The International Programmes Office, located in the Atrium on the first floor of University Place, provides information and support on a wide range of international opportunities for undergraduate students, including study abroad.

Further information can be obtained from the Study Abroad Advisor in the School of Mathematics (Dr. Carolyn Dean, Room 2.208, Alan Turing Building) and from the Study Abroad website:

http://www.studyabroad.manchester.ac.uk/

2.10 MODES OF STUDY

(a) Course Units and Credits

Each course unit (or lecture course) is worth a certain number of credits (usually 10, 15 or 20). To obtain the MMath or BSc Honours Degree, students normally need to take course units worth 120 credits in total per year. The number of credits allocated to an individual course unit indicates the weighting of that course unit relative to the whole year's work.

Codes for Mathematics course units consist of the letters MATH followed by five digits. The first indicates the level of the course unit. In general, a level of 1 corresponds to a First Year course unit, a level of 2 corresponds to a Second Year course unit, and so on. The fifth digit denotes the semester in which the course unit is offered: 1 indicates a First Semester course unit, 2 indicates a Second Semester course unit and 0 indicates a full-year course unit.

The following table shows the number of lectures and support classes per week for each of the First Year course units and whether the course unit is supported by feedback supervisions or feedback tutorials or workshops.

<table>
<thead>
<tr>
<th>CODE</th>
<th>TITLE</th>
<th>TEACHING METHOD</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH10001</td>
<td>Mathematical Workshop</td>
<td>1 lecture and one two-hour workshop</td>
</tr>
<tr>
<td>MATH10101</td>
<td>Sets, Numbers and Functions A</td>
<td>4 lectures and 1 feedback supervision</td>
</tr>
<tr>
<td>MATH10111</td>
<td>Sets, Numbers and Functions B</td>
<td>3 lectures and 1 feedback supervision</td>
</tr>
<tr>
<td>MATH10121</td>
<td>Calculus and Vectors A</td>
<td>4 lectures and 1 feedback supervision</td>
</tr>
<tr>
<td>MATH10131</td>
<td>Calculus and Vectors B</td>
<td>3 lectures and 1 feedback supervision</td>
</tr>
<tr>
<td>MATH10141</td>
<td>Probability 1</td>
<td>2 lectures and 1 feedback tutorial</td>
</tr>
<tr>
<td>MATH10951</td>
<td>Financial Mathematics for Actuarial Science 1</td>
<td>2 lectures and 1 feedback tutorial</td>
</tr>
<tr>
<td>MATH10202</td>
<td>Linear Algebra A</td>
<td>4 lectures and 1 feedback supervision</td>
</tr>
<tr>
<td>MATH10212</td>
<td>Linear Algebra B</td>
<td>3 lectures and 1 feedback supervision</td>
</tr>
<tr>
<td>MATH10222</td>
<td>Calculus and Applications A</td>
<td>4 lectures and 1 feedback supervision</td>
</tr>
<tr>
<td>CODE</td>
<td>TITLE</td>
<td>TEACHING METHOD</td>
</tr>
<tr>
<td>------------</td>
<td>------------------------------------</td>
<td>----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>MATH11222</td>
<td>Calculus and Applications C</td>
<td>4 lectures and 1 feedback supervision per week for the first 6 weeks of Semester 2</td>
</tr>
<tr>
<td>MATH10232</td>
<td>Calculus and Applications B</td>
<td>3 lectures and 1 feedback supervision</td>
</tr>
<tr>
<td>MATH10242</td>
<td>Sequences and Series</td>
<td>2 lectures and 1 feedback tutorial</td>
</tr>
<tr>
<td>MATH10282</td>
<td>Introduction to Statistics</td>
<td>2 lectures and 1 feedback tutorial (or 1 computing workshop) per week. There will be 4 computing workshops and 7 feedback tutorials.</td>
</tr>
</tbody>
</table>

At Levels 2 and 3, a course unit worth 20 credits normally consists of 4 lectures and 1 or 2 feedback tutorials per week, while a course unit worth 10 credits normally consists of 2 lectures and 1 feedback tutorial per week. At Level 4, a course unit worth 15 credits usually consists of 2 or 3 lectures per week and 1 or 2 feedback tutorials per fortnight, although at this level some material may be taught as a reading course, rather than by lectures.

