

# ECON1202

## Quantitative Analysis for Business and Economics

### Course Outline Semester 1, 2017

## Part A: Course-Specific Information

Students are also expected to have read and be familiar with **Part B Supplement to All Course Outlines**. This contains Policies on Student Responsibilities and Support, Including Special Consideration, Academic Misconduct and Plagiarism, and Key Dates. It also contains the Business School PROGRAM LEARNING GOALS.

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# 1 STAFF CONTACT DETAILS

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Consultation Times: Thursdays 3-5pm

Lecturer: Arpita Chatterjee  
Room: UNSW Business School 430C  
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Email: [arpita.chatterjee@unsw.edu.au](mailto:arpita.chatterjee@unsw.edu.au)  
Consultation Times: Thursdays 11:30-2:30pm

List of tutors will be posted on Website.

## 1.1 Communications with staff

Consultations are an opportunity for you to ask questions. You may need to ask about the material introduced in lectures, the problems you have attempted or questions that were not fully answered in tutorials.

You should feel free to contact your lecturers about any matter. For issues regarding the material taught during lectures, please contact the lecturer responsible for your class. For efficiency, all enquiries about the subject material should be made at lectures or tutorials or during consultation time. Discussion of course subject material will not be entered into via lengthy emails.

Email correspondence on administrative matters (e.g. advising inability to attend tutorials) will be responded to within 48 hours, but not over weekends. Please note that the lecturer has no advance notice of the date and time of the exam (the subject of many emails).

Email enquiries should be directed to the QABE staff as follows:

- Lecture-related enquires to your lecturer;
- Tutorial material enquiries to your tutor;
- Course related issues and enquiries about special consideration, assessments and examination to the lecturer-in-charge;
- Administrative enquiries about the tutorials to the tutor-in-charge.

We will reply to emails within 3 working days with the following provisions:

- The question should require at most a two-sentence response. If it takes more, office hours are the more appropriate venue.
- The email should not request information that can be found on the website or the course outline.
- The email is not about grading. For such matters, office hours are appropriate.
- Always identify yourself and the course code in the subject of your email.
- Please do not send attachments of any kind unless requested.

## 1.2 Pitstop and PASS

In the weeks leading up to exams, starting from about Week 12, the School will be providing **Pitstop**, an opportunity for consultation with tutors as you revise for the exams. Details of Pitstop locations and hours for this course will be advised closer to the time.

**PASS** (the Peer Assisted Support Scheme) is a system of voluntary study groups available to QABE students. The groups are each led by senior students and are an opportunity to practice problems, develop study methods, ask questions, and consolidate your knowledge in a friendly informal environment. The PASS sessions will start in Week 3 and the timetable will be available from the Course Website in Week 2.

## 2 COURSE DETAILS

### 2.1 Teaching Times and Locations

Lectures start in Week 1 (to Week 12). One stream of lectures is on Thursdays 9-11am in the Richie Theatre; another stream of lectures is on Tuesdays 6-8 pm in Law Theatre G04.

Tutorials start in Week 2 (to Week 13). A list of tutorials and tutors will be on the Course Website.

### 2.2 Units of Credit

The course is worth 6 units of credit.

### 2.3 Summary of Course

Mathematics is an important part of theoretical and applied analysis in economics and business. This course equips students with a working knowledge of the most common techniques, providing the basis for their further studies. Topics include the mathematics of finance, matrix algebra, linear programming, as well as calculus and (unconstrained and constrained) optimisation. Special emphasis is put on the illustration of the covered concepts and techniques with applications to typical problems in business and economics.

### 2.4 Aims and Relationship to Other Courses

This course is offered as part of the first year core in the Bachelor of Economics degrees. For students in the Bachelor of Commerce program in 2010, it is not part of the 1st year core BUT it is a prerequisite for most 2nd year economics courses, so it is strongly recommended for those contemplating one of the economics majors.

It aims to give students a good insight and understanding of how mathematical concepts, theories and techniques are applied to the fields of business, economics and the social sciences in order to generate solutions to problems encountered in these fields. In this course we build on mathematical knowledge which you should have gained in high school. The course content constitutes the minimum mathematical knowledge and skills that graduates from the Faculty should possess in order to be effective in their later studies at UNSW, and in the world of work.

