

**THE UNIVERSITY OF NEW SOUTH WALES**  
**SCHOOL OF MATHEMATICS AND STATISTICS**

**MATH1011 Fundamentals of Mathematics B**

**INFORMATION BOOKLET**

**Semester 2 2009**



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# GENERAL INFORMATION FOR MATH1011

## Background

MATH1011, Fundamentals of Mathematics B, is a 6 units of credit first year course offered by the School of Mathematics and Statistics in semesters 1 and 2, and provides a good introduction to Calculus and Linear Algebra. MATH1011 is specified in such programs as Industrial design, but also provides an appropriate preparatory course for enrolment into MATH1131, Mathematics 1A, for those students who don't have a sufficiently good background for immediate enrolment in that course.

However, be aware that MATH1011 and MATH1131 cannot both count towards meeting the requirements of any degree. The excluded courses for MATH1011 are MATH1031, MATH1131, MATH1141, MATH1151, ECON1201 and ECON2291.

## Assumed knowledge

To enrol in MATH1011 it is assumed that you have the equivalent knowledge of a mark of about 70 in HSC Mathematics (2 unit). **It will be assumed that you have a good understanding of everything in the syllabuses for School Certificate Advanced Mathematics and HSC Mathematics(2 unit) and that you have well-developed skills in the basic techniques of high school mathematics.** If you feel that you don't have sufficient knowledge to successfully complete the course then you should seek advice from the mathematics staff or the First Year Office. You will probably be advised to discontinue and to enrol in the Mathematics Skills Program. This course begins in Week 1 of semester 1 and semester 2 and will give you the background to successfully complete Math1011 at a later date. Enrolment in the Mathematics Skills Program is possible up to the end of week 2.

## Aims

The aim of MATH1011 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. The exact syllabus is defined by the content of the lectures and tutorial problems.

The syllabus includes a computing component, based on the software package Maple, and you should develop sufficient facility with Maple to solve appropriate problems.

## 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 in the Algebra and Calculus booklets.

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 MATH1011 Course Pack.

## Teaching Strategies

MATH1011 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 and independently at understanding the solutions to the exercises.

Students are encouraged to give constructive feedback to 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 and Statistics has responded to student and staff concerns about plagiarism in assignments. Consequently, First Year Mathematics Courses are generally assessed by short class tests and a written examination.

The short class tests provide regular feedback to students. They also allow the course to be broken into smaller segments to facilitate learning.

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

## Contacting the First Year Office

The School of Mathematics and Statistics web-site

<http://www.maths.unsw.edu.au>

contains many pages of useful information on mathematics courses, school policies and how to obtain help, both academic and administrative. If you cannot find the answer to your queries on the web pages you are welcome to contact the First Year office directly.

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](mailto: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 improvement 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.

## Lecturers

Calculus lecturer	Mr Alex Davyskib	RC-3090	z3275950@science.unsw.edu.au
Algebra Lecturer	Mr Frank Reid	RC-3092	freid@maths.unsw.edu.au
Lecturer-in-charge of computing	Dr Teresa Bates	RC-6107	teresa@unsw.edu.au

For tutorial administration:

Mrs N. Narouz    The First Year Office    Room 3072, Red Centre

## Lecture Times

Lectures commence in week 1 and run to week 12 according to the following timetable.

Wednesday:

1-2	Algebra	OMB-149
2-3	Calculus	OMB-149

Friday:

1-2	Calculus	Mathews-D
2-3	Algebra	Mathews-D

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

## Tutorials

Students in MATH1011 are enrolled in two tutorials, one for algebra and one for calculus. The algebra tutorial is timetabled for the 2nd half of the week, whilst the calculus tutorial is scheduled for the 1st half of the week. Students are able to change their tutorials via myUNSW until the end of week 1, and after that time, they can only change their tutorials with the agreement of the First Year Office, RC3072. To change a tutorial you will need to provide proof of a timetable clash or work commitments.

Note that

- **ALL tutorials commence in Week 2** and continue to week 13;
- attendance at tutorials is compulsory and the roll will be called in tutorials;
- some tutorial classes may have to be amalgamated or created after the start of semester to maintain efficient tutorial sizes. If you are affected by any tutorial room changes you will be notified by an email to your official UNSW email account. During week 1 and 2 it is good practice to check your timetable regularly on myUNSW.

