# Government of South Australia LogoSACE Board Logo2024 General Mathematics Subject Assessment Advice

Overview

This subject assessment advice, based on the 2024 assessment cycle, gives an overview of how students performed in their school and external assessments in relation to the learning requirements, assessment design criteria, and performance standards set out in the relevant subject outline. It provides information and advice regarding the assessment types, the application of the performance standards in school and external assessments, and the quality of student performance.

The Subject Renewal program has introduced changes for many subjects in 2025; these changes are detailed in the change log at the front of each subject outline. When reviewing the 2024 subject assessment advice, it is important to consider any updates to this subject to ensure the feedback in this document remains accurate.

# School Assessment

Teachers can improve the moderation process and the online process by:

* thoroughly checking that all grades entered in school online are correct
* uploading the SATs as a single scanned file with a summary of student results in each of the SATs on the first page of the uploaded SATs file
* ensuring the uploaded tasks are legible, all facing up (and all the same way) and remove blank pages and student note pages
* filling in the variation form if a student did not complete one or more skills and applications tasks or mathematical investigation(s)
* including clearly marked answers for SATs and mathematical investigations responses, showing which mathematical calculations are fully or partially correct and which are incorrect is a requirement of moderation. Showing marks and totals for SATs is also helpful.

Assessment Type 1: Skills and Applications Tasks

In 2024 students were required to undertake five skills and applications tasks, including at least one skills and applications task from each of the non-examined topics. Please note that in 2025 assessment groups are able to complete four or five skills and assessment tasks, with the two non-examined topics being covered in either the SATS or mathematical investigation.

It is a requirement for moderation that SATs are marked to clearly indicate how much of each mathematical problem a student has been successful in attempting. Marking of all calculations in assessment responses is essential to support the moderation process.

All nine assessment criteria should be assessed at least once in either the skills and applications tasks or in the mathematical investigation. In particular, RC5, ‘forming and testing of predictions’ is easier to assess within Assessment Type 2: Mathematical Investigations. If it is assessed in the skills and applications tasks, then students should have plenty of opportunity to meet the specific feature to an A standard.

Teachers can elicit more successful responses by:

* designing tasks that provide a mix of routine and more complex problems that effectively differentiate student mathematical knowledge and understanding of concepts and relationships across the grade bands. A complexity guide has been provided to support teachers to identify key questions and key concepts that provide the opportunity for complexity in responses

The document ‘Complexity Guide General Mathematics’ is available under resources at the following link: <https://www.sace.sa.edu.au/web/general-mathematics/resources>

* allowing students to answer a wide variety of concepts within a topic rather than testing the same concept multiple times
* providing multiple opportunities for students to demonstrate interpretation of concepts and results in the context of the problem, including discussion of the assumption and limitations of the results in all skills and applications tasks
* using appropriate verbs such as state, explain, and interpret to guide students to form an appropriate response
* strategically placing ‘show’ questions that allow students back into a question if they were not able to complete a previous part successfully. An example of a ‘show’ question is providing the approximate answer to an annuity problem so that students who are not able to find the value can use the provided figure to continue through the following questions. In a ‘show’ question, students are required to not only present the final value but also provide evidence of the method used to determine that value, with marks not awarded for simply stating the given value in the question stem
* guiding students with information on the allocated marks for each question and the provided space for writing the answers, helping them understand the expected level of detail in their answers.

The more successful responses commonly:

* showed clear working out of all relevant steps, in particular for the ‘show that’ questions (an example of this is when students provide N, I, PV, PMT, FV, P/Y, C/Y as well as the exact answer in a ‘show that’ finance question)
* discussed the assumptions and limitations of the result in the context of the problem across all skills and applications tasks
* showed the ability to answer complex questions without excessive scaffolding which reduces the complexity. Examples include completing a linear programming from start to end without scaffolding, a loan where the offset goes both in and out of the loan, and changing the original transition, dominance, or connectivity matrix to see the impact.

