Mathematics

Stage 6

Non-calculus-based Courses

Draft Writing Brief

2007

Responses to the Mathematics Stage 6 Non-calculus-based Courses Draft Writing Brief can be made on the associated survey form as follows:

a) written response to:
   Mathematics Curriculum Support Officer
   Office of the Board of Studies NSW
   GPO Box 5300
   SYDNEY NSW 2001

b) email response to david.howe@bos.nsw.edu.au

c) online response through the Board's website at:
   www.boardofstudies.nsw.edu.au

Consultation period: 1 May 2007 to 1 June 2007

Note: A copy of this document can also be found on the Board's website at
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1 Draft Writing Brief
1 Draft Writing Brief

Preparation of a writing brief takes place in Phase 2 of the Board of Studies’ syllabus development process (see page 8).

1.1 Purpose

This draft writing brief provides the proposed ‘blueprint’ for the new Mathematics Stage 6 non-calculus-based syllabus: Mathematics General 1/Mathematics General 2 Syllabus. (A further draft writing brief has been developed for the new Mathematics Stage 6 calculus-based syllabuses and is also available for consultation.)

Following consultation, the writing brief will be finalised to provide the detailed blueprint for the development of the non-calculus-based syllabus, against which the final syllabus will be judged.

The final syllabus document will be developed during Phase 3 of the syllabus development process.

1.2 Structure

The draft writing brief is structured according to the elements of the courses (see Section 5).

The draft writing brief covers the Mathematics Stage 6 non-calculus-based courses: Mathematics General 1 and Mathematics General 2. Responses to the draft writing brief could focus on one or both of these courses.

1.3 For your information

Sections 1 to 3 of this document provide background reading on the development of the draft writing brief. Sections 4, 5 and 6 provide details of the structure of the Mathematics Stage 6 courses, the place of the courses in the K–12 curriculum, and proposed elements of the Mathematics Stage 6 non-calculus-based courses. In Sections 5, 6, 7 and 8 the following icons are used to assist your reading and response:

<table>
<thead>
<tr>
<th>i</th>
<th>for your information</th>
<th>The information following this icon is general information, in the form of definitions or other items, that assists in reading or understanding the draft writing brief.</th>
</tr>
</thead>
<tbody>
<tr>
<td>💬</td>
<td>consult</td>
<td>The material following this icon is material on which responses and views are sought.</td>
</tr>
</tbody>
</table>

1.4 Audience

Teachers and the wider community are invited to read the draft writing brief and to comment on the directions it provides to the syllabus writers.
1.5 Consultation

There will be several methods of consultation in relation to the writing brief:
• teacher focus groups will be conducted
• meetings and discussions will be held with key groups
• a survey will be published with the draft writing brief (in hard copy and on the Board’s
  website) to enable responses from schools and interest groups.

1.6 Matters for consideration

‘Matters for Consideration’ contains questions on a number of issues. Please use your
responses to these questions to assist you when completing the survey that accompanies the
draft writing brief.

1.7 How to respond to the draft writing brief

Survey for the Mathematics Stage 6 Non-calculus-based Courses Draft Writing Brief

The purpose of the survey is to obtain detailed comments from individuals and systems/
organisations on the Mathematics Stage 6 Non-calculus-based Courses Draft Writing Brief.

Please comment on both the strengths and the weaknesses of the draft writing brief.

Comments made by you and others will be taken into account when the draft writing brief is
amended.

The final version of the writing brief will provide directions to writers of the syllabus for the
Mathematics Stage 6 non-calculus-based courses.

Schools, teachers and other interested individuals and organisations can respond to the
consultation document on the associated survey form as follows:

(1) written response to:

Mathematics Curriculum Support Officer
Office of the Board of Studies NSW
GPO Box 5300
SYDNEY 2001

OR

(2) email response to david.howe@bos.nsw.edu.au

OR

(3) online response through the Board’s website at:

www.boardofstudies.nsw.edu.au

The consultation period is 1 May 2007 to 1 June 2007.
2 Syllabus Development
2 Syllabus Development

2.1 Mathematics Stage 6 syllabus development process

Syllabuses in NSW are developed in accordance with the Board of Studies’ syllabus development process. This process is detailed in the Board’s Syllabus Development Handbook (July 2006), which is available on the Board’s website at

www.boardofstudies.nsw.edu.au/manuals/#syl_develop_process

Syllabus Review, the first phase of the development of new Mathematics Stage 6 syllabuses, is now complete. This phase involved several key data-collection strategies, including oral and written submissions, a symposium, a survey of a sample of schools, and a literature and curriculum review.

SYLLABUS REVIEW
Phase 1
March 2006–December 2006

This involved:
• consultation with teachers and key groups regarding the existing syllabuses and the general directions for syllabus development
• research, including a review of literature and practice in Australia and overseas
• development of the project plan
• information to schools about the syllabus development
• endorsement by the Board of the broad directions for syllabus development.

WRITING BRIEF DEVELOPMENT
Phase 2

This involves:
• writing teams developing the writing briefs from analysis of research and analysis of consultation input
• distribution of the draft writing briefs (in hard copy and on the Board’s website) to schools and interest groups for comment
• revision of the draft writing briefs in response to consultation input
• checking out the modifications with key interest groups
• endorsement of the writing briefs by the Board.

SYLLABUS DEVELOPMENT
Phase 3
August 2007–November 2008

This will involve:
• preparation of the draft syllabus packages developed from the writing briefs
• the distribution of the draft packages for (in hard copy and on the Board’s website) to schools and interest groups for comment
• revision of the draft syllabus packages in response to consultation input
• endorsement of the syllabus packages by the Board and approval of the syllabuses by the Minister
• handover of the syllabus packages to school systems and distribution to schools.

2009

* Note: The Board’s Syllabus Development Process provides for the new syllabuses to be in schools for at least one year prior to implementation for familiarisation and programming.

IMPLEMENTATION
Phase 4
2010

The new syllabuses will be implemented in Year 11 in 2010 and Year 12 in 2011.

During implementation of the syllabuses the Board will:
• collect, collate and analyse data on the use of the syllabuses
• identify and record issues that need to be taken into account in subsequent syllabus revision.
2.2 Timeline for the development of the syllabus packages for the Mathematics Stage 6 courses

The syllabus packages for the Mathematics Stage 6 courses will be developed in accordance with:

- the Board’s *Syllabus Development Handbook*, a copy of which is available on the Board’s website at: www.boardofstudies.nsw.edu.au/manuals/#syl_develop_process
- the syllabus development plan for the Mathematics Stage 6 syllabuses approved by the Board of Studies on 14 December 2004, details of which are set out below. Details of the timeline were published in *Board Bulletin* Vol. 15, No. 2, 2006, and in subsequent bulletins.

