



UNIVERSITY OF CAMBRIDGE
Faculty of Mathematics

SUPERVISION IN MATHEMATICS

This guide is intended for anyone planning to give undergraduate supervisions in mathematics.

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Summary of the essentials

As a supervisor, you are expected to

- know how to solve the example sheet questions (this usually should involve you solving them yourself);
- mark the students' work before the supervision;
- write clear notes during the supervision which the students can take away;
- give constructive feedback to the students on their work and in the supervision;
- write supervision reports at the end of term.

These points, which are the bare essentials, are explained in more detail in this booklet, together with many practical points and pieces of advice.

As any Cambridge graduate will know, supervisions are a very important part of the Cambridge undergraduate education, and having a good supervisor makes all the difference to a student's experience. Less well appreciated, perhaps, is that *being* a good supervisor is very rewarding when you see your supervisions helping your supervisees grow in their understanding, confidence and enjoyment of mathematics.

Faculty of Mathematics
Cambridge
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1 About this document

This document has evolved over 20 years from an original piece by Tom Körner. Feedback would be much appreciated, whether in the form of suggestions from experienced supervisors and Directors of Studies, or questions and comments from less experienced supervisors. Please e-mail `undergrad-office@maths.cam.ac.uk`.

2 Introduction

Supervision is the word used in Cambridge¹ to describe small-scale teaching. In mathematics, the typical supervision consists of a supervisor — normally a college or university lecturer, a research worker in one of the university departments (not always the mathematics departments), or a research student — going over mathematical problems with a pair of students. Sometimes, if there is a shortage of supervisors, there may be more than two students in the group. Sometimes there may be just one student, but colleges (who have to foot the bill) do not like this because it is expensive.

Supervisions are arranged by colleges, acting individually or in groups, and the responsibility for providing supervisions lies with the Director of Studies in mathematics in each college. The general aims of a supervision are to explain and amplify the material given in the lectures and to prepare students for the Tripos Examinations.

Most colleges adhere to the Faculty guidelines for the number of supervisions in each course: they expect their students to receive four supervisions for a lecture course of 24 lectures and three supervisions for a 16-lecture course, plus (probably) a revision supervision near the examinations. There are also a few 12-lecture courses (two supervisions). If you wish to deviate from this, you should consult the relevant Director of Studies.

There is no one correct way of supervising and there is no one set of arrangements which is common to all colleges and to all lecture courses. You should bear this in mind when reading the information and advice given below.

¹Elsewhere, supervisions might be called tutorials.

3 Training

The Faculty (in conjunction with the University Researcher Development Programme) runs three identical sessions for supervisors in mathematics at the beginning of each academic year (normally in the first week or two of lectures) and an additional session later in the year. These sessions last for a couple of hours and are intended primarily for new supervisors. For further information, contact the Postgraduate Office: researcherdevelopment@maths.cam.ac.uk.

Anyone planning to supervise should attend one of these sessions: students have the right to expect trained teachers. Having been supervised yourself as a student is **not** sufficient training.

The University also offers generic introductory training sessions for supervisors, which are less useful because they are not subject specific. However, sessions such as supervising students with Asperger's or other disabilities might add to your skills once you have had a bit of experience; see <https://www.cctl.cam.ac.uk/>.

4 Resources

You will find two useful web sites on the Faculty's pages for Undergraduate Supervisors, at

<https://www.maths.cam.ac.uk/internal/teaching/supervising>.

- *Maths Supervisor Resources*. You can access this site is on Moodle, which is the University's online teaching resource: <https://www.vle.cam.ac.uk/login/index.php>. You will need to log in using Raven. This site is not visible unless you register. If you attend a supervisor training session this year, you will be automatically registered; otherwise, send an e-mail to phd-admin@maths.cam.ac.uk. You can find here links to all the relevant Faculty documentation. It is also available as a forum, allowing supervisors to discuss issues with other supervisors. In particular, you can find out who is supervising the same course as you so that you can make direct contact if you wish to.

- '*Sign up sheet*' for supervisions. You can access this at <https://bit.ly/maths2024-supervisors-signup> if you have a Cambridge CRSID. Here, you can add your name if you wish to offer supervisions for a course, and Directors of Studies can add requests for supervisors. If you do not have a Cambridge account you should e-mail undergrad-office@maths.cam.ac.uk with the words *Sign up sheet for supervisors* in the subject field.

