DEPARTMENT OF MATHEMATICS TEACHING COMMITTEE
PROGRAMME SPECIFICATION FOR THE BA AND THE MMATH IN MATHEMATICS COMMENCING OCTOBER 2008

1. Awarding institution/body	University of Oxford
2. Teaching institution	University of Oxford
3. Programme accredited by	n/a
4. Final award	MMath (Hons) [4 year course] BA (Hons) [3 year course]
5. Programme	Mathematics
6. UCAS code	G100 BA/MMath
7. Relevant subject benchmark statement	Mathematics, Statistics and Operational Research (QAA) http://www.qaa.ac.uk/academicinfrastructure/benchmark/statements/Maths07.asp
8. Date of programme specification	First Drafted in 2002. Subsequently revised annually; most recently October 23rd, 2008

9. Educational aims of the programme

The programme aims:

E1 • to provide, within the supportive and stimulating environment of the collegiate university, a mathematical education of excellent quality through a course which attracts students of the highest mathematical potential;

E2 • to provide a learning environment which, by drawing on the expertise and talent of the staff, both encourages and challenges the students (recognising their different needs, interests and aspirations) to reach their full potential, personally and academically;

E3 • to provide students with a systematic understanding of core areas and some advanced topics in mathematics, an appreciation of its wide-ranging applications, and to offer the students a range of ways to develop their skills and knowledge.

E4 • to lay the foundations for a wide choice of careers and the successful long-term pursuit of them, particularly careers requiring numeracy, modelling and problem-solving abilities;

E5 • to lay the foundations for employment as specialist mathematicians or in research through the study in depth of some of a broad range of topics offered;

and for students taking the 4-year MMath (Hons):

E6 • To provide the foundations for graduate study through a research degree at a leading university, either in the UK or overseas.

Links to the Subject Benchmark in Mathematics, Statistics and Operational Research

These include, but are not limited to the following

E1: to provide, within the supportive and stimulating environment of the collegiate university, a mathematical education of excellent quality through a course which attracts students of the highest mathematical potential;

[cf Subject Benchmark paragraphs 1.13- 1.15, 2.8, 3.8]

E2: to provide a learning environment which, by drawing on the expertise and talent of the staff, both encourages and challenges the students (recognising their different needs, interests and aspirations) to reach their full potential, personally and academically;

[cf Subject Benchmark paragraphs 2.15, 2.8, 4.2]

E3: to provide students with a systematic understanding of core areas and some advanced topics in mathematics, an appreciation of its wide-ranging applications, and to offer the students a range of ways to develop their skills and knowledge.
[cf Subject Benchmark paragraphs 1.16,1.17, 1.23, 2.10, 2.20 - .22, 2.28, 3.3, 3.12, 3.14, 3.15]

E4 : to lay the foundations for a wide choice of careers and the successful long-term pursuit of them, particularly careers requiring numeracy, modelling and problem-solving abilities;
[cf Subject Benchmark paragraphs 1.24-1.27, 3.8]

E5 : to lay the foundations for employment as specialist mathematicians or in research through the study in depth of some of a broad range of topics offered;
[cf Subject Benchmark paragraphs 3.6, 3.21, 3.23-3.25, 3.27]

E6 :To provide the foundations for graduate study through a research degree at a leading university, either in the UK or overseas.

[cf Subject Benchmark paragraphs 3.12, 3.14, 3.21, 3.27, Annex to Subject Benchmark (consultation Document August 2008) Paragraphs A4,A5,A7,A15]

10. Programme outcomes

Below are the programme's intended learning outcomes, each outcome is broadly related to the Educational programme Aims (E1-E6) and each outcome is associated with a learning opportunity and an assessment strategy.

A. Students will develop a knowledge and understanding of	***Related teaching/learning methods and strategies***
1. The core areas of mathematics including the principal areas of mathematics needed in applications. (E1-E3)	1. In the first four terms of the programme there are lectures on algebra, analysis, differential equations, probability, and mathematical methods, supported by college-based tutorials.
2. Some of the principal areas of application of mathematics. (E1-E3)	2. In the first year there are lectures on dynamics, probability, statistics, and mathematical models, supported by college-based tutorials; together with further options later in the course.
3. The correct use of mathematical language and formalism in mathematical thinking and logical processes. (E1,E2)	3. Example in lectures in the first two years, practice in weekly problem sheets, with critical feedback by college tutors, tutorial discussion, printed notes of guidance (also available on the web).
4. The basic ideas of mathematical modelling. (E3)	4. Lectures on mathematical models in the first year, supported by practice in work for college tutorials, together with further options later in the course.
5. Some of the processes and pitfalls of mathematical approximation. (E3)	5. Examples on problem sheets and Maple in first year.
6. Techniques of manipulation and computer-aided numerical calculation. (E3)	6. Practice in work for college tutorials and Maple practical work in the first year.
7. The basic ideas of a variety of pure and applied areas of specialisation. (E3)	7 A choice of lecture courses, supported by college tutorials or small classes in the second part of the second year.
8. Several specialised areas of mathematics or its applications, the principal results in these areas, how they relate to real-world problems and to problems within mathematics (including, in the four-year course, problems at the frontiers of current research). (E3-E6)	8 Lectures in the third and fourth years delivered by lecturers actively engaged in research, together with supporting problem classes conducted by subject specialists.

