

## CAMBRIDGE MATHEMATICS

University mathematics is nothing like school mathematics. If you enjoy doing long algebraic manipulations but have little interest in how and when the various methods which you learn at school work then you should consider subjects to which mathematics is applicable instead. If you worry about the justifications for the methods which you have learnt at school and when doing long calculations have one eye on the meaning of the expressions then you should take mathematics.

If you love the subject then do not be put off by being told Cambridge mathematics is hard and you might not get an offer. If you do not try then you will not succeed. If you always succeed easily in your life then you are clearly not stretching yourself. Rejection is a part of life and fear of it should never hold you back.

## ST. CATHARINE'S MATHEMATICIANS

The college currently has three Fellows who are involved in running the undergraduate course in mathematics at the college. There are also other mathematicians who have a long association with the college and a wide experience of teaching in supervisions. First and second year teaching is generally conducted by this group of specialists. Third year teaching is shared by groups of colleges. At present, St. Catharine's arranges the pure mathematics teaching for one group of colleges and belongs to the Trinity run group for applied subjects. The supervisions, teaching sessions, are given by lecturers, PhD students or post-doctoral research staff who are subject specialists. The same is true of part 3 teaching.

## INTERVIEW CONSIDERATIONS

The mathematics course here starts at rather a high level and the material is covered very quickly with almost no repetition. Unless you are very familiar with your A level or other equivalent school courses and confident about using them, you will not be able to cope with the Cambridge Tripos in Mathematics.

I am speaking only for myself. I will choose the students who are the most promising mathematicians and the most able to make use of the teaching that the College has to offer. There are examples of very good, and examples of very poor, standards of teaching at all the different types of school. The quality of your teaching will be taken into account at your interview but so will many other factors. These are the factors which I will take into account during the interview.

1. Raw native talent.
2. Sufficient background to survive the first 2 terms of the Tripos.
3. Enthusiasm for the subject.
4. Self-discipline and high motivation.
5. High aspirations.
6. Stubborn determination to solve hard problems.
7. Imagination.
8. Enough emotional robustness and an ability to cope with stress and a high workload.
9. Critical but receptive approach to new material.
10. Supportive of peers and a cooperative individual in groups.
11. A life outside mathematics.

Ideally, you should have the equivalent of double mathematics at A2 level. The most important modules are the pure mathematics and the dynamics. If possible then you should take these in preference to statistics or discrete modules. Physics at A2 is helpful but not essential. Other choices should be guided by your own interests. Unusual combinations of subjects will not put you at a disadvantage, for example, mathematics, further mathematics and art would be reasonable for a candidate planning to train as an architect.

If a school offers further mathematics then the student would normally be expected to take this at A2. Some schools do not offer the equivalent of two full mathematics courses at A2. In such exceptional situations, St. Catharine's will consider very good students with a single A2 mathematics and the equivalent of AS further mathematics topics which would put their knowledge base in mathematics on a par with IB or Scottish Highers at the time of starting the undergraduate course. Increasingly many students take extra courses, such as A2 further mathematics, on their own, online or only with the informal support of their school teachers. If you are in this position then make sure that the subject interviewer, whether here or at another university, knows that you are working by yourself so that this can be taken into account. If your work has been disrupted for any reason in the period just before your interview then please let the interviewer know so that any special circumstances which may affect your interview performance can also be taken into account.

STEP teaching at school is the exception rather than the norm. There is support available on the web and also there are books to help you with the style of the problems. Stephen Siklos has written a very helpful book called *Advanced Problems in Mathematics: Preparing for University (2nd ed) (PDF)*. This is available as a free download of the second edition from October 2019 at <https://www.openbookpublishers.com/product/1050>. There is a STEP correspondence course for students taking STEP and some extra mentoring support is available for students who are holding Cambridge offers. Details on the Faculty website. <https://www.maths.cam.ac.uk/undergraduate-admissions>. The site includes links to the syllabus and past papers which can be obtained from OCR. The link <https://www.maths.cam.ac.uk/undergrad/admissions/undergraduate-admissions> also gives further links to help with further mathematics and with STEP.

## GAP YEARS

St. Catharine's discourages gap years for mathematics applicants. Exceptions can be made provided the College can be satisfied that there will be enough mathematics during the year out for the subject to remain fresh.

## ENTRY REQUIREMENTS

The university tries to recruit its mathematics students from the top 3% of the mathematicians in the country. This means that most of the applicants have nearly perfect "supporting paperwork" and the university needs to use additional criteria to distinguish between the candidates.