5 Aims and general advice

To be a successful supervisor, you must:

- (a) create or maintain the interest and enthusiasm of your students for the subject — in particular,
 - for weak students (and some strong ones), try to build up their confidence,
 - for all students, especially strong ones, stimulate them;
- (b) give your students the opportunity to ask about aspects of the course that they find difficult, puzzling or fascinating;
- (c) find out whether your students have understood the course material and thought about its wider implications, and help them to do so;
- (d) ensure that your students are doing an appropriate amount of work and that their efforts are suitably directed;
- (e) monitor your students' progress and report back to the Director of Studies, immediately in the case of an emerging problem;
- (f) encourage your students to develop a measure of personal responsibility for their education.

Note that supervisions are not meant to be supplementary lectures: you should encourage students to participate as much as possible. Some students will sit through your supervisions like puddings if you let them, usually because they are too embarrassed to admit that

they do not know what you are talking about. This is not good use of supervision time. Great patience, sympathy and encouragement is required; ask very easy questions to give them confidence and try to point out some virtue in their response even if it is completely absurd. Do not be afraid of prolonged pauses in response to questions. You will soon find out that while some supervisions are immensely enjoyable, others can be like breaking stones.

An important function of supervisions is to give students confidence and encouragement: many of our students underestimate their abilities. First year students in particular are often unable to judge how they are doing. Try to be as relaxed and friendly as possible, remembering that a tense atmosphere is not conducive to learning.

You may find it helpful to see what advice is given to the students on the receiving end of your supervisions: if so, take a look at *Study Skills in Mathematics* available on the Faculty website at www.maths.cam.ac.uk/undergrad/studyskills.

6 Why supervise?

Many PhD students and Post-Docs value the opportunity to give supervisions to undergraduates. Here are some possible reasons why you might consider supervising.

The money.

This is not a bad reason but you would do well to calculate how much you expect to earn before you start. You will find that the sum involved is useful but no more than that.

It will look good on my CV.

This is not usually a good reason on its own, but it is true that some teaching experience is likely to benefit your career, and not many other teaching opportunities are available in Cambridge, especially if you are a PhD student. Besides, teaching will also help you develop many transferable skills, such as good organisation and communication skills.

It is a good introduction to teaching.

This is an excellent reason. Like most skills, teaching is mainly learnt by doing and where better to start than with a small group of able

and motivated students? In supervisions you can actually see the effects of your teaching and learn both what teaching can achieve and what it can not.

The best way of learning something is to teach it.

Undoubtedly true, but you must remember that you will be improving your general mathematical culture rather than learning things which are directly useful in your research.

My college or my research supervisor expects me to.

This should not be the only reason, and should be balanced towards other considerations. If you are a research student, your primary duty is to do good research, and you should consider how to balance your teaching and your research, and only take on an amount of teaching that is not likely to affect your research, and at the same time lets you deliver good teaching to the students ou supervise.

It is a change.

Research can be a lonely occupation in which long periods may pass without apparent progress. Supervising provides social contact and immediate rewards as you see your teaching having its effect.

It provides a way of putting back into the system something of what you have gained from it.

Quite a good reason, particularly if you were a Cambridge undergraduate and want to emulate the supervisors who gave you really good supervisions.

Whatever your reason for starting supervising, you should ensure that you have both the motivation and the time to do a good job of it and to enjoy it. In particular it is generally considered that Part III students will be so busy following this gruelling and testing course that they should have no time to supervise others; especially as they will almost certainly not be able to give the requisite revision supervisions in the Easter term.

7 Preliminary organisation

Finding supervision work

Supervisions are arranged very early in the term (or often before the beginning) so, if you wish to supervise, you should start looking for supervision work well before lectures start. If you are a member of a college that takes undergraduates it is considered courteous to offer your services first to the Director of Studies at your own college. If they cannot offer you anything directly they may pass your name on to an organiser of a Part II ‘circus’. You can also look up yourself the list of Directors of Studies by Part II Circus on the Faculty webpage for Directors of Studies in Mathematics at <https://www.maths.cam.ac.uk/internal/faculty/maths-dos>. Even if you belong to a graduate college it may be best to start with your own Director of Studies, if such a person exists, since he or she may well have good connections with an undergraduate college. If this does not work, your Research Supervisor may be able to help (though such assistance is not part of their duties towards you). The Faculty is keen to promote the exchange of information regarding demands for, and offers of, supervision work; see the ‘Resources’ section above².