Assessment
Formative assessment on a weekly basis by marking of tutorial and class work, and on a termly basis by college collections (college examinations at the beginning of term) or assessed vacation assignments. Summative assessment by four three-hour written papers at the end of year one, assessment of two computer projects in year one, by two three-hour 'breadth papers' in year two designed to test, through bookwork and unseen problems, breadth of understanding across the whole syllabus for the year; and two three-hour 'depth papers', designed to test understanding in depth through further questions on bookwork and more substantial unseen problems. In years three and four, summative assessment is by a combination of one and three quarter- or three-hour subject papers on bookwork and unseen problems (the usual form of assessment in year three), extended essays, dissertations, practical work, projects, and mini-projects.

B. ***Students will have the opportunity to develop the following skills during the course***

I. Intellectual skills
1. The ability to demonstrate knowledge of key mathematical concepts and topics, both explicitly and by applying them to the solution of problems. (E1,E2)
2. The ability to comprehend problems, abstract the essentials of problems and formulate them mathematically and in symbolic form so as to facilitate their analysis and solution. (E1,E2)
3. Grasp how mathematical processes may be applied to problems including, where appropriate, an understanding that this might give only a partial solution. (E1,E2)
4. The ability to select and apply appropriate mathematical processes. (E1,E2)
5. The ability to construct and develop logical mathematical arguments with clear identification of assumptions and conclusions. (E1,E2)
6. The ability to use computational and more general IT facilities as an aid to mathematical processes and for acquiring any further information that is needed and available. (E1,E2)
7. The ability to present mathematical arguments and conclusions from them with clarity and accuracy, in forms suitable for the audiences being addressed. (E1,E2)
8. Students who have focussed on pure mathematics will have skills relating particularly to rigorous argument and solving problems in generality, and facility with abstraction including the logical development of formal theories and the relationships between them. (E1,E2)
9. Students who have focussed on physical applied mathematics will have skills relating particularly to formulating physical theories in mathematical terms, solving the resulting equations analytically or numerically, and giving physical interpretations of the solutions. (E1,E2)

Teaching/learning methods and strategies
These are acquired through lectures, classes, tutorials, practical classes, studying recommended textbooks and through work done for projects, extended essays, dissertations and oral presentations.

Assessment.
These intellectual skills are tested summatively in the examination processes at the end of each year, in projects, extended essays, dissertations and submitted practical work, and formatively in weekly tutorials or classes, and college collections.

II. Mathematics related practical skills	*Teaching/Learning methods and strategies*
1. Calculating fluently and accurately in abstract notation. (E3)	1. Practised throughout the course in problem work for tutorials and classes.
2. Use of mathematics computer packages (E3)	2. Lectures, Maple practical classes and informal practice sessions supported by demonstrators in the first year; use of Maple and other packages where appropriate in problems and lectures in later years.

Assessment.
There is summative assessment of (1) in the examination process at the end of each year and of (2) in the assessment of first year Maple projects for the first year examinations, and second- and third-year practicals (by the Computing Laboratory and Statistics Department) plus formative assessment in weekly tutorials or classes, and in college collections.

III. General skills	*Teaching/Learning methods and strategies*
1. To analyse and solve problems, and to reason logically and creatively. (E1,E2)	1. Weekly mathematical problem sheets with tutorial or class support, often requiring significant development of ideas beyond material found in lectures and books.
2. Effective communication and presentation orally. (E2,E5,E6)	2. Weekly tutorial and class assignments; requirement to defend written work in tutorials, develop accurate citation of references, and oral presentation of solutions in classes. Presentation of project work.
3. The ability to learn independently. (E2,E5,E6)	3. A learning process that requires students to put together material from a number of sources, including lectures, tutorials, text-books, and electronic sources, largely in their own time.
4. Independent time management. (E5,E6)	4. Requirement to produce substantial amounts of written work against strict tutorial and class deadlines; necessity to balance academic and non-academic activities without continuous oversight.
5. To think critically about solutions and to defend an intellectual position. (E2,E5,E6)	5. Discussion and criticism in tutorials.
6. Collaboration (E5,E6)	6. Tutorial groups are encouraged by the tutorial system to work together, to share ideas and to develop the practice of crediting others for their contributions.
7. Use of information technology. (E4)	7. Compulsory practical work; extensive use of the network for distributing teaching materials and for communication.
8. Language skills. (E4)	8. The opportunity is available in the third or fourth year to study a foreign language.

Assessment.
The tutorial system provides formative assessment of (1–6). There is summative assessment of (2) in the yearly examinations and of (7) in the assessment of first-year computer projects and second- and third-year practicals. There is summative assessment of (2,3, and 4) in some Part B and C units including Extended Essays, History of Mathematics, The Undergraduate Ambassadors Scheme and Dissertations. The language option does not contribute to final class, but successful completion will be recorded on student transcripts.