The main purpose of tutorials is to provide you with an opportunity to get help with any exercises 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 exercises **before** the tutorial so that you can find out the areas in which you have difficulties.
- Complete the online calculus tutorial preparation tests.
- 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 differentiation”.
- Be an active participant in tutorials, asking and answering questions rather than just sitting and watching.

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

## Computing

In addition to the Calculus and Algebra components, there is a Computing component in MATH1011. This is partly interwoven with the Calculus and Algebra components and partly independent of them. This computing component is constructed so that you teach yourself how to use the Maple software package to solve a selection of mathematical problems. The aim here is to give you experience in learning new (computational) techniques by yourself.

You should start work on the computing component in week 1, when there are no tutorials. There will be a computing laboratory demonstration class at

**4pm Thursday week 1 in the computing laboratory RC-G012A.**

Instructional videos on using the PCs in the School computing laboratory and other topics will also be available in the Computing folder in My eLearning Vista. More information about the Computing component and its assessment 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 Web 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.

Help using My eLearning in the School of Mathematics and Statistics can be found on the School's website at

[www.maths.unsw.edu.au/students/computing/studentwebctinfo.html](http://www.maths.unsw.edu.au/students/computing/studentwebctinfo.html)

## Textbooks

- J.C. Arya and R.W. Lardner, *Mathematics for the Biological Sciences*, Prentice-Hall.
- J.B. Fitzpatrick, *New Senior Mathematics — Three Unit Course for Years 11 and 12*, Heinemann.
- MATH1011 *Course Pack 2009*.

Arya & Lardner and Fitzpatrick are available at the UNSW Bookshop, as are the Course Packs. Note that booklets contained in the Course Pack will **not** be available separately from the School of Mathematics.

You may also find it helpful to refer to other HSC 2/3 Unit textbooks.

## Getting help outside tutorials

If you are having difficulty understanding the lectures or doing the suggested problems, always try to get help through your tutorials. In most cases there will be other students who are having the same difficulties and it is better to provide help to all at once rather than giving the same explanation to ten or twenty students individually outside class.

However, there may be occasions when there is not enough time to get your questions answered in a tutorial. In these cases you may be able to get some help outside tutorials. If your tutor is a full-time member of staff you can ask them for their room number and times when they are available to see students (many members of staff put a notice on their office door showing the times when they are available). Tutors who are not full-time members of staff are not required to be available outside tutorial class times and may not have offices in the School. To cover students whose tutor is not available, there is a roster which shows for each hour of the week a list of names of members of staff who are available at that time to help students in Fundamentals of Mathematics, Mathematics 1 and Higher Mathematics 1. This roster is displayed on the noticeboard near the Mathematics and Statistics School Office (Room 3070, Red Centre), outside the First Year Office (RC-3072) and also on the School's web-site via a link from the page

<http://www.maths.unsw.edu.au/students/current/help/studentconsult.html>

You can also avail yourself of the **Student Support Scheme**. This Scheme is financed by the School of Mathematics and Statistics and is staffed by later year mathematics students.

## Student Support Scheme

The Student Support Scheme (SSS) is a drop-in consultation centre where students can come for free help with certain first- and second-year mathematics courses. The type of help offered by the tutors of the SSS is either one-on-one assistance; or, at busier times, assistance in small groups. Students typically bring their partial solutions of mathematics coursepack questions to the SSS office. An SSS tutor then provides guidance and advice. The SSS office is located in **RC-3064**. During semester 2, 2009 the SSS has opening times from **10am–12noon** and **1pm–3pm** from **Mondays to Fridays**. The times are extended up to 3pm–4pm on Fridays.

The courses the SSS services in semester 2 will be MATH1011, MATH1041, MATH1131, MATH1231, MATH2019 and MATH2089. The schedule will be available on the SSS website at

<http://www.maths.unsw.edu.au/students/current/help/sss.html>

by the end of Week 1. Please remember that there is no appointment needed. Just drop-in and you will be able to obtain one-on-one help from SSS tutors.

## Recommended exercises

The detailed syllabuses for the Algebra and Calculus parts of MATH1011 appear on pages 15 and 16 of this booklet and are also included in the Algebra and Calculus Booklets. These syllabuses show exercises which you are recommended to do before each tutorial.

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 recommended exercises in your own time.** To get the most out of tutorials, you should attempt the relevant exercises **before** the tutorial so that you know which exercises you find difficult.

