HANDBOOK FOR THE UNDERGRADUATE MATHEMATICS COURSES

ISSUED OCTOBER 2015

This handbook applies to students starting the course in Michaelmas term 2015. The information in this handbook may be different for students staring in other years. This handbook is intended as a guide and reference for you throughout your Mathematics course at Oxford. Please keep it as a handy reference guide.

The Examination Regulations relating to this course are available at https://www.admin.ox.ac.uk/examregs/2015-16/pexaminmath/studentview/ (for the Preliminary Examination) and https://www.admin.ox.ac.uk/examregs/2015-16/hschoofmath/studentview/ (for the Final Honour School). If there is a conflict between information in this handbook and the Examination Regulations then you should follow the Examination Regulations. If you have any concerns please contact the Academic Administrator in the Mathematical Institute (`academic.administrator@maths.ox.ac.uk`).

The information in this handbook is accurate as at October 2015, however it may be necessary for changes to be made in certain circumstances, as explained at www.ox.ac.uk/coursechanges. If such changes are made the department will publish a new version of this handbook together with a list of the changes and students will be informed.

Version 1.2, June 2016.

1. 11th March 2016: Information about disability support updated on pages 31 and 45.
2. 14th June 2016: Partial Pass descriptor added to page 26.

The Mathematical Institute

Welcome from the Head of Department

Three or four years of studying mathematics lie ahead of you, and we sincerely hope that they prove exciting and memorable. You certainly have reason to hope so! You are joining one of the largest and most successful mathematics departments in the world, shortly after it has moved into its new home, the Andrew Wiles Building, and at a time when mathematical patterns in all their diversity are more widely appreciated than ever as mathematics permeates and influences society.

The diversity and scope of modern mathematics will become ever more apparent to you as your studies progress. One of the advantages of studying in a large department such as ours is the range of options that will be available in later years, often taught by internationally renowned mathematicians.

In the early days of your first academic year you may feel uncertain as well as excited, but you will soon settle into the rhythms of an Oxford week and term. The Department will be a key part of that week as you attend lectures, but we hope that you also find it a good place to study (for example, in the Undergraduate Study Area) and to meet your fellow students (for example, in the cafeteria or at Invariants lectures).

From the off you will be learning a different style of mathematics to a schedule much more of your making, than was previously the case at school or college. Your lecturers and tutors are there to support and guide you, but there is no denying that the most important component of your week is your independent study. The time you spend thinking about mathematics, trying to make sense of new ideas and trying to resolve for yourself your uncertainties, is the single most important aspect of your developing as a mathematician.

So, again, welcome to the Mathematical Institute, Oxford, and warm wishes for your time here.

Prof. Martin Bridson

Contents

1 Introduction

1.1 Using this Handbook

The **handbook** supplements the material printed in the **Examination Regulations**, a document containing the formal regulations of the University relating to examinations and to the different programmes of study offered by the University. The **handbook**, read in conjunction with its supplements, defines the course syllabus, provides you with information to help you understand the processes and procedures of the Mathematical Institute, and the other facilities such as libraries and computers to which you have access. It gives you information on how you will be assessed and how your examinations are classified. You are supplied with the **handbook** at the beginning of your course and will be informed of the availability of supplements, including the **synopses of lecture courses** for each year of your course. All this material is also published on the Mathematical Institute website (http://www.maths.ox.ac.uk/members/students/undergraduate-courses/teaching-and-learning/handbooks-synopses).

The **handbook** also gives you some information about how colleges work in relation to your Mathematics course. Your college tutors will give you more detailed information about the support provided within the tutorial system. Further information is also available in the form of College Handbooks on College websites.

This is primarily the course handbook for the single subject Mathematics courses. Much of what is said is also relevant to the Mathematics parts of the joint courses (Mathematics & Computer Science, Mathematics & Philosophy and Mathematics & Statistics). However, students on the joint courses should also consult the handbooks designed specifically for those courses. See appendix B for details of where to find these.

1.2 Other Important Documents

Examination Regulations: these govern all academic matters within the University and contain the general regulations for the conduct of University examinations, as well as specific regulations for each degree programme offered by the University. The Examination are available online at http://www.admin.ox.ac.uk/examregs/ and

http://www.ox.ac.uk/students/academic/exams.

If any information in the Examination Regulations affecting you is changed you will be informed. However, there is a convention that the syllabus cannot be changed to your disadvantage once you have started studying for the examination concerned, provided you take your examinations at the normal times.

Oxford Student Handbook:http://www.admin.ox.ac.uk/proctors/info/pam/. This contains general information and guidance about studying at the University of Oxford, and gives you formal notification and explanation of the University's codes, regulations, policies and procedures. The **Oxford Student website** (http://www.ox.ac.uk/students) provides access to information, services and resources.

Synopses of Lecture Courses: at the start of each year the Mathematics Department produces the syllabi for the coming year's examinations and synopses of lecture courses. The syllabi are the content on which examinations may be set; the synopses state the intended

content of lecture courses but lecturers may include extra material enhancing the syllabus but which is not examinable. Included with the course synopsis is the course reading list. For Prelims, a formal syllabus giving the examinable content is published. For Parts A, B and C the syllabi are defined by the synopses. At the induction session new students will be provided with hard copy of the Prelims syllabi and synopses of lectures. It is also available online at

http://www.maths.ox.ac.uk/members/students/undergraduate-courses/teaching-and-learning/handbooks-synopses

as are the syllabi and synopses for latter parts of the course. Any student may obtain a printed copy of this information on request from the Reception at the Mathematical Institute.

A separate guide is produced annually for the third and fourth year projects options and is available online at http://www.maths.ox.ac.uk/members/students/undergraduate-courses/teaching-and-learning/projects.

Computational Mathematics Manual: this guide contains information about the content and assessment of the first-year **Computational Mathematics** course. A hard copy of this document will be given to you at the induction but it can also be found online at http://www.maths.ox.ac.uk/courses/course/28830/material.

Lecture List: this document gives the titles, times and places of lectures for Mathematics courses and is available online at

http://www.maths.ox.ac.uk/members/students/lecture-lists.

1.3 Useful Contacts

A list of useful contacts is given in appendix F.

1.4 Email

You will be allocated a college email account. Important information about your course will be sent to this account. If you do not plan to access it regularly then you should arrange for mail to be forwarded to an account which you do read regularly. You are asked to bear in mind that lost email is the students' responsibility should they choose to forward email to a system outside the university.

General

Comments or suggestions for matters which might be amended or which might usefully be covered in subsequent editions of this booklet would be welcome. They should be sent to the Director of Undergraduate Studies in the Mathematical Institute, or emailed to `academic.administrator@maths.ox.ac.uk`.

If you require this handbook in a different format, please contact the Academic Administrator in the Mathematical Institute: `academic.administrator@maths.ox.ac.uk` or `(6)15203`.

2 Your First Weeks at Oxford University

Many of you will already have read 'How do Undergraduates do Mathematics?' originally prepared by Professor Charles Batty with the assistance of Professor Nick Woodhouse with more recent updates by Dr Richard Earl, Prof Frances Kirwan and Dr Vicky Neale. If you have not done so, then it is available online at

https://www.maths.ox.ac.uk/system/files/attachments/study_public_0.pdf

and you are strongly recommended to read it as part of the induction to your course.

The Department Induction session is held at 2pm on Friday Week 0 in the Mathematical Institute, lecture theatre 1, at which you will be given important documentation for your course. Further useful information can be found at

http://www.maths.ox.ac.uk/members/students/undergraduate-courses/teaching-and-learning/prelims-students

The mathematics students have also developed a useful "Guide to Freshers" and website (https://www.maths.ox.ac.uk/members/students/undergraduate-courses/undergraduate-representation/murc). You may find it helpful to read their briefer more informal view on what you need to know at the beginning of your course.

3 The Mathematics Courses

3.1 Background

Oxford University is a large collegiate university, with over 22,000 students including around 12,000 undergraduates and 10,000 postgraduates.

3.2 Mathematical, Physical & Life Sciences Division

The Mathematics, Statistics and Computer Science Departments are all part of the Mathematical, Physical & Life Sciences Division. These departments provide most of the rooms and resources for the mathematics courses.

3.2.1 Academic Staff

Most established Mathematics University postholders are based in the Mathematical Institute, the Department of Statistics, or the Department of Computer Science; a few are also in Philosophy, Social Sciences, and Physics.

The University staff in each department, and main college teachers in the subject areas, are grouped together in a faculty. The faculties provide a broad consultative framework which ensures that the views of all teaching staff are taken into account when decisions about admissions, syllabus, teaching and examining are made.

The most recent research ratings (the 2014 Research Excellence Framework (REF)) showed that Oxford mathematicians were assessed extremely highly with a significant percentage of faculty with internationally renowned reputations. Oxford's Mathematical Sciences submission was ranked overall best in the UK.

3.2.2 The Departments

The Mathematical Institute

The Mathematical Institute is a focus for mathematical activity in Oxford. The members of the Mathematical Institute include more than 200 graduate students as well as professors, readers, other members of staff and academic visitors. There are currently 15 statutory chairs held in the department, though many other academics hold the title of Professor. The Mathematical Institute, as the mathematics department is known, incorporates the Oxford Centre for Industrial and Applied Mathematics, as well as the Wolfson Centre for Mathematical Biology and the Oxford Centre for Nonlinear PDE. Whilst it is usual for mathematics departments in Britain to be split into departments of Pure and Applied Mathematics, the unitary Oxford structure, which encourages numerous strong interactions between the different groups, is regarded as a major factor in the continued high reputation enjoyed by Oxford Mathematics.

Research is carried out in a wide variety of fields including algebraic, differential and general topology, group theory, representation theory and other branches of algebra, number theory, mathematical logic, functional analysis, harmonic analysis, algebraic and differential geometry, differential equations, probability theory and its applications, combinatorial

theory, global analysis, mathematical modelling, financial mathematics, stochastic analysis, mathematical biology, ecology and epidemiology, continuum mechanics, elasticity, applied and fluid mechanics, magnetohydrodynamics and plasmas, atomic and molecular structure, quantum theory and field theory, relativity and mathematical physics, applied analysis, materials science and numerical analysis.

The Department of Statistics

The Department of Statistics provides a focus for Statistics within the University, and has numerous links with outside scientific and industrial concerns, especially in the area of genetics.

Department of Computer Science

The Department of Computer Science is a leading centre for the study, development and exploitation of computing technology.

3.3 The Courses

The University offers two single-subject courses in Mathematics, and seven joint courses:

MMath	Mathematics	4-year
BA	Mathematics	3-year
MMathCompSci	Mathematics & Computer Science	4-year
BA	Mathematics & Computer Science	3-year
MMathPhil	Mathematics & Philosophy	4-year
BA	Mathematics & Philosophy	3-year
MMath	Mathematics & Statistics	4-year
BA	Mathematics & Statistics	3-year
MMathPhys	Mathematical & Theoretical Physics	4-year

3.3.1 Overall Course Structure

The degree programmes listed in 3.3 are structured so as to share certain lectures and supporting classes, and to share certain examination papers. The first-year courses, in particular, have been constructed so that it is sometimes possible to move from one course to another. Such a change needs the permission of your college, and if you think you may want to change course you should consult your college tutor as soon as possible (see 3.8 Exit Points).

