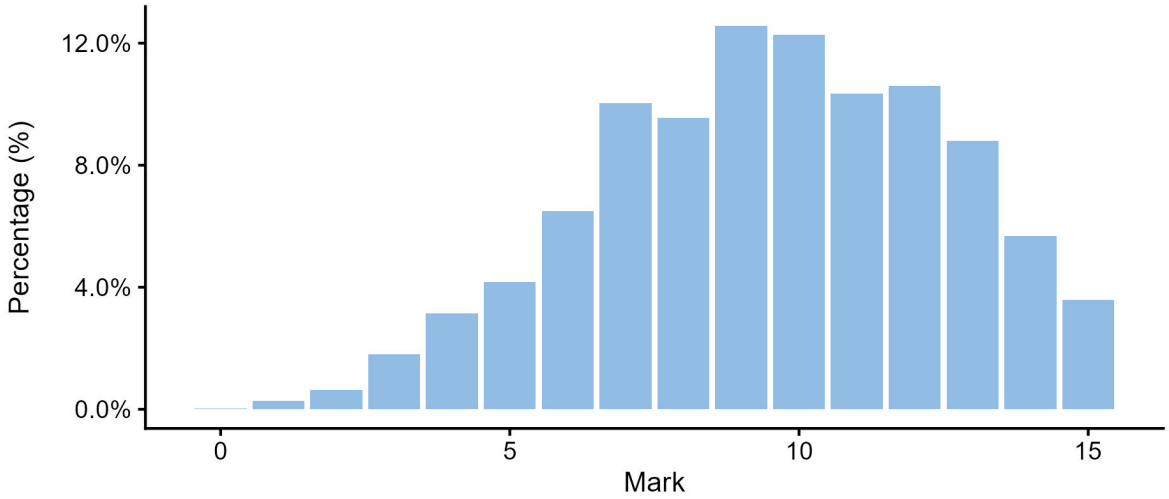


IA2 Criterion: Foundational knowledge and problem-solving

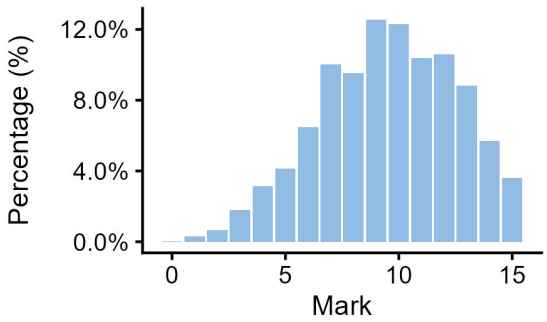


IA3 marks

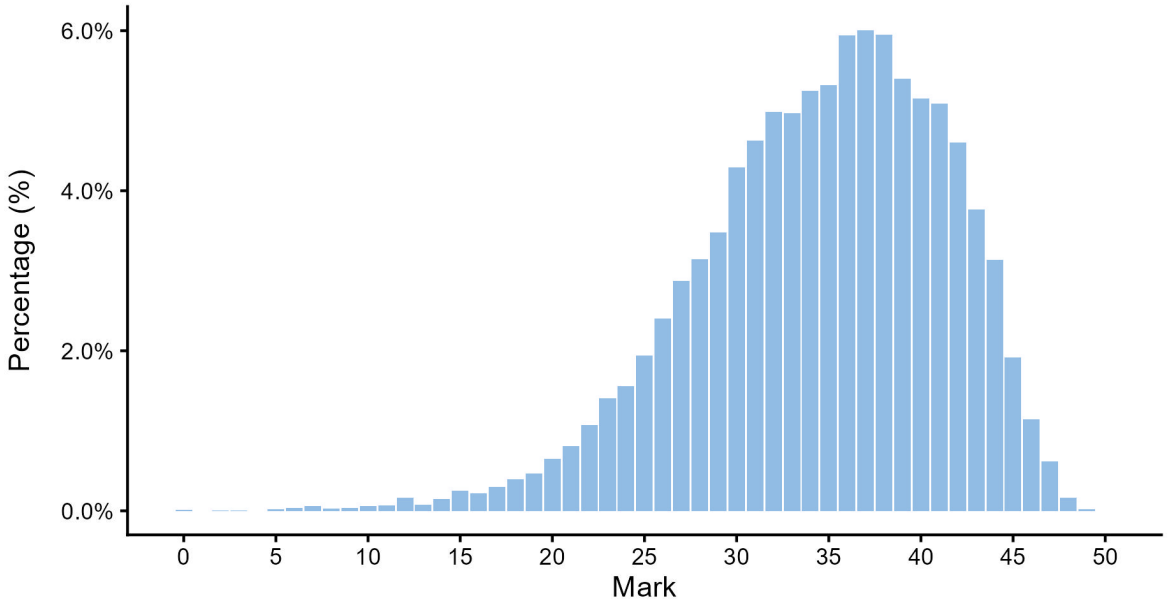
IA3 total



IA3 Criterion: Foundational knowledge and problem-solving

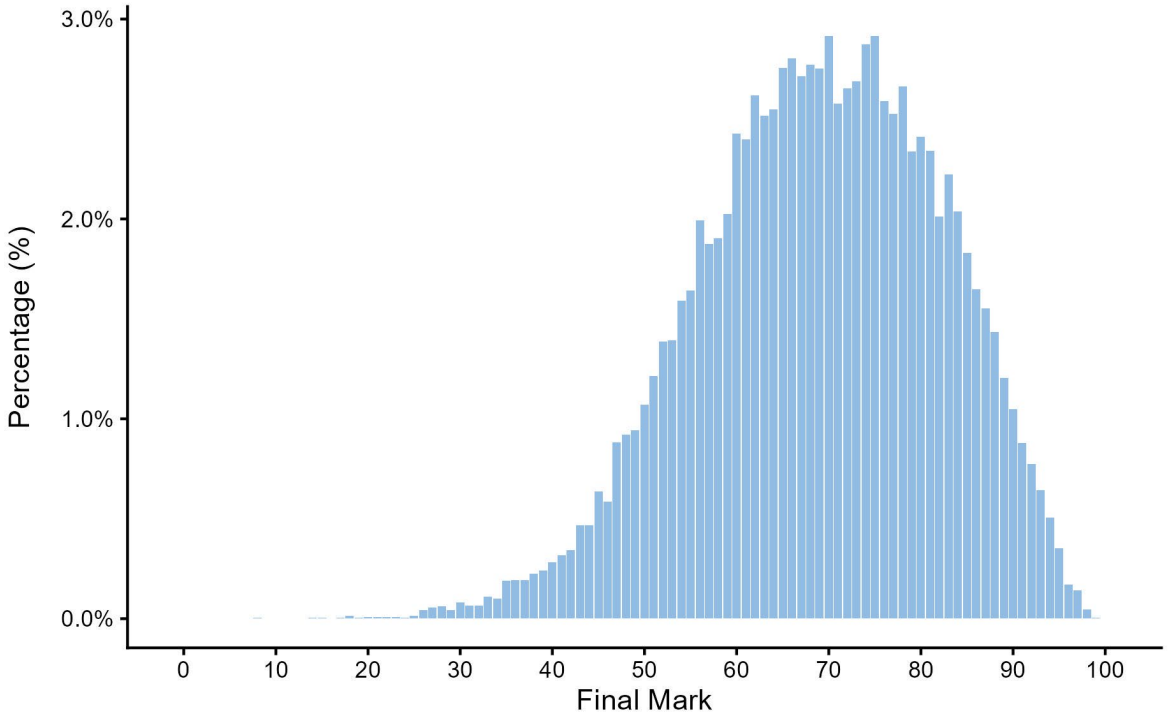


External assessment (EA) marks



Final subject results

Final marks for IA and EA



Grade boundaries

The grade boundaries are determined using a process to compare results on a numeric scale to the reporting standards.

Standard	A	B	C	D	E
Marks achieved	100–84	83–68	67–45	44–22	21–0

Distribution of standards

Number of students who achieved each standard across the state.

Standard	A	B	C	D	E
Number of students	3,024	8,740	8,653	759	12
Percentage of students	14.27	41.25	40.84	3.58	0.06

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

Internal assessment	IA1	IA2	IA3
Number of instruments	468	467	465
Percentage endorsed in Application 1	74	46	44

Confirmation

Confirmation is the quality assurance process based on the attribute of reliability. The QCAA uses provisional criterion marks determined by teachers to identify the samples of student responses that schools are required to submit for confirmation.

Confirmation samples are representative of the school's decisions about the quality of student work in relation to the instrument-specific marking guide (ISMG) and are used to make decisions about the cohort's results.

Refer to *QCE and QCIA policy and procedures handbook v7.0*, Section 9.6.

The following table includes the percentage agreement between the provisional marks and confirmed marks by assessment instrument. The Assessment decisions section for each assessment instrument identifies the agreement trends between provisional and confirmed marks by criterion.

Number of samples reviewed and percentage agreement

IA	Number of schools	Number of samples requested	Number of additional samples requested	Percentage agreement with provisional marks
1	467	4,189	49	82.23
2	467	4,167	0	100.00
3	467	4,112	0	100.00

Internal assessment 1 (IA1

Problem-solving and modelling task (20%)

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 at least one of the following topics in Unit 3:

Topic 1: Bivariate data analysis

Topic 2: Time series analysis

Topic 3: Growth and decay in sequences.

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	19
Authentication	29
Authenticity	5
Item construction	12
Scope and scale	71

Effective practices

Validity priorities were effectively demonstrated in assessment instruments that:

- provided a well-defined, specific, real-life mathematical task for students to respond to and independently demonstrate the ISMG criteria
- identified the topics and subject matter that the student is required to use to solve and evaluate the problem. For instance, a task focused on the analysis of data over a period of time identified Unit 3 Topic 2: Time series analysis and a task focused on the analysis of bivariate data identified Unit 3 Topic 1: Bivariate data analysis
- allowed students to independently choose what model to develop and the solution approach to demonstrate simple through to complex procedures to solve the problem
- had sufficient scope for students to identify their own observations and assumptions outside of those detailed on the task sheet.

Practices to strengthen

It is recommended that assessment instruments:

- include a checkpoint or authentication strategy requiring students to submit one complete or near-complete draft (*QCE and QCIA policy and procedures handbook v7.0*, Section 8.2.5)
- provide a context that aligns clearly with the relevant subject matter but avoids narrowing the scope by directing students to specific content or methods
- avoid excessive scaffolding that limits student autonomy or exploration
- provide appropriate and accessible website links and/or data, unless data can be readily collected individually or in groups, such as measuring lengths or times within the school. This is because research is not the focus of this 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	2
Language	10
Layout	1
Transparency	5

Effective practices

Accessibility priorities were effectively demonstrated in assessment instruments that:

- were well presented with appropriate page breaks and other formatting features. Schools can check formatting using the **Print preview** function within the Endorsement application (app) before submitting the IA1 for endorsement
- provided clear information within the context and task sections for students to understand what the task requires.

Practices to strengthen

It is recommended that assessment instruments:

- use everyday, age-appropriate language in the context and task sections and avoid unnecessary jargon and complex technical or scientific terms in the stimulus.

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:

- While the 2019 syllabus required the use of subject matter drawn from Unit 3, the 2025 syllabus requires the use of subject matter from at least one of the topics in Unit 3 or Unit 4.
- The duration of 4 weeks has been removed from the assessment conditions. Therefore, schools will now determine the duration of the task, ensuring the scope and scale of the task is appropriate for the selected duration.

- While students are expected to follow the approach to problem-solving and mathematical modelling flow chart, it is not necessary to include or refer to this flow chart in the task.

Schools should also:

- consider consulting with the Lead endorser about a non-endorsed assessment instrument from Application 1 before submitting their revised assessment instrument for Application 2. These consultations are supportive and provide feedback to school communities to strengthen the endorsement process.

Assessment decisions

Reliability

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

Agreement trends between provisional and confirmed marks

Criterion number	Criterion name	Percentage agreement with provisional	Percentage less than provisional	Percentage greater than provisional	Percentage both less and greater than provisional
1	Formulate	91.22	8.14	0.64	0.00
2	Solve	94.22	5.57	0.21	0.00
3	Evaluate and verify	90.79	8.14	0.86	0.21
4	Communicate	98.29	1.07	0.64	0.00

Effective practices

Reliable judgments were made using the ISMG for this IA when:

- for the Solve criterion, responses matched to the top performance-level descriptors
  - reached a valid solution consistent with the intention of the problem
  - demonstrated accurate use of complex procedures, i.e. sequential, interrelated steps drawing on a range of relevant subject matter
  - applied mathematical concepts and techniques chosen for their relevance and importance to the task
  - integrated within the report the accurate and appropriate use of technology as a tool to solve the problem
- for the Communicate criterion, responses matched to the top performance-level descriptors featured
  - coherent and concise organisation, and a suitable introduction, body and conclusion, which could be read independently of the task sheet
  - appropriate technical and procedural vocabulary to connect the mathematical processes used in the developed solution
- schools used the ISMG as provided in the Endorsement app and did not edit, modify, or retype it.

Practices to strengthen

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

- For the Formulate criterion, wording is changed in the 2025 syllabus, and responses matched to the top performance-level descriptors
  - use evidence to justify the important observations. This could include citing a source to explain where the observation came from to support the reliability of the observation or an explanation of its relevance and importance in solving the task
  - use evidence to justify the important assumptions. This could include explaining why the assumptions are fundamental to mathematising the problem and solving the task, or the impact on the problem of not making those assumptions.
- The Evaluate and verify criterion in the 2019 syllabus is named Evaluate in the 2025 syllabus and this now has five descriptors at the top performance level. The 2019 descriptor for 'justification of decisions' is replaced by 'verify results', the descriptor regarding 'strengths and limitations' is now two separate descriptors, and 'evaluation of the reasonableness of solutions by considering the results, assumptions and observations' has also been split into separate descriptors for clarity.
- For the Evaluate criterion, responses matched to the top performance-level descriptors
  - verify results by using estimation, alternative/algebraic methods, technology or research to show that outcomes are accurate, reliable and/or consistent with addressing the problem
  - provide justified statements about the reasonableness of the solution by relating these to the assumptions and the observations (either given in the task sheet or made by the student)
  - provide strengths and limitations that are relevant to the solution and justified using evidence.

To further ensure reliable judgments are made using the ISMG for this IA, it is recommended that:

- teachers use information in the *Unpacking internal assessment terminology* document (available under Resources in the Syllabuses app) as a guide to what the 2025 ISMG descriptors look like in practice. Teachers can continue to enhance their judgments by using the discussion prompts in this resource during moderation sessions, planning meetings, or review conversations.

