



13 March 2024

Dear Secretary

On behalf of the members of the expert panel – myself, Ms Juliette Mendelovits and Mr Menchi Schneier – I am pleased to provide you with the final report from the Independent Review into the Victorian Curriculum and Assessment Authority’s (VCAA) examination-setting policies, processes and procedures for the Victorian Certification of Education (VCE) examinations.

The expert panel (the Panel) conducted its review from 8 December 2023 until 12 March 2024.

It undertook 42 detailed consultations with key officials from the VCAA (including Chairs and members of VCE examination-setting panels of Mathematics and Chemistry, and staff involved in the administration of the VCE examinations), the Department of Education (the Department), staff from the Queensland Curriculum and Assessment Authority and the NSW Education Standards Authority, and representatives from Mathematics and Chemistry faculties from multiple Victorian universities. It also consulted with representatives from the Victorian Catholic Education Authority and Independent Schools Victoria.

To assist in its considerations, the Panel also drew on the expertise of independent Mathematics experts from other universities and credible educational organisations.

The Panel would also like to recognise the cooperation and commitment of staff and executives from the VCAA.

I would like to thank my fellow Panel members for their commitment to the review task.

I would also like to recognise the Secretariat support provided by Nous Group.

Your sincerely

Dr John Bennett AM  
Chair, Independent Review Panel

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# EXECUTIVE SUMMARY

## Introduction

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The Victorian Certificate of Education (VCE) is a world-recognised senior secondary school credential. The Victorian Curriculum and Assessment Authority (VCAA) is responsible for the development of the curriculum and assessment requirements for the VCE.

The VCAA develops and administers over 160 examinations to more than 80,000 students in approximately 630 examination centres in Victoria. The examinations include written examinations and oral and performance examinations held during October and November each year. In addition, the VCAA develops a separate suite of 14 examinations in VCE subjects that are sat by students attending schools operating under the northern hemisphere school timetable.

In response to several issues emerging around the 2023 VCE examinations, the Secretary of the Department of Education (the Department) initiated an Independent Review (the Review) of the VCAA's VCE examination-setting policies, processes and procedures, with a focus on Mathematics, Chemistry and the incorrect distribution of copies of the Chinese Second Language examination.

The specific issues were as follows:

- An open letter signed by 73 university mathematicians presenting a critique of the 2022 VCE Mathematics examinations including 5 alleged 'major' mathematical errors, which coincided with similar concerns being expressed about alleged errors in the 2023 Mathematics examination papers.
- An error in one of the questions in the 2023 VCE Chemistry examination paper.
- At 2 schools (examination centres), students were incorrectly given the VCE Chinese Second Language examination paper instead of the Chinese Second Language Advanced examination paper.

## Approach

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The Secretary appointed an independent expert panel (the Panel) to the Review, with 3 broad Terms of Reference including:

1. Content of the questions in the Mathematics and Chemistry examination papers
2. Editorial review of the questions in the Mathematics and Chemistry examination papers
3. Process for the distribution of examination papers to ensure students received the correct examination in subjects where there are multiple examination papers for different levels of study.

The Panel was chaired by Dr John Bennett AM, former Chief Executive Officer (CEO) of the New South Wales Office of the Board of Studies, now known as the NSW Education Standards Authority. The other members of the Panel were Ms Juliette Mendelovits, a quality assurance expert from the Australian Council for Educational Research, and Mr Menchi Schneier, a partner from Ernst and Young. Nous Group was commissioned to provide Secretariat support to the Review.

The Review began on 8 December 2023 and concluded on 12 March 2024. In this time the Panel undertook over 40 consultations as outlined in Table 1.

**Table 1: Individuals and groups interviewed by the Independent Panel**

VCAA staff	<ul style="list-style-type: none"> <li>Acting and substantive Chief Executive Officer (CEO)</li> <li>Executive Director, Curriculum Division</li> <li>Executive Director, Assessment &amp; Reporting Division</li> <li>Directors of Curriculum and Enrolment, Assessment and Results</li> <li>Acting and former Examinations Unit Managers</li> <li>Assessment Operations Unit Manager</li> <li>Curriculum Managers for Mathematics and Chemistry</li> <li>Examination Development Managers for Mathematics and Chemistry examinations</li> <li>Production Coordinator</li> <li>Desktop Publishing Manager</li> </ul>
Examination Development Panel Chairs and Reviewers	<ul style="list-style-type: none"> <li>Panel Chairs for Mathematical Methods and Specialist Mathematics</li> <li>Study Specialist Reviewers for Chemistry, Mathematical Methods and Specialist Mathematics (2023 and future)</li> </ul>
Examination Supervisors	<ul style="list-style-type: none"> <li>Chief Supervisors of VCE examinations for schools with students enrolled in both Chinese Second Language and Chinese Second Language Advanced</li> </ul>
University academics	<ul style="list-style-type: none"> <li>Representatives from the Mathematics faculty at Monash University, the University of Melbourne and Australian Catholic University</li> <li>Representatives from the Chemistry faculty of Monash University and the University of Melbourne</li> </ul>
Interstate curriculum and assessment bodies	<ul style="list-style-type: none"> <li>New South Wales Education Standards Authority – examination development, distribution, and administration supervisors</li> <li>Queensland Curriculum and Assessment Authority – examination development, distribution, and administration supervisors</li> </ul>
School system representatives	<ul style="list-style-type: none"> <li>Independent Schools Victoria</li> <li>Victorian Catholic Education Authority</li> <li>Diocese of Ballarat Catholic Education</li> </ul>
Department of Education staff	<ul style="list-style-type: none"> <li>Deputy Secretary, School Education Programs and Support</li> <li>Deputy Secretary, Schools and Regional Services</li> <li>Deputy Secretary, People and Executive Services</li> </ul>

The Panel considered numerous published and in-confidence documents related to the policies, processes and procedures for VCE examinations, as well as in-confidence documents and records specific to the setting and production of the 2023 VCE examinations for Mathematics and Chemistry.

The Panel also engaged 7 independent Mathematics experts including university academics from interstate, past chairs of VCE Mathematics setting panels, and professional educational

assessment experts specialising in Mathematics, to provide advice on issues arising from the 2022 and 2023 VCE Mathematics examinations.

The Panel is grateful for the support it received from the staff of the VCAA who provided explanations and materials to assist the Panel to better understand its policies, processes and procedures as they related to the Review.

Other individuals and groups the Panel interviewed were also very helpful in sharing their thoughts and experiences. These included Examination Development Panel members,<sup>1</sup> Chief Supervisors and those critical of aspects of the VCE Mathematics examinations.

The Panel is also grateful to staff from the Queensland Curriculum and Assessment Authority (QCAA) and the New South Wales Education Standards Authority (NESA) for providing materials and commentary about their processes and procedures in the matters being reviewed.

## Findings

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The annual VCE examinations process represents a comprehensive and challenging program of curriculum-based assessment, involving multiple processes over many months and relying on dedicated people with a wide range of knowledge and skills.

The Panel has concluded that, overall, the VCAA has comprehensive policies, processes and procedures for developing, reviewing, distributing and administering these external examinations.

However, there is a need for the VCAA to review and strengthen some of these policies, processes and procedures, including consistency in practice, to improve the VCAA's quality assurance settings and to ensure it maintains the integrity of the external examinations system. This applies particularly to Mathematics.

## Mathematics

The VCAA has acknowledged the discovery of 4 clear errors in the final 2023 Mathematics examination papers (one in each of the 2 General Mathematics papers, one in a Mathematical Methods paper and one in a Specialist Mathematics paper). These 4 errors were dealt with in the administration of the examination papers and/or in their scoring. The Panel found that the actions taken by the VCAA in dealing with the impacts of these issues on students appear to be appropriate under the circumstances and are similar to what other comparable Australian jurisdictions would do.

However, concerns have been expressed by Mathematics academics that many other questions in the Mathematics papers were flawed. To investigate the validity of these criticisms, the Panel has relied on the analysis of 7 highly qualified experts to examine issues with the 2022 and 2023 Mathematics examinations.

<sup>1</sup> In its *2023 VCE Examination Development Manual*, the VCAA states that 'an examination development panel consists of the writing team and the reviewers appointed to review the examination. All are involved in the development of the examination.' The examination development panel comprises the Panel Chair, Panel Members, the Study Specialist Reviewers, the Examination Sitter Reviewer, and the English as an Additional Language Reviewer.

In this context, it is worth noting that a common experience in test development is that, when a question is initially submitted for review to a panel of experts, flaws – or at least points for improvement – will very often be found. The development of Mathematics examinations needs to take into account several factors, amongst them:

- The Study Design specifications
- The technical correctness (or perhaps better, acceptability) of the mathematical phrasing and layout of the questions
- The level of mathematical proficiency that can reasonably be expected from the students.

Balancing these 3 factors is challenging, and the Panel found that in the case of some questions in the 2022 and 2023 VCE Mathematics examinations, mathematical precision and ‘correctness’ have been given a lower priority in the interests of accessibility for test takers.

Regarding the 2023 examinations, concerns had been expressed by Mathematics academics and others around 19 questions. The independent Mathematics experts engaged by the Panel found that:

- Of the 5 questions of concern in the General Mathematics papers, all 5 were found to be poorly worded and could have been improved. Two questions had more than one answer and another had an error in the question, which was acknowledged and dealt with by the VCAA.
- Of the 14 questions of concern from the Mathematical Methods and Specialist Mathematics examination papers, 3 were found to be acceptable by all 7 independent experts. However, of the remaining 11 questions, at least 5 of the experts (and in some instances 6 or 7) found the questions to be poorly worded or to use poor terminology; not to be aligned with the Study Design (regarding a term used in 2 of the questions); or, in the case of one question, to have a wrongly labelled graph, which was acknowledged and dealt with by the VCAA.

Regarding the 2022 examinations, concerns had been expressed by a significant number of Mathematics academics around 5 questions in particular, which they described as ‘unacceptably flawed’. These 5 questions were also identified as containing errors by all or all but one of the independent Mathematics experts engaged by the Panel.

Inspection of the archived documentation for Specialist Mathematics and Mathematical Methods in 2022 and 2023 indicates that the processes documented by the VCAA were generally followed, though not always rigorously.

In most cases, the errors identified in the Mathematics papers were present from the earliest drafts. These were not detected in any of the multiple opportunities for review and revision that were undertaken.

While it is important that experienced and fully qualified teachers are members of Examination Development Panels, it is just as critical that suitable academic specialists are also included. The VCAA has recognised this to a degree, but the Panel found that there is scope for a greater representation of Mathematics academics on Examination Development Panels, both as Panel Members (i.e. question writers) and as Study Specialist Reviewers.

The VCAA has positive, professional relationships with some Mathematics academics who provide sound and constructive support to a variety of projects, including the development of VCE examinations. There is, however, considerable potential for expanding this network and engaging with a much wider group.

## Chemistry

An error was discovered in Section B Question 1(a) of the VCE Chemistry paper whilst the examination was underway. A table containing the information students needed to answer this question (about the composition of coconut oil) contained an incorrect chemical formula for linoleic acid. Instead of listing the chemical formula for linoleic acid, it gave the chemical formula for linolenic acid.