11. Programme Structures and Features

The programme is offered either as a three-year course leading to the BA in Mathematics, or with a further fourth year at M level, leading to the MMath in Mathematics.

Year 1
Subjects
This foundation year facilitates the transition from school to university and is designed:

- to ensure that all students have an adequate facility with elementary technique;
- to ensure that all students have adequate knowledge of the syllabuses in Mathematics and Further Mathematics A-level to the depth that our courses require, recognising that students come from a variety of backgrounds;
- to allow students to adapt to the change of style and pace of the university course;
- to ensure that students develop the technique necessary for mathematics at Moderations level, including the use of the computer package Maple;
- to ensure that all students have the opportunity to study a range of central mathematics topics at Moderations level;
- to teach students to argue rigorously and develop a critical faculty;
- to teach students to present mathematics professionally.

All students study the same material in the first year (no options) leading to the Honour Moderations in Mathematics Examination. The aim is to bring students from diverse backgrounds to the same point in one year, to allow them to discover the branches of mathematics for which they have a natural aptitude and which they particularly like, so they have the opportunity to enjoy choosing from the full range of options available in later years.

This Examination consists of four papers and two pieces of assessed practical work in Maple. The papers are:

Paper A. Pure Mathematics I
Paper B. Pure Mathematics II
Paper C. Applied Mathematics I
Paper D. Applied Mathematics II

There is also a resit examination, the Preliminary Examination in Mathematics, taken in the summer vacation consisting of two papers:

Paper 1. Pure Mathematics
Paper 2. Applied Mathematics

Assessment
Students' progress during the year is monitored continuously in weekly tutorials, and also by college collections with diagnostic feedback. For the Honour Moderations Examination, students must sit all four papers at the same time. A student who is not awarded a Pass in Moderations but who subsequently passes the Preliminary Examination taken during the summer vacation may, at the discretion of the student's college, proceed to the second year of the course.

Year 2

Subjects
In the second year, students complete the compulsory core: Algebra, Analysis and Differential Equations, and then continue their studies choosing from a menu of second year Options: Introduction to Fields, Group Theory, Number Theory, Integration, Topology, Multivariable Calculus, Calculus of Variations, Classical Mechanics, Electromagnetism, Fluid Dynamics and Waves, Probability, Statistics, Numerical Analysis.
The syllabus is examined at the end of the year in the Part A examinations which consist of four papers.
AC1: Algebra, Analysis, Differential Equations
AC2: Algebra, Analysis, Differential Equations
AO1: Options
AO2: Options
These Part A papers may be taken on one occasion only.

Assessment
Students continue to be monitored in weekly college tutorials or classes together with college collections with diagnostic feedback.

The Part A examination taken at the end of the second year consists of cross-section papers designed so that both breadth and depth of coverage of the syllabus are assessed.

Papers AC1 and AC2 cover the syllabus of the three compulsory core topics: Algebra, Analysis and Differential Equations. Paper AC1 consists of 9 short, straightforward questions. The aim of the paper is to assess the breadth of coverage of the compulsory core at a basic level and students are expected to answer all questions. Paper AC2 consists of 9 questions of a more traditional style where depth of knowledge is tested. Examination candidates are required to answer at least one question from each section of the core topics (from 2008/09).

Papers AO1 and AO2 are cross-section papers on the menu of optional units and half-units with Paper AO1 assessing breadth and Paper AO2 assessing depth similar to Papers AC1 and AC2.

Years 3 and 4
The main aim in the third and fourth years is to offer the opportunity to study a range of options designed and taught by specialists within the highly research active faculty. The menu of options is constructed to encourage flexibility within a coherent structure. In line with divisional policy, the unit of learning and teaching is a 32-lecture unit. Where appropriate, however, a number of specialisms will be delivered in different formats. In particular, half-units (equivalent to a 16-lecture course) will also be available, as will project options. The units and half units which are more central to mathematics will be referred to as

Mathematics Department units and half units. There will also be an opportunity to study a small number of options in related areas, and these will be referred to as Other Mathematical and Non-Mathematical units and half units.

Units and half-units are designated as either H-level (aimed at 3rd year undergraduates) or M-level (aimed primarily at 4th year undergraduates or MSc students). Although most units are the conjunction of two half-units at the same level, for a small number of units it may be appropriate that the first half is at H-level and the second at M-level.

The examinations in the third year of the course are referred to as Part B and the examinations in the fourth year of the course, Part C. Most H-level and M-level units or half-units will be assessed through examination papers of the traditional kind but some may be assessed through mini-projects, coursework, extended essays or dissertations; most H-level material will be assessed in separate examination papers. Candidates for the BA degree will take a total of 4 units in Part B (the third year), and those for the MMath degree will in addition take a total of another three units in Part C (the fourth year), all at M level. For Part B, a total of at least three units must be Mathematics Department units or half units. Candidates may offer one unit which is an Extended Essay. For Part C a total of at least 2 units must be Mathematics Department units or half units. Candidates may offer either one whole unit or one half unit which is a Dissertation.