<table>
<thead>
<tr>
<th>Steps in the syllabus development process</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Syllabus Review</td>
<td></td>
</tr>
<tr>
<td>• Oral submissions</td>
<td>24–25 May 2006</td>
</tr>
<tr>
<td>• Written submissions</td>
<td>closed 30 June 2006</td>
</tr>
<tr>
<td>• Symposium</td>
<td>19 August 2006</td>
</tr>
<tr>
<td>• Surveys of a sample of schools</td>
<td>closed 18 September 2006</td>
</tr>
<tr>
<td>• Literature and curriculum review</td>
<td>August–September 2006</td>
</tr>
<tr>
<td>Writing Brief Development</td>
<td></td>
</tr>
<tr>
<td>• Preparation of draft writing briefs and surveys</td>
<td>January 2007 – April 2007</td>
</tr>
<tr>
<td>• Consultation (5 weeks)</td>
<td>1 May 2007 – 1 June 2007</td>
</tr>
<tr>
<td>• Development of consultation reports and revision of draft writing briefs</td>
<td>June 2007 – July 2007</td>
</tr>
<tr>
<td>Syllabus Development</td>
<td></td>
</tr>
<tr>
<td>• Development of draft syllabuses and surveys</td>
<td>August 2007 – April 2008</td>
</tr>
<tr>
<td>• Consultation (8 weeks)</td>
<td>5 May 2008 – 27 June 2008</td>
</tr>
<tr>
<td>• Development of consultation reports and revision of draft syllabuses</td>
<td>July 2008 – October 2008</td>
</tr>
<tr>
<td>• Distribution of syllabuses</td>
<td>November 2008</td>
</tr>
<tr>
<td>• Development and distribution of specimen examination papers and marking guidelines</td>
<td>(Date to be determined)</td>
</tr>
</tbody>
</table>

*Note: Support Materials*

The nature of proposed support materials is presented in section 7.
3 Background Information
3 Background Information

3.1 Evaluation and review of the current Stage 6 Mathematics syllabuses

The current Mathematics 2/3 Unit Syllabus – Years 11–12 was introduced in 1983, while the current 4 Unit Mathematics Syllabus was introduced in 1980, with some amendment in 1989. The current General Mathematics course was introduced in 2000 as part of the New Higher School Certificate.

The Board of Studies initiated the revision of the suite of Stage 6 Mathematics courses, following the completion of new K–6 and Years 7–10 Mathematics syllabuses in 2002, to ensure an up-to-date and cohesive K–12 continuum of mathematics teaching and learning in New South Wales that meets the needs of the full range of students.

In 1998, the Board undertook the evaluation of all existing Higher School Certificate (HSC) courses against the specific criteria of the Government’s White Paper Securing Their Future (August 1997). For Stage 6 Mathematics, two evaluation reports were developed: Mathematics 2/3/4 Unit and Non-Calculus-Based Mathematics (incorporates Mathematics in Society and Mathematics in Practice).

Following the release of these reports, the Board endorsed the development of a single, non-calculus-based course (which became General Mathematics) to replace Mathematics in Society and Mathematics in Practice and the maintenance of the 2, 3 and 4 Unit courses for the immediate future, with ‘minimal change to existing content’. The Board also agreed to ‘a longer-term, comprehensive review of the present 2/3/4 Unit courses by an appropriately constituted expert committee’.

The General Mathematics syllabus was released to schools in June 1999, with the study of the Preliminary course undertaken for the first time in 2000, and the first HSC examination undertaken in 2001. As an interim arrangement for the introductory years of the new HSC, the Board of Studies maintained the course content, internal assessment arrangements and examination specifications of the 2, 3 and 4 Unit Mathematics courses from the previous HSC. The new HSC standards-referencing procedures that were introduced for all new HSC Board-developed courses were also put in place for these Mathematics courses, which were renamed Mathematics, Mathematics Extension 1 and Mathematics Extension 2 respectively.

In July 2000, the NSW Government announced the review of Years 7–10 Mathematics following its 1999 commitment in Literacy and Numeracy Plan: Focusing on the basics that ‘A new Years 7–10 Mathematics syllabus will be developed to ensure it provides students with the skills, knowledge and understanding required and appropriately prepares students for the New School Certificate and the New Higher School Certificate’. At about this time, the Board of Studies announced the review and development of the K–6 Mathematics syllabus.

The review and development of K–10 Mathematics consequently became the focus of Mathematics curriculum development in 2000–2002, with its completion a necessary prerequisite to the ‘longer-term, comprehensive review of the present 2/3/4 Unit courses’ agreed to by the Board in 1998.

With the completion of the new K–6 and Years 7–10 syllabuses at the end of 2002, a plan was established for the review and development of the Stage 6 calculus-based Mathematics
courses. In considering the plan, the Board felt that it would be necessary to review the full Stage 6 Mathematics provision, taking account of the needs of less able students as well as those who would undertake the higher-level calculus-based courses. The Board endorsed the plan for the review and development of the full Stage 6 Mathematics course provision in December 2004.

3.2 Scope of Mathematics Stage 6 review and development

The implementation of the plan in 2006, with the commencement of the Mathematics Stage 6 Review and Development Project, recognised the importance of teachers having appropriate time to focus on the implementation of the new Mathematics Years 7–10 Syllabus, and the value of obtaining feedback following 2004 and 2005, the initial years of implementation.

The first phase of the project, Syllabus Review, commenced in March 2006. The main purpose in undertaking the Syllabus Review phase was to review the existing Mathematics course provision and to establish Broad Directions for revision and development.

A range of strategies was used to gather data in the Syllabus Review phase. The most significant of these were:
- oral submissions
- written submissions
- a survey of a sample of schools
- a symposium
- a literature and curriculum review.

The information obtained through the data-gathering strategies used in the Syllabus Review phase was analysed to identify issues that need to be considered in the revision and development of Stage 6 Mathematics courses. Key findings were synthesised from the data and a set of draft Broad Directions for the revision and development compiled.

The Board’s endorsement of the Broad Directions at its December 2006 meeting represented the conclusion of the Syllabus Review phase of the project. The Broad Directions have guided the development of the draft Writing Briefs for the calculus-based, and non-calculus-based, Stage 6 Mathematics courses.

(The Broad Directions are appended.)
4 Mathematics in Stage 6
4 Mathematics in Stage 6

4.1 Structure of the proposed Mathematics Stage 6 courses

In the review and development of the Mathematics Stage 6 courses, it is proposed that there be five Board-developed Mathematics courses of study for the Higher School Certificate (in increasing order of difficulty): Mathematics General 1, Mathematics General 2 (together referred to as the ‘non-calculus-based courses’), and Mathematics Advanced, Mathematics Extension 1, and Mathematics Extension 2 (together referred to as the ‘calculus-based courses’).

Mathematics General 1 represents an additional non-calculus-based course of study in the suite of Mathematics Stage 6 courses (currently, there is a single, non-calculus-based Stage 6 course, General Mathematics), while Mathematics General 2 will replace the current General Mathematics course (on which it is largely modelled). The Mathematics General 1 course has been included in accordance with the Broad Direction (see section 8) ‘That the set of Stage 6 Mathematics courses include an additional offering to accommodate the purposes of students who wish to study a Board-developed Mathematics course in Stage 6 but who are currently choosing not to, as well as those whose purposes are not accommodated through the study of General Mathematics.’

It is proposed that there be a largely common Preliminary course for the non-calculus-based courses, Preliminary Mathematics General, leading to the HSC Mathematics General 1 and HSC Mathematics General 2 courses.

Mathematics Advanced, which consists of Preliminary Mathematics Advanced and HSC Mathematics Advanced courses, replaces the current Mathematics (‘2 Unit’) course. Mathematics Extension 1 and Mathematics Extension 2 replace the current Mathematics Extension 1 and Mathematics Extension 2 courses. As in the current situation, students studying the HSC Mathematics Extension 1 course, or the HSC Mathematics Extension 1 and (HSC) Mathematics Extension 2 courses, will be required to have studied the Preliminary Mathematics Extension course.