The Panel found that the error had appeared in the initial draft of the examination question and that this was not detected by the subsequent quality assurance and review processes.

The Panel observed that the composition of the Examination Development Panel for Chemistry appears to be well-balanced in terms of its members' background and experience. It has a mixture of specialist academics and teachers from both the government and non-government sectors.

The Panel is not aware of any other issues that have occurred in VCE Chemistry examinations papers in recent years.

## Chinese Second Language

Students at 2 different schools enrolled in the Chinese Second Language Advanced course were instead given the written examination paper for the Chinese Second Language course. The students completed this examination paper and it was only after the examination was completed that it was discovered that they had been given the incorrect paper.

The Panel found that the incorrect distribution of the examination paper at 2 centres was a result of local administrative errors in adhering to VCAA policies, processes and procedures.

After reviewing documentation related to the packing and delivery of examination papers to schools, the Panel was satisfied that the VCAA has appropriate processes and procedures to ensure that schools receive the examination papers and other materials that they need, and that when schools receive the papers they have the appropriate guidance to ensure that they are stored securely until they are needed.

Having noted the above, the Panel has identified refinements that could further assist in reducing the likelihood of such errors occurring at examination centres in future.

## Transparency and handling of errors

During the consultations there were criticisms from Mathematics academics and others that the VCAA was on occasion slow in the public release of the Mathematics examination materials and reports, and that queries and complaints were not addressed or satisfactorily answered in a timely manner.

The Panel acknowledges that in large-scale credentialling programs like the VCE, despite the best efforts of staff, it can sometimes take considerable time to properly investigate issues and respond to the correspondent. In addition, there are matters that, in order to maintain the integrity of the credential, must remain confidential.

Nevertheless, when reviewing the timeliness of publication of materials, including comparisons against other states, the Panel identified opportunities for the VCAA to publish documentation earlier. The Panel also believes that there are measures that the VCAA can take to deal more effectively with issues when they are raised, and give all stakeholders confidence that any problems that arise will be dealt with appropriately.



The Panel understands that the VCAA has held some internal discussions to identify where errors might have occurred with the 2023 Mathematics, Chemistry and Chinese Second Language examinations and what actions it could take in the future to prevent such an issue arising again. The Panel acknowledges this positive step.

## Recommendations

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The Panel has made 6 high-level recommendations, each with associated actions.

The Panel believes that this set of recommendations, if implemented effectively by the VCAA, should address the issues encountered in the 2023 Mathematics, Chemistry and Chinese Second Language examinations.

The VCAA should commence implementation of these recommendations immediately to ensure that the VCE examination processes demonstrate the appropriate quality and rigour in 2024 and beyond.

The recommendations are made in the context of addressing the issues identified related to Mathematics, Chemistry and Chinese Second Language. However, the VCAA should consider applying the learnings and insights to other study areas, where applicable.

### **1. The VCAA should increase the representation of suitably qualified academics on the Mathematics Examination Development Panels<sup>2</sup> including by:**

- a. Establishing stronger partnerships with Mathematics faculties at Victorian universities to encourage the participation of suitably qualified Mathematics academics in Examination Development Panels.
- b. Updating the advice on the VCAA website to ensure that it is clear that academics are an important cohort for inclusion in Mathematics Examination Development Panels.
- c. Introducing a required minimum number of academics into the Mathematics Examination Development Panels as follows:
  - i. For the 2024 examinations, include 2 Mathematics academics as additional Study Specialist Reviewers for Mathematical Methods and Specialist Mathematics, and one Mathematics academic as an additional Study Specialist Reviewer for General Mathematics.
  - ii. For the 2025 examinations and beyond, include in each of the Mathematics Examination Development Panels:
    - (a) Two suitable Mathematics academics as question writers for the examination.
    - (b) Two suitable Mathematics academics as Study Specialist Reviewers for each of Mathematical Methods and Specialist Mathematics and one for General Mathematics.

### **2. The VCAA should strengthen the examination-setting process and construction of the Mathematics examination papers to ensure they are of sufficient rigour and quality, including by:**

<sup>2</sup> The 3 Mathematics examination panels referred to here and throughout the recommendations are: General Mathematics, Mathematical Methods and Specialist Mathematics. It does not include Foundation Mathematics, which was introduced in 2023.

- a. Requiring that all members of Mathematics Examination Development Panels participate in a training session outlining best practice in the design of Mathematics examination questions, including that they should be constructed using the appropriate symbols, conventions and the ‘language of Mathematics’; and that efforts to make questions more accessible to students must not distort their mathematical integrity.
  - b. Simplifying the development of examinations for the 3 Mathematics Study Designs by requiring multiple-choice questions in all examination papers to have only 4 options instead of 5, to bring them into line with the examinations in all other VCE Study Designs and examinations conducted by other comparable Australian jurisdictions.
- 3. The VCAA should strengthen the examination review processes for Mathematics and Chemistry including by:**
- a. Strengthening the guidance for the VCAA Examination Development Manager in convening the initial meetings for each of the Mathematics and Chemistry Examination Development Panels to ensure everyone is fully aware of their role and responsibilities in relation to the review and checking of materials, and the procedures they need to follow. This should include a reflection on learnings from the prior year’s examinations process based on the report from the Chief Assessor.
  - b. Introducing an additional Study Specialist Review of the ‘print-ready’ examination papers for each of Mathematical Methods, Specialist Mathematics and Chemistry by an academic who has not been involved in the development of the examination.
  - c. Requiring that the reports of the Subject Specialist Reviewers, Examination Sitter Reviewers and the English as an Additional Language Reviewer are considered at a joint meeting of the full Examination Development Panel – as well as the relevant VCAA staff – to endorse the final examination paper(s).
  - d. Refining the current process as required, to ensure that all reviewers – Subject Specialist Reviewers, Examination Sitter Reviewers, and English as an Additional Language Reviewers – receive feedback on how the matters included in their reports were considered and addressed.
  - e. Requiring that wherever possible, once the examination paper has been assembled, meetings of the Examination Development Panels and the review processes occur face-to-face within the VCAA’s secure offices.
  - f. Improving the records management protocols and practices associated with the reviews of the examinations.
- 4. The VCAA should update its training of and guidance to the in-house Editors and Desktop Publishers involved in the Mathematics and Chemistry examinations as follows:**
- a. Ensure staff responsible for editing and desktop publishing of Mathematics and Chemistry examinations papers have relevant training in formatting Mathematics and Chemistry questions, including diagrams, graphs, formulae and other stimulus material.
  - b. Ensure there is clear guidance for Editors and Desktop Publishers such that, if they believe an amendment is required, it is marked up and submitted for the Panel Chair’s approval.

- c. Ensure that after amendments are made by an Editor or Desktop Publisher a new version of the examination paper is printed and checked by the Panel Chair to see that the amendments have been made correctly and no other flaw introduced.
- 5. The VCAA should update its guidance for staff at examination centres to reduce the possibility that students could receive the incorrect examination paper, as follows:**
- a. Amend the standard script of the instructions given to students before an examination session begins to ensure it includes appropriate checks that the students have been given the correct examination paper.
  - b. Require an orientation meeting to be held involving the Chief Supervisor, all Supervisors and the VCE Coordinator at each examination centre before the first examination is held.
  - c. Develop training materials and guidance for staff at examination centres covering the key actions needed from the time examination papers are delivered to an examination centre to the conclusion of an examination, and discuss this material at the orientation meeting referred to in Recommendation 5b.
- 6. The VCAA should publish examination material in a more timely manner and update its policies and processes relating to the management of errors and alleged errors as follows:**
- a. Tighten publication timelines for examination documentation to more closely align with other comparable Australian jurisdictions as follows:
    - i. Publish the VCE Mathematics examination paper on the VCAA website within 5 days of a paper being sat.
    - ii. Publish the final version of the Marking Guide used to assess students' performance on the VCAA website within 5 days of the end of the marking of each Mathematics examination.
    - iii. Publish the report prepared by the Chief Assessor on the VCAA website before the end of January the following year.
  - b. Require Panel Chairs to meet with the Chief Assessors and other senior Assessors during the Assessment operation to provide advice and obtain feedback.
  - c. Update the VCAA's documented policies, processes and procedures to articulate its approach to responding to an issue raised in relation to an examination by a member of the community.
  - d. Provide annual training to relevant VCAA staff to ensure they are aware of the documented policies, processes and procedures applying in the case of an issue being identified in an examination paper, including determining and explaining how the issue will be addressed to ensure students are not disadvantaged.
  - e. Provide a report to the VCAA Board each year regarding the performance of the annual examination series, including reporting any issues that arose, explaining how they were managed and outlining the steps to be taken to reduce the likelihood of such issues occurring in the future.

# DISCUSSION OF FINDINGS

## Overview of VCE Examinations development process

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The VCAA develops and administers over 160 examinations to more than 80,000 students in approximately 630 examination centres in Victoria. Examinations include written examinations and oral and performance examinations, held during October and November each year. In addition, the VCAA develops a separate suite of 14 examinations in VCE subjects that are sat by students attending schools operating under the northern hemisphere school timetable. This is a comprehensive and challenging program of curriculum-based assessment.

The development and review of an external examination paper for the VCE involves many steps and relies on people with a wide range of knowledge and skills.

### **Management and Approval**

The Examination Development Manager (EDM) is a VCAA employee who convenes and provides expert advice and support to the Examination Development Panel and VCAA production staff to ensure the timely completion of a valid, reliable, fair, comparable, appropriate and secure examination.

The Curriculum Manager (CM) is a VCAA employee who reviews the examination to ensure compliance with VCAA documentation related to the study and confirms the examination's readiness to proceed to desktop publishing.

### **Examination Development Panel**

The papers are developed by an Examination Development Panel that, in the case of Study Designs for Mathematics and Chemistry, is made up of an Examination Panel Chair (ECH), Examination Panel Members (EPM), Study Specialist Reviewers (SSV), an Examination Sitter Reviewer (ESV) and an English as an Additional Language (EAL) Reviewer.

The Examination Panel Chair and Examination Panel Members are responsible for writing the examination questions and developing the first version of the marking guidelines.

The work of the Examination Development Panel is guided and supported by VCAA staff members, including an Examination Development Manager (EDM), a Curriculum Manager (CM), Examination Unit (EXU) Managers, Editors and Desktop Publishers.

### **VCAA Production Staff**

When examination papers and their accompanying documents are submitted by the Examination Development Panel, the questions have been structured and formatted by the panel.

Following these early reviews and amendments the examination paper is edited to ensure that it conforms to the VCAA's uniform house style. The house style includes the presentation of instructions, the questions, examination categories, sections and parts of questions within the examination paper. If the Editor has any other suggestions to improve clarity or accuracy, these must be provided to the Panel Chair for consideration on an 'Editorial Query Form.'

As further reviews are undertaken, and the comments considered by the Examination Development Panel, new versions of the examination paper are checked and approved by the Panel Chair at key points.

At the end of the process a final 'print-ready' version is prepared by the Desktop Publisher for a final sign-off. This version is subject to a final series of proofreading checks before it is sent to the printers. Brief descriptions of the roles outlined above are provided in Appendix 1.