St. Catharine's will give two subject interviews each lasting 20 - 25 minutes. There is no general interview. Candidates for mathematics with physics may also have a physics interview. A traditional style Cambridge subject interview consists of about 20 minutes of questions of increasing difficulty. These are intended to assess both the level and quality of your background knowledge of the subject and also your ability to apply your knowledge. The St. Catharine's interviews typically comprise of one half of this style of question with the other half consisting of teaching new material. This is your reward for making the effort to attend the interview. This might mean a short of supervision on something which may or may not be on your school curriculum. This gives the interviewers an idea of how well you would take to the teaching style at the College and it gives you an idea of how subjects are taught at the College. Even if you do not get an offer you should, at least, leave having learnt some useful mathematics. Of course the two parts of the interview are mixed together so that you do not really know when you are being asked about material which you should know and when you are being taught something new. It is possible that in the future St. Catharine's may ask you to do a short test just before the interview to provide a basis for the interview.

***Look around the colleges. Look carefully at the different interview procedures and pick the process which suits you the best.***

Any offer will almost certainly include A grades at A2, usually in specified subjects. It will also ask for STEP 2 and STEP 3, the mathematics STEP papers, again with the grades specified. These may require some students to do some self teaching. The experience at this College has been that students who do well in these two STEP papers can cope well with the coursework. There has been a good statistical correlation between good performance in STEP and good performance in the Tripos. Although the **STEP papers are set and marked by OCR** it is possible for College Directors of Studies to see the scripts and this is helpful in borderline decisions.

Offers for A level candidates usually include A\*A\*A at A2 level, or the equivalent, with an A\* in further mathematics and in addition grades 1 and 1 in STEP 2 and STEP 3. The further mathematics course is highly desirable but it is understood that not all schools are in a position to offer this option. Such candidates may need to do some extra work to complete the material for the STEP papers and this might require self teaching or distance learning. Students should feel encouraged to take Physics in order to secure some knowledge of dynamics but this is not a requirement for single subject mathematics.

Students reading for the I.B. should take as many mathematics courses at the higher level as are available. For STEP purposes I.B. is viewed as being on the same level as A2 mathematics and A/S further mathematics. Therefore the offer is typically grade 1 and 1 in STEP 2 and STEP 3. The I.B. offer is typically 7,7,7 and 42-45.

Students taking Scottish Highers will be expected to take as much mathematics as the course allows. For STEP purposes Scottish Highers are viewed as being on the same level as A2 mathematics and A/S further mathematics. Therefore

the offer is typically grade 1 and 1 in STEP 2 and STEP 3. There is some variation in the offers to reflect interview performance. The Highers offers are typically A1 and A2, A2 in advanced higher.

There have also been some applicants with pre-Us. The offers are typically three D2s and grade 1 and 1 in STEP 2 and STEP 3.

Overseas applicants will have offers decided on a case by case basis based on their training but these will typically include grade 1 and 1 in STEP 2 and STEP 3.

There is some variation in the offers to reflect interview performance and overall number of applicants. There may also be alternative offers or similar initiatives for some students in order to promote inclusivity and access.

**Candidates whose workload is light or whose selection of modules does not prepare them sufficiently for the Tripos or who are borderline decisions may be given harder offers including offers which require them to learn extra material.** In exceptionally strong years the offers may be higher to reflect the restriction on places and the strength of the competition. This means that students who do not make their offer in such years have the opportunity and a good chance of being taken from the pool by other colleges in Cambridge.

## ACCESS SCHEMES

There are evolving initiatives to broaden access. St. Catharine's supports such schemes and the mathematicians have included access considerations at the offer stage and also at the decision stage in the summer.

## POST INTERVIEW PROCESS

After the interview there are three possibilities.

1. You may be given a conditional offer as described above.
2. You may be put into the winter pool. This means that you have not been offered a place by the college which interviewed you but the college thought that you might be offered a place by another college. This might involve a second interview by the other College.
3. You are rejected.

If you are rejected please do not think that you are no good at mathematics. The number of places is small and always oversubscribed. You may have been good enough for Cambridge but not quite as strong on the day as the students who were offered places. Students are rejected or pooled, because they fall below the cut off on that particular day.

A conditional offer from St. Catharine's means that we think that you are capable of a Class 2.1 in Cambridge mathematics. Students who are thought to be capable of a Class 2.1 in Cambridge but fall below the cut off for St. Catharine's are pooled. Students who need reassessment for some reason are also pooled.

If you just miss your offer in the summer exams then you may or may not still be offered a place. This will depend in part on the number of places available and also on a closer inspection of your STEP papers. At this stage you again have three possibilities.

1. You are accepted by your College.
2. You are pooled by your College.
3. You are rejected outright and must go to another university.