The less successful responses commonly:

* were seen in skills and applications tasks that provided limited opportunities for students to respond to questions of a complex nature. Teachers need to ensure that at least 30% of the marks in each task are composed of questions covering complex concepts or requiring complex processes to solve the questions. Making changes to questions that results in multiple solutions such as changing a profit function or constraint in linear programming, changing a task length or prerequisite in critical path analysis questions, or adding or removing a row or column a Hungarian algorithm add complexity
* were seen where questions requiring complex processes or concepts were too heavily scaffolded to support progress through the solution, and the complexity was reduced. An example of a reduction in complexity due to scaffolding is in linear programming, where the constraints are stepped out using a table format with some parts already filled in
* were seen when questions required the use of answers from previous parts of the question, yet no ‘show’ question was provided to allow students to attempt the latter parts of the question if they were unable to complete the initial parts
* occurred when students provided an answer only for a multiple mark question as it limited the student’s ability to show what understanding they did have if they had a mistake in their answer. Teachers should promote students to show all their working
* were found when students provided generic assumptions and limitations rather then in context of the problem. An example of this is where a student would write the limitation of an interest minimisation strategy for a loan of ‘change of interest rate’ instead of showing a deeper understanding of the limitation that the interest rate could increase which would reduce the interest saved or in critical path analysis, where a student writes ‘delay to a job’ with no indication of what might cause a delay, such as building materials might be taking longer to arrive
* occurred where teachers indicated that they were assessing RC5 (forming and testing of predictions) and CT3 (application of mathematical models), yet the students were not given an opportunity to show these skills at an A level, or at all
* were seen when questions were based on tasks that used directly used questions from a textbook or from past exams. Questions from past examinations or exemplar skills and application tasks can be used as the basis for questions in skills and applications tasks, however they should be amended so they are not easily recognisable and do not form the majority of questions assessed in any individual task
* occurred where an open topic was included that did not have enough complexity for students to achieve in the higher-grade bands.

Assessment Type 2: Mathematical Investigations

In 2024 Students completed two mathematical investigations with a maximum length of 12 A4 single-sided pages with a minimum of size 10 font. The evidence presented in the two investigations should include key ideas and key concepts from at least two different topics. Please note in 2025 students complete only one mathematical investigation.

It is a requirement for moderation that teachers ensure that all mathematical solutions produced by the student in the investigations are marked for accuracy and errors are identified, as well as making comments about the written component. This supports the moderation process.

Teachers can elicit more successful responses by:

* providing some structure by having an initial problem that has scaffolding before leading to a more open-ended section, to allow the student to develop the model at the higher-grade bands
* ensuring the task explicitly states where students should be creating predictions as well as the steps to completing a prediction (make, test, and discuss the accuracy of the prediction)
* ensuring that the task allows for the discussion of limitations and reasonableness in context, both in the initial problem as well as the open-ended section
* students presenting the response in report format with the use of appropriate headings as well as labelling graphs and tables (e.g. table 1) so that they can be referred to them in the written responses
* where students use appendices for repetitive calculations only rather than all calculations. The first time a student does a calculation it should be in the main part of the investigation
* students using a sub heading for predictions and assumptions and limitations to make it clear to the moderator where they are covered. If they haven’t, please make it clear for the moderators where the student has made predictions and covered assumptions and limitations by stating RC2 and RC5 next to where it is located on their investigation.

The more successful responses commonly:

* occurred in response to tasks designed with enough scaffolding for students to achieve at the C grade band in the initial parts of the task, but also with an open-ended section which required students to extend their investigation in a direction of their own choosing. This allowed them to demonstrate their understanding at the higher-grade bands
* included a detailed development and application of a mathematical model beyond the initial model, with enough complexity. A complexity guide has been provided to support teachers to identify key questions and concepts that provide the opportunity for complexity. The document ‘Complexity Guide General Mathematics’ is available under resources at the following link: <https://www.sace.sa.edu.au/web/general-mathematics/resources>
* where students explained the concepts covered in the investigation when they first used them for example in critical path analysis (CPA) explaining all the key parts of a CPA such as dummy link, prerequisites, forward scan, backward scan, Earliest and latest start time, how to draw the network, slack time, critical time, and critical path as this showed an understanding of key concepts of this topic
* were seen where students completed the whole prediction process, that is they made an appropriate prediction, tested it by performing calculations, and discussed the outcome of their predictions
* where students refined their predictions by using prior knowledge to create better predictions. An example of this is when students first tested a prediction of increasing a home loan payment by $100 before using the result to make a prediction if they increased the payment by $200
* were seen in statistics tasks where students made a prediction about the model instead of subbing into a model and calling this a prediction. An example of an appropriate prediction in the coffee cooling experiment would be, due to a lid being on the coffee cup it will take longer to reach 30 degrees compared to a coffee without a lid
* showed comprehensive interpretation of the results, by providing both a complete interpretation of the answers in context, as well as comparing the results of different scenarios
* demonstrated a comprehensive understanding of the assumptions made in the investigation (in context) as well as the limitations of the assumptions and the effect that it has on the results found. An example in finance is the assumption that the interest rate of a loan would stay constant, however due to inflation the average interest rate can increase and if it does then more interest would be paid
* when students made sure the main calculations were in their investigation not the appendix and instead used the appendix for when they were undertaking a set of repetitive calculations, at which they instead used a summary table within the investigation.

