

Victorian Curriculum and Assessment Authority (VCAA)

Independent Review of 2022 VCE Mathematics Examination
Development Process

15 August 2023

[REDACTED]
Level 32, 2 Lonsdale Street
Melbourne VIC 3000

Dear Mr Smallwood

Re: Independent review – VCE 2022 Mathematics Exams

We refer to our Letter of Engagement, dated 13 January 2023 whereby you engaged Deloitte Touché Tohmatsu Ltd (**Deloitte**) to conduct an independent review relating to the Victorian Curriculum and Assessment Authority (**VCAA**) development process of the 2022 VCE Mathematics Exams (**2022 Maths Exams**).

We are pleased to provide you with our recommendations and information gathered in our review. Please do not hesitate to contact me on [REDACTED] if you have any questions.

Yours sincerely

[REDACTED]
[REDACTED]
[REDACTED]

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1 Executive summary

Background and methodology

- 1.1 Deloitte was engaged by VCAA to conduct an independent review relating to VCAA's development process of the 2022 Maths Exams¹ following concerns raised by third parties on the quality of the 2022 Maths Exam content and the lack of transparency on the Maths Exam writing process.
- 1.2 Our engagement activities included:
 - a) Conducting a desktop review of VCAA's policy, guides, and other relevant documents associated with the design and development of the 2022 Maths Exams.
 - b) Conducting 15 interviews with various individuals involved in the Maths development process for Specialist, Maths Methods, and Further Maths.
 - c) Assessing the writing and vetting process of the 2022 Maths Exams against the relevant VCAA policy and guides. In undertaking this review, we considered for each key finding the risk or impact of the finding on the exam development process and developed recommendations to address each risk / impact identified. We have set out our findings, risks and impact, and recommendations in Section 3 below.
 - d) Exam review conducted by external third parties as to the mathematical content of the 2022 Maths Exams.
 - e) Prepared a summary outlining the general and question specific feedback the VCAA has received from various parties in relation to the 2022 Maths Exams, and the commentary of the Maths questions or solutions received from the interstate bodies - NSW Education Standards Authority (NESA) and Queensland Curriculum Assessment Authority (QCAA). This summary is contained in Appendix 4.
 - f) Preparing a report summarising our findings and recommendations.

Observations and recommendations

- 1.3 The following provides a summary of our key findings and recommendations. Our recommendations have been developed based on our understanding of the current Maths Exam development process and matters we consider relevant to assist VCAA operate more effectively in the future.
- 1.4 During our review we found:
 - a) There were no breaches or material deviations of VCAA policy and procedure identified in the 2022 Maths Exam development process that resulted in substantiation of the allegations raised by the third-party complainants. In particular, we did not identify any evidence of misconduct by VCAA employees in the 2022 exam development process. While there may remain different views or opinions on the quality and utility of the 2022 Maths questions between the VCAA and the third party complainants, we found the VCAA acted in accordance with its policies and procedures.
 - b) Several of the current Maths Panel Chairs and Panel Members (employed by VCAA on a 1 year term) did not go through the initial recruitment application process, but were instead directly asked by the EDM, CM (both VCAA employees) or another VCAA officer if they were willing to take on the position.
 - c) There is currently no policy/procedure which outlines what occurs when no suitable applicants are found for a job role (refer to Improvement Opportunity 2).
 - d) Panel Chairs are generally selected from experienced or existing Panel Members to ensure they have experience and a good understanding of the exam development process.
 - e) Panel Chairs stopped receiving a physical copy of any timeline or exam development manual from VCAA in 2022. We note that Panel Chairs were provided the examination development manual via Kiteworks at the Introductory Panel Information Session. At interview one Panel Chair stated "there is a VCAA training session where they are given the exam writing handbook". Another Panel Chair stated that they "used to get a manual, but not anymore".

¹ 2022 VCE Mathematics Exams refers to the exam for each of the subjects in the VCE Mathematics study Design and includes; General (Further) Mathematics, Mathematical Methods, and Specialist Mathematics.



- f) There is no formal training provided to Exam Development Personnel (Panel Members, Panel Chairs, SSV, ESV) when they are appointed to be part of the exam development process (refer to Improvement Opportunity 3). SSVs and ESVs are Independent Contractors employed on a 1 year term.
- g) A number of those interviewed stated that more consistency in Exam Development Personnel staff would allow for a smoother exam development process and better-quality questions (refer to Improvement Opportunity 4).
- h) Generally, meetings and discussions throughout the development process are not documented via meeting minutes or file notes; outcomes are noted in comments or tracked changes on the exam document itself (refer to Improvement Opportunity 12).
- i) An interviewee noted that in the 2022 Specialist Maths Exam, some of the wording was confusing and may have been difficult for those of different nationalities to understand.
- j) SSVs and ESVs noted they did not receive any formal training from the VCAA for their role but instead receive a manual outlining their roles and responsibilities (refer to Improvement Opportunity 3).
- k) There are some inconsistencies and uncertainty around whether responses are provided to the SSV when changes are implemented or not implemented by the Panel as a result of the SSV's work. It was noted at interview that this feedback would assist an SSV in improving their future reviews going forward (refer to Improvement Opportunity 5).
- l) There have been inconsistencies in the materials received by the SSV when performing their review in recent years (refer to Improvement Opportunity 6).
- m) Some SSVs and ESVs noted that they were often given little to no notice before being asked to complete a review before a specified date (refer to Improvement Opportunity 7).
- n) There was a breach of security during the development of the 2022 VCE Specialist Maths Exam when a SSV accidentally emailed some answers to questions within the Specialist Maths Exam. VCAA replaced the breached questions with new questions taken from the respective sections of the 2022 Northern Hemisphere Specialist Maths Exam.

1.5 We provide the following improvement opportunities for VCAA to consider:

Table 1: Improvement priority

Priority	Explanation
Act now	Recommendations directly relevant to ensure an effective exam development process
For consideration in future years	For consideration in the development process in future years

Table 2: Summary of improvement opportunities

Item	Improvement Opportunity	Recommended priority
1	VCAA may consider running introductory sessions for all Panel members of all VCE subjects but additionally consider creating an information pack or learning video tailored to each subject (e.g. an information pack/learning video that is only for Maths Panel Members and contains information that is specifically related to the Maths Exam Development process). Information sessions may be split for new Panel Chairs and an abridged session for experienced Panel Chairs. VCAA may consider if experienced Panel Chairs may only need a refresher session every second year. This improvement opportunity is subject to resourcing.	For consideration in future years
2	Reconsider the way VCAA appoint all roles in the process to ensure fairness, consistency and maintain best practice. This improvement opportunity is subject to resourcing.	For consideration in future years
3	VCAA to consider implementing formal training for those involved in the exam development process including annual refresher training	Act now

Item	Improvement Opportunity	Recommended priority
	for those re-appointed. This improvement opportunity is subject to resourcing.	
4	VCAA may consider a minimum term for Exam Development Personnel in certain roles to ensure consistency within the exam development process and the impact that regular turnover or less experience may have on the quality of exam questions. This should be coupled with a periodic rotation of Exam Development Personnel to ensure diversity of thought. This improvement opportunity is subject to resourcing.	Act now
5	VCAA to consider providing formal feedback to SSVs and ESVs on their work.	Act now
6	VCAA may consider creating a consistent list of documents that VCAA sends out to SSVs across all Maths subjects.	Act now
7	VCAA may consider providing all Exam Development Personnel including the SSV and ESV with timelines of the entire exam development process including an estimated timeframe as to what date their review is estimated to occur or to improve communication to SSV/ESVs regarding the timeline.	Act now
8	VCAA may consider ensuring the ESV test a sample of questions with more than one type of calculator in addition to the existing process, revert to having two ESVs who both use a different calculator or have the same ESV vet the exam twice using different calculators. This improvement opportunity is subject to resourcing.	For consideration in future years
9	VCAA may consider having people of different nationalities attempt the exams or review a sample of questions as an addition to the EAL review performed, to assist in preventing any confusing terminology. This improvement opportunity is subject to resourcing.	For consideration in future years
10	VCAA may consider engaging an independent committee or VCAA employees other than those on the Panel to perform the final sign off/review. This improvement opportunity is subject to resourcing.	Act now
11	VCAA may consider documenting the finalisation/development of the marking guide for each exam as they have done for other stages of the Exam Development Process.	Act now
12	VCAA to consider minimising the need for hardcopy documents. VCAA also to review how hard copy documents are maintained and to consider recording them in a systematic manner, e.g., separated by development stages. They should also be clearly titled, so they can be easily aligned to each stage of review. This improvement opportunity is subject to resourcing.	For consideration in future years
13	VCAA to consider creating and implementing a new policy or enhances an existing policy/procedure document that outlines what constitutes a breach of security and the process for when a breach of security occurs.	Act now
14	We recommend VCAA considers requiring that all Panel Members participate in development of responses to reviews, conducting reviews and in making final decisions about the exam content. This recommendation is considered further in Stage 6, Stage 9, Stage 11 and in the General Findings section of the report.	Act now
15	VCAA to consider reviewing the transparency of the VCAA exam development process to the general public in light of the concerns raised, together with the process identified at other states. Providing the high-level steps in the exam writing process would help inform parties that a lengthy and thorough process is undertaken with contributions from multiple parties. This improvement opportunity is subject to resourcing.	Act now

Conventions used in the report

- 2.7 Interviewees' comments have been paraphrased to capture the essence of the discussion held. Where comments or paraphrases have been taken directly from a person or a document, these are expressed in quotation marks.



3 Detailed findings

Exam development stages

- 3.1 We obtained the VCAA Victorian Timetable examination production timeline from the 2022 VCE Examination Development Manual² and asked Exam Development Personnel³ at interview whether this was the process followed during the exam development process for the 2022 VCE Mathematics Exams.
- 3.2 There were no breaches or material deviations of VCAA policy and procedure identified in the 2022 Maths Exam development process that resulted in substantiation of the allegations raised by the third-party complainants.
- 3.3 In particular, we did not identify any evidence of misconduct by VCAA employees or independent contractors in the 2022 exam development process. While there may remain different views or opinions on the quality and utility of the 2022 Maths questions between the VCAA and the third-party complainants, we found the VCAA acted in accordance with its policies and procedures.
- 3.4 We were provided with the SETVET 2022 document by VCAA which tracks the process and completion dates for all VCAA examination preparation stages. We have not conducted a complete review of the document or stages relating to the Maths Exams, however we note there are some minor differences in SETVET 22⁴ when compared to the 2022 VCE Examination Development Manual⁵ regarding process stages and order.

Table 3: Differences between SETVET 22 document and the 2022 VCE Examination Development Manual

SETVET 22	2022 VCE Examination Development Manual
Section 9 includes: <ul style="list-style-type: none"> • Editor final proofread • Amendments completed. 	Section 9 includes: <ul style="list-style-type: none"> • Panel response to ESV, CM and AOR reviews
Section 10 includes: <ul style="list-style-type: none"> • Social media check completed • Manager check completed 	Section 10 includes: <ul style="list-style-type: none"> • Editor proofread and audit

Table 4: Exam development timeline summary

Stage	Activity	Who
Prelim	Appointment and briefing of Exam Development Panel	VCAA, All Panel Members
0	Examination development and submission	All Panel Members
1	Exam Development Manager (EDM) and Curriculum Manager (CM) review	EDM, CM, All Panel Members
2	Study Specialist Reviewer (SSV) Review	SSV, All Panel Members
3/4/5	Exam sign-off, Editorial, and English and Additional Language (EAL) review	EDM, CM, Editor, EAL Reviewer
6	Panel proofread	Panel Chairs
7	Exam Sitter Reviewer (ESV)	ESV
8	Final CM and Assessment Operations Reviewer (AOR) reviews	CM, AOR
9	Panel response to the ESV, CM (final) and AOR reviews	Panel Chairs

² 2022 VCE Examination Development Manual, p. 50

³ Exam Development Personnel refers to the Exam Panel Members, Exam Panel Chairs, the Study Specialist Reviewers (SSV), and the Exam Sitter Reviewers (ESV).

⁴ Refer to Appendix 1, item 600

⁵ 2022 VCE Examination Development Manual, p. 38 - 42

Stage	Activity	Who
10	Editor proofread and Audit of Changes	Editor
11	Examination Panel Sign-off	All Panel Members
12	EDM Sign-off	EDM
13	Final editor read	Editor
14	Printed proofread and printed paper check	EDM, Examination Chairperson
	Marking guide finalisation	Panel Chairs

Preliminary stage: Appointment and briefing of Exam Development Panel

- 3.5 As per the 2022 VCE Examination Development Manual⁶, VCAA Exam Development Panel Members and Chair are appointed through a recruitment process including application, and a nomination brief reviewed by the Exam Development Manager (EDM) for the specific subject and Curriculum and Assessment Administration Committee. The EDM, Panel Chairs and Panel Members are VCAA employees with the Panel Chairs and Panel Members being employed on a 1-year term.
- 3.6 If all applicants are deemed unsuitable, the VCAA may find Panel Members through direct contact. Applicants must not be teaching the subject which they apply for. To ensure diversity amongst Panel Members, the VCAA may consider gender and school sectors (public, private, catholic) when appointing the positions. The process of direct contact and considering diversity is not formally documented in the 2022 VCE Examination Development Manual.
- 3.7 Historically on appointment, VCAA organised an introductory information session run by the Senior project manager from VCAA for Panel Chairs before the beginning of the exam development process for that year. At the end of 2022 this session changed to include all exam development members and was run online instead of in person. These information sessions provide Panel Chairs with an exam writing handbook and a timeline, and reviews technical aspects such as how to use track changes and secure platforms (Kiteworks, DataLocker).
- 3.8 We note that Exam Development Personnel have provided different answers in relation to who attends the introductory information session with some saying it is attended by Panel Chairs only and others saying as of 2022 it included both Panel Chairs and Panel Members.
- 3.9 In approximately November each year, a preliminary briefing meeting is run by the Exam Development Manager and the Examination Panel Chair for other Panel Members prior to commencing work on the examination questions for the following curriculum year. Historically, the Curriculum Manager has also assisted in running the preliminary briefing meeting but has not attended for the past few years. The Acting Manager has attended on one occasion.
- 3.10 The briefing generally includes an overview of the previous year's paper, rankings, distribution, changes that VCAA would like to see, feedback from teachers from previous years, how the previous years' exam was perceived, and a refresh of the technology used during the process (Kiteworks, Data Locker). The briefing also runs through the different roles in the exam development process and their responsibilities (i.e. SSV, ESV) at a high level. SSVs and ESVs are Independent Contractors employed on a 1-year term.
- 3.11 We understand that there is no formal training provided to Exam Development Personnel other than the introductory information sessions and panel briefings. There is nothing formally noted in the 2022 VCE Examination Development Manual relating to training, other than that the Exam Development Manager, Panel Chair and Panel Members should attend assessor training meetings. This could lead to a lack of consistency in Exam Development Personnel's work and could impact the quality and timing of the exam writing process.
- 3.12 We set out below the findings in relation to the Appointment and Briefing of the Exam Development Panel process and their associated impact or risk to VCAA.

⁶ 2022 VCE Examination Development Manual, p. 3

Table 5: Findings in relation to the Preliminary stage: Appointment and Briefing of the Exam Development Panel

Finding	Impact/Risk
<p>At interviews, we received consistent comments that the generic information sessions for Panel Chairs of all VCE subjects “miss the mark” for Maths, as the other VCE subjects are very different from Maths. The sessions “miss the mark” because they are not tailored to any specific subject. At interview we found it may be beneficial for VCAA to hold separate information sessions for each subject instead of having all combined into one (refer to Improvement Opportunity 1).</p>	<p>Loss of interest from participants during these information sessions</p> <p>Poor retention of topics discussed during information sessions.</p>
<p>It was suggested that separate sessions, one for new Panel Chairs and one for experienced Panel Chairs might be more beneficial (refer to Improvement Opportunity 1).</p>	<p>Loss of interest from participants during these information sessions</p> <p>Poor retention of topics discussed during information sessions.</p>
<p>Several of the current Maths Panel Chairs and Panel Members did not go through the initial application process, but were instead directly asked by the EDM, CM or another VCAA officer if they were willing to take on the position. There is currently no policy/procedure which outlines what occurs when no suitable applicants are found (refer to Improvement Opportunity 2). Panel Chairs are generally selected from the existing or experienced Panel Members to ensure they have experience and a good understanding of the exam development process.</p>	<p>Lack of opportunity for other individuals to be part of the Exam Development Panel. May lead to lack of diverse thought and opinions and ultimately errors or oversight in Maths Exam question development.</p>
<p>Panel Chairs stopped receiving a physical copy of any timeline or exam development manual from VCAA. We note that Panel Chairs were provided the examination development manual via Kiteworks at the Introductory Panel Information Session. At interview one Panel Chair stated “there is a VCAA training session where they are given the exam writing handbook”. Another Panel Chair stated that they “used to get a manual, but not anymore”. (refer to Improvement Opportunity 6).</p>	<p>Lack of understanding of exam development process, especially for new panel chairs.</p>
<p>There is no formal training provided to Exam Development Personnel (Panel Members, Panel Chairs, SSV, ESV) when they are appointed to be part of the exam development process. Interviewees mentioned that they “learnt on the job” or were assisted by their predecessor or someone who had previously worked in that role, and they relied a lot on their external experience and training as teachers or exam markers (refer to Improvement Opportunity 3).</p>	<p>Unclear expectations of the role resulting in inconsistencies in performance.</p>
<p>A number of those interviewed stated that more consistency in Exam Development Personnel staff would allow for a smoother exam development process and better-quality questions (refer to Improvement Opportunity 4).</p>	<p>Inconsistency within the development team or lack of experience may negatively impact the development process resulting in poor quality questions and a poor-quality exam.</p>

3.13 We recommend that VCAA:

- a) Continue running introductory sessions for all Panel members of all VCE subjects but consider creating an information pack or learning video tailored to each subject (e.g. an information pack/learning video that is only for Maths Panel Members and contains information that is specifically related to the Maths Exam Development process (refer to Improvement Opportunity 1)).
- b) Split the introductory information sessions into two sessions, one for new Panel Chair members and one for experienced Panel Chair members or consider only a refresher for experienced Chairs (refer to Improvement Opportunity 1).

- c) Reconsider the way VCAA appoint all levels of personnel in the process to ensure consistency and maintain best practice (refer to Improvement Opportunity 2).
- d) Implement formal training for those involved in the Maths Exam Development Process. This should include training designed to enhance the development of maths questions, the stages of the exam development process and what to do if a breach of security occurs (refer to Improvement Opportunity 3).
- e) Consider a minimum term for Exam Development Personnel in certain roles to ensure consistency with the exam development process and the impact that regular turnover or less experience may have on the quality of exam questions (refer to Improvement Opportunity 4). This should be coupled with a periodic rotation of Exam Development Personnel to ensure diversity of thought.

Stage 0: Examination development and submission

- 3.14 We conducted a review of the hard copy documents⁷ provided (refer to Appendix 1) relating to Stage 0 of the 2022 Maths Exam development.
- 3.15 The Exam Development Panel is responsible for the development of the Maths Exams as stated in the 2022 VCE Examination Development Manual.⁸ After the panel briefing referred to earlier, the exam is split up into dedicated sections for each Panel Member (VCAA employees) to work on. An initial draft exam paper is then prepared on Kiteworks, and the review process commenced (refer to Exhibit 1). At the conclusion of the review process, the exam paper is approved by the Panel Chairs (VCAA employees) and submitted to VCAA.
- 3.16 We were provided with a copy of the PowerPoint Presentation used during the Specialist Exam Panel Meeting in 2022. This presentation went through a number of topics including quality examinations, examination structure and format, content grid, cognitive and key knowledge mapping, difficulty mapping, copyright log, Kiteworks and DataLocker, security, examination trends and teacher feedback survey⁹.
- 3.17 Each part of the process is documented in either soft copy or hard copy version of the exam document, and generally, meetings and discussions throughout the process are not documented via meeting minutes or file notes but the outcomes noted in comments or tracked changes. There is a risk that documentation is difficult to follow. For example, at what point changes to questions were made and why, by whom, and the approval process followed.
- 3.18 We recommend that VCAA:
- a) VCAA to consider minimising the need for hardcopy documents. This would involve automating areas for processes review such as approvals (softcopy forms) while still using hardcopy documents for technical content such as when Maths questions need to be answered.
 - b) Official forms should be used to indicate the completion of each stage and by whom, instead of just writing on the front page of exam papers. Consider tracking decisions by the Panel or changes to questions via an excel log, including reasoning for or against the proposed question change. This will ensure decisions can be easily justified or assist with ease of tracking development progress if required at a later date.
 - c) VCAA may consider creating a document index aligning to each stage of the development process that each document or form is mapped to and can be ticked off during the process and linked to the SETVET tracker. This document can be a similar format to Appendix 3. Refer to Improvement Opportunity 12.