## Calculator Information

For end of semester UNSW exams students must supply their own calculator. Only calculators on the UNSW list of approved calculators may be used in the end of semester exams. This list is similar to the list of calculators approved for HSC examinations. BEFORE the exam period calculators must be given a "UNSW approved" sticker, obtainable from the School of Mathematics and Statistics Office, and other student or Faculty centres. The UNSW list of calculators approved for use in end of semester exams is available at

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

## Assessment

Your final raw mark will be made up as follows:

Class tests	20%
Computing test	5%
Calculus online preparation	5%
End of session exam	70%

Note that:

- You will **not** be allowed to use a calculator in class tests.
- 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 MATH1011 on the My eLearning server. It is **your responsibility** to check that these marks are correct and you should **keep marked tests and assignments until the end of session** 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 Friday 12th June.
- Your final raw mark will be scaled by the School of Mathematics and Statistics. This is done so that the final distribution of marks is consistent with general university guidelines.
- Be aware that a **final mark of 49 often means that the course has been failed.** Therefore, it is very important that you attempt all assessment tasks.

- If your final mark for MATH1011 is in the range 46–49 you may be granted a Pass Conceded (PC) for the course. This decision is not made by the School of Mathematics and Statistics. The rules governing the granting of the grade of PC are on the web page

[https://my.unsw.edu.au/student/academiclife/assessment/concession\\_algorithm.html](https://my.unsw.edu.au/student/academiclife/assessment/concession_algorithm.html)

## Online Calculus Preparation

Before each **calculus tutorial** you must complete a simple online test that is designed to help you prepare for the tutorial. These tests can be found on the MATH1011 My eLearning site. A new test will become available at 3pm on each Tuesday in weeks 1 to 11, and be due by 12 noon on Monday of the following week (i.e. before the first calculus tutorial of the week.)

You will be allowed 3 attempts at each test and your best 8 tests will contribute up to 5% of your final grade.

### Note:

- the first test starts in week 1 as preparation for the week 2 calculus tutorial;
- each attempt at these tests must be your own work, but you are encouraged to discuss the methods required with other students;
- each test presented to you will be slightly different, so don't just copy answers from one attempt to the next.

## Class Tests

The two calculus class tests are scheduled for weeks 5 and 9 whilst the two algebra class tests are scheduled for weeks 6 and 12. The tests will examine topics in the syllabuses as shown in the table below

Test	Lecture Topics
Calculus Test 1	Lecture topics from weeks 1 and 3 inclusive
Calculus Test 2	Lecture topics from weeks 4 to 7 inclusive
Algebra Test 1	Lecture topics from weeks 1 to 4 inclusive (simple complex arithmetic)
Algebra Test 2	Lecture topics from weeks 4 to 10 inclusive

Note that

- **Examples of previous class tests can be found in the back of the Calculus and Algebra Booklets.**
- You **must** be enrolled in an Algebra tutorial and a Calculus tutorial and you **must take every 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 MATH1011 is about 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

MATH1011 will provide you with an in-depth knowledge of topics in Calculus and Linear Algebra and show applications in interdisciplinary contexts through lectures and exercises. It will enhance your skills in analytical thinking and problem solving through illustrative examples in lectures and problem based tutorials. The course will also engage you in independent and reflective learning through your independent mastery of tutorial problems and Maple. The mathematical skills that you will develop are generic problem solving skills, based on logical arguments, 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 read and understand the University's Rules for the conduct of Examinations and the penalties for Academic Misconduct. 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. In order to be offered Additional Assessment it is essential that you **follow the procedures set out in the document entitled “Application for Special Consideration in First Year Mathematics Courses 2009.”** A copy of this document is included in this booklet. 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** necessarily 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. As a matter of course, you should regularly check your official University email address, which is:

**z(STUDENTNO)@student.unsw.edu.au**

- **If you have a poor record of attendance or performance during the session 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 to Student Central. 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.)
- If you arrive too late to be admitted to the end of semester exam, go **immediately** to the First Year Mathematics Office, Room 3072, Red Centre.

## Past examinations

A set of recent past exam papers and their solutions are included in a separate booklet.

## Information and handouts

Important announcements may be made in lectures. 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.

All important administrative announcements, especially those indicating a change to information contained in this booklet, are repeated as announcement on My eLearning. Further notices of an urgent nature may be emailed to students at their official UNSW email address.

## 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 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 Handout and Course Home Page. Lack of knowledge about a policy will not be an excuse for failing to follow the procedures in it.