The less successful responses commonly:

* tasks that allowed for opportunity for different starting parameters or data but instead all students used the same starting parameters or data, reducing the individuality of responses. An example would be all students having the same loan amount
* had evidence of all students following the same modelling processes (with the same changes implemented to their model), which indicated excessive teacher scaffolding. This particularly impacted the students in the higher-grade bands as scaffolding reduces complex mathematical modelling to a more routine level. An example of this is in the coffee cooling statistics task where all students in the assessment group would do the initial plus the exact same changes to their model, for example, add milk or change cup
* did not show enough complexity in calculations and model development at the A level, even though the task allowed them to. Examples included:
* in Topic 1: Modelling with Linear Relationships, where students did not cover concepts such as wastage, change of constraints, multiple solutions, or non-integer solutions
* in Topic 3: Statistical Models, where students only looked at residual plots for the exponential model instead of all models or did not look at the impact of removing an outlier
* in Topic 4: Finance Models, where students only changed one variable at a time, or completed an offset like a lump sum that goes and stays in for the term of the loan
* In Topic 5: Discrete Models, where students didn’t have to go through dummy links or have any changes to the critical path or Hungarian algorithm questions that lead to multiple solutions.
* included excessive routine and often repetitive calculations that were either prescribed in the task design or the student chose to do them. This limited the students’ ability to show understanding of complex concepts at the upper band levels
* were in responses where calculations had been marked correct, yet it was obvious that they were incorrect. An obvious example of this is a lump sum of $10 000 saving more than a $20 000 lump sum or in transition matrices where the steady state changes when the initial state matrix changes
* occurred in finance tasks where a lump sum and offset were treated in the same way. To show the full understanding of an offset the money must go both in and out of the loan
* were seen in statistics tasks where students chose to use screen shots of their calculator for graphs, residual plots, or the regression information instead of creating a graph with an appropriate scale or substituting the regression parameters into the regression equation. This limits students’ ability on criteria such as RC3 where they have not shown an appropriate scale or in CT4 where they have not shown they can use the information from their calculator to state the regression equation or draw the relevant graphs
* students providing a recount of what they did rather than an analysis of the outcomes of the mathematical calculations in the context of the problem. Students should be informed that the analysis of the mathematical results should include interpretation of the answers in context, comparison of results as well as a discussion of key findings rather than a recount of what they did and how they did it
* lacked evidence of both drawing conclusions and understanding of assumptions and limitations to address RC2 - most commonly providing minimal evidence of explanation of the assumptions and limitations in context. Often it was seen that students made a conclusion at an A level yet assumptions and limitations at a lower grade level but overall awarded an A. The final grade for RC2 needs to take into consideration both parts of the criteria
* where the student’s response was difficult to follow what calculations, they were doing or how they were developing a model through their calculations. This can be easily overcome with heading or a simple sentence stating what they were about to do
* lacked evidence of the whole prediction process, that is making the prediction, testing the prediction, and refereeing back to the accuracy of the predictions
* occurred where only one opportunity was allowed for a prediction to be made. This limited the students’ ability to show their understanding at the higher-grade bands where it asks for ‘predictions’
* occurred in the statistics task where students thought a prediction is simply subbing into an equation they have found and discussing if it was reliable based on extrapolation or interpolation. In this case, the students are not actually making a prediction, as they have not indicated what they think the outcome of the model will be. An example of a more appropriate prediction in the coffee cooling task would be that if milk was used in the coffee, the initial temperature would be lower, and the rate of decrease would be slower than a coffee without milk, or if milk was added it is predicted to reach room temperature more quickly
* did not allow the students to show enough complexity to achieve in the higher-grade bands, when an open topic was used.