After completing QABE, your use of mathematics and statistics in your studies will vary depending on the major(s) you choose. If you choose majors such as Economics, Business Economics, Financial Economics and Econometrics you will study further courses in econometrics. These majors are designed to equip students with statistical and other quantitative skills that are widely used and increasingly demanded by employers in commercial fields and the public sector. If you choose other majors where quantitative skills are needed, such as Accounting, Finance and Marketing, a good understanding of concepts taught in QABE will be a major asset.

The aims of this course are for you to:

- Gain experience in areas which every business person needs such as problem solving and using a spreadsheet;

- Develop your ability to perform calculations;
- Develop your ability to solve real life business problems using formal mathematical tools and algorithms;
- Extend your skills in analysis, oral and written communication.

## 2.5 Presumed Knowledge

The Business School has an assumed knowledge requirement that students entering the BCom and BEc are expected to be familiar with HSC Mathematics. Therefore, in this course we will base lectures on a prior knowledge of HSC Mathematics and this assumed knowledge will not be covered or revised as part of the lectures or tutorials.

If you have not studied HSC mathematics in New South Wales, knowledge of the following topics is essential: basic functions and graphs including logarithms and exponentials and solutions of linear and quadratic equations. If you have not studied any or all of these topics previously at an appropriate level of mathematics at high school, remedial work will be necessary.

A short quiz has been designed to give you an evaluation of your mathematics skills. The quiz is available on the course website and students must attempt the quiz in order to get full access to the site. More importantly, the quiz provides an indication of whether you do in fact have a good grasp of the assumed knowledge in mathematics. Students with the appropriate background will find the quiz straightforward. If this is not the case and you feel you require some assistance then there are at least two options. You may wish to engage in some self-study in which case we recommend you purchase the following book available at the UNSW bookshop: *Managing Mathematics: A Refresher Course for Economics and Commerce Students* by Judith Watson, 2nd edition, 2002. Alternatively, UNSW in conjunction with Randwick TAFE, is offering a course, *Essential Mathematics for Higher Education*, that will provide instruction in the required mathematics. For further details go to <http://sydneytafe.edu.au/newsevents/events/essential-mathematics-higher-education>.

## 2.6 Student Learning Outcomes

The Course Learning Outcomes are what you should be able to DO by the end of this course if you participate fully in learning activities and successfully complete the assessment items. The Learning Outcomes in this course also help you to achieve some of the overall Program Learning Goals and Outcomes students in the Business School. Program Learning Goals are what we want you to BE or HAVE by the time you successfully complete your degree. For more information on the Undergraduate Program Learning Goals and Outcomes, see Part B of the course outline.

The following table shows how your Course Learning Outcomes relate to overall Program Learning Goals and Outcomes, and where these are assessed:

Program Learning Goals and Outcomes		Course Learning Outcomes	Course Assessment Item
<i>This course helps you to achieve the following learning goals</i>		<i>On successful completion of the course, you should be able to:</i>	<i>This learning outcome will be assessed in the following items:</i>
1	Knowledge	Apply basic principles of financial mathematics to real life problems. Apply probability tools to solve risk and uncertainty scenarios. Use matrix algebra to represent and solve systems of equations. Use linear programming and calculus to solve optimisation problems. Apply both single variable and multivariable calculus to business and economics problems.	<ul style="list-style-type: none"> <li>• In-tutorial test</li> <li>• Online quizzes</li> <li>• Final Exam</li> </ul>
2	Critical thinking and problem solving	Formulate and solve real problems amenable to mathematical analysis that arise in economics and business using the methods appropriate to the problem.	<ul style="list-style-type: none"> <li>• In-tutorial test</li> <li>• Online quizzes</li> <li>• Final Exam</li> </ul>
3a	Written communication	Construct written work which is logically and professionally presented.	<ul style="list-style-type: none"> <li>• Final Exam</li> </ul>
3b	Oral communication	Communicate successfully with group members in solving analytical problems. Such skills in analytical thinking and effective communication are Graduate Attributes that UNSW seeks to foster in its graduates.	<ul style="list-style-type: none"> <li>• Not specifically assessed</li> </ul>
4	Teamwork	Work collaboratively to complete a task.	Not specifically assessed.
5a.	Ethical, environmental and sustainability considerations	Identify and assess environmental and sustainability considerations in problems in economics and business.	<ul style="list-style-type: none"> <li>• Final Exam</li> </ul>
5b.	Social and cultural awareness	Not applicable in this course.	