The structure of the proposed Mathematics Stage 6 courses is illustrated in the diagram on the next page.
Proposed non-calculus-based courses

Proposed calculus-based courses
4.2 Place of the Mathematics Stage 6 courses in the K–12 curriculum and pathways of learning
5 Mathematics Stage 6
Non-calculus-based Courses

– course elements
5 Mathematics Stage 6 Non-calculus-based Courses
– course elements

This section of the draft writing brief is structured to address the course elements for the
Mathematics Stage 6 non-calculus-based courses, Mathematics General 1 and Mathematics
General 2.

• Rationale
• Aim
• Objectives
• Content organisation
• Outcomes
• Content
• Use of technology
• Assessment and HSC examination.

5.1 Rationale

The rationale describes the nature of the subject and relevant courses in broad terms. It
explains the place and purpose of the subject and relevant courses in the curriculum.

Mathematics is deeply embedded in modern society. From the numeracy skills required to
manage personal finances, to making sense of data in various forms, 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 the ability to check claims and assumptions in a systematic way.
Mathematics is the appropriate training ground for the development of these skills and
abilities. The thinking required to enhance further 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.
Similarly, effective Mathematics teaching and learning often sees teachers and students
involved in a collaborative and interactive process as ‘creators’ of Mathematics, rather than as ‘consumers’ of a static and irrefutable body of knowledge.

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 provided by the non-calculus-based courses, assist students to find solutions for the broad range of problems encountered in life beyond secondary schooling.

The purpose of the non-calculus-based 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. The direction taken by the courses, in focusing on mathematical skills and techniques that have direct application to everyday activity, contrasts with the more abstract approach taken by the Mathematics Stage 6 calculus-based courses.

The study of the non-calculus-based courses provides students with valuable support in a range of concurrent Stage 6 subjects and in fostering development of mathematical skills and techniques that assist students who undertake associated research and projects.

The courses provide a strong foundation for vocational pathways, either in the workforce or in further training. In the case of the higher course, Mathematics General 2, this includes a strong foundation for university courses in the humanities, nursing and paramedical sciences.

<table>
<thead>
<tr>
<th>Matters for Consideration</th>
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</thead>
<tbody>
<tr>
<td>• Does the rationale adequately describe the nature of Mathematics in broad terms?</td>
</tr>
<tr>
<td>• Does the rationale reflect a contemporary view of Mathematics?</td>
</tr>
<tr>
<td>• How well does the rationale reflect the purpose of the non-calculus-based courses?</td>
</tr>
</tbody>
</table>

### 5.2 Aim

The aim states the overall purpose of the courses. It indicates the educational benefits that are intended to accrue for students who satisfactorily complete programs of study based on the courses.

The non-calculus-based Mathematics 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.
Students will learn to use a range of techniques and tools, including relevant technologies, in order to develop solutions to a wide variety of problems relating to their present and future needs and aspirations.

Matter for Consideration
Does the aim adequately describe the overall purpose of the non-calculus-based courses?

5.3 Objectives

i for your information

Objectives provide more specific statements of the intent of the courses. They amplify the aim and provide direction to teachers on the teaching and learning process emerging from the course/s. They define in broad terms the knowledge, skills and understanding and values and attitudes fundamental to the key learning area/subject. They act as organisers of the intended outcomes. The same objectives may apply across Stages in a key learning area/subject.

Knowledge, skills and understanding

Students will develop:
• mathematical and statistical literacy in order to evaluate alternatives
• knowledge, skills and understanding in algebra and modelling
• knowledge, skills and understanding in measurement
• knowledge, skills and understanding in financial mathematics
• knowledge, skills and understanding in data analysis
• knowledge, skills and understanding in probability
• the ability to communicate Mathematics in written and/or verbal form
• knowledge, skills and understanding in workplace mathematics
• competence in the application of technology to communicate, analyse and solve mathematical problems
• the ability to apply mathematical skills and techniques to organise information and interpret practical situations using appropriate tools.

Values and attitudes

Students will develop:
• appreciation of the relevance of Mathematics.

Matters for Consideration

• Do the objectives demonstrate the intention of the non-calculus-based courses?
• Do the objectives adequately define knowledge, skills and understanding and values and attitudes essential for the non-calculus-based courses?
5.4 Content organisation

for your information

The Content organisation section describes how the course content is to be organised.

consult

The course content is organised into areas of study and focus studies. Each of the areas of study (Financial Mathematics, Data Analysis, Measurement, Probability, and Algebra and Modelling) is divided into units of work that lead into the focus studies.

The focus studies should be programmed over a continuous time period as they provide students with the opportunity to apply and develop further the knowledge, skills and understanding initially developed in the areas of study, as well as introducing some new mathematical content. It is intended that students develop, through the focus studies, the capacity to integrate their knowledge, skills and understanding across the areas of study.

The Mathematics General 1 and Mathematics General 2 courses will have a largely common Preliminary course. The focus studies in the Preliminary course are Mathematics and Communication and Mathematics and the Car.

There are four focus studies in the HSC course for Mathematics General 1: Mathematics and Design, Mathematics and Household Finance, Mathematics in the Health and Leisure Industries and Mathematics and Resource Management. There are two focus studies in the HSC course for Mathematics General 2: Mathematics and Health and Mathematics and Resource Management.

The Preliminary course has been structured to provide pathways to both the Mathematics General 1 HSC course and the Mathematics General 2 HSC course. The great majority of the Preliminary course content will be studied by both groups of students. However, some of the content will be marked with the symbol § to signify that it is requisite content for the study of the Mathematics General 2 HSC course. (See section 5.6 pp 26–39.)

When planning learning experiences for students in the Preliminary Year, teachers need to consider the course that students are most likely to follow in the HSC Year. Students progressing to the Mathematics General 2 HSC course need to experience all of the Preliminary course content (ie including the content marked with the § symbol). Students progressing to the Mathematics General 1 HSC course should, as a minimum, study all of the Preliminary course content other than that indicated by §. Teachers may choose to include content indicated by § for particular students likely to progress to the Mathematics General 1 HSC course if this better supports their needs.
Presentation of Content

Units of work (within an area of study) and focus studies are presented in the following format:

Name of area of study and unit of work or Name of focus study

A brief summary of the content/purpose of the unit or focus study.

[Assumed Stage 4 and Stage 5 outcomes]
[This section only appears for units of work in the Preliminary course. Its purpose is to identify outcomes that students should have achieved to engage successfully with the unit.]

Outcomes addressed
A list of the course outcomes that will be addressed in the study of the unit or focus study.

Students learn and acquire the following knowledge, skills and understanding
The mathematical content to be addressed in the unit or focus study.

Terminology introduced in this unit/focus study
A list of words and/or phrases that may be new to students, and which may be used in relevant assessment tasks.

Technology that may be used in support of this unit/focus study
Advice about the nature and use of technology that is appropriate to the unit or focus study.

Applications, considerations, examples
The provision of examples defining the range and style of applications used to introduce and illustrate the mathematical content of the unit or focus study, as well as important considerations for the teaching and learning of the unit or focus study.

Matters for Consideration
• Does the proposed content organisation assist your understanding of the way the study of the non-calculus-based courses is to be structured?
• Is the proposed presentation of content appropriate for the non-calculus-based courses?
5.5 Outcomes

Syllabus outcomes express the specific intended student learning that results from the teaching of the course/s. They are derived from the objectives and content. Outcomes provide clear statements of the knowledge, skills and understanding expected to be gained by most students as a result of effective teaching and learning by the end of a Stage.