# External Assessment

Assessment Type 3: Examination

The evidence in the students’ responses to the 2024 examination showed that the vast majority of well-prepared students were able to complete the paper in the time available.

Like the 2023 examination, the 2024 examination also only had eight questions, with a continued even or approximately even allocation of marks across the three topics. Again this year, students performed best in the Hungarian Algorithm question, with the Discrete models topic continuing to be the topic that students coped the best with of the three examined topics.

The most successful students continue to show clear process in their calculations, including in the recording of calculator inputs (especially for the Financial and Statistical models questions) and displaying calculator solutions before appropriately rounding solutions depending on the needs of the question.

One theme that came across strongly this year is that students are struggling to successfully interpret and provide contextual solutions to questions. This came across clearly in several places and is highlighted in the question responses in the following pages. In many cases, students are simply providing a cheat sheet response and not actually thinking about what the solution means in relation to the question. In all worded response questions, it is important that students pay attention to what the question asks for and the marks available. They then need to give clear and distinct responses with specific reference to the context of the question rather than generic responses from their cheat sheet.

The most common concepts that students struggled with were; (2c) selection of the incorrect tail and area combination for inverse normal calculations, (2ei, 2eii) correctly labelling a probability distribution and drawing a probability distribution from mean and standard deviation information, (3a) correctly explaining the reason for a dummy link, (3cii) Using a precedence table to find a critical path / minimum completion time, (4c) calculations for pension annuities and explaining compound interest vs the balance of an account in context, (5ci and 5cii) finding where two models intersect and discussing that solution in the context of the question, (6aii and 6bi) finding the time a task takes from a completed forward and backward scan, (6e) finding the latest starting time of a task, (7bii) explaining the meaning of the b value in the correct context for a linear model, (7f) manually finding a residual value from additional data provided, (8ai and 8b) effective rate calculations for flat rate and compounding investments (8f) calculation of interest saved for an offset account.

Examination markers aim to award marks for evidence of student understanding in response to examination questions wherever possible, however students should be advised not to cross out their responses or attempted responses to questions in the examination booklet unless they are confident that no part of what is crossed out should be considered by the marker.

If a student crosses out a response and then decides that it was the correct (or the most correct) answer, then the student should indicate clearly to the marker which part of their response should be considered. This could be done by circling or highlighting all or part of the response that the student wants to be considered and writing “please mark this work”. Students do not need to rewrite their answers in this case unless the crossing out has rendered the response unreadable. With this in mind, students should avoid completing the exam in pencil and using an eraser to remove completed work. Pencils should only be used for diagrams or graphical representations and not as the main writing implement. Remember also that there is an additional page at the back of the exam booklet if further space is required for any question, rather than squashing responses and making them harder to read.

In financial modelling questions, students should always round a monetary solution to two decimal places, providing an answer correct to the nearest cent. It is also always better to provide more decimal places in solutions, than an insufficient number. Examples of this would be when calculating a proportion in a normal distribution question or when describing the rate of increase “b” in an exponential regression question. Rounding will be discussed where appropriate in the review of questions. Other examples of the would be when finding either the Coefficient of determination (r2) or Pearsons Correlation Coefficient (r), where students should think about three decimal places, especially if they need to compare values which are very similar.

Within the financial models questions, students will often be asked to “show that xxxxx is approximately $ ”. These questions are in the exam to provide students who are unable to complete one section, a way back into the question and show knowledge in subsequent parts to the question. When this happens, students can continue, without penalty, using either the value that they have calculated themselves or the “show that..” value stated in the question. Exam markers will follow your working to look for correct process and will be provided with marking schemes to suit both calculated and “show that” solutions. Specific reference to this has been made in the comments for question 8 this year.

Question 1 – Hungarian algorithm

With the Hungarian algorithm being the most successful question for students in both the 2022 and 2023 exams, it was logical to have this as question 1 this year. In general students coped extremely well with the content and it was the most successfully answered question this year with over one third of all students gaining full marks and over half the cohort achieving at least 8 of the 10 marks.