Additional advice

It is essential to consider the following key differences between the 2019 and 2025 syllabuses:

- For the 2025 syllabus, each descriptor describes a single characteristic that may be evidenced in a student response, while the 2019 syllabus descriptors sometimes 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.
- A described characteristic can be singular or plural, e.g. the
  - Formulate criterion at the 3–4 mark range requires 'justified statements of important assumptions' (plural) and 'justified statements of important observations' (plural), so the response must typically justify more than one assumption and more than one observation, respectively

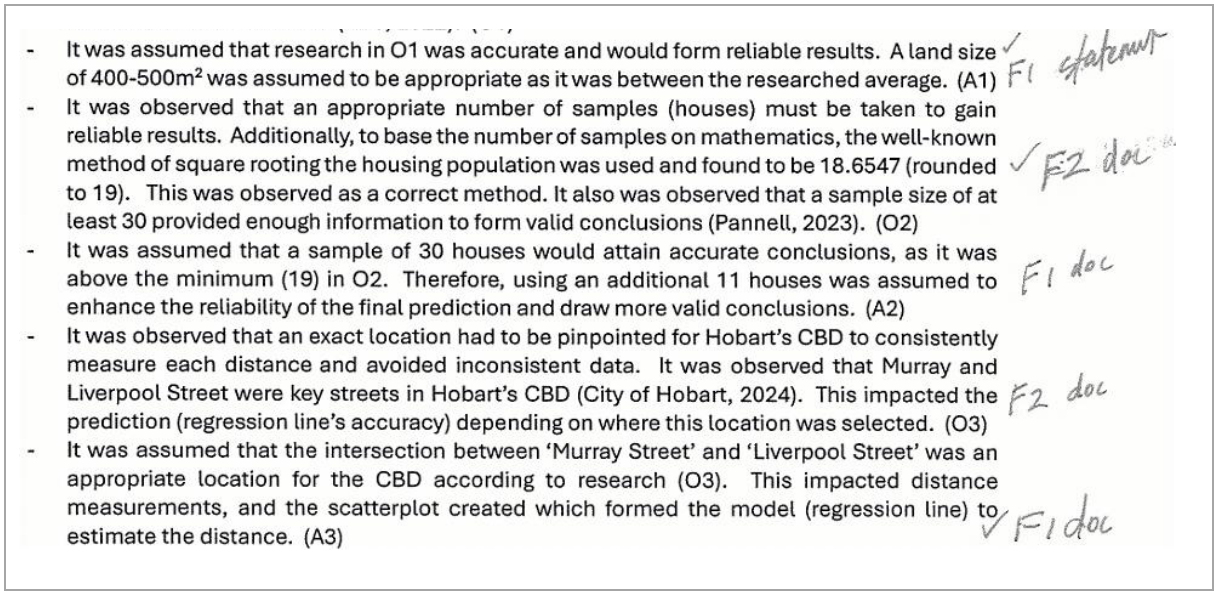
  - Solve criterion requires ‘use of mathematical knowledge for an important aspect of the task (singular) at the 4–5 mark range and ‘accurate use of mathematical knowledge for important aspects of the task (plural) at the 6–7 mark range.

- The descriptors related to ‘justification of decisions’ are now in the Communicate criterion (as opposed to the Evaluate and verify criterion in the 2019 syllabus), so each performance level in this criterion now has three descriptors.

Samples

The following excerpt demonstrates annotations on a response to indicate a typical match to 2025 Formulate descriptors at the 3–4 mark range: justified statements of important assumptions (plural) and justified statements of important observations (plural).

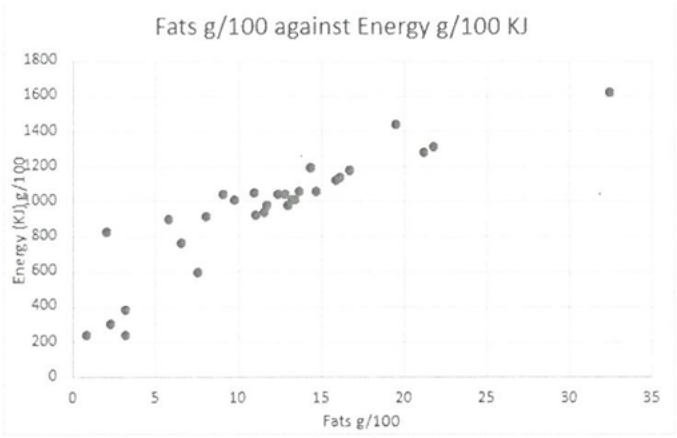
Note: The characteristic/s identified may not be the only time the characteristic/s occurred throughout a response.


- It was assumed that research in O1 was accurate and would form reliable results. A land size of 400-500m² was assumed to be appropriate as it was between the researched average. (A1) ✓ F1 statement
- It was observed that an appropriate number of samples (houses) must be taken to gain reliable results. Additionally, to base the number of samples on mathematics, the well-known method of square rooting the housing population was used and found to be 18.6547 (rounded to 19). This was observed as a correct method. It also was observed that a sample size of at least 30 provided enough information to form valid conclusions (Pannell, 2023). (O2) ✓ F2 doc
- It was assumed that a sample of 30 houses would attain accurate conclusions, as it was above the minimum (19) in O2. Therefore, using an additional 11 houses was assumed to enhance the reliability of the final prediction and draw more valid conclusions. (A2) F1 doc
- It was observed that an exact location had to be pinpointed for Hobart's CBD to consistently measure each distance and avoided inconsistent data. It was observed that Murray and Liverpool Street were key streets in Hobart's CBD (City of Hobart, 2024). This impacted the prediction (regression line's accuracy) depending on where this location was selected. (O3) F2 doc
- It was assumed that the intersection between 'Murray Street' and 'Liverpool Street' was an appropriate location for the CBD according to research (O3). This impacted distance measurements, and the scatterplot created which formed the model (regression line) to estimate the distance. (A3) ✓ F1 doc

The following excerpts illustrate evidence found throughout the report for 2025 Formulate descriptors at the 3–4 mark range: justified statements of important observations and justified mathematical translation of important aspects of the task. These excerpts also show statements that contribute evidence to match the 2025 Evaluate descriptor at the 4–5 mark range: verified results.

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

Excerpt 1



Lastly, the data displayed in Figure 3 displays a strong positive linear relationship between fats and energy. This correlation appears to be very strong as very few data points don't quite fit the linear trend displayed, while the majority forms a clear line. This relationship between fats and energy was proven to be strong with a correlation coefficient of 0.89. There appears to be a sole outlier that can be seen out far from the data, but it appears to still fit the trend, so it doesn't present an issue yet. ✓

To further analyse this data a least squares regression line, or trendline, will be added to the scatter plots and the calculations for standard deviation. This will provide further insight into the true strength of the correlation to clearly display which macronutrient is the best predictor of energy, which currently appears to be fats.

Excerpt 2

3.2 Coefficient of Determination

To calculate the coefficient of determination you must use the formula: $R = r^2$

The coefficient of determination displays what percentage of the data set fits the regression model. For carbohydrates and energy, only 0.12, or 12% of the data suits the model. For proteins, only 28% of the data suits the model. Lastly, for fats, 0.79, 79% of the data suits the regression model, clearly displaying that fats is the best predictor of energy, as majority of the data can be predicted using the least squares regression line. This demonstrates that using fats to predict energy is a reliable model. ✓

Excerpt 3

The value of $\bar{X}$ was 8120 (the mean step count) and the value of $\bar{Y}$ was 25.04 (the mean BMI). This is relevant as it indicates that the average person takes about 8120 steps daily and has a body mass index of 25.04. This reveals the fact that on average the people in this data group are between normal weight and overweight. The average healthy weight is between 18.5 to 24.9 (Australian government, 2021).

Sx =1803.68 and Sy =3.71 (the standard deviation values) reflect how the daily step count and BMI vary from the mean values. The high Sx value suggests high variance from the mean daily step count value. The low Sy value suggests low variance from the mean BMI.

Excerpt 4

Equation 3, substituting into the regression equation

$$y = a + bx$$

$$y = 36.51 - 0.00141x$$

$$BMI = 36.51 - 0.00141 \times (daily\ step\ count)$$

Equation 3 shows that for every step taken, the BMI will decrease by 0.00141 on average. Hence, with every 1000 steps taken BMI will decrease by 1.41. This is relevant because it indicates that as step counts, X value, increases, BMI or Y value decreases. The negative slope (-0.00141) confirms that more steps are generally associated with lower BMI (NIH, 2011).

The $r = -0.6873$ (correlation coefficient), indicates a moderate negative relationship between BMI and Daily step count. The r value is relative and important to the data set as it helps determine how strongly bivariate data is related and in what direction. In this case it suggests a moderate negative trend towards the variables. The r value found suggests that for each step taken the BMI goes down, however this does not happen perfectly.

The following excerpts illustrate evidence for 2025 Solve descriptors at the 6–7 mark range: accurate use of mathematical knowledge for important aspects of the task and efficient use of technology. These excerpts state reasons for using a spreadsheet program and demonstrate the use of technology within the report through the construction of a scatterplot and residual plot. Supporting statements indicate that the appendix contains raw data and repeated calculations.

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

Excerpt 1

2.4 Use of technology

The mathematical spreadsheet program Excel has been used in this assignment. All calculations have been finalised on excel using the formulas present in Figures 7 and 8. This program has been used to speed up the calculation process and to create accurate and informative scatter plots to process the data efficiently.

Excerpt 2

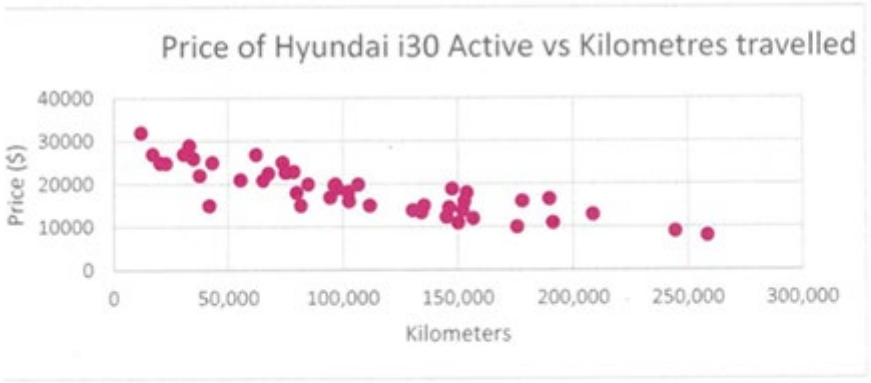
2.3 Use of technology

During the investigation process to organise the raw data, prepare graphs, confirm the regression equation, correlation coefficient, coefficient of determination, and calculate residuals the spreadsheet program Microsoft Excel was used. Excel was also used to calculate the statistical measures of mean required to develop the least-squares regression equation.

3.0 Developing a Solution

3.1 Results of initial model

The raw car data appears in the appendix. A scatterplot was constructed, as displayed below in Graph 1, to identify any initial association between kilometres driven by a used Hyundai i30 Active and its price. Price was displayed on the y-axis as the response variable and kilometres was placed on the x-axis as the explanatory variable.

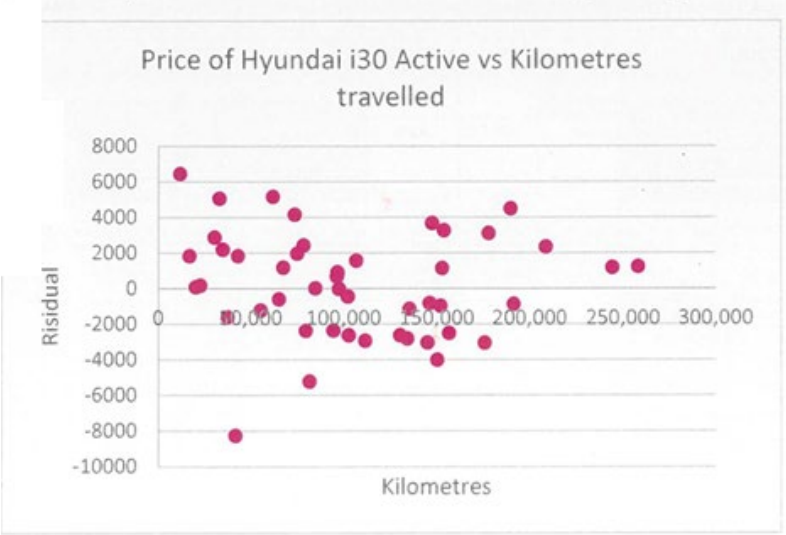


Graph 1: Scatterplot of kilometres travelled by Hyundai i30 Active and the price of the car.

Initially, a moderate-strong negative linear association between the two variables was observed. As the kilometres the car travelled [increased] the price decreased. There is only one point that could be a bivariate outlier; point (42 000, 14 997). Therefore, a linear regression line analysis will be used in this investigation to determine whether this model gives a true reflection of the value of a car based on kilometres travelled.

Excerpt 3

Calculating residual plots, with formula $residual\ value = actual\ data\ value - predicted\ data\ value$, and producing a residual plot is a reliable method to verify if a linear relationship exists between the two variables being investigated.



Graph 3: residual plot

km (x)	Price (y)	predicted price	residual price
55,577	20998	22237.4749	-1239.4749
97,800	18990	19015.86	-25.86
35,141	25990	23796.7417	2193.2583

Table 3: residual plot calculations (continued in appendix)

The following excerpts demonstrate annotations on responses to indicate a typical match to 2025 Evaluate descriptors at the 4–5 mark range: justified statements about the reasonableness of the solution by considering the assumptions (plural) and justified statements about the reasonableness of the solution by considering the observations (plural).

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

Excerpt 1

Reasonableness of Results

A house of $1.5 million in Hobart was calculated -17.880km from the CBD. This was unreasonable as a negative distance was impossible. This could have resulted from the samples taken, as the highest house price did not reach $1.5 million (House #1 was $1,475,000). Therefore, the estimation was outside the data range (extrapolation), meaning the distance prediction was not as accurate as it could have been. Since the data did not supply enough information to reliably predict the distance, this was a partial explanation for the solution's unreasonableness.

The r^2 value of 0.43 indicated 57% of the variation in house prices were explained by factors other than distance. These factors could have been related to O1 where the average number of bedrooms, bathrooms and land size of an Australian house was 3, 2 and 432m² respectively, and its accuracy assumed in A1. Using these features achieved a consistent regression line, but narrowly reflected the vast range of houses. Thousands of other houses had different features (e.g. four bedrooms) which were not sampled. Moreover, a bedroom added an approximate value of $50,000-$80,000 to a house (Delahunty, 2020). A1 was valid because it maintained consistency but was not an effective measure when applied to the broader, more varied housing market. Sampling houses with more bedrooms/bathrooms could have increased prices, significantly improving the model's ability to make an accurate prediction. Therefore, it was unreasonable to sample a slim range of houses.

O2 research stated 30 samples provided valid conclusions, assumed to be correct in A2. It was reasonable to sample 30 houses as it was above the minimum (19), increasing the distance prediction's reliability, as there were more houses to gain information/data. A larger number reduced the impact of random variation, decreasing the margin of error, and the findings were likely to represent the broader housing population. Therefore, the sample size enhanced the investigation as it explored a larger number of houses, providing deeper analysis.