### **Timeline**

The Examination Panel Chair and Members are usually appointed in October and an Examination Panel Chair Briefing is usually held for all Panel Chairs in late November. A briefing and initial meeting for each panel can be held in November or December.

From November to February, some members of the Examination Development Panel develop examination questions according to a plan determined by the Examination Panel Chair. Some of the early development can be done independently off-site provided security protocols are followed.

Once the Examination Panel Members have completed their assigned tasks, the Examination Panel Chair brings the questions together into a first version of the examination paper. The Examination Panel Chair usually involves at least some of the other Examination Panel Members in this step.

In February this version of the examination paper is formally submitted to the VCAA along with the Marking Guide, the Multiple-choice Answer Log, the Content Map, the Difficulty Map and the Copyright Log. Once this is done, the steps undertaken can be summarised as:

1. Reviews by the Examination Development Manager and the Curriculum Manager
2. Reviews by the Study Specialist Reviewers
3. Editing, desktop publishing and review by the English as an Additional Language Reviewer
4. Review by the Examination Sitter Reviewer
5. Editing and desktop publishing
6. Examination Development Panel sign-off
7. Final proofreading and approval.

A high-level overview of the 2023 Examination Development processes is provided in Appendix 2.

## Findings

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### Mathematics

In 2023 four Mathematics Study Designs were offered: Foundation Mathematics, General Mathematics, Mathematical Methods and Specialist Mathematics. Each of General Mathematics, Mathematical Methods and Specialist Mathematics had 2 examinations – Examination 1 and Examination 2 – with a total writing time of 3 hours.

Concerns were raised by community members, including Mathematics academics and some teachers, about the quality of some of the questions in the examination papers for General Mathematics, Mathematical Methods and Specialist Mathematics. Criticism of the examination papers for Mathematical Methods and Specialist Mathematics had also been made in 2022.

The concerns related to whether the mathematical composition of some of the questions had rigour in 3 key areas: whether they were (1) concisely worded and used appropriate and precise mathematical language and concepts; (2) able to be solved; and (3) free from errors (including the correct use of mathematical symbols).

In investigating these concerns, the Panel:

- Commissioned an analysis of selected questions from the 2022 and 2023 examination papers by 7 highly qualified experts, including Mathematics academics from interstate universities and other highly credible educational organisations, and other Mathematics assessment experts.
- Read the correspondence and critiques of the Mathematics examination papers prepared by academics from Mathematics faculties in Victorian universities, and convened a round-table meeting to understand their concerns.
- Reviewed the policies, processes and procedures the VCAA had in place to:
  - develop and construct the examination papers
  - review and quality assure the examination papers
  - desktop publish and edit the examination papers
  - finalise the examination papers as the approved papers for issuing to VCE students.
- Read the Deloitte report, *Independent Review of the 2022 VCE Mathematics Development Process, August 2023*.
- Interviewed staff at the VCAA involved in the development of the examination papers, including Examination Development Managers and the Curriculum Manager (Mathematics).
- Interviewed members of the 3 Mathematics Examination Development Panels for General Mathematics, Mathematical Methods and Specialist Mathematics.
- Interviewed members of the VCAA leadership team who have responsibility for managing the development of the examinations, including the substantive and acting Chief Executive Officers, the Executive Director, Curriculum and the Manager, Examination Unit.
- Interviewed key staff members from QCAA and NESA, and reviewed documentation and materials from those jurisdictions.
- Reviewed the manuals and other documentation provided by the VCAA that explains the tasks performed by Editors and Desktop Publishers.
- Read additional information provided by the VCAA concerning the availability of Editors and Desktop Publishers in 2022 and 2023.

- Interviewed staff of the VCAA with responsibility for overseeing the editing and desktop publishing.
- Reviewed the records associated with the development of those questions from the 2022 and 2023 VCE examinations that had been claimed to have errors to determine whether any of these errors were introduced during editing or templating or when being prepared for printing.

## Analysis and Conclusion

The VCAA provided the Panel with an overview of errors that had occurred in relation to 4 examination questions in 2023. These are summarised as:

### 1. General Mathematics Examination 2

Q14d. Has an additional 'of' in the sentence.

As this was identified prior to the examination date, the error was resolved by having the Chief Supervisors read a message to students during the reading time to cross out the additional 'of.'

### 2. General Mathematics Examination 2

Q9d. Typographical error in a matrix.

This was identified on the day of the examination through an external call. The Curriculum Manager looked at the question during the examination and concluded that this would not adversely impact the students answering the question. The error was in the column of the matrix that students did not need to complete.

Subsequently, the question was deemed invalid and all students who sat the exam received one mark for the question.

### 3. Mathematical Methods Examination 2

Section B Q4j. Used the abbreviation 'm' instead of 'metres.'

This was identified at final checking after the papers were printed.

This flaw was identified prior to the examination date and was resolved by having the Chief Supervisors read a message to students during the reading time instructing them to cross out the letter 'm' after the number 8 and replace it with 'metres.'

### 4. Specialist Mathematics Examination 2

Section B Q6h. The labelling on the curves is reversed.

The Curriculum Manager and Examination Panel Chair reviewed and identified the error following the VCAA receiving a call on the day of the exam.

The question was invalidated and all students who sat the exam received one mark for the question.

The Panel found that the actions taken by the VCAA in dealing with the impacts of these issues on students appear to be appropriate under the circumstances and are similar to what other comparable Australian jurisdictions would do.

However, specific concerns with many more questions on the 2023 Mathematics examination

papers have been raised,<sup>3</sup> including criticism of their lack of clarity; poor use of terminology, mathematical expression and conventions; and in 1 or 2 cases, the absence of a definitively correct answer.

The Panel has relied on the analysis of the 7 highly qualified experts to substantiate whether errors had occurred. Two approaches were used in undertaking the analysis, as outlined in detail at Appendix 3.

Results from the analysis were as follows:

- Most or all of the 7 Mathematics experts identified the same errors in 5 questions in the 2022 Mathematics examinations that had been raised in the original open letter signed by 73 Mathematics academics.
- Of those items from the 2023 General Mathematics, Mathematical Methods and Specialist Mathematics examination papers that had been alleged to have ‘significant errors’, 5 were from the General Mathematics papers and 14 were from the Mathematical Methods or Specialist Mathematics papers.
- Two of the Mathematics experts engaged by the Panel considered the 5 General Mathematics questions. They found that these questions were poorly worded and could have been improved. Two questions had more than one possible answer and another had an error in the question.
- The 14 questions alleged to have major or significant errors in Mathematical Methods and Specialist Mathematics were each considered by 6 or 7 experts.
  - In 9 of those questions at least 5 or 6 of the experts found that the questions were poorly worded or used poor terminology. Comments such as these were offered: *‘The question is very badly worded leading to different possible interpretations.’*; *‘This is another example of a lack of precise language in a question.’*; *‘Not well phrased ...’*. In some cases, this wording was regarded as likely to have caused confusion among some students. In other cases, the consensus was that, though the terminology was not strictly correct, it was more a matter of poor wording or expression than a substantive flaw: *‘a minor wording issue. The intent of the question was clear’* and *‘Technically, you rotate the region between the curve and the x-axis to form the solid, but this is clear from the context.’* In still other cases, the experts found the wording of the questions unnecessarily verbose or clumsy: *‘Introduction contains the information necessary for both parts but is overwhelmingly wordy’*; *‘there is too much reading’*.
  - In 2 questions the experts questioned whether the term ‘smooth’ – as used in Mathematical Methods Exam 2 (MCQ9) and Specialist Mathematics Exam 2 (Q1b) – was within the Study Design.
  - Three of the 14 questions were found to be acceptable by all 7 experts.

Inspection of the archived documentation held by the VCAA for Specialist Mathematics and Mathematical Methods in 2022 and 2023 indicates that generally, the errors and major flaws identified in the Mathematics papers were present from the earliest drafts. These errors and

<sup>3</sup> The authors of the 2022 and 2023 critiques of the Mathematics examinations used different critical terms in the 2 years. In 2022, the authors used the term ‘Major Mathematical Errors’: ‘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.’ In 2023, the authors used the term ‘significant error’ and defined a question with a ‘significant error’ as one that ‘is sufficiently ambiguous or improperly written to have been actively confusing to students; or that cannot be properly answered; or that exhibits some fundamental mathematical misunderstanding.’



major flaws were not detected in the multiple opportunities for review and revision that were subsequently undertaken.

While errors or flaws were in most cases present in the Panel Submission version (the first version of the examination submitted to the VCAA by the Examination Development Panel), in 3 cases errors or major flaws were introduced in the course of the review and revision processes

The Panel found that the VCAA has detailed and comprehensive documented processes for the development of VCE Mathematics examination papers, which if applied consistently and thoroughly by people with the right skills and who have been trained to perform their tasks, should be effective in preventing problems related to subject content and quality of questions occurring.

If there are any flaws or errors in examination questions when they are initially constructed, the various review processes, if carefully applied, should identify them so they can be eliminated and the question either re-drafted or set aside. Care also needs to be taken to ensure that errors are not introduced during the reviewing or editing processes.

After analysing the records provided by the VCAA that included the various versions of the 2023 Mathematics and Chemistry examination papers and the completed forms from the various reviews that were conducted, the Panel concluded that there was no clear evidence that showed any of the problems with questions were the result of errors made by the editorial staff or desktop publishers. If any anomalies or flaws were introduced, they were picked up at some point in the process and rectified. The Panel did find in some cases, however, that the records were not clear as to who had made or authorised a change.

## Chemistry

The external assessment for the Chemistry Study Design consists of a single written examination paper that students have 2.5 hours of writing time to complete.

In 2023, Section A of the paper consisted of 30 multiple-choice items worth 1 mark each. Section B consisted of 9 short-answer and extended-answer questions, including questions with multiple parts that had a total value of 90 marks. Each question was broken into parts, each of which had a maximum possible mark ranging between 1 and 5 marks. Most of these part questions had a maximum value of 1 or 2 marks.

An error was discovered in Section B Question 1(a) while the examination was underway. A table containing the information students needed to answer this question (about the composition of coconut oil) contained an incorrect chemical formula for linoleic acid. Instead of listing the chemical formula for linoleic acid, it gave the chemical formula for linolenic acid.

In investigating this error, the Panel:

- Interviewed the key VCAA staff involved in the development of the Chemistry examination papers, including the Examination Development Manager and the Curriculum Manager (Chemistry).
- Interviewed members of the VCAA leadership team who have responsibility for managing the development of the examinations, including the substantive and acting Chief Executive Officers, the Executive Director, Curriculum and the Manager, Examination Unit.
- Interviewed one of the Study Specialist Reviewers and a Chemistry academic.
- Reviewed the 2023 Chemistry examination-related documents including:
  - Examination paper drafts
  - Reviewer forms
  - Examination Panel Chair responses.

## Analysis and Conclusion

Inspection of the archived documentation indicates that the error in the Chemistry 2023 examination paper occurred when the question was drafted by the Examination Panel Members, and was present when the paper was first submitted to the VCAA for review.

The error was not detected through the subsequent quality assurance and review processes.

The Panel identified that the review process successfully prevented one other potential error which was also within Section B Question 1. However, this occurred only after it had passed through a number of reviews and checks.

