An Unofficial Guide To Part III

Although the production and distribution of these notes has been encouraged by the Cambridge Mathematics Departments, the responsibility for any opinions, jokes or errors therein rests with the author. I should be glad to be told of errors or of any way in which these notes could be made more useful. In particular, I should welcome information about any scholarships and studentships which might be available. This version was last revised on the 1st October 2015 and will be further revised from time to time. **All statements about finance and dates in this guide should be considered provisional and checked against up to date official sources.** The guide is written in LaTeX2e and is available from my home page

http://www.dpmms.cam.ac.uk/~twk/

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1 Description

Part III Mathematics is most simply described as a taught Master's course in mathematics; but this simple description is inadequate for the culminating part of the oldest and most famous mathematics examination in the world. (The Mathematical Tripos goes back to about 1725 and Part III, under the name of 'The Smith's Prize Examination' to 1769[1].) Until 1970 Part III was basically a domestic Cambridge examination with some outside candidates. Since then it has grown (apparently by word of mouth recommendation) until it has more than 200 candidates a substantial majority of whom come from outside. In 1992 the two mathematics departments[2] decided to promote Part III actively outside Cambridge and this document is one of the results. The Departments view our present babble of Chinese, French, German, Russian and other languages as our surest protection against inward

[1]In an article in the *Mathematical Gazette* (vol 20, No 237, p31), Karl Pearson recalls that 'Four professors examined, in my year, Stokes, Clerk Maxwell, Cayley and Todhunter .... We went on each occasion to the examiner's house, did a morning paper, had lunch there, and continued our work on the paper in the afternoon. At Stokes's we had a family lunch, the professor at one end of the table and his wife at the other ...'.

[2]The Department of Applied Mathematics and Theoretical Physics (DAMTP) and The Department of Pure Mathematics and Mathematical Statistics (DPMMS) to give them their full resounding titles.

looking isolation[3]. They see Part III as an essential link in maintaining a buzz of mathematical excitement all the way up from our first year undergraduates through our research students and from there to the staff, to the Newton Institute and all the way down again.

The Cambridge undergraduate mathematics course is one of the largest (about 250 a year), certainly the most most selective (judged by things like A level point score) and, we believe, most intensive in the country. (It is significant that we have 3 undergraduate mathematics societies which, together, organise 1 or 2 talks a week during term time.) The course is entirely devoted to mathematics (broadly understood to include mathematical physics, mathematical statistics and related subjects). The final degree is taken after 3 years, but most of those who wish to continue with mathematical research (again broadly interpreted) stay on to do Part III. They are joined by Cambridge students who have done physics as undergraduates and who wish to take courses in advanced mathematical physics[4] and by students from other universities in the UK, Europe and elsewhere in the world. This has three important consequences.

1. The general standard of the Cambridge students doing Part III is very high and the level of the course reflects this.

2. The Cambridge Mathematics Departments use Part III results as their main (but not their only) way of assigning research places.

3. Many of the Cambridge students already know that they wish to go elsewhere after Part III, either because their speciality is done elsewhere, or on the general grounds that four years in one place, even a place as enchanting as Cambridge, is more than enough.

These consequences have important implications for those coming from outside Cambridge.

1. Only reasonably able and hardworking students are likely to profit from Part III. The Departments normally require First Class Honours[5] from students coming from other British universities. If you come from outside the British system we have to rely on your referees' opinions but,

[3] To quote one of my colleagues, 'The great advantage of lecturing in Cambridge is that there is always a Hungarian in the audience'.

[4] The British conception of applied mathematics is very wide and includes theoretical physics and parts of what, in other countries, would be considered engineering science. For convenience I shall refer to 'mathematicians' throughout, but candidates for Part III range from future astronomers through to future statisticians.

[5] Usually in Mathematics or Mathematical Physics but any sufficiently mathematically based degree is acceptable.

as a rough guide for you and them, you should be able to profit from Part III if you are in the top 10% of mathematicians graduating in your country and you are prepared to work very hard. (German and Swiss students with the Diplom or a very good Vordiplom have the correct level of preparation. French students will find the level of the courses similar to those of the troisième cycle.)

There is a great deal of information on the Faculty website including the syllabuses for all the undergraduate courses and the examination papers for the undergraduate courses and Part III for the last ten years. In addition there is a new page

https://www.maths.cam.ac.uk/
postgrad/mathiii/preparationresources/main.html

I quote the organisers of this page:– 'The *First Level Prerequisites* are meant to act as reality checks to show students whether trying to do Part III courses in that area is realistic, and whether Part III really is for them. The *Second Level Prerequisites* are meant to help students who are in the realistic realm to use their summer effectively to prepare the background material, so they can keep up well with the Part III courses when they are here.'

2. Many students both from Cambridge and outside are happy to study mathematics for its own sake, but if you wish to do research at Cambridge in certain popular subjects you will have to engage in intense competition for a high position in the examination. (I shall return to the subject of research places later.)

3. Part III is a genuine one-year course, not the first year of a Ph.D. This is clearly attractive to some students (including many from British, American and German universities) who want one year in different surroundings before going back to their own or another institution to do research. (However, if you just want to sample the delights of Cambridge life, a couple of weeks wandering round as a tourist will be cheaper and less hassle.)

4. Most of the students who do Part III are highly motivated and view Part III as a stepping stone on the way to a PhD (though, as I said above, not usually at Cambridge). It is not intended as a final year of mathematics and students who wish to treat it as such often find it over-technical and intense.

I now turn to details.

Lectures The Departments offer 70 or so courses between them. Most of the courses are 24 lectures long and delivered at the rate of 3 a week, but some are 16 lectures long and delivered at the rate of 2 a week. The 24 lecture courses count as 3 units for examination purposes and the 16 lecture courses as 2 units. (You may, if you wish, replace 3 units of lectures by an essay. This option is discussed later.) No one is allowed to offer more than 19 units for examination and the standard practice is to offer 17, 18 or 19 units (this matter is discussed again later). A fair amount of effort is spent in trying to avoid likely clashes between lectures but clashes cannot always be avoided. Lecture courses given at the same time are examined at the same time so, if lecture times clash, so will examination times.

If you have been accepted for a PhD and are spending a year doing Part III before taking up the offer, I strongly suggest you discuss your choice of courses with someone from your future department. I also think it is sensible for all students from outside to discuss their choices with their academic advisers from their previous departments and for all students from within Cambridge to do the same with their undergraduate directors of studies.