There are formal University examinations at the end of the first, second, third, and (where relevant) the fourth year of the course. (As mathematics is a progressive subject, later examinations, by implication, cover earlier core work.) The examinations at the end of the first, second and third year are the same for both the 4-year and the 3-year mode of each course.

The first year examination is called the **Preliminary Examination**, usually just referred to as 'Prelims', the second-year examination is called **Part A**, the third-year examination is called **Part B** and the fourth-year examination is called **Part C**.

Teaching is normally through structured lecture courses supported by classes or tutorials, and, where appropriate, practical work. In the third and fourth years, there may be some reading courses involving prescribed reading and group meetings.

Assessment is normally by written examination. However, some units are assessed by coursework for which projects or extended essays are submitted. Further details can be found in the supplements you will receive as you progress through each year of the course. If you want to look ahead, the current supplements are available online (see section 1.2).

3.4 Programme Specification

The Master of Mathematics (MMath) in Mathematics and the Bachelor of Arts (BA) in Mathematics may be compared to national standards for higher education qualifications through the Framework for Higher Education Qualifications (FHEQ). The University awards framework (UAF) maps the awards of the University against the levels of the FHEQ. The FHEQ level for the MMath is 7 and for the BA is 6. The relevant subject benchmark statement for the course, which sets out expectations about standards of degrees in a given subject area, is Mathematics, Statistics and Operational Research (QAA 2015).

The aims of the courses and the intended learning outcomes are listed in appendix A.

3.5 The First Year

The first year course is run as a joint venture with the Statistics Department. The official first year syllabus for the Preliminary Examination for 2015/16 is set out in the Synopses of Prelims Lecture Course (see section 1.2). The lecture courses form a co-ordinated programme, ensuring full and careful coverage, avoiding unnecessary duplication to help you prepare for the examinations.

3.5.1 The Lecture Courses

The lecture courses in the first year are as follows:

Michaelmas Term	
Introduction to University Mathematics	8 lectures
Introduction to Complex Numbers	2 lectures
Linear Algebra I	14 lectures
Analysis I	15 lectures
Introductory Calculus	16 lectures
Probability	16 lectures
Geometry	15 lectures
Hilary Term	
Linear Algebra II	8 lectures

Groups and Group Actions	8 lectures
Analysis II	16 lectures
Dynamics	16 lectures
Fourier Series and Partial Differential Equations	16 lectures
Multivariable Calculus	16 lectures
Trinity Term	
Groups and Group Actions	8 lectures
Analysis III	8 lectures
Statistics and Data Analysis	16 lectures
Constructive Mathematics	8 lectures

3.5.2 The Computational Mathematics Course

In addition to the written papers for Prelims, students reading Mathematics or Mathematics & Statistics are required to follow a compulsory computing course "Computational Mathematics". This course has been devised to acquaint mathematicians with the use of computers as an aid to learning about mathematics, and to give access to a useful mathematical software package. Please refer to the course manual for further information.

The course is computer-based and currently uses the Matlab software. You may access the system through college or individual computers; for the former you should consult the computing support at your own college. Matlab may be installed and used on personally-owned computers under the University's site license. Further details on how to install MATLAB are available at http://www.maths.ox.ac.uk/members/it/software-personal-machines/matlab.

Practicals are held in the Mathematical Institute and you will need to bring a laptop. To save time, you are asked to install Matlab on your laptop prior to the first session. If you do not have a laptop you will be able to borrow one for the practicals from the Institute, please contact Nia Roderick, Academic Assistant (roderick@maths.ox.ac.uk) as soon as possible.

The course is divided into two parts, one part in each of Michaelmas and Hilary terms. The Michaelmas term work consists of preparatory work. Four practicals of two hours each are timetabled and you will be emailed the times of your college's practical sessions.

In Hilary term you work on two projects. The marks for which are communicated to the Moderators (first year examiners), who will take them into account. Candidates shall only be deemed to have passed the Preliminary Examination if they have satisfied the Moderators in all five examination papers *and the practical assessment*. Therefore, candidates who do not obtain an overall USM of 40 or above for their projects will be required to resit them. Details on submitting your project work will be provided in the course manual.

Students transferring into Mathematics from any other subject will still be expected to submit two projects (but may be granted extensions to deadlines).

These projects must be your own unaided work; you will be asked to make a declaration to this effect when you submit them. The University and Mathematical Institute regard plagiarism as a serious issue. Any attempt to submit another's work as your own or to make use of published sources without explicit reference to them will be regarded as an infringement of University's code concerning academic integrity. Your attention is drawn to

the *Student Handbook (incorporating the Proctors' and Assessor's Memorandum),* Section 5.4, "Plagiarism" which covers all forms of assessment. See also section 8.1 for further information.

It is important to observe the deadlines for submitting your Computational Mathematics projects. For 2015/16 the deadlines are:

- **1st project: 12 noon on Monday of week 6, Hilary term**
- **2nd project: 12 noon on Monday of week 9, Hilary term**

If you are unable to meet the above deadlines you may ask your college to apply for permission to submit late. Where there is a valid reason, approval would normally be granted and no penalty applied to the marks. If work is submitted late and it is deemed that there is no valid reason the Moderators may apply a penalty of a reduction in the marks awarded according to the following tariff.

Table 2: Late Submission Tariff

Lateness	Penalty
Up to 4 hours	1 %
4–24 hours	10%
24–48 hours	20%
48–72 hours	30%
72–96 hours	40%
96–101 hours	50%

Note: The penalty will be a percentage reduction of the maximum total mark available for the work. For example, if a 10% penalty is applied to an assessment given a USM out of 100 then 10 marks would be deducted. The final mark awarded after application of the penalty cannot be below 0.

Failure to submit a required element of assessment will result in the failure of the whole of the Preliminary Examination.

3.6 Important Dates

Below is a summary of important dates in the first year.

Michaelmas Term

Friday 9th October, 2pm	Undergraduate Induction
Monday 12th October (week 1)	Michaelmas term lectures begin
Thursday 15th October (week 1)	Undergraduate Welcome Party
Monday 26th October (week 3)	Computational Mathematics practical sessions begin
Friday 4th December (week 8)	Michaelmas term lectures end

Hilary Term

Monday 18th January (week 1)	Hilary term lectures begin
Monday 22nd February, 12 noon (week 6)	Submission deadline for first Computational Mathematics project
Friday 11th March	Hilary term lectures end
Monday 14th March, 12 noon (week 9)	Submission deadline for second Computational Mathematics project

Trinity Term

Monday 25th April (week 1)	Trinity term lectures begin
Friday 20th May (week 4)	Prelims preparation lecture
	Trinity term lectures end
Monday 20th June (week 9)	Provisional start date for the examinations

3.7 The Second, Third and Fourth Years

In the second, third and fourth year of your course many options are available. These vary a little from year to year depending on faculty interests and current research interests. The list of courses currently being taught in these year can be found in the relevant course synopses available at http://www.maths.ox.ac.uk/members/students/undergraduate-courses/teaching-and-learning/handbooks-synopses. You will receive information on the options, year by year, when it becomes available.

3.7.1 The Second Year (Part A)

The second year course consists of three compulsory subjects (core material):

Linear Algebra (16 lectures),
Differential Equations 1 (16 lectures),
Metric Spaces and Complex Analysis (32 lectures),

followed by a number of *long options* (16 lectures each):

Rings and Modules,
Integration,
Topology,
Differential Equations 2,
Numerical Analysis.
Probability,
Statistics,
Fluids and Waves,
Quantum Theory,

and *short options* (8 lectures each):

Number Theory,
Group Theory,
Projective Geometry,
Introduction to Manifolds,
Integral Transforms,

Calculus of Variations,
Graph Theory,
Special Relativity,
Modelling in Mathematical Biology.

The compulsory core is studied in Michaelmas term, alongside some options. The options are mostly studied in Hilary, and the first half of Trinity term. Each student shall be required to offer 9 written examination papers. These will include 3 papers on the core subjects, 5 papers from the long options and 1 paper on the short options (of which students are recommended to take three). Students may opt to offer an additional paper from the long options and so do 10 examinations in total. Students considering taking an additional long option are advised to discuss this with their college tutors.

The Mathematical Institute is responsible for the delivery of all units except for those on Probability and Statistics, which are the responsibility of the Department of Statistics.

3.7.2 The Third and Fourth years (Parts B and C)

You will take the equivalent of eight 16-hour units in the third year from the schedule of Part B units; those continuing to the fourth year will be expected to take the equivalent of eight 16-hour units from the schedule of Part C units in that year.

Units are designated either as H-level (aimed at the third year undergraduates) or M-level (aimed primarily at the fourth year or M.Sc. students).

Options are available to take double unit extended essays, structured projects or dissertations. See section 5.12 for further detail.

3.7.3 Mathematical and Theoretical Physics (MMathPhys)

From the academic year 2015/16, Oxford Physics and Oxford Mathematics are jointly offering a new masters level course in Mathematical and Theoretical Physics. Oxford MMath students will be able to apply for transfer to the MMathPhys mode of the course after their third year and study mathematical and theoretical physics in their fourth year, instead of following the fourth year of their original degree course. The MMathPhys course provides a high-level, internationally competitive training in mathematical and theoretical physics, right up to the level of modern research. It covers the three main areas

- Theoretical Particle Physics.
- Theoretical Condensed Matter Physics.
- Theoretical Astrophysics, Plasma Physics and Physics of Continuous Media.

The programme offers considerable flexibility and freedom to design individual pathways. For example, students can aim for a broad theoretical education across subject areas or, alternatively, focus on one of the three subject areas above. Studies can be pursued with stronger emphasis on mathematical or on physical aspects.

MMathPhys students will graduate with a Master of Mathematical and Theoretical Physics with a double classification, a BA degree class for the first three years of their study in their

original subject and a MMathPhys degree class for their fourth year. For full details see the course website http://mmathphys.physics.ox.ac.uk/.

3.7.4 Pathways

Formal details of which combinations of units you may offer in the examinations will be published by the University in the **Examination Regulations**. The **lecture synopses** will describe recommended 'background courses'. It should be noted that you may choose a course even though you have not done the background courses, but the lecturers and examiners will lecture and examine on the basis that you have the background. If you wish to take a course and you have not taken the recommended background courses then you are advised to consult your college tutors who may be able to help and advise you on background reading.

At the end of the Part A Supplement to the Handbook is a section detailing which Part B options find which Part A options to be essential, recommended or useful.

3.7.5 Making Choices

Your college tutors will be able to give you advice. Some preliminary work in the libraries, looking at the books recommended in the **reading lists** may also help. **Past papers**, and **examiners' reports** may give some of the flavour.

There are Options Fairs run in the Mathematical Institute in Trinity term – of your second year for Part B and of your third year for Part C – where representatives from the different subject groups will discuss the individual options and be available to answer any questions you may have.

When making your choice you should consider not only options which you find interesting and attractive, but also the terms in which lectures and classes are held. Ideally your work in Michaelmas and Hilary terms should be spread evenly.

3.8 Exit Points

We hope, and expect, that you will enjoy studying Mathematics at Oxford and will successfully complete your degree. A high proportion of those admitted to read Mathematics elect to stay for 4 years to complete the MMath; of the remainder, almost all obtain the B.A. in Mathematics after 3 years. A very few students will opt to switch to another Oxford course or, exceptionally, to a course at another university.