If there has been a particular problem with one of your exams then you should let the college or university know. In general students in the summer pool for mathematics will have three or four As at A2, at least one A\* at A2 and 1 and 2 or 2 and 2 or S and 2 in STEP, having just missed the higher grade in each case.

## CONTACTS

St. Catharine's Admissions Office  
CMS website with DAMTP and DPMMS the two arms of the Mathematics department  
OCR contact for syllabus details for STEP papers and past papers  
NRICH Support with STEP and teaching.

## TEACHING ARRANGEMENTS

The lectures are shared by all the colleges. Each lecturer hands out problem sets for the students. A typical lecture course of 24 lectures will have associated 4 problem sets and 4 hours of supervision. The students try the questions and these are marked by supervisors in the college. The students are taught in pairs, usually within their own college and have one hour for each problem set. This means that students must be highly motivated in order to make best use of supervision time. At St. Catharine's the students are all encouraged to help each other and to work together.

## COURSES

### 1A First Year

All eight courses are compulsory and cover "core" material in pure and applied mathematics including probability. The courses are presented in manner very similar to the teaching style in school. The idea is to get everyone speaking the same language at the same level. There are optional courses which are examined in the second year and also a computing course called CATAM. It is college policy that students take some of the optional courses and all students take CATAM. The optional course supervisions are supervised in the first term of the second year. Students are encouraged to seek placements in the summer. Those considering careers in the finance industry are particularly encouraged to apply for Spring Week placements after 1A, their first year.

### 1B Second Year

There is still a core component but students can also choose some courses and begin to specialise. All St. Catharine's students are expected to take the optional computing projects, not all colleges have the same policy. This college believes that a preparation for the workplace is essential in the modern world. Therefore all the 1B students are encouraged to seek placements at the end of 1B the second year. Many of these lead to job offers. The emphasis on the development of "soft skills" depends on the policy within each individual college. St Catharine's mathematicians have traditionally supported students in the development soft skills. Whether or not a particular individual remains in academia, or leaves for another occupation, the ability to communicate with people at all levels, to give presentations, to write reports and to work in a team are essential. The students are also encouraged to maintain language skills.

### Part 2 Third Year

Students choose courses from a very large list of possibilities. There are two levels of difficulty so students in all ability ranges can choose suitable courses. Most students graduate and leave after their third year.

### Part 3 Fourth Year

Students with firsts or very good seconds can stay on to take this course which is a preparation for research. It should be viewed as at the level of an M. Sc. by courses work. Funding for this can be a problem and *if your funding arrangements allow you to apply for the full four years then that is what you should do in the first case.*

### Variations

In the first year some students take combined options. There is a maths with physics option which is a good choice for students who want to specialise in physics but do not want the broad course work of the Natural Science Tripos in their first year. Students who want to specialise in theoretical or mathematical physics should read mathematics.

After the second year there are some "standard" changes of Tripos available to students. Part 2 Astrophysics and Part 2 Management are quite popular choices.

### Work Load

Students who come to Cambridge have often had a rather easy life academically. Everyone here is bright and ambitious. I expect my students to work a normal working week, that is, about 40 hours a week, during the full academic year, not just during terms. The terms are short but very intense. I also expect students to do whatever is required to fulfil their work commitments.

The work load is higher for combined courses and you should take this account when making your choices. On the other hand there is the opportunity to switch into the NST Tripos after the first year if the mathematics course proves unpalatable.

**Play Load**

Students are encouraged to have a life outside mathematics and Cambridge offers an enormous variety of distractions. College has many sporting, musical, political, thespian and other student societies. There are also opportunities within societies which are shared by several colleges.

**Cost of Living**

Cambridge is no more expensive than any other university. There are many bursaries and students in lower or middle income families will get a Cambridge Bursary to help ends meet.

**ACCOMODATION**

St. catharine's will try to accommodate as many students as possible on the college site. This means that everyone in the first year lives in college. In the second year the students live at St. Chads which is about 10 minutes walk away and is a lovely site in the spring. In the third, and for most students, the final year the accommodation is back on the main site. The part 3 students live in graduate accommodate in one of the college houses but priority is given to incoming part 3 students from outside Cambridge.

**EMPLOYMENT**

Cambridge mathematicians are highly employable. The obvious careers include, banking, finance, accountancy, management, software, A.I., some branches of engineering and operations research, medical and biological sciences, strategic planning, economics and education. In reality employers are very keen to employ mathematics graduates in a variety of different careers because the degree is a guarantee of intelligence and an ability to think and solve problems. The choices are extremely diverse.