How many hours?

Three to four hours of supervision use up one afternoon a week, and an evening for marking. Most people will find that their main work does not suffer, and may, indeed, benefit from one afternoon a week doing something different. Six hours of supervision use up two afternoons a week. If afternoon seminars and morning lectures already eat deeply into your time, this may well be too much, though some people can manage this amount of supervision without their main work suffering. If you find yourself doing more than six hours of supervision a week on a regular basis you are almost certainly doing too much for the health of your research. In addition, many

²Directors of Studies in subjects such as Natural Sciences, Engineering and Economics may also be on the lookout for supervisors. Such supervisions are called *service teaching*. This guide applies equally to such teaching.

scholarships and awards specifically limit the amount of teaching you may do to six hours a week. Similar restrictions apply to all students studying for a Cambridge PhD (or any course lasting longer than a year).³ In any case, you should always talk to your supervisor before you take on any supervisions or other paid work.

There is another way of approaching the matter. Observe that the amount of preparation required is much the same whether you give one or three supervisions. There are thus substantial economies of scale in giving several supervisions on the same exercises but, as the number of supervisions increases, you will become aware of the diseconomies of boredom and staleness ('Have I already told them that, or was it the previous pair?'). Most supervisors find that if they give such a series of supervisions they are happiest with the second or third supervision and that their satisfaction with their own performance then tails off. You will also find that, if you supervise the same course again in a subsequent year, the time it takes will be considerably less, because usually the questions on the example sheets do not change from one year to the next (in fact, if you were an undergraduate here, you will find them very familiar!).

Which course?

Many Directors of Studies prefer, if possible, to use experienced supervisors for the general first and second year supervisions where bad supervising will do most harm. Frequently the Director of Studies will do mainly first and second year supervisions in order to get to know their undergraduates. Whenever possible, also, they use members of their own college who will, in theory and usually in practice, feel personally involved in the success of their college's candidates. On the other hand, few, if any, colleges can fill their third-year supervision requirements from their own resources and many specialist subjects have only a limited pool of potential supervisors. Thus the majority of supervisors start by taking on specialist Part II (or Part III) supervising. In many ways, this is the easiest work for new supervi-

³See <https://www.cambridgestudents.cam.ac.uk/your-course/graduate-study/your-student-status/working-while-you-study>

sors: the material is fresh in their minds; the students are more used to handling supervisors; and there are fewer of the unfamiliar and difficult ‘how best to teach this material’ sort of problems.

If you are a Cambridge graduate, you are probably familiar with the material in each course. Otherwise, you can find a summary of the contents of each undergraduate mathematics course (closely specified) in schedules whose scope used to be summarised by the lapidary phrase ‘These schedules are minimal for lecturing and maximal for examining’. Copies of the schedules are given to each undergraduate and hardcopies are available from the Undergraduate Office; they are available at

<http://www.maths.cam.ac.uk/undergrad/course/schedules.pdf>. in pdf format. If the schedule is not sufficiently informative, you can consult recent examples sheets online to see what is covered, and in many cases find an online copy of a recent set of lecturer’s notes. Sets of lecture notes for all courses are also available on the *Maths Supervisor Resources* Moodle site.

If you are in doubt as to how the lecturer covered part of the course then ask the lecturer or consult the lecture notes of one of your better students.⁴

8 The supervision

Preparation

It is of course essential to know the relevant material thoroughly before you give the supervision. This means working through the problems⁵ and may also mean reading up the theory⁶ since your students may want you to explain difficult bits of their lecture notes. Do not be discouraged if something proves difficult for you; it is

⁴You should not expect to get a reliable answer if you ask a student directly whether such and such has been covered in the lectures. You have only to think what you remember from last week’s seminar to understand why this is.

⁵Perhaps even writing out complete solutions; this is very helpful if you plan to supervise the course again.

