Mathematics General 2 and Mathematics General 1
Stage 6

Draft Writing Brief

October 2015
1. Introduction

In 2014, the Board of Studies, Teaching and Educational Standards NSW (BOSTES) commenced a review of NSW senior secondary syllabuses for English, Mathematics, Science and History learning areas to determine directions for the incorporation of senior secondary Australian curriculum. BOSTES conducted consultation in August and September 2014 on proposed directions outlined in the *NSW Senior Secondary Review & Evaluation: English, Mathematics, Science and History* document.

The broad directions for each learning area, developed following consultation, were endorsed by BOSTES in December 2014 and are available in Section 2 of this Draft Writing Brief.

The development of the *Mathematics General 2 and Mathematics General 1 Stage 6 Draft Writing Brief* takes account of the broad directions.

The Draft Writing Brief:

- proposes the nature and number of courses within each learning area
- proposes options for course structures
- provides information about how Australian curriculum content may be modified, reordered and supplemented for inclusion in the draft syllabus.

Following consultation on the Draft Writing Brief, a Consultation Report, detailing feedback received and the key matters arising from consultation will be published. The BOSTES endorsed final Writing Brief will inform the directions for draft syllabus development.

The draft syllabuses for Mathematics General 2 and Mathematics General 1 Stage 6 will be available for consultation during 2016. It will include the elements of a syllabus and Australian curriculum content identified with codes, learning across the curriculum content identified by icons, further information about meeting the diversity of learners, and internal and external assessment.


Diversity of learners

NSW senior secondary syllabuses will be inclusive of the learning needs of all students. The draft syllabuses will be designed to accommodate teaching approaches that support student diversity under the sections ‘Students with special education needs’, ‘Gifted and talented students’ and ‘Students learning English as an additional language or dialect (EAL/D)’.

For example:

**Special education needs**

All students with special education needs are entitled to participate in and progress through the curriculum. Some students may require additional support or adjustments to teaching, learning and assessment activities. Adjustments are measures or actions taken in relation to teaching, learning and assessment that enable a student to access syllabus outcomes and content and demonstrate achievement of outcomes.
Most students with special education needs will undertake regular Board Developed courses and/or Board Endorsed courses. Students with special education needs can access Years 11 and 12 outcomes and content in a range of ways. They should choose the most appropriate courses for the HSC in keeping with their goals, interests and learning needs.

Students may engage with:

- syllabus outcomes and content with adjustments to teaching, learning and/or assessment activities
- selected outcomes and content appropriate to their learning needs
- selected Years 11–12 Life Skills outcomes and content appropriate to their learning needs.

Related Life Skills outcomes and content will be included and will align with the Years 11 and 12 content in the Mathematics General 1 Stage 6 Draft Syllabus.
2. **Broad directions**

The following broad directions for syllabus development have been informed through consultation with stakeholders. These broad directions will guide the development of the NSW Mathematics Stage 6 syllabuses.

1. In the revision of the courses, consideration be given to how the courses provide flexibility to meet the needs of all students.

2. The content prescribed for each of the revised courses:
   a. be carefully monitored to reflect the indicative time of the course. In the case of the revised Mathematics General courses and the revised Mathematics (‘2 Unit’) course, there should be a net reduction in content when compared to the respective current courses
   b. be reviewed for relevance and opportunities for depth of learning.

3. The status of the revised Mathematics General 1 course be reviewed and consideration be given to:
   a. making the course a Board Developed course with an optional HSC examination
   b. developing a separate Preliminary course for the revised Mathematics General 1 course.

4. The nested structure of the current Mathematics (‘2 Unit’), Mathematics Extension 1 and Mathematics Extension 2 courses be retained for the respective revised courses.

5. The inclusion of additional study of statistics be considered, while addressing implications in relation to the extent of relevant teacher expertise, professional development, future pathways of students, school mathematics staffing, and school timetabling.

6. In reviewing the content of the calculus-based courses, the appropriateness and relevance of the applications within the courses be explored, with a view to ensuring that they are contemporary and meet the needs of students.

7. The technology available for use by candidates in the mathematics HSC examinations be clarified in the development of the Draft Writing Briefs.

