



UNIVERSITY OF CAMBRIDGE

Faculty of Mathematics

GUIDE TO ADMISSIONS in MATHEMATICS

This guide is intended for students who are considering applying to Cambridge to study the undergraduate Mathematics, or Mathematics with Physics, course.

The information contained here is only a very rough guide. Further general information about admissions can be found in the *University Undergraduate Admissions Prospectus* obtainable online at

<http://www.study.cam.ac.uk/undergraduate/publications/prospectus/>

or from

Cambridge Admissions Office, Fitzwilliam House, 32 Trumpington Street, Cambridge CB2 1QY
(telephone (+44) (0) 1223 333 308, fax (+44) (0) 1223 366 383, e-mail: admissions@cam.ac.uk),
or from individual colleges. More specific information can be obtained by writing to individual colleges.

Further information about the mathematics course can be found in the leaflet *Guide to the Undergraduate Course in Mathematics* obtainable from

<http://www.maths.cam.ac.uk/undergrad/course/>

or from

Undergraduate Admissions, Undergraduate Office, The Faculty of Mathematics Centre for Mathematical Sciences, Wilberforce Road, Cambridge CB3 0WA
(telephone: (+44) (0) 1223 766879; e-mail: admissions@maths.cam.ac.uk) .

All the documentation is available at

<http://www.maths.cam.ac.uk/undergrad/admissions/>

The pages of the individual Colleges can also be accessed from this site.

1 Cambridge Mathematics

The Cambridge undergraduate mathematics course is widely recognised not only as the most demanding undergraduate mathematics course available in Britain but also as one of the most rewarding. It is one of the largest such courses, having an intake of about 250 students each year.

In the first year **only** there are two options:

- (a) Pure and Applied Mathematics;
- (b) Mathematics with Physics.

Applicants for the two options are considered together: there is no quota of places for the different options and the mathematical criteria for admission are the same for option (b) as for option (a). Within each option, there is no choice of courses in the first year.

In the second year, there is only one option, but there is some choice both in the number of courses you take and the areas of mathematics you study. In the third year, there are 36 courses to choose from, and you can choose the number of courses you take (typically about 8), the level of difficulty of the courses and the areas of mathematics you study.

Although the BA degree course in mathematics lasts three years, the undergraduate course continues to an optional fourth year which leads to the M.Math. degree in addition to the BA. It is a taught course (i.e. not based on a dissertation, though you can choose to do a research essay) and serves to bridge the gap between the end of the BA degree course and the frontiers of research. Admission to the fourth year is conditional on the results of previous years and about one third of our students stay on for the fourth year. They are joined by students from all parts of the world who take this course as a one-year graduate course.

You can find further details in the *Cambridge Admissions Prospectus*, or in the *Guide to the Mathematical Tripos* produced by the Faculty of Mathematics (available on our web site).

Admissions are handled entirely by individual colleges. Most applicants name a college on their application form but you may instead make an open application, in which case you will be allocated a college on the basis of the number of mathematics applications per available place in each college.

2 Why Maths?

Here are some reasons often given for studying Mathematics at university.

- *You find mathematics interesting.* This is an excellent reason.
- *You are good at mathematics.* This is a necessary, but not sufficient, condition (as mathematicians would say). You may be finding the mathematics you are doing now quite straightforward, so that you hardly have to work at it. When you study mathematics at higher levels it is not so straightforward, so you have to be prepared to work hard at it. And remember that this work will be a major part of your daily life.
- *The job prospects are excellent.* This is a true statement: employers love mathematicians because mathematics is all about the vital skill of problem solving, but is **not on its own a good reason** for choosing to study mathematics. There are other ways of getting good jobs than spending three or four years studying something that you don't enjoy.

3 Why Cambridge Maths?

Here are some reasons for studying Mathematics at Cambridge.

- Cambridge is, according to recent surveys, one of the top few universities in the world.
- The Cambridge mathematics course is one of the very best mathematics courses in the UK.

- The fourth year of our mathematics course (called Part III) is world famous and a breeding ground for future leaders in mathematical research.
- Cambridge colleges offer a level of academic, pastoral and financial support that is possibly equalled but certainly not surpassed in any UK universities.
- Cambridge is a beautiful, ancient and vibrant city.

4 Which A-levels?

The first thing to say here is other qualifications at roughly the level of A-levels (Baccalaureate or Scottish Advanced Highers, for example) are perfectly acceptable and may even provide better grounding than A-levels. Many applicants are also accepted every year with a variety of international qualifications. A-levels are referred to here because the majority of our applicants take A-levels. Information relating to other qualifications can be obtained from admissions@maths.cam.ac.uk or from individual colleges or from our faculty web site <http://www.maths.cam.ac.uk/undergraduate-admissions>.