O3 observed an exact CBD location needed to be selected, and its position assumed in A3. It was reasonable to choose a specific area because it ensured the starting point for each measurement was identical. It guaranteed a fair comparison between properties and ensured all data was comparable regarding distances. A3 was reasonable because evidence from an official source removed ambiguity and ensured the information was widely accepted in urban zoning definitions.

Excerpt 2

Additionally, the scatterplot displayed a negative correlation between BMI and step count, confirming the assumption that there would be a negative relationship between the two factors. However, the assumption that all adolescents would have similar lifestyles was proven incorrect. Confounding factors played a much bigger role than expected with each factor affecting individuals differently, which is a reasonable conclusion. Factors like diet, genetics, and metabolism significantly impact BMI, making lifestyle variability a crucial factor in interpreting the results.

Observations indicated that individuals that had higher step counts therefore had a lower BMI value which was reflected in the data. However, it was apparent that some individuals could still maintain a low BMI with a low step count. This reflects the understanding that BMI is not just influenced by step count. Additionally, the scatterplot and residual plot confirmed that while the data was linear there were other factors at work. This is reasonable as they align with both mathematical findings and background research.

The following excerpt illustrates evidence for the 2025 Evaluate descriptors at the 4–5 mark range: justified statements of relevant strengths of the solution (plural) and justified statements of relevant limitations of the solution (plural).

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

4.2 Strengths of the model

The clear main strength of this model is the high accuracy when using the mathematical equation from the trendline to predict energy levels from fats. As shown through extrapolation and interpolation, the predictions were only off by about 10KJ, meaning there is a very small margin for error when predicting the energy intake of fast foods from fats. This model also does not have to be exactly accurate as it is predicting energy from food, as a close estimate is the most accuracy needed when buying fast food. This estimate for fast food is useful for a vast majority of the population as '15.9 million Australians aged 14+ (75.3%) ate take away food in an average four weeks from fast food outlets,' meaning many Australians will find this equation incredibly helpful when determining their energy intake. The linear model clearly displays the relationship between fats and energy, as in Figure 4, the trendline shows a clear positive relationship, with all data fitting around the line. The data has also been collected in g/100 for every measurement, so the sample size is the same across all food items, increasing the comparability of the data set. Overall, there are a lot of strengths to the findings of this investigation, however it is not perfect, the model contains several limitations that could be improved in future.

4.3 Limitations of the model

One of the main limitations present in this model would be the sample size, which was only 30 items. This sample size meant that the few outliers visible across the graphs were not able to be removed, as the sample size was too small, and various pieces of data has outliers across different macronutrients. This inability to remove outliers would have slightly skewed the calculations across the different macronutrients and therefore may be the reason using fats to calculate energy was slightly off exact. To improve this in future, a larger sample size of 50 or so items should be used, this larger range would allow the removal of several outliers before the sample size became too small to provide reliable calculations from the data. When collecting data from the task, only foods from KFC and McDonald's were utilised. This means the formula for predicting energy from fat content is only a reliable way to predict energy in fast foods, not regular foods. This happened due to the limited time allocated for working on the task, and the fast-food websites containing all information for macronutrient and energy intake in g/100. This also skews the data, as fast food is likely to have a higher fat content on average compared to regular foods, due to the nature of the environment it is made in. To improve on this, a variety of food items from supermarkets as well as fast foods can be taken for the data, to ensure that the eventual formula to predict energy from macronutrients is accurate across a wider range of standard foods.

The following excerpts demonstrate introductory and concluding sections of a complete response that matches the 2025 Communicate descriptor at the 3–4 mark range: logical organisation of the response, which 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.

Excerpt 1

1 INTRODUCTION

It is plausible to assume that as children age and grow into teenagers brain growth occurs, causing reaction time to improve by decreasing. Using data from the 'Census at School' website, this assumption will be tested in the following report by examining the reaction times of 500 children 7 to 19 years old. Although the report will be focusing on any correlation seen between 'reaction time' and 'age', other relevant variables such as 'gender' and 'country of birth' will also be analysed for any further correlations.

Remember that correlation is not the same as causation; this means that though there may be a pattern recognized in the data, no generalizable conclusions can be drawn. Variables in this report include:

- Reaction Time – the time taken for a person to respond to a given stimuli (measured in seconds)
- Age – measured in full years
- Gender - otherwise known as sex (measured in Male (M) and Female (F))
- Country – the participant's place of birth, not his current place of residence (although these may be the same)

These variables will be examined using various bivariate data analysis techniques. This includes the classification of variables, construction of scatterplots including the correlation coefficient and the coefficient of determination, the least squares method and the construction of residual plots using Microsoft 'Excel'. This will be done to investigate any possible linear relationship between reaction time and age, as well as other relevant variables.

Excerpt 2

5 CONCLUSION

In summary, this investigation used standardized mathematical techniques and methods through the medium of various software formats (Microsoft 'Word' and 'Excel') to investigate the possibility of a relationship between age and reaction time in children while also examining other pertinent variables. It was found that there is a slight decrease of 0.0013 seconds in reaction time per each increase in one year of age. This is in keeping with the assumption proposed at the beginning of this report that as children age and grow into teenagers brain growth occurs, causing reaction time to improve by decreasing.

Internal assessment 2 (IA2)

Examination (15%)

This examination assesses the application of a range of cognitions to a number of items, drawn from all Unit 3 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	255
Authentication	0
Authenticity	5
Item construction	23
Scope and scale	34

Effective practices

Validity priorities were effectively demonstrated in assessment instruments that:

- used questions relevant to the school context and sufficiently different from items in the QCAA sample instruments and other publicly available resources to ensure student responses were authentic and not rehearsed
- were of a suitable scale, using an appropriate number of questions for the allowed working time and matched to the degree of difficulty. This practice was supported by developing a correct marking scheme that clearly indicated how marks were to be allocated, which assisted schools in checking the scope and scale of the assessment and promoted consistency in the awarding of marks
- included unseen short response items that matched syllabus conditions, such as asking students to use single words, sentences or paragraphs, interpret unseen stimulus, calculate using algorithms, and draw or label graphs, tables or diagrams.

Practices to strengthen

It is recommended that assessment instruments:

- do not include questions that require students to select from given options because these are multiple choice items, which the syllabus does not specify as short response
- include questions matching the complex unfamiliar degree of difficulty so that relationships and interactions have a number of elements, and all the information to solve the problem is not immediately identifiable. These questions require multiple components so connections can be

made with subject matter within and/or across the domains of mathematics, and do not provide instructions, diagrams or graphs that indicate the mathematical procedures and concepts to use

- include questions matching the complex familiar degree of difficulty, for which all the information to solve the problem is identifiable, and that have a number of elements such that connections are made with subject matter within and/or across the domains of mathematics. If complex familiar items include parts, each part must satisfy the definition for a complex familiar question
- provide opportunities for students to demonstrate all syllabus objectives, particularly Assessment objective 4: evaluate the reasonableness of solutions, and ensure the marks allocated in the marking scheme reflects the assessment of this objective.

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	6
Language	26
Layout	3
Transparency	4

Effective practices

Accessibility priorities were effectively demonstrated in assessment instruments that:

- were designed so the question layout and the overall instrument were not distracting. The **Print preview** feature in the Endorsement app can be used to check that visual elements are sufficiently large and accessible (e.g. maps showing latitude and longitude coordinates, equations, or sequence rules) and to ensure that stimulus items like tables, diagrams and graphs are legible and fully visible on a single page
- provided adequate space for students to respond to all questions, which may include adding extra working space, graphs or diagrams at the end of the instrument for students to use, if required.

Practices to strengthen

It is recommended that assessment instruments:

- are free from punctuation, grammatical, spelling and typographical errors
- use correct mathematical textual features such as superscripts and subscripts, e.g. R^2 and t_{n+1}.

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:

- The examination working time has changed from 120 minutes to 90 minutes, with perusal time remaining at 5 minutes. This requires a more concise paper design with careful item selection to ensure coverage of the assessment objectives within the reduced timeframe.
- The revised syllabus specifies that assessment items must sample subject matter from any three of the five Unit 3 topics, rather than requiring all topics. Students must be able to answer the questions using the subject matter from the three nominated topics and assumed knowledge from previous units.
- The Unit 3 subject matter has been revised in the 2025 syllabus, e.g.
  - formulas, variables, terminology and conditions are explicitly described within the syllabus subject matter
  - in Topic 1, students are required to calculate the coefficient of determination (R^2) from raw data using technology and by using the correlation coefficient, r
  - in Topic 3, students smooth time series data by calculating a simple moving average using the mean or median for an odd number of data only
  - in Topic 5, students understand the meaning of angles of latitude and longitude (in decimal degrees, and degrees and minutes) and calculate distances between two places on the same meridian or same parallel of latitude.

Schools should also:

- consider consulting with the Lead endorser about a non-endorsed assessment instrument from Application 1 before submitting their revised assessment instrument for Application 2. These consultations are supportive and provide feedback to school communities to strengthen the endorsement process.

Assessment decisions

Reliability

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

Agreement trends between provisional and confirmed marks

Criterion number	Criterion name	Percentage agreement with provisional	Percentage less than provisional	Percentage greater than provisional	Percentage both less and greater than provisional
1	Foundational knowledge and problem-solving	100.00	0.00	0.00	0.00

Effective practices

Reliable judgments were made using the ISMG for this IA when:

- the marking scheme provided at confirmation
  - matched the endorsed assessment instrument
  - was free from errors
  - indicated the response requirements for the allocated marks or half marks, including allowable variations due to rounding, decimal places, follow-through working and implied understanding
- marking decisions for student responses matched the mark allocation in the marking scheme (e.g. showing ticks where evidence was demonstrated, and including annotations to reflect awarded follow-through marks and implied marks) or had annotations that clearly identified the alternate reason for awarding the mark
- the total marks awarded for each question were accurately recorded, e.g. within the optional 'Mark/s' box in the question header
- the ISMG mark out of 15 was annotated on the ISMG and was accurately determined by
  - correctly totalling all marks the student achieved
  - correctly calculating the percentage using the total available marks and providing the full calculation, e.g. 53.5 / 60 = 89.17%
  - appropriately aligning this percentage to the percentage cut-offs. See *Advice to schools: How to correctly apply a percentage cut-off ISMG*, available from the Internal Assessment and Certification resources for schools tile in the Noticeboard app.

Practices to strengthen

To further ensure reliable judgments are made using the ISMG for this IA, it is recommended that:

- teachers update the marking scheme to include any changes made during the marking phase, such as correcting any errors, incorporating common alternative solutions and refining mark allocations
- schools implement moderation practices to verify consistency of teacher judgments, and quality assurance processes to ensure accuracy of the provisional mark entered for each student in Student Management.

Additional advice

Schools should:

- administer the endorsed instrument without changes or modifications (*QCE and QCIA policy and procedures handbook v7.0*, Section 7.3.3 and Section 8.3)
- indicate in Student Management on the individual student's learning account and in the Confirmation app if a comparable assessment instrument has been administered to a sampled student. Schools must develop comparable assessments in the Endorsement app to ensure the correct examination and its matching marking scheme are available for the confirmation review (*QCE and QCIA policy and procedures handbook v7.0*, Section 7.4 and Section 9.6.3). For further information, see the *Upload samples* guide in the Help section of the Confirmation app
- ensure the required samples of student assessment responses for the confirmation review align with the *Confirmation submission information* for General Mathematics, which is

available under Resources in the Syllabuses app (*QCE and QCIA policy and procedures handbook v7.0*, Section 9.6.3). Schools are advised to check that all scanning of student work has been completed without error, to ensure that

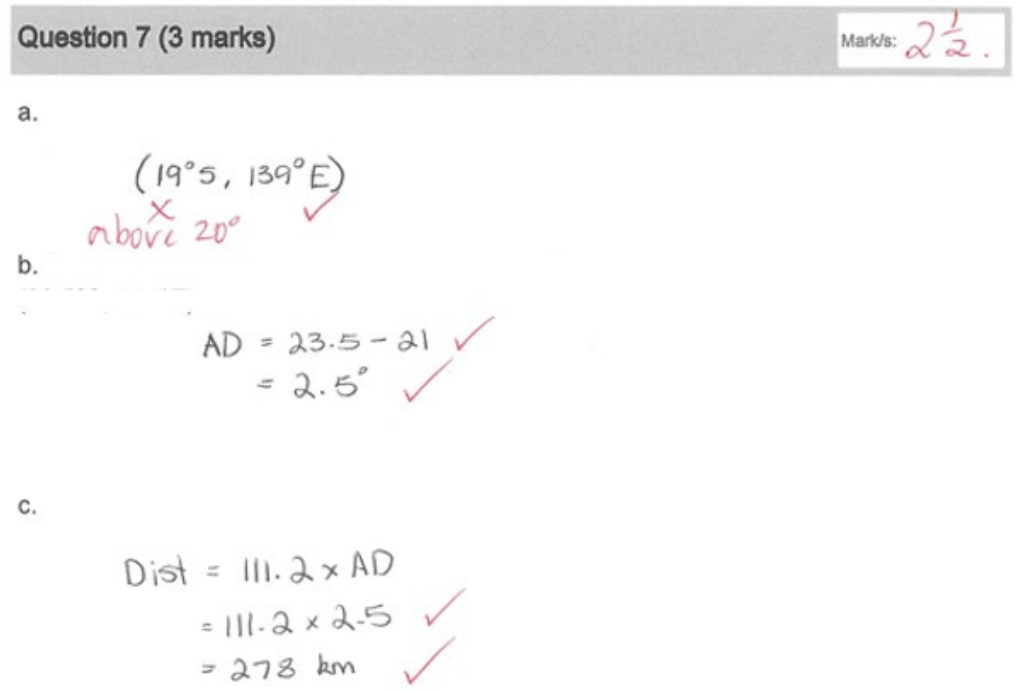
- no pages are missing from the response
- all pages are visible and legible
- the submitted response matches the selected student.

Samples

The following excerpts demonstrate clearly indicated marking decisions matched to the mark allocation in the marking scheme. Ticks are shown where particular evidence is demonstrated and the number of ticks corresponds to the awarded marks, e.g. Excerpt 1 shows a tick for each awarded whole mark and the other excerpts show a tick for each awarded half mark. Excerpts 4, 5 and 6 include teacher annotations to reflect awarded follow-through marks.

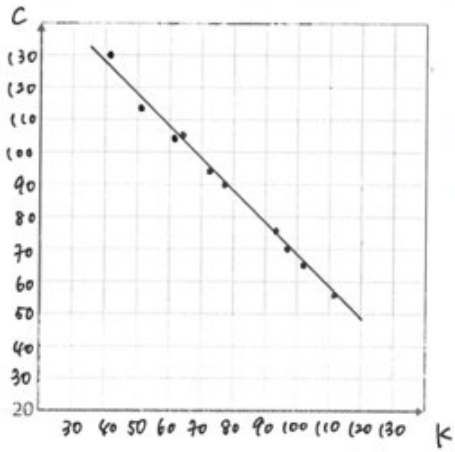
Note: The characteristic/s identified may not be the only time the characteristic/s occurred throughout a response.