## Getting advice

Your Algebra and Calculus tutors and lecturers should be able to give you most of the advice you need on mathematical and administrative matters concerning MATH1011. If your problems are more serious or of a different nature come to the First Year Office in Room 3072, Red Centre.

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 myUNSW website.

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

**APPLICATIONS FOR SPECIAL CONSIDERATION IN  
MATH1011, MATH1041 AND MATH1081 SEMESTER 2 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 rules 1, 2, 5 and 6, which apply to applications for special consideration in all first year Mathematics courses. Rules 3 and 4 apply to the above courses only.**

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. **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.
3. 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 “Maths Info” link in the My eLearning module for your course late on **Friday 20th November**.
  - b) A **final** list of results and of grants of additional assessment will be available via the “Maths Info” link in the My eLearning module for your course late on **Friday 27th November**.
  - c) On **Monday 30th November 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.**
4. 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 Semester 2 additional assessment examinations for the above courses will be held on the days **Tuesday 1st December to Thursday 3rd December**.

5. 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.

6. 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.

Professor A.H. Dooley  
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.<sup>1</sup> 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<sup>2</sup>.

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](http://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.

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<sup>1</sup>Based on that proposed to the University of Newcastle by the St James Ethics Centre. Used with kind permission from the University of Newcastle.

<sup>2</sup>Adapted with kind permission from the University of Melbourne

# Algebra Syllabus

Week	Lecture Topics	Tutorial Exercises for this week
1	Trigonometry Right triangles, sine and cosine rules, applications to 2 and 3 dimensional problems, radians, solution of $\sin x = k$ , introduction to inverse trig. functions, solution of $\sin^{-1} k = x$ , sketching trig. and inverse trig. functions)	<b>Introduction to Computing and Maple. RC-G012A</b>
2	Trigonometry (Trig. identities, exact trig. ratios, auxiliary angle and modelling with waves)	1.1 (1–20)
3	Vectors (introduction, application to displacement, problems, vector geometry, dot and cross products )	1.1 (21–36)
4	Polynomials and complex numbers (Remainder and factor theorems, polynomials with complex roots, arithmetic with complex numbers, modulus and argument, argand diagrams)	1.2 (1–19)
5	Complex Numbers (Polar form of complex numbers, powers, square roots, inequalities in $\mathbb{R}^2$ , sketching regions of the complex plane)	2.1 (1–11) 2.2 (1–7)
6	Matrices (matrix arithmetic, $2 \times 2$ -determinants, inverses, and applications )	2.2 (8–18)
7	Systems of Linear Equations (Gaussian elimination, back-substitution, and applications)	2.3 (1–3) 3.1 (1–8)
8	Counting (sizes of (finite) sets, addition law, inclusion/exclusion, multiplication law, arrangements and selections)	3.2 (1–16)
9	Continuing (Selections and Applications) Probability (introduction, addition and multiplication laws)	4.1 (1–14) 4.2 (1–3)
10	Probability (independent events, conditional probability) Sequences (Arithmetic and geometric)	4.2 (4–10) 4.3 (1–3)
11	Summation and induction (Summation notation, series, mathematical induction) Binomial Theorem	4.3 (3–11) 4.4 (1–9)
12	Binomial Theorem Revision	4.5 (1–10) 4.6 (1–6)
13	<b>No Lectures</b>	4.7 (1–7)

Tutorial exercise numbers refer to the Algebra Booklet in the course pack.

# Calculus Syllabus

Week	Lecture Topics	Tutorial Exercises for this week
1	Sketching Curves Without Calculus (Straight lines, quadratics, cubics)	<b>No tutorial</b> ; try the Revision exercises
2	Inequalities and Absolute Values (Sketching and solving)	1.1
3	Surds, Indices and Logarithms	1.2
4	Functions and Limits (Exponential, logarithm, properties of functions, brief intro. to inverses polynomial and trigonometric limits)	1.3 1.4 (1–3)
5	Calculus of Functions (Polynomials, trig. and inverse trig., exponential, logarithm, higher derivatives, product and quotient rules)	1.4 (4–5) 2.1
6	Calculus of Functions and applications (Chain rule, curve sketching)	2.2 2.3 (1–11)
7	Applications of Calculus (Maxima and minima, Newton's method)	2.3 (12–19) 2.4 (1–6)
8	Implicit Differentiation (Applications to motion and rates of change)	2.4 (7–11) 2.5
9	Modelling with the exponential function	2.6
10	Integration (Includes substitution, Riemann sums)	2.7
11	Areas under Curves (Definite Integrals and practical questions using Simpson's rule)	3.1, 3.2
12	Applications of Integration Revision	3.3 3.4 (1–9)
13	<b>No lectures</b>	3.4 (10–13) 3.5

Tutorial exercise numbers refer to the Calculus Booklet in the course pack.