A proposed set of outcomes for the Mathematics Stage 6 non-calculus-based courses is presented in the table below. The outcomes are derived from the content of the courses, and together with the content, determine the breadth and depth of study to be undertaken by students.

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Preliminary Outcomes</th>
<th>HSC Outcomes Mathematics General 1</th>
<th>HSC Outcomes Mathematics General 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students will develop:</td>
<td>A student:</td>
<td>A student:</td>
<td>A student:</td>
</tr>
<tr>
<td>• mathematical and statistical literacy in order to evaluate alternatives</td>
<td>P1 uses mathematics to compare alternative solutions to contextual problems</td>
<td>H1 uses mathematics to compare and evaluate a range of options</td>
<td>H1 uses mathematics to compare and evaluate a range of options</td>
</tr>
<tr>
<td>• knowledge, skills and understanding in algebra and modelling</td>
<td>P2 develops rules to represent patterns arising from numerical and other sources</td>
<td>H2 tests a general mathematical relationship from observed patterns</td>
<td>H2 develops and tests a general mathematical relationship from observed patterns</td>
</tr>
<tr>
<td>P3 represents information in symbolic, graphical and tabular forms</td>
<td>H3 analyses representations of data in order to make predictions</td>
<td>P4 represents the relationships between changing quantities in algebraic and graphical form</td>
<td>H4 makes predictions about the behaviour of situations based on simple models</td>
</tr>
<tr>
<td>H4 makes predictions about the behaviour of situations based on mathematical models</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Objectives</td>
<td>Preliminary Outcomes</td>
<td>HSC Outcomes Mathematics General 1</td>
<td>HSC Outcomes Mathematics General 2</td>
</tr>
<tr>
<td>---------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Students will develop:</td>
<td>A student:</td>
<td>A student:</td>
<td>A student:</td>
</tr>
<tr>
<td>• knowledge, skills and understanding in measurement</td>
<td>P5 performs calculations in relation to two-dimensional and three-dimensional figures</td>
<td>H5 analyses two-dimensional and three-dimensional models to solve practical problems</td>
<td>H5 analyses two-dimensional and three-dimensional models to solve problems involving spheres and non-right-angled triangles</td>
</tr>
<tr>
<td>• knowledge, skills and understanding in financial mathematics</td>
<td>P6 determines the degree of accuracy of measurements and calculations</td>
<td>H6 interprets the results of measurements and calculations and makes judgements about reasonableness</td>
<td>H6 interprets the results of measurements and calculations and makes judgements about reasonableness</td>
</tr>
<tr>
<td>• knowledge, skills and understanding in data analysis</td>
<td>P7 models financial situations relevant to the student’s current life using appropriate tools</td>
<td>H7 makes informed decisions about financial situations they are likely to encounter post-school</td>
<td>H7 makes informed decisions about financial situations including annuities and loan repayments</td>
</tr>
<tr>
<td>• knowledge, skills and understanding in probability</td>
<td>P9 performs simple calculations in relation to the likelihood of familiar events</td>
<td>H9 solves problems involving uncertainty using basic counting techniques</td>
<td>H9 solves problems requiring knowledge of counting techniques, multi-stage probability and financial expectation</td>
</tr>
<tr>
<td>• the ability to communicate Mathematics in written and/or verbal form</td>
<td>P10 justifies his/her response to a given problem using appropriate mathematical terminology</td>
<td>H10 uses mathematical argument and reasoning to evaluate conclusions drawn from other sources, communicating a position clearly to others</td>
<td>H10 uses mathematical argument and reasoning to evaluate conclusions drawn from other sources, communicating a position clearly to others, and justifies a response</td>
</tr>
</tbody>
</table>
### Objectives

<table>
<thead>
<tr>
<th>Students will develop:</th>
<th>Preliminary Outcomes</th>
<th>HSC Outcomes Mathematics General 1</th>
<th>HSC Outcomes Mathematics General 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>• knowledge, skills and understanding in workplace mathematics</td>
<td>P11 develops the capacity to solve problems involving workplace mathematics</td>
<td>H11 solves mathematical problems derived from a range of workplace contexts</td>
<td>H11 develops mathematical models to represent and analyse problems derived from a range of workplace contexts</td>
</tr>
<tr>
<td>• competence in the application of technology to communicate, analyse and solve mathematical problems</td>
<td>P12 uses technology to create graphical displays and to summarise data sets</td>
<td>H12 uses technology to investigate and solve mathematical problems from real contexts</td>
<td>H12 uses technology to create mathematical models of problems from real contexts</td>
</tr>
<tr>
<td>• the ability to apply mathematical skills and techniques to organise information and interpret practical situations using appropriate tools</td>
<td>P13 applies mathematical knowledge and skills to solving problems within familiar contexts</td>
<td>H13 integrates mathematical knowledge, skills and understanding from different content areas to pose and solve practical problems in a range of contexts</td>
<td>H13 integrates mathematical knowledge, skills and understanding from different content areas to pose and solve practical problems in a range of contexts</td>
</tr>
<tr>
<td>• appreciation of the relevance of Mathematics (Values and attitudes)</td>
<td>P/VA develops a positive attitude to Mathematics and appreciates its capacity to provide enjoyment and recreation</td>
<td>H/VA appreciates the importance of Mathematics in her/his own life and its usefulness in contributing to society</td>
<td>H/VA appreciates the importance of Mathematics in her/his own life and its usefulness in contributing to society</td>
</tr>
</tbody>
</table>

### Matter for Consideration
Are the outcomes for the Preliminary Mathematics General course, the Mathematics General 1 HSC course, and the Mathematics General 2 HSC course, appropriate?
5.6 Content

Content describes the knowledge, skills, understanding and values to be studied and developed by students over a Stage or Stages in a course and the development of processes of learning so that students are encouraged to be effective learners.

Mathematics General 1

1. Areas of study
   • Financial Mathematics
   • Data Analysis
   • Measurement
   • Probability
   • Algebra and Modelling

2. Focus studies
   • Mathematics and Communication (ie telecommunication)
   • Mathematics and the Car
   • Mathematics and Design
   • Mathematics and Household Finance
   • Mathematics in the Health and Leisure Industries
   • Mathematics and Natural Resource Management

In accordance with the Board’s ‘Pathways’ provisions, the units of work within the areas of study, and the focus studies, are designated as Preliminary or HSC, as follows:

• Financial Mathematics
  – Earning money (Preliminary)
  – Investing money (Preliminary)
  – Taxation (Preliminary)
  – Purchasing (HSC)
• Data Analysis
  – Statistics and society (incorporates material from ‘Data collection and sampling’ from the current General Mathematics course) (Preliminary)
  – Displaying single data sets (Preliminary)
  – Summary statistics (Preliminary)
  – Interpreting sets of data (HSC)
  – Distributions (HSC)
  – Statistical reasoning (HSC)
• Measurement
  – Units of measurement and applications (Preliminary)
  – Similarity of two-dimensional figures, right-angled triangles (Preliminary)
  – Right-angled triangles (Review) (HSC)
Further applications of area and volume (HSC)

- Probability
  - The language of chance (Preliminary)
  - Relative frequency and probability (Preliminary)
  - Multi-stage events (HSC)
  - Applications of probability (HSC)

- Algebra and Modelling
  - Basic algebraic skills (Preliminary)
  - Modelling linear and exponential relationships (Preliminary)
  - Further algebraic skills and techniques (HSC)
  - Modelling with non-linear functions (HSC)