3.8.1 Three Years or Four Years?

The choice of which degree you take will be based on your interests and aptitudes, your performance in the first three years and your career intentions. You may wish to discuss your decision with your college tutors, who will be able to advise you on which course is more appropriate for you. **You will need to achieve overall a 2.1 or better in your second and third year exams to progress to Part C**.

By default, all students are registered for the MMath. If you subsequently decide to take the B.A. option you must inform your college office who will in turn inform the central administration and the departments. Around the time that you enter for your Part B examinations you will be asked to confirm whether or not you intend to stay for the fourth year. The decision you declare at this point is not immutable, but should be final if at all possible, and you are strongly advised to take a final decision before the start of your Part B examinations.

Please ensure that you have consulted your college tutor(s) before making your decision. It is important that your college knows your intentions as early as possible in order to plan for the following year. You are therefore requested to notify your college, either yourself or through your tutor, of your intentions, and to keep the college fully informed if these subsequently change.

It could happen that, having embarked upon your fourth year, you are for whatever reason unable to complete the Part C course, or decide that you do not wish to do so. In these circumstances you are advised to discuss your situation with your college's Senior Tutor at the earliest opportunity.

3.8.2 Changing Course

We very much hope, and in the great majority of cases can confidently expect, that you will do well in this course and benefit from your studies. At the same time, you should not feel that your original choice is irrevocable if it is not turning out as you had anticipated. In any degree course, a very few who embark upon it may come to feel it is not the right course for them. Mathematics is no exception and a few students doing the course change to another.

If you are feeling you should change, the first thing is to be patient for a while. You may be finding the course difficult but this is natural enough and your tutors are there to help you with difficulties. Seek their advice, and maybe discuss your problems with your contemporaries: you are not in competition with them, and you should get into the habit of helping and being helped. Nevertheless you may continue to feel that the course is not right for you.

If you are considering changing from Mathematics to another Oxford course, the possibilities are to change to a course joint with Mathematics, or to an entirely different course. This last is the most radical and its feasibility depends on particular interests, background and circumstances. The first is more generally feasible. You will find it helpful to talk to fellow students on the course or courses to which you might like to change and to consult the University Prospectus and course documentation available on the web. Normally your college will have admitted you to read for a specific undergraduate degree (consisting of the sequence of First Public Examination followed by Final Honour School). If you wish to explore the possibility of changing course, first talk to one of your current tutors or, if that is embarrassing, to the Senior Tutor or to someone else in your college with responsibility for academic welfare of students. After that, talk to tutors in the subject to which you wish to change.

If you have already made a substantial start on your course then it is likely that your tutors will advise you to stay with it until you have completed your First Public Examination. By

proceeding in this way you may be able to change course without losing a year, since you must pass a First Public Examination in some course or other before you can proceed to any Final Honour School and any First Public Examination counts as a qualification for any Final Honour School.

Changing to another course joint with Mathematics

If you are considering changing to a Mathematics joint course before Prelims, then you need to be aware that you will need to catch up on course work in the other subject. To change to a joint Mathematics course after Prelims will involve studying over the summer some of the material examined in the second discipline. Your tutors will advise you what to concentrate on.

Changing to another Oxford course: the formalities

If you decide you do want to change course, there are three bodies that must approve: your college, the University, and those who are paying for you. Permission from your college will be needed for change to another course. This is liable to be refused if the receiving tutors think you unsuited to their course, or don't have room. The University is unlikely to be a problem. It accepts for any examination all candidates who are suitably qualified and supported by their colleges. However, a few departments do have quotas for acceptance on to the courses taught in them.

See below as regards financial issues in connection with a change of course.

Moving to another university

The most radical (and rare) change is to decide to study at another university, either because the course you realise you want to do isn't offered by Oxford, or because you feel that you will do better somewhere else. Before deciding to pursue such a step be sure to get lots of advice, both from tutors and from family and friends. If in the end it seems a good idea, you should be able to ask your college to support your application for a place at another university.

3.8.3 Financial Issues

Please be aware that any change to your choice of degree may impact on your level of maintenance funding and the time taken to receive your student loan. You are advised to contact Student Finance,

https://www.gov.uk/student-finance

for further enquiries.

If you have financial support for your studies from an award, scholarship, or sponsorship, this is likely to be on the basis of the specific course you are pursuing, in which case permission from your funding body to change course, even within Oxford, will be required

if this support is to continue. You will need to ask your Senior Tutor to write to your funding body to certify that you have been given permission to change course.

The MMath is recognized as a masters-level qualification. For students not classified as Overseas, there may be adverse financial consequences in taking the MMath (rather than the B.A.) if they wish thereafter to take another masters-level Taught Course. This arises because of ELQ (Equivalent or Lower Qualifications) fee liabilities: universities do not receive any government funding for ELQ students and consequently adopt a special ELQ fees rate, which is likely to be roughly double that of the standard fee for graduate taught courses. Information can be found at

http://www.ox.ac.uk/feesandfunding/fees/information/elq/.

3.9 The Long Vacation

3.9.1 Summer Projects

Various bursaries become available each year supporting undergraduates in project work during the long vacations in Oxford. More typically (but not solely) these are in areas associated with Applied Mathematics, Statistics and Computer Science and are usually aimed at students at the end of their third or fourth years. What is offered varies from year to year; usually the department's Academic Administration team will circulate details of these opportunities by email.

Details of these opportunites will also be posted on

https://www.maths.ox.ac.uk/members/students/undergraduate-courses/teaching-and-learning/projects.

4 Teaching and Learning

4.1 The Department and the Colleges

Oxford University is a collegiate university. All undergraduates are members both of a college and the University. Courses, syllabi, lectures, and examinations are organised and delivered by the University. Colleges are responsible for making undergraduate admissions to the University. They deliver tutorial and class teaching, and are generally responsible for the academic and personal well-being of their students.

In a college there will usually be two or more subject tutors to select students, deliver tutorial and class teaching and generally guide students through their studies. Usually at the beginning of each term, a student will meet their subject tutor(s) to discuss selection of options and to make and receive information on teaching arrangements, etc. Your subject tutor(s) will monitor your academic progression through the each term and will receive reports from other tutors who teach you through OxCORT (Oxford Colleges On-line Reports for Tutorials system) and Minerva (the Mathematical Institute and Department of Statistics reporting system). You will usually meet with your subject tutor to review these reports at the end of term. Students will also be assigned personal tutors to whom they may turn for general advice. The personal tutor may be in the same subject as the student or another subject altogether. Colleges have other welfare officers to whom students may turn for support and advice. Students will be advised at the beginning of their studies how things are arranged in their individual colleges. Please refer to your College handbook or website for more information on who to contact and what support is available through your College.

The Mathematical Institute contains lecture theatres and seminar rooms in which undergraduate lectures and intercollegiate classes are given. Problem sheets may be downloaded from the departments' websites, also some lecture notes. Most matters concerned with the administration of the Mathematics courses are dealt with in the Institute – for example the production of synopses, lecture timetables and lecture notes. If you have any comments relating to departmental provision, please contact the Academic Administrator in the first instance (contact details in Appendix F.)

If you have any issues with teaching or supervision please raise these as soon as possible so that they can be addressed promptly. Details of who to contact are provided in Appendix E Complaints and Appeals.

4.2 An Average Week

Students are responsible for their own academic progress. Typically your tutors will be expecting you to work **around 40 hours per week** during term time. This may vary a little from week-to-week, depending on how you are finding the material. Also many of these hours are *flexitime*, meaning that you will be free to follow other pursuits providing that you put the hours in elsewhere during the week. You are advised to read the University's guidance on undertaking paid work at www.ox.ac.uk/students/life/experience.

Of these 40 or so hours, around 10 will be **lectures**, and around 2-3 will be on **tutorials** or **classes**. This means that there is a good deal of time (25+ hours) that is unassigned,

to be filled by your own independent study.

It is important that you quickly get into a mode of learning that suits you. In an effort to help structure this independent study, the (first year) lecturers produce five weekly exercise sheets (one per two lectures) that will form the basis of tutorials. This means that roughly 5 hours should be assigned to each sheet. (From the second year onwards there will be one sheet per four lectures so you should be spending closer to 10 hours per sheet.)

Success on the course is not simply a matter of completing these sheets. The problems will be chosen as a guide to what you need to know and to demonstrate how the material hangs together: these are their aims. To those ends you will no doubt wish to review your lecture notes and to appreciate the importance of the main theory and the tools and methods to hand. Some of the exercises you may find routine and quickly solve; others will take longer to crack, perhaps only at your third or fourth attempt. Do not be surprised if some of the final questions prove too difficult to complete, but you should have attempted everything. Ultimately the problems you have had (in general or with specific problems) will be addressed in the next tutorial.

So the main ingredient for success in mathematics at university is committed independent study. It is the breaking down of subtle analytical problems yourself, the appreciation of how method and theory connect, the necessary organisation and perseverance that the course requires, which ultimately make our students successful academics or sought-after employees more widely.

4.3 Lectures and how to get the best out of them

All official lectures are advertised in the termly **lecture list** (see section 1.2 above).

Lectures are usually timetabled to last an hour but there is a convention for undergraduate lectures to commence a few minutes after the hour and likewise finish a few minutes before the hour to allow for students to move in and out of the room.

Lectures are a traditional way of presenting material at university level; they are an integral part of learning at university but will no doubt prove a rather unfamiliar means of communicating mathematics initially. They demand a mature, disciplined, motivated audience. For mathematics, they are a particularly important, intense and effective way of conveying information. A course of lectures might be thought of as learning to find your way around a new town. For most people the most effective way to familiarise themselves is to have a guided tour by someone who already knows the main features and how to get to them. A tour might be quite fast and miss some things out so that you need to go again relatively soon afterwards to see if you can find the way yourself. Similarly with lectures you will not take not in everything first time around and you will need to do further work yourself to gain a complete understanding. Revisiting the material you may find connections of your own in amongst the theory they way a second tour might lead you down side alleys that the first tour necessarily omitted. But without lectures it is hard to get started and very hard to gain a full understanding. The lecturer knows the important facts and theorems and can lead you along a path which includes the background necessary to understand and appreciate the results as they unfold. Most mathematicians find it easier to learn from lectures than books.