Mathematics Department units and half-units will usually be of the following kinds:

- 32 lectures supported by 8 one- and- half- hour intercollegiate classes (Part B) or 14 one hour intercollegiate classes (Part C) and assessed by traditional examination paper;
- 16 lectures supported by 4 one- and- half- hour intercollegiate classes (Part B) or 7 one hour intercollegiate classes (Part C) and assessed by traditional examination paper;
- a project equivalent to either a whole or half unit and assessed by extended essay/dissertation, supported by up to 8 hours supervision over two terms for a whole unit, and 4 hours over 1 term for a half unit.

Most units and half-units offered will be confirmed by the Trinity Term of the year before they are studied. Full details of each course, including prerequisites, any preparatory reading, syllabus, method of delivery, reading list and method of assessment are published by the Mathematical Institute in the Course Handbook in the form of Lecture Synopses by the start of Michaelmas Term in the year in which they are studied.

The regulations permit undergraduates, in either year, to take some units (or, where they can be matched for size, half-units) from other departments or faculties. The lists of such units and half units available plus further details and descriptions of methods of assessment will appear in the Course Handbook.

A range of Mathematics Department units will be offered at H-level, covering the whole spectrum of mathematics from foundations (logic and set theory), through main-line pure mathematics (algebra, geometry, analysis, etc.), physical applied mathematics and mathematical modelling, theoretical physics, to non-physical applied mathematics and numerical analysis.

The Teaching Committee will also consider which units and half units offered by other departments and faculties will appear on the schedule.

Options offered in the third year (2008/2009) will be as follows:
Mathematics Department units and half-units – all H-level and one unit unless otherwise indicated

B1: Logic and Set Theory
B1a Logic (half unit)
B1b Set Theory (half unit)
B2 Algebra
B2a Introduction to Representation Theory (half unit)
B2b Group Theory (half unit)
B3 Geometry
B3a Geometry of Surfaces (half unit)
B3b Algebraic Curves (half unit)
B4 Analysis
B4a Banach Spaces (half unit)
B4b Hilbert Spaces (half unit)
B568 Introduction to Applied Mathematics
B5 Applied Analysis
B5a: Techniques of Applied Mathematics (half unit)
B5b Applied Partial Differential Equations (half unit)
B6 Theoretical Mechanics
B6a Viscous Flow (half unit)
B6b Waves and Compressible Flow (half unit)
B7.1/C7.1 Quantum Mechanics; Quantum Theory and Quantum Computers (the first half of this unit is H-level, and the second half is M-level)
B7.1a Quantum Mechanics (half unit)
C7.1b Quantum Theory and Quantum Computers (half unit, M-level)
B7.2/C7.2 Relativity (the first half of this unit is H-level, and the second half is M-level)
B7.2a Special Relativity and Electromagnetism (half unit)
C7.2b General Relativity I (half unit, M-level)
B8 Topics in Applied Mathematics
B8a Mathematical Ecology and Biology (half unit)
B8b Nonlinear Systems (half unit)
B9 Number Theory
B9a Galois Theory (half unit)
B9b Algebraic Number Theory half unit)
B10 Martingales and Financial Mathematics
B10a Martingales Through Measure Theory (half unit)
B10b Mathematical Models of Financial Derivatives (half unit)
B11a Communication Theory (half unit)
B12a Applied Probability (this is the same course as OBS3a)
B21 Numerical Solutions of Differential Equations
B21a Numerical Solution of Differential Equations I (half unit)
B21b Numerical Solution of Differential Equations II (half unit)
B22a Integer Programming (half unit)
BE Mathematical Extended Essay
C3.1, C5.1a are also permitted (see M-level C list below)
Other Mathematical units and half-units

O1 History of Mathematics
OBS1 Applied Statistics
OBS2 Statistical Inference
OBS2a Foundations of Statistical Inference (half unit)
OBS3 Stochastic Modelling
OBS4 Actuarial Science
OCS1 Functional Programming and Design and Analysis of Algorithms
OCS1a Functional Programming (half unit)
OCS1b Design and Analysis of Algorithms (half unit)
OCS3a Lambda Calculus and Types (half unit)
OE Other Mathematical Extended Essay

Non-Mathematical units and half-units

N1 Undergraduate Ambassadors' Scheme (half unit)
N101 History of Philosophy from Descartes to Kant
N102 Knowledge and Reality
N122 Philosophy of Mathematics

A wide variety of other Mathematics Department units and half-units at M level covering almost all specialisms in modern mathematics and its applications will be proposed each year by subject panels and by individual specialists, in addition to the possibility of a dissertation. Proposals for Mathematics Department units or half-units at M-level will come to the Teaching Committee of the Department, via the Subject Panel, furnished with:

- Aims and objectives;
- Learning Outcomes
- Syllabus and synopsis;
- Case for a quota (if needed);
- Reading List;
- Proposals for assessment.