## 3 LEARNING AND TEACHING ACTIVITIES

### 3.1 Approach to Learning and Teaching in the Course

The philosophy underpinning this course and its Teaching and Learning Strategies are based on “Guidelines on Learning that Inform Teaching at UNSW. These guidelines may be viewed at: [www.guidelinesonlearning.unsw.edu.au](http://www.guidelinesonlearning.unsw.edu.au). Specifically, the lectures, tutorials and assessment have been designed to appropriately challenge students and support the achievement of the desired learning outcomes. A climate of inquiry and dialogue is encouraged between students and teachers and among students (in and out of class). The lecturers and tutors aim to provide meaningful and timely feedback to students to improve learning outcomes.

This is not a course where you can become proficient just by observing. You will need to get involved in class - evaluating information, asking and answering questions. You also must learn to organise your independent study and practise enough problems to gain a thorough understanding of concepts and how to apply them.

You are expected to:

- put a consistent effort into learning activities throughout the session by preparing for the regular assessment tasks,
- take a more responsible role in preparing for tutorials and participating in them,
- develop communication skills through engaging in classroom discussions and preparing an assignment,
- concentrate on understanding how and why to use formulas and less on memorising them,
- make continuous improvements by using the feedback from assessments.

### 3.2 Learning Activities and Teaching Strategies

The examinable content of the course is defined by the references given in the Lecture Schedule, the content of Lectures, and the content of the Tutorial Program.

In this course there are two types of formal classes: lectures and tutorials. There are also peer assisted study groups (PASS) which you can attend on a voluntary basis. In addition you will be expected to spend a considerable amount of extra time working with group members on your assignment and working on your own to attempt tutorial preparation and self study questions.

#### 3.2.1 Lectures

The purpose of Lectures is to provide a logical structure for the topics that make up the course; to emphasize the important concepts and methods of each topic. They will include explanation of relevant topics and theory together with worked examples to demonstrate the theory in practice. Where possible, lectures will show the relevance and application of the quantitative techniques covered in this course to business, economic and financial applications.

To get the most out of the lectures, students are strongly encouraged to familiarise themselves with the readings as given in the course outline prior to attending each lecture. To aid note taking a “book” of lecture outlines, with space for working, is available from the course website. While some students prefer to take their own notes, others will prefer to use the outline as a template for their notes.

Due to the size of lecture classes and the large amount of course material to be covered there is only a very limited time for questions during the lectures themselves. However, the smaller tutorial classes (see below) are ideal forums for students to test their



understanding and seek further instruction. Additionally there are consultation times with lecturers.

### 3.2.2 Tutorials

Tutorials are an integral part of the subject. Tutorial presentations / discussion questions / problems will build on the material discussed in lectures. Tutorials will increase your understanding of the material covered in lectures if you have tried to work through some numerical problems yourself beforehand.

**Focus.** Besides learning practical problem-solving skills, there is an emphasis on the development of communication skills and the ability to construct arguments. Discussions, both in small groups and between the whole class, will be an opportunity for you to examine your understanding of concepts and applications before working on numerical examples.

**Preparation.** Each week you will be given two sets of questions to work on.

Tutorial questions must be prepared for your tutorial. Expect that your tutor or another student will check that you have attempted these. You are expected to attend the tutorials and discuss any difficulties you encountered solving the tutorial questions with our tutor. Solutions to these tutorial questions will be available on QABE website on each week on Wednesday after 7pm.

Self study questions will also be set for each week. Attempting these will assist you in answering the tutorial questions and will form a necessary part of the practice you will need to do to successfully complete this course. Solutions to some of these questions will be posted on QABE website before the examination time. Further help in understanding the tutorial solutions and in solving the self study problems can be obtained through consultations with your lecturer and tutor.

**Discussion.** The first part of your tutorial will involve discussion questions related to the numerical questions you have prepared. These will help you improve your understanding of concepts and mathematical methods and assist you to see the relevance of these in business and economics. In some weeks you may also discuss topics such as how to approach your group assignment. During this part of the tutorial, you may also suggest topics you would like to be discussed, for example areas where you are confused or need more explanation.

**Numerical solutions.** During the second part of the tutorial, the students and the tutor, working together, will examine the solutions to the prepared questions. If time permits, extra questions may be attempted. In the case where there is not time to work through all the prepared questions, answers to these questions (but not complete solutions) will be made available on each week on Wednesday on the website.