The following points should be noted.

1. There is no restriction on your choice of courses. In particular, you are welcome to take a mixture of 'Pure' and 'Applied' courses.

2. You do not have to choose which courses you wish to be examined in until the beginning of the third term. Many people attend extra lecture courses either purely out of interest or in order to defer a final choice until later.

3. As a general rule, students find it easier to prepare a related set of courses for examination. It is probably a good idea to have at least half your examination courses in the first term. However, all rules of this kind have many exceptions. Both Departments have advisers assigned to each mathematical area who will be happy to discuss your choices with you.

4. You will certainly gain more from the lectures (and probably do better in the examination) if you try to keep up with the lectures rather than just making notes to be reread at a later time.

Lecturers issue a syllabus in advance, but this is merely a statement of intent and the actual course may develop in a different way. This year's lecture syllabuses are available on the web via the Faculty of Mathematics web pages.

The titles of the courses and the lecturers change from year to year particularly on the 'Pure' side.

Additional Papers It is possible to request additional papers based on chosen books (or parts of books) or on the notes of a course given in a preceding year. The decision on whether to allow such papers rests entirely with the Faculty Board. Speaking generally, the Board tends to view favourably proposals which broaden the course or fill clear gaps and unfavourably proposals which are either narrow in themselves or which would allow undue specialisation when taken with other courses; but the Board is not constrained in any way when making its decision. Any new paper is open to any candidate. Even if you request a paper you can later change your mind and not take it. If you are thinking of requesting an extra paper, you should discuss it with a member of staff since proposals prepared without such advice tend to be over-ambitious. (The Board is unlikely to approve a proposal for an extra paper unless it comes with name of a member of staff who is prepared to examine it.)

Essays If you wish, you may substitute an essay for 3 units of examination. A list of about 100 essay titles[6] is issued at the end of the first term and, provided you can find a lecturer willing to set such an essay[7] you may request a particular additional title which the Examiners may or may not approve (using much the same criteria as in the case of additional papers). The list of titles changes from year to year. Typically you will be asked to read 3 or 4 recent papers and to combine them into a coherent whole. (The typical length of such an essay is 7000 words.) Original work is not expected, but you will be judged on how well you have understood and explained your subject. The member of staff who will mark your essay will also be available to give advice and encouragement in writing it.

Most students choose the essay option for the following reasons.

1. With luck, the essay may provide you with ideas and background for further research. In any case, it provides you with experience in sustained mathematical exposition.

2. Writing an essay brings you into closer contact with a particular member of staff.

3. If you write an essay, you have 'money in the bank' before the examination starts. It is easier to do an alpha+ examination than to write

[6]This is on the web but less useful for prospective applicants because you are specifically forbidden to submit an essay on a topic if an essay on that topic was submitted the previous year.

[7]This is an important restriction.

an alpha+ essay but (as one would expect) most essays obtain good or excellent marks.

You are perfectly free not to choose this option, or, if your attempt at essay writing is not a success, to abandon it at any time before the final choice of papers at the beginning of the third term[8].

Examinations Almost all the courses are given in the first two terms to allow plenty of time for revision. The examinations take place over about two weeks starting (roughly) on the Thursday five weeks after the first Thursday of the third term. Three-unit courses have a 3 hour examination and two-unit courses a 2 hour examination. In general, the examination paper for a course is set and marked by the lecturer for the course. The lecturer has considerable freedom in choosing the form of the paper and examinations range from open book through mixed book work and problem papers to pure book work. Lecturers should tell their classes what form they intend to use (and, if not, you should ask). The papers for the last 5 or 6 years are available on the web.

The marker gives each candidate a numerical mark and a 'quality mark' from alpha+ to gamma– and sends the results to a small group of staff specifically designated as 'The Examiners'. This group is joined by three outside experts 'The External Examiners' whose job is make sure that the stated standards of the examination are actually achieved. The marker may add written comments on the difficulty of the course and the examination and on the performance of individual candidates. The Examiners use all this information to classify the candidates into 4 groups: 'Distinction', 'Merit', 'Pass' and 'Fail'. Few people fail[9] but this reflects the fact that most candidates have worked hard rather than any reluctance to maintain standards. Distinctions reflect a very high standard indeed[10].

Grade boundaries The Examiners form a totally independent body and are not constrained to act in any particular way[11]. Candidates at the border

[8]This statement was correct at the time the guide was revised. However the Faculty may, at some point, decide that the essay is so valuable an experience that it should be made compulsory.

[9]The percentage fluctuates. A figure of 5% would be a reasonable guide but the figure has reached 12%.

[10]Though not quite as high as that prevailing in the remarkable 1952 examination when there were 40 candidates and the 11 Distinctions included the future Professors J. F. Adams, M. F. Atiyah, I. G. MacDonald, A. G. Mackie, J. C. Polkinghorne, R. Shaw, T. J. Smiley and J. C. Taylor.

[11]So what the present writer expects and what the Examiners do are two different things. The advice offered in the next two sections is the best that I can give but has *no official standing whatsoever*. Appendix 3 of the *Part III Handbook*, which is available on the web, gives the Faculty Board's advice to examiners.

lines are looked at individually and decisions are not made by applying a magic formula. The following remarks do however reflect how the examiners have behaved in the past.

The examiners look at the candidates' best results rather than their worst. Most (but not all) candidates who get alpha quality marks on four 3 unit papers will obtain a distinction. (In some past years every candidate who got alphas on four 3 unit papers obtained a distinction but it is generally felt that the distinction level should be somewhat higher than this.) Most (but not all) candidates who get alpha quality marks on three 3 unit papers or two three unit and one 2 unit papers will obtain a merit.

Units No one should start Part III with the aim of 'just passing'. If you start with low aspirations you will probably end up having spent a useless and unpleasant year at the end of which you fail. However, even if you start with the correct ambition of obtaining a distinction, you may find that you need to lower your sights.

We suspect that many of those who come low down in the examination lists would have done better to concentrate on understanding fewer courses. The examiners are more impressed by a single beta than by three gamma papers even if the raw marks for the gamma papers add up to substantially more than the mark for the beta paper.

My advice would be the following. If you are aiming for a distinction or a high merit you should do 17–19 units. If you are doing 17 units you should only do an extra two unit paper if you are likely to get at least a beta on it. It is possible though unusual to obtain a distinction on fewer than 17 units (in the past people have done so on 14 units) but the examiners will take into account the fact that you have done fewer than 17 units.