(b) **Lectures**

The main method of teaching used by the School of Mathematics is the formal lecture. Lectures usually start on the hour and are of 50 minutes duration. In a lecture, the lecturer presents the subject orally and usually writes notes on the blackboard or gives a power-point presentation or makes use of a visualiser. You will need to listen, think and take notes.

Your ability to take concise notes is dependent on your ability to listen. Listening needs to be more analytical than is often realised. You need to think at the same time as you listen, so that you develop the ability to recognise what is likely to be important and what is not.

You must make sure that you write down at least everything that the lecturer writes on the board. However, what the lecturer is saying is heard only once; you do not have much time to decide what part of it to write down. A balance must be achieved between taking no notes of the spoken word and trying to make a word-for-word transcript.

When you don't understand the lecturer, don't panic. Keep taking notes and seek help as soon as possible from the lecturer, your tutor or supervisor, and other students. Don't be afraid to ask questions during or at the end of the lecture. Usually other students don't understand either and will admire your courage. Like everybody else, lecturers often make mistakes, so do point these out as soon as you spot them. Remember, too, that you can only master concepts if you keep working at them, by reading textbooks and doing problems.

Aim to make a set of neatly set out, coherent notes during the lecture. Some people prefer to make rough notes during the lecture and rewrite them afterwards.
but very few can keep this up for long. Moreover, the time after the lecture can be spent more profitably.

Notes should be well spaced so that you can read them through and amplify them as a result of further work. You will need to use your notes for revision later in the year, so it is well worth spending a little time after each lecture making sure that your notes are legible and that you can understand them. It is very important that you have a complete set of notes for each course unit.

When reading and amplifying your lecture notes, you should identify the key material (for example, concepts, theorems, applications of theorems, counter examples, techniques), be clear about their role and the way they are used. Look for examples in your notes, textbooks, examples sheets and past examination papers, and add these references to your notes. The syllabus (course unit description) will often clarify the structure of the course unit.

If you are having difficulty with the lecture content, do go to see your lecturer. Do this as soon as possible. Otherwise you will fall behind and will have several poorly understood lectures to sort out. It will be easier for your lecturer to help if you can be precise about your difficulty. Take your notes with you and mark the relevant places, with a concise note of your exact difficulty. Sometimes a change of topic in lectures will give you a fresh start, but don't put off sorting out your difficulties.

If you need help from a lecturer (perhaps because you are having difficulty with the lecture content), try to seek help in an examples class (feedback tutorial), whenever possible. Otherwise, you should speak to the lecturer at the end of a lecture, or contact him or her by e-mail or telephone to arrange a meeting. Contact details for lecturers are given in Appendix A of this Handbook.

If you find that a course unit causes considerable difficulties not only to you but also to many other students, then you should first approach the lecturer concerned (either individually or collectively) and discuss the problem with him/her. If the problem persists then you should approach your Academic Advisor, who will discuss the problem with the lecturer concerned and other members of staff. If you are still unhappy at the outcome you can seek advice from your Programme Director, or the Senior Tutor (Dr. R. M. Thomas, Room 1.108, Alan Turing Building), or the Director of Teaching (Dr. M. D. Coleman, Room 1.109, Alan Turing Building), or the Director of Undergraduate Studies (Dr. L. A. Walker, Room 2.243, Alan Turing Building) or you can ask your student representative to raise the issue at the next meeting of the Staff-Student Liaison Committee. (See Section 6.1 of this Handbook for further information about the Staff-Student Liaison Committee.)

In lectures, students are asked to behave with courtesy and consideration for other students and for the lecturer. Please do not chat to your neighbour during lectures, as this will disturb the concentration of other students and may even
distract the lecturer. Students who disrupt lectures persistently will be reported to the Head of School.