Most students were able to correctly identify the shaded box in the table and explain its meaning in part (a). Students do need to pay particular attention to units and ensure that they use them in their answer. Allocations of tasks from zeros was completed very well, although some students did forget to write down the total time in part (b).

Part (c) required students to recognise that the algorithm can only be applied to square matrices. In some cases students struggled with terminology here. The completion of the algorithm was done well by the majority of students although errors were noted in the addition and subtraction of minimum values. Feedback from markers suggests that some students found the completion of a partially complete problem difficult as not all steps were required. It is also worth noting here that a lot of students forgot to state the new minimum completion time, highlighting the need to fully read the question in more detail. The final part of question 1 asked why the statement would be unreasonable. This required a response which referred to the context of the question and previous solutions. In this section the most successful responses commented on something dog related, employee related or time related. It is important to note here that stating an employee can’t do two jobs or another does no jobs or comments about the non square array will gain zero marks.

Question 2 – Normal distribution

Normal distribution is generally a topic that has been answered well by students in previous examinations and placed early in the examination. In the 2024 examination, just under 40% of students achieved 8 or more marks out of the 10 available. This was the 4th best answered question within the exam.

Part (a) allowed students to either answer using the standard % curve or use the Ncd function on the graphics calculator. In general this was completed well. Students should note that we do look at accuracy within the statistics questions and solutions that have been too harshly rounded risk not attaining full marks. Examples of this would be evident in (b)(i), (b)(ii) and (c). In part (b)(i), 4% solution while correct is lacking accuracy. Students should be encouraged to use 3 significant figures in a question like this as it is a better level of accuracy. This also holds true in part c, where a solution of 16 months would not hold enough accuracy based on the context of this question.

Part (b)(ii) required students to provide an integer solution as it was asking about the number of children. Students need to recognise whether the type of variable used is discrete or continuous, thus the requirement for appropriate rounding. This was a common issue not just this year, but in previous exams as well.

The other common notable error in part (c), was the incorrect selection of tail right, 10% or tail left, 90% when using the Inverse Normal function on the calculator. In a case where the student picks the incorrect combination, follow through is awarded.

Part (d) was generally not well completed. In this question students were required to selected yes and then provide a solution which compared either the percentage funded, the time at which funding happened or the actual number of children receiving funding. In lots of cases students did not provide enough detail in their response.

Part (e) was completed very poorly overall. There were lots of errors in the completion of boxes A and B, with the most common error allocating First molar to either box A or B. Note that simply writing the standard deviation and mean values in the boxes was not sufficient to gain the mark, students needed to specifically state the markers.

It has been a reasonably long time since students were required to sketch a normal distribution curve in the exam. This was not completed well. It was expected that student show correct mean value position based on the height of the curve and horizontal positioning of the mean. There are lots of past examination questions like this and it would be advised that students practice this skill.

The final part of the question if correctly completed would produce a probability in scientific notation. Please not that 9.815E-3 is not an acceptable response. Feedback from the marking panel indicated that students struggled with the interpretation of the scientific notation and how to convert to either a decimal or a percentage. It is important that students read the question carefully again here as calculation and a statement were required for the 2 marks. Again, as with question 1f, it is important that students appropriately reference the question context.

Question 3 – Network with a precedence table

This was the 2nd best attempted question in this year’s exam with 41% of students attaining at least 7 out of 8 marks in this question and 63% of students attaining at least 6 marks.

Feedback from markers around part a indicated that while lots of students are providing an accurate explanation of the need for the dummy link, many students are still only providing a partially complete answer or missing key information. As highlighted in previous exam feedback students must mention all relevant tasks. In this case, two marks would be awarded for a statement like “ Tasks G and F required tasks C and D to be completed before they can start, however Task E only requires the completion of Task C”. This response deals with the path to E from C without the dummy link and also addresses the combined requirement of Tasks G and F having two immediate prerequisite tasks. Students should be encouraged to discuss all tasks adjacent to both ends of the dummy link in their response.

Part (b) required students to add an additional dummy link to the network diagram. Common errors included the incorrect starting or ending vertex or a missing arrowhead to indicate direction.

