The University of New South Wales

MATH1231 Mathematics 1B

INFORMATION BOOKLET

School of Mathematics and Statistics

Summer Session 2008-2009

CONTENTS OF THE MATH1231 course pack summer 2008-2009

Your course pack should contain the following four items:

1. *Information Booklet*

   Information on administrative matters, lectures, tutorials, assessment, syllabuses, class tests, computing, special consideration and additional assessment

2. *Algebra Notes*
3. *Calculus Lecture Notes (for MATH1231/1241)*
4. *Past Exam Papers Booklet*

Information booklet contents

GENERAL INFORMATION FOR MATH1231 SUMMER SESSION 2008-2009

Important

If you did not do MATH1231 MATHEMATICS 1B in Semester 2 then you should strongly consider buying the MATH1231/MATH1241 Course Pack 2008. These packs are available at the UNSW Bookshop.

The Course Pack was prepared for use in Semester 2. To adapt it for use in the Summer Session you should:

1. **DISCARD THE INFORMATION BOOKLET** from the Course Pack and replace it with this booklet. This booklet is available at the Mathematics School Office.

2. **DELETE ALL SCHEDULES** for lectures, problems and tests in the Algebra Notes and the Calculus Notes. The schedules for problems and tests are different in the Summer Session and they are given in this Booklet.

Prerequisites

MATH1231, Mathematics 1B, is a first year 6UOC course offered by the School of Mathematics and Statistics in semester 2 and Summer Session. It develops the Calculus and Linear Algebra introduced in MATH1131, Mathematics 1A. MATH1241, Higher Mathematics 1B, is the higher version of MATH1231 and covers the topics of MATH1231, but in greater depth. Both courses contain an introduction to Statistics.

The prerquisite for MATH1231 Mathematcs 1B is a conceded pass or better in either MATH1131 or MATH1141. The exclusions for MATH1231 are MATH1021, MATH1031, MATH1241, MATH1251, ECON1202 and ECON2291.

Aims

The aim of MATH1231 is that by the time you finish the course you should understand the concepts and techniques covered by the syllabus and have developed skills in applying those concepts and techniques to the solution of appropriate problems. Students who achieve good competence in this course should be well equipped both technically and psychologically to cope with the mathematics that they will meet later in their program. It is expected that students will be able to use the Symbolic Computing Package Maple as an aid to solve problems that were generally inaccessible just a generation ago.

Learning Outcomes

A student should be able to:

- state definitions as specified in the syllabus,

- state and prove appropriate theorems,

- explain how a theorem relates to specific examples,

- apply the concepts and techniques of the syllabus to solve appropriate problems,
- prove specific and general results given specified assumptions,
- use mathematical and other terminology appropriately to communicate information and understanding,
- use the Symbolic Computing Package Maple as an aid to solve appropriate problems.

Advice to students

Students are advised to take particular note of the detailed syllabus and notes provided later in this document.

The level of depth of understanding required in this course is best understood by considering the exercises, the sample class tests and the past examination papers that are included in the MATH1231 Course Pack.

Teaching Strategies

MATH1231 is taught through carefully planned lectures that logically develop the concepts and techniques specified in the course. Examples are emphasised as they provide the underlying motivation for the course, and because students best understand the general theory when it is developed from simple, and then more complex, examples.

Small group tutorials allow students to apply the material introduced in the lectures. These tutorials provide the opportunity for individual assistance. Students are expected to work conscientiously at understanding the solutions to the exercises.

Students are encouraged to give constructive feedback to the teaching staff during the teaching semester. They are also encouraged to work collaboratively with other students in the course to develop their understanding and their problem solving skills.

Statement on Assessment

The School of Mathematics has responded to student and staff concerns about plagiarism in assignments. Consequently, all First Year Mathematics courses are assessed by randomly generated online tests, short class tests and a written examination. The online tests and short class tests provide regular feedback to students and allow the course to be broken into smaller segments to facilitate learning.

It is unusual for questions on class tests to be marked out of more than 3 or 4 marks, and advice is given to tutors as to how those marks are to be awarded. Generally part-marks are awarded according to the number of correct steps made in answering the question. Students should raise any concerns that they have regarding their marks with their tutor when their papers are returned. If their concerns are not satisfactorily resolved, they may speak to the First Year Director.

Detailed marking schemes are prepared for the marking of the end of semester examination and check marking is generally used for quality assurance. Marks will only be changed if the mark is inconsistent with the marking scheme.

At the end of the marking process a committee of staff determines the pass mark and produces the final (scaled) marks.

Details regarding the tests and examination are given later in this document.

Contacting the First Year Office

The student administration officer in the First Year Office of the School of Mathematics and Statistics is Mrs N. Narouz (Neffi). All administrative enquiries concerning first year Mathematics courses should be sent to Mrs Narouz, either:

- by email to fy.MathsStats@unsw.edu.au
- by phone to 9385 7011
- or in person in room RC-3072 (between 9am to 12 noon or 2pm to 4pm)

Change of tutorials, due to timetable clashes or work commitments, permission to take class tests outside your scheduled tutorial, advice on course selection and other administrative matters are handled in the First Year Office. Constructive comments on course improvment may also be emailed to the First Year Office. Should we need to contact you, we will use your official UNSW email address of

zSTUDENTNO@student.unsw.edu.au

in the first instance.

Lectures

Classes in MATH1231 Summer Session are held on Monday afternoon, Tuesday morning and Thursday afternoon. All lectures are to be given in the Keith Burrows Theatre:

Monday:	1-2pm Algebra lecture	*4-5pm Calculus lecture
Tuesday:	9-10am Calculus lecture	*12-1pm Algebra lecture
Thursday:	1-2pm Algebra lecture	4-5pm Calculus lecture

***In week 1 only**, the Monday Calculus lecture will be held from 2-3pm, and the Tuesday Algebra lecture will be held from 10-11am. The lecturers for MATH1231 are:

Algebra Dr D. Trenerry
Calculus Dr J. Kress (weeks 1-4); Mr P. Brown (weeks 5-8)

Important announcements and handouts may be given out in lectures, so missing lectures (or even arriving late) may cause significant difficulties for you.

Tutorials

All students will be assigned to a single tutorial in each of the 2 hour blocks between lectures, which means that all students will have one free hour between lectures. Specifically, students will be assigned to a tutorial that either meets at the times

Monday 2-3pm, Tuesday 10-11am, Thursday 2-3pm

or at the times

Monday 3-4pm, Tuesday 11-12noon, Thursday 3-4pm.

You will have the same tutor for all tutorials and there is not a fixed division into Algebra and Calculus tutorials.

The first tutorial will be on Thursday 27th November. All tutorial information is available via myUNSW and you should check this site regularly as we may need to amalgamate or stream the tutorials. You will recieve an email to your student account if we change your tutorial room or time.

Attendance at tutorials is compulsory and the roll will be called at all tutorial classes.

The main purpose of tutorials is to provide you with an opportunity to get help with any problems which you find difficult and any parts of the lectures or textbook which you don't understand. In order to get real benefit from tutorials you should

- Study your lecture notes and attempt relevant problems **before** the tutorial so that you can find out the areas in which you have difficulties.
- Make sure that your tutor is aware of the areas in which you need help.
- Be as specific as possible in describing your difficulties — don't just say "could you explain about series".
- Be an active participant in tutorials, asking and answering questions rather than just sitting and watching.

All the class tests which you submit (except formal examination scripts) will be marked by your tutor and returned through tutorials.

Getting help outside tutorials

Full time members of staff will announce through lectures when they are available for consultation.

Course Materials

The course materials for MATH1231/1241 are:

MATH1231/1241 *Course Pack 2008.*

Computing Notes For First Year Mathematics courses 2008.

S.L. Salas, E. Hille and G.J. Etgen, *Calculus - One and Several Variables*, any recent edition, Wiley.