⁶If you are not a Cambridge graduate, you are recommended to get a set of lecture notes to consult; if you can’t find a recent set online, ask a friend who was at Cambridge for a photocopy of their notes, or possibly email the lecturer.

perfectly acceptable to seek help from other supervisors or from the lecturer, and much, much better than trying to muddle through. You will also find that the *Maths Supervisor Resources* Moodle site has annotated example sheets intended for supervisors in most courses. This is ongoing work, to increase support for supervisors, with the aim of providing soon annotated sheets for all courses.

Setting work

All lecturers hand out problem sheets. These are supposed to cover the schedule and relate closely to their own treatment of the material.⁷ Hence, unless you are particularly confident of the course as it is given by that particular lecturer, you should set work from these sheets. The number of sheets per course should match the recommended number (4, 3, or 2) of supervisions for a course of its length, and each sheet should be suitable for discussion in one supervision. In an ideal world, the sheets would consist of basic questions followed by some supplementary questions intended as extras for the good or well-prepared students. Usually, students are expected to attempt all questions on an example sheet⁸, though some may find they struggle to keep up with the workload. In such cases you should try to give them gentle encouragement, perhaps recommending that they find the time to finish off/tackle any missed questions that you know are essential preparation for exams. In any case, unless you are a genius, you will want to work through the material thoroughly yourself before the supervision. Some lecturers provide written guidance for supervisors, to indicate how some of the problems on their examples sheets should be tackled to be consistent with the approach of the lecture course or what the significance of a problem is in the context of the lecture course. **In any case, do not hesitate to approach the lecturer: he or she will often be glad to have the feedback.**

All examples sheets should be viewable on and downloadable from the departmental websites (<http://www.damtp.cam.ac.uk/> and <http://www.dpmms.cam.ac.uk/>) — follow the links from

⁷So you should not rely on the sheets being the same as last year's.

⁸Some lecturers have extra questions 'for enthusiasts' or 'for practice' (usually 'starred') and you might want to clarify how enthusiastic you expect your supervisees to be, bearing in mind their total workload.

<https://www.maths.cam.ac.uk/undergrad/examplesheets>. It is recommended that you also enrol on the Moodle site of the course(s) you supervise, as it may contain extra material and/or specific instructions for the students in a particular year.

For revision supervisions in the Easter term, students usually like to prepare past Tripos questions. It is sensible to select them yourself: it is not safe to assume that last year's questions are suitable. Choose those which are pedagogically valuable, but not pure bookwork. Eight questions is about the right number for a third year course. The solutions to all Tripos questions are available from the Undergraduate Office for inspection by supervisors. **These should never be copied and handed to students.** There are very sound reasons for this, in particular: the solutions provided are often a short version, for convenience, and represent a *possible* solution (other solutions are usually acceptable); the mark scheme used is highly dependent on the syllabus that was lectured that year, and on the example sheets used that year, and therefore marks may be assigned differently in different years.

Timing

Most courses are 24 lectures (three/week) or 16 lectures (two/week). Lecturers are supposed to provide four examples sheets for a 24-lecture course and three examples sheets for a 16-lecture course. Since these are likely to be distributed evenly over the course, you should not arrange supervisions before the middle of the third week of lectures for a 24-lecture course and not before the fourth week of lectures for most 16-lecture courses. The exceptions are a number of 16-lecture courses in Part IB, which are given at an accelerated rate of three/week over the first 2/3 of term, where you should time the supervisions as if they were the first three supervisions of a 24-lecture course.

Students find it extremely dispiriting to be asked to do problems on material that they have not yet covered in lectures. It is also tough on them if they have their final supervision on every course in the last week of term. Hence, it is often best to arrange the last supervision for the beginning of the following term, when the students will have

had time to learn the material in the last few lectures and catch up.

Marking work

You are expected to mark students' work. There is a limit to the amount of time you should spend on marking: it is not realistic to aim to find every single missing sign or arithmetic error (though your students will appreciate it if you do). However, it is very important to get a good idea of whether the student has understood the material or merely copied it from the lecture notes, from a book, from a pal, or from the solution you wrote last week for another student. You should write congratulatory comments on the good bits,⁹ but you should not be too damning of the bad bits: it sometimes takes as much time and effort to produce poor work as it does good work, in which case, your student might be very upset and discouraged.

It is a very good plan to tell your students to mark in the margin of their work any step they are unsure of. This not only saves your time, but is also very good discipline for them.