Unsurprisingly different lecturers have different styles and in any case different topics in

Mathematics warrant different treatments. You will find that some lecturers produce lecture notes which are posted online, but it is still usually a good idea to take your own notes, so that you stay attentive during the lecture and more closely pay attention to how one line of an argument or calculation follows from another. Notetaking itself is a valuable transferable skill to acquire. Afterwards be sure to file neatly your lecture notes (together with tutorial notes, problem sheets, your marked solutions, etc.) so that they can be easily referenced afterwards, especially during periods revising for examinations. The University's policy on making either audio or visual recordings of lectures or other teaching sessions can be found at http://www.admin.ox.ac.uk/media/global/wwwadminoxacuk/localsites/educationcommittee/documents/policyguidance/Policy_on_the_recording_of_lectures_and_other_formal_teaching_sessions_by_students.pdf

Practically, then, how do lectures fit into the process of learning and understanding mathematics? Even if you are reasonably on top of the material that has been discussed in previous lectures (re-reading beforehand the earlier material will help if not, and remind you of definitions and notation) you will likely find the pace of the lecture and the high-level nature of the material a little too intense to take absolutely everything in. So, for your understanding to cohere, you will need to revisit the material by re-reading the lecture notes and by doing the problem sheets that the lecturer (or possibly your tutor) has set. More to follow on that! But one thing to be sure of mathematics is a serial subject. Try not to fall behind with a topic: if you miss a lecture, quickly get a copy of the notes; if a course has not gone well during the term, spend some extra time over the vacation catching up. As John von Neumann famously once said: "in mathematics, you don't understand things. You just get used to them." He was probably being a little facetious, but it is the case that the mathematics you meet in your first year, complicated though it may seem now, will appear rather routine a year later (probably in less time than that) and it is only by repeatedly familiarising yourself with its ways and patterns that this will become so.

If you have missed a number of lectures through illness or other reasons, please consult with your College Tutor for advise on catching up missed work.

4.4 Problem Sheets

All lectures in Mathematics are supported by **problem sheets** compiled by the lecturers. These are available for downloading from the Mathematical Institute website. Most students prefer to print their own copies, although they can be printed by the department by prior arrangement. Many college tutors use these problems for their tutorials; others prefer to make up their own problem sheets. In Part B and Part C, problem sheets will be used for the intercollegiate classes run in conjunction with the lectures.

Many of the books recommended in the **reading lists** contain exercises and worked examples; **past papers** and **specimen papers** are another source of such material, useful for revision.

Problem sheets tend to start with straightforward examples, checking your understanding of an important theorem or a standard technique, but usually they progress on to trickier exercises that really test and probe your understanding of the material. It is *not* a good idea to start the problem sheet by looking at a problem and then simply searching the lecture notes for a bit that resembles the exercise. The lecture material usually represents a coherent piece of theory and it is a good idea to have some sense of this (its motivation

and internal logic) *before* starting the problem sheets. Similarly the exercise will likely involve some technical language: if your sense of any of these technical terms is fuzzy or half-remembered then revisit your lecture notes (or text) and look up the *precise* definition before proceeding. A well set exercise will often crack just as a chunk of the theory comes into place; it will usually take a few tries though before the harder exercises are resolved (if at all).

4.5 Some Thoughts on Problem Solving and Presenting Solutions

The problems you are asked to solve at university are likely to be rather different to those you met at school. As well as covering rather more sophisticated material, they are much less routine and often give fewer clues as to how to proceed. The questions will vary in difficulty, but often you will need persistence, time and effort to solve them. The following gives some general pointers to successful problem solving.

- You have no hope of solving a problem unless you know about the theory behind it. So first study the reading set and/or your lecture notes.
- Now look at the problem. Do you know precisely what the words mean? If not find out. Do you understand what you are being asked to do and what answering the question entails? Think about what strategies you might use and/or what theorems are relevant and helpful. Have you seen anything like it before?
- You could try leafing through a few books to see if you can see anything like it.
- If you still cannot start, talk to other students about it, and see if you can help each other. However, don't just copy a solution. Always work out and write out the solution yourself. If you are not wholly comfortable with your solution, leave a marginal note to your tutor to this effect.
- Sometimes it helps to sleep on it or to move on to another question.
- Once you have produced a solution, look at it critically. Is your argument logical? Is it properly explained? Have you introduced/defined your notation? If you need a hypothesis or theorem for one line to follow from another then quote it/them carefully. If there is an answer, is it sensible? For example, if you have integrated something positive the answer should be positive and a probability should lie between 0 and 1!
- Check you have answered the whole question and have not left bits out. If a question asks you to prove that A is true if and only if B is true then you have two things to prove; that A implies B and that B implies A. Similarly if you are asked to prove that a condition is necessary and sufficient, you must prove that it is necessary and also that it is sufficient.
- It's probably best not to think of attending lectures and solving problems as separate tasks. Each is there to help the other. It may be a good idea to read the problem sheet before you go to the lecture, to help you link the problems to the lecture notes.
- In all cases, imagine how your answer would appear to a reader.

4.6 Tutorials

To support lectures in the first and second years, colleges arrange tutorials and classes for their students. How these are organised will vary from college to college and subject to subject. For example, in your first and second years you might have two (one-hour) tutorials each week, with between one or two other students. Consequently it is a highly individual and flexible way of teaching and tutorial groups are usually arranged to include students that work well together and, perhaps, who are progressing academically at about the same rate.

You will be set some work for each tutorial and in the tutorial you will discuss the work and be able to ask about any difficulties you have experienced. In order to get the best out of a tutorial, it is important that you are well prepared and also that you see the tutorial as an opportunity to get resolved all the problems that you have encountered that week – to that end you may well want to make a list during the week of queries to be raised in the tutorial. A tutorial is, after all, a hour with an expert in that area. Your tutor is unlikely to give up the answer to your question immediately and may respond with hints or questions of his/her own to that end – but this is all towards improving your understanding of the material and showing you how you might have made further progress with the problem yourself.

4.7 Classes

Each 16-hour lecture unit in the subjects of Parts B and C will be supported by classes run under the Intercollegiate Class Scheme. Students generally attend four $1\frac{1}{2}$-hours classes (or equivalent) for each Part B and Part C unit.

Each class will usually consist of between five and twelve students from a number of different colleges and is run by a class tutor and a teaching assistant. The course lecturer provides suitable **problem sheets**, and also provides specimen solutions for the class tutors and teaching assistants. Students hand in their solutions in advance and these are marked by the teaching assistants; at each class, some of the problems are discussed in detail, and there is an opportunity to ask the class tutor and teaching assistant about any particular difficulties. The class tutors report to colleges through the intercollegiate class database on your performance throughout the term. If you are ill and unable to attend the class please inform the Class Tutor in advance of the class.

Consultation sessions to help with revision are run during Trinity term.

4.8 Some Thoughts on Revision and Exam Technique

Different people revise in different ways, so these notes give some general suggestions for how you might approach revision. Your tutor will also be able to give you more personalised advice. Many first year undergraduates will not have had to revise much for maths exams in the past, but one thing is certain: now that you are at university serious revision will be necessary.

You should consolidate and revise the material covered in Michaelmas term and in Hilary term in the following vacations. Most colleges will set their students 'collections' (that is

internal college exams) at the beginning of Hilary term and Trinity term to help check on this and to give some exam practice.

It is also very much the case that if you have properly, or at least largely, understood material when first meeting it, that understanding will be recalled (and improved upon) that much more readily when it comes to revision.

Getting Organised: It is a good idea to have your material well organised. So for each course make sure you have to hand, in one place: your lecture notes, the problem sheets, your solutions, the tutorial notes, the course synopsis (from the web), and anything else you need including your own revision notes.

You will find the Examiners' reports for each examination on the web, and these are useful to see what the Examiners were looking for (and also to give you hints about how to solve the questions). You will find information about how the examination is marked and classified in the relevant Examination Conventions (also on the web). You will also get a letter from the Chairman of Examiners giving you more information about this, and be sure to read the letter carefully. The exam syllabus is given with the course synopses. This tells you what you are expected to know. You will also find past examination papers on the web, and you should use these both to see what sort of exams are set, and also to practise answering questions.

You will need to start your revision for the end of year examinations in good time. Try to spread your revision evenly across the papers. Don't spend all your time on the paper you find hardest (nor the one you find most interesting).

Advice on how to revise: Different people work in different ways but here is some general advice about how you might approach revision. There are various stages:

a. First you need to understand the material: You need an overall view. What is it about? How does it fit together? Also detailed understanding of the proofs etc..

b. You need to learn the definitions and the statements and proofs of the theorems (find out which proofs you need to know), so that you can reproduce them.

c. Do not learn parrot fashion, but remember the main steps so you can then fill in the details in the exam. In a like manner, if you can be in the habit of thinking in such "steps" then you'll be able to adapt your thinking to the harder last parts of questions more readily.

d. Most people find that they need to write summary notes to get an overview of the subject. It may also be a good idea to write notes on proofs giving the main steps.

e. Keep reviewing what you have learnt. Give yourself (or a friend) an account of it. This often reveals what you do not understand.

f. Now you need to be able to use your knowledge. Practise problems first using books and notes if necessary, then without. You can use problems from tutorials or old exam questions.

Advice about exam technique: You should talk to your tutor about exam technique, and your strategy for answering questions, as s/he can give you targeted advice. However, here are a few general pointers:

- Plan your time carefully and be sure to attempt the required number of questions. (It is generally easier to get the first few marks on each question, than the last few).
- Answer the question set, not the one you wish had been set (there are no marks for writing out bookwork that has not been set). Don't omit parts by mistake.
- Read each question carefully and fully. Do not start a question simply because you can do the first part – the remainder of the question might be considerably more problematic for you.
- Remember that the questions are set on the syllabus.
- If stuck, can you work backwards from a given answer/formula? What aspects of the given formula are familiar to you? If you can't do a certain part but its answer is given, then you may use that answer to progress with the rest of the question.
- When stuck, then give yourself some time to think further about the problem. However after a while it will be sensible to move on to other parts or other questions. You may well be able to return to this problem later.
- Explain what you are doing; give proper justification; show your working; define your notation.
- Set out your answer logically and legibly. Make clear and apparent any answers to the marker. Carefully introduce any notation not already given in the question.
- Try to make it easy and pleasant for the examiner to read.
- There are no formulae books, so make sure you know the required formulae, including, if relevant, trig and integration formulae.
- Be sure to obey the rubric (the specifics of the exam given on the front of the exam paper).

4.9 Practicals

For some of the units there is a component of compulsory practical work. Arrangements will be explained by the course lecturer; your college tutor will also advise. Those who run the practical sessions will also give advice on how the work is to be written-up.

4.10 History of Mathematics

You are encouraged to read around your subject, and it can be very beneficial to look through texts, other than the main recommended text(s), to see a treatment of the material other than your lecturer's and tutor's. College libraries will usually have such texts so this should not cost you extra.

It can also help to have a sense of the subject's history and development. There is a *History of Mathematics* option in the third year, but otherwise you will find (because of time constraints) that lecturers largely focus on teaching the syllabus and have little time to comment on historical sidelines, to discuss how the current material used to be treated or

even what problems initially motivated the topic. We include here a short list of books recommended by tutors, for you to dip into at various times during your time at Oxford.

H Dörrie, *100 Great Problems of Elementary Mathematics*, Dover (1965)

J Fauvel, R Flood & R Wilson, *Oxford figures: 800 years of the mathematical sciences*, OUP (2000)

E M Fellmann, *Leonhard Euler*, Birkhäuser (2007)

M Kline, *Mathematics in Western Culture*, Penguin (1972)

M Kline, *Mathematical Thought from Ancient to Modern Times*, OUP (1972)

V Katz, *A History of Mathematics: An Introduction* Second Edition, Addison-Wesley (1998)

J Stillwell *Mathematics and Its History* Third Edition, Springer (2010)

D Struik, *A Concise History of Mathematics*, Dover Paperback, (1946)

5 Assessment and Examinations

5.1 College Examinations

The tutorial, as well as a medium of instruction, is a personally tailored form of continuous, formative assessment, and both you and your tutor should have a good idea of how your studies are progressing. College tutors will also organise college examinations, called **collections**, usually at the start of term. These are not to be confused with the University's **public** examinations which count towards you for your degree classification(s); rather they are an opportunity to check on how you are progressing academically and provide you with feedback to allow you to identify misunderstandings you may have with the material and improve your examination technique.