- Focus Study: Mathematics and Communication (Preliminary)
- Focus Study: Mathematics and the Car (Preliminary)
- Focus Study: Mathematics and Design (HSC)
- Focus Study: Mathematics and Household Finance (HSC)
- Focus Study: Mathematics in the Health and Leisure Industries (HSC)
- Focus Study: Mathematics and Natural Resource Management (HSC)

The table on the next page illustrates the division of the Mathematics General 1 course into a Preliminary course and an HSC course, each of 120 (indicative) hours of school study, with estimated hours of study for the areas of study and focus studies.
## Mathematics General 1

<table>
<thead>
<tr>
<th>Preliminary Course</th>
<th>Hrs</th>
<th>HSC Course</th>
<th>Hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Financial Mathematics</strong></td>
<td>18</td>
<td><strong>Measurement</strong></td>
<td>6</td>
</tr>
<tr>
<td>• Earning money</td>
<td></td>
<td>• Right-angled triangles (Review)</td>
<td></td>
</tr>
<tr>
<td>• Investing money</td>
<td></td>
<td>• Further applications of area and volume</td>
<td></td>
</tr>
<tr>
<td>• Taxation</td>
<td></td>
<td><strong>Data Analysis</strong></td>
<td>5</td>
</tr>
<tr>
<td><strong>Data Analysis</strong></td>
<td>14</td>
<td>• Interpreting sets of data</td>
<td></td>
</tr>
<tr>
<td>• Statistics and society (incorporating</td>
<td></td>
<td><strong>Focus Study: Mathematics and Design</strong></td>
<td>20</td>
</tr>
<tr>
<td>‘Data collection and sampling’)</td>
<td></td>
<td>• Displaying single data sets</td>
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<tr>
<td>• Displaying single data sets</td>
<td></td>
<td><strong>Financial Mathematics</strong></td>
<td>6</td>
</tr>
<tr>
<td>• Summary statistics</td>
<td></td>
<td>• Purchasing</td>
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<td><strong>Focus Study: Mathematics and Design</strong></td>
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<td><strong>Data Analysis</strong></td>
<td>14</td>
<td>• Distributions</td>
<td></td>
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<tr>
<td>• Interpreting sets of data</td>
<td></td>
<td>• Statistical reasoning</td>
<td></td>
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<tr>
<td><strong>Financial Mathematics</strong></td>
<td>6</td>
<td><strong>Algebra and Modelling 1</strong></td>
<td>12</td>
</tr>
<tr>
<td>• Further algebraic skills and techniques</td>
<td></td>
<td>• Modelling with non-linear functions</td>
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</tr>
<tr>
<td><strong>Focus Study: Mathematics and Design</strong></td>
<td>20</td>
<td><strong>Probability</strong></td>
<td>5</td>
</tr>
<tr>
<td><strong>Focus Study: Mathematics and World</strong></td>
<td>20</td>
<td>• Multi-stage events</td>
<td></td>
</tr>
<tr>
<td><strong>Measurement</strong></td>
<td>14</td>
<td>• Applications of probability</td>
<td></td>
</tr>
<tr>
<td>• Units of measurement and applications</td>
<td></td>
<td><strong>Focus Study: Mathematics in the Health and Leisure Industries</strong></td>
<td>20</td>
</tr>
<tr>
<td>• Similarity of two-dimensional figures,</td>
<td></td>
<td><strong>Algebra and Modelling 2</strong></td>
<td>6</td>
</tr>
<tr>
<td>right-angled triangles</td>
<td></td>
<td>• Further algebraic skills and techniques</td>
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<tr>
<td><strong>Probability</strong></td>
<td>10</td>
<td>• Modelling with non-linear functions</td>
<td></td>
</tr>
<tr>
<td>• The language of chance</td>
<td></td>
<td><strong>Focus Study: Mathematics and Natural Resource Management</strong></td>
<td>20</td>
</tr>
<tr>
<td>• Relative frequency and probability</td>
<td></td>
<td><strong>Focus Study: Mathematics and the Car</strong></td>
<td>20</td>
</tr>
<tr>
<td><strong>Algebra and Modelling 2</strong></td>
<td>12</td>
<td><strong>Focus Study: Mathematics and Natural Resource Management</strong></td>
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<td>• Basic algebraic skills</td>
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<td></td>
<td><strong>Focus Study: Mathematics and the Car</strong></td>
<td>20</td>
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<tr>
<td>relationships</td>
<td></td>
<td><strong>Focus Study: Mathematics and Natural Resource Management</strong></td>
<td>20</td>
</tr>
</tbody>
</table>

**Total indicative hours** 120  **Total indicative hours** 120
Mathematics General 2

1. Areas of study
   • Financial Mathematics
   • Data Analysis
   • Measurement
   • Probability
   • Algebra and Modelling

2. Focus studies
   • Mathematics and Communication
   • Mathematics and the Car
   • Mathematics and Health
   • Mathematics and Natural Resource Management

In accordance with the Board’s ‘Pathways’ provisions, the units of work within the areas of study, and the focus studies, are designated as Preliminary or HSC, as follows:

• Financial Mathematics
  – Earning money (Preliminary)
  – Investing money (Preliminary)
  – Taxation (Preliminary)
  – Credit and borrowing (HSC)
  – Annuities and loan repayments (HSC)

• Data Analysis
  – Statistics and society (incorporates ‘Data collection and sampling’ from the current General Mathematics course) (Preliminary)
  – Displaying single data sets (Preliminary)
  – Summary statistics (Preliminary)
  – Interpreting sets of data (HSC)
  – The normal distribution (HSC)
  – Correlation (HSC)

• Measurement
  – Units of measurement and applications (Preliminary)
  – Similarity of two-dimensional figures, right-angled triangles (Preliminary)
  – Further applications of area and volume (HSC)
  – Applications of trigonometry (HSC)
  – Spherical geometry (HSC)

• Probability
  – The language of chance (Preliminary)
  – Relative frequency and probability (Preliminary)
  – Multi-stage events (HSC)
  – Applications of probability (HSC)

• Algebra and Modelling
  – Basic algebraic skills (Preliminary)
  – Modelling linear and exponential relationships (Preliminary)
  – Further algebraic skills and techniques (HSC)
  – Modelling linear and non-linear relationships (HSC)

• Focus Study: Mathematics and Communication (Preliminary)
• Focus Study: Mathematics and the Car (Preliminary)
• Focus Study: Mathematics and Health (HSC)
• Focus Study: Mathematics and Natural Resource Management (HSC)

The table below illustrates the division of the Mathematics General 2 course into a Preliminary course and an HSC course, each of 120 (indicative) hours of school study, with estimated hours of study for the areas of study and focus studies.

### Mathematics General 2

<table>
<thead>
<tr>
<th>Preliminary Course</th>
<th>Hrs</th>
<th>HSC Course</th>
<th>Hrs</th>
</tr>
</thead>
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<td>Financial Mathematics</td>
<td>18</td>
<td>Measurement 1</td>
<td>8</td>
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<tr>
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<td>Algebra and Modelling 1</td>
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</tr>
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<td>• Statistics and society (incorporating ‘Data collection and sampling’)</td>
<td></td>
<td>• Further algebraic skills and techniques</td>
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</tr>
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<td>Focus Study: Mathematics and Natural Resource Management</td>
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</tr>
<tr>
<td>Total indicative hours</td>
<td>120</td>
<td>Total indicative hours</td>
<td>120</td>
</tr>
</tbody>
</table>
Sample Unit of Work (Preliminary course Mathematics General 1 and Mathematics General 2)

The following unit of work from the Preliminary course for Mathematics General 1 and Mathematics General 2 is provided to demonstrate:

- the representation of the content that needs to be experienced by students progressing to the:
  - Mathematics General 1 HSC course (all of the content other than that indicated by §)
  - Mathematics General 2 HSC course (all of the content including the content indicated by §)
- the intended format of the units of work and focus studies.