# Computing in MATH1011

## Why computing?

MATH1011 covers many mathematical techniques that are useful in industrial design and in understanding and predicting the behaviour of physical systems. In order for you to become comfortable with these techniques, the problems presented in lectures and tutorials often involve only small data sets, few variables or simple functions.

The aim of the computing component of this course is to show you how you can use **computer algebra software** to apply the mathematics you have learnt to solve problems that would be very cumbersome to tackle by hand. In MATH1011, the software we will be using is called Maple. Even for relatively simple problems, Maple can be useful as it does not make simple arithmetic errors!

Whether or not you continue on in mathematics, the computing skills you learn with us should still be useful in your university studies and beyond because:

- Your experience with Maple will make it easier to learn other software packages.
- Many other Schools are starting to use packages like Maple.
- Symbolic computing techniques will be useful when you use mathematics in your future career.

UNSW has a policy that all students (no matter what program they are in) should be introduced to the basic techniques of computer use. For students in science and engineering programs, part of this requirement is met by the computing included in first year mathematics.

## What sort of computer or applications do I need?

The School of mathematics provides computing labs with everything you will need for computing in MATH1011 (see below). Most of the School's computers run Linux, and we encourage you to use these. There are also PCs running Microsoft Windows that you may use.

You can access material on My eLearning Vista (see page 5), including the Maple and pre-tutorial tests, and the School's website (see page 3) from almost any web browser anywhere. In addition, if you have your own recent copy of Maple, you will be able to work on Maple tests at home. Maple is available from the bookshop but you are **not** expected to buy your own copy.

**Note:** We recommend that you attempt the final test in one of the School's computer labs. If you have your own copy of Maple and wish to attempt the final Maple test from home, we cannot be responsible for the reliability of your computer and internet connection.

## What will I have to do and when?

In MATH1011 you will be required to complete an online Maple test which will make up 5% of your final grade. **There will also be at least one Maple question in the end of semester exam. The online Maple test will prepare you for the Maple question(s) in the exam.**

Questions will be presented to you via My eLearning, you will answer them using Maple and then submit your answers online. A mark and feedback will be available as soon as the test is completed.

An unlimited number of practice tests will be available from the beginning of the semester and you should score at least 5/10 in one of these before the end of week 8 to gain access to a declaration form and then the final test. By completing the declaration form you agree to attempt the final test without assistance from any other persons. You then have access to the final test. Once you have this access, and until 5pm on Friday at the end of week 12, you will be allowed 3 attempts at the final test. Your final mark will be the best mark from your 3 attempts. Each attempt at a

practice or final test will have a time limit of 1 hour. **Note:** Historically the most common mark for this test is 9 or 10/10.

All the information that you will need will be available on the MATH1011 My eLearning site (see page 5).

To prepare for this test, you should:

1. Attend the laboratory demonstration class “Introduction to Computing and Maple” at 4pm Thursday of week 1 in the lab RC-G012A.
2. Pay attention in lectures. There will be information on Maple in lectures early in the semester.
3. Work through the introductory material on My eLearning in your own time.
4. Continue to attempt Maple practice tests (on My eLearning) until you are confident with them. You should score at least 5/10 before the end of week 8 in order to be allowed to attempt the final test.

**WARNING:** Your answers to the final test must be your own work. You must not receive any help during an attempt at the final test.

## Getting started with computing in MATH1011

In week 1 there will be a lecture to introduce you to the School’s computing facilities, Maple and the online Maple test. You can continue to get help even after the introductory session in week 1. There is a wide range of self-help material in the computing pages in the MATH1011 module on My eLearning and this should be the place you check in the first instance.

A **computing consultant** will be available in Room G012 from at least 12noon to 3 pm every weekday until at least the end of week 9. There will be no computing consultants available during week 10 and only a reduced consultation roster in weeks 11 and 12. The consultant will be sitting at one of the **Consultant’s Terminals** at the front of the main blocks of PCs or helping people at their computers and wearing a bright yellow vest. If you have a problem with Maple, ask the consultant.