The best advice is to do as much mathematics as possible. The normal minimum requirement for our course is AS-level Further Mathematics (or an equivalent qualification) and most of our students have studied beyond this. Nevertheless, applications from students whose schools do not provide mathematics teaching to the full A2 Further Mathematics level are welcomed, and suitable allowance is made both in the interview and in the conditional offer. Note that if your school does not offer teaching for Further Mathematics modules, you may be able to get help from the Further Mathematics Support Programme (<http://www.furthermaths.org.uk/>).

If a choice of mathematics modules is available to you (and we recognise that for most of you there will be little or no choice of which modules you study at school), it is best (from the point of view of our course) to take as much pure mathematics and mechanics as possible, in preference to statistics and discrete mathematics.

Our course contains a significant component of Theoretical Physics in the first and second years; in the third year there is even more but you can avoid it completely if you want to. Nevertheless, you should not worry if you are not taking A-level Physics because we teach Theoretical Physics courses from scratch. You should also not worry if you have not enjoyed Physics much so far, because we teach Theoretical Physics courses from a mathematical point of view. However, some of the material in the A-level Physics course does provide useful background for our course.

As for other A-level or AS-level subjects, you should just choose the subjects you enjoy most.

5 Gap Year

Only a small minority of mathematics students take a gap year. Some of those who do take a gap year apply for a deferred place before they leave school. Although in many subjects the extra maturity gained from a gap year is a great asset, in mathematics this has to be balanced against the danger of going stale or 'off the boil'. If you do decide that you want a gap year, then you should plan to keep up your mathematics in some way if possible, and you should certainly get back into good practice (for example, by working through past STEP papers) before you start the course. Some colleges are more encouraging than others to those wishing to defer entry, and mature colleges realise that their applicants will have had 'gap years' for a variety of reasons at some point in their lives before applying to university: see section 9.

6 STEP

All Cambridge colleges normally include Sixth Term Examination Papers (STEP) grades in their conditional offers, Warwick also uses STEP for its conditional offers, and many other universities recommend that their mathematics applicants practise on past papers as preparation for university-style mathematics.

STEP is administered by the Admissions Testing Service which is part of Cambridge Assessment. Examination entries are handled by authorised test centres in the UK and abroad (which can often be your school).

The reasons all colleges like to make offers involving STEP are:

1. STEP is an excellent predictor of success in the Mathematical Tripos, partly because the questions are less standard and less structured, which helps to distinguish between ability (or potential) and good teaching.
2. Preparation for STEP also serves as useful preparation for our course.
3. The STEP marks and the scripts themselves are available for inspection by college staff. This means that it is possible to make allowances for a near miss and to make judgements on the actual work rather than on just the marks or grades.
4. The meaning of A-level grades may differ significantly between the different boards, and some applicants, especially those from overseas, may have taken different qualifications, so STEP provides a fairer across-the-board comparison.

You may find STEP a bit daunting at first, but you should not be worried. Here are two important pieces of advice (and see Appendix A for more):

- **Do not worry if your school is not able to provide much help with STEP.**

There is plenty of material with which you can help yourself freely available online. The best preparation for STEP is to work through past papers. The University of Cambridge provides many free resources and other support, all available through <http://maths.org/step>. Full solutions are available to guide you if you get stuck.

- **Do not worry if the STEP questions seem very difficult.**

STEP is supposed to be difficult: it is aimed at the top few percent of all A-level candidates. It is therefore important to adjust your sights when tackling a STEP paper. The questions are much longer and more demanding than A-level questions (they are intended to take about 45 minutes, rather than the 10 or so minutes for an A-level question). They therefore look daunting; but you should not be daunted. In most years, good (not perfect) answers to four questions are sufficient for a grade 1.

7 Which college?

Your choice of college is quite separate from your decision to study mathematics at Cambridge, and is in many ways secondary with respect to this: often your choice will be based on factors such as the size or situation of the college, sporting or musical facilities, and other personal preferences. The University Undergraduate Prospectus includes a section about the colleges (<http://www.undergraduate.study.cam.ac.uk/colleges>), which contains a substantial amount of useful information and will help you choose a college.

If you are not made an offer by your chosen college (perhaps because it has an unusually large number of applicants), you will be ‘pooled’ if your application fulfils certain criteria agreed by all the colleges. This means that your application will then be considered by other colleges. Every year many applicants (about 250) are pooled through this mechanism, and about half or more of them receive an offer.

8 Admissions Procedures

All colleges look for talented mathematicians who have a passion for the subject. Colleges assess candidates using a combination of many different criteria, allowing them to show strength in a range of areas. They achieve this by each using a slightly different style of assessment, which includes interviews with specialists in both pure and applied mathematics, and mathematical problems at time of interview.