Stage 1: Exam Development Manager and Curriculum Manager review

- 3.19 We conducted a review of the hard copy documents¹⁰ provided (refer to Appendix 1) relating to Stage 1 of the 2022 Maths Exam development.
- 3.20 After submission to the VCAA of the initial draft, the EDM and the Curriculum Manager (CM) (both VCAA employees) conduct an initial review of the exam papers for basic wording issues, to ensure it fits the scope of the study design and for any issues with the mathematics. They then prepare a feedback

⁷ Refer to Appendix 1, item 4, 5, 11, 68, 75, 134, 135, 145, 155, 259, 271, 272, 273, 290, 302, 306, 352, 366, 367, 368, 370, 375, 433, 444, 486 and 511.

⁸ 2022 VCE Examination Manual, p. 34

⁹ Refer to Appendix 1, item 567.

¹⁰ Refer to Appendix 1, items 19, 25, 39, 131, 147, 260, 330, 381, 416, 417, 418, 419, 420, 421, 458, 478, 479 and 555.



document for the Panel (VCAA employees). The feedback is considered by the Panel and changes accepted or rejected. Once the Panel has made its decisions on changes, they will send it back to the EDM and CM again for their approval. This process may be repeated several times until both sides are happy with the document.

3.21 We did not identify any findings on this stage of the exam development process.

Stage 2: Study Specialist Reviewer (SSV) Review

3.22 We conducted a review of the hard copy documents¹¹ provided (refer to Appendix 1) relating to Stage 2 of the 2022 Maths Exam development.

3.23 The Study Specialist Reviewer (SSV) is responsible for working through the exam paper, checking the accuracy of theoretical and technical content, the level of difficulty, ensuring questions are part of the curriculum and that there is an “even spread” of content throughout the curriculum. The SSV is employed as an independent contractor on a 1 year term.

3.24 They are provided with relevant documents to aid their review including the subject study design, manual and usually, a content map. Once they have completed their review and filled out the associated review documents, it is returned to the Panel (VCAA employees) for consideration. There are usually one to two SSVs per subject and there is no collaboration between them during this process.

3.25 We set out below the findings in relation to the SSV role within the Maths Exam development process and their associated impact or risk to VCAA.

Table 6: Findings in relation to the Study Specialist Reviewer (SSV) Review

Finding	Impact/Risk
The SSVs interviewed noted they did not receive any formal training from the VCAA for their role but instead receive a manual outlining their roles and responsibilities (refer to Improvement Opportunity 3).	Unclear expectations of the role resulting in inconsistencies between SSVs performance.
There are some inconsistencies and uncertainty around whether responses are provided to the SSV when changes are implemented or not implemented by the Panel as a result of the SSV’s work. It was noted at interview that this feedback would assist an SSV in improving their future reviews going forward (refer to Improvement Opportunity 5).	Inability to use lessons learned from prior year role and potential lack of efficiency.
There have been inconsistencies in the materials received by the SSV when performing their review in recent years. For example, some years the SSV received a content map detailing the sections of the exam that certain parts of the curriculum were covered in. Other years they did not receive this. It was noted at interview, that receiving the content map makes it easier for an SSV to ensure the exam covers the curriculum and aligns with the study design. The SSV for Methods and Specialist Maths also mentioned that in 2022, they received the wrong Content Map, which did not match the exam questions (refer to Improvement Opportunity 6).	Reduction in efficiency for SSV reviewers.
Some SSVs have noted that they were often given little to no notice before being asked to complete a review before a specified date. For example, VCAA would contact the reviewer and inform them the review needed to be completed by a certain date or short timeframe with little notice or time provided. Some reviewers also noted they did not receive an estimated date/date range for when their review would occur (refer to Improvement Opportunity 7).	Inability to meet VCAA deadline around existing work or completing the role in a rushed manner resulting in less quality output.

3.26 We recommend that VCAA:

- a) Implement formal training for those involved in the Maths Exam Development Process. This should include training around training designed to enhance the development of Maths questions, the stages

¹¹ Refer to Appendix 1, items 35, 36, 43, 126, 140, 146, 150, 238, 258, 269, 270, 322, 332, 362, 383, 422, 423, 424, 425, 427, 428, 429, 465, 468, 469, 470, 471, 472, 473, 474, 504 and 505.

of the exam development process and what to do if a breach of security occurs (refer to Improvement Opportunity 3).

- b) Provide reviewers with formal feedback on their work (refer to Improvement Opportunity 5).
- c) Create a consistent list of documents that VCAA send out to SSVs for when they perform their review (refer to Improvement Opportunity 6).
- d) Provide reviewers with an estimated timeframe or regular updates as to what date their review is estimated to occur or to improve communication to SSV/ESVs regarding the timeline (refer to Improvement Opportunity 7).

Stage 3-5: Exam sign-off, Editorial, and English and Additional Language (EAL) review

- 3.27 We conducted a review of the hard copy documents¹² provided (refer to Appendix 1) relating to Stage 3-5 the 2022 Maths Exam development.
- 3.28 At the completion of Stage 2, the draft exams are returned to the EDM and CM (both VCAA employees) for further review. They consider how the Panel (VCAA employees) has responded to the SSV (independent contractor) comments or notes and review any adjustments. If the EDM and CM do not feel as though the panel have responded to the feedback appropriately, they will send the exam back to the Panel to respond accordingly.
- 3.29 Following this, the VCAA Editor (VCAA employee) reviews the final exam and make changes to the editorial of the exam not the mathematical content, as per the 2022 VCE Examination Development Manual.¹³ At this stage of the process, the exam is put on the official exam template.
- 3.30 The exam is then sent to the English as an Additional Language (EAL) Reviewer (independent contractor) to consider the language used for each question and ensure that the questions are readable to second language students. This written feedback is then provided back to the Panel.
- 3.31 At interview we were advised that in the 2022 Specialist Maths Exam, some of the wording was confusing and may have been difficult for those of different nationalities to understand. This assertion was made by the 2022 Mathematical Methods ESV who did not review the Specialist Maths Exam. This comment was made to us following the process that had been carried out by the VCAA and was made in the reviewer's separate role as a Specialist Maths teacher. VCAA may consider utilising contractors of different nationalities to review a sample of questions as an addition to the EAL review noted above to assist in preventing any confusing terminology (refer to Improvement Opportunity 9). The risk/impact of not doing this is that EAL students may not understand wording of questions, causing confusion as to what the question is asking. This may result in incorrect answers and lost marks.

Stage 6: Panel proofread

- 3.32 We conducted a review of the hard copy documents¹⁴ provided (refer to Appendix 1) relating to Stage 6 of the 2022 Maths Exam development.
- 3.33 During Stage 6, the Panel (VCAA employees) review the results of the Editorial and EAL review and implement any changes recommended by the feedback. This involves ensuring the draft exam paper formatting has transferred correctly onto the official exam template (e.g. diagrams and layouts are correct).
- 3.34 We found that generally only the Panel Chairs conduct the panel proofread for Further Maths and Specialist Maths. In these instances, interviewees stated that the Panel Members would only be involved in the panel proofread if one of the Panel Chairs is unable to attend. The Panel Chairs deem that each Panel Chair is considered a Panel Member for the exam that they are not the Chair of (i.e. Panel Chair for Exam 1 is considered a Panel Member for the development of Exam 2).
- 3.35 This differs from Maths Methods who stated the "Panel sits down and works through the entire exam from start to finish". The 2022 VCE Examination Development Manual¹⁵ states that this stage should include the Examination Panel Chair and one Examination Panel Member.

¹² Refer to Appendix 1, items 20, 21, 47, 52, 81, 103, 107, 108, 118, 137, 156, 211, 212, 231, 236, 237, 245, 246, 256, 263, 268, 325, 326, 328, 342, 347, 350, 378, 397, 399, 432, 434, 446, 447, 459, 460, 462, 463, 464, 507, 508, 535, 545, 545 and 558.

¹³ 2022 VCE Examination Development Manual, p. 39

¹⁴ Refer to Appendix 1, items 51, 52, 103, 107, 108, 212, 231, 237, 256, 325, 347, 348, 349, 434, 446, 448, 507, 508, 542, 543 and 544.

¹⁵ 2022 VCE Examination Development Manual, p. 39



- 3.36 We recommend VCAA require and ensure that all Panel Members participate in development of responses to reviews, conducting reviews and in making final decisions about the exam content (refer to Improvement Opportunity 14).

Stage 7: Exam Sitter Reviewer (ESV)

- 3.37 We conducted a review of the hard copy documents¹⁶ provided (refer to Appendix 1) relating to Stage 7 of the 2022 Maths Exam development.
- 3.38 The Exam Sitter Reviewer (ESV) is responsible for sitting the examination paper like a student and providing feedback on any problems encountered while completing the exam, any ambiguity in questions and how long it took them to complete the exam. The ESV is employed as an independent contractor on a 1-year term.
- 3.39 The ESV provides the panel (VCAA employees) with an understanding as how the questions can be interpreted by students and will comment on whether the exam is appropriate for students to sit. The ESV provides feedback to the Panel via a review form or report, which is written in hard copy form.
- 3.40 We set out below the findings in relation to the ESV role within the Maths Exam development process and their associated impact or risk to VCAA.

Table 7: Findings in relation to the Exam Sitter Reviewer (ESV)

Finding	Impact/Risk
The ESVs interviewed noted they did not receive any training from VCAA for their role (refer to Improvement Opportunity 3)	Unclear expectations of the role of ESV resulting in inconsistencies in job performance.
There are some inconsistencies and uncertainty around whether responses are provided to the ESV by the Panel or VCAA when changes are implemented or not implemented (refer to Improvement Opportunity 5).	Inability to use lessons learned from prior year role as ESV and potential lack of efficiency.
Some ESVs noted that they were often given little to no notice before being asked to complete a review before a specified date which made it difficult to fit around existing workloads. For example, VCAA would contact the reviewer and inform them the review needed to be completed by a certain date or short timeframe with little notice or time provided. Some reviewers also noted they did not receive an estimated date/date range for when their review would occur (refer to Improvement Opportunity 7).	Inability for ESV's to meet VCAA deadline around existing work or completing the role in a rushed manner resulting in less quality output.
There are two types of calculators used by students. However potentially only one type of calculator is currently used to vet the exams, meaning there is the possibility of students with another calculator type struggling with a question, for example because their calculator is slower or returns a different solution. An interviewee stated that when calculators were first introduced into Maths Exams, one ESV used one calculator; and the other ESV used the second calculator, to ensure both calculators are checked. We were informed that ESVs now use the same calculator (refer to Improvement Opportunity 8).	Students may be disadvantaged by untested calculators which run slower, have a different degree of accuracy to those tested or have different order of operations. A possible advantage to those students who use calculators tested by VCAA.

- 3.41 We recommend that VCAA:
- a) May consider changing the existing process regarding use of calculators when vetting the exams (refer to Improvement Opportunity 8).
 - b) Refer to Improvement Opportunities 3, 5 and 7 for other ESV relevant recommendations referred to earlier within Stage 2: SSV.

¹⁶ Refer to Appendix 1, items 101, 102, 205, 123, 206, 207, 274, 280, 353, 354, 364, 435, 436, 437, 497, 498 and 499.

Stage 8: Final CM and Assessment Operations Reviewer (AOR) reviews

- 3.42 We conducted a review of the hard copy documents¹⁷ provided (refer to Appendix 1) relating to Stage 8 of the 2022 Maths Exam development.
- 3.43 The CM and Assessment Operations Reviewer (AOR) (VCAA employees) conduct the final review once the ESV review is completed and the Panel have provided a response to the ESV review as per the 2022 VCE Examination Development Guide.¹⁸
- 3.44 The exam paper is sent to an AOR who compares the exam to the marking guide. The AOR determines if any questions will cause disagreement between markers. We note that the AOR review stage of the review process does not relate to the development of exam questions and therefore was not reviewed in detail other than to confirm that the process had occurred in 2022 to the standard required. We did not identify any findings on this stage of the exam development process.
- 3.45 The CM will complete a final review of the changes made, feedback incorporated and exam overall. We did not identify any findings on this stage of the exam development process.

Stage 9: Panel response to the ESV, CM and AOR reviews

- 3.46 We conducted a review of the hard copy documents¹⁹ provided (refer to Appendix 1) relating to Stage 9 of the 2022 Maths Exam development.
- 3.47 The Panel (VCAA employees) respond to the ESV feedback via an ESV Form in writing and determine whether to implement the ESV's suggestions. If they decide not to implement the changes, there is a discussion with the EDM about why they were not implemented. The Panel response to the ESV feedback is not to the ESV but to the CM/EDM (VCAA employees). We note that this process or the requirement for a discussion is not documented in the Exam Development Manual. The Panel will also respond to the feedback provided by Stage 8 review.
- 3.48 We identified that for Further Maths the Panel Chairs address the suggestions provided by the ESV and only engage with other Panel Members that wrote specific questions, for their input.
- 3.49 Refer to Improvement Opportunity 14, also mentioned above in Stage 6.

Stage 10: Editor proofread and Audit of Changes

- 3.50 We conducted a review of the hard copy documents²⁰ provided (refer to Appendix 1) relating to Stage 10 of the 2022 Maths Exam development.
- 3.51 The VCAA Editor (VCAA employee) makes additional comments during the editorial process, they don't comment on the mathematical or technical content of the questions, as per the 2022 VCE Examination Development Guide.²¹ These changes consist of font changes and expression.
- 3.52 We did not identify any findings on this stage of the exam development process.

Stage 11: Examination Panel Sign-off

- 3.53 We conducted a review of the hard copy documents²² provided (refer to Appendix 1) relating to Stage 11 of the 2022 Maths Exam development.
- 3.54 The entire Panel (VCAA employees) come together to have a 'Panel Sit' where they go through the exam for the final time, sit the exam themselves, ensure all the feedback has been responded to and provide final opinions. The Panel ensure wording is clear, the questions cannot be misinterpreted and will check the solutions against the marking guide. Once this is complete the Panel sign-off on the Maths Exams.
- 3.55 We believe that this type of review should be independent and VCAA should consider whether panel members should be involved at this stage of the process or whether an independent committee should be used. Having the panel perform the final sign off could be perceived as a conflict of interest (self-review threat). VCAA may consider engaging an independent committee or VCAA employees other than those on the Panel to perform the final sign off/review (refer to Improvement Opportunity 10).

¹⁷ Refer to Appendix 1, items 70, 71, 72, 97, 98, 99, 100, 122, 201, 202, 204, 209, 210, 227, 243, 265, 281, 282, 283, 284, 343, 355, 356, 357, 358, 359, 360, 438, 439, 440, 441, 442, 490, 491, 492, 493, 494 and 495.

¹⁸ 2022 VCE Examination Development Manual, p. 40

¹⁹ Refer to Appendix 1, items 76, 84, 226, 228, 229, 251, 252, 317, 363, 405, 406, 526 and 527.

²⁰ Refer to Appendix 1, items 83, 179, 254, 319, 404 and 523.

²¹ 2022 VCE Examination Development Manual, p. 41

²² Refer to Appendix 1, items 55, 106, 119, 154, 242, 351, 407, 408 and 524.



- 3.56 We found that for the Further Maths Exam the Panel Chair do not usually sit the entire exam as they have seen it more than the Panel Members and ensures the exam is seen through “fresh eyes”. Refer to Improvement Opportunity 14, referred to above in Stage 6 and Stage 9.

Stage 12: EDM Sign-off

- 3.57 We conducted a review of the hard copy documents²³ provided (refer to Appendix 1) relating to Stage 12 of the 2022 Maths Exam development and confirmed evidence of the EDM (VCAA employee) sign off.
- 3.58 The EDMs sign off on the Exam Papers and authorises them for printing, as per the 2022 VCE Examination Development Guide.²⁴
- 3.59 We did not identify any findings on this stage of the exam development process.

Stage 13: Final editor read

- 3.60 We conducted a review of the hard copy documents²⁵ provided (refer to Appendix 1) relating to Stage 13 of the 2022 Maths Exam development and confirmed evidence of the checks.
- 3.61 A VCAA Editor (VCAA employee) that has not previously seen the exam will conduct a final editor read prior to the exam being sent to the printers as per the 2022 VCE Examination Development Guide.²⁶ This final editor read checks for grammar issues.
- 3.62 All six Maths Exams’ Question and Answer Booklet and Formula Sheet also go through a Manager and Executive Check (VCAA employee), before approval for printing. We did not interview anyone involved in the final editor read or Manager and Executive Check.
- 3.63 We did not identify any findings on this stage of the exam development process.

Stage 14: Printer’s proofread and printed paper check

- 3.64 We conducted a review of the hard copy documents²⁷ provided (refer to Appendix 1) relating to Stage 14 of the 2022 Maths Exam development.
- 3.65 At the end of the exam development process, a preliminary proof from the printer is checked by the Panel Chairs (VCAA employees) for specific elements such as colour, diagrams, inserts and font and final approval is given for the print run to go ahead. Once the print run has been completed, the exams are supplied to the VCAA warehouse where they are collated for distribution to examination centres around the State. Ten random copies of the print run are then delivered to VCAA Officials for the EDM (VCAA employee) and other production staff to check as per the 2022 VCE Examination Development Guide.²⁸
- 3.66 We did not identify any findings on this stage of the exam development process.
- 3.67 Within the documents provided by VCAA, we found evidence that the Printed Examination Paper Check had been completed for all subjects, for both the question-and-answer books and the formula sheets, by the subject’s respective EDM and also by the Examination Chairperson in Methods and Further.

Stage 14: Marking guide finalisation

- 3.68 We conducted a review of the hard copy documents²⁹ provided (refer to Appendix 1) relating to Stage 14, marking guide for the 2022 Maths Exams.
- 3.69 From the interviews with the Panel Chairs (VCAA employees) of each Maths subject, we found that the marking guide is finalised by the two Panel Chairs of both exams for each subject, together. The Chairs put together a marking scheme that will be submitted to the Assessment Team (VCAA employees), who then alter it as needed to increase the fairness of the marking process.

²³ Refer to Appendix 1, items 53, 93, 94, 176, 277, 340, 372, 451, 452 and 548.

²⁴ 2022 VCE Examination Development Manual, p. 41

²⁵ Refer to Appendix 1, items 89, 104, 169, 341, 453, 454, 455, 547, 561 and 562.

²⁶ 2022 VCE Examination Development Manual, p. 41

²⁷ Refer to Appendix 1, items 49, 50, 110, 111, 244, 266, 286, 300, 334, 396, 450 and 537.

²⁸ 2022 VCE Examination Development Manual, p. 42

²⁹ Refer to Appendix 1, items 27, 346, 536, 586, 587, 588, 589 and 590.



Table 8: Findings in relation to the Marking Guide Finalisation

Finding	Impact/Risk
There is no documented process within the Exam Development Manual for finalisation or development of the marking guide for each exam (refer to Improvement Opportunity 10).	Different Maths Exams may complete this step of the exam process differently leading to inconsistencies.

3.70 We recommend that VCAA consider documenting the finalisation/development of the marking guide for each exam (refer to Improvement Opportunity 11).

Document gaps

3.71 We were provided with approximately 600 hard copy documents by VCAA for review, relating to the development of the 2022 Maths Exam. During our review we found evidence of documents that aligned with all stages throughout the exam development process for the 2022 Maths Exams. Refer to Appendix 1 for the documents that are aligned with each stage.