---

Measurement: Units of measurement and applications

In this unit, the principal focus is on metric units of measurement, and rates and ratios. Students learn about making judgements in relation to measurement errors.

Assumed Stage 4 and Stage 5 outcomes

MS4.1 (Stage 4 topic: Perimeter and Area)
NS4.3 (Stage 4 topic: Fractions, Decimals and Percentages)
NS5.1.1 (Stage 5 topic: Rational Numbers)

Outcomes addressed

A student:
P1 uses mathematics to compare alternative solutions to contextual problems
P4 represents the relationships between changing quantities in algebraic and graphical form
P6 determines the degree of accuracy of measurements and calculations.

Students learn and acquire the following knowledge, skills and understanding

- recognition that accuracy of physical measurement is limited to \( \pm \frac{1}{2} \) of the smallest unit of which the measuring instrument is capable
- \( \S \) calculation of the percentage error in a measurement eg if the measured height was 155 cm ± 0.5 cm (ie to the nearest cm),
  the percentage error for this measurement is \( \pm \left( \frac{0.5}{155} \right) \times 100\% \)
- determination of possible sources of error in measuring
- repeating and averaging measurements to reduce likelihood of error
- determination of the significant figures to be used in recording measurements, in relation to the accuracy of the measuring instrument being used
- use of scientific notation and standard prefix es (milli, micro etc) in the context of measurement
• use of positive and negative powers of ten in expressing measurements in scientific notation
• conversion between units for rates, eg km/h to m/s
• calculation of concentrations expressed as weight/weight, weight/volume or volume/volume

Note: These calculations have particular applications to nursing and agriculture
• calculation of area of triangles and quadrilaterals, calculation of area and perimeter of circle (review)
• using appropriate formulae in calculating volume of right prisms, cylinders, pyramids, cones, spheres
• application of the relationship between units of capacity and units of volume.
Sample Focus Study (Preliminary course Mathematics General 1 and Mathematics General 2)

The following focus study is provided as an example of the focus studies to be included in the Preliminary course for Mathematics General 1 and Mathematics General 2.

Mathematics and the Car

In this focus study, students learn to integrate and apply a range of knowledge and skills in order to compare, contrast and evaluate costs and safety aspects associated with the running of a car or other vehicle.

Outcomes addressed

A student:
P1 uses mathematics to compare alternative solutions to contextual problems
P3 represents information in symbolic, graphical and tabular forms
P4 represents the relationships between changing quantities in algebraic and graphical form
P6 determines the degree of accuracy of measurements and calculations
P7 models financial situations relevant to the student’s current life using appropriate tools
P8 determines an appropriate form of organisation and representation of collected data
P10 justifies his/her response to a given problem using appropriate mathematical terminology
P13 applies mathematical knowledge and skills to solving problems within familiar contexts.

Students learn and acquire the following knowledge, skills and understanding

Costs of purchase
• comparison of prices of new and used cars and motorcycles
• calculation of purchase costs including costs of finance, stamp duty, transfer of registration (emphasis on cars and motorcycles).

Running Costs
• calculating and comparing registration and insurance costs (emphasis on cars and motorcycles)
• calculation of running costs and other travel costs, eg road tolls
• calculation and comparison of fuel consumption for various modes of transport
• collection and presentation of data on the price of fuel over time to identify trends
• interpreting and calculating statistical data relating to vehicle use
• calculation of vehicle value and depreciation using formulae for depreciation:
  a) the straight-line method
  \[ S = V_0 - Dn, \] where \( S \) = salvage (current) value of asset, \( D \) = amount of depreciation apportioned per period, \( V_0 \) = purchase price of the asset, and \( n \) = total number of periods
b) the declining-balance method

\[ S = V_0 (1 - r)^n \]

where \( S \) is the salvage value after \( n \) periods, \( V_0 \) is the purchase price of the asset and \( r \) is the percentage interest rate per period, expressed as a decimal

- preparation of a depreciation graph based on the straight-line method
- use of prepared graphs and tables (for straight-line and declining-balance methods) to solve depreciation problems
- comparing costs of car-sharing schemes and car pools.

**Safety**

- calculation and interpretation of blood alcohol level based on drink consumption and body mass
  - using formulae, both in words and algebraic, to calculate an estimate for blood alcohol content (BAC)
  - using tables and graphs to estimate BAC
  - determining the number of hours from when a person stops drinking to reach zero BAC
  - describing limitations of methods of estimating BAC
- construction and interpretation of graphs that illustrate the level of blood alcohol over time
- collecting, presenting and interpreting road accident, drink driving, and fatigue statistics
- calculation of distance (\( D \)), speed (\( S \)) and time (\( T \)) given two of the three quantities, including changing units of measurement as required

\[
D = ST \\
S = \frac{D}{T} \\
T = \frac{D}{S}
\]

- calculation of the average speed of a journey by formula
- investigation of stopping distances for different speeds, road conditions and weather conditions
- collecting, presenting and interpreting tables and graphs relating to motor vehicle accidents
- solving problems based on methods of speed detection, eg fixed speed cameras, hand-held radar etc.
Sample Focus Study (HSC course Mathematics General 1)

The following focus study is provided as an example of the focus studies to be included in the HSC course for Mathematics General 1.

Mathematics and Design

In this focus study, students learn to integrate and apply a range of knowledge and skills to practical contexts drawn from the areas of building construction, architecture, art and design.

Outcomes addressed

A student:
H/VA appreciates the importance of Mathematics in her/his own life and its usefulness in contributing to society
H5 analyses two-dimensional and three-dimensional models to solve practical problems
H6 interprets the results of measurements and calculations and makes judgements about reasonableness
H10 uses mathematical argument and reasoning to evaluate conclusions drawn from other sources, communicating a position clearly to others