Syllabuses (course unit descriptions) for all Mathematics course units may be found at the website:

http://www.maths.manchester.ac.uk/study/undergraduate/information-for-current-students/course-units-offered/

Each course unit has some online course material associated with it. The nature of the online course material varies from course unit to course unit, but it may include lecture notes, examples sheets and solutions, and past examination papers. For some course units, the syllabus page on the web contains a link to the online course material. For all course units, however, the online course material can be accessed via the Blackboard Learning System. Blackboard is a web-based system that complements and builds upon traditional learning methods used at the University of Manchester. By using the Blackboard system, you can view course materials and learning resources. The software also provides tools for communicating with your lecturer or other students about the course unit, using discussions, chat or e-mail. You can find more information about Blackboard at the website:

http://www.studentnet.manchester.ac.uk/blackboard/

You can access Blackboard by logging into My Manchester at

https://my.manchester.ac.uk.

Then select the My Blackboard tab.

(c) Feedback Tutorials (Examples Classes)

Each course unit normally has a number of feedback tutorials (or examples classes) associated with it. Feedback tutorials are usually of 50 minutes duration and start on the hour. Lecturers provide examples sheets for students (usually online) on a regular basis. In a feedback tutorial, the lecturer goes round the class, helping students individually with any problems they may be having with the questions on the examples sheets or with the lecture material. The lecturer may also work through some of the questions on the blackboard or whiteboard.

It is important that you attempt as many questions as possible from the examples sheet before the feedback tutorial. This will enable you to find out what your difficulties are, so that you can make optimum use of the time in the feedback tutorial to ask questions and get help. Discussions with peers will also be helpful in such matters.

Make sure you take all relevant notes, paper and pen to the feedback tutorial.
Don't be afraid to ask questions, no matter how trivial they may seem. If you are really shy about asking questions yourself, try to form a group and appoint a spokesman.

When model solutions to questions on the examples sheets are provided by the lecturer, do make use of them. Compare your solutions with those given. Sometimes you may learn more from a model solution to a problem for which you have found a correct solution than you will from solutions to problems which have baffled you.

**Students are expected to attend all lectures and feedback tutorials.** A record of attendance at feedback tutorials is taken at Levels 1 and 2. Students who miss classes will be contacted in the first instance by staff in the Teaching and Learning Office. Full details of attendance requirements and the action that will be taken against students who persistently miss classes are given in Section 4.1 of this Handbook.

(d) **Feedback Supervisions**

Some First Year course units are supported by feedback supervisions, rather than feedback tutorials. In a feedback supervision, a small group of about ten students meets with a member of staff each week to discuss the lecture material and examples sheets for the course unit. You will be asked to submit your solutions to the questions on the examples sheets to your Supervisor each week so that he or she may mark them, comment on them and try to help you over any difficulties.

**Attendance at feedback supervisions is compulsory.** We monitor your work and attendance at feedback supervisions. Students whose work and attendance is unsatisfactory will receive a warning letter. If their work and attendance does not improve, they will be interviewed by a senior member of staff. Ultimately, students whose work and attendance at feedback supervisions is unsatisfactory can be excluded from the university. Further information about attendance requirements is given in Section 4.1 of this Handbook. **Note that feedback supervisions begin in the first week of each semester.**

For First Year course units with feedback supervisions, 10% of the marks are given for submission of the weekly coursework and participation in the feedback supervision. Each week, you will receive one mark if you attend the supervision and a mark of 0, 1 or 2 depending on the quality of your written work and your participation in the feedback supervision. This participation may involve, for example, answering questions, joining in discussions and writing solutions on the blackboard. The weekly marks will be used to determine your overall mark out of 10. The assessed coursework for the course unit normally contributes 15% to the marks for the course unit, with 75% coming from the examination. Two exceptions to this rule are MATH10121 and MATH10222, for which the assessed coursework contributes 10% to the marks for the course unit, with 80% coming
from the examination.

Should you be unable to attend a feedback supervision as a result of illness or any other acceptable cause, you should see your Supervisor as soon as possible to explain the reasons. You should also submit electronically a School of Mathematics Mitigating Circumstances Form, obtainable from the School’s website:

http://www.maths.manchester.ac.uk/study/undergraduate/information-for-current-students/student-support/mitigating-circumstances/

Further information on sickness and absence is given in Section 5.8 of this Handbook.