Options offered in the fourth year (2008/2009) will be as follows:

Mathematics Department units and half-units – all M-level and one unit unless otherwise indicated

C1.1 Model Theory and Gödel's Incompleteness Theorems
C1.1a Gödel's Incompleteness Theorems (half unit)
C1.1b Model Theory (half unit)
C1.2 Analytic Topology and Axiomatic Set Theory
C1.2a Analytic Topology (half unit)
C1.2b Axiomatic Set Theory (half unit)
C2.1 Lie Algebras and Representation Theory of Symmetric Groups
C2.1a Lie Algebras (half unit)
C2.1b Representation Theory of Symmetric Groups
(half unit)
*C3.1 Topology and Groups and Algebraic Topology
*C3.1a Topology and Groups (half unit)
*C3.1b Algebraic topology (half unit)
C4.1 Functional Analysis and Banach and C* Algebras
C4.1a Functional Analysis (half unit)
C4.1b Banach and C* Algebras (half unit)
C5.1 Methods of Applied Functional Analysis
*C5.1a Methods of Functional Analsis for PDEs (half unit)

C5.1b Fixed Point Methods for Nonlinear PDEs (half unit)
C5.2b Calculus of Variations (half unit)
C6.1 Solid Mechanics (half unit)
C6.2 Elasticity and Plasticity (half unit)
C6.3 Perturbation Methods and Applied Complex Variables
C6.3a Perturbation Methods (half unit)
C6.3b Applied Complex Variables (half unit)
C6.4a Topics in Fluid Mechanics (half unit)
*C7.1b Quantum Theory and Quantum Computers (half unit)
*C7.2b General Relativity I (half unit)
C7.4 Theoretical Physics
C8.1 Mathematics and the Environment and Mathematical Physiology
C8.1a Mathematics and the Environment (half unit)
C8.1b Mathematical Physiology (half unit)
C9.1 Analytic Number Theory and Elliptic Curves
C9.1a Analytic Number Theory (half unit)
C9.1b Elliptic Curves (half unit)
C10.1 Stochastic Differential Equations and Brownian Motion in Complex Analysis
C10.1a Stochastic Differential Equations (half unit)
C10.1b Brownian Motion in Complex Analysis (half unit)
C11.1 Graph Theory and Probabilistic Combinatorics
C11.1a Graph Theory (half unit)
C11.1 b Probabilistic Combinatorics (half unit)
C12.1 Numerical Linear Algebra and Continuous Optimisation
C12.1a Numerical Linear Algebra
C12.1b Continuous Optimisation
C12.2 Approximation Theory and Finite Element Methods
C12.2a Approximation of Functions
C12.2b Finite Element Methods for Partial Differential Equations
Dissertation on a topic in Mathematics (half unit)
Dissertation on a topic in Mathematics (whole unit)

Other Mathematical half units

MS1b Statistical Data Mining
MS2a Bioinformatics and Computational Biology
MS2b Stochastic Models in Mathematical Genetics
MS3b Levy Processes and Finance
CCS1 Categories, Proofs and Processes (half unit)
CCS3b Quantum Computer Science (half unit)
CCS4b Automata, Logic and Games (half unit)

Non-Mathematical units

Rise of Modern Logic

In line with the general policy of the Divisional Academic Committee, a Language Option will be available as an optional extra, equivalent in work to a half-paper. The result of assessment of the course will appear on the student's 'transcript' but will not count towards the Mathematics degree.

* The M-level options starred may be taken in the third year.

12. Support for Students and their learning

A. College support

Each student has a College Tutor to oversee his/her academic progress. The College Tutor arranges college teaching (tutorials and classes), advises on general academic matters such as course content and choice of options, oversees library provision of relevant texts in the college, arranges college collections, provides career advice (when requested) and references. Each undergraduate also has a Personal Tutor or Advisor (who in many cases is the same person as the College Tutor) concerned with the student's personal welfare and to whom the student can turn for support and advice on non-academic matters. Regular personal contact between students and tutors ensure that problems are addressed promptly.

In addition, in each college, there are a number of other people to whom students may turn for advice and support: Senior Tutor, Tutor for Undergraduates, Tutor for Graduates, Dean and Junior Deans, Chaplain, College Counsellor, College Doctor and Nurse, peer support groups. (The University Counselling service offers a range of assistance). All students have access to college and university hardship funds, and for some purposes, travel funds.

B. Role of college tutorials and classes

Undergraduates have college tutorials and classes to support the syllabus in the first and the second years of the degree course (typically two paired tutorials per week) for which students submit written work (normally solutions to set problems). Student progression and reports are administered centrally via the University's OxCort system, providing tutors with an overview of each student's work at the end of each term. Lecturers provide problem sheets to support the lecture courses and college tutors may set these problems for solution and discussion in tutorials. However, college tutors may set alternative or additional problems. The syllabuses for Mathematics Department units in the third and fourth years of the degree course are supported by (centrally organised) intercollegiate classes which typically contain 6–10 students and are given by a class tutor supported by a graduate teaching assistant. For these classes students submit, before each class, written solutions to problems set by lecturers for marking by the teaching assistant or class tutor. Through the departmentally coordinated intercollegiate class system, the intention is that students are taught by experts in the field, usually without the need to restrict numbers of students taking options. A record of attendance and student achievement is recorded on the class database. College tutors have access to the database and can monitor the attendance and achievement of students at their college during the term.