The Chemistry Examination Development Panel has a composition similar to the Mathematics Examination Development Panels. It has a Panel Chair, Panel Members, Study Specialist Reviewers, an Examination Sitter Reviewer and an English as an Additional Language Reviewer. The Panel noted that the composition of the Examination Development Panel for Chemistry appeared to be well-balanced in terms of its members' background and experience. It has a mixture of specialist academics and teachers.

Whilst a single error occurred in relation to the 2023 Chemistry examination, and no additional historical issues were raised with the Panel during the consultation process, that the error occurred indicates the various quality assurance processes were not operating as intended. As such, the Panel has recommended several improvements to systems and processes related to the development of VCE Chemistry examinations.

## Chinese Second Language

Chinese is the only language within the VCE curriculum that has a Study Design for both Second Language and Second Language Advanced.

In 2023 the written examinations for both Chinese Second Language and Chinese Second Language Advanced had very similar structures. Each had 3 sections: Section 1 was divided into Part A and Part B, and Section 2 was divided into Part A and Part B. Each Section and Part of both examinations had the same maximum mark. The maximum possible mark for both papers was 75. Students had 2 hours of writing time for both examinations.

On 6 November 2023, students at 2 different schools enrolled in the Chinese Second Language Advanced course were instead given the written examination paper for the Chinese Second Language course. The Chinese Second Language examination was scheduled for 15 November.

The students at these 2 schools completed the Chinese Second Language examination paper that they were given. It was only after the examination was completed that it was discovered that they had been given the incorrect paper.

In investigating this error, the Panel:

- Reviewed the documentation provided by the VCAA that explained its policies, processes and procedures in relation to administering examinations, including the *VCE Examination Manual (2023)* and the *2023 VCE Written Examinations Session Details and Equipment Listing*.
- Read correspondence and reports from the 2 schools to the VCAA explaining what had happened.
- Interviewed VCAA staff with responsibility for overseeing the processes of packing and delivering examination papers to schools, and those involved in overseeing the administration of examinations in schools.
- Interviewed 3 experienced Chief Supervisors.
- Interviewed staff from the QCAA and NESAs involved in the delivery of examinations to schools and the administration of examinations to investigate the practices in those jurisdictions.

A description of the role of Chief Supervisor is provided in Appendix 4.

### Analysis and Conclusion

After reviewing the VCAA's documented processes and procedures, reviewing the correspondence related to the incidents, and speaking with VCAA staff and experienced Chief Supervisors, the Panel has concluded that these incidents occurred as a result of errors made at individual examination centres.

The Panel concluded that the errors occurred at the centres when

resulting in students being provided with the incorrect examination paper.

The Panel was satisfied that the VCAA has appropriate processes and procedures to ensure that schools receive the examination papers and other materials that they need, and that when schools receive the papers they have the appropriate guidance to ensure that they are stored securely until they are needed.

The Panel noted in particular that the VCAA had appropriate labelling of examination papers (i.e. the front cover gives the name of the course, along with the date and time of the examination). The Chinese Second Language Advanced paper also has a coloured stripe down its spine to distinguish it from the Chinese Second Language paper.

However, the Panel identified a small number of enhancements that could be made to further reduce the likelihood of such errors occurring in future.

## Transparency and handling of errors

During the consultations there were several criticisms from Mathematics academics that the VCAA was on occasion slow in the public release of the Mathematics examination materials and reports, and that queries and complaints were not addressed or satisfactorily answered in a timely manner.

### Analysis and Conclusion

The Panel acknowledges that despite the best efforts of staff, in large-scale credentialling programs like the VCE it can sometimes take considerable time to properly investigate issues and respond to the correspondent. In addition, there are matters that, must remain confidential, in order to maintain the integrity of the credential.

Nevertheless, the Panel believes that there are measures that the VCAA can take to deal with issues more effectively when they are raised, and give all stakeholders confidence that any problems that arise will be dealt with appropriately.

At present the VCAA makes spare printed copies of examination papers available to the staff of a school which is an examination centre at the conclusion of the examination, but it takes some further time before any other material is released.

Each year the written examination paper for all Study Designs and a report titled 'exam report' (e.g. '2023 Chemistry exam report') are published. The exam report is a useful document that provides some general comments on the examination and how students performed: in the case of free-response questions a table for each question showing the percentage of students who received each of the marks available and a worked solution; in the case of multiple-choice items the correct answer and the percentage of students who selected each option; and some summary comments about areas of strength and weakness in students' performances. This material is very helpful for teachers and students preparing to undertake the examinations in future years.

A check of the VCAA website in mid-February 2024 showed that for the 2023 examinations the examination papers for the 4 Mathematics studies have been published, but not the exam reports.

The Panel understands that the VCAA has held some internal discussions to identify where errors might have occurred with the 2023 Mathematics, Chemistry and Chinese Second Language examinations and what actions it could take in the future to prevent such an issue arising again. The Panel acknowledges this positive step.

The VCAA's existing procedures include options that can be taken to deal with errors that are identified prior to the examination being held. It also has procedures that can be taken if the errors are discovered during or after the examinations have been sat. These procedures, if applied as quickly as possible, should result in acceptable outcomes.

The VCAA needs to develop procedures for managing issues that have been raised by the public or those that will take longer to resolve.

# RECOMMENDATIONS

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The Panel has made 6 high-level recommendations, each with associated actions.

The Panel believes that this set of recommendations, if implemented effectively by the VCAA, should address the issues encountered in the 2023 Mathematics, Chemistry and Chinese Second Language examinations.

The VCAA should commence implementation of these recommendations immediately to ensure that the VCE examination processes demonstrate the appropriate quality and rigour in 2024 and beyond.

The recommendations are made in the context of addressing the issues identified related to Mathematics, Chemistry and Chinese Second Language. However, the VCAA should consider applying the learnings and insights to other study areas, where applicable.

**1. The VCAA should increase the representation of suitably qualified academics on the Mathematics Examination Development Panels including by:**

**a. Establishing stronger partnerships with Mathematics faculties at Victorian universities to encourage the participation of suitably qualified Mathematics academics in Examination Development Panels.**

The VCAA has positive, professional relationships with some Mathematics academics who provide sound and constructive support to a variety of projects, including the development of VCE examinations.

The Panel found, however, considerable potential for expanding this network and engaging with a much wider group.

The Panel believes that having more academics working on Examination Development Panels will lead to an improved product and minimise (and ideally eliminate) criticism that leads people to question the quality of the Mathematics examination papers. Some of the Mathematics academics the Panel spoke with indicated their willingness to become involved in Examination Development Panels.

In their open letter, the group of 73 Mathematics academics highlighted the importance of having skilled mathematicians involved in writing and vetting the examination papers.

The VCAA should therefore establish stronger partnerships with Mathematics faculties at Victorian Universities to encourage the participation of suitably qualified academics in Examination Development Panels.

**Insight: Queensland**

**b. Updating the advice on the VCAA website to ensure that it is clear that academics are an important cohort for inclusion in Mathematics Examination Development Panels.**

Increasing the number of Mathematics academics from Victoria's universities, both as question writers and as reviewers, will further strengthen the Examination Development Panels. The Panel's analysis indicated that more could be done to ensure academics are acknowledged and welcomed as important participants of Examination Development Panels.

On the VCAA website there is a link that enables people interested in becoming involved in VCE examination development to apply online. There is a 7-minute video that encourages people to apply and explains the professional benefits they will receive from the experience. This is a positive initiative, but it is aimed at teachers. There is only one reference in the video to academics and that is 'teachers and academics.'

The website lists the essential criteria for the roles of Examination Panel Chair, Examination Panel Member, Study Specialist Reviewer and Examination Sitter Reviewer as:

- Teaching experience in the nominated study
- Knowledge of VCE curriculum and assessment policy, and of the nominated study
- Relevant tertiary or education qualifications
- No close connection with a student undertaking Units 3 and 4 in the nominated study.

There is no reference to specialist university academics.

In the course of the Panel's interviews with a number of Mathematics academics it became clear that some of them, at least, were not sure how to become involved. They felt that the VCAA did not make it clear to universities the steps academics needed to take to apply for positions on Mathematics Examination Development Panels.

While it is important that experienced and fully qualified teachers are members of Examination Development Panels, it is just as critical that suitable academic specialists are also included. The VCAA has recognised this to a degree, but there is scope for a greater representation of Mathematics academics on Examination Development Panels, both as Panel Members (i.e. question writers) and as Study Specialist Reviewers.

**c. Introducing a required minimum number of academics into the Mathematics Examination Development Panels as follows:**

- i) **For the 2024 examinations, include 2 Mathematics academics as additional Study Specialist Reviewers for Mathematical Methods and Specialist Mathematics, and one Mathematics academic as an additional Study Specialist Reviewer for General Mathematics.**
- ii) **For the 2025 examinations and beyond, include in each of the Mathematics Examination Development Panels:**
  - (a) **Two suitable Mathematics academics as question writers for the examination.**

**(b) Two suitable Mathematics academics as Study Specialist Reviewers for each of Mathematical Methods and Specialist Mathematics and one for General Mathematics.**

Each Examination Development Panel consists of the Examination Panel Chair, 4 or 5 Examination Panel Members (who write the questions), 2 Study Specialist Reviewers, one Examination Sitter Reviewer and one English as an Additional Language (EAL) Reviewer.

The Panel's analysis of the composition of the Examination Development Panels across the Study Designs General Mathematics, Mathematical Methods and Specialist Mathematics shows that there is a mix of experience and areas of expertise.

There is a mixture of suitably experienced teachers from across the 3 sectors (government, Catholic, independent). Some include highly experienced retired teachers, which is appropriate, provided they have retained their understanding of the Study Designs and are aware of any changes to them.

In 2023 each of the 3 Examination Development Panels for Mathematics included some university academics as follows:

- In the case of the General Mathematics and Specialist Mathematics Panels, these academics performed the role of Study Specialist Reviewers.
- In the case of Mathematical Methods, one of the Examination Panel Members responsible for writing the questions was an academic mathematician, and one of the Study Specialist Reviewers was also an academic mathematician. The Panel saw evidence to indicate that the Panel Chair for Mathematical Methods had requested that an academic mathematician be engaged as a question writer.

The Panel recommends that, for the preparation of the 2025 VCE examinations, the VCAA ensures there are Mathematics academics included in the Examination Development Panels as both question writers and Study Specialist Reviewers.

**Insight: New South Wales**

**Insight: New South Wales**



**2. The VCAA should strengthen the examination-setting process and construction of the Mathematics examination papers to ensure they are of sufficient rigour and quality, including by:**

- a. Requiring that all members of Mathematics Examination Development Panels participate in a training session outlining best practice in the design of Mathematics examination questions, including that they should be constructed using the appropriate symbols, conventions and the ‘language of Mathematics’; and that efforts to make questions more accessible to students must not distort their mathematical integrity.**

When the VCAA appoints a new member to an Examination Development Panel they are given a booklet that lists in dot-point form the role and the functions they are to perform, along with information about Examination Development Panels, Essential Security Measures, the blank forms they need to complete as part of their task(s), where relevant, and information about the use of the VCAA’s current secure document-sharing platform (a third party platform).