Note that, unlike many other subjects that have introduced new ‘common format’ admissions assessments, *this is not the case in mathematics*. As in previous years, we continue to use STEP as part of our conditional offer. We believe that STEP provides excellent preparation for university mathematics here and elsewhere.

Typical offers across colleges are broadly the same, and include A*A*A at A-level and conditions based on STEP papers 2 and 3. You must bear in mind that *all colleges are willing to be flexible in both assessing candidates and making offers, in order to take into account the background of individual applicants*. For example, many applicants each year take examinations other than A-level, including a range of international qualifications. If you are made a conditional offer and you do not quite fulfil the conditions, you may still be accepted by your chosen college; otherwise, you may be pooled and your application will then be considered by other colleges.

In any case, the common features of the admissions process are:

- All colleges are prepared to be flexible to meet the needs of individual applicants.
- All colleges like to interview all realistic applicants.
- All colleges require some information beyond A-level grades (or the equivalent qualification if you are not taking A-levels), normally in the form of mathematical interviews and STEP grades.
- All colleges assess applicants by considering all available information as a whole (for example a single bad grade or weak reference will not in isolation mean you do not get an offer). Interviews are intended to complement and explore the data provided by exam grades, application statements and references.

The three mature colleges¹, who admit only students who will be 21 or over on the 1st of October of the year they start, have more experience in assessing non-standard qualifications and different paths to higher education, and tend to be more flexible. Their admissions procedures reflect this, for example by accepting candidates for interview at an additional round in March. However, they still aim to admit only candidates for whom the course is suitable, and require evidence of a high level of mathematical ability.

More information is provided in the table on the next page. For further details, you should get in touch with individual colleges directly (enquiries are welcome) or consult their web pages: a convenient central access point is the Mathematics Faculty page (<http://maths.cam.ac.uk/undergrad/admissions>).

We hope that you have found this information useful, but let us know if you have any questions which are left unanswered.

¹Hughes Hall, Lucy Cavendish (women only) and St Edmund’s

9 Admissions Data and Typical Offers

The following table gives some information which you may find useful. It should be read in conjunction with the preceding section. Last year, about 1300 students applied for the roughly 250 places allocated to Mathematics. About 500 conditional offers were made, 150 of them to pooled applicants.

COLLEGE	No. of places per year	Applications per place	Attitude to gap year
Christ's	10	–	N
Churchill	14	–	N
Clare	12	–	EI
Corpus Christi	7	–	DU
Downing	6	–	DU
Emmanuel	12	–	DU
Fitzwilliam	7	–	N
Girton	10	↓	DU
Gonville & Caius	10	–	DU
Homerton	10	↓	DU
Jesus	8	–	N
King's	10	↑↑	N
Magdalene	6	–	DU
Murray Edwards	4	↓↓	N
Newnham	5	↓	EI
Pembroke	9	–	DU
Peterhouse	7	↓	DU
Queens'	15	–	E
Robinson	8	–	EI
St Catharine's	8	↓	DU
St John's	16	–	N
Selwyn	6	–	DU
Sidney Sussex	7	–	N
Trinity	40	–	DU
Trinity Hall	7	–	DU
Hughes Hall*	N/A	N/A	N/A
Lucy Cavendish*	N/A	N/A	N/A
St Edmund's *	N/A	N/A	N/A

Note that that the number of places per year in this table is the target intended for next year, and applications per place is an average based on recent history.

* The number of mature mathematicians in any given year is small, so entries in this table would not convey useful information; by definition mature students have had 'gap years' for a variety of reasons at some point in their lives before applying to university.

Key

Number of applicants per place Number of applicants per place for Mathematics compared with the average (of about 5) for all colleges: higher (↑↑); slightly higher (↑); about the same (–); slightly lower (↓); lower (↓↓).

Attitude to gap year Attitude to deferred places (i.e. a gap year): **D**iscourage, **D**iscourage **U**nless you have something particularly worthwhile/relevant to do, **N**eutral, **E**ncourage **I**f you have something particularly worthwhile/relevant to do; **E**ncourage.

Appendix A STEP

This section is intended to give you more information about the Sixth Term Examination Papers (STEP), and the resources available to help you prepare for it.

The Admission Testing Service, which administers STEP, has a STEP website at

<http://www.stepmathematics.org.uk>

and maintains an e-mail helpline via an online form at

<https://support.admissionstestingservice.org/hc/en-gb/requests/new>;

or you can call 01223 553366.

STEP papers are taken in the summer at the end of June. They fit in the time-line for applications as follows (you should check the exact dates yourself).