C. Library provision

University libraries provide all students with excellent resources. The Radcliffe Science library contains a good collection of mathematics books but is not a borrowing library. The Hooke library and particularly college libraries are borrowing libraries which provide all primary course texts (multiple copies in the Hooke library and many colleges) and a wealth of supplementary reading.

It is general practice for College libraries to purchase books which appear in the Main Reading Lists for every Mods, Part A, and Part B course (ie. first, second and third year courses). Also that, in practice, College libraries tend to provide a good selection of the books listed as 'Further Reading' for these courses. College libraries frequently have a number of copies of popular books and are often responsive to requests for new purchases. Different colleges have different mechanisms for these requests. Students are advised to contact their college tutors for advice.

Other excellent resources are: first rate local bookshops; a successful student-run second hand virtual book-stall; Mathematical Institute Notes (mini-text books written by faculty members and produced cheaply at the Mathematical Institute); an increasing electronic archive of lecture notes and problem sets; many text books written by staff members; easily available past examination papers (electronic archive); detailed examiners' reports available on the Mathematical Institute Web site and in college libraries.

D. IT

The provision of IT services and access to them is made within the context of the University's IT policy. The university has installed the IT network infrastructure, and also manages central servers, and provides training courses. Users have benefitted from substantial college enhancements. All students are given email accounts with the University network (Herald). Information is circulated to students in a number of ways: key general academic information and learning materials are posted on the Mathematical Institute web-site, students are sent information by e-mail and in hard-copy when appropriate. The Department provides all computing facilities necessary for the practical work of the courses. By taking advantage of site licences, students may run most relevant packages on their own PCs in college. Most students have their own PCs but the department has some provision for those who do not.

13. Criteria for Admission

Admissions criteria for the Mathematical Sciences Admissions Group

The following honour Schools (either three or four year, when appropriate) fall within the aegis of the Group

- Mathematics
- Mathematics and Philosophy
- Mathematics and Statistics
- Computer Science
- Mathematics and Computer Science

and the criteria will be measured with full regard to their differing requirements.

Candidates will be invited to take the Common Test (on 5th November 2008) and to come for Interview in Oxford (or just to take the Common Test if living outside Europe*) if their application gives evidence of the motivation and ability (including an appropriate mathematical background) to undertake what are demanding courses at one of the world's leading universities, sufficient to offer the possibility of final selection given the overall field of applicants. In the case of candidates whose first language is not English, an English language qualification (such as IELTS level 7) will form part of the admissions requirements.

(* Some candidates may live in parts of the world where the Admissions Office arranges interviews; sometimes colleges will arrange for candidates to be interviewed in their home countries.)

A syllabus for the entrance test is published on our web pages together with sample tests.

During the selection process, tutors will seek a demonstration of the skills and/or the aptitude necessary for the successful study of the course in question together with the motivation to undertake a demanding programme on that course, and will assess these via

i. the Common Test,

ii. submitted written material in the case of those applying to read Mathematics and Philosophy and
iii. interviews (when held),

taking into account the level of existing relevant knowledge and experience.

Tutors will, in addition to assessing aptitude and technical skills, seek in successful candidates

a. a capacity to absorb and use new ideas,
b. the ability to think and work independently, and
c. perseverance and enthusiasm,

in each case to be assessed in respect of the course applied for.

Evidence of the extent to which these criteria have been met will be taken from the performance in i, ii (when relevant), and iii above, together with

iv. past examination records, and
v. references and the personal statements contained on the UCAS form.

Candidates will also have the opportunity to present any special factors that they would wish to be considered.

An overall assessment of the strength of each candidate relative to the field of all applicants at this stage will normally be made by at least two colleges, based on the criteria detailed above. Ultimate selection is necessarily competitive since the number of places is limited. However, through early identification during the interview process of strong candidates who may not gain places at their first or second choice colleges, the Mathematical Sciences Group takes active steps to ensure that (whenever possible) such candidates may be offered places at other colleges.

Applications for undergraduate places are made to the colleges of the University. Entrance is competitive and an offer of a place is made on the basis of a student's academic record, predicted results, recommendation of teachers, performance on the entrance test and performance at interview. Arrangements are made for overseas students to sit the test abroad and to be assessed without attending for interview in Oxford.

The entrance test (2.5 hours) contains questions on core knowledge common to A-level syllabuses in Mathematics and is designed to be accessible to students who are studying for a single mathematics A-level. The aim of the test is to provide additional information on candidates, and is particularly valuable for those applicants who may not perform well in the interview situation, or whose mathematical background is unconventional.

The majority of applicants are invited to come for interview and are interviewed not only by tutors of the college of first choice but also by those in the college of second choice, and in a number of cases, several other colleges interview the applicants. The purpose of the interview is to determine those students, from an excellent cadre of applicants, who might best benefit from the intensive, tutorially based learning methods. The overall assessments of a candidate (based on the candidate's academic record, recommendations of teachers, the Common test score and performance at interview, including contextual information) by both the first and second choice colleges are made available to all other colleges to facilitate the further consideration of promising candidates. This is done by storing information on test scores, college assessments and UCAS forms in an electronic database. This has proved to be a very valuable resource for promoting good practice towards ensuring that the best candidates are offered (mostly conditional) places. College cooperation extends to making a small number of Open Offers.