During the interviews the Panel was advised that no additional training in educational assessment, including writing quality items and critically reviewing them, is provided by the VCAA.

The Panel recommends that the VCAA provide enhanced training for members of the Mathematics Examination Development Panels to ensure they understand the principles of assessment and how to write high quality questions. This would be expected to achieve greater consistency across the panel and improve the quality of the questions from the outset, thus reducing the amount of re-working needed.

The correspondence concerning the errors and flaws in some of the questions in the 2022 and 2023 examinations would be useful as part of this training. The Examination Development Panels could undertake a review of these questions, in the same manner as the external experts engaged by the Panel have done, to understand how these questions could have been improved.

**Insight: Queensland**

**Insight: New South Wales**

- b. Simplifying the development of examinations for the 3 Mathematics Study Designs by requiring multiple-choice questions in all examination papers to have only 4 options instead of 5, to bring them into line with the examinations in all other VCE Study Designs and examinations conducted by other comparable Australian jurisdictions.**

In the Mathematics examinations produced by the VCAA, multiple-choice questions have 5 options. By contrast, in all other VCE examinations that contain multiple-choice questions and in all examinations conducted by other comparable Australian jurisdictions, only 4 options are provided.

The Panel sought expert comment on the issue of the number of options provided in multiple-choice questions in the examination papers for the Mathematics Study Designs. This information is included in Appendix 5.

Having reviewed this advice, the Panel recommends that, in future, only 4 options should be provided in multiple-choice questions in VCE Mathematics papers. This change will simplify the writing of these questions and save reading time for students in examinations, while not diminishing the challenge of these items.

During an interview the Panel held in early February, it was informed that the VCAA has decided to take this action. This is a sound step.

**3. The VCAA should strengthen the examination review processes for Mathematics and Chemistry including by:**

- a. Strengthening the guidance for the VCAA Examination Development Managers in convening the initial meetings for each of the Mathematics and Chemistry Examination Development Panels to ensure everyone is fully aware of their role and responsibilities in relation to the review and checking of materials, and the procedures they need to follow. This should include a reflection on learnings from the prior year's examinations process including the report from the Chief Assessor.**

During its discussions with one of the Chemistry Study Specialist Reviewers, [REDACTED] the Panel was told that they had been provided with very little information about what they were expected to focus on when undertaking this task, and did not think when they reviewed the examination paper that it was part of their role to check such things as whether chemical formulae were correct. Similar comments from a Study Specialist Reviewer for Mathematics, and a review of the reports they produced, led the Panel to conclude that these reviewers were not entirely certain of the scope of their responsibilities.

Therefore, as part of the annual cycle for Mathematics and Chemistry Examination Development Panels, the Review Panel recommends that the VCAA ensure an establishment meeting is held which focuses on the respective roles, responsibilities and procedures to be followed.

As part of this meeting, it should be standard practice to consider learnings from the prior year, including whether any procedures can be improved, such as the allocation of roles and records management.

- b. Introducing an additional Study Specialist Review of the ‘print-ready’ examination papers for each of Mathematical Methods, Specialist Mathematics and Chemistry by an academic who has not been involved in the development of the examination.**

Based on the issues identified in this Review, the Panel recommends that the VCAA should introduce an additional check at the end of the examination development process of the ‘print-ready’ version of examinations for Chemistry, Specialist Mathematics and Mathematical Methods.

This additional review should be conducted by an academic who has had no previous involvement with the papers.

- c. Requiring that the reports of the Subject Specialist Reviewers, Examination Sitter Reviewers and the English as an Additional Language Reviewer are considered at a joint meeting of the full Examination Development Panel – as well as the relevant VCAA staff – to endorse the final examination paper(s).**

Subject Specialist Reviewers (SSVs) and Examination Sitter Reviewers (ESVs) work through the examination paper and complete a report that requires them to comment on a range of features of the examination and its questions.

These reports are then considered by the Examination Panel Chair and, in some instances, other members of the Examination Development Panel, and a decision is made as to which of the reviewers’ suggested amendments should be implemented in the paper. The Examination Panel Chair is required to document the changes that will be made in response to the reviewers’ suggestions, and to explain the reasons for rejecting any suggested changes that have not been acted upon.

The Panel recommends that the VCAA require the full Examination Development Panel – as well as the relevant VCAA staff – to come together to consider the reports of the Study Specialist Reviewers and Examination Sitter Reviewers (including the additional Study Specialist Reviewer outlined above). They should work through the reports to ensure the whole Examination Development Panel is satisfied that the examination papers are of the quality required.

In working through the report, the Examination Development Panel should pay additional attention to questions that have been introduced at a stage after initial setting, and to questions that have been substantially revised.

In addition to having the whole Examination Development Panel work through the paper again, all members will then be able to share ideas and receive feedback on their comments and reports, and develop an enhanced understanding of the whole task.

- d. Refine the current process as required, to ensure that all reviewers – Subject Specialist Reviewers, Examination Sitter Reviewers and English as an Additional Language Reviewers – receive feedback on how the matters included in their reports were considered and addressed.**

The VCAA's protocols require that the question writers from the Examination Development Panels provide feedback to the Examination Sitter Reviewers and the English as an Additional Language Reviewers on the usefulness of their reports. The form that Examination Sitter reviewers complete contains a section where the question writers provide write comments about 'Aspects of the review that were most helpful' and 'Further information that would have been useful.' In contrast, the Panel was informed by a newly appointed Study Specialist Reviewer for Chemistry that they had received no feedback on the appropriateness or quality of the feedback they had provided in their report. This issue was also raised in relation to Mathematics.

Like Examination Sitter Reviewers, Study Specialist Reviewers should be given feedback on their reports as an effective way for them to understand how they can improve their feedback to the Examination Development Panel in the future. This is particularly valuable for Study Specialist Reviewers who have been recently appointed.

Such a feedback loop is also valuable in highlighting any differences of understanding. If the Study Specialist Reviewer believes the Examination Development Panel has missed the intention of a comment they made, it provides an opportunity for them to directly explain the significance of it. This can act as a point in the examination development process where problems within questions can be addressed, reducing the risk that they persist into the final paper.

The Panel therefore recommends that feedback should be provided from the question writers on the Examination Development Panel to the Study Specialist Reviewers, in a manner similar to that provided to Examination Sitter Reviewers. Descriptions of the roles of the Study Specialist Reviewer and the Examination Sitter Reviewer are provided in Appendix 6.

- e. Requiring that wherever possible, once the examination paper has been assembled, meetings of the Examination Development Panels and the review processes occur face-to-face within the VCAA's secure offices.**

During the years impacted by COVID-19, the VCAA did well in continuing to conduct the VCE program. Necessary changes to work practices saw many activities needing to be undertaken from people's homes or other safe places.

In the early stages when items are being prepared and submitted by Examination Panel Members, working offsite is appropriate.

However, the Panel believes that once the paper is assembled all further meetings should be held at the VCAA offices. In particular, the VCAA should consider a default position of expecting that the Study Specialist reviews and the Examination Sitter reviews will be undertaken onsite at the VCAA's secure examination development area. It is acknowledged that it may be necessary on some occasions for this to be varied. Completing the reviews onsite will enable reviewers to apply themselves to their task in a thorough and holistic manner and provide them with greater support and guidance as the VCAA staff will be on hand to assist them.

An onsite approach is used in Queensland and NSW, and it is anticipated that it will be more effective in producing high-quality papers in Victoria.

**f. Improving the records management protocols and practices associated with the reviews of the examinations.**

Inspection of the archived documentation held by the VCAA for Specialist Mathematics and Mathematical Methods in 2022 and 2023 indicates that the processes documented by the VCAA were generally followed, though not always rigorously.

It was sometimes difficult to trace the sequence of reviews and revisions in the archived material. [REDACTED]

It is notable that in one case – 2022 Specialist Mathematics MCQ4 – in which a ‘Major Mathematical Error’ was identified, [REDACTED]

[REDACTED] This is a known problem with revisions: correcting one error is often accompanied by introduction of another.<sup>4</sup>

Based on the above, the Panel recommends that the VCAA:

- Ensures that all process documents are clearly labelled, dated and signed.
- Ensures that any changes made to questions are accompanied by a documented explanation for the change, and a detailed account of the concomitant effects of the change on the question’s intent and consequences, as far as they can be anticipated.

**4. The VCAA should update its training of and guidance to the in-house Editors and Desktop Publishers involved in the Mathematics and Chemistry examinations as follows:**

- a. Ensure staff responsible for editing and desktop publishing of Mathematics and Chemistry examinations papers have relevant training in formatting Mathematics and Chemistry questions, including diagrams, graphs, formulae and other stimulus material.**

Mathematics and Chemistry have quite specific subject conventions for the layout and structure of questions, the correct way of writing a formula, and how diagrams and graphs should be constructed and labelled. In order to achieve what is required, special software applications are usually needed.

The VCAA should ensure staff have training in the use of those applications for those Editors and Desktop Publishers involved in the preparation of Mathematics and Chemistry examination papers.

<sup>4</sup> ‘The statistics we have show that, on average, 1 out of 8 corrections made by a reviewer introduces an error that was not present initially.’ (Steve Dept, cApStAn Linguistic Quality Control, Personal Communication, 13/2/24.

- b. Ensure there is clear guidance for Editors and Desktop Publishers such that, if they believe an amendment is required, it is marked up and submitted for the Panel Chair’s approval.**

The activities of Editors and Desktop Publishers are interwoven with the reviews, revisions and checks conducted by the Examination Development Panel and the Examination Development Manager.

It is important to retaining the integrity of examinations that Editors and other production staff understand they should not make changes to examination questions without seeking appropriate authorisation.

- c. Ensure that after amendments are made by an Editor or Desktop Publisher a new version of the examination paper is printed and checked by the Panel Chair to see that the amendments have been made correctly and no other flaw introduced.**

The guidance referenced above should reinforce that any changes they propose, and any changes they make, are checked by those with a deep understanding of the Study Design and its conventions.

**5. The VCAA should update its guidance for staff at examination centres to reduce the possibility that students could receive the incorrect examination paper, as follows:**

- a. Amend the standard script of the instructions given to students before an examination session begins to ensure it includes appropriate checks that the students have been given the correct examination paper.**

As outlined earlier in the paper, in the case of the 2 schools who gave students the wrong Chinese examination paper, the wrong papers were removed from the secure storage and taken to the examination room and placed on the students’ tables.

Even at that point, however, there was an opportunity to rectify the situation. Had the Supervisor told students to check the title of the Study Design on the examination paper and the date and time of the examination, the mistake would have been discovered.

The ‘VCE Examination Manual’ (2023) includes the text of the announcements that Supervisors are to read to students for all written examinations. The cover page for these announcements (page 59) includes the statement, *‘Read these announcements exactly as they are printed. Do not paraphrase the announcements.’*

One of these announcements, *‘A-1 Before the commencement of reading time’* (page 60), is printed on a green background with white boxes containing the messages the supervisor is required to read.

