



# **NSW Stage 6 Mathematics syllabus review and development**

Outcomes and directions to assist consultation  
on the national curriculum in Mathematics K–12

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## **The review and development project**

Syllabuses for each of five new Stage 6 Mathematics courses, Mathematics General 1, Mathematics General 2, Mathematics Advanced, Mathematics Extension 1 and Mathematics Extension 2, were developed in 2007–2008. The Board endorsed the syllabuses in March 2009, but agreed that the syllabuses should not be approved for implementation given the development of a national Mathematics curriculum K–12 for implementation from 2011.

The Board advised that NSW senior secondary Mathematics teachers should continue working with the current Stage 6 Mathematics syllabuses until further notice.

The Board agreed that the new syllabuses be used as the basis of its advice to the Australian Curriculum, Assessment and Reporting Authority (ACARA) concerning the national Mathematics curriculum.

The purpose of this document is to provide interested teachers with a succinct reference to the characteristics of a Stage 6 Mathematics curriculum that reflects current research and thinking. More detailed information on the review and development of NSW Stage 6 Mathematics in 2006–2008, including a report on the Syllabus Review phase, literature and curriculum review, symposium proceedings and consultation reports, is available on the BOS website.

## **What has the project shown in relation to the nature and content of a contemporary, research-based Mathematics curriculum?**

A detailed review of the existing NSW Stage 6 Mathematics syllabus provision resulted in the establishment of broad directions for the project including that:

- due attention needs to be given to clarifying the purpose of a Stage 6 Mathematics course and identifying future learning or vocational pathways of the intended candidature
- a course needs to be of an appropriate level of rigour and challenge for the intended candidature
- the amount of content prescribed for a course needs to reflect the amount that can be taught and learnt by the typical student in the indicative time
- the appropriateness and relevance of the applications within a course need to be explored, with a view to ensuring that they are contemporary and that they meet the needs of students
- in the consideration of the use of technology in courses, due regard must be given to the related access and equity issues
- the use of technology with capabilities beyond the level of scientific calculators should be encouraged in the learning and teaching, and school-based assessment of courses
- syllabus documents should incorporate applications, implications and considerations for the teaching of the syllabus content, including in relation to the depth of coverage.

The project confirmed the need:

- for a suite of Stage 6 Mathematics courses to cater for the wide variation in students' mathematical competence at the conclusion of the compulsory years of secondary schooling
- to provide opportunities for continuing mathematical growth. Students should 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.

Statistics and mathematical modelling are seen as important aspects of a contemporary senior-secondary Mathematics curriculum. The increase in their use and importance can be linked to the rapid technological advances of recent years. The inclusion of the study of Statistics recognises the need for people in contemporary society to develop competence in understanding, interpreting and

analysing information displayed in tabular or graphical forms. Such competence, often described as ‘statistical literacy’, has become increasingly important with advances in technology and the resulting availability of large amounts of data. The study of topics in Statistics provides a foundation for extending the types of practical situations with which courses are concerned to situations where the impact of uncertainty is recognised.

The mathematical modelling process should be given explicit attention and can be thought of as a logical adjunct to the ‘Working Mathematically’ strand of the NSW K–10 Mathematics syllabuses. The aim of a focus on modelling is to develop further students’ understanding of the Mathematics involved, and to improve their ability to interpret and critically analyse results in context. These skills improve students’ mathematical literacy and are invaluable in workplace contexts and in the tertiary education environment, where heavy emphasis is placed on understanding, applying and interpreting Mathematics.

### **What did the project show in relation to the nature and content of general level courses?**

The project showed that more than one general level course needs to be provided for students who have demonstrated competence in Mathematics up to and including at least the level expected of all students by the end of the compulsory years of secondary schooling. The purpose of such 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 to be taken in these courses, in focusing on mathematical skills and techniques that have direct application to everyday activity, contrasts with the more abstract approach that needs to be taken by higher-level Mathematics courses.

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. Opportunities provided for creative thinking, communication and contextualised problem solving assist students to find solutions for the broad range of problems encountered in life beyond secondary schooling.

Appropriate areas of study for students undertaking such courses include financial mathematics, statistics, aspects of measurement such as applications of area and volume, probability and its applications, and algebraic modelling. The new NSW courses written to meet the needs of these students include various focus studies, designed to be programmed over a continuous time period and to give students the opportunity to apply and develop further the knowledge, skills and understanding initially developed in the various areas of study, as well as to introduce some new mathematical content. The focus studies include studies on communication, driving, household finance, health, and personal resource usage. Through such focus studies, students develop the capacity to integrate their knowledge, skills and understanding across the areas of study in contemporary contexts chosen for their ongoing relevance to the students’ everyday lives and likely vocational pathways.