5.2 University Examinations

For the undergraduate degrees in Mathematics you will sit examinations each year in Trinity term, called **public examinations**. The regulations governing the examinations are set out in the University Examination Regulations (see section 1.2) and guidance for students is given in the Examination Conventions which are published online at https://www.maths.ox.ac.uk/members/students/undergraduate-courses/examinations-assessments/examination-conventions. The definitive version of the conventions is made available online each October. Modifications must be published to prospective candidates not less than one whole term before the examination takes place. Examination conventions are the formal record of the specific assessment standards for the course or courses to which they apply. They set out how your examined work will be marked and how the resulting marks will be used to arrive at a final result and classification of you award. They include information on: marking scales, marking and classification criteria, scaling of marks, progression, resits, use of viva voce examinations, penalties for late submission, and penalties for over-length work.

For each examination (Prelims, Part A, Part B and Part C) the department nominates a board of examiners, which is made up of internal examiners and, for the second public examinations, external examiners (academics from another university). Assessors may also be appointed to assist the examiners. Formally, the examiners are independent of the Department and of those who lecture courses. However, for written papers in mathematics, the examiners are expected to consult with course lecturers in the process of setting questions. It must be stressed that to preserve the independence of the examiners, students are strictly prohibited from contacting examiners directly about matters relating to the content or marking of papers. If you are unhappy with an aspect of your assessment you may make a complaint or appeal (see Section 7.1.6). The names of all examiners can be found in the relevant Examination Conventions.

General information on University examinations can be found on the Examinations and Assessment section of the University website http://www.ox.ac.uk/students/exams/.

5.3 Preparation

Your tutors will advise you about revision and practice. As well as any consolidation work done after the end of term, it is usual to spend much of Trinity term revising work for

the coming examinations. The department holds examination forums, one for Prelims and one for Finals, to provide advice on revision techniques and give further details about the format of the examinations.

In subjects which were taught in previous years, past examination papers are another good guide to the typical format and content of examination question. Past papers can be accessed online at http://www.oxam.ox.ac.uk. However, please note that previous papers may have been set on different syllabi and you will need to be guided to relevant questions by your tutors. Students will find past papers most valuable when used in conjunction with corresponding examiners' reports which are posted online at http://www.maths.ox.ac.uk/members/students/undergraduate-courses/examinations-assessments/examiners-reports. Examiners' reports will include generic feedback on the co-hort performance and may highlight common difficulties or mistakes made in the examinations.

The department also runs consultation sessions for Part B and C students each Trinity term to help with revision. Details of sessions will be made available to students each Trinity term. Further advice on preparing for examinations and requesting alternative arrangements can be found on the University's website at http://www.ox.ac.uk/students/academic/exams.

5.4 Entering for University Examinations and Examination Timetables

Entry for the Prelims examinations happens automatically when you register at the beginning of the year. Information about entering for examinations in future years is available online at http://www.ox.ac.uk/students/academic/exams along with guidance on alternative examination arrangements.

You will be issued with a personal timetable of examinations which will be sent to your college a month or so before the examination. This gives details of where and when each of the written papers for which you are entered will take place. Your college will pass on your timetable together with a randomly allocated **candidate number** which you will use to identify your scripts, instead of your name and college. You must take your candidate number to every examination you sit. As a general guide, Trinity term examinations take place in the following weeks.

- Part C: Weeks 6-7 TT
- Part B: Weeks 6-8 TT
- Part A: Weeks 8-9 TT
- Prelims: Week 9 TT

Further information on examination timetables can be found at http://www.ox.ac.uk/students/academic/exams/timetables.

5.5 Procedure for Written Examinations

Before the examinations you will receive at least one **notice to candidates** from the examiners to give you the details of the examination procedure. These notices are also published

online at http://www.maths.ox.ac.uk/members/students/undergraduate-courses/examinations-assessments/examination-conventions.

For all mathematics examinations no books or tables may be taken into the examination room. Calculators are not normally permitted and you should follow instructions in notices sent to you by the Chairman of Examiners regarding calculators.

Information on (a) the standards of conduct expected in examinations and (b) what to do if you would like examiners to be aware of any factors that may have affected your performance before or during an examination (such as illness, accident or bereavement) are available on the Oxford Students website www.ox.ac.uk/students/academic/exams/guidance

5.6 Illness during Examinations

For advice on what to do if you become ill during your examinations please see http://www.admin.ox.ac.uk/proctors/info/pam/ Section 5.1.

5.7 Marking of Mathematics Examinations

All mathematics examinations are marked by a single assessor or examiner according to a pre-agreed mark scheme which is strictly adhered to. The examination scripts are then checked by an independent checker to ensure that all work has been marked.

The project options available in Part B and Part C, such as the extended essays and dissertations, and the History of Mathematics examination are independently marked by at least two assessors. The examiners oversee the reconciliation of the marks according to the agreed reconciliation procedure.

5.8 University Standardised Marks

The marks for each individual examination paper or assessment you sit will be reported as University Standardised Marks (USMs). The object of the USMs is to allow direct comparison between the results of examinations in different subjects. Raw marks are turned into USMs by recalibration, sometimes necessary to ensure that all papers are fairly and equally rewarded. The correspondence between the USM ranges and classes in a classified examination is according to the following rules:

- 70-100: First Class
- 60-69: Upper Second Class
- 50-59: Lower Second Class
- 40-49: Third Class
- 30-39: Pass
- 0-29: Fail

These marks reflect the qualitative descriptors given in appendix C.

5.9 Examination Results

You will be able to access your results via the Student Self Service (https://evision.ox.ac.uk). The Academic and Assessment Results page within Student Self Service gives details of all your assessment results (examination papers and/or submissions) and the overall result for the year (if applicable).

5.10 First Public Examination

At the end of the third term of the first year you will sit the Preliminary Examination in Mathematics, which you need to pass in order to proceed to Part A. There are no lectures in the second half of this term to give you extra time to prepare for the examination. The examination consists of five papers: Mathematics I, II, and IV are of two and a half hours' duration and contain seven questions. You are instructed to submit answers to five questions. Mathematics III is of three hours' duration and contains nine questions. You are instructed to submit answers to six questions. Mathematics V is of two hours' duration and contains six questions. You are instructed to submit answers to four questions. The Moderators (i.e the examiners) will also take into account the marks awarded for your work on the Computational Mathematics projects.

Candidates shall be deemed to have passed the examination if they have satisfied the Moderators in all five papers and the practical assessment. The overall outcome (distinction/pass/fail) is calculated from the USMs for individual papers according to the following. Weighted averages are calculated hence, the first including CM (the Computational Mathematics USM) and the second without.

$$Av_1 = \frac{MI + MII + \frac{6}{5}(MIII) + MIV + \frac{4}{5}(MV) + \frac{1}{3}CM}{5\frac{1}{3}},$$

$$Av_2 = \frac{MI + MII + \frac{6}{5}(MIII) + MIV + \frac{4}{5}(MV)}{5},$$

each symmetrically rounded. [62.49 will be rounded down and 62.50 would be rounded up]

Year outcomes are awarded according to the following conventions:

Distinction Both $Av_1 \geqslant 70$ and $Av_2 \geqslant 70$.

Pass: Not meriting a Distinction and a mark of at least 40 on each paper and for the practical assessment.

Fail: A mark of less than 40 on three or more papers (including the practical assessment).

Partial Pass: A partial pass is awarded to candidates who obtain a standardised mark of less than 40 on one or two papers (including the practical assessment). Such candidates will be required to resit the failed paper(s) or practical assessment before being awarded their final year outcome.

Computational Mathematics

Marks for the Computational Mathematics projects will be communicated to the Moderators early in Trinity term. The raw marks will consist of two marks out of 20 but will be incorporated into the average Prelims USM (Av_1) as the equivalent of one third of a paper.

5.10.1 Resits

Those who fail one of more of the Prelims papers in June, or who were unable to sit the examination because of illness or other urgent and reasonable cause, may enter for the Preliminary Examination in September (Resits). A candidate who failed one or two papers will be required to resit and pass those papers only to progress to Part A; any candidate failing three or more papers will be required to resit all five papers. A candidate who fails to satisfy the moderators in the practical work assessment may also offer the assessment on one subsequent occasion.

5.11 Second Public Examination

5.11.1 Part A

Part A is taken at the end of the third term of the second year. In Part A, there are three Core papers A0, A1 and A2, nine papers A3-A11 relating to the Long Options and paper ASO relating to the Short Options. You are required to offer Papers A0, A1, A2 and ASO and five or six of Papers A3-A11.

Part A is not classified, but the results will be carried forward to the classification awarded at the end of the third year (see below). The Part A papers should be completed before taking the Part B. Any deviation requires the approval of the Education Committee of the University. Previous to 2013-14 the Part A Examination was in a different format. In particular you should pay attention to differences with previous past papers.

5.11.2 Part B

At the end of the third term of your third year you will take Part B. You will be examined in eight units (or equivalent). If you offer a double-unit option for examination this is given a weighting of two. The formal details of which combination of papers you may offer in the examination will be published by the University in the **Examination Regulations**.

On the basis of your performance in the Parts A and B examinations you will be classified (First, Upper Second, Lower Second, Third Class) or given a Pass or failed according to the following classification conventions which include a *Strong Paper Rule*. Students wishing to continue to Part C will need to obtain a 2.1 or better for Parts A and B.

Every candidate must offer

- 10 units at Part A (counting A2 as a double-unit and, for candidates offering 6 long options, two of the long options papers as half units)
- 8 units (or equivalent) at Part B.

The relative weightings of the Parts is as follows:

- The weighting of Part A is 40%.
- The weighting of Part B is 60%.

Strong Paper Rule

A candidate will have satisfied the First Class, resp., Upper Second Class, resp., Lower Second Class strong paper rule if at least 6 units from Parts A and B lie in that class (or better) and include at least 2 of them in Part B.

To give an example, a candidate will have satisfied the Upper Second Class strong paper rule if the USMs of at least (the equivalent of) 6 units are at least Upper Second Class marks with (the equivalent of) at least 2 Upper Second Class units at Part B level.

In the following $Av\ USM = Average\ weighted\ USM\ for\ Parts\ A\ and\ B\ together$ (symmetrically rounded [62.49 will be rounded down and 62.50 will be rounded up]);

- First Class: $Av\ USM \geqslant 70$ and the First Class Strong Paper Rule satisfied.
- Upper Second Class: $Av\ USM \geqslant 70$ and the First Class Strong Paper Rule not satisfied **OR** $70 > Av\ USM \geqslant 60$ and the Upper Second Class Strong Paper Rule satisfied.
- Lower Second Class: $70 > Av\ USM \geqslant 60$ and the Upper Second Class Strong Paper Rule not satisfied **OR** $60 > Av\ USM \geqslant 50$ and the Lower Second Class Strong Paper Rule satisfied.
- Third Class: $50 > Av\ USM \geqslant 40$ **OR** $60 > Av\ USM \geqslant 50$ and the Lower Second Class Strong Paper Rule not satisfied.
- Pass: $40 > Av\ USM \geqslant 30$.
- Fail: $Av\ USM < 30$.