If you are aiming for a merit it seems to me unlikely that you will try to aim for 19 units (surely you can do better by improving your results on other courses) but 15–18 units[12] seems a reasonable aim. Of course, it will be possible to obtain a merit with fewer units but you will probably want insurance against one of your papers proving unexpectedly difficult. Again it is unlikely to be to your advantage to spend time preparing a paper unless you expect to get at least a beta.

If the year has gone badly and you are just trying for a pass then the examiners have explicitly announced that when making pass/fail decisions they will not hold it against a student that they have only done 12 units.

[12]This is quite wide range but some will be aiming for a merit but hoping for a distinction and some will be aiming for a merit but not disappointed by a pass. Also there are other reasons for doing a paper. You may feel that doing it for exam will make you work harder at it or you may feel that possible future PhD supervisors will want evidence that you have done a certain course.

(You may be able to pass if you offer fewer than 12 units but the examiners will take into account the fact that you have done fewer than than 12.) If you genuinely only wish to pass, then 12–14 units seems a reasonable load.

Please note that *doing fewer units will be to your advantage only if you do the remaining papers better*. The best time to consider these matters is at the end of the first or the beginning of the second term[13] when you should think realistically about how well you have understood the first term courses. If you genuinely think you are in trouble, you would be particularly well advised to do the essay option, partly because if you do respectably in the essay you are already half way to a pass and partly because your year will have been better spent if you produce an essay that you can feel satisfied with rather than just scraping (or failing to scrape) a pass by examination only.

If you are considering a reduced number of units you should discuss it with your college director of studies. More generally you should consult him or her if you have problems with the courses. Your college is often able to provide help (or simple reassurance, which is sometimes all that is needed) but can not do so unless you ask for it.

Other choices You should choose for examination those subjects that you are best at and those subjects that you will need for the field in which you wish to do a PhD. You should remember that prospective PhD supervisors may be more interested in how you have done in the papers relevant to their (and so presumably your) interests rather than whether you got 20 marks more or less in total compared with somebody doing a different set of courses. Do not do a course that you do not like on the grounds that it is easy (it will not be easy for you if you dislike it) or that it is hard (doing badly in a hard subject will not strike the examiners as a positive virtue).

Bologna The name Bologna conveys various ideas to the University of Cambridge.

(1) The first European *University* to which Cambridge will always owe a great grand daughter's[14] affection and reverence.

(2) A rather messy *sauce* containing a great deal of bull.

(3) A *process* by which European education ministries attempt to align their university degree systems with a supposed Anglo-Saxon model. Not surprisingly, the result is quite unlike any known Anglo-Saxon system. After a delay of several years, rumours of this mysterious process have reached Cambridge with the result encapsulated in the following sentence. 'The Ed-

[13]The worst time is two weeks before the exam. By then, you will have invested a great deal of time and effort in the course and you might as well take the exam.

[14]Bologna, Paris, Oxford, Cambridge.

ucation Committee has agreed that ECTS equivalences should not, at the present time, be published either centrally or by Faculties and Departments, but should be articulated, as required by individual students, through a standard letter from the International Office.' If you need such a letter you should write to

International Student Team
ECTS Equivalences
16 Mill Lane,
Cambridge CB2 1SB

making clear exactly what you need. If you are worried about such matters, you should remember that leading universities all over the world consider Part III to be 'adequate preparation for direct entry to doctoral study'[15].

Further Research In The Departments If you wish to do a Ph.D in one of the mathematics departments, the success or otherwise of your application will normally depend on the availability of supervisors, the availability of funds and your performance in Part III[16]. The two Departments receive a limited number of studentships from the British Government[17] which provide 3 years' fees (that is University and College fees) and maintenance for British nationals and 3 years' fees for EU nationals. (Some 'Applied' subjects have access to other studentships. As might be expected, it is easier to get funds to study fluid mechanics than quantum relativity.) The same Cambridge schemes that support Part III also support PhD students and there are (highly competitive) research studentships at some colleges. The Departments generally do well in the competition for places under all these schemes. Some foreign governments are prepared to support their nationals at Cambridge.

Further Research Elsewhere Most students doing Part III wish to do research elsewhere (this includes departments like engineering, physics, astronomy and chemistry at Cambridge) and even those who wish who stay on should certainly take out insurance. You should approach the lecturers in the subjects which most interest you for their advice on which universities in

[15] Not to be outdone in the effort to compare the incomparable, the British have OFQUAL (whose web site has useful links to NDQA, WBA, EAB, BIS and QCDA). So far as OFQUAL is concerned, the MASt is *a level seven qualification*. Naturally, OFQAL works closely with the QAA which verifies the compatibility of the FHEQ with the FQ-EHEA (ie checks that British university qualifications are Bologna compliant) on behalf of DIUS, WAG and DELNI. Scotland is dealt with separately under the SQCF.

[16] Let me emphasise once again that acceptance to do Part III does not imply acceptance to do a PhD.

[17] I have grossly simplified the mechanics of the process but the effects are as described.

Britain and abroad do their subjects best. (In my opinion it is better to go for a good department or supervisor in your general area of interest rather than a weaker department or supervisor on the grounds of exactly matching interests.) The Careers Service has many university prospectuses and will be happy to advise you on the mechanics of applications. You should start thinking seriously about British universities by the end of the first term. Some US departments have very early cut-off dates so you will have to start thinking about them the moment you arrive in Cambridge. (The Careers service runs an early lecture on American Universities, look out for notices or enquire at the Careers service.)

Important notes (1) Any student considering a PhD should certainly consider the possibility of study in the United States. Anybody considering study in the United States should take the GRE (Graduate Record Examinations) general test and the GRE mathematics subject test[18]. These are only available at specific times at specific places and preregistration is required. (For details, see ETS.org and prepare for a fairly lengthy session.) By the time Part III starts, it is rather late in the day to begin the process and you will have plenty of other things on your plate. We *strongly suggest* that you begin booking tests as soon as possible (ie *now*) and that you have completed both the administrative details and the 'test familiarisation' process well before arrival in Cambridge. (The GRE web page contains a booklet of specimen questions.)

(2) Many universities have very early application dates and this means that you will need to supply very early references. Subject to the bureaucratic restrictions imposed by each university, my advice is that *the best references are those given by the professors who know you best* and this will usually mean the professors who taught you at your present university. You should make arrangements with them so that they can send references when you ask for them. (Usually all this requires is that they update your Part III reference to include your final examination results.) If it turns out that you also need a Cambridge reference, then the normal procedure is to ask your *college* to provide it.