8. The appropriateness of the current structures and durations of the HSC examinations for the senior mathematics courses be reviewed, with particular emphasis on the examination of ‘2 Unit’-only candidates.

9. An appropriate Formula sheet be provided for each HSC mathematics examination.

10. In the development of course structures and HSC examinations for the revised Mathematics (‘2 Unit’) and Mathematics General 2 courses, consideration be given to student movement between the courses and the need to make meaningful comparisons of student performance.

11. The rationale, outcomes and content of the Mathematics Life Skills course be reviewed to better meet the needs of the students for whom the course is intended, as well as to provide an appropriate progression from Mathematics Life Skills Stage 5 outcomes and content and alignment with the regular mathematics Stage 6 courses where appropriate.

12. In the naming of the revised mathematics Stage 6 courses, consideration be given to the nomenclature used for English Stage 6 courses.
Australian curriculum

BOSTES began its syllabus development process for Stage 6 English, Mathematics, Science and History in 2014. This follows state and territory education Ministers’ endorsement of senior secondary Australian curriculum in these learning areas as the agreed and common base for development of state and territory senior secondary courses. It was also agreed that states and territories would have the flexibility to integrate the approved senior secondary Australian curriculum as appropriate. The development of Draft Writing Briefs will determine how Australian curriculum content can be modified, reordered and supplemented in each learning area, while remaining compatible with the NSW senior years assessment and examinations structures.
3. **Rationale**

The rationale describes the distinctive nature of the subject and outlines its relationship to the contemporary world and current practice. It explains the place and purpose of the subject in the curriculum:

- why the subject exists
- what the theoretical underpinnings are
- what makes the subject distinctive
- why students would study the subject
- how it contributes to the purpose of the Stage 6 curriculum.

**Proposed rationale for Mathematics General 2 and Mathematics General 1 Stage 6**

Mathematics is deeply embedded in modern society. From the numeracy skills required to manage personal finances, to devices and scales for measuring something of interest, to leading-edge technologies in the sciences and engineering, Mathematics provides the framework for interpreting, analysing and predicting, and the tools for effective participation in an increasingly complex society.

The need to interpret the large volumes of data made available through technology, draws on skills in logical thought and skills in checking claims and assumptions in a systematic way. Mathematics is the appropriate training ground for the development of these skills. The thinking required to further enhance the power and usefulness of technology in real-world applications requires advanced mathematical training. The rapid advances in technology experienced in recent years have driven, and been driven by, advances in the discipline of mathematics.

The development of mathematics throughout history has been catalysed by its utility in explaining real-world phenomena and its inherent beauty. In this way, the discipline has continued to evolve through a process of observation, conjecture, proof and application.

Effective participation in a changing society is enhanced by the development of mathematical competence in contextualised problem-solving. Experience in such problem-solving is gained by students gathering, analysing and interpreting mathematical information, and applying mathematics to model situations.

The opportunities for creative thinking, communication and contextualised problem-solving within the Mathematics General 2 and Mathematics General 1 courses assist students in finding solutions to a broad range of problems encountered in life, beyond secondary schooling.
The purpose of the courses is to provide an appropriate mathematical background for students who wish to enter occupations that require the use of a variety of mathematical and statistical techniques. As well as introducing some new mathematical content, the various Focus Studies within the courses give students the opportunity to apply, and develop further, the knowledge, skills and understanding initially developed in the various Strands: Financial Mathematics, Data and Statistics, Measurement, Probability, and Algebra and Modelling. Through the Focus Studies, students develop the capacity to integrate their knowledge, skills and understanding across the Strands, in contemporary contexts chosen for their ongoing relevance to the students’ everyday lives and likely vocational pathways.

The Mathematics General 2 course has been constructed on the assumption that students have studied the content and achieved the outcomes of the *Mathematics Years 7–10 Syllabus* up to and including the content and outcomes of Stage 5.1. Where possible, it is recommended that they experience at least some of the Stage 5.2 content, particularly the Patterns and Algebra topics and Trigonometry, if not all of the content. The course provides students with the opportunity to develop an understanding of, and competence in, further aspects of mathematics through a large variety of real-world applications for a range of concurrent HSC studies such as in the life sciences, the humanities and business studies. The course also provides a strong foundation for vocational pathways, in the workforce and in further training, and for university courses in the humanities, nursing and paramedical sciences.