The second part of this announcement states:

The 'VCE Examination Manual' (2023) includes the text of the announcements that Supervisors are to read to students for all written examinations. The cover page for these announcements (page 59) includes the statement, '*Read these announcements exactly as they are printed. Do not paraphrase the announcements.*'

'Check that the name and student number on the place card belongs to you. If it does not, please raise your hand.'

'Check that you have received all the examination materials\*\* for the examination you are about to do.'

'Check that the student number on the label of your response materials is the same as the student number on your place card. If they do not match, please raise your hand.'

Underneath this box on the green background is written:

\*\*The supervisor must state the specific name of the examination materials, as printed in the *Session Details and Equipment Listing* booklet.

While it might be expected from the sentence above that the Supervisor would state the name of the examination and the date and time, the earlier instruction to read the message exactly as it is printed may mean that some Supervisors stick strictly to the wording in the white box. In fact, one of the experienced Chief Supervisors interviewed by the Panel indicated that is what they do.

To prevent this sort of incident happening again, the Supervisor should clearly state the name, date and time of the examination. The Panel recommends that the VCAA should modify the announcement so that the second sentence (namely, 'Check that you have received all the examination materials for the examination you are about to do.') includes the current date and time, the title of the examination, its date, reading time period and writing time period.

**b. Require an orientation meeting to be held involving the Chief Supervisor, all Supervisors and the VCE Coordinator at each examination centre before the first examination is held.**

When they are first appointed, Chief Supervisors for each examination centre attend an induction training session conducted by the VCAA, which explains their role and responsibilities. They are also given a manual that documents what they need to do prior to and during the examinations.

It is the responsibility of the Chief Supervisor, in conjunction with school personnel, to ensure that all Supervisors are appropriately briefed on the procedures for the conduct and administration of the examinations, and Supervisors are able to step into the position of Chief Supervisor at short notice if need be. It is left to the Chief Supervisor and the school personnel to determine how this briefing will be done. There is no requirement that the full team of Supervisors assemble for any initial meeting prior to the first examination. Some Chief Supervisors may use this approach.

The Panel recommends that the VCAA should require the Chief Supervisor and the school's VCE Coordinator to hold a meeting prior to the first examination held at the school, which all Supervisors are required to attend in order to meet the rest of the team and have their duties explained to them. This will help ensure that all

examinations run smoothly, and the team of Supervisors performs its duties consistently.

- c. **Develop training materials and guidance for staff at examination centres covering the key actions needed from the time examination papers are delivered to an examination centre to the conclusion of an examination, and discuss this material at the orientation meeting referred to in Recommendation 5b.**

The VCAA has produced a manual, 'VCE Examination Manual', designed to be used by Chief Supervisors, Supervisors and school personnel when conducting VCE external examinations. This is a comprehensive document that has sections covering:

- General information
- Receipt of assessment materials
- Setting up the centre
- Admittance to the centre
- Conducting the assessment
- Collection of materials
- VCAA rules for the conduct of VCE examinations
- Incidents and irregularities during VCE external assessments
- Special Examination Arrangements
- Derived Examination Scores.

The Panel was advised that this manual is made available to Principals and also to Chief Supervisors during their initial orientation session. It is then up to the Principal, VCE Coordinator and Chief Supervisor to ensure that they establish and maintain facilities and practices in the school that are consistent with the VCAA's requirements.

Given that this manual is comprehensive, and much of it is not within the scope of the duties of a general examination Supervisor, a copy is not given to every Supervisor. Instead, those Chief Supervisors the Panel interviewed indicated that they had developed their own materials which they used to brief their Supervisors.

In order to assist both the Chief Supervisor in preparing their team for the tasks and the other Supervisors in understanding what is expected of them, the VCAA should prepare some short training videos that explain key aspects of a Supervisor's role and how they need to perform their tasks. Working through and discussing these videos could form a part of the initial meeting of the Supervisors outlined above.

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**Insight: New South Wales**

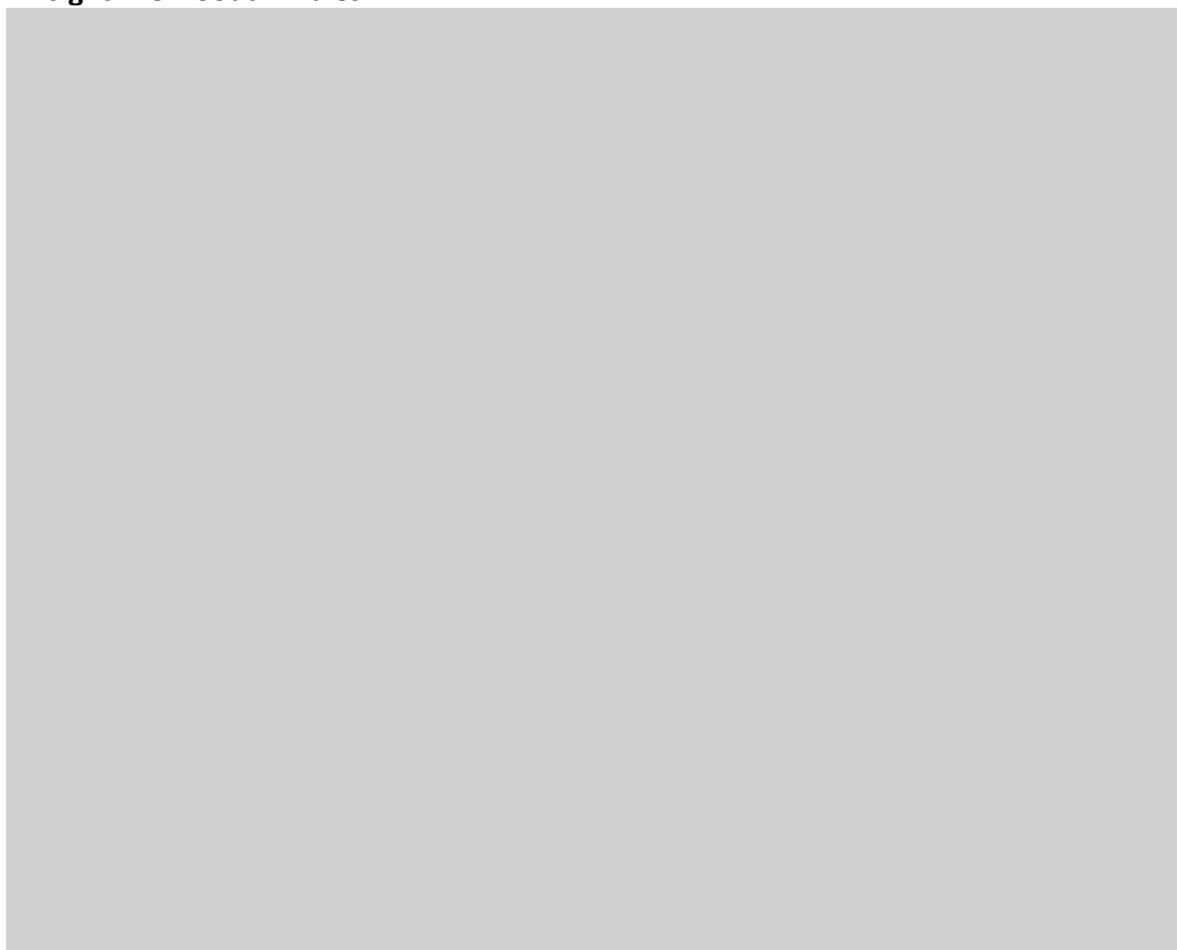


6. The VCAA should publish examination material in a more timely manner and update its policies and processes relating to the management of errors and alleged errors as follows:
- a. Tighten publication timelines for examination documentation to align with other comparable Australian jurisdictions as follows:
    - i. Publish the VCE Mathematics examination paper on the VCAA website within 5 days of a paper being sat.
    - ii. Publish the final version of the Marking Guide used to assess students' performance on the VCAA website within 5 days of the end of the marking of each Mathematics examination.
    - iii. Publish the report prepared by the Chief Assessor on the VCAA website before the end of January the following year.

An important aid for teachers in analysing and understanding the results of their students in the VCE examinations is to review the examination papers and reports on student performance from previous examinations. If teachers review this material, they can use it to good effect in teaching their students. If they can get access to this material in a timely manner, they can incorporate it into their lessons as they are introducing new topics throughout the course.

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**Insight: New South Wales**



- b. Require Panel Chairs to meet with the Chief Assessors and other senior Assessors during the Assessment operation to provide advice and obtain feedback.**

If the Panel Chairs meet with the Chief Assessors and other senior Assessors at key stages in the Assessment operation, they can provide advice on why the questions were included, obtain information on the effectiveness of the questions and the marking guidelines, and receive early data on student performance. This information will be useful as they start to plan for the development of the examination for the following year. The knowledge they gain from these experiences will complement the statistical information and report they receive later.

- c. Update the VCAA's documented policies, processes and procedures to articulate its approach to responding to an issue raised in relation to an examination by a member of the community.**

The Panel believes that the VCAA should update its documentation regarding management of issues raised by the community in relation to the VCE examinations to give all stakeholders confidence that any problems that arise will be dealt with appropriately.

In the case of a well-regarded credential like the VCE, if a problem with an examination question arises, the Panel believes that the best approach is always to investigate it as quickly as possible and make a statement as to the nature of the problem and how it will be managed to ensure no student is disadvantaged.

- d. Provide annual training to relevant VCAA staff to ensure they are aware of the documented policies, processes and procedures applying in the case of an issue being identified in an examination paper, including determining and explaining how the issue will be addressed to ensure students are not disadvantaged.**

After the updates to the VCAA's documented arrangements for responding to issues have been made, it is important that relevant staff are provided with annual training to ensure they are aware of these procedures and they should be applied.

- e. Provide a report to the VCAA Board each year regarding the performance of the annual examination series, including reporting any issues that arose, explaining how they were managed and outlining the steps to be taken to reduce the likelihood of such issues occurring in the future.**

To undertake its oversight role the VCAA Board needs to have a sound high-level understanding of the quality and delivery of the VCE program. A comprehensive report to the VCAA Board on the annual examination series will ensure it can provide the necessary guidance and support.

# APPENDICES

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- 1) Glossary of terms
- 2) Overview of the documented 2023 examination development and distribution process
- 3) Methodology for analysis of alleged errors in Mathematics examinations
- 4) Overview of examinations process at the school level
- 5) Multiple-choice items (questions) in the Mathematics examinations
- 6) Study Specialist Reviewer and Examination Sitter Reviewer

## Appendix 1

### Glossary of terms

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#### General terms

- **Assessment Operations Report (AOR)** covers the mark structure of the paper and also the accuracy of the marking guide to address each specific question.
- **Examination Centre** refers to the place in which the examination is conducted. This is not always a school. The VCAA may deliver examination materials to the school but the school may or may not be the examination centre.
- **Examination Development Panel** is an existing VCAA panel with membership composed of the Examination Panel Chair, Panel Members, Subject Specialist Reviewers, Examination Sitter Reviewer and English as an Additional Language Reviewer. Some exams will also have a script reader, a comparability reviewer.
- **Independent Review Panel (or Panel)** refers to the expert panel commissioned by the Secretary to lead this review.
- **Study Design** refers to a subject's planned curriculum providing details on the subject's areas of study, outcomes and assessment.