Excerpt 1



Excerpt 2

Question 5 (4 marks) Mark/s: 4



✓✓ plot
✓✓ trend
✓✓

There is a strong, negative and linear relationship between the variables k and C.

Excerpt 3

Question 4 (4 marks) Mark/s: 4

		Year level		
		Yr 11	Yr 12	Total
School sport	Soccer	10	9	19
	B ball	3	12	15
	No sport	9	12	21
	Total	22	33	55

- correct set up of the two-way table ✓✓
- substitute correct values into table ✓✓
- calculate all other values correctly ✓✓✓

Excerpt 4

Question 12 (4 marks) Mark/s: 3/4

Max = 3800

$t_1 = 250$, $t_{n+1} = t_n + 167$

$t_1 = 250$

$d = 175 - 14 + 30 - (2 \times 12)$ ✓
$= 167$ ✓

$t_n = t_1 + (n-1)d$
$= 250 + (n-1)167$ ✓✓

t_1 t_2 t_3
250 y1 y2
+167 +167

25yrs $= t_{26}$

$t_{26} = 250 + (26-1)167$ ✓
~~$= 250 +$~~
$= 4175$ 4425 ×

∴ Thomas's farm will be over capacity ✓

$4175 - 3800$
$= 375$ ✓ FT

∴ Thomas will have to sell 375 pigs.

Excerpt 5

Question 5 (4 marks) Mark/s: 3½

Average
$\frac{645+325+156+538}{4}$ ✓
$= 341$ ×
416
Calc error!

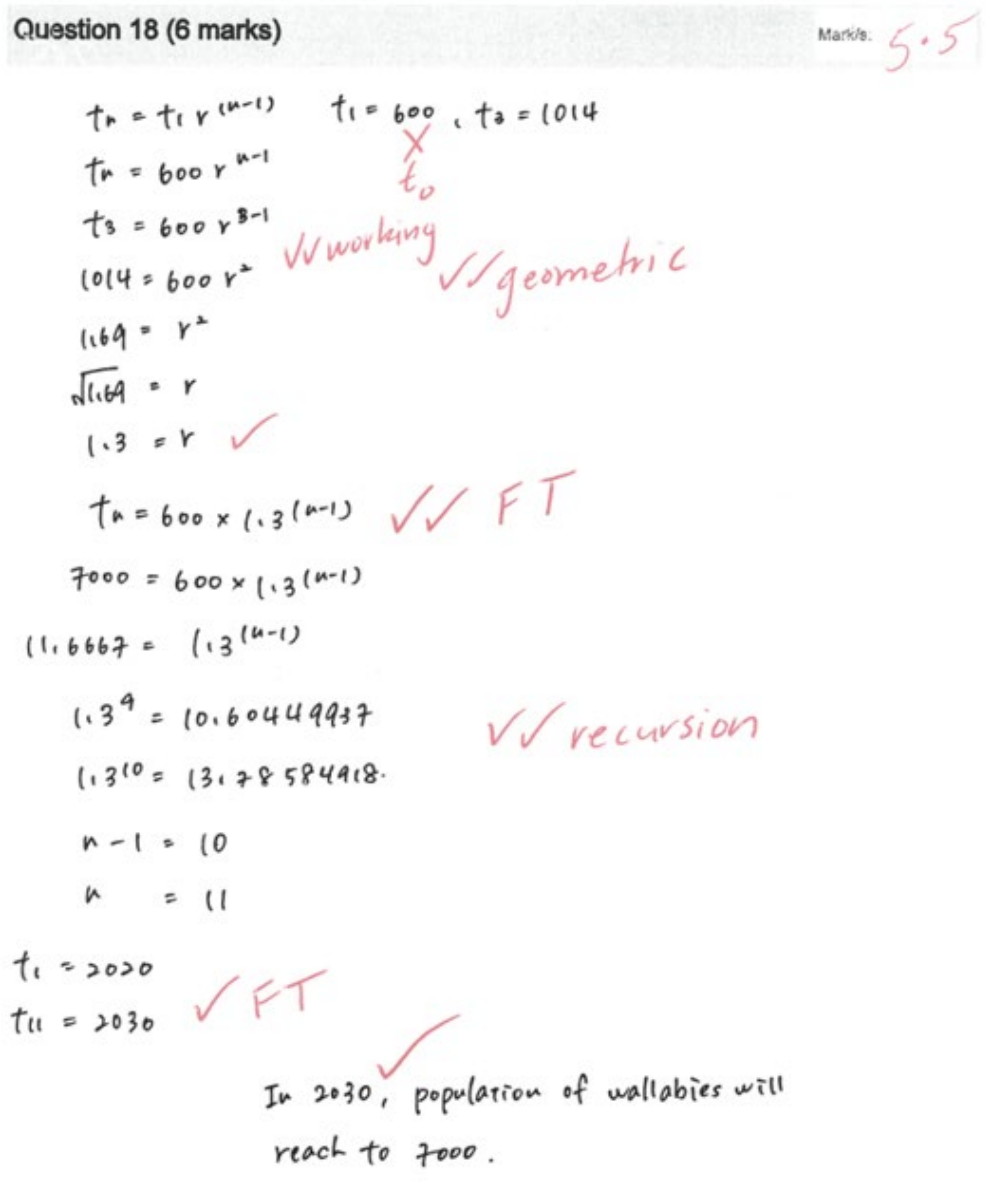
Summer (FT)
$\frac{645}{341} = 1.8914^{5}$ ✓

Autumn
$\frac{325}{341} = 0.9531$ ✓✓

$\frac{156}{341} = 0.4575$ ✓

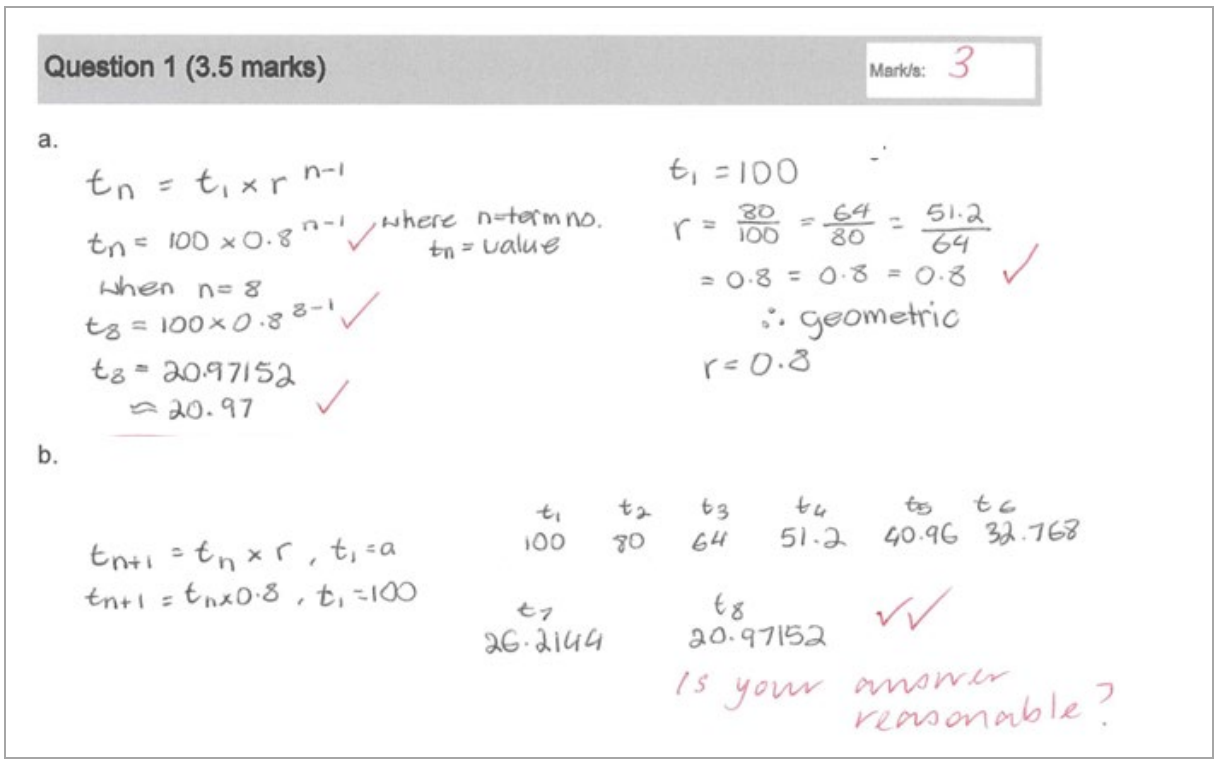
$\frac{538}{341} = 1.5777$ ✓

Excerpt 6



The following excerpt illustrates a marking judgment for the demonstration of Assessment objective 4: evaluate the reasonableness of solutions. This response to an examination question that explicitly addressed this objective is annotated by the teacher and marked according to the corresponding mark allocation in the marking scheme.

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



The following excerpts illustrate responses where the total marks awarded for each question are accurately recorded, e.g. within the optional 'Mark/s' box in the question header or at the end of the response. This indicates to the student how well each question response matches the marking scheme and assists the teacher in accurately calculating the total awarded marks for the examination.

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

Excerpt 1

Question 6 (2.5 marks) Mark/s: 2½

a.

3-point moving mean $= \frac{y_1+y_2+y_3}{3}$

3-point mean for March $= \frac{211+378+299}{3}$

$= 296$ ✓

b.

October SI $= 1.06$

This means October's apple pie sales were 6% higher than the seasonal average. ✓

c.

SI $= 1.06$

deseasonlised sales $= \frac{\text{actual}}{\text{SI}}$

$= \frac{221}{1.06}$ ✓

$= 208.49$

∴ The deseasonalised sales for October is $208.49 ✓

Excerpt 2

Question 7 (6 marks)

a)

$y = -0.7125x + 10.309$ ✓ $x = 3$ ✓

$= -0.7125 \times 3 + 10.309$

$= 8.17$ hours. ✓

b)

The coefficient of determination, which equals 0.58 in this situation, implies that 58% of the change in hours of sleep can be explained by the change in the hours of daily video gaming. ✓✓

no mention of 42%

c)

The residual plot of this data confirms the suitability of a linear regression model. This is because there is no clear pattern in the residual plot; it is random scatter. ✓

5.5 SF

The following excerpts demonstrate use of the syllabus ISMG to align the student's achievement percentage to the correct ISMG mark out of 15 by applying the appropriate 'greater than' percentage cut-off. Various methods are used to accurately tally and calculate the total awarded marks out of available marks. Excerpt 2 shows 46.5 out of 50, resulting from the subtotals for an examination with two sections, which equals 93% (not greater than 93%). This achievement percentage is greater than 87% and therefore correctly aligns with an ISMG mark of 14/15. Excerpt 3 shows a summary table (separate from the syllabus ISMG) used for accurately recording and tallying the marks awarded for each question.

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

Excerpt 1

Instrument-specific marking guide (IA2): Examination (15%)

Criterion: Foundational knowledge and problem-solving

$\frac{44}{54} = 81.5\%$

Assessment objectives

1. select , recall and use facts, rules, definitions and procedures drawn from all Unit 3 topics
2. comprehend mathematical concepts and techniques drawn from all Unit 3 topics
3. communicate using mathematical, statistical and everyday language and conventions
4. evaluate the reasonableness of solutions
5. justify procedures and decisions by explaining mathematical reasoning
6. solve problems by applying mathematical concepts and techniques drawn from all Unit 3 topics.

The student work has the following characteristics:	Cut-off	Marks
• consistently correct selection, recall and use of facts, rules, definitions and procedures; authoritative and accurate command of mathematical concepts and techniques; astute evaluation of the reasonableness of solutions and use of mathematical reasoning to correctly justify procedures and decisions; and fluent application of mathematical concepts and techniques to solve problems in a comprehensive range of simple familiar , complex familiar and complex unfamiliar situations.	> 93%	15
	> 87%	14
• correct selection, recall and use of facts, rules, definitions and procedures; comprehension and clear communication of mathematical concepts and techniques; considered evaluation of the reasonableness of solutions and use of mathematical reasoning to justify procedures and decisions; and proficient application of mathematical concepts and techniques to solve problems in simple familiar , complex familiar and complex unfamiliar situations.	> 80%	13
	> 73%	12

Excerpt 2

$\frac{21\frac{1}{2}}{23} \times \frac{25}{27}$ $\quad \frac{46\frac{1}{2}}{50} \div \frac{14}{15}$

Instrument-specific marking guide (IA2): Examination (15%)

Criterion: Foundational knowledge and problem-solving

Assessment objectives

1. select , recall and use facts, rules, definitions and procedures drawn from all Unit 3 topics
2. comprehend mathematical concepts and techniques drawn from all Unit 3 topics
3. communicate using mathematical, statistical and everyday language and conventions
4. evaluate the reasonableness of solutions
5. justify procedures and decisions by explaining mathematical reasoning
6. solve problems by applying mathematical concepts and techniques drawn from all Unit 3 topics.

The student work has the following characteristics:	Cut-off	Marks
• consistently correct selection, recall and use of facts, rules, definitions and procedures; authoritative and accurate command of mathematical concepts and techniques; astute evaluation of the reasonableness of solutions and use of mathematical reasoning to correctly justify procedures and decisions; and fluent application of mathematical concepts and techniques to solve problems in a comprehensive range of simple familiar , complex familiar and complex unfamiliar situations.	> 93%	15
	> 87%	14

Excerpt 3

EXAMINATION MARKING SUMMARY

Question Number	Simple Familiar (SF)	Complex Familiar (CF)	Complex Unfamiliar (CU)
1	2 /2	-	-
2	2 /3	-	-
3	/4	-	-
4	4 /4	-	-
5	2½ /3	-	-
6	4½ /5	-	-
7	4½ /6	-	-
8	2 /4	-	-
9	4 /4	-	-
10	-	2½ /4	-
11	-	3 /3	-
12	-	-	4 /4
13	-	4 /4	-
14	-	-	3 /4
15	-	-	3 /3
TOTALS	25½ /35 marks	9½ /11 marks	10 /11 marks

TOTAL 45 / 57

PROVISIONAL PERCENTAGE 79 %

Instrument-specific marking guide (IA2): Examination (15%)

Criterion: Foundational knowledge and problem-solving

Assessment objectives

1. select, recall and use facts, rules, definitions and procedures drawn from all Unit 3 topics
2. comprehend mathematical concepts and techniques drawn from all Unit 3 topics
3. communicate using mathematical, statistical and everyday language and conventions
4. evaluate the reasonableness of solutions
5. justify procedures and decisions by explaining mathematical reasoning
6. solve problems by applying mathematical concepts and techniques drawn from all Unit 3 topics.