Some students like to know whether their attempt at a question, especially a Tripos question for a revision supervision, would have earned them an alpha or a beta. You may be able to judge this for yourself; alternatively, you may find that the model answers kept by the Undergraduate Office include a marking scheme. As a rule of thumb, an alpha corresponds to 3/4 correct and a beta to 1/2 correct.

Supervising

Stephen Leacock (a Canadian economist) described the Oxford method of supervision as follows. (His description dates from 1922 but things change slowly in that university.) 'I understand that the key to this mystery [the Oxford method of education] is found in the operations of a person called the tutor [i.e. supervisor]. It is from him or rather with him, that the students learn all they know: one and all are agreed on that. Yet it is a little odd to know just how he does it. 'We

⁹Your students will take much pleasure from the simple comment 'Nice!' on their work; remember that they are only a few years out of school and praise from a Great Mathematician still cuts ice.

go over to his rooms,’ said one student, ‘and he just lights his pipe and talks to us.’ ‘We sit round him,’ said another, ‘and he simply smokes and goes over our exercises with us.’ From this and other evidence I gather that what an Oxford tutor does is to get a little group of students together and smoke at them. Men who have been systematically smoked at for four years turn into ripe scholars.’

Many arts subjects rely on the pipe-smoking method of supervision (speaking metaphorically of course: nobody smokes in supervisions) but most scientists believe that only non-scientists (if anyone at all) can successfully smoke at students. Normally, a mathematics supervision will be conducted in person, in which case you sit at a desk¹⁰ with your students (preferably two of them, one on either side of you so that they can read what you write) and write out solutions to exercises or explanations of pieces of mathematics on paper, or, if necessary, the students sit at a desk and you write on a board. In either case, the students should be able to take copies of everything you write. If for some reason it is necessary to hold a remote supervision, you should save everything to write on whatever online platform you use, and send it to the students immediately after the supervision as a pdf document. The students should be persuaded *not* to take notes themselves; they need to leave their minds completely free to concentrate on understanding everything you say. At the end of the supervision, the students should take away what you have written and (best) use it to annotate, correct or complete their own supervision work or (second best) file your notes with their own work. It is worth telling them a few times that they should go over the supervision as soon as possible, while it is still fresh in their minds.

What you actually do in the supervision will depend very much on your students. It is a good idea always to start by handing them back their (marked!) work, allowing them a minute or two to look over it. Often, it is worth then asking the students how the lectures are going and whether there are any problems arising from them. This is useful for breaking the ice; and there may not be another

¹⁰One colleague used to sit on a sofa and use a tea-tray on her knees, but most students will be comfortable at a desk. Some (very few) supervisors offer tea/coffee; this is friendly, but neither necessary nor sufficient for a good supervision and can be a great distraction.

opportunity once you get to work on the set problems. With the very best students, the supervision can turn into a general discussion of the subject, but most students are anxious to go over the work they have done in detail, question by question.

For problems which one or both of the students did not manage to complete, unless there are just small points of interest, it is often best to write out the entire solution, explaining the derivation of each line. You should make sure that what you write is not scrappy; the students should be able to recognise which question is being answered (write the number on the paper) when they come back to it later and be able to reproduce the entire solution from what you have written.

Generally, students are not interested in your neat and elegant solution (which you may well have learnt from your supervisor, and they from theirs); they will accuse you of just performing mathematical tricks. They want to know why you thought of tackling the problem in this way and what features are common to a class of problems.

You should try to use each problem to explore the extent to which they have understood their lecture notes, perhaps working in a bit of the theory in your explanation (or getting them to).

Remember that showing students how to get the answer to problems is not the main purpose of a supervision. Most students seem to prefer a problem-based learning process. This means using the problem as a tool to illustrate, and enhance the student's understanding of, the theory. The solution is not an end in itself.

9 Addressing specific issues

Lack of confidence

You might expect most of your students to possess a healthy amount of confidence, acquired at least in part by having been admitted to such a prestigious University to read Maths. In many cases this could not be further from the truth.

There are always some students who could be described as suffering 'Impostor Syndrome', i.e. a kind of inability to recognise their accomplishments (often dismissing them as 'luck' or similar), accom-

panied by a nagging doubt that any weakness they may have would overcome any positive strength and a persistent fear of being ‘found out’. It is worth remembering that our selection procedures mean that all our students range in ability from excellent to truly superb.