- Mid-October: deadline for applications.
- December: interviews (you will be invited for interview unless there is a strong indication that our course is not suitable for you).
- Early January: conditional offer letters sent.
- End of April: first deadline for STEP entries (there is a later deadline in May, but the fees are higher if you miss the earlier deadline).
- Late June: STEP examinations. You sit the papers specified in your conditional offer (see below); you can sit a paper or papers not specified in the conditional offer (if, for example, required or recommended by another university).
- Mid-August: STEP results (at the same time as A-level results).

There are three mathematics papers. Each paper consists of 13 questions: 8 pure, 3 mechanics and 2 statistics/probability. You are assessed on 6 questions. There are five grades: S, 1, 2, 3 and U.

The syllabus for Mathematics I and II is based on a typical single subject A-level syllabus: the pure mathematics content is very slightly more than the A-level common core. The syllabuses for the Mechanics and the Probability and Statistics sections are each equivalent to more than two A-level modules but, since there is no common core for these areas, the material may not coincide with the modules of your particular A-level. Note that there are no questions that are designated ‘Decision Mathematics’. Also, the Probability and Statistics questions are mainly based on probability rather than statistics, and so do not match the A-level statistics modules very well. Paper I is intended specifically for candidates who are not taking the full Further Mathematics A-level (or the equivalent).

The syllabus for Mathematics III is based on a ‘typical’ Further Mathematics A-level syllabus (there is no Further Mathematics core syllabus). The comments above about Decision Mathematics and the Probability and Statistics section apply also to Paper III. Full syllabus specifications can be found on the Admissions Testing Service website above.

If you live in the UK, you should be able to sit the STEP examinations in your school. *If you live abroad*, it is still possible for you to sit STEP at your own school, providing your examinations officer is happy to administer the test. This may involve setting up the school as a CIE (Cambridge International Examinations) examination centre

(<http://www.admissionstestingservice.org/administering-our-tests/become-a-test-centre/>);

further information can be obtained from the STEP e-mail help line (see above). Alternatively, you can sit the examination at a British Council office, or the STEP help line may be able to advise you of a nearby school in which candidates are taking STEP papers, and you can also use their online search at <http://www.admissionstestingservice.org/find-a-centre/> to find a centre, in the UK or abroad, where you can sit your STEP exams.

Section 6 carried two important pieces of advice:

- **Do not worry if your school is not able to provide much help with STEP.**

Here are more details about the sources of help available.

You can find past papers (and solutions) on the Admissions Testing Service at <http://www.stepmathematics.org.uk>.

Full solutions (and much more) are available to guide you if you get stuck from the Meikleriggs mathematics site (<http://meikleriggs.org.uk/>).

Past papers, hints, full solutions, and much useful advice are also provided in the following book:

- ◊ *Advanced Problems in Mathematics: Preparing for University* - free to read online at <http://www.openbookpublishers.com> which is a combined and updated version by Stephen Siklos of his two previous booklets on STEP problems: *Advanced Problems in Core Mathematics* and *Advanced Problems in Mathematics*.

The University of Cambridge provides a wealth of mathematical resources designed to develop your problem-solving skills, mathematical confidence and mathematical thinking, and some specifically designed to help you prepare for STEP:

- ◊ A site intended to help students to prepare for studying mathematics at university: <http://nrich.maths.org/university>
- ◊ STEP - specific resources, all available from maths.org/step. These include an online structured STEP course, forums for sharing resources and ideas, and much more.
- ◊ Support for students from non-selective UK state schools that offer no help with STEP preparation. This is currently under review and details of the provision for students applying in October 2015 will be available nearer the time.

You can get tuition and support and much more when studying the Further Mathematics syllabus, whether in a school/college or by your self, from the Further Mathematics Support programme:

<http://furthermaths.org.uk>

- **Do not worry if the STEP questions seem very difficult.**

As mentioned previously, STEP is supposed to be difficult and you need to adjust your sights when tackling a STEP paper. It is also worth repeating: the questions are much longer and more demanding than A-level questions and you are only expected to answer a few of them: in most years, good (not perfect) answers to four questions are sufficient for a grade 1.

You may be interested to know the exact borderlines in terms of marks. They vary from year to year, since the marks are not scaled to fit pre-stated borderlines (such as UMS marks at A-level). Here are some examples (questions marked out of 20); more information can be found on the Admissions Testing Service STEP website.

2009	S/1	1/2	2/3	2003	S/1	1/2	2/3
Paper 1	95	72	58	Paper 1	94	73	55
Paper 2	98	71	61	Paper 2	95	70	55
Paper 3	95	67	55	Paper 3	77	56	43

As you see, the grade borderlines can vary significantly from year to year, depending on how hard the paper turns out to be. However, the standard required for the different grades does not vary.