The Mathematics General 1 course has been constructed on the assumption that students have studied the content of the *Mathematics Years 7–10 Syllabus* up to and including the content and outcomes of Stage 5.1. The course provides students with the opportunity to develop an understanding of, and competence in, further aspects of mathematics through a large variety of real-world applications for concurrent HSC studies, such as in vocational education and training courses, other practical-oriented courses and some humanities courses, and for vocational pathways, in the workforce or in further training.
4. **Aim**

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In NSW syllabuses, the aim provides a succinct statement of the overall purpose of the syllabus. It indicates the general educational benefits for students from programs based on the syllabus.

The aim, objectives, outcomes and content of a syllabus are clearly linked.

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**Proposed aim for Mathematics General 2 and Mathematics General 1 Stage 6**

The Mathematics General 2 and Mathematics General 1 courses are designed to promote the development of knowledge, skills and understanding in areas of mathematics that have direct application to the broad range of human activity, including a range of post-school pathways requiring a variety of mathematical and statistical techniques.

Students will learn to use a range of techniques and tools, including appropriate technologies, in order to develop solutions to a wide variety of problems relating to their present and future needs and aspirations.
5. Objectives

In NSW syllabuses, objectives provide specific statements of the intention of a syllabus. They amplify the aim and provide direction to teachers on the teaching and learning process emerging from the syllabus. They define, in broad terms, the knowledge, understanding, skills, values and attitudes to be developed through study in the subject. They act as organisers for the intended outcomes.

Proposed objectives for Mathematics General 2 and Mathematics General 1 Stage 6

Knowledge, skills and understanding

Students:

- apply reasoning, and the use of appropriate language, in the evaluation and construction of arguments and the interpretation and use of models based on mathematical and statistical concepts
- use concepts and apply techniques to the solution of problems in algebra and modelling, measurement, financial mathematics, data and statistics, and probability
- use mathematical skills and techniques, aided by appropriate technology, to organise information and interpret practical situations
- interpret and communicate mathematics in a variety of written and verbal forms, including diagrams and statistical graphs.

Values and attitudes

Students:

- appreciate of the relevance of mathematics.
6. Outcomes

In NSW syllabuses, outcomes provide detail about what students are expected to achieve at the end of each Stage in relation to the objectives. They indicate the knowledge, understanding and skills expected to be gained by most students as a result of effective teaching and learning. They are derived from the objectives of the syllabus.

Outcomes for Mathematics General 2 and Mathematics General 1 Stage 6

It is not envisaged that the Mathematics General 2 course (including its outcomes) will be significantly different from the current Mathematics General 2 course, even allowing for possible common content with the Mathematics Advanced course. Similarly, it is not envisaged that the HSC Mathematics General 1 course will be significantly different from the current HSC Mathematics General 1 course. The current General courses were only examined for the first time in 2014, and teachers have invested significant time and resources into their teaching.

However, the courses will be examined for areas where the use of updated technology would be more appropriate than pen-and-paper methods, and the possible use of Australian curriculum content will also be explored (see page 14).

As such, it is not envisaged that current course outcomes will change significantly.

The exception is with the possible inclusion of a separate Preliminary Mathematics General 1 course, which would be written to provide a continuation of the Mathematics continuum of learning from the end of Stage 5.1.
7. Course structure and options

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The following provides an outline of some proposed Preliminary and HSC course structures for the Mathematics General 2 and Mathematics General 1 Stage 6 syllabuses with indicative course hours and the arrangement of course content, along with outlining relationships between specific components and between core and options.

Proposed options for course structure for Mathematics General 2 and Mathematics General 1 Stage 6

It is not envisaged that the structure for the Mathematics General courses will be significantly different from the current Mathematics General courses, as the courses were first implemented with the Preliminary Year in 2013.