5.11.3 Part C

If you take the MMath course, you will sit the Part C examination at the end of your fourth year and be examined in eight units (or equivalent). If you offer a double-unit option for examination this is given a weighting of two. The **Examination Regulations** and amendments published in the University Gazette will give full details. You will receive a class at the end of Part B (as above) and a separate class for Part C according to the following classification conventions.

Let $AvUSM$ denote the weighted average of USMs achieved in Part C (symmetrically rounded).

- First Class: $AvUSM \geqslant 70$.
- Upper Second Class: $70 > AvUSM \geqslant 60$.

- Lower Second Class: $60 > AvUSM \geqslant 50$.
- Third Class: $50 > AvUSM \geqslant 40$.

5.11.4 Repeats and Resits

For details of the regulations concerning repeats see the relevant sections of the **Examination Regulations**. Your college tutor will also be able to give advice about these procedures.

5.12 Projects, Dissertations, Extended Essays

Third year students may write an extended essay or structured project each equivalent to a double unit or 32 lectures. Fourth-year students may write a double-unit dissertation.

Projects give students the opportunity to develop valuable skills – collecting material, explaining it, expounding it clearly and persuasively, and using citations. Some students show their abilities better on a sustained piece of exposition rather than on solving problems set in an examination paper.

Note: further information may be found in project guidance notes http://www.maths.ox.ac.uk/members/students/undergraduate-courses/teaching-and-learning/projects.

5.13 Prizes

The following prizes are available for undergraduate students. These are awarded by the Examiners, and no application is necessary. A list of previous winners is available online https://www.maths.ox.ac.uk/members/students/undergraduate-courses/ba-master-mathematics/examinations-assessments/prizes.

Prelims

- Two IBM prizes are available for performance in Mathematics papers for candidates in the Preliminary Examination.
- Gibbs Mathematics Prize for Mathematics and Philosophy candidates.

Part A

- Two equal Gibbs Mathematics Prizes.
- Gibbs Mathematics Prize for Mathematics and Philosophy candidates.

Part B

- Two equal Gibbs Mathematics Prizes.
- Gibbs Mathematics Prize for Mathematics and Philosophy candidates for performance in Mathematics papers.

- Gibbs Mathematics Prize for Mathematics and Philosophy candidates for performance in Philosophy papers.
- 2 Junior Mathematical Prizes.
- IMA Prize of a year's free membership.

Part C

- Two equal Gibbs Mathematics Prizes.
- Gibbs Mathematics Prize for Mathematics and Philosophy candidates for performance in Mathematics papers.
- Gibbs Mathematics Prize for Mathematics and Philosophy candidates for performance in Philosophy papers.
- Two equal Gibbs Dissertation Prizes for the best dissertations.
- Junior Mathematical Prize.
- IMA Prize of a year's free membership.

6 Study Skills and Resources

6.1 Study Skills

Much of the advice and training in study skills will come in the regular tutorial and class teaching your college arranges for you. In these sessions, and in preparation for them, you will develop your powers of expression and argument. Further advice can also be found on the following webpages.

"How do Undergraduates do Mathematics?": https://www.maths.ox.ac.uk/system/files/attachments/study_public_0.pdf.

The Projects Committee's Guidance on the choice and preparation of extended essays and dissertations: http://www.maths.ox.ac.uk/members/students/undergraduate-courses/teaching-and-learning/projects.

A wide range of information and training materials are available to help you develop your academic skills - including time management, research and library skills, referencing, revision skills and academic writing - through the Oxford Students website: http://www.ox.ac.uk/students/academic/guidance/skills.

6.1.1 Student Support

Disability Related Study Support Specialised advice and assistance is available for dyslexic, blind/partially sighted, and other disabled students from the Disability Advisory Service on the web

https://www.ox.ac.uk/students/welfare/disability

or contact disability@admin.ox.ac.uk or 01865 (2)80459.

If you experience difficulties with your course because of a disability then you should discuss this with your college tutors. Some colleges have a specific member of staff who assists students with welfare difficulties. Please also see the Mathematical Institute Departmental Disability Statement, in Appendix D.

Health and Welfare In addition to the support provided by your college there are several central services which exist to support you during your studies, including the Student Counselling Service and the student-led Nightline. Further details can be found online at http://www.ox.ac.uk/students/welfare.

6.2 Resources

6.2.1 Books

A complete set of lecture notes should not be viewed as your sole source of information for a course. If you have found the course relatively straightforward then they may prove sufficient, though that is not to say you couldn't benefit from other texts and further reading, but if the course has gone less well then you would certainly be wise to consult other texts in the college library (or sources on the internet) for more examples and other treatments

of the material. Access to other mathematical texts and sources will help in clarifying points made in lectures, completing arguments given partially, doing things in different ways, and so on. **Reading lists** are issued alongside the **lecture synopses** and are revised annually. They contain a range of suggestions, including alternatives and suggestions for further reading.

To make best use of a book, it is easiest to have your own copy so think seriously of buying some texts – your tutor will be able to advise you on which to buy. Often you will be able to buy such books from your predecessors in your college, or through the virtual second-hand bookstall run by MURC. Second-hand copies are also available in Blackwell's second-hand department but they sell out rapidly. Amazon also sells second-hand books.

6.2.2 Libraries

The main source of borrowed books is your **college library**. College libraries generally purchase the books which appear in the **reading lists** for every Prelims, Part A and Part B course, and many Part C courses. In practice, college libraries also provide a good selection of the books listed as 'further reading', and, indeed, a wider selection of background and alternative reading, some of which have gone out of print.

Many college libraries have a number of copies of key books and are usually responsive to requests for new purchases, but *they need to be asked*. The colleges have various mechanisms for these requests; again your college tutor will be able to advise you.

The other source of books to borrow is the **Radcliffe Science Library** in Parks Road. This library is associated with the **Bodleian** and as an undergraduate you are entitled to use it. When you arrive in Oxford you will be given a combined reader's card/University Card which you should carry with you. This will give you access to any part of the **Bodleian Library** and any of its dependent libraries.

6.2.3 IT

The University is committed to making available computer facilities sufficient to cover the course-work requirements of undergraduates. Your computing requirements will be supported primarily by departmental and college IT staff.

All students will be automatically allocated a University email account and may register for further services with IT Services. IT Services are located at 13 Banbury Road and offer facilities, training and advice to members of the University in all aspects of academic computing. You can find more information at http://www.it.ox.ac.uk/. The Guide to IT at Oxford for New Users is available online at http://www.it.ox.ac.uk/want/get-started.

Colleges have PCs (and in some cases Macs), mostly networked, for the use of junior members. Many college students' rooms are wired with ethernet points to enable students to connect their own PCs to the network. There is a concern for computer security and anyone opening an account must agree to abide by the University's rules. At Oxford there is a University disciplinary procedure for enforcing the rules, and breaches of them will involve the Proctors with all the sanctions and penalties available to them.

Some University webpages are NOT available from outside the Oxford network.

But if you are regularly using a computer outside the Oxford network, you need to set up VPN. Instructions on how to do this can be found at:

http://www.maths.ox.ac.uk/members/it/faqs/undergrads

Undergraduates are not issued with departmental IT accounts, however if you find you have a particular need for departmental IT facilities (for example, to work on the first year Computational Mathematics projects should you have no access to a laptop) you are welcome to apply by contacting the Academic Administration team in the first instance via acadadmin@maths.ox.ac.uk.

6.2.4 Andrew Wiles Building

The mezzanine teaching floor of the Mathematical Institute, Andrew Wiles Building, contains three lecture theatres (L1–L3), three smaller lecture rooms (L4–L6) and six classrooms (C1–C6).

The area also contains an undergraduate study room with desk space for about 40 people, along with sockets for personal laptop use. There is wifi throughout the building.

The mezzanine area also hosts a café with seating and tables for 100; serving drinks, snacks and meals at competitive prices.

Also found on the mezzanine is the work hand–in area for third/fourth year intercollegiate classes.

The building is accessible to undergraduates during the opening hours 8am–6pm

6.2.5 The Language Centre

The *Language Centre* provides resources and services for members of the University who need foreign languages for their study, research or for personal interest, and also to improve English language skills.

Language courses in 10 languages, the Language Library (consisting of over 13,000 textbooks with accompanying audio-visual material in over 180 languages) and its study area (computer-based learning resources and audio/video study rooms) are available to junior members of the University pursuing a course. Those in possession of a University Card must present it when they register at the Centre. You can find more information at http://www.lang.ox.ac.uk/

There may be an opportunity for Mathematics and joint schools students who have studied some French, German or Spanish to take a course in the third or fourth year. This will not count towards your degree class but you will receive a certificate upon passing the course.

6.2.6 Careers

Careers guidance is provided by the *Careers Service*, and at a personal level by college tutors. Careers advisers carry out guidance interviews with students, discussing with them their skills and aspirations. The Careers Service also provides training in writing applications, interview techniques and analysis of transferable skills. The Careers Service provides

information about occupations and employers, and advertises work experience opportunities.

Members of the Faculty who have taught you are usually willing to provide support and references. The Careers Service provides a link-person, who has expertise in areas where mathematicians are often in demand, for example, in finance careers. College tutors are regularly updated on Careers Service activities.

In addition to its general programme, the Careers Service runs an annual 'Jobs for Mathematicians' half-day, in collaboration with the Mathematical Institute. At this event there are talks from alumni currently working in jobs suitable for mathematicians. The event also helps students consider their transferable skills. You can find more information at http://www.careers.ox.ac.uk.

The Mathematics Undergraduate Representation Committee (MURC) has set up an emailing list for careers and studentship information, to which you could sign up. You can do this by sending a blank message to `murc-jobs-join@maths.ox.ac.uk`. The system will confirm your request and once that is completed you will be registered to receive careers information.

A significant proportion of students continue on to further study after completing their undergraduate degree. A talk on postgraduate study is included in the annual 'Jobs for Mathematicians' event and further information about postgraduate study opportunities at the Mathematical Institute can be found at http://www.maths.ox.ac.uk/study-here/postgraduate-study.

6.2.7 University Lectures

University **lectures** in all subjects are open to all students. A consolidated **lecture list** is available on the University website at:

http://www.ox.ac.uk/students/academic/lectures/.

Seminars and colloquia given in the Mathematical Institute, often by mathematicians of international repute, are announced on the departmental notice boards; although usually aimed at faculty and research students, all interested in the subject are welcome to attend.

7 Undergraduate Representation and Societies

7.1 Feedback

There is plenty of opportunity, both formal and informal, for you to comment on the mathematics course. The informal ways are through the members of the Faculty who teach you in classes, lectures and tutorials, and also through your personal tutors in college. Feedback is formally sought through surveys conducted by the Mathematical Institute and the University, and also the National Student Survey. All input from undergraduates about the course content, structure and facilities generally is welcomed by the department and taken seriously.

Written questionnaires are handed out by each lecturer, who will give time during a lecture for their completion. A similar monitoring of the intercollegiate classes takes place termly. A specimen questionnaire form can be downloaded from the web at http://www.maths.ox.ac.uk/members/students/undergraduate-courses/undergraduate-representation/forms-and-questionnaires.