The student work has the following characteristics:	Cut-off	Marks
• consistently correct selection, recall and use of facts, rules, definitions and procedures; authoritative and accurate command of mathematical concepts and techniques; astute evaluation of the reasonableness of solutions and use of mathematical reasoning to correctly justify procedures and decisions; and fluent application of mathematical concepts and techniques to solve problems in a comprehensive range of simple familiar, complex familiar and complex unfamiliar situations.	> 93%	15
	> 87%	14
• correct selection, recall and use of facts, rules, definitions and procedures; comprehension and clear communication of mathematical concepts and techniques; considered evaluation of the reasonableness of solutions and use of mathematical reasoning to justify procedures and decisions; and proficient application of mathematical concepts and techniques to solve problems in simple familiar, complex familiar and complex unfamiliar situations.	> 80%	13
	> 73%	12

Internal assessment 3 (IA3)

Examination (15%)

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	243
Authentication	0
Authenticity	5
Item construction	8
Scope and scale	71

Effective practices

Validity priorities were effectively demonstrated in assessment instruments that:

- used questions relevant to the school context and sufficiently different from items in the QCAA sample instruments and other publicly available resources to ensure student responses were authentic and not rehearsed
- were of a suitable scale using an appropriate number of questions for the allowed working time, matched to the degree of difficulty. This practice was supported by developing a correct marking scheme that clearly indicated how marks were to be allocated, which assisted schools in checking the scope and scale of the assessment and promoted consistency in the awarding of marks
- included unseen short response items that matched syllabus conditions, such as asking students to use single words, sentences or paragraphs, interpret unseen stimulus, calculate using algorithms, and draw or label graphs, tables or diagrams
- used authentic and contextually relevant questions and carefully selected stimulus materials that address Unit 4 subject matter, e.g. for critical paths, minimal spanning trees and flow networks.

Practices to strengthen

It is recommended that assessment instruments:

- do not include questions that require students to select from given options because these are multiple choice items, which the syllabus does not specify as short response

- include questions matching the complex unfamiliar degree of difficulty such that relationships and interactions have a number of elements, and all the information to solve the problem is not immediately identifiable. These questions have multiple components such that connections are made with subject matter within and/or across the domains of mathematics, and do not provide instructions, diagrams or graphs that indicate the mathematical procedures and concepts to use
- include questions matching the complex familiar degree of difficulty, for which all the information to solve the problem is identifiable, and that have a number of elements such that connections are made with subject matter within and/or across the domains of mathematics. If complex familiar items are scaffolded into parts, each part must satisfy the definition for a complex familiar question, e.g. including construction costs in minimum spanning tree problems or calculating total travel time in Hamiltonian graph scenarios
- provide opportunities for students to demonstrate all syllabus objectives, particularly Assessment objective 4: evaluate the reasonableness of solutions, and ensure the mark allocation in the marking scheme reflects the assessment of this objective.

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	14
Layout	4
Transparency	6

Effective practices

Accessibility priorities were effectively demonstrated in assessment instruments that:

- were designed so the question layout and the overall instrument were not distracting. The **Print preview** feature in the Endorsement app can be used to check that visual elements are sufficiently large and accessible (e.g. network diagrams for students to demonstrate forward and backward scanning and to identify the critical path) and to ensure that stimulus items like tables, diagrams and graphs are legible and fully visible on a single page
- provided adequate space for students to respond to all questions, including those requiring the construction of an adjacency matrix, project network diagram, or bipartite graph. This may include adding extra working space, graphs or diagrams at the end of the instrument for students to use, if required.

Practices to strengthen

It is recommended that assessment instruments:

- are free from punctuation, grammatical, spelling and typographical errors
- use correct syllabus terminology such as reducing balance loan, earliest and latest starting times, and float time for non-critical activities

- use correct mathematical textual features such as subscripts for recurrence relations, e.g. $A_{n+1} = r\,A_n$.

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:

- The examination working time has changed from 120 minutes to 90 minutes, with perusal time remaining at 5 minutes. This requires a more concise paper design with careful item selection to ensure coverage of the assessment objectives within the reduced timeframe.
- The revised syllabus specifies that assessment items must sample subject matter from any three of the five Unit 4 topics, rather than requiring all topics. Students must be able to answer the questions using the subject matter from the three nominated topics and assumed knowledge from previous units.
- The Unit 4 subject matter has been revised in the 2025 syllabus, e.g.
  - formulas, variables, terminology and conditions are explicitly described within the syllabus subject matter
  - in Topic 3, students are required to construct a graph or digraph from a given adjacency matrix and to construct an adjacency matrix from a given graph or digraph
  - in Topic 4, students construct a project network diagram with the activity on the arc and dummy activities are excluded
  - in Topic 5, solving small-scale practical problems involving flow networks is for up to 8 possible cuts and the required concepts and skills are more clearly identified
  - in Topic 5, the required optimum assignment could be a minimum or a maximum, and using the Hungarian algorithm is expanded to 3 x 3 up to 5 x 5 square matrices.

Schools should also:

- consider consulting with the Lead endorser about a non-endorsed assessment instrument from Application 1 before submitting their revised assessment instrument for Application 2. These consultations are supportive and provide feedback to school communities to strengthen the endorsement process.

Assessment decisions

Reliability

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

Agreement trends between provisional and confirmed marks

Criterion number	Criterion name	Percentage agreement with provisional	Percentage less than provisional	Percentage greater than provisional	Percentage both less and greater than provisional
1	Foundational knowledge and problem-solving	100.00	0.21	0.00	0.00

Effective practices

Reliable judgments were made using the ISMG for this IA when:

- the marking scheme provided at confirmation
  - matched the endorsed assessment instrument
  - was free from errors
  - indicated the response requirements for the allocated marks or half marks, including allowable variations due to rounding, decimal places, follow-through working and implied understanding
- marking decisions for student responses matched the mark allocation in the marking scheme (e.g. showing ticks where evidence was demonstrated, and including annotations to reflect awarded follow-through marks and implied marks) or had annotations that clearly identified the alternate reason for awarding the mark
- the total marks awarded for each question were accurately recorded, e.g. within the optional 'Mark/s' box in the question header
- the ISMG mark out of 15 was annotated on the ISMG and was accurately determined by
  - correctly totalling all marks the student achieved
  - correctly calculating the percentage using the total available marks and providing the full calculation, e.g. 37 / 45 = 82.22%
  - appropriately aligning this percentage to the percentage cut-offs. See *Advice to schools: How to correctly apply a percentage cut-off ISMG*, available from the Internal Assessment and Certification resources for schools tile in the Noticeboard app.

Practices to strengthen

To further ensure reliable judgments are made using the ISMG for this IA, it is recommended that:

- teachers update the marking scheme to include any changes made during the marking phase, such as correcting any errors, incorporating common alternative solutions and refining mark allocations
- schools implement moderation practices to verify consistency of teacher judgments, and quality assurance processes to ensure accuracy of the provisional mark entered for each student in Student Management.

Additional advice

Schools should:

- administer the endorsed instrument without changes or modifications (*QCE and QCIA policy and procedures handbook v7.0*, Section 7.3.3 and Section 8.3)
- indicate in Student Management on the individual student's learning account and in the Confirmation app if a comparable assessment instrument has been administered to a sampled student. Schools must develop comparable assessments in the Endorsement app to ensure the correct examination and its matching marking scheme are available for the confirmation review (*QCE and QCIA policy and procedures handbook v7.0*, Section 7.4 and Section 9.6.3). For further information, see the *Upload samples* guide in the Help section of the Confirmation app
- ensure the required samples of student assessment responses for the confirmation review align with the *Confirmation submission information* for General Mathematics, which is

available under Resources in the Syllabuses app (*QCE and QCIA policy and procedures handbook v7.0*, Section 9.6.3). Schools are advised to check that all scanning of student work has been completed without error, so that

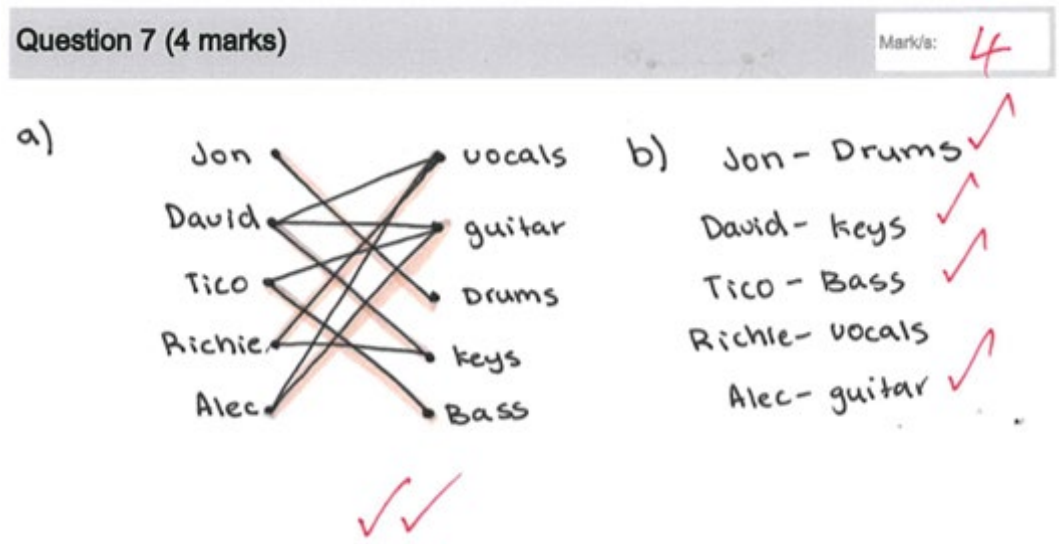
- no pages are missing from the response
- all pages are visible and legible
- the submitted response matches the selected student.

Samples

The following excerpts demonstrate clearly indicated marking decisions matched to the mark allocation in the marking scheme. In Excerpts 1 and 2, different styles are used to clearly distinguish a tick for an awarded whole mark compared to an awarded half mark. Excerpts 3, 4 and 5 include teacher annotations to reflect awarded follow-through marks and implied marks.

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

Excerpt 1



Excerpt 2

Question 4 (3 marks) Mark/s: 3

$P = 28{,}000$ ✓½

$i = \frac{0.022}{12}$

$= 0.0018333$ ✓½

$n = 6 \times 12$

$= 72$ ✓½

$A = P(1+i)^n$

$A = 28{,}000(1.0018333)^{72}$ ✓

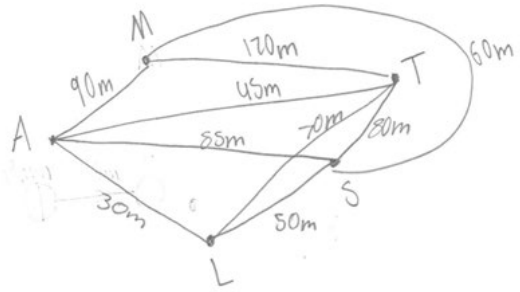
$A = 31947.1718$

$A = ?$

∴ After 6 years the balance will be $31,947.17 ✓½

Excerpt 3

Question 19 (5 marks) Mark/s: 4



shortest route to all buildings:

A - L - S - T - M = 280m

A - T - M - S - L = 275m ✗

Cost for all cable = 275 × $12.50

= $3437.5

time to lay cable = $\frac{275}{9}$

= 30.6

✓ lab + mat FT.