3.72 We note that as some of the documents were not clearly labelled, recorded or stored in a specific order (e.g., no dates, titles, document index) certain documents may have been misaligned (refer to Improvement Opportunity 12).

3.73 We recommend that VCAA consider storing documentation in a systematic manner (separated by development stages, clearly titled, clearly dated) (refer to Improvement Opportunity 12).

Breach of Security

3.74 We identified that some of the questions involved in the breach of security as noted in the 2022 VCE Examination Development Manual were mentioned in the allegations received by VCAA.

3.75 The 2022 VCE Examination Development Manual³⁰ states that documents relating to the exam development process should be stored on an encrypted USB flash drive (DataLocker) and should not be sent by email, mail, text message, fax or any other means.

3.76 At interview we were informed that there was a breach of security during the development of the 2022 VCE Specialist Maths Exam. The breach of security occurred when an SSV (independent contractor) accidentally emailed some answers to questions within the Specialist Maths Exam. The emailed documents were immediately deleted by the sender and the recipient.

3.77 The questions were identified as the following:

- Specialist Maths Exam 1: Q3
- Specialist Maths Exam 2: Section B Q4, 5 and 6

3.78 At interview we were informed that when the breach of security occurred the Unit Manager (VCAA employee) was immediately advised as per the process outlined in the 2022 VCE Examination Manual.³¹ The Unit Manager, CM, both the Panel Chairs and the EDM (all VCAA employees) managed the breach of security by replacing the breached questions with new questions ("the replacement questions") which were taken from the respective sections of the 2022 Northern Hemisphere Specialist Maths Exam. We found that these replacement questions had undergone the same review process as the rest of the 2022 (Southern Hemisphere) Specialist Maths Exam questions, as the same process is followed for both exams.

3.79 The SSV who was responsible for the breach did not review the replacement questions in their capacity as an SSV, nor have they continued their employment with VCAA in 2023. We note that where a security breach occurs, the replacement questions cannot be reviewed or handled by the person responsible for the breach.

3.80 We found that the other Specialist Maths SSV was requested to vet the replacement questions after completing their original SSV review. The Specialist Maths SSV recalled this occurring as it was out of the ordinary for the usual process.

³⁰ 2022 VCE Examination Development Manual, p. 6

³¹ 2022 VCE Examination Development Manual, p. 6

- 3.81 Through document review and discussion with the Specialist Maths Exam EDM, we confirmed that replacement Q3 from SM1 and replacement Q4, 5 and 6 from SM2 were all treated the same way, were taken from the Northern Hemisphere exam and went through the same vetting process.
- 3.82 The allegations by the first concerned party identified the following questions which coincided with those involved in the breach of security as noted in the 2022 VCE Examination Development Manual:
- Specialist Maths Exam 1: Q3b – Identified as a major error
 - Specialist Maths Exam 2: Q4d – Identified as a minor error
 - Specialist Maths Exam 2: Q6f – Identified as a major error
- 3.83 The allegations by the second concerned party identified the following questions which coincided with those involved in the breach of security as noted in the 2022 VCE Examination Development Manual:
- Specialist Maths Exam 2: Q6f
- 3.84 We did not find evidence to suggest that the development of the replacement questions or use of the replacement questions was inappropriate.
- 3.85 We found that there was no certainty by interviewees around the process that needs to be taken when a breach of security occurs. While the 2022 VCE Examination Development Manual outlined what would constitute a breach of security, there does not appear to be a written process within the documentation provided to detail a process when a breach of security occurs (refer to Improvement Opportunity 13).
- 3.86 There is a risk that a breach won't be reported correct and exam development personnel won't know what the correct process is to follow if a breach does occur. There is also a risk that breached questions may not be identified prior to the exam.
- 3.87 We recommend that VCAA creates a policy/procedure document for what constitutes a breach of security and what the process is to deal with it when it occurs (refer to Improvement Opportunity 13).

General findings

- 3.88 We found some stages of the review process only involved the Panel Chair and (at least) one Panel Member (both VCAA employees). We also received comments that Panel Members would prefer to have more input from the whole panel and not have final decisions made by the Panel Chair alone. For example, Panel Response to ESV, CM, AOR (refer to Improvement Opportunity 14). There is a risk of a lack of diverse thought and opinion during the exam development process.
- 3.89 We recommend that VCAA:
- a) Require all Panel Members to participate in responses to reviews and in making final decisions about the exam (refer to Improvement Opportunity 14).

Exam Development Process transparency comparison with NSW and QLD

- 3.90 We conducted a comparison of the transparency of the Exam Development Process to the public between Victoria, New South Wales and Queensland on 24 March 2023. This comparison involved examining the websites of the Victorian Curriculum and Assessment Authority (VCAA), New South Wales Education Standards Authority (NESA) and Queensland Curriculum and Assessment Authority (QCAA) for details around the level of disclosure available to stakeholders.

Victorian Curriculum and Assessment Authority (VCAA)

- 3.91 On the VCAA website, there is no information regarding the Exam Development Process.

New South Wales Education Standards Authority (NESA)

- 3.92 On the NESA website, there is an outline of the three main steps of the HSC exam development process: drafting, reviewing and finalising. There is a brief description outlining each stage, including the type of people involved, their training and background requirements, their responsibilities and principles that need to be followed, and the rounds of review processes that the exam goes through and how quality is ensured.



Queensland Curriculum and Assessment Authority (QCAA)

3.93 On the QCAA website, there is a short, animated video briefly outlining the QCAA’s Exam Development and marking process including information on the assessment proposal, writing teams, subject matter experts, editors and the rounds of checking and editing involved.

Comparison

3.94 In all three states, in the recruitment section of the website, there is detail regarding the requirement process and position description of the Exam Development Personnel, with the NESAs website being the most comprehensive and the VCAA one being the least. We note that information from the VCAA³² website was used in figure 9 below. Information includes responsibilities, selection criteria and conditions of appointment.

Red	Not available on website
Green	Available on website

Figure 9: Comparison of the transparency of the Exam Development Process to the public between Victoria, New South Wales and Queensland

VCAA	NESA	QCAA
Recruitment Process & Exam Development Personnel		
<input checked="" type="checkbox"/> Responsibilities	<input checked="" type="checkbox"/> Responsibilities	<input checked="" type="checkbox"/> Responsibilities
<input type="checkbox"/> Time commitment	<input type="checkbox"/> Time commitment	<input type="checkbox"/> Time commitment
<input checked="" type="checkbox"/> Background requirements	<input checked="" type="checkbox"/> Background requirements	<input checked="" type="checkbox"/> Background requirements
<input type="checkbox"/> Selection criteria	<input checked="" type="checkbox"/> Selection criteria	<input type="checkbox"/> Selection criteria
<input type="checkbox"/> Conditions of appointment	<input checked="" type="checkbox"/> Conditions of appointment	<input type="checkbox"/> Conditions of appointment
<input type="checkbox"/> Selection process	<input type="checkbox"/> Selection process	<input checked="" type="checkbox"/> Selection process
<input type="checkbox"/> Remuneration	<input type="checkbox"/> Remuneration	<input checked="" type="checkbox"/> Remuneration
Exam Development Process		
<input type="checkbox"/> Outline the roles involved in the process	<input checked="" type="checkbox"/> Outline the roles involved in the process	<input checked="" type="checkbox"/> Outline the roles involved in the process
<input type="checkbox"/> Outline main steps	<input checked="" type="checkbox"/> Outline main steps	<input checked="" type="checkbox"/> Outline main steps
<input type="checkbox"/> Drafting of exams	<input checked="" type="checkbox"/> Drafting of exams	<input checked="" type="checkbox"/> Drafting of exams
- Type of personnel involved	- Type of personnel involved	- Type of personnel involved
- General principles and guideline requirements	- General principles and guideline requirements	- General principles and guideline requirements
<input type="checkbox"/> Review Process	<input checked="" type="checkbox"/> Review Process	<input checked="" type="checkbox"/> Review Process
- Type of personnel involved	- Type of personnel involved	- Type of personnel involved
- # of review stages	- # of review stages	- # of review stages
<input type="checkbox"/> Finalisation of exams	<input checked="" type="checkbox"/> Finalisation of exams	<input checked="" type="checkbox"/> Finalisation of exams
<input type="checkbox"/> How to ensure quality	<input checked="" type="checkbox"/> How to ensure quality	<input type="checkbox"/> How to ensure quality

3.95 We note that the VCAA conduct recruitment through the SSMS website³³. SSMS lists some general information about what should be included in an application. VCAA have stated that information about panel recruitment is available to the public during the recruitment period for active roles (selection criteria, conditions of appointment, selection process and remuneration). We note that NESAs and QCAA have recruitment information such as Remuneration available all year round.

³² VCAA website - <https://www.vcaa.vic.edu.au>
³³ Sessional Staff Management System (SSMS) website

Figure 10: VCAA via SSMS website

VCAA	
<input type="checkbox"/>	Responsibilities
<input type="checkbox"/>	Time commitment
<input checked="" type="checkbox"/>	Background requirements
<input type="checkbox"/>	Selection criteria
<input checked="" type="checkbox"/>	Conditions of appointment
<input type="checkbox"/>	Selection process
<input type="checkbox"/>	Remuneration
<input type="checkbox"/>	Outline the roles involved in the process
<input type="checkbox"/>	Outline main steps
<input type="checkbox"/>	Drafting of exams
	- Type of personnel involved
	- General principles and guideline requirements
<input type="checkbox"/>	Review Process
	- Type of personnel involved
	- # of review stages
<input type="checkbox"/>	Finalisation of exams
<input type="checkbox"/>	How to ensure quality

3.96 We recommend that VCAA reviews the transparency of the VCAA exam development process to the general public in light of the concerns raised, together with the process identified in other states (refer to Improvement Opportunity 15). There is a risk that VCAA will receive criticism from the public and the public will have a lack of understanding about VCAA’s exam development process. Providing the high-level steps in the exam writing process would help inform parties that a lengthy and thorough process is undertaken with contributions from multiple parties.

NSW/QLD review of questions

- 3.97 In November and December of 2022, the VCAA received concerns from three parties surrounding the lack of transparency in the exam development process including uncertainty around the appropriate qualifications of those involved in the Maths Exam development process and alleged serious errors within the 2022 Maths Exams.
- 3.98 The VCAA received a complaint from Mr John Kermond on 8 November 2022 in relation to three questions on the 2022 Specialist Mathematics Exam 2. These questions were Q 4 and Q19 of Section A Question 6f of Section B (refer to Exhibit 3). The details of this complaint are outlined in Appendix 4 as 'Query – Person 3'. This same complaint was forwarded to the VCAA by [REDACTED] (refer to Exhibit 3).
- 3.99 The VCAA received a document titled 'Critique of Victorian VCE Mathematics Exams' from Mr Burkard Polster and Mr Marty Ross on 20 November 2022 (refer to Exhibit 2). Mr Polster and Mr Ross were asked by the VCAA to put their concerns about the VCE Mathematics Exams in writing on 16 November 2022. This document outlined concerns about the 2022 Specialist Maths Exams and the 2022 Mathematical Methods Exams. Mr Polster and Mr Ross listed questions which they believed had major mathematical errors, minor mathematical errors, poorly conceived questions and poor writing on the 2022 Exams. Details of this complaint are outlined in Appendix 4 as 'Query – Person 1 & 2' as they related to the 2022 Specialist Maths Exam only.
- 3.100 We have sought third parties including NESAs and QCAAs to conduct an independent mathematical assessment of the 2022 exam content and questions. These assessments involved NESAs and QCAAs answering the questions for each 2022 exam (Specialist Maths, Maths Methods, and Further Maths), providing an explanation of their answers and commenting on any issues within the questions (e.g. quality of questions, appropriateness to VCE level, mathematical ambiguity and grammar).
- 3.101 QCAA reviewed all questions for each of the 2022 Maths Exams and provided their response on 19 May 2023.
- 3.102 NESAs reviewed a sample of questions detailed below, across each of the 2022 Maths Exams and provided their response on 31 May 2023.

Table 10: Summary of question sample for NESAs

Exam	Questions
Specialist Maths 1	Question 3b, 4, 6b, 8, 10b
Specialist Maths 2	Multiple Choice Question 4, 6, 8-10, 18-20 Extended Response Question 3, 4, 6f
Maths Methods 1	Question 2a, 4, 6-8
Maths Methods 2	Multiple Choice Questions 5, 6, 9, 14, 16, 18 Extended Response Question 1b, 2, 3, 4eii
Further Maths 1	-
Further Maths 2	Section A Core Q4 Module 2 Q2 Module 3 Q3

- 3.103 We have prepared a summary outlining general and question specific feedback the VCAA has received from various parties (refer to Exhibit 2 and 3) in relation to the 2022 Maths Exams, and the commentary of the Maths questions or solutions received from the interstate bodies, NESAs and QCAAs in Appendix 4.
- 3.104 There were three questions in the Specialist Maths Exam 2 identified by Mr Kermond as erroneous or which were poorly constructed, for which NESAs/QCAAs also provided specific comments.
- 3.105 There were fourteen questions in the Specialist Maths Exam 2 identified by Mr Polster and Mr Ross as erroneous or which were poorly constructed, for which NESAs/QCAAs also provided specific comments.

4 Improvement opportunities

Below we have outlined our key observations, the impact, our recommendations, and our suggested priority of implementation for recommendations.

Priority	Explanation
Act now	Recommendations directly relevant to ensure an effective exam development process for 2023 (where practically achievable) and 2024.
For consideration in future years	For consideration in future years' development process (from 2024/2025 onwards).

Item	Observation	Impact	Improvement Opportunity	Priority
Preliminary stage: Appointment and briefing of Exam Development Panel				
1	<p>Interview participants stated that the information sessions for Panel Chairs of all VCE subjects were generic and "missed the mark".</p> <p>Interview participants noted that the information sessions for Panel Chairs were repetitive for experienced Panel Chairs.</p>	<p>Loss of interest from participants during these information sessions</p> <p>Poor retention of topics discussed during information sessions.</p>	<p>VCAA may consider continuing to run introductory sessions for all Panel members of all VCE subjects but also consider creating an information pack or learning video tailored to each subject (e.g. an information pack/learning video that is only for Maths Panel Members and contains information that is specifically related to the Maths Exam Development process).</p> <p>Information sessions should be split for new Panel Chairs and an abridged session for experienced Panel Chairs. VCAA may consider if experienced Panel Chairs may only need a refresher session every second year.</p> <p>The information session for new Panel Chairs may cover the existing content including information on the exam writing handbook, the timeline and technical aspects such as how to use track changes and secure platforms (Kiteworks, DataLocker). The information session for experienced Panel Chairs may include updates on new process and procedures and a summary review of the exam writing handbook and the timeline.</p> <p>This improvement opportunity is subject to resourcing.</p>	For consideration in future years
2	Several of the Maths Panel Chairs and Panel Members did not go through the initial application process during recruitment but were instead directly asked if they were willing to take on the position.	Lack of opportunity for other individuals to be part of the Exam Development Panel. May lead to lack of diverse thought and opinions and ultimately errors or oversight in Maths Exam question development.	<p>Reconsider the way VCAA appoint all levels in the process to ensure consistency and maintain best practice. If VCAA decide to hire Panel Members (VCAA employees) via a channel outside of the VCAA application portal they should formalise this in a policy/procedure document (e.g. in what circumstances this would occur, how they determine the candidate is qualified for the job, whether the candidate will still go through the relevant checks such as an Independence Check, National Criminal History Record Check).</p> <p>This improvement opportunity is subject to resourcing.</p>	For consideration in future years


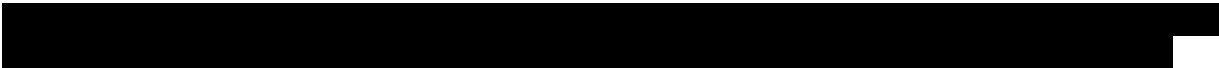

Item	Observation	Impact	Improvement Opportunity	Priority
3	Exam Development Personnel including the EDM, Panel, SSV and ESV do not receive formal training when they are appointed to be a part of the exam development process and instead learn "on the job".	Unclear expectations of the role resulting in inconsistencies in performance.	VCAA may consider implementing formal training for those involved in the exam development process. This should include an overview of VCAA's expectations when writing questions, the stages of the exam development process and what to do if a breach of security occurs. It should also include the provision of the development manual and a timeline that they are able to refer to throughout the development process to assist with clarity and understanding. This improvement opportunity is subject to resourcing.	Act now
4	A number of those interviewed stated that more consistency in Exam Development Personnel staff would allow for a smoother exam development process and better-quality questions.	Inconsistency within the development team or lack of experience may negatively impact the development process resulting in poor quality questions and a poor-quality exam.	VCAA may consider a minimum term for Exam Development Personnel in certain roles to ensure consistency within the exam development process and the impact that regular turnover or less experience may have on the quality of exam questions. This should be coupled with a periodic rotation of Exam Development Personnel to ensure diversity of thought. This improvement opportunity is subject to resourcing.	Act now
Stage 2 and 7: SSV and ESV Review				
5	SSVs and ESVs noted they do not receive any formal feedback or response from the Panel or VCAA about whether changes have been implemented by the Panel as a result of the SSV and ESV's work.	Inability to use lessons learned from prior year role and potential lack of efficiency.	VCAA may consider providing formal feedback to SSVs and ESVs (both independent contractors hired on a 1 year term basis) on their work. This should include at a minimum whether their changes were implemented by the panel or if not why, and ideally what was done well and any improvement opportunities.	Act now
6	There have been inconsistencies in the materials received by the SSV when performing their review in recent years.	Reduction in efficiency for SSV reviewers.	VCAA may consider creating a consistent list of documents that they send out to SSVs (independent contractors) (and other Exam Development Personnel) across all Maths subjects for when they perform their review, including but not limited to the content map, study design/curriculum outline, exam expectations and exam development timeline.	Act now

Item	Observation	Impact	Improvement Opportunity	Priority
7	SSVs and ESVs were often given little to no notice before being asked to complete a review before a specified date or were not given an estimate of timing early in the process.	Inability to meet VCAA deadline around existing work or completing the role in a rushed manner resulted in less quality output.	VCAA may consider providing all Exam Development Personnel including the SSV and ESV (independent contractors) with timelines of the entire exam development process including an estimated timeframe as to what date their review is estimated to occur or to improve communication to SSV/ESVs regarding the timeline. The EDM (VCAA employee) should provide regular updates to the ESV and SSV regarding this timing and notify them in a timely manner where exam development has been delayed and there is an impact on the timing of the SSV or ESV's review.	Act now
8	There is <u>more than one</u> different calculator type acceptable for students to use in the Maths Exams, however ESVs currently only test the exam with one type of calculator.	Students may be disadvantaged by untested calculators which run slower, have a different degree of accuracy to those tested or have a different order of operations. A possible advantage to those students who use calculators tested by VCAA.	VCAA may consider ensuring the ESV (independent contractors) test a sample of questions with more than one type of calculator in addition to the existing process, revert to having two ESVs who both use a different calculator or have the same ESV vet the exam twice using different calculators. This improvement opportunity is subject to resourcing.	For consideration in future years
Stage 3-5: Exam sign-off, Editorial, and English and Additional Language (EAL) review				
9	An interviewee stated that in the 2022 Specialist Maths Exam, some of the wording was confusing and may have been difficult for those of different nationalities to understand.	EAL students may not understand wording of questions causing confusion as to what the question is asking.	VCAA may consider having people of different nationalities attempt the exams or review a sample of questions as an addition to the EAL review performed, to assist in preventing any confusing terminology. This improvement opportunity is subject to resourcing.	For consideration in future years
Stage 11: Examination Panel Sign-off				
10	The entire Panel come together to have a 'Panel Sit' where they go through the exam for the final time, sit the exam themselves, ensure all the feedback has been responded to and provide final opinions.	Could be perceived as a conflict of interest (self-review threat)	VCAA may consider engaging an independent committee or VCAA employees other than those on the Panel to perform the final sign off/review. This improvement opportunity is subject to resourcing.	Act now