General level courses provide 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 senior-school studies, such as in vocational education and training courses, other practically oriented courses and some humanities courses, and for vocational pathways, in the workforce or in further training.

Higher general level courses provide students with the opportunity to develop an understanding of and competence in further aspects of Mathematics for concurrent senior-school studies such as in the life sciences, the humanities and business studies, and a strong foundation for vocational pathways in the workforce, in further training, and for university courses in the humanities, nursing and paramedical sciences.

### **What did the project show in relation to the nature and content of higher-level courses?**

In higher-level senior-secondary Mathematics courses, students should develop an appreciation of Mathematics as a study with high levels of internal structure that provide opportunities for the development of logical and disciplined thought. Through the learning experiences within such courses, students are able to progress from a knowledge and understanding of facts, procedures and applications in idealised contexts to facility in the use of mathematical models that situate the Mathematics in context, and to more advanced generalisations based on deductive and inductive reasoning processes. This involves the development and use of an increasingly sophisticated level of communication and literacy.

The concept of a function of a real variable, the algebraic and geometrical representations of a number of important functions, and the introductory concepts and techniques of differential and integral calculus, together form a strong basis for such courses. These concepts, representations and techniques should be developed and utilised across such courses.

The concepts and techniques of calculus provide a means of modelling and developing increased understanding of many real-world situations and of solving a variety of related problems. These situations and problems include many of those arising in the sciences, including in relation to the natural environment and medicine, and in statistics, business, finance and economics. A number of related applications should be studied in higher-level senior-secondary Mathematics courses.

The modelling theme developed in the new NSW Mathematics Advanced course is further developed in the Mathematics Extension 1 course. Through the study of difference equations students are exposed to contemporary ideas in Discrete Mathematics, which have a range of important applications. This, together with the application of calculus in physical, biological and business scenarios provides opportunities for students to develop further their understanding of algebra, function and calculus concepts in context and through the analysis of real-world problems.

The inclusion of contemporary applications is more likely to stimulate the interest of students. A focus on ordinary differential equations will also better prepare students for tertiary studies requiring Mathematics as a major discipline. In the new Mathematics Extension 2 course, the topic includes the basic theory of the solution methods and applications of simple first-order equations, with a focus on mathematical modelling.

The new Mathematics Advanced course was written on the assumption that students have demonstrated competence in Mathematics up to and including Stage 5.2 level by the end of the compulsory years of secondary schooling. The course provides such students with the opportunity to develop an understanding of and competence in further aspects of Mathematics through real-world applications for concurrent senior school studies, such as in science, business studies and economics, and for further studies at tertiary level in such areas as the life sciences, business, finance, technology and education.

The new Mathematics Extension 1 course was written to meet the needs of students who have demonstrated a high level of competence in Mathematics up to and including Stage 5.3 level by the end of the compulsory years of secondary schooling. The course provides such students with the opportunity to develop a thorough understanding of and competence in further aspects of Mathematics through real-world applications for concurrent senior school studies, such as in science, engineering studies and economics, and for further studies at tertiary level in Mathematics, and in such areas as the physical sciences and engineering.

The new Mathematics Extension 2 course was written to meet the needs of students who have demonstrated outstanding ability in Mathematics. The course represents a distinctly high level in school mathematics and provides such students with the opportunity to develop considerable manipulative skills and a high degree of understanding of the fundamental ideas of algebra and calculus. The course, therefore, provides a sufficient basis for a wide range of useful applications of Mathematics as well as a strong foundation for the further study of the subject.

### **What did the project show in relation to the use of technology?**

The project confirmed that the appropriateness, viability and level of use of different types of technology in the learning and teaching of courses within the Mathematics learning area are decisions for students, teachers and schools. The broad directions developed during the first phase of the project, however, 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 senior-secondary Mathematics courses.

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

### **How can I continue to be involved in the national developments?**

Teachers are encouraged to register for the BOS RSS feeds. This is the best way of keeping up-to-date with relevant news from the Board of Studies. Log onto the [Board website](#). Click on Board Bulletin on the left hand side of the home page and follow the prompts.

Visit the [Australian Curriculum, Assessment and Reporting Authority website](#). A registration process will enable you to access papers and provide feedback.

Be ready to contribute to consultation on the draft national Mathematics curriculum for K–10 in February 2010, and the draft national Mathematics curriculum for Years 11–12 in March 2010.