cost to lay cable = 30.6 × 60

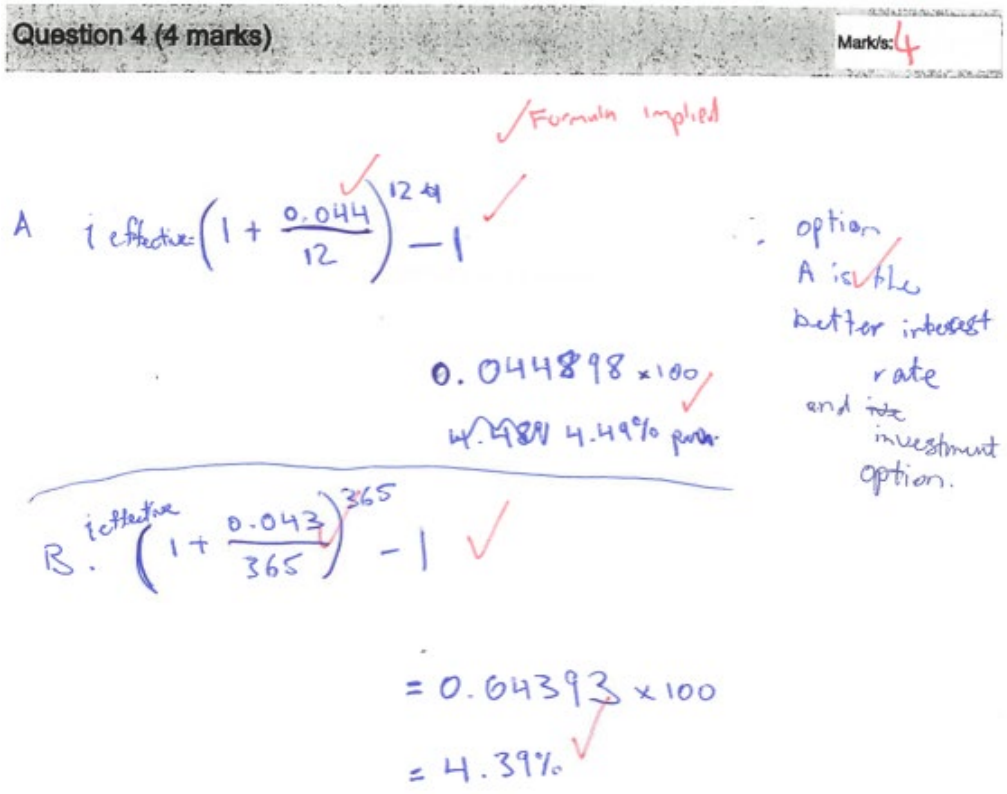
= $1836

Overall cost = $3437.5 + $1836

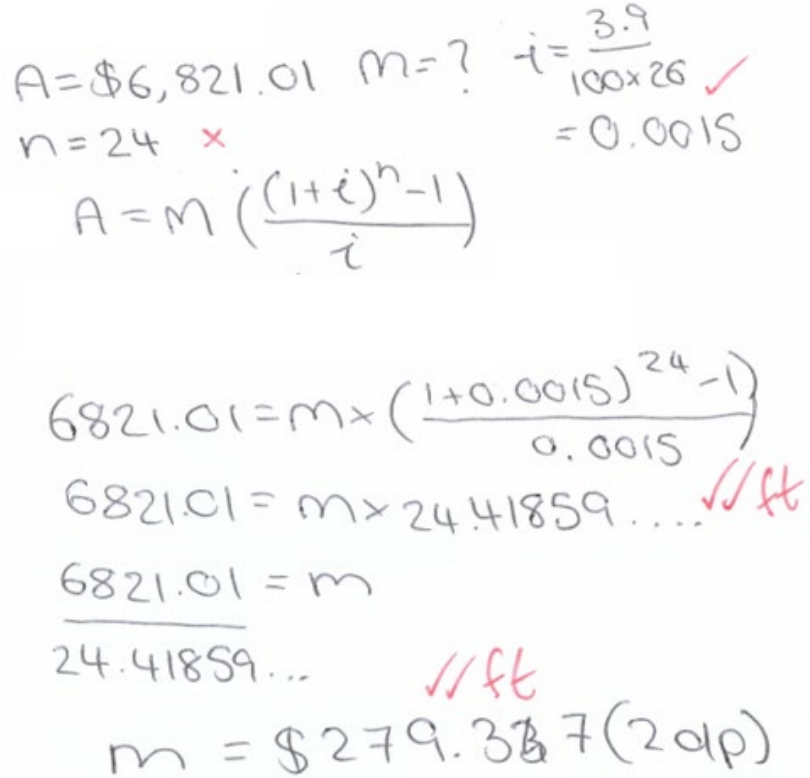
= $5273.5 ✓ total

the quote of $3570 was to low as the overall cost would be $5273.50 ✓ FT

Excerpt 4



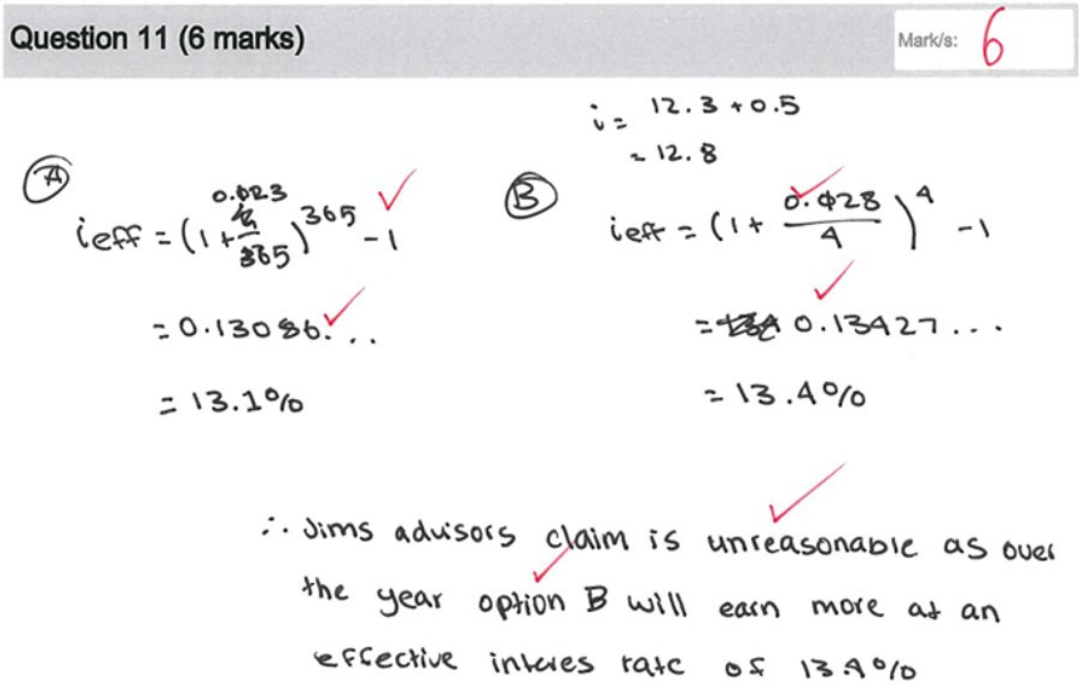
Excerpt 5



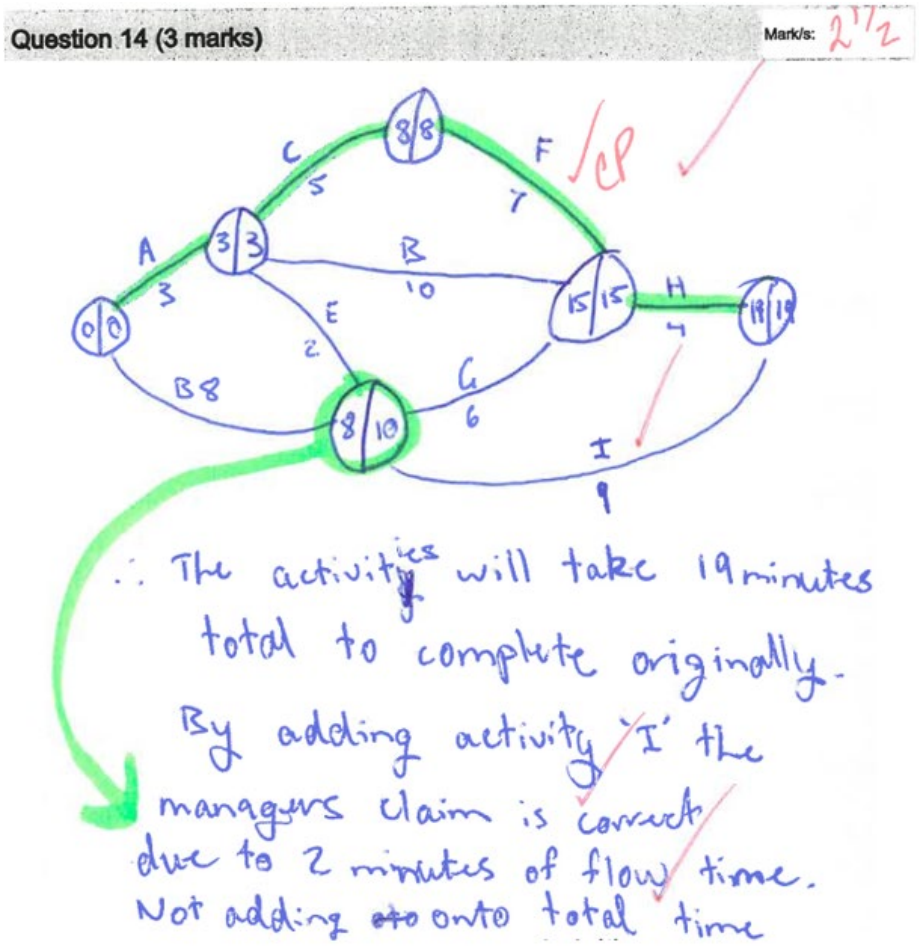
The following excerpts illustrate marking judgments for the demonstration of Assessment objective 4: evaluate the reasonableness of solutions. Each response to an examination question that explicitly addressed this objective is annotated by the teacher and marked according to the corresponding mark allocation in the marking scheme.

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

Excerpt 1

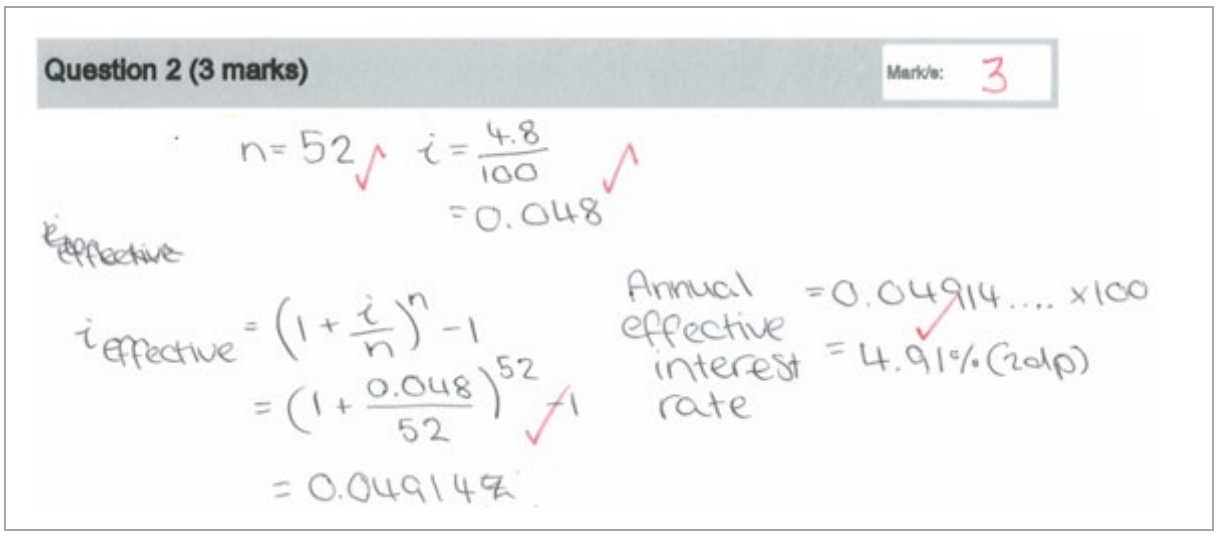


Excerpt 2



The following excerpt illustrates a response where the total marks awarded for the question is accurately recorded, e.g. within the optional 'Mark/s' box in the question header or at the end of the response. This indicates to the student how well the question response matches the marking scheme and assists the teacher in accurately calculating the total awarded marks for the examination.

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



The following excerpts demonstrate use of the ISMG to align the student's achievement percentage to the correct mark out of 15 by applying the appropriate 'greater than' percentage cut-off. Excerpt 1 shows the awarded total marks recorded in the summary table on the front cover of the examination. The non-rounded percentage of 80.9% is greater than 80% and therefore correctly aligns with an ISMG mark of 13/15. Excerpt 2 shows the awarded total marks recorded on the ISMG. The non-rounded percentage of 93.8% is greater than 93% and therefore correctly aligns with an ISMG mark of 14/15.

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

Excerpt 1

Marking summary

Criterion	Maximum possible marks	Marks allocated	Provisional marks
Foundational knowledge and problem-solving	55	15	80.9%
Overall	**68.0**	**15**	13

Instrument-specific marking guide (IA3): Examination (15%)

Criterion: Foundational knowledge and problem-solving

Assessment objectives

1. select, recall and use facts, rules, definitions and procedures drawn from all Unit 4 topics
2. comprehend mathematical concepts and techniques drawn from all Unit 4 topics
3. communicate using mathematical, statistical and everyday language and conventions
4. evaluate the reasonableness of solutions
5. justify procedures and decisions by explaining mathematical reasoning
6. solve problems by applying mathematical concepts and techniques drawn from all Unit 4 topics.

The student work has the following characteristics:	Cut-off	Marks
• consistently correct selection, recall and use of facts, rules, definitions and procedures; authoritative and accurate command of mathematical concepts and techniques; astute evaluation of the reasonableness of solutions and use of mathematical reasoning to correctly justify procedures and decisions; and fluent application of mathematical concepts and techniques to solve problems in a comprehensive range of simple familiar, complex familiar and complex unfamiliar situations.	> 93%	15
	> 87%	14
• correct selection, recall and use of facts, rules, definitions and procedures; comprehension and clear communication of mathematical concepts and techniques; considered evaluation of the reasonableness of solutions and use of mathematical reasoning to justify procedures and decisions; and proficient application of mathematical concepts and techniques to solve problems in simple familiar, complex familiar and complex unfamiliar situations.	> 80%	13
	> 73%	12

Excerpt 2

61/65 93.8%

15

Instrument-specific marking guide (IA3): Examination (15%)

Criterion: Foundational knowledge and problem-solving

Assessment objectives

1. select , recall and use facts, rules, definitions and procedures drawn from all Unit 4 topics
2. comprehend mathematical concepts and techniques drawn from all Unit 4 topics
3. communicate using mathematical, statistical and everyday language and conventions
4. evaluate the reasonableness of solutions
5. justify procedures and decisions by explaining mathematical reasoning
6. solve problems by applying mathematical concepts and techniques drawn from all Unit 4 topics.

The student work has the following characteristics:	Cut-off	Marks
• consistently correct selection, recall and use of facts, rules, definitions and procedures; authoritative and accurate command of mathematical concepts and techniques; astute evaluation of the reasonableness of solutions and use of mathematical reasoning to correctly justify procedures and decisions; and fluent application of mathematical concepts and techniques to solve problems in a comprehensive range of simple familiar , complex familiar and complex unfamiliar situations.	> 93%	15
	> 87%	14

External assessment

External assessment (EA) is developed and marked by the QCAA. The external assessment for a subject is common to all schools and administered under the same conditions, at the same time, on the same day. The external assessment papers and the EAMG are published in the year after they are administered.

Examination (50%)

Assessment design

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

- Paper 1, Section 1 consisted of multiple choice questions (15 marks)
- Paper 1, Section 2 consisted of short response questions (42 marks)
- Paper 2, Section 1 consisted of short response questions (38 marks).

Assessment decisions

Assessment decisions are made by markers by matching student responses to the external assessment marking guide (EAMG).

Multiple choice question responses

There were 15 multiple choice questions in Paper 1.

Percentage of student responses to each option

Note:

- The correct answer is **bold** and in a blue shaded table cell.
- Some students may not have responded to every question.

Question	A	B	C	D
1	10.90	2.32	1.45	**84.80**
2	**76.53**	5.47	4.67	12.59
3	2.18	**84.66**	12.13	0.48
4	**55.42**	5.02	14.04	24.80
5	2.25	7.68	**82.55**	6.83
6	4.57	**56.29**	25.68	12.70
7	5.01	**77.40**	3.40	13.59
8	8.05	**46.74**	29.53	14.75
9	7.78	10.02	**77.55**	4.08
10	5.08	6.47	**83.45**	4.16
11	**61.93**	20.86	5.64	10.81

Question	A	B	C	D
12	10.49	29.44	10.75	**48.46**
13	17.68	**44.92**	20.77	15.61
14	18.27	19.71	19.02	**42.23**
15	5.61	5.09	6.54	**82.02**

Effective practices

Overall, students responded well to:

- questions related to Earth geometry and time zones, including using latitude and longitude and calculating time difference, angular distance and distance (in kilometres) between two places on Earth
- situations requiring the construction of a scatterplot (with or without provided axis scaling), including a question that asked students to distinguish between an arithmetic and geometric sequence
- familiar financial situations, e.g. application of a geometric sequence to model diminishing-value depreciation and calculation of a fortnightly payment for a perpetuity
- network situations requiring the construction of a network graph, identification of a minimum spanning tree or shortest walk, use of forward and backward scanning to locate the critical path
- questions that required the development of, and substitution into, a least-squares line equation or rule for the nth term of a geometric sequence to make a prediction
- components of questions that required assumed knowledge, such as the use of Pythagoras' theorem and calculation of speed, and the effective use of technology, such as entering data and generating successive terms for a recurrence relation.