Item	Observation	Impact	Improvement Opportunity	Priority
Stage 14: Marking guide finalisation				
11	There is no documented process within the Exam Development Manual for finalisation or development of the marking guide for each exam.	Different Maths Exams may complete this step of the exam process differently leading to inconsistencies.	VCAA may consider documenting the finalisation/development of the marking guide for each exam as they have done for other stages of the Exam Development Process.	Act now
General - Document management				
12	The large quantity of documents produced during the Exam Development Process are not clearly identifiable, documented or recorded.	Difficult to follow at what point changes to questions were made and why or by whom and the approval process followed. Documents may be easily lost.	VCAA to consider minimising the need for hardcopy documents. This would involve automating areas for processes review such as approvals (softcopy forms) while still using hardcopy documents for technical content such as when Maths questions need to be answered. VCAA might consider ensuring hard copy documents be recorded in a systematic manner, e.g., separated by development stages. They should also be clearly titled, so they can be easily aligned to each stage of review. Official forms should be used to indicate the completion of each stage and by whom, instead of just writing on the front page of exam papers. Consider tracking decisions by the Panel (VCAA employees) or changes to questions via an excel log, including reasoning for or against the proposed question change. This will ensure decisions can be easily justified or assist with ease of tracking development progress if required at a later date. VCAA may consider creating a document index aligning to each stage of the development process that each document or form is mapped to and can be ticked off during the process and linked to the SETVET tracker. This document can be a similar format to Appendix 3. This improvement opportunity is subject to resourcing.	For consideration in future years
13	There is a lack of understanding or certainty by Exam Development Personnel around the process that needs to be taken when a breach of security or policy occurs. There is no formalised or documented process outlining what to	The risk that a breach won't be reported correctly and exam development personnel won't know what the correct process is to follow if a breach does occur. The risk that breached questions may not be	VCAA may consider creating and implementing a new policy or enhancing an existing policy/procedure document that outlines what constitutes a breach of security and the process for when a breach of security occurs. This document should be distributed to all Exam Development Personnel and an overview provided during the initial training sessions.	Act now

Item	Observation	Impact	Improvement Opportunity	Priority
	do when a breach of security occurs.	identified prior to the exam.		
General – Panel management				
14	We found some stages of the review process only involved the Panel Chair and (at least) one Panel Member. We also received comments that Panel Members would prefer to have more input from the whole panel and not have final decisions made by the Panel Chair alone.	A lack of diverse thought and opinions during the exam development process.	We recommend VCAA consider requiring and ensuring that all Panel Members participate in development of responses to reviews, conducting reviews and in making final decisions about the exam content.	Act now
General				
15	We found that the transparency of VCAA exam development process to the general public is not in line with that of NESAs and QCAAs and there is very minimal information available.	Criticism from the public of VCAA's exam development process. Lack of understanding from the public as to how VCAA develops their exams.	VCAA to consider reviewing the transparency of the VCAA exam development process to the general public in light of the complaints and commentary received, together with the process identified at other states. VCAA to consider whether they provide additional information on the website at a high level such as; an outline of the overall process, including general principles and guideline requirements when drafting exams, the rounds of review processes that the exam goes through and how quality is ensured. This improvement opportunity is subject to resourcing.	Act now

5 Limitations

- 5.1 This report has been prepared using resources from the Deloitte Forensic practice (Deloitte Forensic). Deloitte Forensic partners and staff are not lawyers, and this report should not be relied upon as legal advice.
- 5.2 This report has been prepared based on interviews and documents provided relating to the 2022 Maths Exams. We have not carried out any testing of the procedures or controls nor have we carried out any observations of the procedures or controls to determine whether actions actually took place in the development of the 2022 Maths Exams.
- 5.3 This report has been prepared based on work completed as at 14 August 2023. Deloitte has not updated its work since that date. Deloitte assumes no responsibility for updating this report for events and circumstances occurring after the date of this report.
- 2.8 In preparing this report, the VCAA has provided Deloitte with copies of emails of concerns from three parties (refer Exhibits 2 and 3) together with 2022 Maths Exam solutions and commentary from the QCAA and NESA interstate bodies. Deloitte has not reviewed or provided any opinions on the accuracy of these complaints or review notes.
- 5.4 
The VCAA also acknowledge the report contains commentary from NESA and QCAA which is not to be shared without the written consent from NESA and QCAA.
- 5.5 We reserve the right to alter the findings reached in this report on completion of our work or should information that is relevant to our findings subsequently become available after the date of this report, including after meeting with and receiving exam answers and commentary from interstate bodies.
- 5.6 For the purposes of preparing this report, reliance has been placed upon the material, representations, information and instructions provided to us. Original documentation has not been seen (unless otherwise stated) and no audit or examination of the validity of the documentation, representations, information and instructions provided has been undertaken, except where it is expressly stated to have been.
- 5.7 The Services provided are advisory in nature and have not been conducted in accordance with the standards issued by the Australian Auditing and Assurance Standards Board and consequently no opinions or conclusions under these standards are expressed. The procedures and enquiries undertaken in the preparation of this report do not include verification work, nor do they constitute an audit or review in accordance with Australian Accounting and Assurance Standards.
- 5.8 We believe that the statements made in this report are accurate, but no warranty of completeness, accuracy, or reliability is given in relation to the statements and representations made by, and the information and documentation provided by VCAA. We have not attempted to verify these sources independently unless otherwise noted within the report.
- 5.9 
 This report should not be used for any other purpose without our prior written consent and, if it is used otherwise, neither Deloitte nor its partners or staff accept any liability or responsibility for loss suffered by any party.

6 Appendices and exhibits

Appendix 1: Information relied upon

Appendix 2: Interview schedule

Appendix 3: Exam Development Process Document Index – Example

Appendix 4: Independent mathematical assessment by third parties

Exhibit 1: Victorian Timetable examination production timeline

Exhibit 2: “Critique of Victorian VCE Mathematics Exams” by Burkard Polster and Marty Ross

Exhibit 3: Email correspondence between John Kermond and VCAA



Appendix 1: Information relied upon

#	Subject	Document name
1	Further Mathematics 1	Further Maths Exam 1 written descriptions
2	Further Mathematics 1	MA072 - Further Maths Paper 1
3	Further Mathematics 1	Component Table
4	Further Mathematics 1	Further Mathematics Examination content and level of difficulty grid: Submission
5	Further Mathematics 1	Further Mathematics Examination content and level of difficulty grid
6	Further Mathematics 1	CM answer to geometry Q8
7	Further Mathematics 1	Further Mathematics Written Examination 1: Formula Sheet
8	Further Mathematics 1	Further Mathematics Written Examination 1: Multiple-Choice Question Book
9	Further Mathematics 1	MA072 - Further Maths Paper 1: CM Copy
10	Further Mathematics 1	Loose Handwritten Workings
11	Further Mathematics 1	2022 Copyright Log
12	Further Mathematics 1	Morphological Variation among Populations of the Mountain Brushtail Possum, <i>Trichosurus caninus</i> Ogilby
13	Further Mathematics 1	Research Article
14	Further Mathematics 1	Gross and microscopic visceral anatomy of the male Cape fur seal
15	Further Mathematics 1	Crocodile_lengths
16	Further Mathematics 1	Section B Module 2 Q2
17	Further Mathematics 1	Further Mathematics Written Examination 1: Executive Check
18	Further Mathematics 1	Further Mathematics: Written Examination 1: Formula Sheet
19	Further Mathematics 1	PR to Joint EDM-CM Review
20	Further Mathematics 1	MA072 - Further Maths Paper 1: EAL Review
21	Further Mathematics 1	Proceed to Editorial Mark Up Form
22	Further Mathematics 1	Further Maths Exam 1 MA072 2022 Exam S3V1_Orange
23	Further Mathematics 1	Further Maths Exam 1 MA072 2022 Exam S3V1
24	Further Mathematics 1	Further Maths Exam 1 MA072 2022 Exam S2V4
25	Further Mathematics 1	Joint Review: Examination Development Manager and Curriculum Manager
26	Further Mathematics 1	Further Maths Exam 1 MA072 2022 Exam
27	Further Mathematics 1	Multiple Choice Answer Log 2022
28	Further Mathematics 1	Review Form: Study Specialist
29	Further Mathematics 1	Further Maths Exam 1 MA072 2022 Exam_Purple
30	Further Mathematics 1	Duties and Responsibilities of the Study Specialist
31	Further Mathematics 1	DEED - 2022 VCE Examination Panel Member
32	Further Mathematics 1	Review Form: Study Specialist
33	Further Mathematics 1	Further Maths Exam 1 MA072 2022 Exam_Dark pink
34	Further Mathematics 1	Review Form: Study Specialist
35	Further Mathematics 1	Further Maths Exam 1 MA072 2022 Exam Panel Response to SSV_20220511
36	Further Mathematics 1	Further Maths Exam 1 MA072 2022 Exam Panel Response to SSV_20220407
37	Further Mathematics 1	Further Maths Exam 1 MA072 2022 Exam_Blue
38	Further Mathematics 1	Joint Review Examination Development Manager and Curriculum Manager EDM - CM
39	Further Mathematics 1	Further Maths exam 1 MA072 2022 Exam: EDM-CM
40	Further Mathematics 1	Further Maths Exam 1 MA072 2022 Exam EDM Only
41	Further Mathematics 1	Further Maths Exam 1 MA072 2022 Exam: Proceed to DTP Answers on Last Page
42	Further Mathematics 1	APS Setup Form - GA Structure 2022
43	Further Mathematics 1	Multiple-Choice Answer Log 2022 - 2 SSVs - FM1
44	Further Mathematics 1	Post examination multiple choice answer log
45	Further Mathematics 1	Multiple-Choice Answers Audited Pauline Rule
46	Further Mathematics 1	Printed Email
47	Further Mathematics 1	DTP Log sheet 2022 Further Mathematics
48	Further Mathematics 1	Further Mathematics 1 stages table
49	Further Mathematics 1	Printer Examination Paper Check- Print run samples (10 copies) _Formula
50	Further Mathematics 1	Printer Examination Paper Check- Print run samples (10 copies) _Multiple Choice Book
51	Further Mathematics 1	Follow Up editorial queries
52	Further Mathematics 1	Editorial query sheet
53	Further Mathematics 1	Sign-Off Form: Examination Development Manager 2022
54	Further Mathematics 1	Further Mathematics Written Examination 1 Formula Sheet Manuscript

#	Subject	Document name
55	Further Mathematics 1	Sign Off Form- Examination Panel
56	Further Mathematics 1	Archive: Core A Data Analysis
57	Further Mathematics 1	Further Mathematics Written Examination 1 Multiple-Choice Question Book Copy 1-6
58	Further Mathematics 1	Further Mathematics Written Examination 1 Formula Sheet Copy 2-6
59	Further Mathematics 1	Further Mathematics Written Examination 1 Multiple-Choice Question Book Copy 2-6
60	Further Mathematics 1	Further Mathematics Written Examination 1 Formula Sheet Copy 1-6
61	Further Mathematics 1	Further Mathematics Written Examination 1 Multiple-Choice Question Book Copy 4-6
62	Further Mathematics 1	Further Mathematics Written Examination 1 Formula Sheet Copy 4-6
63	Further Mathematics 1	Further Mathematics Written Examination 1 Multiple-Choice Question Book Copy 5-6
64	Further Mathematics 1	Further Mathematics Written Examination 1 Formula Sheet Copy 5-6
65	Further Mathematics 1	Further Mathematics Written Examination 1 Multiple-Choice Question Book Copy 6-6
66	Further Mathematics 1	Further Mathematics Written Examination 1 Formula Sheet Copy 6-6
67	Further Mathematics 1	MA072 Further Maths Paper 1: February
68	Further Mathematics 1	Further Mathematics Examination content and level of difficulty grid
69	Further Mathematics 1	Changes from final proofread marked up on panel signoff (7th proof) - Multi Choice Question Book
70	Further Mathematics 1	Sign off Form - Curriculum Manager 2022
71	Further Mathematics 1	CM Final Review - Multi Choice Question Book
72	Further Mathematics 1	CM Final Review - Formula Sheet
73	Further Mathematics 1	Further Maths Exam 1 MA072 - Submission Exam
74	Further Mathematics 1	FM1 - Exam Development Stage Schedule
75	Further Mathematics 1	2022 Examination Submission Checklist
76	Further Mathematics 1	Panel Response to ESV on 4th Proof - Multi Choice Question Book
77	Further Mathematics 1	4th Proof - Multi Choice Question Book
78	Further Mathematics 1	3rd Proof - Multi Choice Question Book
79	Further Mathematics 1	2nd Proof - Multi Choice Question Book
80	Further Mathematics 1	1st Proof - Multi Choice Question Book
81	Further Mathematics 1	MA072 - Mark up (Comment refers to soft copy uploaded to KW by [REDACTED])
82	Further Mathematics 1	Further Maths 1 - Formula Sheet (Ok to print)
83	Further Mathematics 1	7th Proof - Final Proofread - Multi Choice Question Book
84	Further Mathematics 1	Panel Response to CM-AOR - Multi Choice Question Book
85	Further Mathematics 1	6th Proof - Multi Choice Question Book
86	Further Mathematics 1	5th Proof - Multi Choice Question Book
87	Further Mathematics 1	11th Proof - Multi Choice Question Book
88	Further Mathematics 1	10th Proof (QT) - Multi Choice Question Book
89	Further Mathematics 1	Final Editor Proofread (FER) Checklist
90	Further Mathematics 1	Manager Check - Multi Choice Question Book
91	Further Mathematics 1	Manager Check - Formula Sheet
92	Further Mathematics 1	Executive Check - Further Maths 1
93	Further Mathematics 1	EDM Sign Off - Multi Choice Question Book
94	Further Mathematics 1	EDM Sign Off - Formula Sheet
95	Further Mathematics 1	8th Proof - Multi Choice Question Book
96	Further Mathematics 1	MA072 - Assessment Operations Review 2022
97	Further Mathematics 1	AOR - Multi Choice Question Book
98	Further Mathematics 1	AOR - Formula Sheet
99	Further Mathematics 1	MA072 - AOR Copy Answer Key
100	Further Mathematics 1	2022 Assessment Guide - Further Maths (AOR Copy)
101	Further Mathematics 1	Examination Sitter Review Form 2022
102	Further Mathematics 1	ESV on 4th Proof - Multi Choice Question Book
103	Further Mathematics 1	Review Form - EAL
104	Further Mathematics 1	Final editor proofread (FER) + 9th Proof FER
105	Further Mathematics 1	SSV Deed
106	Further Mathematics 1	Panel Sign-off form
107	Further Mathematics 1	EAL Review Form
108	Further Mathematics 2	Editorial query sheet
109	Further Mathematics 2	Follow-up editorial queries
110	Further Mathematics 2	Printed Examination Paper Check Formula
111	Further Mathematics 2	Printed Examination Paper Check Q&A
112	Further Mathematics 2	Further Mathematics Written Examination 2 - 15th proof
113	Further Mathematics 2	Further Mathematics Written Examination 2 - 14th Proof
114	Further Mathematics 2	Further Mathematics Written Examination 2 - 13th Proof

#	Subject	Document name
115	Further Mathematics 2	Further Mathematics Written Examination 2- 2nd Proof Formula Sheet
116	Further Mathematics 2	Further Mathematics Written Examination 2 - 1st Proof Formula Sheet
117	Further Mathematics 2	Further Maths Exam 2 Editor Mark Up
118	Further Mathematics 2	2022 Furmath Exam 2 Mark up
119	Further Mathematics 2	Further Mathematics Written Examination 2 - Panel Sign off on 7th proof
120	Further Mathematics 2	Further Mathematics Written Examination 2 - Formula Sheet
121	Further Mathematics 2	Further Mathematics Written Examination 2 - 7th Proof
122	Further Mathematics 2	Further Mathematics Written Examination 2 - 6th Proof Formula Sheet (PCM-AOR)
123	Further Mathematics 2	Further Mathematics Written Examination 2 - 5th Proof Formula Sheet (PESV)
124	Further Mathematics 2	Further Mathematics Written Examination 2 - 4th Proof Formula Sheet
125	Further Mathematics 2	Further Mathematics Written Examination 2 - 3rd Proof Formula Sheet
126	Further Mathematics 2	MA073 Further Maths 2 Panel Response to SSV_Pink
127	Further Mathematics 2	MA073 Further Maths 2_S2V4_Yellow
128	Further Mathematics 2	MA073 Further Maths 2_S1V4_Yellow
129	Further Mathematics 2	Joint Review: Examination Development Manager and Curriculum Manager
130	Further Mathematics 2	MA073 Further Maths 2: Panel Response to EDM -CM
131	Further Mathematics 2	PR to Joint EDM - CM Review: Panel Response to EDM-CM
132	Further Mathematics 2	2022 Assessment Guide: Further Mathematics: FM2 MG 14/6/22 Archive
133	Further Mathematics 2	2022 Assessment Guide: Further Mathematics
134	Further Mathematics 2	Further Mathematics Examination content and level of difficulty grid (Incomplete?)
135	Further Mathematics 2	Examination Submission Checklist
136	Further Mathematics 2	Answers provided by panel Data analysis paper 2
137	Further Mathematics 2	Proceed to Editorial Mark Up Form 2022_S3V1_Purple
138	Further Mathematics 2	MA073 Further Maths 2 S3V1_Purple
139	Further Mathematics 2	2022 Assessment Guide: Further Mathematics - Latest Marking Guide
140	Further Mathematics 2	MA073 Further Maths 2 Panel Response to SSV_Pink
141	Further Mathematics 2	Review Form: Study Specialist
142	Further Mathematics 2	MA073 Further Maths 2_Dark Pink
143	Further Mathematics 2	Review Form Study Specialist
144	Further Mathematics 2	MA073 Further Maths 2_Blue
145	Further Mathematics 2	Further Mathematics Examination content and level of difficulty grid
146	Further Mathematics 2	Study Specialist Review Form 2022 Panel Response to SSV
147	Further Mathematics 2	Joint Review: Examination Development Manager and Curriculum Manager - EDM-CM
148	Further Mathematics 2	MA073 Further Maths 2 EDM - CM 01
149	Further Mathematics 2	MA073 Further Maths 2 EDM - CM 02
150	Further Mathematics 2	Study Specialist Review Form 2022_Panel Response to SSV [REDACTED]
151	Further Mathematics 2	VCAA Internal Office Use only FM2
152	Further Mathematics 2	2022 Assessment Guide: Further Mathematics Archive 18/07/22
153	Further Mathematics 2	2022 Assessment Guide: Further Mathematics: Archive
154	Further Mathematics 2	Sign - Off Form Examination Panel 2022
155	Further Mathematics 2	Copyright Log VCE Examinations
156	Further Mathematics 2	DTP Log Sheet 2022 Further Mathematics 2
157	Further Mathematics 2	Further Mathematics 2 Stages Action table
158	Further Mathematics 2	Further Mathematics Written Examination 2
159	Further Mathematics 2	Further Mathematics Written Examination 2: Formula Sheet
160	Further Mathematics 2	MA073 2022 Further Maths Exam 2
161	Further Mathematics 2	Ferny Creek, Victoria Weather Observations
162	Further Mathematics 2	Written Examination 2: Question and Answer Book
163	Further Mathematics 2	Written Examination 2: Question and Answer Book
164	Further Mathematics 2	Components Table
165	Further Mathematics 2	Written Descriptions Further Maths Exam 2
166	Further Mathematics 2	Handwritten Workings
167	Further Mathematics 2	Written Examination 2: Question and Answer Book - Executive Check Copy
168	Further Mathematics 2	Written Examination 2: Question and Answer Book - Written Descriptions
169	Further Mathematics 2	Final Editor Proofread (FER) Checklist
170	Further Mathematics 2	APS Setup Form - GA Structure 2022
171	Further Mathematics 2	Managers Check - Question & Answer Book (COPY)
172	Further Mathematics 2	MA073 Further Maths 2 - 2022 Exam
173	Further Mathematics 2	2022 Assessment Guide - Further Maths (Updated 07/08/2022)
174	Further Mathematics 2	11th Proof - Further Maths Written Exam Question & Answer Book