### 3.2.3 Out-of-Class Study

Lectures can only provide a structure to assist your study, and tutorial time is limited. Most learning will be achieved outside of class time. Students differ in their learning styles but a learning strategy might include:

- Read sections of the textbook before/after the lecture;
- Attempt the self study problems and compare your methods with the online practice problems to prepare for quizzes or the past exam required; try extra problems from the textbook if required;
- Prepare tutorial questions;
- Take the online quiz, look at your results and if necessary and carry out further preparation before re-attempting it;
- Work with other group members on the computing assignment;
- Seek assistance from staff, PASS leaders or fellow students to have queries answered.

## 4 ASSESSMENT

### 4.1 Formal Requirements

In order to pass this course, you must:

- achieve a composite mark of at least 50 out of 100; and
- make a satisfactory attempt at ALL assessment tasks (see below); and

### 4.2 Assessment Details

Assessment Task	Weighting	Length	Due Date
Online Quizzes	4 x 2% (Total 8%)	See 4.4 below	Weeks 3, 6, 8, 12
In-Tutorial Tests	3 x 10% (Total 30%)	See 4.5 below	Weeks 4, 7, 10
Tutorial Participation	5%	See 4.3 below	
Final Exam	57%		University Exam Period
	100%		

### 4.3 Tutorial Participation

#### Marks Guide for Tutorial Participation

0	Below 80% of attendance as required by UNSW and Business School rules. Attendance at 9 of 12 tutorials will be deemed as meeting the requirement. Students must sign on by 10 minutes from start of tutorial to qualify as 'in attendance'. Signing on for another student will be treated as misconduct.
1	Has satisfied the attendance requirement (attended at least 9 tutorials) but has not contributed to class discussion.
2-5	Has attended 10-11 tutorials and contributed to class discussion in relevant and constructive ways.

In certain circumstances, such as where a request for special consideration is made in relation to assessment items, tutorial attendance will be taken into account in determining your final assessment or whether special consideration is granted.

If, owing to illness or other exceptional circumstances, you are unable to attend your usual tutorial, you may try to attend another tutorial in the same week. However, you are required to attend your usual tutorial class at least 9 times during the session. This allows for occasional absence due to minor illness and other reasons, hence special consideration applications will not reduce this requirement.

#### **4.4 Online Quizzes**

Four online quizzes have been designed to assist you to learn, so you can practice, check your understanding of topics and improve on your first attempt if necessary. Each quiz will count 2% of the overall mark for the course.

Quizzes will test material up to and including lectures ending the previous week. Before completing each quiz you will have the opportunity to try online self-check practice questions that are similar in content to the topics to be examined. The format of the practice questions will be a mixture of multiple-choice and true-false questions. For each quiz there will be two attempts allowed, but only your highest mark will be recorded.

Each of the online quizzes will consist of ten questions. You will need to perform calculations similar to those in the practice set but enter numerical answers rather than checking a box. In order to avoid rounding errors you should try to store as much information in your calculator's memory as possible. You will be allocated a time limit of one hour to complete each attempt and you may have two attempts at each quiz. For the second attempt, you may not get exactly the same set of questions or data.

The dates between which quizzes will be available online are:

**Quiz 1 – Week 3: Week beginning 13 March**

**Quiz 2 – Week 6: Week beginning 3 April**

**Quiz 3 – Week 8: Week beginning 24 April**

**Quiz 4 – Week 12: Week beginning 22 May**

You can access the quizzes at the website, <http://moodle.telt.unsw.edu.au>, by clicking on the quizzes link.

It is a good idea to save each answer as you progress through the questions in case your internet connection fails. Do not leave it until Sunday night to begin your first quiz attempt as overuse of the website may cause access problems.

You are encouraged to make your attempts at UNSW computing labs. There are no supplementary quizzes. You are given two attempts to cover for any unseen technical problems that may cause you to lose one attempt. You may contact the lecturer-in-charge if and only if you lose the two attempts due to technical problems (connecting to Moodle, Moodle shut down...) encountered in a UNSW computer lab. No considerations will be given if you leave your two attempts till Sunday evening!

## 4.5 In-Tutorial Tests

There will be 3 written tutorial tests in Weeks 4, 7 and 10, each one counting towards 10% of the overall mark for the course. You will be notified by your lecturer of the time given to complete each test, as well as the material covered. This announcement will be made in lectures during the week before the test and will also be posted on QABE website.