Difficulties for Outsiders There are a couple of points that may worry students from outside Cambridge.

(a) *Language* The courses are given in English and the final examinations involve writing in English for two or three hours at a stretch (though you will be marked on your mathematics and not on your command of the intricacies

[18]The present author suspects that many US mathematics departments do not make much use of these tests in making decisions, but most US universities demand the tests as part of their admissions procedures

of English idiom). If you feel that your English is not good enough to allow you to take the essay option, then Part III is not for you.

Our experience is that students whose first foreign language is English cope well (after all, mathematical English constitutes a small subset of all English). However, Part III is designed as a Mathematics rather than an English Language course and should be treated as such. I would advise students who have not previously spent some time in an English-speaking country to read plenty of English thrillers (short, trashy and simple) and to go to plenty of English or American films to train their ears before lectures start.

From time to time there is public disquiet[19] about British universities accepting students with inadequate English. This means that, you must satisfy the conditions set forth in the graduate admissions prospectus under the heading *Competence in English.* For many countries, these form part of the visa requirements which the university cannot alter.

(b) *Assumed Knowledge* With students from so many universities coming together it is inevitable that, from time to time, lecturers assume knowledge which some students do not have. If this happens to you then should should raise the matter at once. The lecturer will then ask whether other members of the audience have the same difficulty and take appropriate action. (For example, this could take the form of a supplementary class or the clear statement of the required theorem together with the information that the proof is non-examinable.) In practice, the problem does not seem a serious one provided that you are generally well prepared. I will return to this point later.

Contact with Staff The Departments run a number of schemes of varying effectiveness to bring you into contact with your lecturers but, in the end, this depends on you. The first and, in my opinion, most important place of interaction is the lecture room itself. The lecturers actually prefer an interested, questioning class to a group of note-taking Zombies (though even an interested, questioning class should take complete notes) and consider you as future colleagues. (Six out of the fifteen students in my first Part III class went on to hold appointments in British Universities.) Lecturers do not normally have 'Office Hours' but you can arrange to meet them by e-mail or, better still, talk to them after the lecture or during tea or coffee time.

Other Training For the past few years we have run a scheme under which groups of six to eight students give short half hour talks to each other on aspects of the lectures or their essays under the guidance of a more senior

[19]That is to say, journalists find this a useful issue with which to pander to their readers' prejudices.

mathematician. The object is twofold, firstly to give training both in mathematical *lecturing* and mathematical *listening*, and secondly to help absorb the courses and prepare the essay. It must be stressed that the scheme is experimental, voluntary and does not carry credit[20].

Other Facilities You are welcome to attend any undergraduate or graduate courses in mathematics and any of the numerous seminars in the Departments and the Isaac Newton Institute[21]. You are also welcome (subject only to space limitations) at lectures in other subjects. After complying with the appropriate formalities you may use the University Computing Service, the University Library[22] and its mathematical branch, the Moore Library which is on the same site as the two departments.

As you would expect in a British university, the social life of the two Departments revolves round coffee and tea in an enormous common room. There is also a large Part III common room with computer terminals, places to sit and think and places to just sit.

The Cambridge Experience If your picture of Cambridge is based on 'Brideshead Revisited', 'Sinister Street', 'A Yank At Oxford' and 'Charlie's Aunt' you may be slightly disappointed. One reason is that the works referred to all take place in Oxford and a second that they are all set in an earlier age when Oxbridge students had more money, more leisure and fewer academic ambitions. There is, however, a more important reason why your experience will differ from the popular expectation. Undergraduate life in Cambridge is still college based and undergraduates still have college supervisions in ones and twos, sherry with the Dean, formal halls and 'bedders' (though fewer and threatened with extinction), college boats, 'squashes' and so on. Graduate life is department based and more like that in a 'normal' university (though you must be a member of a college and pay college fees). If you wish, you can avoid 'college life' altogether but most graduates find that the college MCR ('middle combination room') provides a useful social focus and a place where they can meet graduates studying different subjects. A minority of graduates throw themselves into every aspect of college life but should be reminded that the 'Terrible Three' of excessive rowing, acting and bridge are as dangerous for graduates as for undergraduates.

[20] But, in the present writer's opinion, is extremely worthwhile.

[21] During term there are over 30 seminars a week including, from time to time, graduate seminars with the motto 'By Graduates for Graduates'. There is often a general colloquium at 5pm on Mondays. These are very popular and I recommend them highly.

[22] When copyright was introduced in 1710 it was made a condition that a copy of every book published in the UK be sent free to the nine 'Copyright Libraries'. Cambridge University Library is one of these. Scarcely less important in the eyes of many users are the delicious cheese scones served in its canteen.

Having issued these moralising platitudes let me add that, in the couple of weeks after the examinations Cambridge reverts to a 19th century mode when '...Youth and Pleasure meet to chase the Hours with flying feet'. There are tea parties and drinks parties and walks to Granchester and May Balls (very expensive but, for many participants, the experience of a lifetime). There are concerts and plays and sometimes even operas performed in old College halls or College gardens. (There are few more romantic occupations than watching Shakespeare as dusk falls over the Cam.) You should forget for a moment troubles past and troubles future and just enjoy yourself.

Degree titles If you are a Cambridge student doing Part III as the fourth year of a four year course you will, provided you pass Part III, be entitled to a 'BA with MMath'. (Note that the MMath does not exist as a separate degree, the BA with MMath is, in effect, a *single* degree.) Everybody else who passes Part III is entitled[23] to a 'Master of Advanced Studies' or MASt.

2 Warnings

Most people who come to do Part III enjoy it (not all the time, it is very hard course) and are glad they came. However, each year we get a some students who discover that Part III is not at all what they expected or want. Here are some points that you may wish to bear in mind.

Purpose We view Part III as a preparation for a PhD. If you are only interested in doing another year of mathematics you may well find the course too intense and too specialised. The answer to 'Why are we doing this' will often be 'Because it may come in useful when you are doing research'.

Preparation I said earlier that it does not matter if you do not know a particular theorem or fact which your lecturer makes use of since the lecturer will be happy to help. It does, however, matter if you do not have the same kind of background as the rest of your class.