#	Subject	Document name
175	Further Mathematics 2	Sign off form - Exam Development Manager 2022 (Further Maths 2)
176	Further Mathematics 2	EDM Sign off on 10th Proof - Question & Answer Book
177	Further Mathematics 2	QT 10th Proof - Question & Answer Book
178	Further Mathematics 2	QT 9th Proof - Question & Answer Book
179	Further Mathematics 2	Final Proofread 8th Proof - Question & Answer Book - Pages 1 & 2
180	Further Mathematics 2	Final Proofread 8th Proof - Question & Answer Book - Pages 3 & 4
181	Further Mathematics 2	Final Proofread 8th Proof - Question & Answer Book - Pages 5 & 6
182	Further Mathematics 2	Final Proofread 8th Proof - Question & Answer Book - Pages 7 & 8
183	Further Mathematics 2	Final Proofread 8th Proof - Question & Answer Book - Pages 9 & 10
184	Further Mathematics 2	Final Proofread 8th Proof - Question & Answer Book - Pages 11 & 12
185	Further Mathematics 2	Final Proofread 8th Proof - Question & Answer Book - Pages 13 & 14
186	Further Mathematics 2	Final Proofread 8th Proof - Question & Answer Book - Pages 15 & 16
187	Further Mathematics 2	Final Proofread 8th Proof - Question & Answer Book - Pages 17 & 18
188	Further Mathematics 2	Final Proofread 8th Proof - Question & Answer Book - Pages 19 & 20
189	Further Mathematics 2	Final Proofread 8th Proof - Question & Answer Book - Pages 21 & 22
190	Further Mathematics 2	Final Proofread 8th Proof - Question & Answer Book - Pages 23 & 24
191	Further Mathematics 2	Final Proofread 8th Proof - Question & Answer Book - Pages 25 & 26
192	Further Mathematics 2	Final Proofread 8th Proof - Question & Answer Book - Pages 27 & 28
193	Further Mathematics 2	Final Proofread 8th Proof - Question & Answer Book - Pages 29 & 30
194	Further Mathematics 2	Final Proofread 8th Proof - Question & Answer Book - Pages 31 & 32
195	Further Mathematics 2	Final Proofread 8th Proof - Question & Answer Book - Pages 33 & 34
196	Further Mathematics 2	Final Proofread 8th Proof - Question & Answer Book - Pages 35 & 36
197	Further Mathematics 2	Final Proofread 8th Proof - Question & Answer Book - Pages 37 & 38
198	Further Mathematics 2	Blank VCAA Sheet
199	Further Mathematics 2	Further maths Written Exam 2 Formula Sheet - Pages 1 & 2
200	Further Mathematics 2	Further maths Written Exam 2 Formula Sheet - Pages 3 & 4
201	Further Mathematics 2	Sign-off Form Curriculum Manager 2022
202	Further Mathematics 2	CM Final Review - Question & Answer Book
203	Further Mathematics 2	CM Final Review - Formula Sheet
204	Further Mathematics 2	CM Copy - 2022 Assessment Guide - Further Maths
205	Further Mathematics 2	Examination Sitter Review Form 2022
206	Further Mathematics 2	ESV on 4th Proof - Question & Answer Book
207	Further Mathematics 2	ESV - Formula Sheet
208	Further Mathematics 2	Assessment Operations Review 2022
209	Further Mathematics 2	AOR - Question & Answer Book
210	Further Mathematics 2	AOR - Formula Sheet
211	Further Mathematics 2	Review Form - EAL- Second language check
212	Further Mathematics 2	Further Maths Exam 2 - EAL Review
213	Further Mathematics 2	Copy 1 of 6 - Question & Answer Book
214	Further Mathematics 2	Copy 1 of 6 - Formula Sheet
215	Further Mathematics 2	Copy 2 of 6 - Question & Answer Book
216	Further Mathematics 2	Copy 2 of 6 - Formula Sheet
217	Further Mathematics 2	Copy 3 of 6 - Question & Answer Book
218	Further Mathematics 2	Copy 3 of 6 - Formula Sheet
219	Further Mathematics 2	Copy 4 of 6 - Question & Answer Book
220	Further Mathematics 2	Copy 4 of 6 - Formula Sheet
221	Further Mathematics 2	Copy 5 of 6 - Question & Answer Book
222	Further Mathematics 2	Copy 5 of 6 - Formula Sheet
223	Further Mathematics 2	Executive Check - Further Maths 2
224	Further Mathematics 2	Copy of 8th Proof - Formula Sheet
225	Further Mathematics 2	Copy of 8th Proof - Question & Answer Book
226	Further Mathematics 2	Panel Response to CM-AOR - Question & Answer Book
227	Further Mathematics 2	CM-AOR - Formula Sheet
228	Further Mathematics 2	Panel Response to ESV on 4th Proof - Question & Answer Book
229	Further Mathematics 2	Panel Response to ESV - Formula Sheet
230	Further Mathematics 2	Marking guide - Latest
231	Further Mathematics 2	Editorial query sheet
232	Further Mathematics 2	Question spreadsheet
233	Mathematical Methods 1	Mathematical Methods Written Examination 1 - Executive Check
234	Mathematical Methods 1	Executive Check

#	Subject	Document name
235	Mathematical Methods 1	Final editor proofread checklist + Mathematical Methods Written Examination 1 8th Proof + Formula Sheet
236	Mathematical Methods 1	Review Form - English as an Additional Language - EAL
237	Mathematical Methods 1	VIC 2022 Mathematical Methods Exam 1 - EAL Review
238	Mathematical Methods 1	MA112 Maths Methods Exam 1 2022 Exam - SSV Copy
239	Mathematical Methods 1	APS Setup Form: GA structure 2022
240	Mathematical Methods 1	Tolerances Record Form for Panels
241	Mathematical Methods 1	Printer's Proof - Approval to Print
242	Mathematical Methods 1	Mathematical Methods Written Examination 1 - Panel Sign Off
243	Mathematical Methods 1	Sign-Off Form: Curriculum Manager 2022
244	Mathematical Methods 1	Printed Examination Paper Check
245	Mathematical Methods 1	VIC 2022 Mathematical Methods Exam 1 - Mark up
246	Mathematical Methods 1	2022 Mathmeth Exam Editor Mark up
247	Mathematical Methods 1	Mathematical Methods Written Examination 1 1st Proof - Formula Sheet
248	Mathematical Methods 1	Mathematical Methods Written Examination 1 2nd Proof - Formula Sheet
249	Mathematical Methods 1	Mathematical Methods Written Examination 1 3rd Proof - Formula Sheet
250	Mathematical Methods 1	Mathematical Methods Written Examination 1 4th Proof - Formula Sheet
251	Mathematical Methods 1	Mathematical Methods Written Examination Formula Sheet Panel Response to ESV-CM-AOR
252	Mathematical Methods 1	Mathematical Methods Written Examination 1 Panel Response to ESV-CM-AOR
253	Mathematical Methods 1	Mathematical Methods Written Examination 1 - 5th Proof
254	Mathematical Methods 1	Mathematical Methods 1 Written Examination - 6th Proof
255	Mathematical Methods 1	Mathematical Methods 1 Written Examination - 7th Proof
256	Mathematical Methods 1	Editorial Query Sheet
257	Mathematical Methods 1	Mathematical Methods Written Examination 1 Copy - 4th Proof - Formula Sheet
258	Mathematical Methods 1	Review Form: Study Specialist - Panel response to SSV
259	Mathematical Methods 1	2022 Examination submission checklist
260	Mathematical Methods 1	MA112 Maths Methods Exam 1 2022 Exam - Panel response to EDM-CM
261	Mathematical Methods 1	Joint Review Examination Development Manager and Curriculum Manager
262	Mathematical Methods 1	MA112 Maths Methods Exam 1_S1V4_Yellow
263	Mathematical Methods 1	Proceed to Editorial Mark Up form 2022
264	Mathematical Methods 1	VCAA internal office use Maths Methods 1
265	Mathematical Methods 1	Assessment Operations Review 2022 AOR
266	Mathematical Methods 1	Follow-up editorial queries
267	Mathematical Methods 1	Mathematical Methods Stages Table Follow-up query sheet
268	Mathematical Methods 1	DTP Log Sheet 2022 Mathematical Methods 1
269	Mathematical Methods 1	MA112 Maths Methods Exam 1 - SSV Copy
270	Mathematical Methods 1	Review Form: Study Specialist: SSV
271	Mathematical Methods 1	Content Map 2022 - Submission
272	Mathematical Methods 1	2022 Difficulty Map - Submission
273	Mathematical Methods 1	2022 Copyright Log
274	Mathematical Methods 1	Examination Sitter Review Form 2022
275	Mathematical Methods 1	Mathematical Methods Written Examination 1 - 9th Proof
276	Mathematical Methods 1	Mathematical Methods Written Examination 1 - 10th Proof
277	Mathematical Methods 1	Mathematical Methods Written Examination 1 EDM Sign Off
278	Mathematical Methods 1	Mathematical Methods Written Examination 1 Question and Answer Book - Manager Check
279	Mathematical Methods 1	Mathematical Methods Written Examination 1 Formula Sheet - Manager Check
280	Mathematical Methods 1	Mathematical Methods Written Examination 1 Question and Answer Book - ESV
281	Mathematical Methods 1	Mathematical Methods Written Examination 1 Question and Answer Book - CM Final Review
282	Mathematical Methods 1	Mathematical Methods Written Examination 1 Formula Sheet - CM Final Review
283	Mathematical Methods 1	Mathematical Methods Written Examination 1 Formula Sheet AOR
284	Mathematical Methods 1	Mathematical Methods Written Examination 1 Question and Answer Book - AOR
285	Mathematical Methods 1	Mathematical Methods Written Examination 1: Question and Answer Booklet
286	Mathematical Methods 1	Printed Examination Paper Check + Mathematical Methods Written Examination 1: Formula Sheet
287	Mathematical Methods 1	Mathematical Methods Written Examination 1: Question and Answer Booklet
288	Mathematical Methods 1	2022 Mathematical Methods 1 Marking Guide
289	Mathematical Methods 1	2022 Mathematical Methods 1 Marking Guide: MOR
290	Mathematical Methods 1	2022 Mathematical Methods 2 Marking Guide: Submission

#	Subject	Document name
291	Mathematical Methods 1	VIC 2022 Mathematical Methods Exam 1: Submission
292	Mathematical Methods 1	2022 Mathematical Methods 1 Marking Guide
293	Mathematical Methods 1	Component Table
294	Mathematical Methods 1	Mathematical Methods: Written Examination 1: Question and Answer Book
295	Mathematical Methods 2	2022 Multiple-Choice Answer Log: Submission
296	Mathematical Methods 2	2022 Mathematical Methods 2 Marking Guide
297	Mathematical Methods 2	Mathematical Methods Written Descriptions Exam 2
298	Mathematical Methods 2	Mathematical Methods Written Examination 2 Question and Answer Book
299	Mathematical Methods 2	Printer's Proof: Approval to Print
300	Mathematical Methods 2	Printed Examination Paper Check + MM2 Formula Sheet
301	Mathematical Methods 2	MA113 Maths Methods Exam 2
302	Mathematical Methods 2	2022 Difficulty Map: Submission
303	Mathematical Methods 2	VCE Examination Timetable
304	Mathematical Methods 2	Pages: VCE examination timetable
305	Mathematical Methods 2	2022 MathMeth Exam 2 : Submission
306	Mathematical Methods 2	2022 Mathematical Methods 2 Marking Guide: Submission
307	Mathematical Methods 2	Mathematical Methods Written Examination 2: Formula Sheet
308	Mathematical Methods 2	2022 Multiple-Choice Answer Log
309	Mathematical Methods 2	Component Table
310	Mathematical Methods 2	2022 Mathematical Methods 2 Marking Guide
311	Mathematical Methods 2	2022 Multiple-Choice Answer Log
312	Mathematical Methods 2	2022 Maths Methods Exam 2
313	Mathematical Methods 2	Mathematical Methods Written Examination 2 Question and Answer Book
314	Mathematical Methods 2	2nd Proof - Question & Answer Book
315	Mathematical Methods 2	3rd Proof - Question & Answer Book
316	Mathematical Methods 2	4th Proof - Question & Answer Book
317	Mathematical Methods 2	Panel response to ESV-CM-AOR - Question & Answer Book
318	Mathematical Methods 2	5th Proof - Question & Answer Book
319	Mathematical Methods 2	6th Proof - Final Proofread - Question & Answer Book
320	Mathematical Methods 2	7th Proof - Final Proofread - Question & Answer Book
321	Mathematical Methods 2	8th Proof - Final Proofread - Question & Answer Book
322	Mathematical Methods 2	MA113 2022 Exam - SSV Copy_S2V4_Yellow
323	Mathematical Methods 2	Post Examination Multiple Choice Answer Log
324	Mathematical Methods 2	10th Proof - Question & Answer Book
325	Mathematical Methods 2	Maths Methods Exam 2 - EAL Review
326	Mathematical Methods 2	Review Form - English as an Additional Language
327	Mathematical Methods 2	1st Proof - Question & Answer Book
328	Mathematical Methods 2	Proceed to Editorial Mark-up Form 2022
329	Mathematical Methods 2	VCAA Internal Office us only - Exam Development Stage Schedule MM2
330	Mathematical Methods 2	Panel Response to EDM-CM - Maths Methods Exam 2 2022 Exam
331	Mathematical Methods 2	Panel Response to EDM - CM - Joint Review: EDM & CM
332	Mathematical Methods 2	MA113 MM Exam 2 2022 Exam - SSV Copy
333	Mathematical Methods 2	Review Form: Study Specialist MM 1&2
334	Mathematical Methods 2	Printed Examination Paper Check
335	Mathematical Methods 2	Manager Check Formula Sheet
336	Mathematical Methods 2	Manager Check Question & Answer Book
337	Mathematical Methods 2	Executive Check Question & Answer Book
338	Mathematical Methods 2	Executive Check Form
339	Mathematical Methods 2	4th Proof Copy - Formula Sheet
340	Mathematical Methods 2	EDM Sign Off - Question & Answer Book
341	Mathematical Methods 2	Final editor proofread FER Checklist (9th Proof)
342	Mathematical Methods 2	MA113 2022 Exam - SSV Copy (Proceed to DTP)
343	Mathematical Methods 2	2022 Multiple Choice Answer Log - AOR Copy
344	Mathematical Methods 2	APS Setup Form - GA Structure 2022
345	Mathematical Methods 2	Tolerances Record Form for Panels
346	Mathematical Methods 2	2022 Multiple Choice Answer Log
347	Mathematical Methods 2	Editorial Query Sheet - MM2
348	Mathematical Methods 2	Follow up editorial queries - MM2
349	Mathematical Methods 2	Follow up query sheet - MM2
350	Mathematical Methods 2	DTP Log Sheet - 2022 MM2

#	Subject	Document name
351	Mathematical Methods 2	Panel Sign Off - Question & Answer Book
352	Mathematical Methods 2	2022 Copyright Log
353	Mathematical Methods 2	ESV - MM2 Question & Answer Book
354	Mathematical Methods 2	Examination Sitter Review Form 2022
355	Mathematical Methods 2	CM Final Review - Formula Sheet
356	Mathematical Methods 2	CM Final Review - Question & Answer Book
357	Mathematical Methods 2	Sign-off Form: Curriculum Manager 2022
358	Mathematical Methods 2	AOR - Formula Sheet
359	Mathematical Methods 2	AOR MM2 2022 Marking Guide
360	Mathematical Methods 2	AOR - Question & Answer Book
361	Mathematical Methods 2	Assessment Operations Review 2022
362	Mathematical Methods 2	Panel Response to SSV - Review Form Study Specialist
363	Mathematical Methods 2	Panel Response ESV-CM-AOR - Formula Sheet
364	Mathematical Methods 2	ESV - Formula Sheet
365	Mathematical Methods 2	Question & Answer Book - Suggestions Included
366	Mathematical Methods 2	2022 Examination Submission Checklist (Digital)
367	Mathematical Methods 2	2022 Examination Submission Checklist (Handwritten)
368	Mathematical Methods 2	Content Map 2022 Submission
369	Mathematical Methods 2	MA113 Maths Methods Exam 2 (S1V4)
370	Mathematical Methods 2	Marking Guide - Submission
371	Mathematical Methods 2	Exam paper mark-up
372	Mathematical Methods 2	2022 Multiple Choice Answer Log - EDM
373	Mathematical Methods 2	Question Log
374	Mathematical Methods 2	Marking Guide - Submission (2)
375	Mathematical Methods 2	Difficulty Map
376	Mathematical Methods 2	Marking Guide
377	Mathematical Methods 2	Exam paper editor mark-up
378	Mathematical Methods 2	Marking guide - mark up
379	Specialist Maths 1	MA092 Exam SM1 2022
380	Specialist Maths 1	Specialist Maths Exam 1 MA092 2022 Exam
381	Specialist Maths 1	MA092 Solutions 2022 SM1: Joint EDM-CM
382	Specialist Maths 1	MA092 Solutions 2022 SM1: S1V4
383	Specialist Maths 1	MA092 2022 SM1 marking guide - post panel resp to SSV - 17 May 2022
384	Specialist Maths 1	MA092 2022 SM1 Marking guide - Proceed to markup meeting
385	Specialist Maths 1	Replacement Question SM1
386	Specialist Maths 1	MA092 2022 SM1 marking guide - post panel proofread - 7 July 2022
387	Specialist Maths 1	MA092 2022 SM1 marking guide
388	Specialist Maths 1	MA092 2022 SM1 marking guide: post panel proofread - 7 July 2022: CM Copy
389	Specialist Maths 1	MA092 2022 SM1 marking guide - post panel proofread - 7 July 2022: COPY AOR
390	Specialist Maths 1	Specialist Mathematics Written Examination 1: Formula Sheet
391	Specialist Maths 1	Specialist Mathematics: Written examination 1: Question and Answer Book
392	Specialist Maths 1	MA092 2022 SM1 marking guide: FINAL 1 Sep 2022
393	Specialist Maths 1	MA092 2022 SM1 Examination
394	Specialist Maths 1	2022 Vic Specialist Mathematics - Exam 1 - Written Descriptions
395	Specialist Maths 1	Components Table: ECH Check + Apm enter + EDM Check
396	Specialist Maths 1	Printed Examination Paper Check
397	Specialist Maths 1	Proceed to Editorial Mark-up Form 2022
398	Specialist Maths 1	1st Proof - Specialist Maths 1 Written Exam - Question & Answer Book
399	Specialist Maths 1	2022 SpecMath Exam 1 Editor Mark Up - [REDACTED] edited
400	Specialist Maths 1	2nd Proof - Specialist Maths 1 Written Exam - Question & Answer Book
401	Specialist Maths 1	3rd Proof - Specialist Maths 1 Written Exam - Question & Answer Book
402	Specialist Maths 1	3rd Proof - Specialist Maths 1 Written Exam - Question & Answer Book
403	Specialist Maths 1	5th Proof - Specialist Maths 1 Written Exam - Question & Answer Book
404	Specialist Maths 1	6th Proof - Final Proofread - Specialist Maths 1 Written Exam - Question & Answer Book
405	Specialist Maths 1	Panel Response to ESV - Specialist Maths 1 Written Exam - Question & Answer Book
406	Specialist Maths 1	Panel Response to CM-AOR - Specialist Maths 1 Written Exam - Question & Answer Book
407	Specialist Maths 1	Panel Sign Off - Specialist Maths 1 Written Exam - Question & Answer Book
408	Specialist Maths 1	Sign Off Form - Examination Panel 2022