Once the termly questionnaire results are processed, each course lecturer receives the comments and statistical analysis from their own course and in addition consolidated information is made available to relevant committees for discussion, and where necessary, action. One of the key committees to consider this information is the Joint Consultative Committee for Undergraduates, (JCCU). The statistical feedback from the questionnaires is sent to a designated undergraduate member of the Mathematics Undergraduate Representation Committee (the MURC Questionnaire Representative) for consideration by MURC and a report brought to JCCU. Any action taken as a result of questionnaire comments is made known to your MURC representatives through JCCU.

Students on full-time and part-time matriculated courses are surveyed once per year on all aspects of their course (learning, living, pastoral support, college) through the Student Barometer. Previous results can be viewed by students, staff and the general public at: http://www.ox.ac.uk/students/life/feedback

Final year undergraduate students are surveyed instead through the National Student Survey. Results from previous NSS can be found at http://www.unistats.com/.

The results of both these surveys are discussed by the Teaching Committee and appropriate action agreed as necessary.

7.1.1 MURC

The Mathematics Undergraduate Representative Committee (MURC) is composed of students who represent the interests of Mathematics and joint school students. It consists of a representative from each college. It holds regular meetings to discuss issues connected with academic organisation of the course such as lectures, examinations and syllabus content. It is the forum which allows undergraduates, through their representatives, to raise issues connected with their courses. It is important for colleges to have a representative to the committee.

The views of this committee are channelled to the faculties and departments through the Joint Consultative Committee with Undergraduates.

During the year, open days for prospective Mathematics students are run by the Mathematics Faculty in collaboration with MURC.

Further information about MURC activities and facilities can be found on the MURC website, https://www.maths.ox.ac.uk/members/students/undergraduate-courses/undergraduate-representation/murc.

7.1.2 JCCU

The Joint Consultative Committee with Undergraduates (JCCU) meets regularly once a term and discusses any matters that the MURC representatives wish to raise; in addition, it considers matters relating to the synopses and proposed changes of syllabus, and as mentioned above the statistical feedback from questionnaires.

The membership of the JCCU consists of thirteen members of MURC appointed by MURC and representatives of the Department of Mathematics and of Statistics. The committee is usually chaired by the Director of Undergraduate Studies and the Secretary is an undergraduate member of the committee. This committee is available for consultation by the departments and by the divisional board on any matter which relates to the undergraduate courses. Minutes of the JCCU meetings taken by your student representatives, reports and feedback on student requests can also be found at http://www.maths.ox.ac.uk/members/students/undergraduate-courses/undergraduate-representation/jccu.

The Chairperson and Secretary of MURC may attend meetings of the Faculty of Mathematics, and the Chairperson may attend meetings of the Mathematics Teaching Committee.

7.1.3 UJCF

The MPLS Division runs a divisional Undergraduate Joint Consultative Forum which is chaired by the senior MPLS Academic who is responsible for that area across the division. An undergraduate representative from each department within the MPLS Division attends the forum. In addition, an undergraduate representative attends the meetings of the Divisional Board and the MPLS Academic Committee. The student representatives is elected through the Oxford University Student Union (OUSU). See http://www.mpls.ox.ac.uk/study/applicants/student-representation.

7.1.4 OUSU

Undergraduate representation at University (as opposed to subject or college) level is coordinated through the Oxford University Student Union (OUSU). Details of these arrangements can be found in **Essential Information for Students** (the **Proctors' and Assessor's Memorandum**). Contact details for OUSU can be found in Appendix F.

7.1.5 College

Most colleges have procedures in place for consultation, monitoring, and feedback. Your subject or personal tutors will be able to advise you on this.

7.1.6 The Proctors and Academic Appeals

In the rare case of any student wishing to make an appeal against an examination result, the appeal is made on their behalf by the college to the Proctors. Students should also be aware that they have the right to take certain other matters directly to the Proctors. Contact details can be found in Appendix F.

7.2 Student Societies

There are number of Mathematics student societies which you may like to join. Details of the main societies are given below. In addition there are also over 200 clubs and societies covering a wide range of interest which you may join or attend. A full list is available at http://www.ox.ac.uk/students/life/clubs/list.

7.2.1 Invariants Society

The Oxford University Invariant Society, with website http://www.invariants.org.uk/ is the undergraduate mathematical society. Its primary aim is to host weekly talks by notable speakers, on a wide variety of mathematical subjects. The Invariants also host social events, a Christmas party and an annual formal dinner. Titles of talks previously given include: Mathematics, Magic and Electric Guitars; Juggling: theory and practice; Bells and Change Ringing. There are opportunities for members to give their own talks. Meetings are held on Tuesdays at 8.00 pm at the Mathematical Institute. Anyone interested should come to the first meeting (which is free) to find out more.

7.2.2 Mirzakhani Society

The Mirzakhani Society is a society aimed at supporting women in Oxford who are studying maths. Their main event is 'Sip and Solve' which happens once a week, tea and cake are provided, and women are encouraged to come along to do problem sheets. Contact: `mirzakhanisociety@gmail.com`.

8 University Policies and Other Important Documents

The University has a wide range of policies and regulations that apply to students. These are easily accessible through the A-Z of University regulations, codes of conduct and policies available on the Oxford Students website http://www.ox.ac.uk/students/academic/regulations/a-z. Particular attention is drawn to the following University and Departmental policies.

8.1 Plagiarism

Plagiarism is presenting someone else's work or ideas as your own, with or without their consent, by incorporating it into your work without full acknowledgement. All published and unpublished material, whether in manuscript, printed or electronic form, is covered under this definition. Plagiarism may be intentional or reckless, or unintentional. Under the regulations for examinations, intentional or reckless plagiarism is a disciplinary offence. Please see the University's guidance on plagiarism http://www.ox.ac.uk/students/academic/guidance/skills/plagiarism for further information.

8.2 Intellectual Property Rights

The University in its Statutes claims ownership of certain forms of intellectual property which students create in the course of, or incidentally to, their studies. There are arrangements in the University's regulations for protecting and exploiting this property, and sharing the commercial exploitation revenues with the student originators. By accepting a place at Oxford and signing the Student Contract with the University, you agree to be legally bound by these provisions. The regulations relating to intellectual property can be found on the University website at www.admin.ox.ac.uk/rso/ip.

8.3 Code on Harassment

The Mathematical Institute has appointed two senior members who may be consulted in connection with the University's Code on Harassment. Details are posted in the Undergraduate Study Room.

8.4 Disabilities and Equal Opportunities

The University is committed to making arrangements where appropriate to enable students with disabilities to participate fully in student life. Please see the University's Equal Opportunities Statement available at http://www.admin.ox.ac.uk/eop/missionstatement/integratedequalitypolicy/, and the Mathematics Departmental Disability Statement in Appendix D.

8.5 Safety

You are urged to act at all times responsibly, and with a proper care for your own safety and that of others. Departmental statements of safety policy are posted in all departments, and you must comply with them. Students should note that they (and others entering onto departmental premises or who are involved in departmental activities) are responsible for exercising care in relation to themselves and others who may be affected by their actions.

They should also note that in the Institute accidents should be reported immediately to reception, telephone 73525, who keep the accident book. There is a first aid room located on the ground floor of the South wing. If you require access to this room please report to reception.

Each lecture theatre has its own proper escape route and you are urged to familiarise yourself with these. Those for the Mathematical Institute lecture and seminar rooms, are set online at http://www.maths.ox.ac.uk/members/building-information/security-safety-and-reporting-building-issues. In the case of evacuation of the lecture theatre give heed to the instructions of the lecturer.

9 Information for International Students

This is aimed at International students but in fact may be helpful to all students.

9.1 Contacts

Student Immigration
Examination Schools, High Street, Oxford
email: student.immigration@admin.ox.ac.uk
website: http://www.ox.ac.uk/students/visa

Oxford University Language Centre (tel:(2)83360)
email: admin@lang.ox.ac.uk, website: www.lang.ox.ac.uk

Oxford University Student Union - International Students Officer
email: international@ousu.ox.ac.uk

9.2 Language Skills

It is important, for many international students, to continue to develop English language skills, both for academic studies in Oxford and future careers. Some students, at the beginning of their time in Oxford, find they need to translate academic material into their first language before it can be digested. Some even go so far as to read translations of recommended texts. Students should aim to reach the point where they can think about their subject and solve problems directly in English, without any translation. Students are encouraged to discuss their work, even work together with other students, and we recommend that such joint work is conducted in English.

Undergraduates may attend one of the courses organised by The Oxford University Language Centre and also use their library of independent learning materials. More generally, the mastery of English will improve with constant reading and social interaction in English.

Part I
Appendices

A Programme Specifications

A.1 Aims of the Courses

The programme aims:

- 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;
- 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;
- 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;
- 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;
- 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):

- to provide the foundations for graduate study through a research degree at a leading university either in the UK or overseas.

A.2 Intended Learning Outcomes

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

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.	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.	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.	Examples 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.	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.	Examples on problem sheets and Computational Mathematics in first year.
6.Techniques of manipulation and computer-aided numerical calculation.	Practice in work for college tutorials and Computational Mathematics practical work in the first year.
7. The basic ideas of a variety of pure and applied areas of specialisation.	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).	Lectures in the third year and fourth years delivered by lecturers actively engaged in research, together with supporting problem classes conducted by subject specialists.

B The Joint Courses

B.1 Mathematics & Statistics

This handbook applies to the first year in Mathematics and Statistics, which is shared with the single-subject degree. For other details about the course please see the separate handbook and Statistics Department website (http://www.stats.ox.ac.uk/).

B.2 Mathematics & Computer Science

Mathematics & Computer Science is a three-year or four-year course intended to equip the future computer scientist with the fundamental understanding and practical skills needed by potential leaders of a demanding profession.

For more details about this course please see the separate handbook and Department of Computer Science website (http://www.cs.ox.ac.uk/).

B.3 Mathematics & Philosophy

Mathematics & Philosophy is a three-year or four-year course intended for those who would like to combine the development of their mathematical skills with the study of philosophy. There is a natural bridge in the philosophy of mathematics, as well as in logic. The latter has always been reckoned a part of philosophy, and over the last hundred years it has developed as a branch of mathematics.

For more details about this course please see the separate handbook available at

http://www.maths.ox.ac.uk/members/students/undergraduate-courses/teaching-and-learning/handbooks-synopses.

B.4 Mathematical and Theoretical Physics

From the academic year 2015/16, Oxford Physics and Oxford Mathematics will jointly offer a new masters level course in mathematical and theoretical physics. Oxford MPhys, MMath or MPhysPhil students will be able to apply for transfer to the MMathPhys mode of the course after their third year and study mathematical and theoretical physics in their fourth year, instead of following the fourth year of their original degree course. Students from outside Oxford can join the MSc mode. The MMathPhys course provides a high-level, internationally competitive training in mathematical and theoretical physics, right up to the level of modern research.

For more detail about this course please see the seperate handbook and course website http://mmathphys.physics.ox.ac.uk/.