The vast majority of English students enter Oxford with at least 3 A grades at A-level; conditional offers are typically made at AAA level with variations to accommodate candidates taking a single mathematics A-level or a restricted range of Higher or SYS papers, also Scottish Highers and various Baccalaureates. Every effort is made to recognise potential in cases where data other than forecast grades suggests that predicted A-level grades may underestimate academic ability.

14. Methods for evaluating and improving the quality and standards of learning

Responsibility for the course is vested in the Mathematical, Physical and Life Sciences Division. The divisional board has formal responsibility for the maintenance of educational quality and standards in the broad subject areas, and exercises its responsibility through its Academic Committee, and in particular the scrutiny it gives to the new course proposals and proposed course revisions, to reports from examiners, and to more general questions of academic policy.

There are regular procedures for monitoring and evaluation of courses, and the programme structure. Examiners' reports are considered at a meeting of the Teaching Committee at the beginning of the academic year. The syllabus, its presentation and student feedback are discussed in meetings of the Teaching Committee and the Faculty throughout the academic year. A student representative sits on Teaching Committee.

Student feedback on (undergraduate) lectures and intercollegiate classes is encouraged by the distribution and collection of multiple-choice questionnaires during one of the later lectures or classes in a series. There is an additional slot for commenting on college provision of supporting tutorials and classes. Responses are anonymous. Space is provided for comments on aspects not covered by the questionnaire. Results are analysed statistically and the results, plus comments, relayed to the individual lecturers and class tutors. The Chairman of Mathematics and the Director of Undergraduate Studies scrutinise the results, and discuss them with a designated undergraduate representative. The Director of Undergraduate Studies uses the questionnaire results to identify where the lecturer might need additional support. The Teaching Committee considers them when allocating lecture courses. Feedback from the questionnaires on the performance of lecturers in their initial years of appointment are made available to the Teaching Advisor, who will raise any apparent problem with the lecturer concerned, in a supportive way. A summary of results is forwarded to the Chairman of Mathematics and the Director of Undergraduate Studies and further action taken when appropriate.

An annual report on intercollegiate classes is provided for the Chairman of the Senior Tutors Committee.

Student concerns are discussed at termly meetings of the JCCU (Joint Consultative Committee with Undergraduates). The Minutes of the JCCU (prepared by junior members) are considered by the Teaching Committee. Follow-up regarding student concerns or questions or consultation documents is fed back to undergraduates and is made available to students on-line (with notification via e-mail). There is further student representation at the Faculty meetings. There is a student representative on the Department's Teaching Committee and on the Divisional JCC.

Student comments on tutorial provision are solicited by colleges and reviewed in ways which vary from college to college, typically by the Senior Tutor, Tutor for Undergraduates or Head of House.

Each term Tutors are invited to offer feedback on lecture courses including information on how well their students tackled the problem sheets, collections and lecture courses overall, including how well each course builds on previous courses. This is reported to Teaching Committee and individual lecturers. General feedback of course questionnaires is given to Honour Moderation Lecturers to help guide subsequent courses for that year, and share good practice via the Moderations Co-ordinators Committee.

The Teaching Committee of the Faculty oversees the minor changes to syllabus and lists of recommended textbooks published in the course handbooks as well as proposals from subject panels for variations in advanced options available in the fourth year.

Major revisions to the curriculum are widely discussed. It is usual for an ad-hoc committee to be established to prepare proposals for debate in the Faculty.

The divisional board is also responsible for academic appointments and for the arrangements (including mentoring, appraisal, and reviews of performance) for the support of newly appointed lecturers and for monitoring their teaching competence.

Staff are encouraged to participate in staff development sessions run by the OLI (particularly the national induction day for new staff) and sessions organised by the Undergraduate Teaching Advisor/Director of Undergraduate Studies within the department.

Peer review of lecturing skill has been introduced to be performed in roughly five year cycles.

The results from the National Student Survey and the Oxford Student Course Experience Questionnaire are reviewed by the Teaching Committee and action is taken if necessary.

The External Advisory Panel offer input to the department on a range of issues, including policy, strategy and direction, and curriculum content.

15. Regulation of assessment

Examiners and the Examining Framework

The Teaching Committee of the Mathematical Institute is responsible for establishing the conventions for the setting, checking, marking of the examinations; and for the classification conventions.

The examinations are conducted within this framework by small Boards of Examiners appointed by the Nominating Committee; an important feature is that its internal members are formally independent of the course lecturers and tutors. The Boards of Examiners, under their elected Chairs, are responsible for the setting of all papers, and marking of scripts. The Board appoints Assessors (generally course lecturers) to assist in setting and marking papers. Candidate numbers are used to ensure anonymity.

At the conclusion of the examination, Boards of Examiners make detailed written reports giving overall statistical information, information on new examining methods and procedures, and changes under consideration; and also giving detailed commentary on each paper, usually on a question-by-question basis.