When students find themselves in a minority within a group, they may feel isolated and be reluctant to join in or speak out. For example, currently around 20% of undergraduates in mathematics at Cambridge are women and some women feel uncomfortable in such a male-dominated environment. Other examples are students from non-traditional backgrounds (including mature students) and students with a disability (such as a hearing impairment or Asperger’s syndrome).

Whenever students may lack confidence in comparison with others, it is very important that supervisors make every effort to build up this confidence. The main thing that supervisors tend to get wrong is not realising that the lack of confidence (especially in women) stems from them being very self-critical. They can help by making encouraging comments such as ‘That is a good answer’.

Here are some comments by students:

It is very hard to admit that you are having difficulties because no one else seems to and the mathematics fellows always express great surprise if you say that you don’t understand something. This is humiliating in supervisions and has put me off speaking out.

It was nice when supervisors said that you’d done stuff right — just a little bit of praise and encouragement. I think so much of this Cambridge thing is just confidence.

Some supervisors are extremely nice people and not consciously biased at all, but it’s noticeable that if one supervisee is a lass and the other is a bloke and they’ve got different answers, it’s the lass’s answer that gets checked first.

Often at the beginning of a supervision, the supervisor would say things like ‘This one was straightforward. I assume you could do it?’ Such comments made it difficult to admit that actually I hadn’t been able to do the question. Some supervisors would even laugh when I admitted that I couldn’t do a so-called ‘easy’ question.

We would all do well to consider our own supervisions in the light of these comments.

Cultural differences

The number of non-UK students coming to study Mathematics in Cambridge has increased significantly in recent years. Many will have already spent two years in Britain taking A-levels, but some will have come directly from school in their home country.

Cultural awareness is essential. Many international students may initially struggle to express themselves in the academic context; for example, because there is no ethos of challenging those considered to be academically ‘superior’ in their own culture.

Supervisors should take great pains to encourage all their supervisees to ask questions and express opinions.

English as a second language

Language difficulties should also be kept in mind and supervisors should remember that many students who don’t have English as a first language may find it hard to follow a mathematical explanation in what for them is a foreign language, even if they appear fluent in conversational English. After all, they may have studied Maths in a different language and may be used to a different terminology and very often a different notation.

Supervisors should make an effort to establish common terminology and notation and not assume at the start that everybody will be familiar with the same conventions.

If you happen to share a language other than English with one or more of your supervisees, you may think it helpful to supervise them in their own language. Resist this temptation! Even though it might be helpful sometimes to clarify something using the language they know best, it is imperative to use English as the language of instruction for discussing Maths, and students should be actively encouraged to use English language texts for study and revision.

10 The first meeting

Having found some supervision work, the first task is to arrange the first supervision. It is possible to make all your supervision arrangements by e-mail, but many supervisors find it easier to have a preliminary meeting to settle a supervision timetable that suits everyone, give clear arrangements for handing in work, and to set supervision work. Here are some hints concerning these matters.

Ground rules

It is a very good idea to set out the ground rules for your supervisions straight away. This will save awkwardness later on, for example, if you criticise students for handing in work late and the students are able to say that they didn't know you minded about late work.¹¹

Typical ground rules for your supervisees might be:

- turn up on time;
- hand in work on time;
- present work neatly;
- contribute and participate;
- make sure you know the material in the course;
- give advanced notice if you are unable to attend.

Of course, you must have ground rules for yourself. For example:

- turn up on time;
- mark work;
- make sure you know the material in the course;
- give constructive feedback;
- give advanced notice if you are unable to attend.

¹¹In case you are not sure: you **do** mind!

It is a good idea at the early stage to tell your students how to address you: you can be Sir/Madam, Dr/Mr/Ms X, first name, etc. Graduate students usually like to be on first-name terms with their supervisees, but this won't happen unless you tell them that it is what you would like.¹²

Supervision times

If you have, say, four supervision pairs per week (or per fortnight) the simplest procedure is to name four times and leave it to the students to choose which pair goes to which supervision. You may believe that students are here to do mathematics, not to play cricket, act or row, but some flexibility in timing is often appropriate and in some cases essential (for example, some students may be nervous of having to wander about Cambridge after dark).