The latest edition of the textbook, Salas, Hille and Etgen *Calculus - One and Several Variables*, 10th Edition comes packaged with access to the electronic resources known as WileyPlus. This electronic version provides internet access to the textbook, problems, worked solutions, tests (for self-assessment) and other electronic resources related to the text material. The purchase of the text from the UNSW Bookshop gives web access to the WileyPlus server for one year; it is possible to renew the web access on a yearly basis at a fee determined by the publisher. It is also possible to purchase just the web access to the electronic version of the textbook for one year. This can also be done at the UNSW Bookshop. Note that these WileyPlus electronic resources are provided by the publisher John Wiley, and **not** by the School of Mathematics and Statistics. Any difficulties that you might have with access to WileyPlus must be resolved directly with the publisher.

Salas & Hille is sold at the UNSW Bookshop. Course Packs and Computing Notes are sold through the UNSW Bookshop.

The Course Pack contains the following items:

- *Information Booklet for Semester 2 – replace with this Information Booklet for Summer session.*
- *Algebra Notes;*
- *Calculus Lecture Notes (for MATH1231/1241);*
- *Past Exam Papers Booklet.*

Booklets contained in the Course Pack will **not** be available separately from the School of Mathematics and Statistics. However the information in this booklet and the algebra and calculus problems can be accessed through the web from the MATH1231 module on the My eLearning Vista server. Information on accessing the My eLearning Vista server is given later in this booklet.

My eLearning Vista

The School of Mathematics and Statistics makes extensive use of the centrally provided electronic learning environment known as "My eLearning Vista". This information booklet, the algebra and calculus problems sets and computing information are all available via the appropriate course module on the My eLearning server. Access to this server is via any suitably configured web browser from any computer with an internet connection. The URL for My eLearning Vista is

http://vista.elearning.unsw.edu.au

and the School of Mathematics and Statistics web pages for Current Students also has a Quicklink to My eLearning Vista. From this page you will need to click the link "UNSW Online Courses", which takes you to another page where, after a warning about links to external sites, there is a "Log In" button to click. After clicking the Log In button you will be prompted for your User name (z immediately followed by your student number) and your Password, also known as your Unipass. Once logged in you will have a choice of modules for all your courses, including your current mathematics course. The home pages for all My eLearning Vista modules for First Year Mathematics courses have a similar structure, with links to "Important Information", "Course Materials", etc. The "Maths Info" is particularly important as this takes you to the log-in page of the Student Portal for the School of Mathematics and Statistics. Once through this gateway you have access to your mathematics assessment marks, including results of any class tests that may be available and your provisional end of semester mark. You also set your mathematics computing laboratory password from this portal.

Problem sets

Problems for Algebra are included in the Algebra Notes and problems for Calculus are included in the Calculus Notes.

Remember that Mathematics, like tennis, can't be learnt just by watching someone else do it. **The key to success is to work through all the problem sets in your own time.** To get the most out of tutorials, you should attempt the relevant problems (as indicated in the problem schedules) **before** the tutorial so that you know which problems you find difficult.

Computing

In addition to the Calculus and Algebra components, there is a Computing component in MATH1231. This is mainly interwoven with the Algebra component of the course. More information about the Computing component is given later in this booklet and in the booklet *Computing Notes For First Year Mathematics courses 2008.*

Assessment

The final raw mark will be made up as follows:

Algebra and Calculus class tests	20%
On-line Algebra and Calculus tests	4%
Laboratory Computing test (Maple)	8%
End of semester exam	68%

Note that:

- You will **not** be allowed to take a calculator into class tests or the end of semester exam. In the exam you will be provided with a CASIO fx-911w calculator but in class tests you will **not** be allowed to use a calculator at all.
- Tutors are expected to enter class test marks into the School's database within a fortnight of the test being sat. These marks are then available to you through the Student Web Portal accessed via the "Maths Info" link on the home page of MATH1231 on the UNSW My eLearning server. Quick access to My eLearning is obtained via the "My eLearning Vista" links on the School web pages or via the URL http://vista.elearning.unsw.edu.au. It is **your responsibility** to check that these marks are correct and you should **keep marked tests until the end of semester** in case an error has been made in recording the marks. If there is an error, either speak to your tutor or bring your test paper to the First Year Office as soon as possible but no later than Monday 2nd February 2009.
- Your final raw mark is scaled by the School of Mathematics and Statistics to produce your final mark. This is done so that the final distribution of marks is consistent with general university guidelines regarding the percentages of students with various grades, and to maintain consistent standards from year to year. A small committee of the teaching staff determines this final scaling.
- The end of session exam will be held on the morning of Wednesday, 4th February 2009. Details of the time and location will be announced in lectures and on My eLearning. The web page

  https://my.unsw.edu.au/student/academiclife/assessment/examinations/examinations.html

  has many useful links related to the running of UNSW examinations. In particular, you can find information about the CASIO fx-911W calculator.
- Be aware that a **final mark of 49 often means that the course has been failed and has to be repeated.** Therefore, it is very important that you attempt all tests.
- If your final mark is in the range 46-49 then you may be awarded the grade of "Pass Conceded" provided your average mark for all your courses is sufficiently high. This decision is not made by the School of Mathematics and Statistics.

- **Medicals will generally not be accepted for the computing test**. See section on "Computing Information".

Online Algebra and Calculus tests

Before the algebra and calculus tutorial class tests you must complete a simple online test that is designed to help you prepare for the tutorial tests. These tests are accessed via the web page

http://mapleta.elearning.unsw.edu.au/mapleta

A new online test will become available at 2pm on the Wednesday of the week preceding the week when the test is due. For MATH1231 the due dates for these online tests are

1pm on Wednesday of weeks 3, 4, 6 and 7.

Thus the tests become available on Wednesday in weeks 2, 3, 5 and 6 respectively, as shown in the table below.

	TP1 (cal)	TP2 (alg)	TP3 (cal)	TP4 (alg)
Online test available	2pm Wed wk 2	2pm Wed wk 3	2pm Wed wk 5	2pm Wed wk 6
Online test ends	1pm Wed wk 3	1pm Wed wk 4	1pm Wed wk 6	1pm Wed wk 7

Detailed information on how to use the online testing system is available from the MATH1231 course module on My eLearning in the "On-line Tutorial Tests" section of the "Course Materials" folder. In this section there is also a link, labelled Maple TA, to the web page where the tests are available. Despite the name "Maple" appearing in the link, these online tests are algebra and calculus tests and should **not** be confused with the **Maple computing** component of the course. To give you some familiarity with the online testing system a practice test will be available from week 1.

You will be allowed 3 attempts at each online test but only your best mark for each test will count. Then, the best 3 of these 4 marks, one from each online test, will contribute up to 4% of your final grade.

Note:

- the first test becomes available on Wednesday of week 2;
- each attempt at these tests must be your own work, but you are encouraged to discuss the methods required with other students;
- each version of a test will be slightly different, so don't just copy answers from one attempt to the next.

Class tests

Details of the dates and content of tests are given later in this booklet.

Note that

- **YOU MUST TAKE EACH TEST IN THE TUTORIAL TO WHICH YOU HAVE BEEN OFFICIALLY ALLOCATED.**
- To each test you must bring
  - your **Student ID** card

  - some blank A4 writing paper
  - a **stapler** (so that you can staple a cover sheet to your answers).

- Normal exam conditions apply in tests. In particular, you must not bring any kind of written material into the test and you must not try to get assistance from (or give assistance to) any other person.
- You will **not** be allowed to use a calculator in class tests.
- When your test answers have been marked and handed back to you by your tutor, don't try to change your answers or falsify the marks awarded — a student who tried to do this recently was penalised by being given a failure in the course.
- Your **best three scores** in the four tests will be counted towards your final assessment mark.

Interpretation of test results

The average mark for tests in MATH1231 is between 6 and 7 out of 10. Past experience is that students are likely to have difficulty passing this course if their average test mark is less than 5. If you find that your average after the first two tests is less than 5, you should talk to your tutors about your situation and what you can do about it.