The Cambridge students in your class will have followed courses whose syllabuses (and examination papers for the last few years) are given on the Faculty web site. Typically, they will have good control over all the courses in Part 1A, all the appropriate courses in Part 1B (that is the pure courses for pure students and the applied course for the applied students) and about six course in Part II. Thus, for example, if you attend a course in Quantum Mechanics the Cambridge students may have done 56 hours of courses. If you have done 40 hours and different topics you will probably still have the

[23] Although you are *entitled* to take the degree you are not *obliged* to take it – a subtlety which is very occasionally useful.

kind of general background required but, if you have only done one course of 24 hours, then the gap may be too great.

The lecturer's Part III syllabus will often give prerequisites in sufficient detail to enable you to see whether you can tackle them. Frequently these show that some undergraduate course is not required. For example, there are undergraduate courses in General Relativity and Differential Geometry but the corresponding Part III courses often start from scratch. You should, however, expect such course to go quite fast and some general preliminary reading would be useful.

If you are a very able student whose first degree course is not up to the standard required for Part III, it may make sense to apply to become an 'Affiliated Student' taking the second and third year of the Cambridge mathematics course to obtain the Cambridge first degree. Note that this will take two years and financial considerations are likely to loom very large. Information on this option is given in the pamphlet 'Information for Overseas Students' available on the University's web pages.

Further remarks on preparation Most people are prepared to accept that Part III is a very hard course and that they will have to work very hard once it starts. It is also helpful to work quite hard before it starts. It is a good idea to discuss the Part III courses you intend to take with your present professors and ask their advice on preliminary reading. If you have a choice of final year courses, choose the ones which are most appropriate for your future plans.

Look at the old Cambridge Part II papers in the topics you intend to pursue and work through some of the questions. (Note that you are not preparing for an exam. Do the questions slowly, consulting the appropriate textbooks and thinking about the questions after you have done them.) If, in spite of your good intentions, you find that you are not doing as much as you should, remember that some preparation is better than none and persevere.

Changing subjects Sometimes people do Part III to change subjects. If this is your case reread the previous paragraphs on preparation. The level of specialisation assumed in Part III may make it *very hard* to use Part III as you want.

Part III is very traditional If you can not face another year of being lectured at followed by series of three and two hour exams then Part III is not for you.

A psychological point There is a problem which may not seem serious to you now but which you should remember if you get here. Because of the hard driving system of Cambridge undergraduate education almost all of the Cambridge students *have tasted failure*. Almost all have been to lecture courses which they could not understand without a great deal of effort. Some

Part III students come here having breezed through their school and university courses. They suddenly find themselves attending classes in which they are not the cleverest or best informed and in which they do not instantly understand what the lecturer is saying. Most survive the shock but some do not.

A second psychological point Let me recall a well known story[24] .

> One evening, about the time when bananas were first being imported in Britain, Lord Leconfield was dining in his stately home with a friend. His guest observed that nobody really knew how good a banana could be unless he had tasted one straight off the tree.
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> Lord Leconfield said nothing at the time, but next morning he sent for his head gardener. 'Go', he told him tersely, 'to Kew. Find out how to grow a banana. Come back here and grow one.'
>
> Off went the head gardener. A special greenhouse was constructed. The banana tree was splendid. Lord Leconfield took a lively interest in in its progress until it fructified. 'I will have the banana for dinner tonight,' he said as soon as the banana was ripe. And so he did — amid a deadly hush. The head gardener himself was there, concealed behind a screen.
>
> The banana was brought in on a splendid dish. Lord Leconfield peeled it with a golden knife. He then cut a sliver off and, with a golden fork, put it in his mouth and carefully tasted it. Whereupon he flung dish, plate, knife, fork and banana on to the floor and shouted 'Oh God, it tastes like any other damn banana!' Banana tree and all were ordered to be destroyed.

The Cambridge Mathematics Departments are just mathematics departments like any other damn mathematics departments. If you did not enjoy the course at your previous institution you will probably not enjoy the course here.

3 Application

Whether you are an internal or an external student, admission to Part III requires the permission of the Faculty Board of Mathematics.

Internal students Each year, before the end of the first term, the Faculty will set out the procedures it intends to follow for internal students[25] in that year.

[24]Lightly edited from *Wyndham and Children First* Lord Egremont, Macmillan 1968.

[25]This class includes *all* students doing Part II whatever their status.

It is likely that students who do not obtain a First in Part II Mathematics will need to apply through their College for permission to take Part III. If you are a Cambridge student and you wish to do Part III, you should discuss this with your College Director of Studies well before the examinations. The decision to take Part III is a serious one and you should listen carefully to advice from those who know you. The rest of this section does not apply to you.
External students If you are from outside Cambridge and are interested in applying for Part III, you will normally apply electronically.

The technical details of the application process along with much else is dealt with in the Graduate Studies Prospectus. available on the web at

http://www.cam.ac.uk/CambUniv/GSProspectus/index.html

The Prospectus contains all that can be officially said and I shall not repeat its contents. I shall however make various unofficial comments.

Close scrutiny of the various documents you have been sent will reveal that the running of Part III involves to a greater or lesser degree the Graduate Admissions Office[26], the Faculty Board of Mathematics, two departments (one of which contains a sub-department) and thirty independent colleges. Clearly the lunatics have taken over the asylum[27]. It is, of course, possible that the lunatics have a better idea of their own interests than even the most efficient manager and, in any case, an understanding of Cambridge administrative theory is not a prerequisite for Part III.

Expenses These are detailed near the beginning of the Graduate Prospectus. I could spend many pages describing how the University Composition Fee and the College Fee are arrived at, but you should simply grit your teeth and add these together to find the total fee payable. (Note that the fees for EU and home students are lower than for other 'Overseas' Students.) You should consider the fees as the cost of doing Part III of the Mathematical Tripos. Anything that your College provides should be considered an uncovenanted bonus.

Brexit When news of the vote was brought to the Vice Chancellor he is reported to have said 'If Cambridge could survive the Black Death it can

[26]Older members of the University still refer to the Board of Graduate Studies, but this nomenclature is out of date. The Board of Graduate Studies still exists, but at that higher administrative level where, to quote its minutes, 'the interface between the Board of Graduate Studies and the University's Education Committee continue[s] to be fundamental to establishing and maintaining good practice [with] significant feed-through of information.'

[27]Or to put it another way, eight centuries of evolution since 1209 have left Cambridge with a complex administrative structure.

probably survive Brexit'. Until negociations are complete we will not know the financial consequences for EU students (although until things are changed they will remain the same). All that can be said is that if the University tells you that it will charge you a particular level of fees it will stick to its agreement.