#	Subject	Document name
409	Specialist Maths 1	7th Proof - Final Proofread - Specialist Maths 1 Written Exam - Question & Answer Book
410	Specialist Maths 1	8th Proof - Specialist Maths 1 Written Exam - Question & Answer Book
411	Specialist Maths 1	Deed - 2022 VCE Examination Panel Member [REDACTED]
412	Specialist Maths 1	MA092 2022 SM1 Marking Guide - Post Panel Proofread - 7 July 2022
413	Specialist Maths 1	Executive Check - Question & Answer Book
414	Specialist Maths 1	Executive Check Form
415	Specialist Maths 1	Deed - 2022 VCE Examination Panel Member - [REDACTED]
416	Specialist Maths 1	Specialist Maths Exam 1 MA092 - Joint EDM-CM
417	Specialist Maths 1	Joint Review: EDM & CM
418	Specialist Maths 1	Panel Response to EDM-CM - MA092 Specialist Maths Exam 1
419	Specialist Maths 1	Panel Response to EDM-CM - MA092 Solutions 2022 SM1
420	Specialist Maths 1	Panel Response to EDM-CM - Study Specialist Review - MA092
421	Specialist Maths 1	Post PR to EDM-CM Review (S1V4) - MA092
422	Specialist Maths 1	SSV2 Specialist Maths Exam 1 2022 Exam
423	Specialist Maths 1	Review Form Study Specialist S2V2-SSV2
424	Specialist Maths 1	Review Form Study Specialist S2V2-SSV1
425	Specialist Maths 1	Post Panel Response to ESM-CM - Panel Response to SSV - Ma092 Marking Guide
426	Specialist Maths 1	Specialist Maths Exam 1 - S2V4
427	Specialist Maths 1	Panel Response to SSV - 2022 Specialist Maths Exam 1 MA092
428	Specialist Maths 1	Panel Response to SSV - Comments on Questions 3b, 3c, 4, 8, 10b
429	Specialist Maths 1	Review Form Study Specialist - Panel Response to SSV
430	Specialist Maths 1	Proceed to Markup Meeting - CM Meeting Notes - MA092 2022 Exam
431	Specialist Maths 1	SM1 Exam Development Stage Schedule
432	Specialist Maths 1	Review Form English as an Additional Language
433	Specialist Maths 1	Level of Difficulty Schedule Table
434	Specialist Maths 1	MA092 2022 SM1 Exam - EAL Review
435	Specialist Maths 1	ESV - SM1 2022 Exam Formula Sheet
436	Specialist Maths 1	ESV - SM1 2022 Question & Answer Book
437	Specialist Maths 1	Examination Sitter Review Form 2022 - SM1
438	Specialist Maths 1	CM Final Review - Formula Sheet
439	Specialist Maths 1	CM Final Review - Question & Answer Book
440	Specialist Maths 1	Sign-off Form: Curriculum Manager 2022
441	Specialist Maths 1	AOR - Formula Sheet
442	Specialist Maths 1	AOR - Question & Answer Book
443	Specialist Maths 1	Assessment Operations Review 2022
444	Specialist Maths 1	Copyright Log VCE Examinations (Final)
445	Specialist Maths 1	2nd Proof - Formula Sheet (Copy)
446	Specialist Maths 1	Editorial Query Sheet - Specialist Maths 1
447	Specialist Maths 1	DTP Log Sheet 2022 Specialist Maths 1
448	Specialist Maths 1	Follow Up Query sheet - Specialist Maths 1
449	Specialist Maths 1	Manager Check - Question & Answer Book
450	Specialist Maths 1	Printed Examination Paper Check (2)
451	Specialist Maths 1	EDM Sign-Off - Question & Answer Booklet
452	Specialist Maths 1	Sign-off Form: Examination Development Manager 2022
453	Specialist Maths 1	Final Editor Proofread (FER) Checklist - Specialist Maths 1
454	Specialist Maths 1	10th Proof PFER - Question & Answer Book
455	Specialist Maths 1	9th Proof PFER - Question & Answer Book
456	Specialist Maths 1	APS Setup Form - GA Structure 2022
457	Specialist Maths 1	Marking Guide - FINAL
458	Specialist Maths 1	Replacement paper - mark up - EDM-CM review
459	Specialist Maths 2	Specialist Maths Exam 2 MA093 - proceed to mark up (S3V2)
460	Specialist Maths 2	Proceed to Editorial Mark-up Form 2022
461	Specialist Maths 2	Exam Development Stage - VCAA internal office use only
462	Specialist Maths 2	Specialist Maths Exam 2 MA093 - panel response to SSV review (proceed to DTP meeting)
463	Specialist Maths 2	2022 Answer Key (Proceed to DTP meeting)
464	Specialist Maths 2	Multiple Choice Answer Log (Proceed to DTP meeting)
465	Specialist Maths 2	Specialist Maths Exam 2 - panel response to SSV review (S2V4)
466	Specialist Maths 2	2022 Answer Key (S2v4)
467	Specialist Maths 2	Multiple Choice Answer Log (S2v4)

#	Subject	Document name
468	Specialist Maths 2	Review Form: Study Specialist (panel response to SSV)
469	Specialist Maths 2	Multiple Choice Answer Log (panel response to SSV)
470	Specialist Maths 2	2022 Answer Key (panel response to SSV)
471	Specialist Maths 2	Review Form: Study Specialist (SSV)
472	Specialist Maths 2	Specialist Maths Exam 2 MA093 - SSV Review
473	Specialist Maths 2	Study Specialist Review Form Table 2 Panel Response to SSV
474	Specialist Maths 2	Review Form: Study Specialist (SSV) (Attached to full exam)
475	Specialist Maths 2	Specialist Maths Exam 2 - Answer Key - S1V4
476	Specialist Maths 2	Multiple Choice Answer Log (S1V4)
477	Specialist Maths 2	2022 Answer Key (S1v4)
478	Specialist Maths 2	Specialist Maths Exam 2 (Panel response to EDM-CM)
479	Specialist Maths 2	Joint Review: EDM & CM
480	Specialist Maths 2	Specialist Maths Exam 2 (Joint EDM & CM Review)
481	Specialist Maths 2	2022 Answer Key (EDM - CM)
482	Specialist Maths 2	Specialist Maths Exam 2 (CM 8/3/22)
483	Specialist Maths 2	SM2 Exam Feb 2022
484	Specialist Maths 2	2022 Answer Key (No annotations)
485	Specialist Maths 2	Multiple Choice Answer Log (Initial)
486	Specialist Maths 2	Copyright Log VCE Examinations (Final)
487	Specialist Maths 2	Assessment Operations Review 2022
488	Specialist Maths 2	2022 Answer Key (Copy AOR - Post Panel proofread)
489	Specialist Maths 2	Specialist Maths 2 - Formula Sheet
490	Specialist Maths 2	Multiple Choice Answer Log (Copy AOR)
491	Specialist Maths 2	Sign Off Form - Curriculum Manager
492	Specialist Maths 2	Multiple Choice Answer Log (Copy - CM Final Review)
493	Specialist Maths 2	2022 Answer Key (Copy - CM Final Review)
494	Specialist Maths 2	Specialist Maths Written Exam 2 (CM Final Review)
495	Specialist Maths 2	Specialist Maths 2 - Formula Sheet (CM Final Review)
496	Specialist Maths 2	Specialist Maths Written Exam 2 Question & Answer Book 2022
497	Specialist Maths 2	Examination Sitter Review Form 2022
498	Specialist Maths 2	Specialist Maths 2 Formula Sheet (ESV)
499	Specialist Maths 2	Specialist Maths Written Exam 2 Question & Answer Book 2022 (ESV)
500	Specialist Maths 2	Specialist Maths Written Exam 2 Question & Answer Book 2022 (Copy 4 of 4)
501	Specialist Maths 2	Specialist Maths Written Exam 2 Question & Answer Book 2022 (Copy 3 of 4)
502	Specialist Maths 2	Specialist Maths Written Exam 2 Question & Answer Book 2022 (Copy 2 of 4)
503	Specialist Maths 2	Specialist Maths Written Exam 2 Question & Answer Book 2022 (Copy 1 of 4)
504	Specialist Maths 2	2022 Answer Key (Post Panel proofread and new SSV 18 August 2022)
505	Specialist Maths 2	2022 Answer Key (Post Panel proofread and new SSV 13 July 2022)
506	Specialist Maths 2	Multiple Choice Answer Log (S3V2)
507	Specialist Maths 2	EAL Review Form
508	Specialist Maths 2	Ma093 2022 SM2 Examination - EAL Review
509	Specialist Maths 2	2022 Answer Key (Post Panel proofread 7 July 2022)
510	Specialist Maths 2	2022 Answer Key (S3v2 - Old Scheme)
511	Specialist Maths 2	Difficulty Log Multiple Choice & Extended Answer
512	Specialist Maths 2	Curriculum log per question - Specialist Maths 2
513	Specialist Maths 2	EDM - CM Prelim Review (Q 4a - 4bi)
514	Specialist Maths 2	EDM - CM Prelim Review (Q 4bii - 4d)
515	Specialist Maths 2	EDM - CM Prelim Review (Q 5&6)
516	Specialist Maths 2	Question 4a, b(i) - looseleaf
517	Specialist Maths 2	Question 4b(ii), c, d - looseleaf
518	Specialist Maths 2	Question 5a, b - looseleaf
519	Specialist Maths 2	Question 5c, d, e - looseleaf
520	Specialist Maths 2	Question 6 a, b, c, d - looseleaf
521	Specialist Maths 2	Question 6 e, f - looseleaf
522	Specialist Maths 2	Solutions to new questions NHT
523	Specialist Maths 2	Final Proofread - Specialist Maths 2 Written Exam - question & answer book
524	Specialist Maths 2	Panel Sign Off - Specialist Maths 2 Written Exam - question & answer book
525	Specialist Maths 2	Final Proofread - Specialist Maths 2 Written Exam - question & answer book
526	Specialist Maths 2	Panel Response to CM-AOR No Changes
527	Specialist Maths 2	Panel response to ESV - Specialist Maths Written Exam 2 5/8/22
528	Specialist Maths 2	5th Proof - Specialist Maths 2 Written Exam - Question & Answer Book

#	Subject	Document name
529	Specialist Maths 2	4th Proof - Specialist Maths 2 Written Exam - Question & Answer Book
530	Specialist Maths 2	3rd Proof - Specialist Maths 2 Written Exam - Question & Answer Book
531	Specialist Maths 2	2nd Proof - Specialist Maths 2 Written Exam - Question & Answer Book
532	Specialist Maths 2	2nd Proof Copy - Formula Sheet - Specialist Maths 2 Written Exam
533	Specialist Maths 2	1st Proof - Specialist Maths 2 Written Exam - Question & Answer Book
534	Specialist Maths 2	2022 SpecMath Exam 2 Mark up - [REDACTED] 10 June 2022
535	Specialist Maths 2	Ma093 2022 SM2 Examination - Mark Up
536	Specialist Maths 2	Multiple Choice Answer Log - Signed off 31/8/22
537	Specialist Maths 2	Printed Examination Paper Check
538	Specialist Maths 2	Specialist Maths Formula Sheet (Lilac Paper)
539	Specialist Maths 2	Specialist Maths Written Exam 2 (Lilac Stripe)
540	Specialist Maths 2	Post Examination Multiple Choice Answer Log
541	Specialist Maths 2	Manager Check - Specialist Maths 2 Question & Answer Book
542	Specialist Maths 2	Follow up query sheet - Specialist Maths 2
543	Specialist Maths 2	Editorial Query Sheet - Specialist Maths 2
544	Specialist Maths 2	Follow up editorial queries
545	Specialist Maths 2	DTP Log Sheet: 2022 Specialist Maths 2
546	Specialist Maths 2	9th Proof - Specialist Maths 2 Written Exam - Question & Answer Book
547	Specialist Maths 2	Final Editor Proofread (FER) Checklist
548	Specialist Maths 2	EDM Sign Off - Ok to print 1/9/22
549	Specialist Maths 2	Sign Off Form - Exam Development Manager 2022
550	Specialist Maths 2	APS Setup Form - GA Structure 2022
551	Specialist Maths 2	Question Breakdown Spreadsheet
552	Specialist Maths 2	2022 Answer Key - Final 1 Sept 2022
553	Specialist Maths 2	Executive Check - Specialist Maths 2
554	Specialist Maths 2	Executive Check - Question & Answer Book
555	Specialist Maths 2	Multiple-Choice Answer Log 2022 - Joint EDM-CM
556	Specialist Maths 2	Specialist Maths Exam 2 Written Descriptions - with annotations
557	Specialist Maths 2	Email - [REDACTED]
558	Specialist Maths 2	MA093 SM2 Exam - Mark up
559	Specialist Maths 2	Specialist Maths Exam 2 - Replacement Question 4, 5, 6
560	Specialist Maths 2	Study - SM2 NHT 2023 Q6
561	Specialist Maths 2	Final Editor Proofread (FER)
562	Specialist Maths 2	8th Proof - Specialist Maths 2 Written Exam - Question & Answer Book - FER
563	N/A	EDM Project Management Spreadsheet (2)
564	N/A	_EXT_Re_ Independent Review Discussion Request [REDACTED]
565	N/A	[REDACTED] Post Discussion
566	N/A	Email SM 2022 Specialist Exam Panel
567	Specialist Maths	Meeting
568	N/A	VCAA Maths exam development org chart
569	N/A	2022 Correspondence and Call log for Deloitte
570	N/A	FW Errors on Specialist Mathematics Exam2
571	N/A	FW mathshof Fw Errors in itute 2022 Specialist Maths Exam 2 solutions
572	N/A	FW_ VCE Maths Examinations - review request from Deloitte
573	N/A	Marty Ross Blog links
574	N/A	Specific responses to critique_alleged errors_initial BP email
575	N/A	The Age - Specialist Maths exam 2 article (002)
576	N/A	VCAA - POLSTER-ROSS
577	N/A	VCE Mathematics Exams - concerns raised
578	N/A	2016MathematicsSD
579	N/A	2023MathematicsSD (1)
580	N/A	AdminHandbook2022
581	Further Mathematics	furmath-specs-w
582	N/A	MANUAL - 2022 VCE Development Manual v9
583	Mathematical Methods	mathmethods-specs-w
584	Specialist Maths	specmaths-specs-w
585	N/A	VCEVCALAdministrativeHandbook2021
586	N/A	VPCAdministrativeHandbook2023
578	Further Mathematics 1	2022 Further Maths (General) Exam 1 Report
579	Further Mathematics 2	2022 Further Maths (General) Exam 2 Report

#	Subject	Document name
580	Mathematical Methods 1	2022 Maths Methods Exam 1 Report
581	Mathematical Methods 2	2022 Maths Methods Exam 2 Report
582	Specialist Maths 1	2022 Specialist Maths Exam 1 Report
583	Specialist Maths 2	2022 Specialist Maths Exam 2 Report
584	Specialist Maths	_EXT_RE_VCAA_Deloitte Independent Review - Query
585	N/A	Final proofread checklist
586	Further Mathematics 2	2022_FM2_Marking_Guide_FINAL
587	Mathematical Methods 1	2022_MM1_Marking_Guide_FINAL
588	Mathematical Methods 2	2022_MM2_Marking_Guide_FINAL
589	Specialist Maths 1	2022_SM1_Marking_Guide_FINAL
590	Specialist Maths 2	2022_SM2_Marking_Guide_FINAL
591	Mathematical Methods 1	1.3 Maths Methods 1
592	Mathematical Methods 2	1.3 Maths Methods 2
593	Mathematical Methods	2022 Deed (signed [REDACTED])
594	Mathematical Methods 1	2022 Deed [REDACTED]
595	Mathematical Methods 1	2022 Deed MA112
596	Mathematical Methods 2	2022 Deed MA113
597	Mathematical Methods	2022 Signed Deed [REDACTED]
598	Mathematical Methods 2	2022_Deed_GM
599	Mathematical Methods	[REDACTED]
600	N/A	SETVET2022

Appendix 2: Interview schedule

Interview date/time	Name	Position	Subject	Interview location
11am AEST Friday 10 March 2023			All Maths subjects	Microsoft Teams (virtually)
11:30am AEST Friday 17 March 2023			Specialist Maths	Microsoft Teams (virtually)
12pm AEST Wednesday 15 March 2023			Maths methods	Microsoft Teams (virtually)
10:30 AEST Wednesday 15 March 2023			Further Maths	Microsoft Teams (virtually)
9:30am AEST Monday 3 April 2023			Specialist Maths	Microsoft Teams (virtually)
10:30am AEST Tuesday 28 March 2023			Specialist Maths	Microsoft Teams (virtually)
1:30pm AEST Wednesday 29 March 2023			Maths methods 1	Microsoft Teams (virtually)
10:30am AEST Wednesday 29 March 2023			Maths methods 2	Microsoft Teams (virtually)
2pm AEST Monday 3 April 2023			Further Maths 1	Microsoft Teams (virtually)
9:30am AEST Thursday 30 March 2023			Further Maths 2	Microsoft Teams (virtually)
11:30am AEST Friday 31 March 2023			Specialist and Maths methods	Microsoft Teams (virtually)
11:30am AEST Wednesday 22 March 2023			Further Maths	Microsoft Teams (virtually)
2pm AEST Monday 20 March 2023			Specialist Maths	Microsoft Teams (virtually)
3pm AEST Tuesday 4 April 2023			Maths methods	Microsoft Teams (virtually)
3pm AEST Thursday 6 April 2023			Further Maths	Microsoft Teams (virtually)

Appendix 3: Exam Development Process Document Index – Example

Exam	Stage	Activity	Documents required	Document included?
[Insert Exam Name]	Prelim	Appointment of Examination Panel	[Insert document name]	<input type="checkbox"/>
			[Insert document name]	<input type="checkbox"/>
	Prelim	Examination Panel Member Briefing	[Insert document name]	<input type="checkbox"/>
			[Insert document name]	<input type="checkbox"/>
	Prelim	Examination Development	[Insert document name]	<input type="checkbox"/>
			[Insert document name]	<input type="checkbox"/>
	Stage 0	Examination Submission	[Insert document name]	<input type="checkbox"/>
			[Insert document name]	<input type="checkbox"/>
	Stage 1	Reviews: EDM, CM	[Insert document name]	<input type="checkbox"/>
			[Insert document name]	<input type="checkbox"/>
	Stage 1	Joint EDM-CM Review	[Insert document name]	<input type="checkbox"/>
			[Insert document name]	<input type="checkbox"/>
	Stage 1	Panel Response to Joint EDM-CM	[Insert document name]	<input type="checkbox"/>
			[Insert document name]	<input type="checkbox"/>
	Stage 2	Review: Study Specialist	[Insert document name]	<input type="checkbox"/>
			[Insert document name]	<input type="checkbox"/>
	Stage 2	Panel Response to Study Specialist	[Insert document name]	<input type="checkbox"/>
			[Insert document name]	<input type="checkbox"/>
	Stage 3	Exam Sign Off – ready for Mark up and DTP	[Insert document name]	<input type="checkbox"/>
			[Insert document name]	<input type="checkbox"/>
	Stage 4	Review: Mark up	[Insert document name]	<input type="checkbox"/>
			[Insert document name]	<input type="checkbox"/>
	Stage 5	Desktop Publishing	[Insert document name]	<input type="checkbox"/>
			[Insert document name]	<input type="checkbox"/>
	Stage 5	Review: English as an Additional Language	[Insert document name]	<input type="checkbox"/>
			[Insert document name]	<input type="checkbox"/>
	Stage 6		[Insert document name]	<input type="checkbox"/>