Students learn and acquire the following knowledge, skills and understanding

• (review)
  – classification and construction of triangles and quadrilaterals
  – sketching common three-dimensional shapes including rectangular and triangular prisms, cylinders, pyramids and cones
  – recognition of common three-dimensional shapes in, for example, buildings, the natural world, artistic works
  – sketching plan views and elevation views of three-dimensional objects
  – use of instruments to construct parallel and perpendicular lines, bisect a line segment, construct the perpendicular bisector of a line segment, bisect an angle
  – use of instruments to construct triangles and quadrilaterals, eg construct a scalene triangle with sides of 3 cm, 5 cm and 6 cm, or construct a kite with two interior angles of 105°
• naming and identifying polygons
• defining and recognising planes in three-dimensional space
• recognising parallel, perpendicular, intersecting and skew lines in two-dimensional and three-dimensional objects where applicable
• use of measurement and the scale on a plan, design or map to calculate actual dimensions and vice versa
• interpretation of common symbols and abbreviations on house plans
• interpretation of plan and elevation views, understanding how to use both to obtain internal dimensions of rooms
• interpreting house plans and making calculations using information on the plan, including the calculation of internal dimensions of rooms. Other calculations to include the length and cost of wood required to make a truss and the length of downpipe required
• calculating area and volume based on information on a plan, including finding the area of a house to be carpeted and the cost of purchasing the carpet, calculating the area and cost of painting of a room, calculating the volume of the rooms in a house and then using a table to determine the appropriate air-conditioner size for the house
• applying right-triangle trigonometry and Pythagoras’ theorem to the solution of problems based on plans, including finding the pitch of a roof
• use of technology to make designs containing mathematical elements
• constructing regular polygons in a circle
• constructing the incentre and circumcentre of a triangle. (Students should verify the location of the circumcentre by constructing the circle that touches each vertex of the triangle.)
• enlarging and reducing plane shapes by a specified scale factor. (Students need to recognise that these shapes are similar.)
• creating examples of simple perspective drawings
• recognising the application of perspective in works of art
• constructing a rotation of a simple shape to a specified angle
• creating a geometrical design containing mathematical elements
• recognising and constructing simple regular, semi-regular, and deformed regular tessellations
• investigation and identification of symmetry (including radial symmetry) in common mathematical shapes, designs, art works and architecture.
Sample Focus Study (HSC course Mathematics General 2)

The following focus study is provided as an example of the focus studies to be included in the HSC course for Mathematics General 2.

Mathematics and Health

In this focus study, students learn to integrate and apply a range of knowledge and skills to problems drawn from health contexts.

Outcomes addressed

A student:
H/VA appreciates the importance of Mathematics in her/his own life and its usefulness in contributing to society
H1 uses mathematics to compare and evaluate a range of options
H2 tests a general mathematical relationship from observed patterns
H3 analyses representations of data in order to make inferences, predictions and conclusions
H4 makes predictions about the behaviour of situations based on mathematical models
H5 analyses two-dimensional and three-dimensional models to solve problems involving spheres and non-right-angled triangles
H6 interprets the results of measurements and calculations and makes judgements about reasonableness
H8 answers questions requiring knowledge of the normal distribution and the correlation of bivariate data
H9 solves problems requiring knowledge of counting techniques, multi-stage probability and financial expectation
H10 uses mathematical argument and reasoning to evaluate conclusions drawn from other sources, communicating a position clearly to others, and justifies a response
H13 integrates mathematical knowledge, skills and understanding from different content areas to pose and solve practical mathematical problems in a range of contexts.

Students learn and acquire the following knowledge, skills and understanding

Health charts and tables
- recognition and interpretation of typical graphs and tables used in assessing health. (Examples could include growth and weight charts containing percentiles similar to those produced by the World Health Organisation.)
- creating charts to compare related groups over time, e.g. average heights of boys compared to girls over a given number of years.

The normal distribution
- describing the z-score (standardised score) corresponding to a particular score in a set of scores as a number indicating the position of that score relative to the mean.
• using the formula $z = \frac{x - \bar{x}}{s}$ to calculate $z$-scores, where $s$ is the standard deviation
  ($s = \sigma_n$ for a population, $s = \sigma_{n-1}$ for a sample)
• using calculated $z$-scores to compare scores from different data sets
• identifying the properties of data that are normally distributed, ie:
  – the mean, median and mode are equal
  – if represented by a histogram, the resulting frequency graph is ‘bell-shaped’
• using collected data to illustrate that, for normally distributed data:
  – approximately 68% of scores will have $z$-scores between $-1$ and $1$
  – approximately 95% of scores will have $z$-scores between $-2$ and $2$
  – approximately 99.7% of scores will have $z$-scores between $-3$ and $3$
• using $z$-score measures to make judgements in individual cases.

**Two-way tables and area charts**
• interpreting data presented in two-way table form, eg male/female versus exercise/no exercise
• preparing an area chart to illustrate and compare different sets of data over time.

**Correlation**
• plotting ordered pairs of data onto a scatterplot, eg height versus weight
• recognising patterns from the scatterplot:
  – whether the points appear to form a mathematical pattern
  – whether the pattern appears to be linear
• constructing a line of fit on a scatterplot and determining its equation
• using the equation to make predictions.

**Correlation** (note: students will not be required to calculate the correlation coefficients)
• interpreting the strength of association using a given correlation coefficient
• interpreting the sign of a given correlation coefficient
• recognising that a high degree of correlation does not necessarily imply causality – eg there is a very high correlation between the sizes of one’s left and right feet, but one does not cause the other.

**Body Mass Index**
• calculation of Body Mass Index, height and weight using $BMI = \frac{m}{h^2}$, where
  $m = \text{mass in kilograms and } h = \text{height in metres.}$ Comparison of calculated BMIs.

**Lung capacity**
• calculation of different measures of lung capacity including Tidal, Vital and Estimated Vital Capacity
• estimation of the volume of an inflated balloon using the formula for the volume of a sphere
• investigation of alternative ways of estimating the volume of a sphere
• conversion of lung capacity from cubic centimetres to millilitres to litres
• calculation of Estimated Vital Lung Capacity in cubic centimetres using formulae
• calculation of Vital Lung Capacity (theoretical).

**Medication**
• calculation of dosages for child and adult medication from tables on packets
• calculation of dosages for children using Fried’s formula, Young’s formula and Clark’s formula (including changing the subject given the other variables).
• calculation of an estimate of Body Surface Area (BSA) using Mosteller’s formula
• comparison of calculated BSA values with published averages.

**Heart rate**
• calculation of the volume (in litres) of blood pumped by the heart, both at rest and during exercise, over a given time
• measurement and recording of heart rate at regular intervals while at rest, during exercise, and after exercise
• calculation of an athlete’s Maximum Heart Rate (MHR).

**Calorie intake**
• converting from kilojoules to calories using a variety of methods, including graphs, online calculators and manual methods
  1 calorie = 0.00418 kilojoules
  1 kilojoule = 239 calories
• investigating energy intake and expenditure by keeping a diary of daily activities and using an online calculator to draw conclusions
• investigating Recommended Daily Intake (RDI) for males and females and using real food labels to make calculations.

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**Matters for Consideration**
• Is the proposed content for the Mathematics General 1 course appropriate?
• Is the proposed content for the Mathematics General 2 course appropriate?
5.7 Use of technology

for your information

(a) in learning and teaching, and school-based assessment
There are no restrictions on the use of different types of technology in the learning and teaching of courses within the Mathematics Key Learning Area. The appropriateness and viability of particular types of technology in the development of students’ knowledge, skills and understanding, in relation to the courses within the suite of Mathematics Stage 6 courses, are decisions for students, teachers and schools.

The final syllabuses will provide a range of opportunities for the use of calculators and computer software packages in learning and teaching. This will include opportunities to utilise the graphing functions and financial and statistical capabilities of calculators, and dynamic geometry and statistics software packages.

The Broad Directions developed during the first phase of the Mathematics Stage 6 Review and Development Project included ‘That the use of technology with capabilities beyond the level of scientific calculators be encouraged in the learning and teaching, and school-based assessment, of all Stage 6 Board-developed Mathematics courses.’