Graduate Attributes

This course will provide you with a good working knowledge of Calculus and Linear Algebra, and show, through the lectures, how this mathematics can be applied in interdisciplinary contexts. Your skills in analytical critical thinking and problem solving will improve because of the illustrative examples used in lectures and because of the problem based tutorial classes. These mathematical problem solving skills, which are based on logical arguments and specific techniques, are generic problem solving skills that can be applied in multidisciplinary work. You will be encouraged to develop your communication skills through active participation in tutorials, and by writing clear, logical arguments when solving problems.

Academic misconduct

It is very important that you understand the University's Rules for the conduct of Examinations and the penalties for Academic Misconduct Guide. This information can be accessed through myUNSW at:

https://my.unsw.edu.au/student/academiclife/assessment/examinations/examinations.html.

In recent years there have been cases where severe penalties have been imposed for misconduct in relation to tests and exams in Mathematics courses.

Illness and other problems

If your performance in this course is affected by illness or other serious difficulties which are beyond your control, you can apply for Special Consideration and you may be offered the opportunity for Additional Assessment. See also the sub-section *Getting advice* on page 11.

In order to be offered Additional Assessment it is essential that you **follow exactly the procedures set out in the document entitled "Application for Special Consideration in First Year Mathematics Summer Session 2008-2009. "** A copy of this document is included in this booklet on page 12. You should read it carefully now and keep it for reference at the time when you actually need it. Each year there are some students who fail a course because they didn't follow these instructions. Take particular note that

- The School will **NOT** contact you to tell you that you have been granted Additional Assessment. It is **YOUR RESPONSIBILITY** to find this out by following the instructions in the document mentioned above.

- **If you have a poor record of attendance or performance during the semester you may be failed regardless of illness or compassionate grounds affecting the final exam.**

Note also that

- If illness affects your attendance at or performance in a **class test**, do **not** make an application for Special Consideration. Simply show a medical certificate to your tutor and this will be taken into account when calculating your final assessment mark.

- Transport delays and oversleeping will **not** be accepted as reasons for missing class tests. (But note that only your best three test results are counted for assessment.)

- Because it is possible to sit the computing tests on many days, **except in very unusual circumstances, medicals will not be accepted as excuses for not sitting the computing test.** Therefore, it is recommended that you book to sit at an early time.

- If you arrive too late to be admitted to the end of semester exam, go **immediately** to the Mathematics and Statistics First Year Office, Room 3072, Red Centre.

Past examinations

Recent exam papers, with their solutions, are included in a separate booklet in the Course Pack.

Information and handouts

Important announcements may be made in lectures. Handouts may be issued in lectures or tutorials. If you miss a lecture or tutorial, or arrive late for it, it is essential that you check whether you have missed any announcements or handouts. Spare copies of handouts will be available from pigeonholes near the Mathematics and Statistics School Office (Room 3070, Red Centre) for two weeks (unless they run out sooner than that).

Notices will be posted on noticeboards on Level 3 (near Room 3070) of the Red Centre. Also, important information will be posted as announcements on the relevent course module on My eLearning.

The First Year Office for the School of Mathematics and Statistics is located in Room 3072, Red Centre. It is open for student enquiries in the morning between 9:00am and 12:00 noon and in the afternoon between 2:00pm and 4:00pm.

School of Mathematics and Statistics Policies

The School of Mathematics and Statistics has adopted a number of policies relating to enrolment, attendance, assessment, plagiarism, cheating, special consideration etc. These are in addition to the policies of the University. Individual courses may also adopt other policies in addition to or replacing some of the School ones. These will be clearly notified in the Course Initial Handout and on the Course Home Page on the MathsStats web site. Students in courses run by the School of Mathematics and Statistics should be aware of the School and Course policies by reading the appropriate pages on the MathsStats web site starting at:

http://www.maths.unsw.edu.au/students/current/policies/studentpolicy.html

The School of Mathematics and Statistics will assume that all its students have read and understood the School policies on the above pages and any individual course policies on the Course Initial Handout and Course Home Page. Lack of knowledge about a policy will not be an excuse for failing to follow the procedures in it.

Course improvement

The School of Mathematics and Statistics has several mechanisms in place for regular review and improvement of First Year courses. One component of the review process is student feedback, generated either by the CATEI surveys or by direct contact from individual students or groups of students. Other elements of our course review processes include:

- feedback on program requirements from academics in other Schools and Faculties;
- regular rotation of lecturing staff teaching First Year courses to generate fresh and innovative approaches to the course content and structure;
- regular review of the quality of the tutors and tutorial problems.

A recent change, requested in several CATEI surveys, is the expansion of the previous "Outline calculus lecture notes" for MATH1131 and MATH1231 to a complete set of calculus notes, comparable to the well liked algebra lecture notes.

Getting advice

Your Algebra and Calculus tutors should be able to give you most of the advice you need on mathematical and administrative matters concerning MATH1231. If your problems are more serious, or haven't been resolved to your satisfaction, come to see me (Peter Blennerhassett) at Room 3072, Red Centre. I am happy to see you.

If you have general study problems or personal problems, don't just hope that they will go away — take advantage of the free and confidential help which is available within the university. The Learning Centre (Room 231 on Level 2 of the Library) provides individual consultations and workshops on study skills, time management, stress management, English language, etc. The Counselling Service (2nd Floor, East Wing, Quadrangle Building) offers the opportunity to discuss any issue which concerns you including academic problems, personal relationships, administrative hassles, vocational uncertainty, sexual identity and financial hardship. For more details, see the UNSW Student Guide.

Peter Blennerhassett
Director of First Year Studies
School of Mathematics and Statistics
fy.MathsStats@unsw.edu.au

APPLICATION FOR SPECIAL CONSIDERATION ON FIRST YEAR MATHEMATICS SUMMER SESSION 2008-2009

If you feel that your performance in, or attendance at, a final examination has been affected by illness or circumstances beyond your control, or if you missed the examination because of illness or other compelling reasons, you may apply for special consideration. Such an application **may** lead to the granting of additional assessment.

It is essential that you take note of the following rules, which apply to applications for special consideration in all first year Mathematics courses.

1. **Within 3 days** of the affected examination, or at least as soon as possible, you must **submit a request for special consideration to UNSW Student Central** (Lower Ground Floor, The Chancellery) **on a special form**, which is available from the Student Central. Please note that in cases of sickness both parts **A and B** of the application form must be completed and the School of Mathematics and Statistics **will not process** an application unless part B has been fully completed by an appropriate professional. In cases other than sickness, appropriate documentation must be supplied with the application.

2. **Within 3 days of the examination**, you must **contact the First Year Office in person** with copies of all the documentation which you submitted through Student Central.

3. **You will NOT be granted additional assessment in a course if your performance in the course** (judged by attendance, class tests, assignments and examinations) **does not meet a minimal standard**. A total mark of at least 40% on all assessment not affected by a request for special consideration will normally be regarded as the minimal standard for award of additional assessment.

4. It is **YOUR RESPONSIBILITY** to find out **FROM THE SCHOOL OF MATHEMATICS AND STATISTICS** whether you have been granted additional assessment and when and where the additional assessment examinations will be held. **Do NOT wait to receive official results from the university**, as these results are not normally available until after the Mathematics additional assessment exams have started. Information about award of additional assessment is available from the School of Mathematics and Statistics in the following ways:

   a) A **provisional** list of results in all Mathematics courses and of grants of additional assessment will be available via the Mathematics website by late **Wednesday 11th February 2009**.

   b) A **final** list of results and of grants of additional assessment will be available via the Mathematics website by late **Friday 20th February 2009**.

   c) On **Monday 2nd March 2009 ONLY**, you may telephone the School Office (9385 7111) to find out whether you have been granted additional assessment and where and when it will be held. **Note that examination results will not be given over the phone.**

5. The **timetables** for the additional assessment examinations will be available on the Mathematics website at the same time as the provisional list of results.