Date of Application I strongly urge you to try to get your application to the Graduate Admissions Office as early as possible and, in any case, *not later than 15 MARCH*[28]. If your application arrives later than 15 March, the Departments *may* still admit you but they become steadily less willing to consider candidates as the days pass, the business of finding a College place may take much longer and your chances of College help with housing will be substantially reduced.

The previous paragraph has been written in stronger and stronger terms in successive versions of this advice. Partly this is because, over the years I have seen the application process interrupted by postal strikes, volcanic eruptions in Iceland, computer failure in Cambridge (and elsewhere) and apparently random decisions by US and British government departments. We have not had a plague of locusts, but we have now had something worse. The University has decided that that in order to control the number of graduate students admitted, the central administration will decide how many acceptances we can offer and, once this number is reached, then close the books *before the stated last date for applications*. Remember that you lose nothing by applying early since you can always turn down an offer. (In view of the possible cap, we would prefer you to tell the Graduate Admissions Office that you are turning down your offer.) In 2011-12 the Faculty web page contained strong encouragement to apply before the 31st of January.

Interviews We do not interview, but make our decisions based on your application and your referees' letters.

MASA, MASP or MASS? The application asks whether you are primarily interested in Applied (MASA), Pure (MASP) or Applicable (MASS) mathematics. Applicable mathematics is the Cambridge term for probability, statistics, OR, financial mathematics and similar subjects. Once you get here you will be a candidate for the MASt and can study whichever courses you wish. Your choice only makes a difference at the application stage where MASA applications are first looked at by applied mathematicians, MASP applications by pure mathematicians and MASS applications by applicable mathematicians. Choose whichever of the three possibilities suits you best.

[28]Referees are difficult people to hurry, but you should try to get them to observe the importance of getting testimonials in by this date. Notice that many scholarship schemes demand much earlier application dates. **In particular the Cambridge Trusts require *very early* application dates, details are given in the University Prospectus.**

Sometimes an application in one group will be passed over to another group for decision or considered jointly by two groups so you do not need to worry about making the wrong choice.

Choice of College Colleges differ in age, beauty, friendliness, access to playing fields, wealth, housing policies and many other ways. You may therefore

(a) select a first and second choice college,

(b) select a first choice college but no second choice college,

(c) not select any college at all.

Unfortunately (and often for not very rational reasons) most students in the past chose the same few colleges which, overwhelmed by applications, were then forced to reject most of those who applied. Although the pooling system means that everybody who is accepted by the Departments will eventually be taken by some college, rejection by your preferred college can lead to long delays before this happens. (In particular, it unwise to list two very popular Colleges as your two preferred choices.)

The Prospectus contains tables which shows statistics of applications and student numbers for all the colleges. My advice would run as follows. If you have a good reason for choosing a particular college of first preference then put it first. If, however, you have no such good reason draw up a list of colleges you do not wish to go to and choose one at random from among the remainder.

It goes without saying that the decision of the Departments on whether to accept you is unaffected by your preference list of colleges.

Process There are three decisions involved in admissions. The first is made on purely mathematical grounds by the Faculty of Mathematics through its admissions officers. Only the Faculty of Mathematics and *no other organisation*, be it a college, a grant giving body, an exchange program or whatever has the power to admit students to Part III. If the Faculty wishes to admit someone, then the Graduate Admissions Office checks things like ability to pay, language requirements and so on. Occasionally it may ask the Faculty to reconsider a decision to admit. If the Graduate Admissions Office is satisfied, it will write to you with a conditional offer. Once this is done, the colleges will decide which of them will take you, but you are guaranteed a place somewhere.

It is important to understand that, if you accept a conditional offer, we are committed to take you, provided that you make the conditions, but you are not committed to come to us. However, if you do decide not to come, please tell your prospective college since accommodation is at a premium.

References and Transcript The Departments do not see Part B of your application. This is the part you fill in if you wish to apply for scholarships and where you list your non-mathematical qualities and achievements. We[29] are only interested in your capacity to cope with Part III. We look very hard at your transcript to check that you appear to have sufficient background[30] to cope with a fair number of the courses. You may feel that, since you are only examined on, say, 6 three hour courses, you only need the background for those 6 courses, but courses change, lecturers change and you change. It is important that your background allows some flexibility.

If your transcript does not detail the courses that you are or will be studying during this year make sure that the information appears elsewhere. Remember that we often turn people down, not because we do not think they are clever enough to cope with Part III, but because we do not think they have sufficient background.

We then look at your references. We realise that different university systems mean that the amount of information in references can vary widely. However the best references show knowledge of the candidate, an appreciation of the kind of challenges posed by Part III and a clear view of how the candidate will cope with those challenges. If your degree is not a specialist mathematics degree (for example 'Mathematics with Economics' or 'Computing'), it is particularly important that at least one of your referees can speak confidently about your mathematical background and potential. It is very helpful if your referee can include comparisons with other students (e.g. 'As good as X who did Part III two years ago and got a merit' or 'Better than Y who obtained a PhD from Imperial'.)

You are asked to describe your current study. Normally this should will tell us something like 'I will be completing a four year mathematics course leading to a BA/MMath at the University of X this July with grade Z'. If your situation cannot be described so simply, then you and your referee should not hesitate to go into detail. Remember that, if you state a particular grade, we may make an offer conditional on your obtaining that grade. (Of course, we are free to make a higher or lower demands.) If your referees feel that we may not understand the grading system at your university (it has been estimated that there are between 9000 and 18000 universities in the world), extra information is welcome.

The rest of the form is less important to us, but you should note that we find that students who have a clear view of why they wish to do Part III and how it fits with their long term goals tend to do better (even if they then change their goals as a result of the experience) than those without such a

[29] 'We' is shorthand for the member or members of the department who handle Part III admissions. Note that the author of the present notes does not handle admissions.

[30] Your grade of 3.9 in rock climbing is amusing but irrelevant.

view.

The insolence of office, the law's delays The world is divided into those who know that a visa is a gift from inscrutable and unpredictable gods and those (mainly from English speaking countries) who mistakenly think that the process of obtaining visas involves fairness and good will. Please be aware that the UK visa system (like every other visa system known to the author) is subject to unexplained delays and unaccountable decisions[31]. Information on the visa system is given in the Graduate Admissions web page web pages which you should consult immediately. The Faculty of Mathematics cannot provide help or information on visas.