Each examination board has at least one External Examiner, who is appointed by the Vice Chancellor, to act as impartial advisor and in particular

- to verify that standards are appropriate to the award, in part by comparison with the standards of comparable institutions, and to ensure that the assessment procedures and the regulations governing them are fair and otherwise appropriate;
- to ensure that the process of the examination and the determination of the awards has been fairly conducted, and that the individual student performance has been judged in accordance with the regulations and conventions of the Examining Board. [This will entail signing the Class List as an endorsement that the process of examination and classification has been fairly conducted.]

Each External Examiner is expected to report annually to the Vice-Chancellor. National guidance requires external examiners to report on three main areas:

- whether the standards are appropriate for the institution's award;
- the standards and comparability of student performance in the programmes concerned;
- the extent to which procedures for assessment, examination and the determination of awards are sound and have been fairly conducted.

The report of the Board of Examiners, and of each External Examiner is addressed to the Vice-Chancellor and considered by the Academic Committee of the Mathematical, Physical and Life Sciences Divisional Board, and by the Education Committee (Formerly the Educational Policy and Standards Committee) of the University.

The reports are also considered in detail by the Teaching Committee of the Mathematical Institute, whose responsibility it is to ensure that full consideration is given to any particular criticism or suggestion made by an External Examiner, and to institute further discussion or action, and to inform the External Examiner within a reasonable time of what is done.

The reports of the Examiners and of the External Examiners are conveyed to the members of the Faculty of Mathematics, and the Joint Consultative Committee with Undergraduates.

The examination papers, and the detailed reports of the Board of Examiners are made available to all students (and others) on the departmental website. External Examiners reports are also available from within the Oxford network. Teaching Committee approves an annual report on examinations which aims to draw together experiences of each board, with detailed actions that are planned or proposed.

Assessment Rules and Classification

- The conventions established by the Teaching Committee are published by the Committee in the Course Handbook and its supplements.

- For the purposes of the final classification, the four papers taken at end of first year do not count.

- Classification for the three-year course is based on four papers taken at end of second year, and four (or their equivalent) at end of third year. Successful candidates may supplicate for the BA Honours degree.

- Classification for the four-year course is normally based on four papers taken at the end of the second year, and four at the end of the third year; together these papers are classified as the Second Public Examination at Part B. The fourth year is classified separately. Thus two classes are now attached to the MMath.

- The performance of each candidate on each paper/module is reported in the form of a Standardised Mark for that paper/module:

    - 70+: First class performance on paper
    - 60–69: Upper Second class performance on paper
    - 50–59: Lower Second class performance on paper
    - 40–49: Third class performance on paper
    - 30–39: Pass performance on paper
    - 0–29: Fail performance on paper

- Qualitative class descriptors for these levels of performance are set out in the Course Handbook; in summary:

First Class: the candidate shows excellent skills in reasoning, deductive logic and problem-solving. He/she demonstrates an excellent knowledge of the material, and is able to use that innovatively in unfamiliar contexts.

Upper Second Class: the candidate shows good or very good skills in reasoning, deductive logic and problem-solving. He/she demonstrates a good or very good knowledge of much of the material.

Lower Second Class: the candidate shows adequate basic skills in reasoning, deductive logic and problem-solving. He/she demonstrates a sound knowledge of much of the material.

Third Class: the candidate shows reasonable understanding of at least part of the basic material and some skills in reasoning, deductive logic and problem-solving.

Pass: the candidate shows some limited grasp of basic material demonstrated by the equivalent of an average of one meaningful attempt at a question on each unit of study. A stronger performance on some papers may compensate for a weaker performance on others.

Fail: little evidence of competence in the topics examined; the work is likely to show major misunderstanding and confusion, coupled with inaccurate calculations; the answers to questions attempted are likely to be fragmentary only.

In relation to the subject benchmark standards we would say “threshold” would be likely to be associated with a third class and “typical” would refer to the II.1/II.2 boundary.

- The final class is determined by the weighted average of the paper standardised marks. A marks profile is also expected.
- For the three-year degree the weights of second and third year papers are 40 : 60.
- The fourth year is classified on its own.

16. Indicators of quality and standards

- QAA Subject Review in 2000 achieving excellent grading.

- Departmental Review (by the MPLS Division) 2004 and follow-up

- The reports of External and Internal Examiners regularly address issues of quality and standards.

- The annual returns on First Destinations of Graduates demonstrate the success graduates from the mathematics courses enjoy in the job-market, and in obtaining admission to graduate courses.

- The External Advisory Panel of the Mathematical Institute (which contains a number of potential employers of mathematics graduates) meets officers of the Teaching Committee annually and is kept informed and may be consulted regarding course content.

- Historic data pertaining to class distributions, comparison with the MPLS Division, and within the University and with other Russell group Mathematics programmes.

GLL, PMN, WBS, NMJW
06/03/02
Revised GLL 2/01/03, 29/05/03, 27/10/03
Revised JD 26/11/04
Revised GLL 27/08/05
Revised criteria for a 'Pass' CG 10/03/06 and ratios 2 : 3: 4 09/08/06
Revised to take account of some factual changes CG 20/09/06; and discussion at Teaching Committee 2nd Oct - 23/10/06
Revised 23rd October 2007 AGC, MS
Revised 23rd October 2008 AGC, MS, CER