   The Summer session additional assessment examinations will be held on **Tuesday 3rd March 2009**.

6. If you have two additional assessment examinations scheduled for the same time, please consult the School of Mathematics and Statistics Office as soon as possible so that special arrangements can be made.

7. You will need to produce your UNSW Student Card to gain entry to additional assessment examinations.

IMPORTANT NOTES

- The additional assessment examination may be of a different form from the original examination and must be expected to be at least as difficult.
- If you believe that your application for special consideration has not been processed, you should immediately consult the Director of First Year Studies of the School of Mathematics and Statistics (Room 3072 Red Centre).
- If you believe that the above arrangements put you at a substantial disadvantage, you should, at the earliest possible time, send full documentation of the circumstances to the Director of First Year Studies, School of Mathematics and Statistics , University of New South Wales, Sydney, 2052.

In particular, if you suffer from a chronic or ongoing illness that has, or is likely to, put you at a serious disadvantage (or you have suffered misadventure of equivalent seriousness) then you should contact the Director of First Year Studies as soon as possible. In these circumstances it may be possible to arrange discontinuation without failure or to make special examination arrangements.

A/Professor R.S. Womersley
Head, School of Mathematics and Statistics

UNIVERSITY STATEMENT ON PLAGIARISM

Plagiarism is the presentation of the thoughts or work of another as one's own.[1] Examples include:

- direct duplication of the thoughts or work of another, including by copying work, or knowingly permitting it to be copied. This includes copying material, ideas or concepts from a book, article, report or other written document (whether published or unpublished), composition, artwork, design, drawing, circuitry, computer program or software, web site, Internet, other electronic resource, or another person's assignment without appropriate acknowledgement
  - paraphrasing another person's work with very minor changes keeping the meaning, form and/or progression of ideas of the original;
  - piecing together sections of the work of others into a new whole;
  - presenting an assessment item as independent work when it has been produced in whole or part in collusion with other people, for example, another student or a tutor; and,
  - claiming credit for a proportion a work contributed to a group assessment item that is greater than that actually contributed[2].

Submitting an assessment item that has already been submitted for academic credit elsewhere may also be considered plagiarism. The inclusion of the thoughts or work of another with attribution appropriate to the academic discipline does not amount to plagiarism.
Students are reminded of their Rights and Responsibilities in respect of plagiarism, as set out in the University Undergraduate and Postgraduate Handbooks, and are encouraged to seek advice from academic staff whenever necessary to ensure they avoid plagiarism in all its forms.
The Learning Centre website is the central University online resource for staff and student information on plagiarism and academic honesty. It can be located at:
www.lc.unsw.edu.au/plagiarism
The Learning Centre also provides substantial educational written materials, workshops, and tutorials to aid students, for example, in:

- correct referencing practices;
- paraphrasing, summarising, essay writing, and time management;
- appropriate use of, and attribution for, a range of materials including text, images, formulae and concepts.

Individual assistance is available on request from The Learning Centre. Students are also reminded that careful time management is an important part of study and one of the identified causes of plagiarism is poor time management. Students should allow sufficient time for research, drafting, and the proper referencing of sources in preparing all assessment items.

[1] Based on that proposed to the University of Newcastle by the St James Ethics Centre. Used with kind permission from the University of Newcastle.

[2] Adapted with kind permission from the University of Melbourne

ALGEBRA SYLLABUS AND LECTURE TIMETABLE

The algebra course for MATH1231 is based on chapters 6 to 9 of the Algebra Notes. Lecturers will not cover all of the material in these notes in their lectures as some sections of the notes are intended for reference and for background reading.

The following timetable is the basic timetable and syllabus which will be followed by MATH1231 algebra lecturers. Lecturers will try to follow this timetable, but some variations are inevitable.

Chapter 6. Vector Spaces

The aim of this section of the course is to introduce the general theory of vector spaces and to give some basic examples. The majority of examples will be for the real vector space $\mathbb{R}^n$, but occasional examples may be given for the complex vector space $\mathbb{C}^n$, as well as from vector spaces of polynomials.

Lectures 1 and 2. Introduction to vector spaces and examples of vector spaces (6.1). Properties of vector arithmetic (6.2).
Lecture 3. Subspaces (6.3).
Lectures 4 and 5. Linear combinations and spans (6.4). Linear independence (6.5).
Lectures 6 and 7. Basis and dimension (6.6).

Chapter 7. Linear Transformations

The basic aims of this section are to introduce the general theory of linear transformations, to give some geometric applications of linear transformations and to establish the close relationship between linear functions and matrices.

Lecture 8. Introduction to linear maps (7.1). Linear maps and the matrix equation (7.2).
Lecture 9. Geometrical examples (7.3).
Lecture 10. Subspaces associated with linear maps (7.4).
Lecture 11. Rank, nullity and solutions of $A\mathbf{x} = \mathbf{b}$ (7.4.3). Further applications (7.5).

Chapter 8. Eigenvalues and Eigenvectors

The aims of this section are to introduce the ideas of eigenvalue and eigenvector and to show some applications of these ideas to diagonalization of matrices, evaluation of powers of matrices and solution of simple systems of linear differential equations. Examples will be restricted to 2×2 matrices and very simple 3×3 matrices.

Lecture 12. Definition, examples and geometric interpretation of eigenvalues and eigenvectors (8.1).
Lecture 13. Eigenvectors, bases and diagonalization of matrices (8.2).
Lectures 14 and 15. Applications to powers of matrices and solution of systems of linear differential equations (8.3).

Chapter 9. Probability and Statistics

The main objective of this section is to introduce some of the ideas in mathematical probability and apply these concepts to discrete valued random variables and their associated probability distributions. Applications of two discrete probability distributions to commonly occurring issues are used throughout this chapter to illustrate the wide range of problems that can be tackled with simple, but careful probabilistic analysis.

Lecture 16. Introduction to probability via examples from recent events and classical problems (9.1).
Lecture 17. Revision of set theory (9.2). Mathematical probability (9.3.1, 9.3.2).
Lecture 18. Probabilities and probability rules, counting rules and associated problems, statistical independence (9.3.3–9.3.6).
Lecture 19. Conditional probability and Bayes' rule (finish 9.3). Discrete random variables (9.4). Mean and variance of a discrete random variable (9.4.1).
Lecture 20. Binomial distribution and applications (9.5.1, 9.5.2).
Lecture 21. Geometric distribution and applications, the Chebyshev inequality (9.5.3, 9.5.4).
Lecture 22. Estimating proportions, margin of error and applications (9.6)
Lecture 23. Review.

PROBLEM SETS

At the end of each chapter there is a set of problems. Some of the problems are very easy, some are less easy but still routine and some are quite hard. To help you decide which problems to try first, each problem is marked with an [**R**], an [**H**] or an [**X**]. The problems marked [**R**] form a basic set of problems which you should try first. Problems marked [**H**] are harder and can be left until you have done the problems marked [**R**]. You *do* need to make an attempt at the [**H**] problems because problems of this type will occur on tests and in the exam. If you have difficulty with the [**H**] problems, ask for help in your tutorial. The problems marked [**X**] are intended for students in MATH1241 – they relate to topics which are only covered in MATH1241.

There are a number of questions marked [**M**], indicating that MAPLE is required in the solution of the problem.

PROBLEM SCHEDULE

The main purpose of tutorials is to give you an opportunity to get help with problems which you have found difficult and with parts of the lectures or the Algebra Notes which you don't understand. In order to get real benefit from tutorials, it is essential that you try to do relevant problems *before* the tutorial, so that you can find out the areas where you need help. The following table is a guide as to the problems which you should try to do before each tutorial. Tutors will not strictly follow this schedule.