Practices to strengthen

When preparing students for external assessment, it is recommended that teachers:

- support students to
  - use correct mathematical terminology to describe syllabus terms, such as tree and cycle
  - interpret (as opposed to state) the slope of a line
  - distinguish between earliest starting time (EST) and latest starting time (LST) for an activity in a project and use the correct values from a completed forward and backward scan to calculate the float time for a non-critical activity
  - use the effective annual rate of interest formula in the same way for a perpetuity as for any other compounding investment or loan. The effective rate can be used to compare perpetuities with different compounding periods or payment frequencies
- support students to develop solutions using mathematical conventions and valid ways of working and communicating results, such as
  - defining variables when developing equations/models
  - writing formulas and identifying values for variables before substituting
  - providing reasons to justify decisions
  - re-reading the question stem to check that all requirements have been addressed

- teach students to complete steps in the correct order when calculating seasonal indices across multiple years using the average percentage method, i.e. first, calculate the average of the data values for each distinct year (not for each season and not for all years). Then express each data value as a percentage (or ratio) of the average for its year. Then average the percentages (or ratios) for the corresponding seasons for different years to arrive at each seasonal index
- instruct students to use a blue or black pen (not a highlighter) when identifying the sequence of edges and vertices for a minimum spanning tree or the required path or trail in a provided network diagram. For response evidence to be clearly visible when scanned, students should draw a thicker line or use a squiggly line or write the vertex sequence in the diagram response space.

Additional advice

- Students should be aware that a question worth more than one mark requires mathematical reasoning and/or working to be shown to support answers. The number of available marks for each question is commensurate to the amount of knowledge and understanding of subject matter that needs to be demonstrated to be awarded the marks described in the mark allocation statements in the external assessment marking guide. For instance, a response awarded five marks provides evidence for five-mark allocation statements in the marking guide and a response awarded two marks provides evidence for two mark allocation statements in the marking guide.
- If additional pages are required to complete a response, students should continue their solution on the additional pages at the back of the response book. On the additional pages, they should clearly indicate the question they are responding to. If a new response is provided, students must rule a single diagonal line through any work to be cancelled; otherwise, the original response will be marked.
- Remind students that work in the Multiple choice question book will not be marked. Instruct students to record their answers to the multiple choice questions in Section 1 of the question and response book by using a 2B pencil to fill in the A, B, C or D answer bubble completely. Students should ensure they have filled an answer bubble for each question.

Samples

Short response

Question 17b from Paper 1

This question required students to justify a suggested association between two variables by comparing percentages across categories for the travel time to school for students in two year levels.

Effective student responses:

- calculated the percentage of Year 6 students who travel less than 15 minutes
- calculated the percentage of Year 10 students who travel less than 15 minutes
- compared percentages to justify the suggested association.

These excerpts have been included:

- as they show correctly calculated percentages
- to demonstrate comparison statements that quantify the difference in percentages as large (e.g. significant, substantial, more than double) to appropriately justify the suggested

association. Stating there is a difference in percentages is not the same as stating there is a large difference in percentages. Percentages that differ but are similar (e.g. 45% and 55%) suggest no association.

Excerpt 1

As approximately 65%. ($^{11}/_{17} \times 100$) of year 6 students travel less than 15 minutes to school and only 25%. ($^{3}/_{12} \times 100$) of year 10 students do the same, there is a clear association between a students year level and their travel time. This is evident because a significantly larger portion of year 6students, when compared to year 10, travel less than 15 minutes.

Excerpt 2

year 6 = $\frac{11}{17}$ = 64.71%

year 10 = $\frac{3}{12}$ = 25%

∴ almost 40% more grade 6 students travel less than 15 minutes to school than grade 10 students. Only 25% of grade 10 students travel less than 15 minutes to school compared to a majority 64.71% of grade 6 students. Therefore, there is an association between a students year level and their travel time to school.

Question 19 from Paper 1

This question provided a store's actual sales each quarter for two years and stated the average quarterly sales for 2023 as $32 500. Students were required to calculate the average quarterly sales for 2024 and use this to calculate the seasonal index for the third quarter.

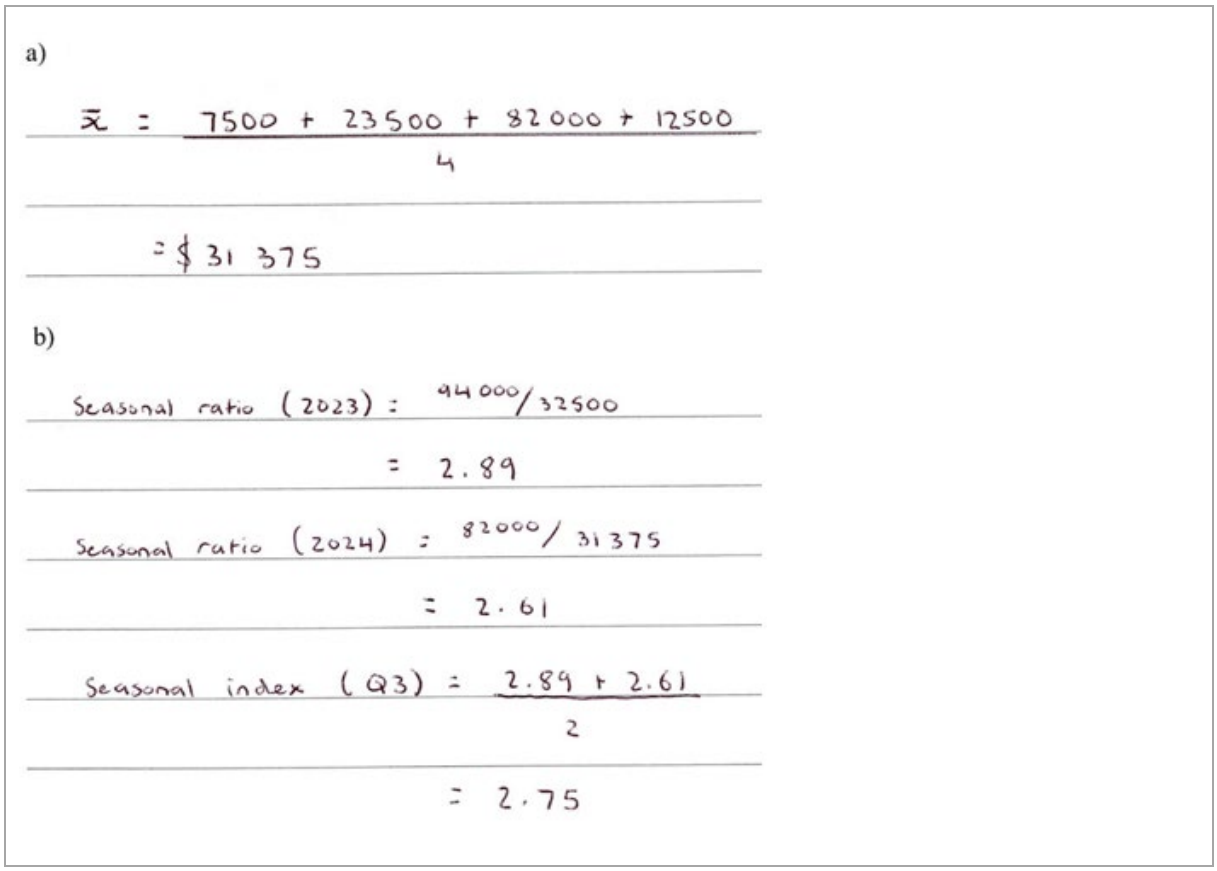
Effective student responses:

- correctly calculated the average quarterly sales for 2024
- correctly determined the ratio of Q3 sales to average quarterly sales for 2023

- determined the ratio of Q3 sales to average quarterly sales for 2024
- calculated the seasonal index for the third quarter.

This excerpt has been included:

- to show the correct order of steps to calculate a seasonal index across the two years. The response first calculates the average (mean) for the quarterly sales for 2024. Then each third quarter value is divided by the average for its year. The third-quarter ratios for different years are then averaged to calculate the seasonal index for the third quarter.



Question 20 from Paper 1

This question required students to use information for a reducing balance loan to write a recurrence relation for the amount owing, where n is the number of months. This was then used to calculate the amount owing, and the reduction in the initial loan balance, after two months. The annual rate of interest, monthly compounding period and monthly repayment were provided.

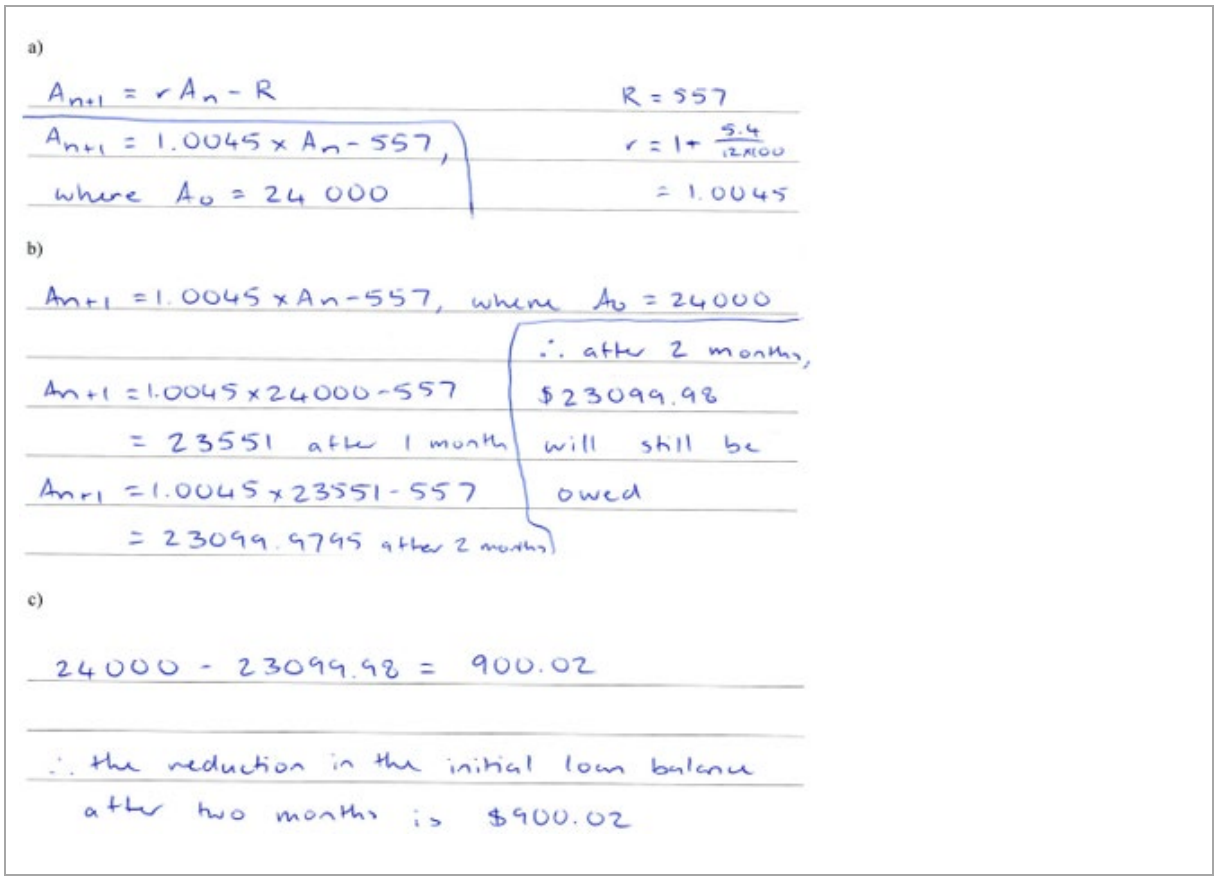
Effective student responses:

- correctly determined the recurrence relation
- provided mathematical reasoning or working to support the answer
- calculated the amount owing after two months
- determined the reduction in initial loan balance after two months.

This excerpt has been included:

- to illustrate a well-constructed response that correctly determines the r value using the monthly interest rate, then substitutes this to state the recurrence relation correctly. Two

iterations of applying the recurrence relation provide mathematical reasoning to support the answer for the amount owing, and the reduction in the initial loan balance, after two months.



Question 23a from Paper 1

This question required students to identify a subgraph of a given network and justify why it was not a tree.

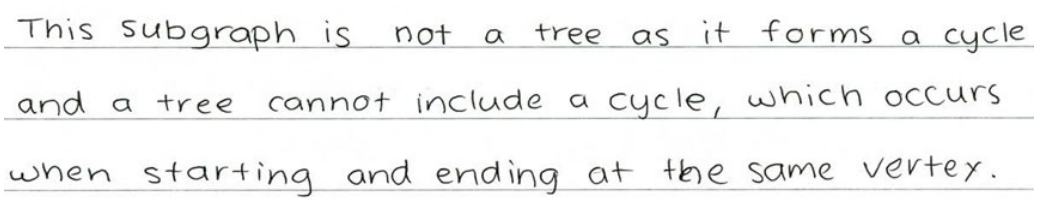
Effective student responses:

- correctly identified that the given features form a cycle
- correctly identified that a tree has no cycles.

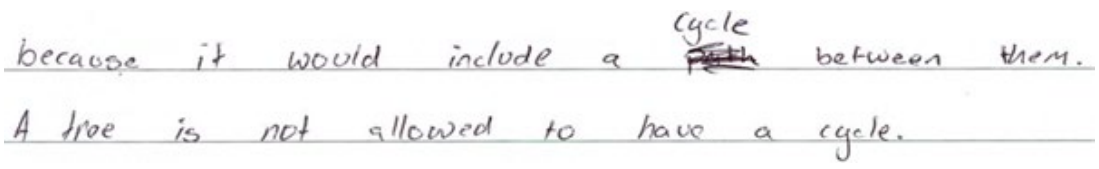
These excerpts have been included:

- to illustrate statements identifying a feature of the subgraph linked to a feature (or non-feature) of a tree.

Excerpt 1



Excerpt 2



Question 24b from Paper 1

This question required students to identify and interpret the slope of a least-squares line. A provided least-squares line equation modelled the average weekly earnings for Australian workers from 2013 to 2023.

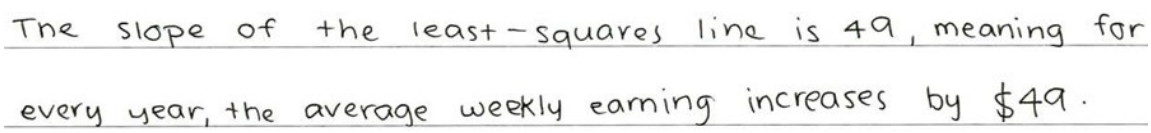
Effective student responses:

- correctly identified the slope value as 49
- correctly interpreted the slope as an increase per year.

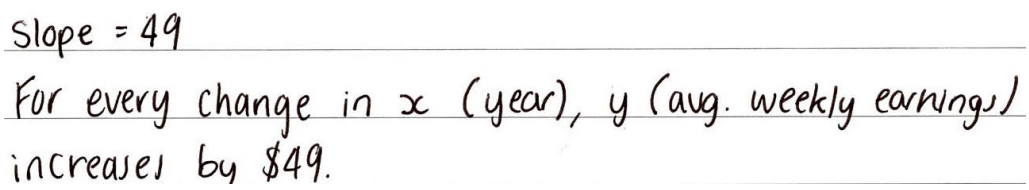
These excerpts have been included:

- to distinguish a value for the slope from an interpretation of the slope
- to show statements that effectively interpret the slope as a relative change in the variables for the given context.