(e) Coursework

Most Mathematics course units have a coursework element, which counts towards the assessment of the course unit. Typically, the coursework counts for about 20% of the total marks available for the course unit, but some course units are assessed entirely by coursework while others are assessed entirely by examination. The coursework can take various forms. It can consist of a short test during the Semester, it may take the form of an assessed computer practical or a project or you may be asked to work through a question sheet in your own time and hand in your solutions. Full details will be provided by the lecturers for the course units.

Handing in work is most important, whether for assessed or unassessed coursework. It is the only way you will find out whether your ideas are right, whether you have understood the problem correctly and whether your solutions are correct (even if the final answers look right). You should also pay close attention to comments on your work.

When coursework or project work is asked for by a given date, this must be adhered to. For the School of Mathematics, unless there are mitigating circumstances, students will lose 20% of the marks awarded to them for the coursework for each weekday late that the work was submitted. Thus, work submitted one week late will receive no marks. For the project course units (MATH30000, MATH30011, MATH30022, MATH40000, MATH40011 and MATH40022), students will lose 10% of the marks awarded to them for the project for each weekday late that the work was submitted. Students may be given permission to submit work late if there are special circumstances but this would need to be authorised in due course by the Mitigating Circumstances Panel. You should apply for an extension by submitting electronically a School of Mathematics Mitigating Circumstances Form and you should apply before the deadline whenever possible. Applications submitted after the deadline must have a good reason for not being submitted before the deadline. Should you be unable to submit coursework (or project work) as a result of illness or any other acceptable cause, you should see the lecturer or supervisor concerned and your
Academic Advisor. You should also obtain a doctor's note (whenever possible) and submit electronically a School of Mathematics Mitigating Circumstances Form, obtainable from the School’s website:

http://www.maths.manchester.ac.uk/study/undergraduate/information-for-current-students/student-support/mitigating-circumstances/

Further information on sickness and absence is given in Section 5.8 of this Handbook.

Sometimes the lecturers will ask you to hand in your coursework to the School’s Teaching and Learning Office (Room G.202/G.204, Alan Turing Building) via Reception in the Alan Turing Building. Before handing in your work, you should complete a Coursework Cover Sheet (available from Reception) and attach it to your coursework. You should make sure that all pages of your coursework are fastened together securely with a staple. You will be given a receipt which you should keep safely, in case you are asked to produce it later.

If you miss a coursework test, then you must obtain a doctor’s note (whenever possible) and submit electronically a School of Mathematics Mitigating Circumstances Form, obtainable from the School’s website:

http://www.maths.manchester.ac.uk/study/undergraduate/information-for-current-students/student-support/mitigating-circumstances/

Your case will then be considered by the appropriate Mitigating Circumstances Panel, which will decide what action to take (if any). In the interests of fairness, it is not normally possible for lecturers to make alternative arrangements for individual students to sit the test at a different time or to submit a different type of coursework.

(f) Private Study

As a rough guide you should be spending approximately twice the number of instruction hours in private study, mainly working through the examples sheets and reading your lecture notes and the recommended text books.

You may study for several hours at a time, or make use of short periods of time. It is easy to fritter away twenty-minute or half-hour periods but over a week they can amount to several hours lost, so try not to waste those valuable twenty-minute periods. The odd hours between lectures and feedback tutorials are particularly valuable, as resources (such as members of staff, the library and other students) are available for consultation.

The transition from school to university can be traumatic. Not only are there inevitable and substantial changes in your social and personal circumstances, but you will also find major changes in the teaching/learning process. At school, your
work was probably directed by a teacher who was in close contact with you and able to give you continual encouragement and feedback on your progress. Although the pace of work is much greater at university, it is left much more to you to decide your own level and direction of study. You will have to find ways of monitoring yourself and checking on your progress.