#### Roles

##### Examination development Panel roles

- **Examination Panel Chair** has overall responsibility for the timely development of a valid, reliable, fair, comparable, appropriate and secure examination by the Examination Development Panel.
- **Examination Panel Member (EPM)** are the members of the Examination Development Panel responsible for writing questions for examination papers. This excludes the Examination Panel Chair and Reviewers included on the Examination Development Panel.
- **English as an Additional Language Reviewer (EAL)** refers to a position appointed by the VCAA to review the clarity, accessibility, currency, ambiguity and expression of English content for students who do not speak English as their first language.
- **Examination Sitter Reviewer (ESV)** refers to a position appointed by the VCAA that attempts to approach the examination paper from a student's point-of-view while concurrently identifying any issues.
- **Study Specialist Reviewer (SSV)** refers to a position appointed by the VCAA to review the quality of examination questions from a theoretical and technical point of view.

##### Other roles

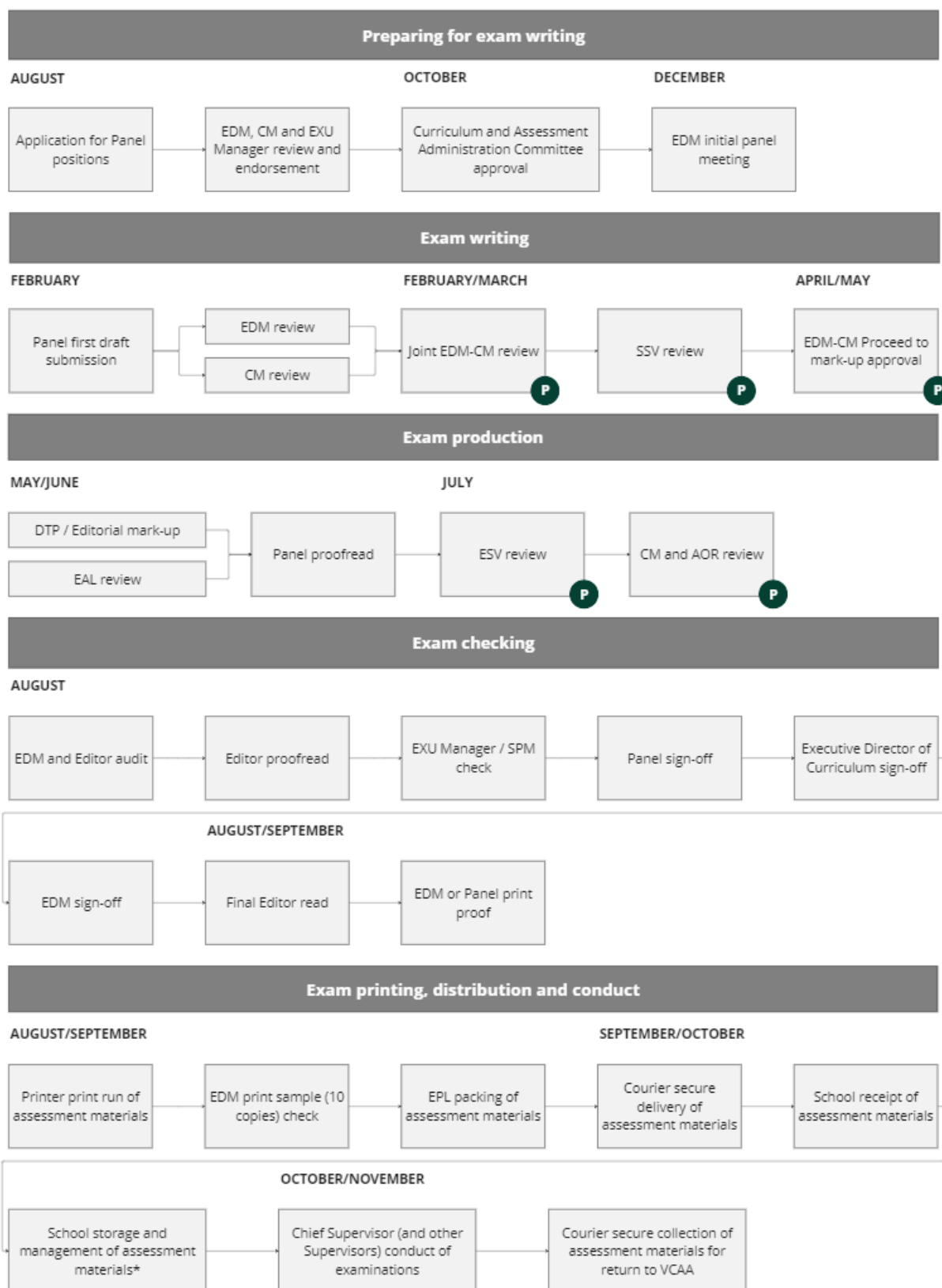
- **Assistant Chief Assessor** is appointed to assist the Chief Assessor.
- **Chief Assessor (CA)** is responsible for planning and conducting the assessor training meeting, monitoring the application of marking principles during marking and making final marking decisions. Under the guidance of a VCAA Project Manager, the Chief Assessor is responsible for the final decisions regarding marking strategies and procedures.

- **Chief Supervisor (CS)** refers to the individual appointed by a school principal and approved by the VCAA to hold overall responsibility for the conduct and administration of VCE external assessments and any additional instructions provided by the VCAA and the school at which they are employed.
- **Curriculum and Assessment Administration Committee (CAAC)** refers to the Committee that oversees key administrative arrangements for F – 10 assessment programs and senior secondary qualifications including:
  - Overseeing and approving appointments to leading casual (sessional) roles.
  - Monitoring and approving pay rates and methods for casual (sessional) positions.
  - Advising on new initiatives and review implementation of appointment policies, conditions of appointment and employment policies and receive expert advice on these issues as they arise.
  - Ensuring that any issues identified are appropriately addressed and actions aligned across different casual (sessional) positions.
  - Monitoring and reviewing the implementation of recruitment strategies, policies and procedures.
  - Identifying and advising on relevant policy and procedural gaps.
  - Referring relevant issues to the VCAA Executive Management or the VCAA Board Committees.
- **Curriculum Manager (CM)** is a VCAA employee who reviews the examination to ensure compliance with VCAA documentation related to the study and confirms the examination’s readiness to proceed to desktop publishing. They The CM also provides VCAA subject matter support.
- **Desktop Publishing (DTP)** refers to the VCAA staff team that handles the formatting of the exam onto prescribed templates, creation of diagrams and layout of the paper. DTP’s work is routinely checked by the editing team.
- **Editor** refers to the individual responsible for correcting spelling, punctuation, grammar, style, and wording of examination papers. Once a paper is past Markup, all changes are run by an editor both before and after incorporation by DTP.
- **Exam Unit (EXU) Manager** was the unit manager and people manager for the examination unit. The examination unit is currently trialling a more distributed leadership model with 3 leaders in the space leading workgroups.
- **Examination Development Manager (EDM)** is a VCAA employee who provides expert advice and support to the Examination Development Panel and VCAA production staff to ensure the timely completion of a valid, reliable, fair, comparable, appropriate and secure examination.
- **Examination, Planning and Logistics (EPL)** refers to the VCAA staff team responsible for the examination planning and logistics of the exam distribution.
- **Executive Director of Curriculum** is the Executive Director of the Curriculum Division encompassing the 7 units of the division.
- **EXU Senior Project Manager** is part of the leadership team of EXU and hold a ½ load of exam and management responsibilities.
- **Final editor** refers to an Editor who has not read the paper before. This Editor performs a ‘clean review’ of the examination.


- **Supervisor** refers to a person appointed by a school Principal and approved by the VCAA to act as a supervisor of a VCE external assessment.
- **VCE Coordinator** refers to a person appointed by a school Principal and approved by the VCAA. Subject to the discretion of the school Principal, they are responsible for the implementation, delivery and management of the VCE at the school to which they have been appointed.

## Appendix 2

### Overview of the 2023 examination development and distribution process



## Notes:

- Roles and acronyms referenced in the Overview of the documented 2023 examination development and distribution process map above are as defined in 'Appendix 1: Glossary of Terms'.
-  Denotes parts of the process when feedback is provided to the Examination Development Panel for consideration and response. The use of the term 'Panel' in this diagram may refer to a representative, such as the Examination Panel Chair, or both the Examination Panel Chair and Members.
- The management involved in this part of the process includes the distribution of assessment materials from the school to examination centres in the cases they are distinct locations, such as a school where the examination centre is a nearby town hall.



## Appendix 3

### Methodology for analysis of alleged errors in Mathematics examinations

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Seven independent Mathematics experts accepted an invitation to review selected questions (or items) from the 2022 and 2023 VCE Mathematics examinations. Two approaches were adopted.

#### Approach 1

In the first approach, 2 Mathematics academics were asked to review questions in the 2022 and 2023 papers that had been claimed to contain ‘major errors’ (2022) or ‘significant errors’ (2023). These comprised questions from the 2022 Specialist Mathematics and Mathematics Methods examination papers and questions from the 2023 General Mathematics, Specialist Mathematics and Mathematical Methods papers. In total, the identified questions amounted to 26 questions or question parts: 5 from 2022 and 21 from 2023 papers. The list of questions was as follows:

#### 2022

- a) Specialist Mathematics Exam 1 Q3(b)
- b) Specialist Mathematics Exam 2 multiple choice Q4
- c) Specialist Mathematics Exam 2 multiple choice Q19
- d) Specialist Mathematics Exam 2 QB6(f)
- e) Mathematics Methods Exam 2 QB4(e)(ii)

(In addition, it was claimed that there were 7 questions across the four 2022 examination papers for Specialist Mathematics and Mathematical Methods that had ‘minor mathematical issues’ and 16 other questions that were ‘poorly conceived questions.’, but the 2 experts were not asked to comment on these questions.)

#### 2023

- a) General Mathematics Exam 1 multiple-choice question 26
- b) General Mathematics Exam 2 7(c), 7(d), 9(d), 11
- c) Mathematics Methods Exam 2 multiple-choice questions 9 and 20, and short response questions Q5(b), Q6(b), Q7
- d) Specialist Mathematics Exam 2 multiple-choice question 6, Q2(a)(b), Q1(b), Q2(d), Q3(a), Q4(e)(ii), Q5(b)(e), Q5(d), Q6(h)

These experts were alerted to the fact that all of the questions provided to them had been queried, but not given any details about the nature of the criticism.

The 2 experts commented on most but not all of the identified items.

#### Approach 2

Five Mathematics specialists accepted an invitation to review questions or question parts, listed in a spreadsheet, from the 2022 and 2023 Specialist Mathematics and Mathematical Methods examination papers. The email inviting them to participate said, in part,

‘Some of these items have been identified as flawed; some not. The review will entail commenting briefly on each listed item against criteria such as its mathematical validity, linguistic quality, presence or lack of ambiguity, and typographical/printing

accuracy. If you are familiar with the Victorian study designs for these subjects, and could comment on the items' fidelity to the curriculum, that would be welcome, but there's no expectation that you are au fait with the current study designs.'