(b) in the Board’s HSC examinations

consult

In accordance with the Broad Direction ‘That the non-calculus-based Stage 6 Mathematics courses be developed with the view that technology with capabilities beyond the level of scientific calculators will need to be utilised for aspects of the associated HSC examinations’, it is proposed that the Board prescribe for use in HSC examinations for the non-calculus-based courses, a clear set of calculator functions and capabilities. These functions and capabilities will be consistent with and support the knowledge and skills students should be able to demonstrate after completing the Mathematics General 1 course and the Mathematics General 2 course. For example, if students are expected to use technology to construct statistical ‘graphs’ such as histograms, box-and-whisker plots and normal curves, then these capabilities would be appropriate to prescribe. The functions and capabilities would be chosen in such a way that fundamental algebraic and conceptual skills are not replaced by technology. For example, where the syllabus indicates that students should demonstrate the algebraic manipulative skills necessary to rearrange and solve certain equations and make substitutions into expressions, then these capabilities would not be included in the set of functions and capabilities for these courses.

These functions and capabilities may be consistent across both the calculus-based and non-calculus-based Stage 6 Mathematics courses. However, as the detailed syllabuses are written, consulted upon and finalised, it may be necessary for different sets of functions and capabilities to be developed for these two Mathematics course groupings.

Matter for Consideration
Is the proposed approach to the use of technology in the HSC examinations appropriate?
5.8 Assessment and HSC examination

The general assessment and reporting advice in the Mathematics Stage 6 non-calculus-based syllabuses will focus on the role of assessment in improving teaching and learning.

The following requirements for internal assessment and external examinations will be contained in the syllabus:
- Preliminary course components and weightings (advisory)
- HSC components and weightings (mandatory)
- HSC specifications.

The following materials will be developed for each course:
- performance band descriptions
- a specimen HSC examination, including a mapping grid linking specimen examination questions to syllabus outcomes, content and targeted performance bands, and sample marking guidelines.

It is proposed that there would be separate HSC examination papers for each of the Mathematics General 1 course and the Mathematics General 2 course and that the students’ HSC results be reported against separate performance descriptions.

Consideration needs to be given to:
- what the components should be for internal assessment, and their weightings
- the length of the examinations
- the types of items to be included in the examinations
- the balance of Preliminary and HSC content to be included in the examinations
- any tables, formulae or other information to be included with the examinations.

### Matter for Consideration
What suggestions would you like to make regarding assessment components and weightings, examination specifications and the proposed arrangements for examination papers to be sat by candidates for the non-calculus-based courses?
6 Glossary
6 Glossary

for your information

The Glossary explains terms that will assist teachers in the interpretation of the Mathematics Stage 6 non-calculus-based syllabus.

consult

Syllabus terminology

Content

Content describes the knowledge, skills, understanding and values and attitudes to be studied and developed by students over a Stage or Stages in a syllabus and the development of processes of learning so that students are encouraged to be effective learners.

Outcomes

Syllabus outcomes express the specifically intended student learning that will result from the teaching of the syllabus. They are derived from the objectives and content of the syllabus. They provide clear statements of the knowledge, skills and understanding expected to be gained by most students as a result of effective teaching and learning by the end of a Stage. They also describe the values and attitudes expected to be developed by students.

Standards

The term standards refers to the knowledge, skills and understanding expected to be learned by:
• students as a result of studying a subject – the content standards
• the levels of achievement of the knowledge, skills and understanding – the performance standards.

Both content standards and performance standards are based on the aims, objectives, outcomes and content of a course. Together they specify what is to be learned and how well it is to be achieved.

Content standards specify what students are expected to know, understand and be able to do as a result of studying a course. Teacher understanding of content standards comes from their consideration of the aims, objectives, outcomes and content of the syllabus.

Performance standards are the different levels of achievement demonstrated by students.

Subject

A subject is a name given to a defined area of knowledge. There may be several courses offered in a subject.
Syllabus

A document that describes for a key learning area or a course of study what students are expected to learn in terms of aims, objectives, outcomes, content and assessment requirements.

A syllabus package includes a syllabus document with additional information on assessment and examination, and support materials.
7 Support Materials
7 Support Materials

It is proposed that a range of support materials be produced to assist teachers with the implementation of the new Mathematics Stage 6 non-calculus-based courses.

In accordance with the Broad Direction ‘That the syllabus documents within the Stage 6 Mathematics syllabus package incorporate applications, implications and considerations for the teaching of the syllabus content, including in relation to depth of coverage’, it is proposed that each of the non-calculus-based courses include an ‘applications, considerations and examples’ section within the syllabus document for each of the Preliminary and HSC topic areas.

The support materials could include:
- sample teaching and learning units
- advice on programming
- program overviews
- advice in relation to teaching ‘new’ areas of course content
- teaching suggestions to assist the development of meaningful and engaging units of work
- sample HSC assessment programs
- advice on the utilisation of different types of assessment tasks
- sample assessment tasks
- suggestions for the utilisation of technology in teaching and learning
- suggested applications that relate to real-world problems.

Matter for Consideration
Would this range of support materials provide teachers with sufficient support for the implementation of the non-calculus-based courses?
8 Appendix
Broad Directions for the Mathematics Stage 6 Writing Briefs – endorsed by the Board of Studies on 12 December 2006.

Note: The Board of Studies endorsed these Broad Directions on 12 December 2006. They reflect the consultation undertaken in Phase 1 of the syllabus development process and inform the development of Section 4 of this draft writing brief, which is subject to consultation. The broad directions are not subject to consultation.

Broad Directions for the Mathematics Stage 6 Writing Briefs:

• That the set of Stage 6 Mathematics courses include an additional offering to accommodate the purposes of students who wish to study a Board-developed Mathematics course in Stage 6 but who are currently choosing not to, as well as those whose purposes are not accommodated through the study of General Mathematics.

• That in the revision, due attention be given to clarifying the purpose of each course and identifying future learning or vocational pathways of the intended candidatures.

• That the nested structure of the current Mathematics (‘2 Unit’), Mathematics Extension 1 and Mathematics Extension 2 courses, and the calculus-basis to these courses, be retained.

• That any revision or development of the calculus-based courses maintain the current rigour and level of challenge of the courses.

• That the amount of content prescribed for Stage 6 Mathematics courses reflect the amount that can be taught, and learnt by the typical student, in the indicative time.

• That in reviewing the content of Stage 6 Mathematics courses, particular attention be given to the purpose of the Mathematics (‘2 Unit’) course for Mathematics (‘2 Unit’)-only students, and the appropriateness and relevance of the course content for those students.

• That 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.

• That the current General Mathematics course material be largely maintained within the structure of Stage 6 non-calculus-based Mathematics courses.

• That, 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 that they meet the needs of students.

• That, in the consideration of the use of technology in Stage 6 Mathematics courses, due regard must be given to the related access and equity issues.
• That the use of technology with capabilities beyond the level of scientific calculators be encouraged in the learning and teaching, and school-based assessment, of all Stage 6 Board-developed Mathematics courses.

• That the non-calculus-based Stage 6 Mathematics courses be developed with the view that technology with capabilities beyond the level of scientific calculators will need to be utilised for aspects of the associated HSC examinations.

• That the use of technology in HSC examinations for the calculus-based courses be further investigated and clarified in the Writing Brief phase.

• That the appropriateness of the current processes for the examination of Stage 6 Mathematics courses be reviewed, with particular emphasis on the examination of Mathematics (‘2 Unit’)-only candidates.

• That the syllabus documents within the Stage 6 Mathematics syllabus package incorporate applications, implications and considerations for the teaching of the syllabus content, including in relation to depth of coverage.

• That each Stage 6 Mathematics course be named so as to avoid confusion with the discipline itself.