If you need a visa you should start the process the moment that you receive your **visa letter** from the University[32]. (The possibility of delays in the visa process provides yet another reason for early application. At one point in the recent past, the process took four months and, although we are constantly assured that things are getting better, I would not count on it[33].) The departments cannot make allowances for students arriving after the beginning of term because of visa problems (or any other reason). Part III lectures run at a bruising pace and each day's missed lectures will make it harder to catch up. The general view is that, if you miss more than the first week, you should probably withdraw from the course.

Deferral If we make you an offer of a place but you cannot take it up for that year then we cannot defer the offer and if you wish to do Part III at a later time you have to reapply. It will probably be to your advantage if you remind us of the earlier offer, but we do not guarantee that your new application will be successful.

Disabilities It seems reasonable that you should not mention any disabilities in your application unless you wish us to take them into account. (We do not see that part of your application which asks for information on the matter.) However, Part III is very hard and we would prefer not to add difficulties if this can easily be avoided. If you do have disability which might cause problems, I suggest that, once you have been admitted, you write a letter to your college with a copy to the Secretary of the Faculty Board explaining your disability. If we can help (and we often can) we welcome early notice and if we cannot (as sometimes happens) then nothing is lost.

[31] Observe also that the easiest way to deal with a visa application is to reject it because the form has not been correctly filled in or the exact documents required have not been submitted.

[32] But not before. If you do not have a visa letter you cannot get a visa.

[33] 'Particularly against books the Home Secretary is. If we can't stamp out literature in the country, we can at least stop its being brought in from outside.' (Evelyn Waugh, *Vile Bodies*.) For 'literature' read 'mathematics'.

Qualifications elsewhere So far as the University of Cambridge is concerned, you qualify for the MASt by paying your fees, living in Cambridge during the appropriate period and passing the Part III exams. Some universities allow students to count their Part III year towards a qualification in that university, but this is entirely a matter for the university involved and does not concern Cambridge.

4 Financial aid

The changeover of Part III from a domestic to an international course happened gradually and without the intervention of the Departments. In particular, no central record was kept of where our students obtained financial support. We have now started to do so and as a result I hope this section will become more useful. You should note that governments and award giving bodies are prone to sudden changes of policy and do not see informing the Cambridge mathematics faculty of these changes as a high priority. It is up to you to check what is available and to check early.

Students used to the North American system should note that the Departments do not have any scholarship funds under their own control. (However the Gates Trust, Cambridge Commonwealth Trust, the Cambridge European Trust and the Cambridge Overseas Trust 'actively seek to help outstandingly able students from overseas to study at the University of Cambridge'. Details of the Trusts' activities are given in Chapter 7 of the prospectus and I will return to them later.)

Home Applicants If you are a Cambridge student you *you should consult your tutor at the earliest possible opportunity* if you feel that there is any possibility that you may wish to do Part III next year. The key point is that you must *on no account graduate* before you do Part III. (If you do not graduate, but then decide not to do Part III, you simply graduate and receive your BA at a later time.) You should also note that it seems very likely (but this represents the view of the present writer rather than a certain fact) that, if you do Part III, you will not be eligible for further funding to do an MSc after Part III.

UK students not from Cambridge Unfortunately present arrangements treat you very harshly unless you come from Scotland. (If you come from Scotland, then Part III is classified as a 'second course which qualifies for support at undergraduate level'. Consult the web page

`http://www.saas.gov.uk/student_support/special_circumstances/postgrad_courses.htm`

for further information.) Research Council Advanced Studentships are not available for Part III and, at the moment, the Cambridge trusts do not make awards to UK students.

Apart from College awards (see below) the only other source I can think of are the 'Career Development Loans' run by the DES and banks. However you would need to make out a case that Part III is suitable for your career development and, even more importantly Career Development Loans are *loans* with (after your course is complete) market rates of interest and will need to be paid back.

Non UK Students and UK Students Who Have Not Obtained LEA Grants If you read through the Section 7.4 of the Prospectus you will see that many of the bursaries and awards offered by colleges are not very large[34] and that competition for them is usually intense. However, someone must get them and every little helps, so you should apply for everything that you can. Non-Collegiate awards are listed in the Graduate Prospectus. Most of these awards are substantial[35] and you should read this section carefully. Many of our students come through schemes which are not listed there so you should search widely.

Apart from the Gates Trust the other Cambridge Trusts prefer to find money to supplement other awards than to provide the entire award themselves. (After all, it is better to enable three people to come to Cambridge by providing three supplementary scholarships of £3000 than to enable one person to come by providing one full scholarship of £9000.)

Unfortunately the Cambridge Trusts have very early application dates. (The year I write this, some are as early as 15th October though others are as late as 31st January.) Contrary to the bureaucratic impression left by the last few sentences, the Cambridge Trusts are genuinely committed to overseas students and will stop at very little in their constant struggle to raise and spend money for this cause.

Here are some further suggestions.

USA The 'Fulbright Advisor' on your campus has details of the Fulbright awards and may well know a great deal about other schemes. Harvard students have access to exchange schemes which commemorate the fact that Harvard was founded by a Cambridge man. Universities including, I think, Yale,

[34]Note that the 'Research Fellowships' mentioned by some Colleges are essentially post Ph.D positions.

[35]The Cambridge Commonwealth Trust gave 309 new awards in 2008 covering all subjects. They included mathematicians from Australia, Canada, India, Malaysia and Pakistan. The Cambridge Overseas Trust gave 528 new awards which included mathematicians from China, Korea, Mexico, Russia Vietnam and the USA. The Cambridge European Trust gave 342 new awards which included mathematicians from Austria, Belgium, Denmark, France Germany, Ireland and Slovenia. The Gates Trust made 113 new awards which included mathematicians from USA and Ireland.

Princeton and Pennsylvania (Thouron awards) and, I suspect, several others have scholarships for study in Britain. The National Research Council (Fellowship Office, 2101 Constitution Avenue, Washington, D. C. 20418) offers Fellowships to US citizens tenable abroad. The Winston Churchill Foundation of the United States (Box 1248, Gracie Station, New York 10028) offers awards tenable at Churchill College (early deadline). Cambridge is one of the few foreign universities for which US government student loans (Stafford Loans) are available in the same way as for domestic US universities[36].

Canada It is worth noting that the Government of Quebec offers awards tenable outside Canada.

NATO Countries Certain NATO countries offer 'NATO Basic Fellowships'. Details from NATO Scientific and Environmental Affairs Division, B-1110, Brussels.