The spreadsheet included:

- 40 questions or parts of questions from the 2022 and 2023 Specialist Mathematics and Mathematical Methods papers that it had been claimed were problematic. The set of items comprised those described as containing 'major' or 'minor' errors, or having been 'poorly conceived', or exemplifying 'poor writing' on the 2022 examinations; or having 'significant errors' on the 2023 examinations.
- 14 questions or parts of questions from the same papers that were intended as controls. That is, they had not been identified as problematic.

The questions included in the spreadsheet as controls had been identified as good questions by an additional Mathematics specialist (i.e. not one of the 5 experts), who was familiar with the Year 12 Mathematics Study Designs in Specialist Mathematics and Mathematical Methods. As controls, these questions were intended to minimise any perceived pressure on the part of the experts to find fault with all the questions.

The reason for excluding General Mathematics and Foundation Mathematics from this exercise was that time was limited and there were relatively few reported problematic questions in those examination papers in comparison with those reported in Specialist Mathematics and Mathematical Methods.

The 5 experts were sent a list of the questions in a spreadsheet with a column for their comments, and digital copies of the relevant exams as implemented (provided by the VCAA). One of the 5 experts who undertook this second approach was only able to review the Specialist Mathematics questions, due to lack of time. The other 4 considered all of the Specialist Mathematics and Mathematics Methods questions listed.

### **Analysing the experts' comments**

The 7 experts' comments were collated and inspected in relation to their match with the criticisms that had been made of those questions following the 2022 and 2023 examinations.

A sample of questions was selected for further inspection. The selection made was based on the severity of the criticism, and the degree of consensus among the 7 experts as to the quality of the questions. For example, the 5 questions in the 2022 Specialist Mathematics and Mathematical Methods examinations that had been claimed to contain 'Major Mathematical Errors' were examined in detail. Where there was clear disagreement with the claims, or substantial difference in the judgements among the experts, it was deemed that the questions were of adequate quality. These questions were not investigated further.

Where several or all of the experts found causes for criticism similar to the original claims, the history of the questions was tracked as far as possible through the archived records of review and revision that are held by the VCAA.

The documentation held by the VCAA begins only at the point when the Examination Development Panel's draft of the examination paper is submitted to the VCAA for initial review. The Examination Development Panels' deliberations prior to this point are not held by the VCAA, and thus are inaccessible to the Independent Review.

Observations about the nature of the reviewers' comments and the investigation of any flaws detected in the VCAA documented processes were summarised in the spreadsheet at question level.

## Appendix 4

### Overview of examinations process at the school level

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Each school appoints one of its staff members to be the VCE Coordinator. This person works closely with the 'Chief Supervisor.' The VCE Coordinator manages each group of students before they enter the examination room. The Chief Supervisor, who is employed casually, administers the examination, including: organising the other Supervisors, checking that students have the correct materials for the examination, providing students the necessary instructions before the examinations begin, monitoring the time allocated for the examination, and collecting and packaging students' responses at the end of the examination.

The Chief Supervisor also has important functions to perform prior to the commencement of the examination period. Among these is checking that the school has received all the examination papers and other materials it will need for each examination to be held at the school. This is done by the Chief Supervisor and at least one other person, who open the boxes of examination papers and other materials and, following procedures specified by the VCAA, check each bundle of papers.

The experienced Chief Supervisors whom the Panel interviewed indicated that they had devised a method of using the secure storage facilities they were allocated at their school to organise the bundles of examination papers and associated materials into date and session order, so that on the day of an examination they could readily locate everything they needed for that examination.

## Appendix 5

### Multiple-choice items (questions) in the Mathematics examinations

The 4 Mathematics Study Designs – Specialist Mathematics, Mathematics Methods, General Mathematics (formerly Further Mathematics, renamed in 2023) and Foundational Mathematics – all include multiple-choice items. All of the multiple-choice items in these examinations have 5 options.

This contrasts with the:

- 4-option format of multiple-choice items in other VCE examinations
- common practice in the examinations of other Year 12 subjects, including Mathematics, across Australia
- typical practice in most highly regarded assessments using the multiple-choice format nationally and internationally: for example, the VCE's General Achievement Test, the Graduate Medical Schools Admissions Test (post-graduate candidature), the Programme for International Student Assessment (15-year-olds), and Trends in International Mathematics and Science Study (Grades 4, 8 and 12).

Why the VCE Mathematics examinations use 5 rather than 4 options is not clear. It is likely a historical decision that may have been intended to minimise the effect of guessing, which does produce some random measurement error. However, psychometric authorities suggest that the impact of guessing, when comparing 4 and 5 options, is marginal. Rodriguez's<sup>5</sup> meta-analysis of 27 studies yielding 56 independent trials found that moving from 5-option to 4-option items on average reduces item difficulty by 0.02, reduces item discrimination by 0.04 and reduces reliability by 0.035: in a nutshell, by small amounts in each case.

Wakefield<sup>6</sup> defined an option as functioning if more than 5% of the participants selected it. This well-accepted criterion, if applied to the 2022 Mathematics exams, yields the outcomes shown in the table below.

#### *Functioning options in multiple-choice items in the 2022 Mathematics exams*

	Number of multiple-choice items in paper	Number of multiple-choice items with 5 functioning options	% of items with 5 functioning options
2022 Further Mathematics exam 1	24	7	29%
2022 Mathematics Methods exam 2	20	4	20%
2022 Specialist Mathematics exam 2	20	8	40%

The table shows that well under half of the multiple-choice items in any of the three 2022 Mathematics exams included 5 functioning options: that is, there was little benefit in including 5 options rather than 4. Any minimal advantage has to be balanced against the

<sup>5</sup> Michael C. Rodriguez, 'Three Options Are Optimal for Multiple-Choice Items: A Meta-Analysis of 80 Years of Research'. *Educational Measurement*, Summer 2005. pp 3–13

<sup>6</sup> Wakefield, J. A. (1958). Does the fifth choice strengthen a test item? *Public Personnel Review*, 19, pp 44–48 (cited in Rodriguez, op.cit.)

increased amount of reading time for candidates, when having to choose between 5 rather than 4 options.

Moreover, writing an additional option for each multiple-choice item uses valuable test development time. An issue raised in many of the Panel's interviews was that time and resources for exam setting are insufficient. The time spent by the Examination Development Panel in creating a fifth – preponderantly non-functioning – option for every item could be replaced with time for more scrupulous and collaborative review of 4 options per item.

Based on this evidence and the practices followed in other reputable assessment programs, the Panel has recommended the reduction of the number of options in multiple-choice questions from 5 to 4 for all Mathematics exams.

It adds one note of caution: some consideration of the recent distribution of scores will be important just in case making the exam marginally easier in one or more of these subjects introduces any risks for downstream study score calculations.

## Appendix 6

### Study Specialist Reviewer and Examination Sitter Reviewer

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The VCAA typically provides Study Specialist Reviewers with a manual, 'VCE Examination Development Manual: Study Specialist Reviewer/Context Reviewer.' This is a 37-page document, most of which is related to administrative matters. Section 4 on Duties and Responsibilities states the following, which is relevant to the Chemistry examination:

'As a Study Specialist/Context Reviewer, you are required to:

- Read the examination paper carefully
- Provide responses to multiple-choice questions
- Write full responses for short-answer questions
- Complete the VCAA Study Specialist/Context Review form to confirm that you have checked/considered the following:
  - That theoretical and technical content of the examination questions is accurate
  - All questions are within the scope of the Study Design
  - There is alignment of terminology/concepts with VCE Study Design and related curriculum material as provided by Examination Development Manager
  - Use of clear language is accessible, up-to-date and avoids jargon
  - Questions are clear and unambiguous, and are expressed concisely
  - Avoids overlap of topics/content across sections
  - Has an appropriate overall level of difficulty
  - Questions do not provide content that may be used to answer other questions
  - For multiple-choice questions only one correct answer and distractors that are plausible/meaningful to students evaluated on their merits
  - For stimulus material, where relevant, inclusion of stimulus material only if specified in a question and/or relevant to a response; labelling is correct and there is consistency with text elsewhere
  - Minimises reading required to respond to question (unless 'reading comprehension' is being assessed.)

As part of their review a Study Specialist Reviewer is required to complete a form which contains 2 tables.

To complete Table 1 the reviewer is required to:

- Read the examination paper carefully
- Provide responses to multiple-choice questions
- Write full responses for short-answer questions
- Write dot points for extended-answer questions.

The reviewer then completes this table by recording an 'X' in either the S (satisfactory) column or in the NS (not satisfactory) column in relation to each of the aspects listed above ('Theoretical and technical content of the examination questions is accurate', 'All questions are within the scope of the Study Design', etc.) If they consider any of the aspects to be 'Not Satisfactory' they need to note the section and question number in the 'Reference' column.

Table 2 has two columns. The first column, 'Study Specialist Reviewer's Comments' is where the reviewer is able to provide further detailed feedback on the examination, including points raised in Table 1, and any other issues that need to be addressed. The second column is for the

response to these comments from the Examination Development Panel (i.e. the question writers).

If the Examination Development Panel Chair agrees with the reviewer's suggested changes this needs to be indicated on the form and the changes marked up using tracked changes to the Word version of the examination paper. If changes are not made, the Examination Development Panel must provide a brief reason indicating why the suggestions were not accepted.

Another important review is conducted by the 'Examination Sitter Reviewer.' While the Study Specialist reviews are conducted in March or April, the Examination Sitter review is conducted in July when the examination paper is much closer to being finalised.<sup>7</sup>

The role of the Examination Sitter Reviewer is to:

- Complete the examination, considering it from the point of view of an average ability student
- Respond to all questions, including multiple-choice items
- Provide critical feedback.

The Examination Sitter Reviewer is required to:

- Complete the examination paper by writing answers to short-answer questions and points/plans for extended-answer questions, and providing answers to multiple-choice questions.
- Complete the relevant VCAA review form indicating that they have considered 8 aspects relating to 'content' and 9 aspects relating to 'clarity'.
- 'Note if the examination **does not** comply with the following:
  - Examination Specifications including correct format for sections, item types, total marks and their distribution
  - Only included prescribed content and terminology from VCE Study Design
  - Assesses a representative sample of the prescribed content
  - There is factual accuracy of theoretical and technical content
  - Questions are not the same as, or too similar to, any previous examinations.'

As part of their task the Examination Sitter Reviewer completes the 'Examination Sitter Review' form which contains 2 tables.

Table 1, which is set out in a similar manner to Table 1 in the Study Specialist Review form, lists all the points to be reviewed with columns for a 'Satisfactory' and 'Not Satisfactory' response.

Table 2, again like Study Specialist Review form, has a column for the Examination Sitter Reviewer to comment on any points from Table 1 that were considered Not Satisfactory, list any other points that need to be addressed and provide any (other) feedback they would like to provide to the Examination Development Panel.

The Examination Development Panel must respond to every comment made, either accepting the comments and making any changes it deems necessary or providing a reason as to why the suggestion was not accepted.

Both the Study Specialist reviews and the Examination Sitter review, if done thoroughly, are significant exercises. They have the potential to improve and refine the contents of the examination papers.

<sup>7</sup> Based on the 2023 'Indicative examination production timelines for Victorian Timetable' provided by the VCAA.