Week	Algebra problems
1	Chapter 6, 1–15
2	Chapter 6, 16–46
3	Chapter 6, 47–59, Chapter 7 1-12
4	Chapter 7, 13–30 (Test 1)
5	Chapter 7, 31–60
6	Chapter 8, 1–28
7	Chapter 9, 1–24 (Test 2)
8	Chapter 9, 24–52

CLASS TESTS AND EXAMS

Questions for the class tests in MATH1231 will be similar to the questions marked [**R**] and [**H**] in the problem sets. Since each class test is only twenty minutes in length only shorter straight forward tests of theory and practice will be set. As a guide, see the recent past class test papers (at the end of the Algebra notes).

Examination questions are, by their nature, different from short test questions. They may test a greater depth of understanding. The questions will be longer, and sections of the course not covered in the class tests will be examined. As a guide, see the recent past exam papers in the separate past exam papers booklet.

Algebra class test 1 will be given on Thursday in week 4 and will be based on suggested problems for weeks 1 to 3.

Algebra class test 2 will be given on Thursday in week 7 and will be based on suggested problems for weeks 4 to 6.

THEORY IN THE ALGEBRA COURSE

The theory is regarded as an essential part of this course and it will be examined both in class tests and in the end of year examination.

You should make sure that you can give DEFINITIONS of the following ideas:
Chapter 6. Subspace of a vector space, linear combination of a set of vectors, span of a set of vectors, linear independence of a set of vectors, spanning set for a vector space, basis for a vector space, dimension of a vector space.
Chapter 7. Linear function, kernel and nullity of a linear function, image and rank of a linear function.
Chapter 8. Eigenvalue and eigenvector, diagonalizable matrix.
Chapter 9. Probability, statistical independence, conditional probability, discrete random variable, expected value (mean) of a random variable, variance of a random variable, binomial distribution, geometric distribution, margin of error.

You should be able to give STATEMENTS of the following theorems and propositions.

Chapter 6. Theorem 1 of §6.3, Propositions 1 and 3 and Theorem 2 of §6.4, Proposition 1 and Theorems 2, 3, 4, 5 and 6 of §6.5, Theorems 1, 2, 3, 4, 5, 6 and 7 of §6.6.
Chapter 7. Theorems 2, 3 and 4 of §7.1, Theorem 1 and 2 of §7.2, Proposition 7 and Theorems 1, 5, 8, 9 and 10 of §7.4.
Chapter 8. Theorems 1, 2 and 3 of §8.1, Theorem 1 and 2 of §8.2.
Chapter 9. Theorem 2 of §9.3, Theorems 1, 2 and 3 of §9.4

You should be able to give PROOFS of the following theorems and propositions.

Chapter 6. Theorem 2 of §6.4, Theorems 2, 3 and 4 of §6.5, Theorem 2 of §6.6.
Chapter 7. Theorem 2 of §7.1, Theorem 1 of §7.2, Theorems 1, 5 and 8 of §7.4.
Chapter 8. Theorem 1 of §8.1.
Chapter 9. Theorems 2 and 3 of §9.4.

CALCULUS SYLLABUS FOR MATH1231 MATHEMATICS 1B

In this syllabus the references to the textbook are *not* intended as a definition of what you will be expected to know. They are just a guide to finding relevant material. Some parts of the subject are not covered in the textbook and some parts of the textbook (even in the sections mentioned in the references below) are not included in the subject. The scope of the course is defined by the content of the lectures and problem sheets. The approximate lecture time for each section is given below. References to the 8th and 10th editions of Salas & Hille are shown as SH8 and SH10.

	SH8	**SH10**
1. **Functions of several variables.** (2 hours)		
Contours and level curves, partial derivatives.	14.1-14.4	15.1-15.4
Mixed derivative theorem, increment estimation.	14.6	15.6
Chain rules, tangent planes.		
2. **Integration techniques.** (4 hours)		
Trigonometric integrals and reduction formulae.	8.3	8.3
Trigonometric and hyperbolic substitutions.	8.4	8.4
Rational functions and partial fractions.	8.5	8.5
Further substitutions.	8.6	8.6
3. **Ordinary differential equations.** (7 hours)		
Particular, general, explicit and implicit solutions.	18.1	
1st order equations: separable, linear, exact.	8.9, 18.2, 15.9	9.1, 9.2, 19.1, 19.2
Modelling with odes		9.1, 9.2
2nd order linear equations with constant coeffts: homogeneous, non-homogeneous (undetermined coeffts).	18.3, 18.4	9.3, 19.4
4. **Taylor series.** (7 hours)		
Taylor polynomials, Taylor's theorem. Application to stationary points.	11.5	12.6, 12.7
Sequences: convergence and divergence; combination of sequences.	10.2, 10.3	11.2-11.4
Series: partial sums; convergence;	11.1, 11.2	12.1, 12.2
kth term test for divergence; comparison and ratio tests;	11.1-11.3	12.3,12.4
alternating series (Leibniz' test); absolute and conditional convergence; rearrangement of series.	11.4	12.5
Taylor and Maclaurin series.	11.6	12.7
Power series; radius and interval of convergence; operations on power series.	11.7, 11.8	12.8, 12.9
5. **Applications of integration.** (3 hours)		
Average value of a function.	5.8	5.9
Arc length.	9.8	10.7
Arc length in polar coordinates.	9.5, 9.8	10.7
Area of surfaces of revolution.	9.9	10.8

PROBLEM SETS

The Calculus problems are located at the end of each chapter of the Calculus Notes booklet. They are also available from the course module on the My eLearning Vista server. Some of the problems are very easy, some are less easy but still routine and some are quite hard. To help you decide which problems to try first, each problem is marked with an [**R**], an [**H**] or an [**HH**]. A few problems are marked with an [**X**] for MATH1241 students.

All students should make sure that they attempt the questions marked [**R**]. The problems marked [**H**] or [**HH**] are intended as a challenge for students in MATH1231 as well as MATH1241. Some harder parts of [**R**] problems are marked with a star. Any problems which depend on work covered only in MATH1241 are marked [**X**].

Remember that working through a wide range of problems is the key to success in mathematics.

PROBLEM SCHEDULE

The main reason for having tutorials is to give you a chance to get help with problems which you find difficult and with parts of the lectures or textbook which you don't understand. To get real benefit from tutorials, you need to try the relevant problems *before* the tutorial so that you can find out the areas in which you need help. The following table shows the calculus problems which are relevant to each week's calculus tutorial. You should work on them at home or in the library between classes. Some of them will be worked through and discussed in the tutorials.

Week	**Calculus problems**	
	Chapter	Problems up to
1	1	17
2	2	14
3	2	22 (Test 1)
4	3	17
5	3	44
6	4	18 (Test 2)
7	4	42
8	4	49
8	5	13

CLASS TESTS AND EXAMS

Questions for the class tests in MATH1231 will be similar to the questions marked [**R**] and [**H**] in the problem sets. Since each class test is only twenty minutes in length only shorter straight forward tests of theory and practice will be set. As a guide, see the recent past class test papers (at the end of the Calculus Notes). The Calculus class tests will take place in tutorials in the following weeks:

Test 1 Thursday Week 3

Test 2 Thursday Week 6

The tests will cover sections of the syllabus as shown in the table below. The test questions will be similar to the questions labelled by [R] and [H] in the Calculus Problems. The table shows which problems are relevant to each test.

Test	Syllabus sections	[R] and [H] problems in
1	1 and up to 2.2	Chapter 1 and up to Q12 in chapter 2
2	2 and up to 3.8.1	Chapter 2 and up to Q31 in chapter 3

It is important to note that the class tests do not cover the whole syllabus.

Examination questions are, by their nature, different from short test questions. They may test a greater depth of understanding. The questions will be longer, and sections of the course not covered in the class tests will be examined. As a guide, see the recent past exam papers in the separate past exam papers booklet.

SCHEDULE OF ALL CLASS ASSESSMENTS

Lectures and tutorials run weeks 1–8, and the table below gives the schedule of online tests, class tests and computing assessments.