Denmark A list of 12 possible sources is available in a LaTeX file available by anonymous FTP from `/pub/twk/List.tex`. at `131.111.24.28`. If you cannot get the file this way write to the address at the end.

Germany Germany is unusually rich in bodies granting scholarships abroad. The most important body seems to be the Deutscher Akademischer Austauschdienst (Kennedyallee 50, 59175 Bonn 2). Their web site https://www.daad.de/de/ contains much information.

DAAD annual scholarships are open to students who have achieved above-average results in their studies. You must apply for these scholarships *as early as possible*. The normal state loan/grant (BAfoeg) may be held abroad for one year. (It also appears that some students who are not eligible for a BAfoeg at home may none the less be eligible for it if they study abroad.) You must apply 6 months in advance and obtain the approval of your university. Another possible source is the Studienstiftung des Deutschen Volkes with web site https://www.studienstiftung.de/ and there are others. Provincial Governments are sometimes willing to help and the various EU schemes are particularly generous to the former East German Länder.

Ireland It might be worth applying for a Robert Gardiner Scholarship (forms from The Registrary, University Registrary, The Old Schools, Cambridge CB2 1TN).

Portugal There are two programs run by JNICT (Junta Nacional de Investigação Cientifica e Tecnológica) entitled 'Formaçãio de Recursos Humanos em Ciência e Tecnológia' and 'Praxis XXXI'. You should apply for a *Masters* scholarship. You may be informed that Part III is not an eligible course, but, in practice, many students have been successful in their applications for a grant to do Part III under this scheme. If required we can write a short note

[36]However, decisions on Stafford Loans may not be made until very late.

explaining that Part III is equivalent to a US MSc course.

Spain The Bank of Spain awards several Grants for Study Extension Abroad (Becas para Ampliacion de Estudios en el Extranjero). They are very generous and there is the possibility (though not the certainty) of extension to cover at least part of a PhD course. Although the awards are slanted towards economics some have gone to mathematics. In 1997 the application dates were January 23 to April 21. T the relevant address is: Centro de Formacion del Banco de Espana, C/ Alcala, 522, 28027 Madrid (Spain), e-mail address: cfogener@@bde.es.

Further EU Sources (Nationals of Norway and Switzerland are eligible for some schemes.) There are various schemes for intellectual mobility involving various countries. One source of information might be the Commission of the European Communities, DG XII–H–1 (MO 75), 200 Rue de la Loi, B-1049 Brussels. There is also a scheme called ERASMUS II (15 Rue d'Arlon, B-1049 Brussels). Most EU Governments maintain offices in Brussels which should be able to give advice. The British Office is the UK Research and Higher Education Office (83 rue de la Loi, 1040 Brussels).

Eastern Europe You should note the three very generous bursaries offered by Trinity College as well as the two Mitsubishi Cambridge Scholarships. There is a complex and ever shifting set of schemes offered by the EU to encourage intellectual mobility, advice may be obtainable from the TEMPUS-Office (14 Rue de Montoyer, B-1040, Brussels) though the TEMPUS scheme itself is mainly post-doctoral.

Hong Kong In addition to the substantial number of awards offered through the University there are several foundations which might help. One is the Croucher Foundation (12 Parker Street, Cambridge CB2 1JL), Apply as early as possible.

China I have been given the names of the following sources but I do not have either details or addresses:- Huo yingdong Education Trust, Li jiacheng Academic Trust, Bao zhaolong Chinese International Students Scholarship, Bao yugang Studying in Britain Scholarship, Wang kuancheng Loan Trust.

Commonwealth It is almost certainly worth your while to consult the most recent edition of the book 'Awards for Postgraduate Study at Commonwealth Universities' (published by the Association of Commonwealth Universities).

Further Literature The following guides are well worth consulting if you can find them in a library. A lot of the awards described are for 'left handed twins wishing to study carpentry in a French speaking country' but others may apply to you.

1. The Grants Register (published by Macmillan).

2. Study Abroad (published by UNESCO, Paris).

The only way of extending and correcting this document is by personal communication. Please send us any information you can.

In applying for scholarships and studentships from bodies which do not know about Part III you should state that 'Part III Mathematics is a one year taught course. The resulting degree of a MASt in mathematics is recognised as the equivalent of an MSc'. If your awarding body is unsure about the status of Part III ask them to write to the Secretary of the Faculty Board (address below) explaining what evidence they require and we will do our best to help. You may find it useful to stress that it is the leading European course of its type, and that if you come here you will meet future leaders not merely of the British but, for example, of the German, US and Commonwealth mathematical communities. Some Scholarships refer to 'subjects relevant to a country's needs'. Modern technology depends on mathematics and many of the 'Applied' and 'Applicable' subjects in Part III have immediate applications.

Finally, if you succeed in gaining an award or scholarship please do not forget to write and thank the sponsoring body at the end of the year. Your successors will need their continued good will.

5 Miscellaneous information

The dates of Cambridge terms are given at

`http://www.cam.ac.uk/CambUniv/TermDates.html`

Lectures begin on the Thursday after the Tuesday given for the first day of full term. There is a meeting at Clarkson Road on the Wednesday after the Tuesday given for the start of Michaelmas term (the first term) which you need to attend. (Although different people need to attend things at different times you should keep the entire day clear.) You may wish to come to Cambridge a little earlier to get your bearings but *your College will tell you which is the earliest day you can arrive.* In theory lectures should finish on the Wednesday before the Friday given for the end of term but in practice they may continue to Friday. Student talks are usually scheduled for the Thursday and Friday so if you need to make early travel bookings it would be wise to make them for dates after the final Friday.

Once you are here you will be given an e-mail address. Communications from the departments and faculty will be sent via e-mail so you will need to check your e-mail regularly.

Please send any comments or queries to

Secretary of the Faculty Board,
Centre for Mathematical Sciences,
Wilberforce Road,
Cambridge CB3 0WA

[The Faculty of Mathematics Wide Web pages, which are the usual mixture of the up to date and out of date, the interesting and the dull are accessible as `http://www.maths.cam.ac.uk` or by the usual browsing methods.

Printed out January 13, 2018. These notes are written in LaTeX2e and may be accessed via my web home page

`http://www.pmms.cam.ac.uk/home/emu/twk/.my-home-page.html`.

Also available:-

'Dr Körner's Helpful Guide For Mathematicians Seeking A Cambridge Research Fellowship',

'In Praise of Lectures' (how to listen to a mathematics lecture),

'How to Write a Part III Essay',

'A Supervisor's Primer'.]