**In-Tutorial test 1: Week 4: Week beginning 20 March: up to and including lecture 4**

**In-Tutorial test 2: Week 7: Week beginning 10 April: up to and including lecture 10**

**In-Tutorial test 3: Week 10: Week beginning 8 May: up to and including lecture 16**

A sheet with a number of selected formulae will be provided. This sheet will be available for download from the course website prior to the exam. The main purpose of these tests is to gauge:

- Knowledge of the topics covered so far. Thus helping achieve learning outcome 1;
- Ability to use formulae appropriately and to perform calculations with speed and in developing analytical skills that are necessary to achieve accuracy. Thus helping achieve learning outcome 2;
- Problem solving ability, thus helping achieve learning outcome 3.

Students must sit the tutorial tests in the tutorial group to which they have been allocated. There will be NO supplementary tests offered for the in-tutorial tests. You should make every effort to take the in-tutorial test(s). Students who fail to attend the tests will need to apply for Special Consideration.

Applications for special consideration for the in-tutorial tests must be lodged online through myUNSW within 3 working days of the assessment. (Log into myUNSW and go to My Student Profile tab > My Student Services channel > Online Services > Special Consideration). Then submit the originals or certified copies of your completed Professional Authority form (pdf - download here) and any supporting documentation to Student Central.

Employment obligations or holiday plans of any kind are not acceptable reasons for absence from any test/examination. In cases of serious illness, students will need full and convincing documentation of that illness. Students who are found to be genuinely too ill to have attended an in-tutorial test will have their mark in the remaining assessment tasks re-weighted to include the mark reserved for the missed test. In all other cases of non-attendance students will receive a grade of zero. Absence will only be approved for one of the in-tutorial tests.

## 4.6 Final Exam Format

The final will be a two hour examination held during the period university examination period. It will be worth 57% of the overall mark for the course, and will cover material from the entire course. There are no multiple choice questions in the final examination. The final exam consists of a number of questions designed to test your analytical skills and your problem solving ability. As with the in-tutorial tests, a sheet with a number of selected formulae will be provided. Full information about the content and format of the final examination will be provided towards the end of the semester. However, as outlined above, all material covered in the lectures and tutorial program is examinable.

## 4.7 Quality Assurance

The Business School is actively monitoring student learning and quality of the student experience in all its programs. A random selection of completed assessment tasks may be used for quality assurance, such as to determine the extent to which program learning goals are being achieved. The information is required for accreditation purposes, and aggregated findings will be used to inform changes aimed at improving the quality of Business School programs. All material used for such processes will be treated as confidential.

# 5 COURSE EVALUATION AND DEVELOPMENT

Each year feedback is sought from students and other stakeholders about the courses offered in the School and continual improvements are made based on this feedback. UNSW's myExperience Survey Tool is one of the ways in which student evaluative feedback is gathered. You are strongly encouraged to take part in the feedback process.

## 6 COURSE RESOURCES

The website for this course is on UNSW Moodle at: <http://moodle.telt.unsw.edu.au>

The **Textbook** for this course is:

Prescribed text	Comment
Haeussler, E.F. Paul, R.S and Wood, R.J., <i>Introductory Mathematical Analysis for Business, Economics and the Life and Social Sciences</i> <b>12th OR 13<sup>th</sup> ed.</b> , Published by Addison Wesley, 2008 .	Text and (optional) student solution manual, which contains solutions to the odd numbered questions, are both available at the UNSW bookshop and in MyCourse reserve in the library.

Students may also find the following textbook useful for some parts of the course:

Prescribed text	Comment
Knox, D.M., Zima, P. and Brown, R.L., <i>Mathematics of Finance</i> , 2 <sup>nd</sup> ed, Published by McGraw-Hill, 1999.	This book is highly recommended reading for the financial maths section and in particular for topics from lectures 8 and 9 which are not in the textbook. Available in MyCourse reserve and at the UNSW Bookshop.
Morris, C., <i>Quantitative Approaches in Business Studies</i> , 6th ed., Published by Financial Times Prentice Hall, 2003.	Easy to read style, this book is an excellent resource for linear programming and decision theory topics. Available in MyCourse reserve.
Watson, J., <i>Managing Mathematics: A Refresher Course for Economics and Commerce Students</i> , 2nd ed., School of Economics, UNSW, 2002.	Recommended for those who have previously gained the assumed knowledge of mathematics, but who now need to refresh algebra or calculus. Available at the UNSW Bookshop.