Week	Algebra	Calculus	Maple Computing
1			
2			
3		TP1, Test 1	
4	TP2, Test 1		
Christmas and New Year break			
5			
6		TP3, Test 2	Test in Laboratory
7	TP4, Test 2		
8			
End of session examination — morning of Wednesday 4th February 2009. Details announced in lectures and on My eLearning			

Examples of class tests are contained in the Algebra Notes and in the Calculus Notes booklet.

TP1, TP2, etc denote the weeks when the online tutorial preparation tests are due for completion. These online tests become available on the Wednesday of the preceding week.

COMPUTING INFORMATION

How much?

MATH1231 **there will be a test, in week 6, worth 8% of your final mark**, and there will be exam questions worth at least another 3% of your final mark. The Computing component depends on the other components and will require a knowledge of the appropriate Algebra and Calculus.

Aim

The aim of the Computing component is twofold.

- Firstly, you will use the Symbolic Computing Package called Maple to do some mathematics on the computer. This use of Maple is integrated with the Algebra and Calculus and is designed to enhance your understanding of the mathematics involved, as well as letting you use Maple as a tool to do the mathematics. You will find the skills you acquire and things you learn useful in many other subjects you study, both within and outside the School of Mathematics. Maple enables you to tackle larger, harder and more realistic mathematical problems as it can handle all the difficult algebra and calculus for you. Furthermore, learning some Maple introduces you to some of the basic ideas in computer programming.

- Secondly, you gain some familiarity with Linux, an operating system used widely in scientific computing.

Computing lab

The main computing laboratory for summer session is Room G012 of the Red Centre. You can get to this lab by entering the building through the main entrance to the School of Mathematics (on the Mezzanine Level) and then going down the stairs to the Ground Level. A second smaller lab is Room M020, on the mezzanine level of the Red Centre.

Accounts and passwords

If you had an account for computers in the Mathematics Labs in semester 1 or 2, you will continue to use the same account with the same password in summer session. If you have forgotten your password you will need to set it again using the "Maths Info" link on the course homepage in My eLearning Vista. If you didn't have an account in semester 1 or 2 then a new Mathematics computing account (with user name z followed by your student number, as in z3198765) is automatically generated for you and all you need to do is set the password for this account. Again, you set your Mathematics computing account password using the "Maths Info" link on the course homepage in My eLearning Vista. This password is only used in the Mathematics Lab and for your online algebra and calculus tests in Maple TA — your UniPass remains unchanged. If you have forgotten how to log in and use the lab computers help can be found in chapters 1–4 of the First Year Computing Notes and the School web site.

If you have problems with your account, you should go to Room M022 on the Mezzanine Level of the Red Centre between 1pm and 2pm on any weekday from Thursday of Week 1. You will need to show your student card.

Using other computers

NOTE: it is not necessary for you to buy Maple at any stage to complete any your mathematics courses at UNSW.

Maple is available for PCs and Macs and a copy of Maple may well be of great use to you throughout your studies at university. For detailed information on using Maple from home see Appendix A of the First Year Computing Notes.

WARNINGS

Misuse of computers is treated as Academic Misconduct and is a serious offence. Guidelines for acceptable conduct are in the Computing Notes.

The Mathematics Computer Labs can be heavily used so plan what you are going to do on the computer BEFORE you sit down at a PC — don't waste your time and other people's. Problems with your own (home) computer, internet service or the UNSW IT systems are not considered to be an excuse for missing tests or test deadlines. So you should PLAN AHEAD and not leave things until the last minute.

You should not use Maple to do your Algebra and Calculus tutorial problems (unless it is explicitly indicated) until you have understood the material thoroughly, as working through the problems is important for learning the material. Once the material is understood you can then use Maple to check your answers. You may also use Maple for other subjects.

Assessment

For MATH1231 there will be one computing test worth 8%. There will also be short questions on the end of semester exam worth about another 3%. This means that a total of up to 11% of the final mark in MATH1231 comes from computing.

The computing tests are run at a number of different times. If you miss your booked timeslot due to illness or other reasons beyond your control, you will be expected provide suitable documentation (such as a medical certificate), contact Dr Kress or Dr Blennerhassett as soon as possible and take the test in the next timeslot that you can attend. Tutors do not have permission to accept medicals for the computing test.

Jonathan Kress (Room 4102)
Lecturer in Charge
First Year Computing

Details of the test follow in the next pages.

MATH1231 LABORATORY TEST

Tests will be held in the Red-Centre computer lab G012 at various times during week 6.

You must make a booking to do the test at one of these times. Bookings must be made through the School of Mathematics and Statistics' Student Web Portal ("Maths Info" link on My eLearning). This should be available after week 4 of session. When you have logged on, follow the appropriate link to get instructions about how to make a booking. If you believe that all the proposed times will be impossible for you, inform the First Year Office immediately.

The test will be on the features of Maple which are covered in Chapter 5 and Chapter 7 of the Computing Notes.

You will NOT need to remember the exact syntax of each command because you will be provided with a hard copy of the Computing Notes in the test and you will also have access to an on-line copy of the Notes. However, you WILL need to practise for the test by working through the problems on the attached problem sheet. Don't just sit at home and work out commands which you think will work. It is essential that you try out your answers on the computer to check that they do work and to get practice at recognising and recovering from common mistakes such as omitting the colon in `:=` or forgetting to unassign a variable.

For each problem on the problem sheet, we have provided an answer which shows you what the final Maple output should be, but not the commands which you might use to get that answer. If you have difficulty doing one of these problems, ask for help from one of the computing consultants in the labs. **If your Maple worksheet crashes while you are working on the practice problems, please make a note of what you were doing at the time and inform one of the computing consultants.**

Note that **you will NOT be awarded any marks for a correct numerical or formula answer without appropriate Maple commands to generate that answer.** For example, if you are asked to differentiate x^2, the answer $2x$ will not get any marks unless it has been generated by an appropriate differentiation command. **Everything that can be done by Maple must be done by Maple.** For example, if you are asked to find the largest member of a set of integers then you must use a Maple command to find it — there will be no marks for looking at the set and picking out the largest member yourself. You must **never read a numerical value from one of Maple's output lines and type it back in as input to a later command**. You must use typed Maple commands and not the GUI (Graphical User Interface) functions such as menus obtained by right clicking on expressions. You should be able to 'run' all the commands in your worksheet by clicking the "!!!" button.

You will need to save your Maple worksheet before the end of the test, following the instructions on the test paper (see Computing Notes section 6.2.2). However, you must **tidy up your worksheet as you go** by deleting mistakes and unsuccessful attempts, so that the worksheet you submit shows only your final attempt at each question. **Make sure that you know how to go back and change a wrong command, how to insert a new input line among existing input lines and how to delete unwanted lines.** Practise doing these things when working through the practice problems.

Note that the Maple worksheet you produce in the test will be printed before marking and **only the first 10 pages will be marked.** Any additional pages will be discarded.

Also attached is a sample test. Try to do it in 40 minutes AFTER you have worked through all the practice problems

You will NOT be allowed to take any calculators or writing materials (pens, pencils, paper) into the test.

PRACTICE PROBLEMS MATH1231/1241

All answers must be EXACT, unless the question asks for a certain number of significant figures.

1. Find $\lim_{n\to\infty} n^{-k}$ where k is a real number greater than 1. *A*nswer: 0

2. Find
$$\frac{\partial^2}{\partial x \partial y}\left(x^2 y^2 e^{x^2+y^2}\right)$$
and apply `factor` to your answer.

   *A*nswer: $4xye^{(x^2+y^2)}(1+y^2)(x^2+1)$

3. Let $\mathbf{u} \in \mathbb{R}^{15}$ be the vector whose kth component, for $k = 1, \ldots, 15$, is k^2 and $\mathbf{v} \in \mathbb{R}^{15}$ be the vector whose kth component, for $k = 1, \ldots, 15$, is k^3. Use the command `seq` to generate these vectors and then evaluate, to 3 significant figures, the vector which is the projection of $\mathbf{u}$ onto $\mathbf{v}$.