For all **Maple** problems (but not equipment faults, login problems and password problems) you should see the consultant, or see your tutor if it is a problem with the mathematics involved.

**Equipment faults, login problems and password problems** should be notified to the operators at the **Help Desk** (the window in Room M020). Please note that the operators and other staff of the Computer Centre are NOT available to act as computing consultants. They are not experts in Maple.

If all else fails, contact or send an email to the Lecturer in Charge of MATH1011 Computing, Dr. Teresa Bates (Red Centre Room 6107), email [teresa@unsw.edu.au](mailto:teresa@unsw.edu.au).

## Computing Facilities

A detailed description of the computing facilities in the School of Mathematics and Statistics is available via documents linked from the web page

<http://www.maths.unsw.edu.au/students/computing/fycompnotes.html>

These documents are also available from within the Linux desktop (see page 21). Here we describe only those features needed for MATH1011.

## The computing laboratories

The School of Mathematics runs 2 Undergraduate Student Laboratories, containing a network of approximately 150 personal computers (PCs) which run either the Linux or Microsoft Windows operating system (see below). It does not matter which PC you use at any particular session, they all behave the same way.

The School's laboratories are in rooms G012 and M020 of the Red Centre. Room M020 is through the glass door (and along the corridor) opposite the Mathematics entrance to the Red Centre. Room G012 is down the stairs from the main entrance, and is split into three sections "A", "B" and "C". The "A" and "C" sections also provide data projection facilities and are therefore not always available for general use. The "C" section (which is immediately to your left as you enter the lab) is made up of Microsoft Windows computers and mostly used in the teaching of Statistics subjects.

The following table describes the labs:

**M020** has 40 dual boot (Linux/Windows) PCs available for your use except when booked for a class.

**G012A** has 35 Linux terminals, and is often booked for teaching sessions.

**G012B** has 40 Linux terminals and is normally available for general use.

**G012C** has 40 Windows terminals, and is often booked for teaching sessions.

Check the door of G012 to find out when G012A or G012C is booked.

These laboratories also have 2 **printers** each. You can use them, but note that there is a **limit** on the number of pages that you may print and so you should not print large documents. For details of the printing quota system, see

[www.maths.unsw.edu.au/students/computing/studentprinting.html](http://www.maths.unsw.edu.au/students/computing/studentprinting.html)

## Hours of Opening

The laboratories will normally be open as follows:

	<b>M020</b>	<b>G012</b>
During semester: Monday to Friday	9.00 am to 9 pm	9 am to 9 pm
<b>Week 10</b> Monday to Friday	9.00 am to 9 pm	<b>Closed</b>
Saturdays, Sundays	Closed	Closed
During holidays: Monday to Friday	9 am to 9 pm	Closed
Public holidays and Weekends	Closed	Closed.

Any changes to these times will be posted on the door of Room M020.

Remember that there will always be unscheduled periods when the computers are not working because of equipment problems and that this is not a valid excuse for not completing tests on time.

## Using the computers

### Passwords

Both My eLearning and the School of Mathematics student web portal require your UNSW user-name (z followed by your student number, e.g. z3900007) and UniPass to log in.

For the computers in the School of Mathematics labs your username is the same as for My eLearning, but a different password is used. Before you can log on to the lab computers, you must set your **Mathematics Lab Password**. To do this, log on the the School of Mathematics **student web portal** (see page 5), and follow the link provided there. This process only alters you lab password — your UniPass remains the same and you should continue using your UniPass to log in to My eLearning and the web portal.

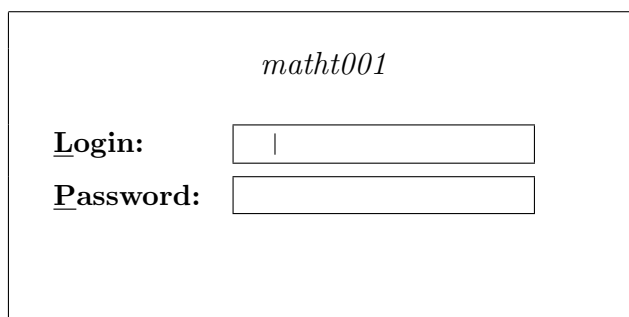
*Note: You can change your lab password at any time using the student web portal. This is particularly useful if you forget your lab password.*

Before creating or changing your password, take care about its choice. It should be a string of 6 to 8 characters (i.e. printable symbols from the main section of the keyboard). You should choose a string of characters which is easy to remember but does NOT form a word which is in any dictionary or a proper name such as Felicity. Note that upper and lower case letters are treated as different letters and it is best if your password contains both upper and lower case letters along with some non-letter characters. Some things which you could include in your password are: two words strung together, a misspelt word or the initial letters of the words of some memorable sentence.