Arrangements for handing in work

You are expected to mark students' work in advance, so you must set a deadline for handing in work. (If you have an official deadline and a later unofficial deadline you will find, within two or three weeks, that all the work is handed in five minutes before the later deadline. You are therefore well advised to have a single deadline and stick to it.) Unless really necessary, it is unfair to students to ask them to hand in work more than 24 hours, say, before the supervision and, if you do demand a longer period, the students may forget what they were thinking when they wrote their work. Make sure that the students know where to hand in the work (e.g. 'My pigeonhole at college', 'The pigeonhole marked K in the DAMTP pigeon holes by the main entrance of CMS'). Remember that CMS is closed after 5.00 and over the weekend. It is a bad plan for the students to send their work to you by college post, which is slow and can be unreliable. If you ask them to hand in work to your college porters' lodge, you might check how long the porters will take to get it to your pigeonhole, particularly

¹²Most students will be used to addressing lecturers and their Director of Studies more formally (Dr X/Prof Y). Some aged male supervisors, in particular, find that students are more comfortable with this.

if the mailroom is not next door and they only do occasional mail rounds.

Work for the first supervision

Many lecturers do not issue the first example sheet until after at least a week or so has passed. You may be able to get round this by asking the lecturer for a copy of his or her first example sheet or by getting a copy of the first example sheet for the previous year. Note that most courses start slowly and are unlikely to have covered all the material for the first sheet until there have been two weeks or so of lectures. Hence you should time your supervisions as described on p.11.

New ideas

You are never too old or experienced to take on ideas for improving supervisions.

For example, a few years ago someone mentioned that he always gives the marked work back to the students before the supervision, even if it is only 10 minutes before, instead of expecting the supervisees to try and assimilate it in the first few minutes of the supervision. This seems to be an excellent idea, though it takes a bit of organising.

Another supervisor mentioned that she tries to write an overall comment on how well the student has done and what they particularly need to work on at the end of their work.

It is a good plan — probably essential in order to improve the quality of your supervisions — to talk about how you supervise with other supervisors. Although mathematics supervisions are rather different from supervisions in other subjects, you may well find it interesting to talk to supervisors from other departments to see if you can import anything.

11 Supervision reports

You have to fill in a supervision report for each student. It is essential that you do so, for at least four reasons:

- this is the main channel of feedback to the student's Director of Studies and Tutor, who need to know how the student is getting on in order to provide appropriate guidance and support;
- this is also a form of feedback to students, supplementing the many things you have said during the supervisions by giving them a summary of how they have got on and perhaps anything they need to work on;
- if for some reason an examination appeal is to be made (for example, if your student fails or is ill), the supervision reports form part of the evidence; supervision reports may also be used by colleges, the faculty and the university in other formal contexts (e.g. the documentation needed by the Permissions Committee, which deals with students wishing to continue to Part III of the Mathematical Tripos);
- otherwise, you won't get paid!

You should aim to get the reports in just before the end of term, so that they can be discussed with students in end-of-term interviews with Directors of Studies. Sometimes this is simply not possible or sensible. However, if you delay for more than a week or so, you will (for reasons only understood only by the Inland Revenue) have to wait another three months before you are paid.¹³

Supervision reports are filed online, using CamCORS (Cambridge Colleges Online Report System) for which documentation can be found on <http://camcors.cam.ac.uk/>. You will need your University Computing Service crsid (this is your @cam.ac.uk e-mail address) and Raven password. If you haven't supervised before then the college or department for who you are supervising will need to register you for a CamCORS account. If you find you can't get onto CamCORS, ask whoever asked you to supervise.

Supervision reports are directed primarily to the college, **but they will also be read by the students** and in general you should expect students to read them carefully and to be negatively affected

¹³Supervisors are paid four times a year on fixed dates in order to avoid taxation at source.

by thoughtless and harsh comments. Hence, in addition to being objective and fair in your assessment, you should also consider carefully the possible effect of your choice of words, and whether you can be helpful and constructive. The student will receive an automatically generated e-mail when your report is approved by their Director of Studies, and they can then log into CamCORS and see what you have written about them. In some circumstances, for example concern about emotional state or likelihood of failure, it may be wiser to transmit these comments directly to the DoS than to put them in the report that the student will read. You can, of course, always e-mail or phone¹⁴ the Director of Studies at any time if you are concerned about the progress of your supervisees.