However, the consultation process will provide opportunity to comment on the proposed structure and to inform the final structure.
Matters for consideration

Option 1 – changes to examination structures and BDC/CEC status of current HSC Mathematics General 1 course

<table>
<thead>
<tr>
<th>Proposed Preliminary courses</th>
<th>Changes to current course structure</th>
<th>Change of BDC/CEC status?</th>
<th>Likely extent/nature of content revision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preliminary Mathematics General (BDC) (common Preliminary course for HSC Mathematics General 2 and HSC Mathematics General 1)</td>
<td>Nil</td>
<td>No</td>
<td>Minor*</td>
</tr>
<tr>
<td>Preliminary Mathematics (BDC) (currently ‘Preliminary Mathematics (‘2 Unit’)’)</td>
<td></td>
<td>No</td>
<td>Major</td>
</tr>
<tr>
<td>Preliminary Mathematics Extension (BDC)</td>
<td></td>
<td>No</td>
<td>Major</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Proposed HSC courses</th>
<th>Changes to current course structure</th>
<th>Change of BDC/CEC status?</th>
<th>Likely extent/nature of content revision</th>
<th>Proposed revised examination specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>HSC Mathematics General 2 (BDC)</td>
<td></td>
<td>No</td>
<td>Minor*</td>
<td></td>
</tr>
<tr>
<td>HSC Mathematics General 1 (BDC) (currently HSC Mathematics General 1 (CEC))</td>
<td></td>
<td>Yes</td>
<td>Minor*</td>
<td>Optional HSC examination</td>
</tr>
<tr>
<td>HSC Mathematics (BDC) (currently HSC Mathematics (‘2 Unit’))</td>
<td>Nil</td>
<td>No</td>
<td>Major</td>
<td>The last two examination questions (approx 30 marks) will be chosen according to whether a student is a Mathematics or Extension 1 candidate</td>
</tr>
<tr>
<td>HSC Mathematics Extension 1 (BDC)</td>
<td></td>
<td>No</td>
<td>Major</td>
<td></td>
</tr>
<tr>
<td>HSC Mathematics Extension 2 (BDC)</td>
<td></td>
<td>No</td>
<td>Major</td>
<td></td>
</tr>
</tbody>
</table>

* A greater level of revision would be considered if required to align with agreed changes to the Mathematics (‘2 Unit’) course.

^ The two questions for Extension 1 students at the end of the paper would be similar in nature and difficulty to questions at the end of the current Mathematics (‘2 Unit’) paper, while the two questions for Mathematics students at the end of the paper would be more routine in nature and, therefore, less difficult than those for Extension 1 students.
### Option 2 – changes to both course and examination structures and BDC/CEC status of current HSC Mathematics General 1 course

<table>
<thead>
<tr>
<th>Proposed Preliminary courses</th>
<th>Changes to current course structure</th>
<th>Change of BDC/CEC status?</th>
<th>Likely extent/nature of content revision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preliminary Mathematics General 2 (BDC) (revised Preliminary Mathematics General)</td>
<td>Separate Preliminary courses replace (common) Preliminary Mathematics General course</td>
<td>No</td>
<td>Moderate revision. The course will have significant overlap with the Mathematics course to assist student movement and to obtain appropriate course relativity in ATAR scaling. Overlap would include rates of change (without getting to the stage of formally calculating derivatives) for stronger tertiary preparation.</td>
</tr>
<tr>
<td>Preliminary Mathematics General 1 (BDC) (revised Preliminary Mathematics General)</td>
<td></td>
<td>No</td>
<td>A new course that will build on student knowledge and skills from Stage 5.1.</td>
</tr>
<tr>
<td>Preliminary Mathematics (BDC) (currently ‘Preliminary Mathematics (‘2 Unit’)’)</td>
<td>No</td>
<td>No</td>
<td>Major revision, including revision of content to provide closer links between concept formation, practice and application/modelling. The course will have significant overlap with the Mathematics General 2 course to assist student movement and to obtain appropriate course relativity in ATAR scaling.</td>
</tr>
<tr>
<td>Preliminary Mathematics Extension (BDC)</td>
<td>No</td>
<td>No</td>
<td>Major revision.</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Proposed HSC courses</th>
<th>Changes to current course structure</th>
<th>Change of BDC/CEC status?</th>
<th>Nature of content revision</th>
<th>Proposed revised examination specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>HSC Mathematics General 2 (BDC)</td>
<td>No</td>
<td>No</td>
<td>Moderate revision. The course will have significant overlap with the Mathematics course to assist student movement and to obtain appropriate course relativity in ATAR scaling. Overlap would include rates of change (without getting to the stage of formally calculating derivatives) for stronger tertiary preparation.</td>
<td>The examination will have some questions in common with the Mathematics examination so UAC can obtain appropriate course relativity in ATAR scaling.</td>
</tr>
<tr>
<td>HSC Mathematics General 1 (BDC) (currently HSC Mathematics General 1 (CEC))</td>
<td>No</td>
<td>Yes</td>
<td>Moderate revision. New course will build on student knowledge and skills from Stage 5.1.</td>
<td>Optional HSC examination</td>
</tr>
<tr>
<td>HSC Mathematics (BDC) (currently HSC Mathematics ('2 Unit'))</td>
<td>No</td>
<td>No</td>
<td>Major revision, including revision of content, to provide closer links between concept formation, practice and application/modelling. The course will have significant overlap with the Mathematics General 2 course, as above.</td>
<td>The examination will have some questions in common with the Mathematics General 2 examination, as above. The last two examination questions (approx 30 marks) will be chosen according to whether a student is a Mathematics or Extension 1 candidate^</td>
</tr>
<tr>
<td>HSC Mathematics Extension 1 (BDC)</td>
<td>No</td>
<td>No</td>
<td>Major revision</td>
<td></td>
</tr>
<tr>
<td>HSC Mathematics Extension 2 (BDC)</td>
<td>No</td>
<td>No</td>
<td>Major revision</td>
<td></td>
</tr>
</tbody>
</table>