Part (c)(i) was generally answered well. A reminder here that 2 marks indicates that there are two correct solutions. It is important to note that any students who ticked 3 boxes could only gain 1 mark maximum and students who ticked all boxes would receive no marks. Part cii was answered well, with common errors including not counting the task time for task J and only using the EST/LST values. A helpful hint here is to highlight where EST and LST are the same, this provides the critical path. You can then add task times to find the minimum completion time.

Question 4 – Superannuation, pension annuity and inflation

Like 2023, the financial models topic was split over 2 question. This was the longest question in the paper this year with 17 marks on offer across 3 sections on 3 pages. This question was the 3rd best answered in the exam this year with approximately 30% of student scoring at least 14 of the 17 marks available.

The first section focussed on superannuation with the majority of students able to successfully answer the routine sections in part a. Students who made errors here used the salary of $67500 as the PV value instead of $0 as it should have been. It is important in this type of question to understand that not all monetary values in the question go into the financial or TVM solver in the calculator you need to be able to interpret what is required.

Part (b)(i) was generally answered well with lots of possible solutions available to students. In part (b)(ii), students struggled with the wording hence and this did cause some confusion. With questions like this, it is again important that students reflect on what is being asked. Many students just provided a status quo response like can’t afford to pay the extra 1% in part (b)(i), pay the extra 1% in (b)(ii). A response like this would gain the first mark, but it did not describe a way to overcome the initial problem.

The second page of this question related to a pension annuity. If students were unable to complete questions on the previous page, they would still be able to complete each of the questions on this page. Part (c)(i) was a show that question asking about a weekly income payment. In this question students need to show the calculator solution of $2364.43 (i.e. the cents should be displayed). Simply writing $2365 with calculator inputs does not satisfy the burden of proof for this solution. It is also worthwhile noting that students who only write down the calculator solutions without stating calculator inputs are less likely to receive follow through credit as it is very difficult for markers to decipher where the error occurred and if it is one or multiple errors occurring. A common error in (c)(i) was the incorrect placement of the $2 000 000 to FV. Part cii required students to calculate the number of years it would take for the balance of the account to reach $1 000 000. In this section students needed to have the signs of pmt and Fv opposite to Pv (ie pmt and Fv both positive with Fv negative or vice versa). This was the most common error as from there, the majority of students were able to divide by 52 to find a solution in years. Part ciii was done well by some students, although in general there was a lack of detail in responses or insufficient depth to gain both marks. Students needed to discuss that while the balance on the annuity is high, the interest generated will also be high resulting in the annuity falling in value very slowly due to the affects of compounding interest. Thus it would take longer than half of the annuity term to reach half of the annuity value. There were students who mistook this as a loan, thus demonstrated incorrect understanding.

The final page of this question focussed on inflation presented in the form on an exponential model. Most students who attempted this section coped well with completing the statement, although some students did struggle with converting the decimal value to a percentage (i.e. explaining the b value in the model). Again most students were able to successfully use either the model or the calculator answer dii. The next part, diii, was less well done, mainly by students who did not recognise that the inflation model was an exponential model. Part (e) was another example of lots of students have some understanding of what the question was asking but perhaps not being specific enough in their response or providing a vague solution. The question asked specifically why this situation was reasonable. Students could have either discussed that it would only be in the final 2 years that she would have a shortfall or that she would have accumulated additional savings from exceeding her standard of living for the majority of the term to cover the last 2 years. Again with this question, the context is important, and students need to pay particular attention to this.

Question 5 – Linear and exponential models

This is the second of the statistical models questions and the 3rd hardest question in the exam based on student responses. In this question approximately 40% of students scored at least 6 of the 9 marks available.

In part (a), students were presented with data, two models (linear and exponential) and the Coefficients of determination for both models. The question asked students to apply the linear model from the table. Successful responses followed those instructions and correctly applied the linear model. It was found that there were significant numbers of students inputting the data into their calculators to find their own model and then complete the question. This is an unnecessary waste of time, and students should trust the model information provided in the question. Other less successful responses applied the exponential model.