The most helpful report is one that is specific and constructive: details of strong or weak points (including presentation of work, punctuality and whether the work has been handed in on time) are immeasurably more useful than general comments such as ‘Decent work’ or ‘A bit feeble’. ‘Should take time to memorise the definitions’ is more helpful than ‘Doesn’t even know the definitions.’ It is *always* a mistake to try to be funny or clever.

Remember that even mild criticisms can be very hurtful. That should not prevent you from criticising where appropriate (particularly regarding punctuality and handing work in), but it is always wrong to make statements such as ‘X is not very good at mathematics’ or ‘X is not a natural mathematician’. Even a comment like ‘X does not work hard enough’ can be very upsetting to X if he or she thinks she has been working hard but not making much progress. If you are not sure whether the problem is a lack of work or a lack of success, a factual statement like ‘X typically only hands in attempts at the first 5 or 6 questions on the sheet, and brings a couple more to the supervision’ raises the issue in a more neutral way.

It is sometimes said that the best way of making a constructive criticism is to include it in a sandwich: say something encouraging; then make the criticism; then say something else encouraging. Of course, this means that you have to think of two nice things to say, which is not always possible.

¹⁴ Under the General Data Protection Regulation a student may request access to any written information about them, including e-mails.

There is a box for you to tick relating to the examination class: you are supposed to estimate not what the student may actually get in the examination by the end of the year, but what they are likely to get if the quality of work that he or she has been handing to you is typical of their overall abilities and effort. This is fine for experienced supervisors, but new supervisors may prefer to leave the box empty. If so you could discuss your guestimates with the relevant Director of Studies as a way of acquiring experience.

You should always **take the business of writing supervision reports seriously**. You should remember that you may well have seen more of the student than the Director of Studies has, so he or she will have to rely on your report, and those of other supervisors, to assess progress through the year and offer appropriate advice before examinations deliver their annual verdict. Reports may well be used at a later date as a basis for a reference for the student or, if the student is in difficulties, as evidence either for the appropriate college committee or even for a university committee deciding whether the student can continue at Cambridge.

Here are some real-life examples:

A. has worked hard on the course. It is a difficult course and the work he has handed in is rather limited, but his understanding has improved as time has gone by. In particular, I think he now appreciates the need for rigour and is laying out his proofs more clearly. With plenty of practice I would expect him to gain a good grasp of the course.

B. has produced very good written work for the supervisions, though her solutions would often benefit from a few more words of explanation. She knows what she is doing but needs to display that knowledge a little more on paper. In supervisions she seems reticent to offer her opinion but always has good things to contribute when she does.

I have enjoyed supervising K. She has shown that she is getting the hang of most of the material involved, and supervisions seem to have provided a valuable opportunity to consolidate understanding. She sometimes has wonderful insights (I especially recall the Riemann sphere discussion), which will serve well in time to come. She should make sure that she practises lots of questions between now and the exams to ensure that she has really got to grips with this material: it forms a foundation for much

later work - maybe have a go at the later questions on the sheets and also the whole of sheet 2 (when she was ill).

L. handed in no work for his first two supervisions, and came to the supervisions with little or none. But for his third supervision he handed in serious attempts at most of the questions on the sheet. He needs to maintain this higher level of effort if he wishes to do himself justice in the exams.

First class work. Keep it up!

12 Feedback

To Directors of Studies

There is normally no need to tell Directors of Studies how their students are getting on except via supervision reports. However, there are some important exceptions: If a student is obviously not doing as much work as he or she should, or if you are worried that the student might not be able to make anything of the examination questions on your course, you should certainly send a message to the Director of Studies. Early action may well be essential.

In a similar vein, if a student fails to turn up for a supervision, giving no explanation, you should certainly alert the Director of Studies. (And you can claim your supervision fee as if he or she had turned up.) It might seem a small thing to you, but if a DoS hears from several supervisors that the same student has missed a supervision then it is often a sign that something is going wrong — for example, illness or the onset of mental health problems — and the sooner help is provided the better.

To lecturers

Lecturers are lonely souls and will appreciate feedback. This will most likely take the form of (constructive) criticism of the example sheets, which is always useful and is particularly helpful if the lecturer is not supervising the course; it may even lead to improvements in the sheets and the course in future years. Notes, e-mails, or contact in the

coffee room will in most cases be warmly welcomed. The lecturer's e-mail address should be on each examples sheet.