C Qualitative Class Descriptors for Examinations

Preliminary Examinations

Whilst the Preliminary Examination is not classified, the average USM ranges reflect the following general **Qualitative Class Descriptors** agreed by the Teaching Committee:

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 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.

Fail: little evidence of competence in many of 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.

Parts A and B

The average USM ranges used in the classifications reflect the following general **Qualitative Class Descriptors** agreed by the Teaching Committee:

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 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 at least part of the basic material.

[Note that the aggregation rules in some circumstances allow a stronger performance on some papers to 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.

Part C

The average USM ranges used in the classifications reflect the following general **Qualitative Class Descriptors** agreed by the Teaching Committee:

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 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.

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.

[Note that the aggregation rules in some circumstances allow a stronger performance on some papers to compensate for a weaker performance on others.]

D Mathematical Institute Departmental Disability Statement

The Mathematical Institute is committed to making its teaching and other resources, facilities and services available to students, staff and others with disabilities as appropriate to ensure that they are not at a disadvantage. In some cases, this may require reasonable adjustments to the building, facilities, services or to teaching methods.

Those with disabilities are encouraged to discuss their needs with the Disability Coordinator [tel: 01865 615203, email academic.administrator@maths.ox.ac.uk] at the earliest possible opportunity.

Further information about disability support is available online https://www.maths.ox.ac.uk/members/policies/disability as well as information on building accessibility https://www.maths.ox.ac.uk/members/building-information/accessibility

E Complaints and Appeals

E.1 Complaints and academic appeals within the Mathematical Institute.

The University, the MPLS Division and the Mathematical Institute all hope that provision made for students at all stages of their course of study will make the need for complaints

(about that provision) or appeals (against the outcomes of any form of assessment) infrequent.

Nothing in the University's complaints procedure precludes an informal discussion with the person immediately responsible for the issue that you wish to complain about (and who may not be one of the individuals identified below). This is often the simplest way to achieve a satisfactory resolution.

Many sources of advice are available within colleges, within faculties/departments and from bodies like Student Advice Service provided by OUSU or the Counselling Service, which have extensive experience in advising students. You may wish to take advice from one of these sources before pursuing your complaint.

General areas of concern about provision affecting students as a whole should be raised through Joint Consultative Committees with Undergraduates or via student representation on the department's committees.

E.2 Complaints

If your concern or complaint relates to teaching or other provision made by the department, then you should raise it with the chairman of the Teaching Committee (Dr Richard Earl, Director of Undergraduate Studies). Within the department the officer concerned will attempt to resolve your concern/complaint informally.

If you are dissatisfied with the outcome, then you may take your concern further by making a formal complaint to the University Proctors. The procedures adopted by the Proctors for the consideration of complaints and appeals are described on the Proctors' webpage (www.admin.ox.ac.uk/proctors/complaints/proceduresforhandlingcomplaints), the Student Handbook (www.admin.ox.ac.uk/proctors/info/pam) and the relevant Council regulations (www.admin.ox.ac.uk/statutes/regulations/247-062.shtml)

If your concern or complaint relates to teaching or other provision made by your college, you should raise it either with your tutor or with one of the college officers, Senior Tutor, Tutor for Graduates (as appropriate). Your college will also be able to explain how to take your complaint further if you are dissatisfied with the outcome of its consideration.

E.3 Academic appeals

An academic appeal is defined as a formal questioning of a decision on an academic matter made by the responsible academic body.

For undergraduate or taught graduate courses, a concern which might lead to an appeal should be raised with your college authorities and the individual responsible for overseeing your work. It must not be raised directly with examiners or assessors. If it is not possible to clear up your concern in this way, you may put your concern in writing and submit it to the Proctors via the Senior Tutor of your college.

As noted above, the procedures adopted by the Proctors in relation to complaints and appeals are described on the Proctors' webpage (www.admin.ox.ac.uk/proctors/complaints/proceduresforhandlingcomplaints), the Student Handbook (www.admin.ox.ac.uk/proctors/info/pam) and the relevant Council regulations (www.admin.ox.ac.uk/statutes/regulations/

247-062.shtml).

Please remember in connection with all the academic appeals that:

- The Proctors are not empowered to challenge the academic judgement of examiners or academic bodies.
- The Proctors can consider whether the procedures for reaching an academic decision were properly followed; i.e. whether there was a significant procedural administrative error; whether there is evidence of bias or inadequate assessment; whether the examiners failed to take into account special factors affecting a candidate's performance.
- On no account should you contact your examiners or assessors directly.

F Contact Points

F.1 Mathematical Institute

There are a number of people in the department who can help you with any queries or problems you may have and their contact details are given below. If you are not sure who to contact please email `academic.administrator@maths.ox.ac.uk`.

Director of Undergraduate Studies Dr Richard Earl (tel: (6)15202)
email: `director-ugrad-studies@maths.ox.ac.uk`
General academic queries and concerns.

Academic Administrator Mrs Charlotte Turner-Smith (tel: (6)15203)
email: `turner-smith@maths.ox.ac.uk`
Disability Co-ordinator for Mathematics.

Deputy Academic Administrator Mrs Helen Lowe (tel: (6)15204)
email: `loweh@maths.ox.ac.uk`
Queries relating to the lecture list, JCCU, Part B and Part C projects and the Part B and Part C exams.

Academic Assistant Miss Nia Roderick (tel:(6)15205)
email: `roderick@maths.ox.ac.uk`
Queries relating to the computational mathematics sessions and projects, Prelims and Part A exams, lecture notes and other teaching material for students requiring disability-related study support.

Academic Assistant Miss Jessica Sheard (tel:(6)15207)
email: `sheard@maths.ox.ac.uk`
Queries relating to registration for Part B and C courses and sign-up for intercollegiate classes.

F.2 Department of Statistics

Chairman of Academic Committee Dr Neil Laws (tel: (2)72597)
email: `laws@stats.ox.ac.uk`

Academic Administrator Ms Jan Boylan (tel: (2)72860)
email: boylan@stats.ox.ac.uk
Queries relating to the teaching of statistics courses, including statistics intercollegiate classes.

F.3 Department of Computer Science

Chairman of Teaching Committee Prof Mike Spivey (tel: (2)73854)
email: mike.spivey@cs.ox.ac.uk

Academic Administrator Dr Shoshannah Holdom (tel: (2)73833)
email: shoshannah.holdom@cs.ox.ac.uk
Queries relating to the teaching of computer science courses, including computer science intercollegiate classes.

F.4 Projects Committee

Chairman Dr Richard Earl
email: director-ugrad-studies@maths.ox.ac.uk
Advice on Part B extended essay and Part C dissertation, including selecting a topic and finding a supervisor.

F.5 Careers Service

Enquiries (tel: (2)74646)
email: reception@careers.ox.ac.uk

F.6 MURC

General
webpage: https://www.maths.ox.ac.uk/members/students/undergraduate-courses/undergraduate-repr
murc
Contains the list of college representative who you can contact to raise an issue related to the teaching of the mathematics and joint schools degrees. Matters can also be sent to the MURC chairperson.

Chairperson Mr Alex Homer, Oriel College
email: alexander.homer@oriel.ox.ac.uk

F.7 Invariants

General
webpage: http://www.invariants.org.uk

President Oliver Verran, Brasenose College
email: president@invariants.org.uk

F.8 Mirzakhani Society

General
mirzakhanisociety@gmail.com

F.9 General

Disability Advisory Service (tel: (2)80459)
email: disability@admin.ox.ac.uk

Counselling Service (tel: (2)70300)
email: counselling@admin.ox.ac.uk

Proctors' Office (tel: (2)70090)
email: proctors.office@proctors.ox.ac.uk

Equal Opportunities Officer (tel: (2)89825)
email: equal.opportunities@admin.ox.ac.uk

Accessible Resources Acquisition and Creation Unit (tel: (2)83862)
email: aracu@bodleian.ox.ac.uk

Oxford University Student Union, Vice President (Welfare) (tel: (2)88452)
email: welfare@ousu.ox.ac.uk

IT Services email: contact@it.ox.ac.uk

Radcliffe Science Library (tel: (2)72800)
email: enquiries.rsl@bodleian.ox.ac.uk

G Useful 'Web' addresses

Mathematical Institute

http://www.maths.ox.ac.uk/

Department of Statistics

http://www.stats.ox.ac.uk/

Department of Computer Science

http://www.cs.ox.ac.uk//

Faculty of Philosophy

http://www.philosophy.ox.ac.uk/

Lecture timetables

http://www.maths.ox.ac.uk/members/students/lecture-lists

Information about remote access to the University restricted pages (VPN service)

http://www.maths.ox.ac.uk/members/it/faqs/connection/vpn

Archive of past exam papers 2000–2015

http://www.oxam.ox.ac.uk/

Unofficial archive of past exam papers 1991–2015

http://www.maths.ox.ac.uk/members/students/undergraduate-courses/examinations-assessments/past-papers

Examiners' reports 2000-2015

http://www.maths.ox.ac.uk/members/students/undergraduate-courses/examinations-assessments/examiners-reports

How do Undergraduates do Mathematics? Institute Notes

https://www.maths.ox.ac.uk/system/files/attachments/study_public_0.pdf

Information on the Joint Consultative Committee for Undergraduates

http://www.maths.ox.ac.uk/members/students/undergraduate-courses/undergraduate-representation/jccu

Webpage for MMathPhys in Mathematical and Theoretical Physics

http://www-thphys.physics.ox.ac.uk/MMathPhys


1. Mathematical Institute, Andrew Wiles Building, Radcliffe Observatory Quarter, Woodstock Road
2. Department of Statistics, 1 South Parks Road
3. Department of Computer Science, Wolfson Building, Parks Road
4. Faculty of Philosophy, Radcliffe Humanities, Radcliffe Observatory Quarter, Woodstock Road
North Mead
South Mead
University Parks
River Cherwell
Sports Ground
Sports Ground
Worcester College Sports Ground
Botanic Garden
Merton Field
Railway Station
Castle Mound
Carfax
Banbury Road
Woodstock Road
Parks Road
St Giles
Beaumont Street
Broad Street
George Street
High Street
Queen's Lane
Holywell Street
Merton Street
Queen St
New Road
Park End Street
Hythe Bridge Street
Botley Road
Oxford Canal
Oxford Canal Path
Castle Mill Stream
Mill Street
Rewley Road
Roger Dudman Way
Walton Street
Observation Street
St Bernard's Road
Bevington Rd
Canterbury Road
Norham Road
Norham Gardens
Bardwell Road
Linton Road
Belbroughton Rd
Northmoor Road
Charlbury Road
Keble Rd
Blackhall Rd
Little Clarendon St
Great Clarendon Street
Cranham St
Nelson St
Richmond Rd
St John Street
Magdalen St East
Magdalen St West
Cornmarket Street
New Inn Hall St
St Michael's Street
Ship Street
Market St
Bird Street
Ock St
Blue Boar St
Pembroke St
St Ebbes Street
Brewer St
Castle St
Norfolk Street
Long Wall Street
Jowett Walk
Mansfield Road
St Cross Road
South Parks Road
Manor
Thorn Walk
Old Walk
South Walk
North Walk
Fyfield Road
Crick Road
Winchester Road
Canal Street
1
2
3
4
A
B
D
E
F
G
H
I
J
K
L
M
N
O
P
Q
R
S
T