In part (b)(i) common errors included missing the subject of the model (either C or y) and missing the negative in front of 1696. In part (b)(ii) students could either compare the strength of correlation (ie higher r2 for the exponential model) or provide an appropriate response in relation to the shape of the scatter plot curve or subsequent residual plot for the linear model. Part (b)(iii) was very poorly attempted by the majority of students. Once again there was a lack of understanding when connecting the model to the question context with many responses coming straight from cheat sheets and not addressing what the question asked. Specifically here, students did not explain the age of the cat in relation to the “a” value. Part (b)(iv) was generally completed well by students who attempted this question and who applied the exponential model. Part (b)(v) required students to comment on reasonableness based on the solution to part (b)(iv). Again most students were able to identify that this is highly unreasonable due to the huge cumulative costs or due to the extrapolated data around age and high costs.

Part (c) was very similar to a question posed in the 2023 paper about tricks mastered. In this question students needed to input both models into their calculator and either use equation solver or graphical solver for the intersection point. Like 2023, this was not completed well, and it is something that students should be more familiar with. There were a number of students who found that there were in fact 2 points of intersection, however one had t = -10.2 years which is obviously not possible as t must be a positive value. The final part of question 5 asked for an interpretation of the intersection point from (c)(i). This was very poorly completed as again students did not refer appropriately to the context of the question with very few students gaining the second mark here. Successful students indicated that a 4 year old cat would have cumulative vet bills of $1624. More successful students would then go into greater detail about which context was better before and after the intersection point (i.e. visit the vet annually or not).

Question 6 – Critical path analysis

This question was in two main parts, the first followed a similar trend from the past couple of years where the forward and backward scan were completed, but tasks times were not provided. The second half then answered questions on a partially completed forward and backward scan where task times were given. This question was considered the 4th hardest when analysing student responses, with approximately 30% of students scoring 8 or more marks out of the 11 available.

In general part (a)(i) was answered successfully by the majority of students attempting the question. It is about a task that lies on the critical path thus a very routine calculation. Part (a)(ii) was less well attempted with 8 weeks being a common incorrect solution. In this case the backward scan was more important and indicated that the correct task time was 7 weeks.

Some additional information was provided at the start of part b indicating that task H had 1 week of slack time. This information needed to be used for both (b)(i) and (b)(ii), although based on the solutions provided by significant numbers of students, it appears that many students did not apply this information to the network correctly. The most common incorrect answer for (b)(i) was 4 weeks, ignoring the 1 week of slack time. When identifying the critical path or paths, again many students disregarded this information and incorrectly included a path with task H included. Students should again consider the number of marks on offer here, with 2 marks, they should provide 2 critical paths. It could however be argued in this case that the only true critical path was in fact ABCEGJ and if that path was given, students did in fact receive both marks.

Part (c) was a relatively simple question that many students overcomplicated. In this question they should be talking about no alternative parallel path being available or that there was no other way to start working through the network.

The second half of this question started with completing three values on a forward scan and three values in a backward scan. In part (d)(i) the forward scan was completed well and the majority of students attempting this question gained this mark. Part (d)(ii) was less well completed with the most common errors in the vertex after task C with 7 or 10 weeks being common errors here. Part (e) was also relatively poorly completed with common errors 2 or 8 weeks.

Part (f) required students to think about a change to the network at the top of the page and then compare the new minimum completion time for that network to the initial network on the previous page. This was generally done well for the most part, although some students stated that J was not on the critical path (not recognising that the delay is longer than the slack time and therefore the path would change to go through J). In this question students needed to state which network was more efficient and show evidence why (i.e. comparison of 23 weeks vs 24 weeks minimum completion time).

Question 7 – Linear model with residual plot

Based on responses this was considered the 2nd hardest question in the examination. In this question approximately 34% of students scored at least 7 out of the 10 available marks on offer.

Part (a) required students to find Pearsons Correlation coefficient for the data provided. Most students were able to successfully answer this however it does need to be highlighted again that students need to provide a solution correct to more than 1 decimal place for accuracy. This is something that has been continually highlighted for the past few years.

Part (b)(i) then required students to select the most appropriate model for the data using correct variables. Again this was relatively well done, with most students selecting the correct option. The scatter plot provided should have helped with this as the variables were clearly shown on the relevant axis. Part (b)(ii) was not completed as well, with many students unable to successfully explain the b value in the correct context with many students incorrectly commenting on simply the y intercept or the “initial value”. Part (c) required students to place a missing residual value onto the residual plot provided. There were a lot of students who skipped this question or missed it. Advice here is to look where marks are allocated and then be aware that something is required. In general, the students who attempted this question were able to place the residual value in an appropriate position to gain the mark. Part (d) was very clear in stating that two reasons were required, from two separate sections of the question to explain why the linear model was appropriate. Here we saw lots of students only give one reason or give two reasons but from the same section (i.e. residual plot or comments about the r value). Again it is really important that students read the question carefully and answer what has been asked. Look for bolded or italicised words or phrases as they are placed there to help emphasise this for students.