Exam	Stage	Activity	Documents required	Document included?
		Panel Proofread (and response to Editorial Queries and EAL Review)	[Insert document name]	<input type="checkbox"/>
	Stage 6	Amendments incorporated and checked	[Insert document name]	<input type="checkbox"/>
			[Insert document name]	<input type="checkbox"/>
	Stage 7	Review: Examination Sitter	[Insert document name]	<input type="checkbox"/>
			[Insert document name]	<input type="checkbox"/>
	Stage 7	Panel Response to ESV	[Insert document name]	<input type="checkbox"/>
			[Insert document name]	<input type="checkbox"/>
	Stage 8	Reviews: CM (final), AOR	[Insert document name]	<input type="checkbox"/>
			[Insert document name]	<input type="checkbox"/>
	Stage 9	Panel Response to CM, AOR	[Insert document name]	<input type="checkbox"/>
			[Insert document name]	<input type="checkbox"/>
	Stage 10	Editor Proofread and Audit of Changes	[Insert document name]	<input type="checkbox"/>
			[Insert document name]	<input type="checkbox"/>
	Stage 11	Sign-Off: Examination Panel	[Insert document name]	<input type="checkbox"/>
			[Insert document name]	<input type="checkbox"/>
	Stage 12	Sign-Off: EDM	[Insert document name]	<input type="checkbox"/>
			[Insert document name]	<input type="checkbox"/>
	Stage 13	Final Editor Read (FER)	[Insert document name]	<input type="checkbox"/>
			[Insert document name]	<input type="checkbox"/>
	Stage 14	Final: ready for printing	[Insert document name]	<input type="checkbox"/>
			[Insert document name]	<input type="checkbox"/>
	Stage 14	Printer's Proof Check	[Insert document name]	<input type="checkbox"/>
			[Insert document name]	<input type="checkbox"/>
	Stage 14	Printed Paper Check	[Insert document name]	<input type="checkbox"/>
			[Insert document name]	<input type="checkbox"/>
	Stage 14	Marking Guide Finalisation	[Insert document name]	<input type="checkbox"/>
			[Insert document name]	<input type="checkbox"/>

Appendix 4: Independent mathematical assessment by third parties

Specialist Maths Exam 2

Question	Query - Person 1 & 2	Query – Person 3	Interstate Body 1	Interstate Body 2 (sample of questions reviewed only)
MCQ 1	No comment	No comment	"Simple familiar type question" "Tech-active"	Not completed
MCQ 2	No comment	No comment	"Simple familiar type question" "Tech-active possible but more efficient to be tech-free"	Not completed
MCQ 3	No comment	No comment	"Complex familiar question" "Tech-active possible but more efficient to be tech-free"	Not completed
MCQ 4	"Major Mathematical Error"	"No correct option. I realise that the answer intended by VCAA was Option B. However, since a and c can be real (*), Option B is not necessarily correct (that is, Option B is not always a correct statement). By its own admission, the question accepts real numbers as being a subset of complex numbers, evidence by the description of the 'complex	"Complex familiar type question" "Tech-active" "Question could be confusing to some students. Are all students aware of the expression 'necessarily true'... would 'always true' be easier to comprehend?"	"Since it is not stated that $\text{Im}(a) \neq 0$ and $\text{Im}(c) \neq 0$ none of the statements are necessarily true"

		<p>roots ... b ... where $\text{Re}(b) \neq 0$ and $\text{Im}(b) = 0$.</p> <p>This same error was made on the 2021 Specialist Maths Exam 2 Section B Question 2 part (a).</p> <p>I raised that error back in April of this year. Although the Examination Report lies about the answer to that question, it eventually does note that there is 'an alternative solution'.</p> <p>* Nothing in the question excludes this possibility."</p>		
MCQ 5	No comment	No comment	<p>"Simple familiar type question"</p> <p>"Tech-free"</p>	Not completed
MCQ 6	"Poor writing"	No comment	<p>"Simple familiar type question."</p> <p>"Tech-free"</p> <p>"MCQs where each distractor needs to be considered in order to determine the correct answer is not considered the preferred style of MCQ by the QCAA"</p>	"A considerable amount of work required to eliminate the first 4 answers."
MCQ 7	No comment	No comment	"Simple familiar type question"	Not completed
MCQ 8	"Poorly conceived question"	No comment	<p>"Simple familiar type question"</p> <p>"Tech-active possible but more efficient to be tech-free"</p>	"Using the point (2,2) we are assuming (by eye) that the gradient of the line segment at that point is less than -1"
MCQ 9	"Poorly conceived question"	No comment	"Complex familiar type question"	"A lot of work for 1 mark and the final necessary step of substitution of possible answers rather"

			"Tech-free"	than solving an equation seems inappropriate for this level"
MCQ 10	"Poorly conceived question"	No comment	"Complex familiar type question" "Tech-free/tech-active"	"If implicit differentiation was the intended method, then an alternative method should not be available to students."
MCQ 11	No comment	No comment	"Complex familiar type question" "Tech-free"	Not completed
MCQ 12	No comment	No comment	"Simple familiar type question" "Tech-free/tech-active"	Not completed
MCQ 13	No comment	No comment	"Simple familiar type question" "Tech-free"	Not completed
MCQ 14	No comment	No comment	"Complex familiar type question" "Tech-free"	Not completed
MCQ 15	No comment	No comment	"Simple familiar type question" "Tech-free"	Not completed
MCQ 16	No comment	No comment	"Complex familiar type question" "Tech-free"	Not completed
MCQ 17	No comment	No comment	"Simple familiar type question" "Tech-free"	Not completed
MCQ 18	"Poor writing"	No comment	"Complex familiar type question" "Tech-active"	"No concerns"
MCQ 19	"Major Mathematical Error"	"The question is defective and therefore cannot be answered."	"Complex familiar type question" "Tech-active"	"Confidence intervals are a range of values that the true value is likely to lie in. This question states the true value of the population mean for the mass so a confidence interval is not necessary as the exact value of the average cost can be

		<p>roots ... b ... where $\text{Re}(b) \neq 0$ and $\text{Im}(b) = 0$.</p> <p>This same error was made on the 2021 Specialist Maths Exam 2 Section B Question 2 part (a).</p> <p>I raised that error back in April of this year. Although the Examination Report lies about the answer to that question, it eventually does note that there is 'an alternative solution'.</p> <p>* Nothing in the question excludes this possibility."</p>		
MCQ 5	No comment	No comment	<p>"Simple familiar type question"</p> <p>"Tech-free"</p>	Not completed
MCQ 6	"Poor writing"	No comment	<p>"Simple familiar type question."</p> <p>"Tech-free"</p> <p>"MCQs where each distractor needs to be considered in order to determine the correct answer is not considered the preferred style of MCQ by the QCAA"</p>	"A considerable amount of work required to eliminate the first 4 answers."
MCQ 7	No comment	No comment	"Simple familiar type question"	Not completed
MCQ 8	"Poorly conceived question"	No comment	<p>"Simple familiar type question"</p> <p>"Tech-active possible but more efficient to be tech-free"</p>	"Using the point (2,2) we are assuming (by eye) that the gradient of the line segment at that point is less than -1"
MCQ 9	"Poorly conceived question"	No comment	"Complex familiar type question"	"A lot of work for 1 mark and the final necessary step of substitution of possible answers rather"

		<p>A confidence interval gives an estimated range of values which is likely to include an unknown population parameter. It is based on a given set of sample data.</p> <p>The question does not give the sample mean. In fact, the question seems to be suggesting that a confidence interval for a sample mean based on the population mean should be calculated. That's total rubbish.</p> <p>Furthermore, the question enables the population mean to be exactly calculated, which makes finding a confidence interval for the population mean pointless, assuming the sample mean was given and such a calculation able to be performed."</p>		<p>calculated by substituting $m = 7$ into the equation for C.</p> <p>To calculate a confidence interval for the population mean, we would need a value for the sample mean, which was not given.</p> <p>If it was intended that 7 is the value of the sample mean mass (not the population mean mass) for the sample size of 100 then... (see solution)"</p>
MCQ 20	"Poorly conceived question"	No comment	<p>"Complex unfamiliar type question"</p> <p>"Tech-active"</p>	"This is very wordy for a one-mark multiple choice question"
General comment - MCQ	No comment	No comment	<p>"Suitable mixture of tech-free and tech-active questions - also allows students to make decisions regarding the use of technology when considering efficiency of solution.</p> <p>Assuming each MCQ is worth 1 mark, working required to solve Q3, 4, 9, 10, 11, 14, 16, 18, 19 and 20 is more complex than the remaining questions.</p>	No comment

			Noted that the overall breakdown was A-4, B-5, C-3, D-3, E-5 which is a reasonable split across the distractors"	
Q1a	No comment	No comment	"Simple familiar type question" "Tech-free/tech-active"	Not completed
Q1b	No comment	No comment	"Simple familiar type question" "Tech-active"	Not completed
Q1ci	No comment	No comment	"Simple familiar type question" "Tech-free"	Not completed
Q1cii	No comment	No comment	"Simple familiar type question" "Tech-free"	Not completed
Q1di	No comment	No comment	"Simple familiar type question" "Tech-free/tech-active"	Not completed
Q1dii	No comment	No comment	"Simple familiar type question" "Tech-free"	Not completed
Q2ai	No comment	No comment	"Complex familiar type question." "Tech-free" "Marks seem disproportionate to work required to solve problem. Showing with CAS – not sure how much CAS can be used or if it is all algebraic"	Not completed
Q2aii	No comment	No comment	"Simple familiar type question."	Not completed

			"Tech-active"	
Q2b	No comment	No comment	"Simple familiar type question" "Liked having polar graph to plot points" "Tech-free"	Not completed
Q2c	No comment	No comment	"Simple familiar type question" "Tech-free" "Are all students familiar with the word 'ray'?" "Having two parts to a problem within the same sentence may be missed by some students"	Not completed
Q2d	No comment	No comment	"Simple familiar type question"	Not completed
Q3ai	"Poorly conceived question"	No comment	"Simple familiar type question" "Tech-free"	"No concerns"
Q3aii	"Poorly conceived question"	No comment	"Simple familiar type question" "Tech-free"	"No concerns"
Q3bi	"Poorly conceived question"	No comment	"Simple familiar type question" "Tech-free" "The orientation of x and t was not clear until the graph in bii)"	"No concerns"
Q3bii	"Poorly conceived question"	No comment	"Simple familiar type question" "Tech-active"	"No concerns"
Q3c	"Poorly conceived question"	No comment	"Simple familiar type question"	"No concerns"

			"Tech-free possible but more efficient to be tech-active"	
Q3d	"Poorly conceived question"	No comment	"Simple familiar type question" "Tech-free possible but more efficient to be tech-active"	"The first particle starts at O, not "passes through O"
Q3e	"Poorly conceived question"	No comment	"Complex familiar type question" "Tech-free possible but more efficient to be tech-active" "Using tech this can be answered very easily" "Compared to other questions worth 2 marks, this could be worth less"	"No concerns"
Q4a	"Poorly conceived question"	No comment	"Complex familiar type question" "Tech-free/tech-active"	"No concerns"
Q4bi	"Poorly conceived question"	No comment	"Simple familiar type question" "Tech-active" "Using tech this can be answered very easily. Compared to other questions worth 2 marks, this could be worth less"	"No concerns"
Q4bii	"Poorly conceived question"	No comment	"Simple familiar type question" "Tech-active" "This question requires use of radians while the earlier parts are using degrees."	"No concerns"

			This could introduce errors for some students"	
Q4c	"Poorly conceived question"	No comment	"Complex familiar type question" "We would give a question like this 3 marks, but compared to other questions on this paper, this is a lot of marks" "Tech-free/tech-active"	"No concerns"
Q4d	"Minor Mathematical Error" "Poorly conceived question"	No comment	"Simple familiar type question" "Tech-active"	"No concerns"
Q5a	No comment	No comment	"Complex familiar type question" "Tech-free/tech-active"	Not completed
Q5b	No comment	No comment	"Simple familiar type question" "Tech-free" "Question is not clear as it has to be assumed that the object is initially at the origin"	Not completed
Q5c	No comment	No comment	"Simple familiar type question" "Tech-free"	Not completed
Q5d	No comment	No comment	"Simple familiar type question" "Tech-free"	Not completed
Q5e	No comment	No comment	"Complex familiar type question" "Tech-free/tech-active" "Some confusion around the original resistance in	Not completed

			part a) and changing it to 38.5 here"	
Q6a	No comment	No comment	"Simple familiar type question" "Tech-free"	Not completed
Q6b	No comment	No comment	"Simple familiar type question" "Tech-active"	Not completed
Q6c	No comment	No comment	"Simple familiar type question" "Tech-free"	Not completed
Q6d	No comment	No comment	"Simple familiar type question" "Tech-active"	Not completed
Q6e	No comment	No comment	"Complex familiar type question" "Tech-active"	Not completed
Q6f	"Major Mathematical Error"	<p>"The question cannot be answered without making an assumption. It must be assumed that the random variables</p> <p>M: "Mass (g) of can filled with soft drink"</p> <p>C: "Mass (g) of empty can" are independent. Although this assumption is reasonable, students should not have to make it for themselves. The question should clearly state that these two random variables are independent.</p> <p>There may be other errors, but these are the most obvious and egregious errors.</p>	"Complex unfamiliar type question" "Tech-active"	<p>"It is not clear from the layout of the exam that the blurb above part e) is also related to part f). There should also have been mention of the independence of the variables for this question to be valid. This is discussed in detail in this blog post:</p> <p>https://mathematicalcrap.com/2022/11/09/witch-87-cannery-row/"</p>

		They are errors that will certainly cause disadvantage for some students, potentially stronger students that have thought and reflected deeply on the subject content."		
General comment – Extended response	No comment	No comment	"The allocated time of 2 hours may make it difficult for students to complete all questions. Suitable mixture of tech-free and tech-active questions - also allows students to make decisions regarding the use of technology when considering efficiency of solution."	No comment

Exhibit 1: Victorian Timetable examination production timeline

Stage	Activity	When	Who
			Panel activities
Prelim	Appointment of Examination Panel	Oct/Nov 2021	VCAA
Prelim	Examination Panel Member Briefing		All panel members
	Languages	18 Nov 2021	
	All Studies	23 Nov 2021	
	Catch-up session	2 Dec 2021	
Prelim	Examination Development	Nov 21 – Feb 2022	All panel members
0	Examination Submission		Panel Chair
	Language	Wednesday 2 February 2022	
	All other studies	Wednesday 16 February 2022	
Checkpoint 1			
1	Reviews: EDM, CM	Feb – March 2022	EDM, CM
1	Joint EDM-CM Review	Feb – March 2022	EDM, CM
1	Panel Response to Joint EDM-CM	Feb – March 2022	All panel members Panel Chair
	Panel meeting		
	Upload Track Changes documents		
2	Review: Study Specialist	March – April 2022	Study Specialist
2	Panel Response to Study Specialist	March – April 2022	All panel members Panel Chair
	Panel meeting		
	Upload Track Changes documents		
3	Exam Sign Off – ready for Mark up and DTP	April	EDM, CM
4	Review: Mark up	April – May 2022	Editor
5	Desktop Publishing	April – May 2022	DTP team
5	Review: English as Additional Language	April – May 2022	EAL Reviewer
6	Panel Proofread (and response to Editorial Queries and EAL Review)	May 2022	Panel Chair and at least one panel member
Checkpoint 2			
Stage	Activity	When	Who
			Panel activities
6	Amendments incorporated and checked	May 2022	DTP/Editor
6A	Audio(visual) Recording (languages, music studies and EAL only)	May – June 2022	Panel Chair, Script Readers
7	Review: Examination Sitter	June 2022 (First 2 weekends June)	ESV
7	Panel Response to ESV	June 2022	Panel Chair and at least one panel member
Checkpoint 3			
8	Reviews: CM (final), AOR	June 2022	CM, AOR
9	Panel Response to CM, AOR	June 2022	Panel Chair and at least one panel member
10	Editor Proofread and Audit of Changes	July 2022	Editor
11	Sign-Off: Examination Panel	July – August 2022	Panel Chair and at least one panel member
12	Sign-Off: EDM	July – August 2022	EDM
13	Final Editor Read (FER)	August 2022	Editor
14	Final: ready for printing	August 2022	DTP
--	Printer's Proof Check (select studies only)	August – September 2022	Panel Chair
--	Printed Paper and Duplicated CD/DVD Check	August – September 2022	Panel Chair
--	Marking Guide Finalisation	August – September 2022	Panel Chair (or their delegate)

Exhibit 2: “Critique of Victorian VCE Mathematics Exams” by Burkard Polster and Marty Ross



Critique of Victorian VCE Mathematics Exams

Prof. Burkard Polster
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Dr. Marty Ross
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December 20, 2022

We thank VCAA for arranging an external review and analysis of our concerns with VCE mathematics exams. For this purpose, and as requested, we provide here a critique, including but not limited to examples of serious errors on the 2022 exams and a summary of concerns with the structure, development and vetting processes for these exams.

It is pleasing that there will be an external view. We have significant concerns, however, that the structure and format of the review, and the plans for post-review communication, may hamper the conduct of the review and its potential effectiveness:

- **The reviewer and the manner of their choosing are confidential**

The meaning of an “external provider” who shall conduct this review is unclear. There is no information regarding how that person or body might be chosen, or by whom, or whether the reviewer will be properly qualified and properly independent. Given that, as we argue in Sections 7 and 8, VCAA has had demonstrable problems with engaging qualified personnel, and with openness and candour, this lack of transparency is of serious concern.

- **The terms of reference for the review are confidential**

The review will not be part of a legislatively formal process. Nonetheless, the reviewer will be provided with an introduction and direction. These details matter, and nothing is known of them. As it stands, it is not even clear that this critique would be forwarded in its entirety to any reviewer.

- **The review is limited in scope and input**

There is good reason for limiting the review to VCE exams, and indeed in our recent communication with VCAA we have focused upon the exams. Nonetheless, we have also continually emphasised that the exams are the tip of the iceberg, the clearest sign of broader, systemic problems. In particular, an appreciation of these broader problems is required to understand why VCAA produces such poor exams. At some point, soon, these broader problems must also be addressed.

We also note that the review is seemingly limited only to the concerns raised in this critique. Marty is perhaps the most prominent critic of VCE exams, but we are far from being the only critics, and we stress that we are not claiming that our list of criticisms is exhaustive. Even addressing every one of our listed concerns does not mean that the exams would then be “fixed”.

- **The report will be confidential**

That the report will be confidential is of the greatest concern. VCAA’s commitment to providing an “overview” does nothing to allay this concern.

In summary, it is pleasing that VCAA has initiated a review of VCE mathematics exams, and VCAA must determine the parameters of that review. In turn, anyone will be free to decide upon their response to the structure of the review, and to any resulting report or “overview”.

1 Introduction

In this critique, we shall indicate a number of ways in which VCE mathematics exams are grossly deficient, including in their production, their grading and their reporting. We shall provide many examples from the 2022 exams to illustrate these deficiencies, focusing upon Specialist Mathematics and Mathematical Methods, the subjects with which we are most familiar.

It is important to recognise that we have not attempted to be comprehensive, even in considering the 2022 exams, and it would be almost impossible to be so. Every Specialist Mathematics and Mathematical Methods exam that we have seen is marred by at least minor mathematical problems, and most exams contains at least one major error. Every exam contains a number of poorly conceived questions, more than a few of which exhibit little mathematical sense or purpose. Every exam consists almost entirely of low-mark questions, requiring only shallow answers and effectively guaranteeing an over-weighting of minor matters of form, at the expense of proper concern for the evaluation of proper mathematical

thought. The clear majority of exam questions are poorly written, in a crabbed and convoluted manner; many such questions are so poorly written as to be close to incomprehensible, and more than a few consequently stray into clear error.

Our critique should thus be seen as the first step, not the last, in a comprehensive documentation and subsequent analysis of deficiencies in VCE mathematics exams and in their administration. Any reasonable analysis must include an in-depth comparison to the high-quality NSW HSC exams, as administered by NESA. On this point, it should be noted that the difference in curricula may be a reason for differences in VCE and HSC exams, but it cannot be an excuse for poor VCE exams. If the VCE Study Design (curriculum) does not permit the proper testing of mathematical knowledge and skills and reasoning, then the necessary conclusion is that the Study Design requires significant reform.

2 Major Mathematical Errors on the 2022 Exams

Here, we list major mathematical errors on the 2022 Specialist Mathematics (SM) and Mathematical Methods (MM) exams. We consider an error to be “major” if as a consequence the question has no proper answer or, even if somehow answerable, the question is so mathematically flawed as to very likely to have caused students considerable confusion. For the sake of brevity, we shall not reproduce questions in full: the complete questions should be read in conjunction with our comments.

(a) SM Exam 1, Q3(b)

Following the service [of a coffee machine], the mean time taken to dispense 25 cups of coffee is found to be 9 seconds.

This is a blatant error: following on from part (a), the intention was clearly for the mean time to be 9 seconds *per cup*. However this question might have been subsequently graded, and that is an active concern, many students would have lost time and composure.