   *A*nswer: [.0754, .603, 2.04, 4.83, 9.43, 16.3, 25.9, 38.6, 55.0, 75.4, 100., $-$ 130., 166., 207., 255.]^T

   [Note: you can use the Maple command `interface(rtablesize=15);` to tell Maple to display the elements of vectors of length 15.]

4. Given the three points $A(1,2,3)$, $B(1,-3,5)$ and $C(0,2,4)$, let

   $L1$ be the line through A and B and
   $L2$ be the line through C parallel to $(1,0,-2)$ and
   $P1$ be the plane through A, B and C and
   $P2$ be the plane through A with normal $(3,0,-1)$.

   Using the `geom3d` package, or otherwise:

   (a) Find, in degrees to 4 significant figures, the angle between $L1$ and $L2$. *A*nswer: 70.60 *degrees*

   (b) Find the distance between $L1$ and $L2$. *A*nswer: $\frac{5}{129}\sqrt{129}$

   (c) Use the `Equation` command to find a cartesian equation for $P1$ with coordinate names x, y, z. *A*nswer: $24 - 5x - 2y - 5z = 0$

   (d) Find a parametric expression for the line $L1$. (You can do this also with the `Equation` command). *A*nswer: $[1, 2-5t, 3+2t]$

   (e) Find a normal to $P1$. *A*nswer: $[-5,-2,-5]$

   (f) Find, in radians to 4 significant figures, the angle between $L1$ and the line $L3$ which forms the intersection of $P1$ and $P2$. *A*nswer: .1312

5. Let $S1$ be the sphere $x^2+y^2+z^2 = 1$ and $S2$ be the sphere with center $(1,2,3)$ and radius 3. Let C be the circle of intersection of $S1$ and $S2$ and let T be the centre of C. Find the coordinates of T and the distance from T to the centre of $S2$.

   *A*nswer: $\left[\frac{3}{14}, \frac{3}{7}, \frac{9}{14}\right]$, $\frac{11}{14}\sqrt{1}4$

6. (a) Find a partial fraction expansion for

$$\frac{3x^5 + 2x^4 + 6x^3 + 7x^2 + 3x - 8}{(x^2+1)^2(x^2-1)}.$$

Answer: $\frac{13}{8}\frac{1}{x-1} + \frac{11}{8}\frac{1}{x+1} + \frac{7}{4}\frac{1}{x^2+1} + \frac{13}{2}\frac{1}{(x^2+1)^2}$

(b) Use a Maple command to pick out the denominator of the third summand of the expansion in part (a). *Answer:* $4x^2 + 4$

7. (a) Find the solution $y(x)$ to the initial value problem

$$y' - xy - x^3y^2 = 0, \quad y(0) = 1/3.$$

Answer: $y(x) = \dfrac{1}{2 - x^2 + e^{(-\frac{1}{2}x^2)}}$

(b) For the y in part (a), find the value of $y''(0)$ and apply `simplify` to your answer. [Hint: `dsolve` does not actually create an expression called y — its output is an equation, not an expression. You will have to create y yourself, either by using `assign(%)` or by using `rhs(%)` to pick out the expression on the right of the equation.] *Answer:* $\frac{1}{3}$

8. Find the solution $y(x)$ to the initial value problem

$$x^2y'' - 2xy' + 2y = x, \quad y'(1) = y(1) = 0.$$

Answer: $y(x) = x^2 - x(\ln(x) + 1)$

9. Find the general solution to the differential equation

$$y'' + ky = 0$$

when k is a negative real number.

Answer: $y(x) = \_C1\, e^{\sqrt{-k\sim}\,x} + \_C2\, e^{-\sqrt{-k\sim}\,x}$

10. Find the largest positive member of the set

$$\{\, \sin k \mid k \in \mathbb{Z},\ 1 \le k \le 100 \,\}.$$

Answer: sin(33)

11. Let $p(x) = 1^2 + 2^2x + 3^2x^2 + 4^2x^3 + \ldots + 21^2x^{20}$

and $q(x) = 1^3 + 2^3x + 3^3x^2 + 4^3x^3 + \ldots + 21^3x^{20}$.

Find the coefficient of x^{21} in the product $p(x)q(x)$. *Answer:* 2456124

12. Define an abstract function f which takes two vectors $\mathbf{u}$ and $\mathbf{v}$ as its arguments and computes the projection of $\mathbf{u}$ onto $\mathbf{v}$. Apply your function to the vectors $\mathbf{u} = (1, 2, 3)^T$ and $\mathbf{v} = (3, 2, 1)^T$.

Answer: $\left[\frac{15}{7}, \frac{10}{7}, \frac{5}{7}\right]^T$

13. Define an abstract function f such that $f(x) = \sinh^{-1}(\cos(e^x))$ and use the D operator to evaluate, to 10 significant figures, the derivative of f at $x = 0$. *A*nswer: $-.7403212721$

14. a) Maple does not have a command to compute the nullity of a matrix but it does have commands `ColumnDimension` and `Rank`. Use these to define an abstract function which computes the nullity of a matrix. Apply your function to the matrix

$$\begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{pmatrix}.$$

*A*nswer: 1.

b) *Without performing row operations*, find a basis for the kernel of

$$A = \begin{pmatrix} 1 & 2 & 3 & 4 \\ 5 & 6 & 7 & 8 \\ 9 & 10 & 11 & 12 \\ 13 & 14 & 15 & 16 \end{pmatrix}.$$

*A*nswer: $\{[2, -3, 0, 1]^T, [1, -2, 1, 0]^T\}$

15. Use `coeff` and `seq` to create an abstract function f such that if p is a polynomial expression of degree n in the variable x then $f(p, n)$ is the list of coefficients of p, arranged in increasing order. Apply f to the polynomial $5 + x + 4x^2 + 2x^3 + 3x^4$. *A*nswer: $[1, 2, 3, 4, 5]$

16. Define an abstract function s such that if k and n are positive integers then $s(k, n)$ is the kth member of the standard basis in $\mathbb{R}^n$. [Hint: The members of the standard basis in $\mathbb{R}^n$ are the columns of the $n \times n$ identity matrix, which can be created using the `IdentityMatrix` command from the `LinearAlgebra` package.]

17. Let $\mathbf{a}$ be the vector $(1, 2, 3)^T$ and $\mathbf{b}$ be the vector $(4, 5, 6)^T$. Define an abstract function such that if $\mathbf{x}$ is a vector in $\mathbb{R}^3$ then

$$f(\mathbf{x}) = (\mathbf{a} \cdot \mathbf{x})\,\mathbf{a} + (\mathbf{b} \cdot \mathbf{x})\,\mathbf{b}.$$

Find the matrix (with respect to the standard basis in $\mathbb{R}^3$) for this function $f : \mathbb{R}^3 \to \mathbb{R}^3$. [This can easily be done in one line using the function s from question 16.]

*A*nswer: $\begin{pmatrix} 17 & 22 & 27 \\ 22 & 29 & 36 \\ 27 & 36 & 45 \end{pmatrix}$.

18. Compare the results of applying the commands `ifactor`, `ifactors` and `factorset` (which is in the `numtheory` package) to the number 96. If you are not sure about what is happening here, look at the online help for these commands.

a) Find the sum of the squares of the first seven (in increasing order of magnitude) of the distinct prime factors of 1 035 981 870. *A*nswer: 1026

b) Let L be the result of applying `ifactors` to 425 217 100. Without reading a numerical value and typing it back in, assign to a variable n the value of the *exponent* of the third factor (in increasing order of magnitude) in the prime factorization of 425 217 100. *A*nswer: 5

19. Read the online help for the `add` and `mul` commands to find out how you can use these commands to add up or multiply the members of a set or list without having to know how many items there are in the set or list. (Look at the second dot point in the help entry and at the fourth and fifth command lines in the examples at the end of the entry.)