Note that in the Lecture Schedule below and in the Tutorial Booklet these texts are referred to according to the initials of their authors as HPW, KZB, CM, and JW.

**Calculator.** A basic scientific calculator is required for this course. Usually the calculator you used at school will be satisfactory. It must be able to perform logarithmic and exponential calculations such as  $\ln x$  and  $xy$ . The calculator must not be a programmable one (i.e. have a full alphabetic keyboard) or a financial one. If you need to purchase a new calculator, keep in mind that, for further use, it will be desirable to have a two variable statistical mode to perform linear regression calculations.

## **7 COURSE SCHEDULE**

### **7.1 Lecture Schedule**

Lectures start in Week 1 and finish in Week 12. The lecture schedule is provided on the next page.

### **7.2 Tutorial Schedule**

Tutorials start in Week 2 and finish in Week 13. The schedule will be on the Course website.

LECTURE SCHEDULE		
Topic		Reference
Week 1 27 February	L1: Introducing QABE <b>Topic 1: TIME VALUE OF MONEY</b> L2: The problem Simple interest Compound interest Continuously compounded interest Present Value Future value	Lecture book 12 <sup>th</sup> ed  KZB 1.1-1.2 HPW 5.1 HPW 5.3 HPW 5.2 KZB 2.3, 2.4
Week 2 6 March	L3: Equations of value Net present value Internal rate of return  L4: Geometric progressions Ordinary annuities Annuities due	HPW pp.202-204 KZB 1.4, 2.3, 2.6 KZB 8.1, 8.2  HPW 5.4 KZB 3.1-3.4, App.B
Week 3 13 March	<b>Topic 2: MATRICES</b>  L5: Introduction to matrices Transpose, diagonal, identity, zero Matrix algebra: addition, subtraction Multiplication: scalar, matrix  L6: Small matrices: Matrix Inversion, Adjoint method Solving systems of Linear Equations Consistency, types of solutions	HPW 6.1- 6.3     HPW 6.6
Week 4 20 March	L7: More on matrices: Large matrices Computing methods Arrays, inversion, other methods  <b>Topic 3: PROBABILITIES</b> L8: Permutations Combinations	HPW 6.1-6.3   HPW pp.347-349 HPW 8.2
Week 5 27 March	L9: Probability Trees Rules of probability Bayes' Theorem  L10: Markov chains	HPW 8.5- 8.7 CM 8  HPW 9.3
Week 6 3 April	<b>Topic 4: LINEAR PROGRAMMING</b>  L11: Introduction to Linear Programming Graphical approaches L12: Changes in the constraints Changes in the objective function Applications	HPW 7.1 CM 19  HPW 7.2-7.3



Week 7 10 April	<b>Topic 5: CALCULUS</b> L13: Limits Rate of change - Differentiation by the limit Differentiation rules Applications (marginal cost/revenue, propensities)  L14: Implicit differentiation Logarithmic and exponential derivatives Differentials Higher derivatives Applications (elasticity of demand)  <i>(Friday 14 April is Good Friday public holiday)</i>	HPW 10.1-10.4 HPW 11.1, 11.3-11.5 HPW 11.2 HPW 12.3  HPW 12.4 HPW 12.1-12.2 HPW 14.1 HPW 12.7 HPW 12.3
Mid-semester break: Friday 14 – Saturday 22 April inclusive		
Week 8 24 April	L15: Relative extrema Concavity, convexity Local, global extrema Inflection points  L16: Introduction to integration The indefinite integral The definite integral Integration rules  <i>(Tuesday 25 April is Anzac Day public holiday)</i>	HPW 13.1 HPW 13.3- 13.4, 13.6  HPW 14.1-14.7, 14.10
Week 9 1 May	L17: Introduction to differential equations Method of separation of variables Introducing growth  L18: Exponential growth Limited growth Applications	HPW 14.10, 15.5  HPW 15.6
Week 10 8 May	L19: Introduction to multivariable calculus Level curves Partial & total derivatives  <b>Topic 6: OPTIMIZATION</b>  L20: Multivariable optimization Unconstrained optimization Constrained optimization	HPW 17.1-17.3 HPW 17.5-17.6  HPW 17.1-17.6 HPW 17.7 HPW 17.8
Week 11 15 May	L21: Applications of constrained optimization Economic applications Lagrange multipliers  <b>L22: EXAM INFORMATION</b>	
Week 12 22 May	<b>REVIEW</b>	