A common problem is feeling overwhelmed by the vast amount of work that has to be done, leading to a reluctance to get started. Try spending a few minutes planning your proposed work before actually starting on it, breaking down the work into manageable amounts.

Your learning is mainly your responsibility and is an independent process, in that nobody can learn on your behalf, although the teaching staff will do all they can to help you. Students who have the greatest success on their degree programmes tend to plan their study time and study in an environment free from distractions such as television or radio. In planning your studies, it is important to determine your priorities and allocate the time that you intend to spend on a particular aspect of study. This may need to be modified in the light of experience, but you can learn from these modifications to allow more, or less, time for a similar task in the future, and thus improve the planning process.

Attempt to keep to the plan and periodically check the time and effort spent on your various activities. If, after a few weeks, the time you spend studying has decreased, ask yourself whether this is because you find your studies less arduous than you expected, or because you have been neglecting them, or because you find them uninteresting. If you have increased the time spent studying, is it because your original expectations of the time required for study were too low, or are you finding the work difficult, or are you so interested in the work that you are spending more time studying? Changes to your study plan can easily be made, if necessary, but if you are finding the work very difficult, then do go and talk to your Academic Advisor, or to your lecturers. Difficulties in studying are quite common, but it is important that you seek help and don't let small problems develop into big ones.

Although many people find the pressure of deadlines for the completion of an assignment helpful to motivation and concentration, it is essential to allow yourself enough time so that the work you submit does you justice. For computing assignments in particular, the earlier you start the better. Your programs have to work, and achieving this usually takes longer than you expect.

Where you carry out your private study is a matter of personal preference. You can, for example, use the Quiet Study Room (Room G.101, Alan Turing Building) or the Work Room (Room G.211, Alan Turing Building) or the Alan Gilbert Learning Commons (see Section 7.2 of this Handbook) or the University of Manchester Library (see Section 7.1 of this Handbook) which has plenty of space for students to study, as well as storing a large selection of journals and books, covering all aspects of the subjects studied in the University.
Solving Mathematical Problems

Solving mathematical problems usually requires some insight and creative use of the mathematics involved. You may find that you are unable to do all of them, and some of them you cannot even start. There are no hard and fast rules for how to go about solving problems, but here are some suggestions that other students have found useful.

1. Have your lecture notes and relevant textbooks at hand for reference.
2. Read the entire question carefully and identify the mathematics likely to be involved. Re-read the relevant sections of your lecture notes, if necessary. Look for similar problems, either in your lecture notes or in your textbooks.
3. If possible, draw a picture or diagram.
4. If the problem is a general one, look at special cases or solve a simpler problem first.
5. If the problem is abstract, look at concrete examples first. For example, put numbers in place of letters, take specific examples of sequences or sets, and so on.
6. Use a computer package such as Matlab to solve specific problems of the same type (perhaps with numbers instead of letters) or plot graphs of the functions involved, to help you to gain insight.
7. Although the final solution should be logically ordered, you may find it helpful in developing it to work backwards from the result to be obtained (if you are given it) as well as forwards from the data of the problem.
8. Discussion with fellow students often produces new insights. Explaining ideas to others will help to clarify your own thinking. Don't be afraid to share ideas. You will find that others share your difficulties, but each contributes new ideas or understanding. At the same time, try to develop your own thinking. There is little value in simply copying someone else's work. Any work to be handed in for assessment should be your own, of course.
9. Don't be afraid to ask your lecturer or supervisor for help.
10. Once you have solved the problem, you will need to write out the final solution. When doing so, be sure you state what the symbols represent and pay careful attention to the logical flow of the argument. Read it back to yourself to make sure that it makes sense. Keep the question and your solution filed for future reference at revision time.

Learning Theorems

The appreciation of theorems and the construction of proofs are two of the most difficult things in learning mathematics. You need plenty of practice and experience, but you may find the following suggestions useful.
1. When tackling a new theorem, find out first what it is for and how to use it. Try to identify the main steps in the proof, to get a broad outline of how it works.