^ The two questions for Extension 1 students at the end of the paper would be similar in nature and difficulty to questions at the end of the current Mathematics ('2 Unit') paper, while the two questions for Mathematics students at the end of the paper would be more routine in nature and, therefore, less difficult than those for Extension 1 students.
Course content
As indicated in the table above:

- **under Option 1:**
  - there would be minor revision only of the current Preliminary Mathematics General, HSC Mathematics General 2 and HSC Mathematics General 1 courses
  - a greater level of revision would be considered, if required, to align with agreed changes to the Mathematics ('2 Unit') course.

- **under Option 2:**
  - there would be moderate revision of the current Preliminary Mathematics General course (to become Preliminary Mathematics General 2), and the HSC Mathematics General 2 and HSC Mathematics General 1 courses. The new Preliminary Mathematics General 2 and HSC Mathematics General 2 courses will have significant overlap with the Mathematics course to assist student movement and to obtain appropriate course relativity in ATAR scaling. This overlap would include rates of change (without getting to the stage of formally calculating derivatives) and could include aspects of such topic areas as financial mathematics, statistics, probability, algebra and modelling, and trigonometry
  - there would be a new Preliminary course (Preliminary Mathematics General 1) that, together with the revised HSC Mathematics General 1 course, will build on student knowledge and skills from Stage 5.1.

In exploring the possible use of Australian curriculum content for the updating and improvement of the Mathematics General courses (and the establishment of the new Preliminary Mathematics General 1 course), material from the topics of the Australian senior secondary curriculum subjects Essential Mathematics and General Mathematics would be considered. The courses comprise the following topics:

**Essential Mathematics:** Calculations, percentages and rates; Measurement; Algebra; Graphs; Representing and comparing data; Percentages; Rates and ratios; Time and motion; Measurement; Scales, plans and models; Graphs; Data collection; Probability and relative frequencies; Earth geometry and time zones; Loans and compound interest

**General Mathematics:** Consumer arithmetic; Algebra and matrices; Shape and measurement; Univariate data analysis and the statistical investigation process; Applications of trigonometry; Linear equations and their graphs; Bivariate data analysis; Growth and decay in sequences; Graphs and networks; Time series analysis; Loans, investments and annuities; Networks and decision mathematics.
Use of technology

(a) In learning and teaching, and school-based assessment
The appropriateness, viability and level of use of different types of technology in the learning and teaching of courses within the Mathematics key learning area are decisions for students, teachers and schools.