The third page of this question focussed on using additional data provided to find and explain a Happiness index value and then to find a residual value. Most students who attempted part (e)(i) were able to apply the linear model to find an H value of -1.93%. Although some students did decide to leave off the negative. Please note that follow through was applied by markers for students who picked the wrong model earlier in the question. The interpretation of the H value in part (e)(ii) was less well done with many students again struggling to explain the reasonableness of their solution in the context of the problem. This interpretation of problems in context has been a common theme throughout several problems. Ultimately students who correctly identified -1.93% should be stating that a negative % of GDP is not possible or making an equivalent statement.

In part (f) most students who attempted the question were able to gain at least 1 of the 2 marks. Here students were required to find the predicted H value and then manually use the formula, residual value = actual value – predicted value, to find the solution. Common errors were to add the new data point and remodel the data to find the residual, this approach was awarded 1 mark resulting in a solution of 1.05. Other errors included using an incorrect formula to find the residual value.

Question 8 – Effective rates, investments, and home loans with offset account

The final question was the hardest question based on student responses. There were lots of students who ran out of time at some point during this question resulting in several unattempted sections. This is something that does happen each year, but students need to think about planning their time throughout the paper to manage this. In this question approximately 13% of students gained at least 12 or more marks out of the 15 available.

This question focussed on three main areas: effective rates, comparisons of investments and home loans with an offset account.

The first page looked at finding effective rates for both a flat rate and a compounding rate. Errors were present in both methods, and it is clear in both scenarios that the majority of students were not confident at changing a nominal rate to an effective rate. In part b, a common error was 4.59.

Part (c) then looked at finding and comparing either the future value of a flat rate investment against a compounding investment over a 5 year period or comparing interest earnt in this time. Most students who attempted this question were able to gain some marks, but very few gained full marks in this question with common errors including only finding the value of the investment using one method or failing to do a comparison of the two future values or interest earned values.

Part (d) looked at finding the value of a home loan after 6 years. Most students who attempted di coped well with this and were able to find an appropriate solution. Part (d)(ii) was not completed as well, with the most common error being students incorrectly applying the formula and forgetting to subtract the $472 000 from the Pv of $510 000. Students who applied the amortization method here were generally successful as the calculation (PM1=1, PM2=72, was less complex.

Part (e)(i) introduced the idea of the offset account and students were only required to subtract the $12 000 from the $472 000 stated in part (d)(i). This was answered well by the majority of students who attempted this. Part (e)(ii) was a relatively simple FV calculation and in most cases, students were able to answer this successfully if attempted. It is important to note here that students could either use the values calculated or the $460 000 from the show that sections for PV, markers will follow both for solutions.

Part (f) was applying the offset account and finding the interest saved by using this facility. Although this was skipped or left blank by large numbers of students, it is fair to say that students did on the whole do better with this question than the previous year. There are several strategies that students could apply to answer this question, but they all start by adding the $7000 back to the balance calculated at the end of part (e)(ii). From there students need to find n, the number of payments still to be paid to pay off the loan. Students could then either have an amortization approach both comparing interest without the offset account to the interest charged in each section or by simply finding the time saved and multiplying this by the monthly payments and subtracting the left over $5000 from the offset account (a step missed by lots of students). Alternatively they could compare the original interest without offset to that with offset using formula (again with the need to remember about the extra $5000). Advice for students is to practice questions like this as they are some of the most complex found in the General Mathematics course.

The final question in the exam asked why Janet needed to consider tax implications but Bill would not. This was a relatively simple question to end the exam, but students tended to not provide enough detail in the context of the question. Successful responses talked about the interest earnt by Janet and Bill explaining that Janet would have a tax liability based on her interest earnt, but that no interest is earnt in the offset account hence no tax implications. Many students only talked about 1 person so insufficient information was provided in the response to gain the mark.