2. Use diagrams and pictures to explore the truth or falsity of statements through explicit illustration.

3. Study lecture notes and textbooks to identify the assumptions and the conclusions of theorems.

4. Try to understand the necessity of each assumption by finding a previous example where that assumption is used. Try to demonstrate the necessity of assumptions and hypotheses by means of counter examples.

5. Attempt proofs of similar theorems left as exercises in the lecture notes or text books.

6. Look for simple special cases. Familiarity with the simple makes complicated results easier.

7. Gain practice in the various methods of proof. Identify the ideas in proofs and note their reappearance.

(i) **Using Textbooks**

Textbooks are often recommended by the lecturers either to supplement or to replace lecture notes. Ideally, you should have your own copy so that you can annotate it and use it at revision time when the library copy is in heavy demand. Books vary widely in the notation they use and in their approach to a subject. During the early stages, you should stick to books recommended by the lecturer and books which use similar conventions and notation.

Read slowly and carefully and always with pen and paper to hand to do supplementary working. Be prepared to go over an argument several times. If there is a step you don’t understand, note it for later consideration. Try to understand the overall structure of an argument as well as the detailed steps. Make notes and cross reference them with your other notes on the subject. Always indicate on these notes the books from which they were taken (with the page numbers) so that you can find the original again easily if necessary.

Problems in the textbooks often have hints (and even answers) at the end of the book. These may help you with work on examples sheets. Definitions and notation differ slightly from one book to another and from lecture notes. There may be an index of symbols and notation to help you.

(j) **Revision Techniques**

Your study plan for the year should include time for revising for the formal examinations, which are held at the end of each Semester. Revision is not a substitute for steady, hard work while course units are in progress. The revision period before examinations is a time for re-familiarising yourself with ideas which may have been crowded out by more recent work, rather than trying to understand new work. The best way to memorise mathematics is by familiarity
through regular use. Some formulae, however, will be hard to remember and these you should be able to derive where necessary from more basic principles. Learn the basic steps in proofs, rather than try to commit the entire proof to memory.

You should allow yourself plenty of time to read through all your lecture notes and look back through (and, where necessary, complete) the examples sheets. Mathematics is best revised (as well as learned) by doing it. Try to answer questions from past examination papers. Practise doing examination questions under self-imposed examination conditions without the aid of your notes. Difficulties which you encounter when trying to do problems and examination questions will force you back to your lecture notes and textbooks for information on the topic you are revising. Make a list of the points you do not understand and the problems you cannot do and arrange to see the appropriate lecturer to go through your difficulties.

Try to avoid working all through the night before an examination, because you might then tire in the examination room. You are likely to do better in the examination if you are feeling wide awake. During your revision, remember to have some variety in your studies. Intersperse reading your lecture notes with working through problems from examples sheets and questions from past examination papers. Do not forget to make time for some relaxation during the revision period.

(k) Examination Technique

It is very important that you organise well the time you spend in the examination room. Before you start writing, you should read the instructions at the start of the paper and then read the whole paper carefully, before deciding which questions you are going to answer first. Try to answer the questions posed and avoid including in your answers things that are not relevant to the question that has been set. Attempt to answer the exact number of questions requested. It is usually easier to get the first 40% of the marks on any question rather than the last 20%. If you are short of time and have not attempted the number of questions specified in the rubric, it is better to spend the remaining time starting to answer another question rather than attempting to make a good answer better.

If you get stuck on a question, don't panic. You may find that you can't do one part of a question but, by assuming the result, you can continue with the rest. You may be able to complete the missing part later. If you are completely stuck, move on to the next question you intend to do. You can always go back later if you have time to spare or a fresh idea occurs to you. Sometimes, when you are working on one question, ideas will occur to you for solving another. Jot them down immediately for future reference so that you do not forget them.

You should aim to allow yourself time to read through your answers before the end of the examination. Never leave early. You may see something that you
missed first time, or get a useful new idea. On the other hand, if you are running out of time on your last question but know how you would have continued, give a brief description of your intended method.

[Much of the material in Section 2.10 is taken from the booklet ‘Study Skills for Mathematics’, edited by Pam Bishop and Laurence Nicholas and published by Sheffield Hallam University Press.]