    Define an abstract function which calculates the sum of the squares of the distinct prime factors of a given integer. Apply your function to 1 035 981 870. *A*nswer: 3356

20. Use a `for` loop to display, for $k = 1, 2, \ldots, 10$, the sum of the first 15 terms of the series

$$\sum_{n=1}^{\infty} n^k.$$

    *A*nswer: 120, 1240, 14400, 178312, 2299200, 30482920, 412420800, 5666482312, 78800938560, 1106532668200

21. The Fibonacci numbers are defined by $a_0 = a_1 = 1$ and

$$a_k = a_{k-1} + a_{k-2} \quad k \geq 2.$$

    Enter the values for $a[0]$ and $a[1]$ and then use a `for...while` loop to find the largest Fibonacci number smaller than 100.
    Suppress printing out of values of $a[k]$ while the loop is running and just display the value of the relevant Fibonacci number after the loop has finished.
    *A*nswer: 89

22. A simple iteration procedure with $a_0 = 0$ and $a_{n+1} = \exp(-a_n)$ for $n \geq 0$ is being used to find an approximate solution to the equation $x = e^{-x}$. Use a `for...while` loop to find the first value of a_n such that $|a_n - a_{n-1}| < 10^{-5}$. Display this value of a_n to 10 significant figures. (See Computing Notes section 7.20.1 for a useful example.) *A*nswer: .5671407814

23. Write a procedure which takes an integer n as input and returns $n^2/9$ if n is divisible by 3 and $(n^2 - 1)/3$ if n is not divisible by 3. Do NOT use the command `piecewise`. (You can make use of the fact that n is divisible by 3 if and only if n `mod` $3 = 0$.) Apply your procedure to $n = 363$ and $n = 364$.
    *A*nswer: 14641, 44165

UNIVERSITY OF NEW SOUTH WALES
SCHOOL OF MATHEMATICS AND STATISTICS

MATH1231/MATH1241 COMPUTING TEST

SESSION 2, 2008 SAMPLE VERSION A

INSTRUCTIONS

- **No calculators, pens, paper or writing materials of any kind are permitted**, but you will be provided with a copy of the Computing Notes.
- Start up a Maple session and open the worksheet `test.mw` using the Open option on the File menu or the Open Worksheet Icon. This worksheet has been prepared with comments separating it into sections for each question. You will then be able to save your session just by clicking on the save icon.
  Do not change the input mode from "Text" to "Math".
- In case your Maple session crashes, you should **frequently save your work** during the test, **by clicking on the save icon**.
- You may attempt the questions in any order, but each question must be attempted at only one place in the record of your session, NOT in a number of places interspersed with attempts at other questions. Work which is not labelled with the appropriate question number may not be marked.
- You will not be awarded any marks for a correct numerical or formula answer unless you have used **appropriate typed Maple commands** to generate that answer. Everything that *can* be done by means of typed Maple commands *must* be done by means of typed Maple commands. In particular, do NOT read numerical values from output lines and type them back in as input, or cut-and-paste output to input.
- **All answers should be EXACT**, unless the question asks you to find the answer to a certain number of significant figures.
- You must **tidy up your session** as you go by deleting mistakes and unsuccessful attempts, so that the session you submit shows only your final attempt at each question.
- **BEFORE THE END OF THE TEST** you must **print your session to a file** with the following steps.

  i) **Open** the `Print` window *either* by clicking on the printer icon in the tool bar of the Maple window *or* by selecting `Print` from the `File` menu.
  ii) **Tick** the "Print to File" box.
  iii) Click on the `Print` button at the bottom of the `Print` window.
  iv) **Click** on the `OK` button in the **Print to File** window

  You do NOT have to enter a file name or any other details in the `Print to File` window. You do NOT have to give any command to submit the saved file.
- *Before* closing your Maple session, open a local window and enter the command `gv out.ps`, which will open a window allowing you to check that your session has been saved correctly.
- At the end of the test you must **leave this test paper and the copy of the First Year Computing Notes behind.**

The test questions are on the back of this sheet.

Time allowed: 40 minutes

1. *(3 marks)*
   Let

$$\begin{aligned} p(x) &= x + 2x^2 + 3x^3 + \ldots + 12x^{12}, \\ q(x) &= (1+x^2)(2+x^2)(3+x^2)\ldots(6+x^2). \end{aligned}$$

   Find a partial fraction expansion for $p(x)/q(x)$ and use a Maple command to extract the numerator of the 5th summand in the partial fraction expansion.

2. *(3 marks)*

   (a) Find the solution $y(x)$ to the initial value problem

$$y' - xy + xy^2 = 0, \quad y(0) = \frac{1}{2}\,.$$

   (b) For the function y in part (i), find the value of $y''(1)$ to 10 significant figures.

3. *(4 marks)*
   A simple iteration procedure with $a_0 = 1$ and

$$a_{n+1} = 2 + \ln a_n, \qquad n \geq 0,$$

   is being used to find an approximate solution to the equation $\ln x = x - 2$. Use a `for...while` loop to find the first value of a_n such that $|a_n - a_{n-1}| < 10^{-5}$. Display this value of a_n to 10 significant figures. Do NOT allow Maple to display any of the earlier values of a_n.
   [Don't forget that you need to use `evalf` in stating conditions and you will probably need to assign values to both $a[0]$ and $a[1]$ before starting your loop.]

4. *(4 marks)*
   Given the three points $A(1,2,3),\ B(-2,3,4),\ C(1,3,2)$,
   let

   - $L1$ be the line through A and B,
   - $P1$ be the plane through C with normal $(1,-2,1)$,
   - $P2$ be the plane whose equation is $x + y + z = 1$,
   - $L2$ be the line of intersection of $P1$ and $P2$.

   Using the `geom3d` package, or otherwise:

   (a) Find (in radians to 10 significant figures) the angle between $L1$ and $L2$.

   (b) Find distance between $L1$ and $L2$.

One mark will be awarded for any one correct relevant Maple command.

LEAVE THIS PAPER BEHIND WHEN YOU ARE FINISHED

STUDENT-OWNED COMPUTERS FOR MATHEMATICS COURSES

The School of Mathematics and Statistics is committed to providing, through its own laboratories, all the computing facilities which students need for courses taught by the School. No student should feel the need to buy their own computer in order to undertake any Mathematics course. Nevertheless, the following information is provided for the benefit of those who may wish to use their own computer for work associated with Mathematics courses.

All of our courses have a My eLearning Vista presence, and it is there you should look for course materials or links unless your lecturer tells you otherwise. My eLearning Vista may be accessed from any computer with internet access; see their help files and pages for technical requirements and how to check whether your web browser is supported. Some courses may also make use of Maple TA for testing. If you use your own computer to access this system, you should have an up to date browser and java plugin.

The School of Mathematics and Statistics provides assistance to students using teaching software in its laboratories. It does not have the resources to advise or assist students in the use of home computers or in communication between home computers and university facilities. If you experience problems using your home computer in a School of Mathematics and Statistics course, you are advised to use the School's computing labs for your work.

Some software in the School's labs, for example Maple, has been configured for use in our labs. If you obtain your own version of software available in our labs, you may find that it appears to work differently. Since you may have to use our version of the software on the lab PCs during a test, you are advised to familiarise yourself with the setup in the Red-Centre labs.

SOME GREEK CHARACTERS

Listed below are the Greek characters most commonly used in mathematics.

Name	Lower case	Upper case	**Name**	Lower case	Upper case
Alpha	α		Nu	ν	
Beta	β		Xi	ξ	
Gamma	γ	Γ	Pi	π	Π
Delta	δ	Δ	Rho	ρ	
Epsilon	ϵ		Sigma	σ	Σ
Zeta	ζ		Tau	τ	
Eta	η		Phi	φ or ϕ	Φ
Theta	θ	Θa	Chi	χ	
Kappa	κ		Psi	ψ	Ψ
Lambda	λ	Λ	Omega	ω	Ω
Mu	μ				