To be crystal clear, and this should be confirmed, a student who has answered 3(b) in the manner in which it was *unambiguously* written must have been eligible for full marks. For VCAA to have done otherwise would have been unconscionable. We cannot know since, over a month after the exam, VCAA has not even published exam answers. (By comparison, NESA has already released full sample solutions to the 2022 HSC mathematics exams.)

Given the manner in which VCAA tends to excuse itself of error (see Section 7), we provide some preemptive argument on the proper approach to grading this flawed question. Notwithstanding the implausibility of the quoted sentence in the light of part (a), it is not the students’ responsibility to be second-guessing a clear statement of fact in a question. Similarly, although the resulting confidence interval straying into the negative may be considered a red flag, this can occur in the correct solution of a well-posed problem. But again, it is simply not the students’ responsibility to be concerned with any of this.

(b) SM Exam 2, MCQ4

The polynomial $p(z) = (z - a)(z - b)(z - c)$ has complex roots a, b and c , where $\operatorname{Re}(a) \neq 0, \operatorname{Re}(b) \neq 0, \operatorname{Re}(c) \neq 0$ and $\operatorname{Im}(b) = 0$. When expanded, the polynomial is a cubic with real coefficients.

The question simply cannot be answered: none of the statements that follow are “necessarily true”, as is illustrated by the simple example $a = 1, b = 2, c = 3$.

It is not entirely clear how such an inexcusable error has occurred, but one must note the atrocious wording, which is an open invitation to error – and to students’ misinterpretation – and is inexcusable in its own right. This error is also doubly egregious, since an essentially identical error occurred in 2021 (SM Exam 2, QB2(a)). VCAA’s deceit following on from their 2021 error is discussed in Section 7.

(c) SM Exam 2, MCQ19

The question provides enough information to determine the mean cost for an item, but then asks students to determine a confidence interval for this mean. That can formally be done, but it is absurd to find a confidence interval for a known mean, and is thus also astonishingly confusing.

(d) SM Exam 2, QB6(f)

The question asks for the probability that the volume of liquid in a can is below a certain amount. The can masses and the total (can + liquid) masses have been given to be normally distributed, with the parameters provided, but no independence assumption has been declared. As such, the students cannot answer the question without making an unwarranted assumption.

It is not remotely the students’ responsibility to resolve the issues with this question, but it also must be noted that it is not even clear which variables might reasonably be assumed independent, or why. It should also be noted that the answer to the exam question depends upon the covariance of the variables; as it happens, and even assuming that the liquid mass is a normal random variable, the answer cannot be determined to the requested three decimal places. Of course any such analysis is beyond the concern of a student taking the exam but, given VCAA’s past willingness to minimise the effect of their errors, it should be kept in mind.

(e) MM Exam 2, QB4(e)(ii)

Explain why the domain of $A(k)$ does not include all values of k .

The question is expressed badly, and is effectively meaningless for multiple reasons. First, it has been declared at the outset that $k > 0$. Second, the question has introduced the function

$A(k)$ implicitly for all positive k as if this is not a concern, and before part (i): any querying of the domain should have been done immediately. Third, the question in part (i) only makes sense if one accepts that $A(k) = 0$ also makes sense, implying that all such (positive) k would be in the domain of A , irrespective of whether the region is empty. Fourthly, the conclusion of the question is best though to be false: there is no reason why one cannot consider a region to be empty, and consequently $A(k)$ make sense for all (positive) k :

3 Minor Mathematical Issues with the 2022 Exams

We list here relatively minor mathematical issues with questions on the 2022 exams. Although these may not be as egregious as the major errors listed above, they are not insignificant and are not to be taken lightly: many amount to error, and all exhibit a lack of care or a lack of clear mathematical thought, or both. Their nature and their number is concerning.

(a) SM Exam 1, Q6(b)(i)

The question asks for vectors to be expressed in terms of x and y (and other terms), but is ambiguous: y has already been given as a function of x .

(b) SM Exam 1, Q6(b)(ii)

The question refers to “the vector scalar (dot) product”, which is confusing to the point of meaninglessness.

(c) SM Exam 1, Q10(b)

The question asks for the answer to be given in the form $\frac{(a-\sqrt{b})\pi}{c}$, with a, b and c real. This is absurd. The intended answer was $\frac{(3-\sqrt{3})\pi}{6}$, but of course there are multi-infinitely other correct expressions. This type of instruction is common in VCE exams, and is almost always misconceived. It is reasonable to ask for an answer to be stated in a particular form, but the form must be purposeful and the answer in that form unique.

(d) SM Exam 2, QB4(d)

How far does the ball travel during the first four seconds after passing through O ?

The “passing through” framing is unnecessary and distracting: the ball can naturally be considered to have begun its travel at $t = 0$. The question is also ambiguous, since it is unclear whether arc length or Euclidean distance is being requested.

(e) MM Exam 1, Q6(c)(ii) and (iii)

Part (ii) asks for “the smallest positive value for a ”, which is confused: a has already been declared (implicitly) to be positive, and a has a single unknown value, not a set of values. Part (iii) then begins “Hence ...”, but this confuses what has been done in part (ii): determining the smallest positive/possible value of a is not the same as declaring a to have that value.

(f) MM Exam 1, Q8(c)

Consider the average value of the function f over the interval $x \in [0, k]$, where $k \in [0, 2]$.

The inclusion of “ $x \in$ ” is meaningless and confusing. The value $k = 0$ should have been excluded from consideration, since this moves the attention from the continuous to the discrete, and it seems that averages of discrete functions are not within the VCE Study Design.

(g) MM Exam 2, MCQ9

The question asks for “the shortest distance” between two specific points, rather than simply asking for the distance, which is very badly misleading, suggesting that some max-min computation might be required.

4 Poorly Conceived Questions on the 2022 Exams

Here, we provide examples of poorly conceived and/or poorly constructed and/or shallow questions from the 2022 exams; there are many more. The issues with these questions may not amount to errors, but in some ways these questions are even worse: they fail to test proper mathematical thought and computation in a clear and coherent manner. We shall not provide many details of the questions here: it is up to any reviewer to undertake a proper analysis of these and all questions, and consider our suggested, and all, shortcomings.

(a) SM Exam 1, Q4

A simple partial fractions question, worth four marks, which can easily be separated by inspection.

(b) SM Exam 1, Q6(b)

An awkwardly constructed and needlessly complicated vector proof question, with too much scaffolding.

(c) SM Exam 2, MCQ8

A ill-considered and inaccurately worded “direction field” (slope field) question, requiring students to look too carefully to determine the correct answer.

(d) SM Exam 2, MCQ9

A badly executed inverse Euler’s method question. A question of this form could be good, but would need to be much cleaner, with simpler numbers, enabling a focus on the algebraic.

(e) SM Exam 2, MCQ10

A needlessly fussy and involved implicit differentiation question: poorly worded and poorly constructed, requiring too careful a consideration of signs.

(f) SM Exam 2, MCQ20

In principle a very good question, but much too long a prompt and much too involved for a multiple choice question.

(g) SM Exam 2, QB3

A very poor differential equations question. Mostly routine, if somewhat meaningless, but the wording for (d) and (e) is so heavy, clumsy and opaque as to be seriously misleading. There is no reason for the first particle to pass through O , rather than beginning at O , and there is no reason for the second particle to begin two seconds later. In principle, (e) is a good question, but the interesting algebra is lost in the mess.

(h) SM Exam 2, QB4

A contrived kinematics question, testing simple CAS skills rather than decent algebra.

(i) MM Exam 1, Q4

A poorly conceived, repetitive and very badly worded probability question. The mathematics being tested is simple, the question consisting of little more than an invitation for students to trick themselves into attempting to calculate probabilities for sampling without replacement.

(j) MM Exam 1, Q7

A long, aimless question, testing almost nothing of substance. It would have been almost impossible to have worded clearly, and it was not. The grading for this question should be very closely scrutinised.

(k) MM Exam 2, MCQ6

Too busy a question, made needlessly busier by the function notation. Students have to hunt too carefully for the correct answer.

(l) MM Exam 2, MCQ14

A pointless test of pushing buttons.

(m) MM Exam 2, MCQ16

In principle a reasonable question, but made pointless by CAS.

(n) MM Exam 2, MCQ18

In principle a reasonable question, but made ugly by CAS. Such a question would be significantly improved by using simpler numbers, or being framed algebraically.

(o) MM Exam 2, QB2

An aimless, pseudo-modelling question, investigating and testing nothing of worth or interest. Part (e) is simply absurd.

(p) MM Exam 2, QB3

A long and contrived pseudo-modelling question, to be answered almost entirely with CAS. The story is pointless and distracting. Although the question is very long and worth 14 marks, nothing is tested to any significant depth.

5 Poor Writing on the 2022 Exams

The questions flagged in Sections 3 – 5 already provide many examples of poor writing, but it is important to understand how consistently poor the writing of VCE mathematics exams has become. Most questions could be improved with proper editing, and very many are so poorly written as to be difficult to read or much worse.

Evidently, a low priority has been put on writing questions in as clear and as short and as straightforward a manner as possible. Rather, the aim appears to have been inflexible adherence to a pedantic, overly-prescriptive and hence confusing formalism, and to following established but pointless conventions. Such needlessly confused wording must disadvantage

ESL students. Such wording will also disproportionately disadvantage stronger students, who will potentially spend time looking for nuances that are not there. Hence, such wording indirectly benefits students trained not to read and not to consider the words, but rather trained to pick out key words in the salad and guess the intended question.

We provide a few examples here, but the list could be much, much longer. The very long, multi-part questions are too awkward to quote here, but are worth particular scrutiny. Seldom does the framing and length of these questions offer anything but confusion.

(a) SM Exam 1, Q8

A body moves in a straight line so that when its displacement from a fixed origin O is x metres, its acceleration, a , is $-4x \text{ ms}^{-2}$. The body accelerates from rest and its velocity, v , is equal to -2 ms^{-1} as it passes through the origin. The body then comes to rest again.

Find v in terms of x for this interval.

The wording of this very standard kinematics question is not formally wrong, but it is crowded and disordered. More clearly, one could ask,

A body moves in a straight line, and at the origin O has a velocity of -2 ms^{-1} . The acceleration of the body is $-4x \text{ ms}^{-2}$, where x is the displacement of the body from O in meters. Find the velocity of the body in terms of x until the body comes to rest.

(b) SM Exam 2, MCQ6

Given $z = x + yi$, where $x, y \in \mathbb{R}$ and $z \in \mathbb{C}$, an equation that has a graph that has two points of intersection with the graph given by $|z - 5| = 2$ is ...

This is a very common phrasing, where a fussy pile of standard framing comes before the critical information, in this case the equation for the relation. An alternative:

Consider the relation $|z - 5| = 2$, where $z = x + yi$, and $x, y \in \mathbb{R}$. A second relation for which the graphs of the two relations intersect at two points is ...

(c) SM Exam 2, MCQ18

The time taken, T minutes, for a student to travel to school is normally distributed with a mean of 30 minutes and a standard deviation of 2.5 minutes.

Assuming that individual travel times are independent of each other, the probability, correct to four decimal places, that two consecutive travel times differ by more than 6 minutes is

This is needlessly dense and tangled. The information and instruction should have been arranged so that the final sentence was simply “The probability that two consecutive travel times differ by more than 6 minutes is ...”.

(d) MM Exam 1, Q2(a)

Find the rule for an antiderivative of $g(x)$.

The phrase “the rule for” is, always, unnecessary and muddying, and is ubiquitous in VCE mathematics. Also, and astonishingly, it appears that the intention of “an antiderivative” is the literal meaning, that *any* antiderivative would have been accepted as an answer, with or without $+c$, with or without $+59$. *However*, the expression “the antiderivative” in VCE triggers that $+c$ is required in the answer. To concern students with such micro-interpretation is absurd. It could all be avoided by simply, always, asking for the general antiderivative of the function.

(e) MM Exam 1, Q6

The graph of $y = f(x)$, where $f: [0, 2\pi] \rightarrow R$, $f(x) = 2 \sin(2x) - 1$ is shown below.

On the axes above, draw the graph of $y = g(x)$, where $g(x)$ is the reflection of $f(x)$ in the horizontal axis.

Find all values of k such that $f(k) = 0$ and $k \in [0, 2\pi]$.

Such convoluted ordering, and the inclusion of fussy and often gratuitous detail is ubiquitous. An alternative:

Consider the function $f(x) = 2 \sin(2x) - 1$ on $[0, 2\pi]$. The graph of f is shown below.

Let the function g be the reflection of f across the x -axis. Draw the graph of g on the axes above.

Solve the equation $f(x) = 0$.

(f) MM Exam 1, Q8

Part of the graph of $y = f(x)$ is shown below. The rule $A(k) = k \sin(k)$ gives the area bounded by the graph of f , the horizontal axis and the line $x = k$.

The phrase “Part of” is unnecessary and distracting: if there is any other part of the graph, it is never considered. The second sentence is a tangle, including the needless “The rule”. An alternative:

The graph of the function f is shown below. The area bounded by the graph of f , the x -axis and the line $x = k$ is given by the function $A(k) = k \sin k$.

(g) MM Exam 2, MCQ5

The largest value of a such that the function $f: (-\infty, a] \rightarrow R, f(x) = x^2 + 3x - 10$, where f is one-to-one, is ...

At minimum the “where” should be “for which”, but the entire sentence should be restructured, and would be best split into two. In general, preliminary information for a question should be clearly separated from and come prior to the final statement of the question, and this is too rarely done in VCE mathematics exams.

(h) MM Exam 2, QB1(b)

State the derivative of f with respect to x .

This is literally using seven words where one would have sufficed: “Find $f'(x)$ ” is all that was required. Such verbiage is standard.

6 The Overall Structure of the 2022 Exams

Above, we have provided many examples of flawed questions, but the VCE mathematics exams should be also be reviewed as a whole, noting the weighting and predominance of CAS. Particular comparison should be made to NESA’s HSC exams, with consideration given to the extent and depth of examinable material. To this end, we provide here the mark breakdown for each of the four 2022 VCE exams:

Specialist Mathematics Exam 1 (1 hour, tech-free):

$$(3 \times 1) + (5 \times 2) + (5 \times 3) + (3 \times 4)$$

Specialist Exam 2 (2 hours, CAS):

$$(20 \times 1) + (12 \times 1) + (18 \times 2) + (4 \times 3)$$

Methods Exam 1 (1 hour, tech-free):

$$(9 \times 1) + (8 \times 2) + (5 \times 3)$$

Methods Exam 2 (2 hours, CAS):

$$(20 \times 1) + (23 \times 1) + (10 \times 2) + (3 \times 3) + (2 \times 4)$$

The depth, or lack thereof, of the 3-mark and 4-mark questions warrants particular scrutiny.

7 Delay and Dishonesty in the Exams and Reports

It should be clear to any objective and knowledgeable observer that VCE mathematics exams are seriously, systemically flawed. It should also be clear to VCAA. If, however, there is a concern within VCAA to improve VCE mathematics exams, it is not apparent.

VCAA's approach to providing public information about the VCE exams lacks transparency, and the timing and manner of the release of their exam reports actively inhibits external feedback. VCAA is extraordinarily slow to publish exams and reports, the reports are less than informative, and by the reports are much less than candid about flaws in the exams.

To summarise and to compare VCAA's timeline:

- It takes over a month for VCAA to publish the exams, whereas it takes NESAs a couple of days;
- It takes at least five months for VCAA exam reports to appear, whereas NESAs publishes full sample solutions within about a month, and detailed exam feedback by the beginning of the following school year;
- VCAA reports include only answers and sketches of solutions, whereas NESAs publishes full sample solutions.

We cannot know whether this delay and lack of full information is conscious tactic or just self-serving bureaucratic incompetence, but it hardly matters, since the effect is the same: the possibility of and interest in important public scrutiny and debate is diffused. By the time the exam reports have come out, not only has the horse bolted, the horse is well on its way to graduating from university. As for VCE teachers, they are by then too way busy coping with the current year to seek battle on the previous year's nonsense. And so the cycle continues.

The possibility of public pressure is also complicated by VCAA's stubborn unwillingness to acknowledge error, much less apologise for it. The willingness of VCAA to obfuscate, or to simply be silent, is legendary. We provide some examples regarding the 2021 exams.

(a) SM 2021 Exam 2, QB2(a)

The error here is almost identical to the error in SM 2022 Exam 2, MCQ4, which we indicated above. The report acknowledges the "alternative solution" to part (ii), and there are words to the effect that working "correct and complete across" parts (i) and (ii) was "accepted". But the fundamental error is not acknowledged, and the consequential meaningless of the question in part (i) is not acknowledged. This failure amounts to deliberate deceit. It is unprofessional, unethical and cowardly.

(b) SM 2021 Exam 2, QB6(c)

The preamble to the question referred to “main daily sales” rather than the intended “mean daily sales”. The error was acknowledged in the report, and one can argue how serious the error was, if not how foolish; the report is at pains to assure us that “students were not disadvantaged”, although it is unclear what the evidence for that might be. The problem is that VCAA altered the wording for the published exam, without any indication that they had done so. It is astonishing that VCAA considers such a stealth edit to be acceptable.

(c) MM 2021 Exam 2, QB1(f)

The preamble to the question referred to a “box’s length” being “still twice its width”, rather than this being true of the rectangle from which the box was constructed. It is possible that the error did not affect many students, but that is unclear, and at minimum the error had to be acknowledged. The report is silent.

(d) MM 2021 Exam 2, QB5

The entire question is a mess, but part (g) is incomprehensible and how students were expected to solve it is unknowable. The exam report provides nothing except the intended answer, a “common incorrect answer” and a self-centred complaint that “an exact answer was required”.

8 Conclusion: the Writing and Vetting of Exams

We do not know who writes or vets VCE mathematics exams. We do not know how the teams and their duties are organised. We do know that the current process is not remotely close to working as it should. Whatever the qualifications and skills of its members, and despite their undoubted good intentions, the writing and vetting teams are functionally incompetent.

Looking from the outside, weighing the evidence provided by the exams that VCAA produces, there appear to be three overlapping reasons for the current failure.

First of all, there is a clear lack of mathematical expertise. There are errors on the exams that no competent and attentive mathematician would miss. There are questions and wordings of questions that no mathematician would permit. There is a shallowness to the exams to which any mathematician would object.

Secondly, there appears to have been a process of cultural ossification. There are types of questions and conventions for the wording of questions that we cannot imagine would be acceptable in any other setting. This culture seems so entrenched that even when it leads

to questions being meaningless or in error, this can too often go uncorrected.

Thirdly, there appears to have developed within VCAA a self-defensive culture of pedantry and certainty. The principle concern appears not to be to write questions as clearly as possible, not to assess questions with reasonable generosity, but to take an overly formal and legalistic approach, in an attempt to preclude the possibility of complaint. Ironically, this culture, which is highly disrespectful of students, naturally becomes a major source of dissatisfaction.

Last year, we met with VCAA representatives, in order to discuss VCE exams. We were grateful for the meeting. We felt we were taken seriously and VCAA's representatives were tolerant of our strong criticism. Two things, however, stood out from the meeting. First of all, VCAA offered no defense of their exams, but also offered no suggestion of how the process of producing VCE exams might be improved. The second thing that stood out was VCAA's response to *our* suggestion of how the process of producing VCE exams might be improved.

During that meeting, we offered to vet VCE exams, for free. Alternatively, we offered to arrange for other mathematicians to vet the exams. (We are aware that such vetting by strong mathematicians occurs in at least two other States.) Our offer was declined on the spot. The reason, which had something to do with the "democratic" nature of VCAA process, made absolutely no sense to us. Whatever the reason, and whatever the sense or otherwise in that reason, we regarded the outcome, the rejection of our offer, as highly regrettable.

Serious change is required in the production of VCE mathematics exams, and in the state of VCE mathematics more generally. We offered to assist in that change, and our offer was declined. That is ok, but only if VCAA is also prepared to acknowledge that such change is required, and develops good and proper and public plans to effect this change.

[REDACTED] Email correspondence between
[REDACTED] and VCAA



From: [Redacted]

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For members of the question should clearly state that these two random variables are independent



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