The final syllabuses will provide a range of opportunities for the use of contemporary mathematics technologies. This will include opportunities to utilise various types of calculators (including those that perform algebraic calculations), a wide variety of software packages, and apps for graphing functions, performing measurement, financial and statistical calculations and explorations. Sophisticated applications such as Wolfram Alpha provide opportunities for students to analyse answers and to backward-map in obtaining solutions to problems.

(b) In the HSC examinations
It has been previously agreed that the technology available for use by candidates in Mathematics HSC examinations be clarified in relevant Draft Writing Briefs.

Accordingly, it is proposed that in HSC examinations for these courses, candidates be permitted to use only devices manufactured to meet a clear set of Board-prescribed functions and capabilities. These functions and capabilities will be consistent with and support the knowledge and skills that students should be able to demonstrate after completing the Mathematics General 2 and Mathematics General 1 courses. For this reason, the functions and capabilities will be determined in parallel with the development of the content for the courses in the Syllabus Development Phase.

Naming the courses
In the revision of the suite of Mathematics Stage 6 courses, it is proposed that the nomenclature for the English Stage 6 courses\(^1\) be used in the naming of the courses.

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\(^1\) Mathematics General 1 \(\rightarrow\) Mathematics Studies
Mathematics General 2 \(\rightarrow\) Mathematics Standard
Mathematics (‘2 Unit’) \(\rightarrow\) Mathematics Advanced
Mathematics Extension 1 \(\rightarrow\) Mathematics Extension 1
Mathematics Extension 2 \(\rightarrow\) Mathematics Extension 2
8. Learning across the curriculum

for your information

NSW syllabuses provide a context within which to develop core skills, knowledge and understanding considered essential for the acquisition of effective, higher-order thinking skills that underpin successful participation in further education, work and everyday life including problem-solving, collaboration, self-management, communication and information technology skills.

BOSTES has described learning across the curriculum areas that are to be included in syllabuses. In Stage 6 syllabuses, the identified areas will be embedded in the descriptions of content and identified by icons. Learning across the curriculum content, including the cross-curriculum priorities and general capabilities, assists students to achieve the broad learning outcomes defined in the BOSTES Statement of Equity Principles, the Melbourne Declaration on Educational Goals for Young Australians (December 2008) and in the Australian Government’s Core Skills for Work Developmental Framework (2013).

Knowledge, understanding, skills, values and attitudes derived from the learning across the curriculum areas will be included in BOSTES syllabuses, while ensuring that subject integrity is maintained.

Cross-curriculum priorities enable students to develop understanding about and address the contemporary issues they face.

The cross-curriculum priorities are:

- Aboriginal and Torres Strait Islander histories and cultures
- Asia and Australia’s engagement with Asia
- Sustainability

General capabilities encompass the knowledge, skills, attitudes and behaviours to assist students to live and work successfully in the 21st century.

The general capabilities are:

- Critical and creative thinking
- Ethical understanding
- Information and communication technology capability
- Intercultural understanding
- Literacy
- Numeracy
- Personal and social capability

BOSTES’ syllabuses include other areas identified as important learning for all students:

- Civics and citizenship
- Difference and diversity
- Work and enterprise
9. **Glossary**

For your information

A glossary will be developed for the draft Mathematics General 2 and Mathematics General 1 Stage 6 syllabuses which explains terms that will assist teachers in the interpretation of the subject.
10. Assessment and reporting

BOSTES continues to promote a standards-referenced approach to assessing and reporting student achievement in NSW, and the importance of assessment for, of and as learning as essential components of quality teaching and learning.

Information on assessment and reporting for Preliminary and HSC courses will be developed for the draft syllabus consultation in 2016.

The information will include:

- suggested components and weightings for school-based assessment of the Preliminary course
- mandatory components and weightings for school-based assessment of the HSC course
- HSC examination specifications which describe the format of the HSC examination program for Mathematics General 2 and Mathematics General 1.

Advice about assessment in relation to the Mathematics General 2 and Mathematics General syllabuses is contained in Assessment and Reporting in Mathematics General 2 Stage 6. This document provides general advice on assessment in Stage 6 as well as the specific requirements for the Preliminary and HSC courses.

Consultation on assessment and reporting during the Draft Writing Brief phase will focus on providing feedback about assessment and reporting practices in schools, school-based assessment requirements, the use of technology in assessment, and external assessment programs.