Excerpt 1



Excerpt 2



Question 3 from Paper 2

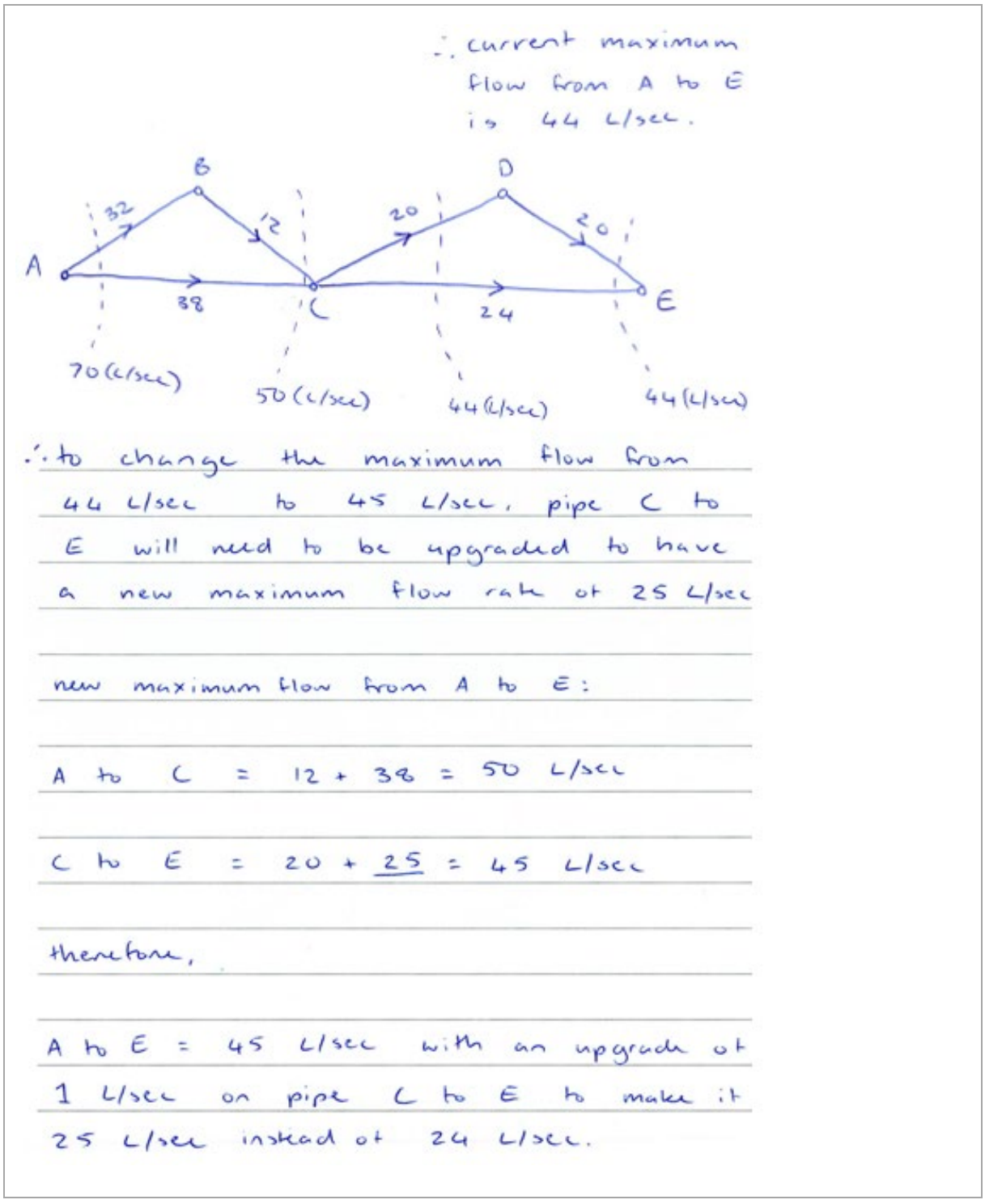
This question required students to create and use a flow network diagram to determine the new maximum flow rate for an upgraded pipe. A provided table showed the maximum flow rate through each pipe connecting different parts of the original network. It was stated that only one pipe would be upgraded to change the maximum flow from source (A) to river (E) to 45 L/sec.

Effective student responses:

- correctly constructed a flow network diagram showing all vertices, edges and correct weights
- applied an appropriate method for determining the maximum flow
- determined the original maximum flow from source to river
- identified the upgraded pipe
- determined the new maximum flow rate for the upgraded pipe.

This excerpt has been included:

- to show a correctly constructed flow network diagram
- to demonstrate an appropriate method that included finding all cuts and calculating the flow across each cut to identify the original maximum flow for the network
- to highlight a justified decision for which pipe would be upgraded to change the maximum flow to 45 L/sec.



Question 5 from Paper 2

This question required students to use a provided Eulerian graph to calculate the lengths of two trails, a usual trail that takes 17 minutes and a changed trail due to a condition constraint. Students needed to use the difference in trail lengths to provide a justified decision about the time taken for the changed trail.

Effective student responses:

- correctly calculated the distance for the walkway between A and C
- correctly identified an open Eulerian trail starting at A
- correctly identified the closed Eulerian trail starting at A (due to the condition constraint)
- determined the total distance for the usual trail and changed trail
- provided a decision supported by mathematical reasoning or working.

This excerpt has been included:

- to demonstrate the use of Pythagoras' theorem as an appropriate method of determining the walkway distance between A and C
- to show clear setting out of key steps, including finding the lengths of the usual and changed trails
- to illustrate an appropriate strategy to determine the walking speed and then the walking time for the changed condition.

usual walk: A - B - C - D - E - C - A - E

↳ open Eulerian trail

in metres: 208 + 105 + 140 + 140 + 208 + 233 + 105

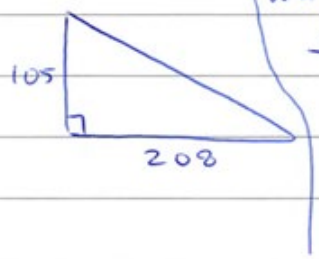
= 1139

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

$105^2 + 208^2 = c^2$

$54289 = c^2$

$233 = c$



walking speed:

$\frac{1139 \text{ metres}}{17 \text{ mins}} = 67$

∴ 67 metres per minute

tuesday walk: A - B - C - D - E - C - A

↳ closed Eulerian trail

in metres: 208 + 105 + 140 + 140 + 208 + 233

= 1034

new walk time: $\frac{1034}{67} = 15.43$ = 15 minutes and 26 seco

$15.43 - 15 = 0.43$ $\frac{0.43}{100} \times 60 = 26$

∴ Helen would not complete her walk on Tuesday in under 15 minutes as it would take her 15 minutes and 26 seconds to complete the walk at her usual pace.

Question 6 from Paper 2

This question required students to determine a hiking speed (km/h) for two people who start from opposite ends of a walking track. Students needed to determine when the two people met along the track for a break before walking together to the car park. For each person, the distance from the car park at the start of the hike was provided in equation form.

Effective student responses:

- correctly used an appropriate method for determining when and where the two people met on the track (simultaneous solution)
- determined the time since the start of the hike and the distance from the car park when they met
- determined the time of day when they finished their break
- determined the hiking speed
- showed logical organisation.

These excerpts have been included:

- to highlight alternative approaches, where an efficient method is selected and then applied accurately to reach the solution
- to demonstrate two appropriate algebraic strategies for finding a simultaneous solution — Excerpt 1 solves the equations simultaneously and Excerpt 2 finds equivalent terms from each model
- to illustrate an effectively structured solution, including prompts for the key steps, stated rules and working presented in a clear and logical order, including using appropriate mathematical terminology.

Excerpt 1

ADDITIONAL PAGE FOR STUDENT RESPONSES

Write the question number you are responding to.

Question 6

$F_n = 2n$

$G_n = 12 - 3(n-1)$

Find time where Fiore and Goran meet

$F_n = G_n$

$2n = 12 - 3(n-1)$

$2n = 12 - 3n + 3$ ∴ after 3 hours they meet on the track

$5n = 12 + 3$

$5n = 15$

$n = 3$

Find distance from the carpark after 3 hours:

$F_3 = 2 \times 3 = 6$ km

$G_3 = 12 - 3(3-1) = 6$km

Find time after break to walk back.

10 AM → 4PM = 6 hours

6 hours - 3 hours = 3 hours ∴ See next

3 hours - 0.5 = 2.5 hours Page.

2.5 hours to walk 6 km

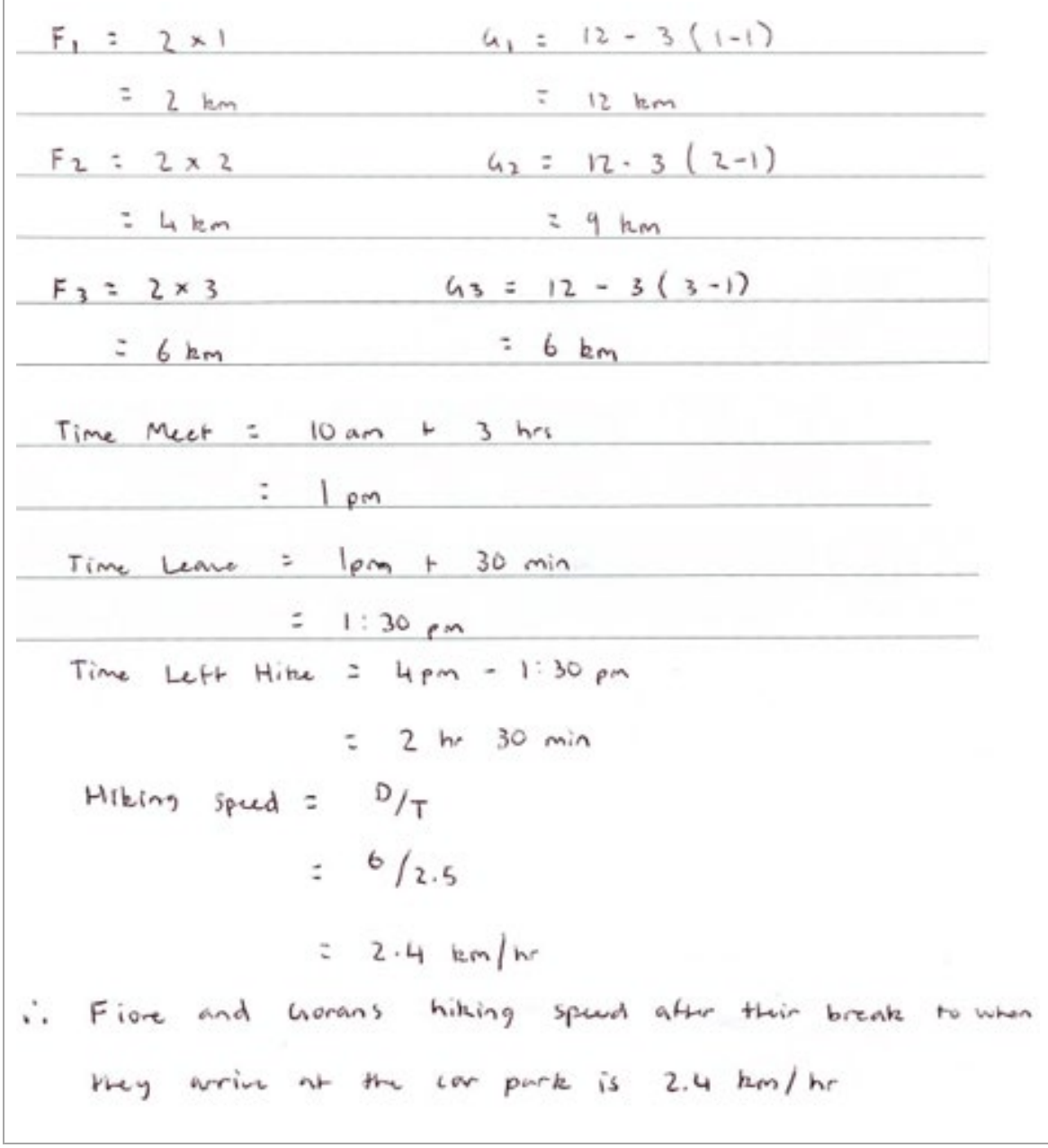
$\text{Speed} = \frac{\text{distance}}{\text{time}}$

$\text{Speed} = \frac{6}{2.5}$

Speed = 2.4 km/hour

∴ Fiore and Goran will be hiking 2.4 km/hour from when they finish their break to when they arrive back at the carpark at 4PM

Excerpt 2



Question 7 from Paper 2

This question required students to use financial data for two businesses, B_1 and B_2, over four years to evaluate the reasonableness of a prediction for the annual profit of a merged company, C. Students first needed to determine a model for the merged data to make a justified decision.

Effective student responses:

- correctly summed B_1 and B_2
- determined a model
- determined a suitable substitution
- determined C's predicted annual profit at the end of 2040
- provided a decision.

This excerpt has been included:

- to demonstrate a fully developed solution that identifies all relevant variables and shows clear and logical organisation, including prompts for the key steps and the use of appropriate mathematical terminology
- to illustrate a justified decision and a suitable reasonableness statement, supported by a comparison between the student's calculated result and the given prediction.

Find equation for B_1 =

$A = -191770000$

$B = 95000$ ∴ Annual profit = $-191770000 + Year \times 95000$

x = Year

y = Annual profit

Find equation for B_2

$A = -212090000$

$B = 105000$ ∴ Annual profit = $-212090000 + Year \times 105000$

x = year

y = annual Profit

Find Annual profit for $B_1 + B_2$ in 2040

B_1 = Annual profit = $-191770000 + Year \times 95000$

Annual Profit = $-191770000 + 2040 \times 95000$

2040 B_1 = $2030000

B_2 = Annual Profit = $-212090000 + Year \times 105000$

Annual Profit = $-212090000 + 2040 \times 105000$

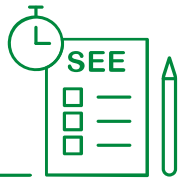
2040 B_2 = $2110000

B_1 Annual profit 2040 + B_2 Annual profit 2040 = Total Profit for company C 2040

∴ $2030000 + 2110000 = $4140000

∴ The claim is reasonable as if both companies continue to grow at the same rate when in combined in company C, the Annual profit in 2040 will be more than $4 million. It will be $4140000

Senior External Examination



The General Mathematics Senior External Examination (SEE) is a standalone examination offered to eligible Year 12 students and adult learners. It contributes 100% to a student's final subject result.

Assessment design

The assessment was designed using the specifications, conditions and assessment objectives described in the summative external assessment section of the General Mathematics Senior External Examination syllabus.

The SEE consisted of two assessments:

- SEE 1 contributed 50% of the marks
- SEE 2 contributed 50% of the marks.

Note: The SEE information should be read in conjunction with the rest of the subject report.

Number of students who completed the General Mathematics Senior External Examination: 9.

There were insufficient student enrolments in this subject to provide useful analytics.