*Remember that YOU ARE RESPONSIBLE FOR YOUR ACCOUNT, and any misuse of it by you or anyone else (for example, using the account for anything not related to your mathematics subjects) will be treated as a case of Academic Misconduct. DO NOT GIVE YOUR PASSWORD TO ANYONE ELSE. You must NOT write your password down anywhere where it can be identified with your student number. If you think someone has found out what your password is, change it immediately.*

## Logging in to a Linux machine

When you first sit down at a School computer running Linux the screen should have a dark background with a small lighter section (a **window**) in the middle of the screen similar to the following (anything else in this screen can be ignored):



The image shows a terminal window with a dark background and a lighter rectangular area in the center. At the top of the window, the text "matht001" is displayed. Below this, there are two prompts: "Login:" followed by a single-character input field containing a vertical bar "|", and "Password:" followed by a longer empty input field.

(If the screen is totally blank, move the mouse a little and the window should appear.)

If the screen does not have this window, you may need to find a different machine.

Type your user name and press the key marked Enter. Then enter your Mathematics Password and you will be logged in.

Note that all student accounts will be preserved from one semester to the next, with the same password and this will apply throughout your time at UNSW. However, if there is a semester in which you do not take a Mathematics course your account will be deleted. You will be warned about this via an email to your University account in time to take any necessary steps to preserve your data.

## A common login problem

*“Although I try several times, the computer will not accept my password.”*

Check that you are using the correct password.

Also check that you are using the Shift and Caps Lock keys correctly. In particular, do not use Caps Lock for isolated capital letters.

If there are no capital letters in your password, check that the Caps Lock key was not left on by the previous user.

If all else fails, go to the Help Desk, which is open between 9 am and 5 pm on any weekday.

## Using the Linux Desktop

The Linux interface is known as **KDE**, which stands for K Desktop Environment. It is designed to work in a manner very similar to Microsoft Windows. It is assumed that a windows like environment will be familiar to you.

If you are not familiar with a Windows like computing environment you should consult the “Computing Laboratories Information” notes used by students of MATH1131/1141. These are available for purchase or on the School’s website (follow the link from [www.maths.unsw.edu.au](http://www.maths.unsw.edu.au) marked “Current Students” and then under the heading “Computing” is a link to “Computing information for first year”).

## Programs and windows

Along the bottom of the screen is the **taskbar**. The buttons on the left of this bar can be used to start programs. In MATH1011 you will probably only need the Maple and Iceweasel (Firefox) (a web browser) icons. To the right of this is an area that lists all the windows you have opened, including those that have been **minimized**. This is very useful if you can’t find a window that you think should be there — it may be underneath other windows or minimized — but you will be able to find it here.

Windows on the desktop have a border, title bar and buttons that act in a similar way to those found on Microsoft Windows. Experiment with these so you are familiar with them before you attempt your final test! If you are not sure what some feature on the desktop does, hold the mouse over it and see if a short explanation pops up.

Some important icons on the task bar are:



a menu with many applications and controls. Similar to the “Start Menu” in Microsoft Windows.



the Iceweasel (Firefox) Web Browser. You can access My eLearning, for example, by entering [vista.elearning.unsw.edu.au](http://vista.elearning.unsw.edu.au) in its location bar.



zMail (UniMail)



Maple



File Manager



OpenOffice



Logout

## IMPORTANT

Our computers are designed to be left on and you will never need to switch one off.

**NEVER SWITCH THE COMPUTER OFF.**

If you are really stuck and nothing seems to be working on your keyboard, report this at the Help Desk.

**DO NOT FORGET TO LOGOUT**

## Code of Conduct

The School of Mathematics reserves the right to monitor all use of its computer systems, and to share the monitoring results with the relevant law enforcement authorities. You should read the School's policy on the use of School computing equipment. It is available of the web at

[www.maths.unsw.edu.au/students/computing/studentcomcode.html](http://www.maths.unsw.edu.au/students/computing/studentcomcode.html)

A link to the university's Code of Conduct can be found on this page.

**The computing facilities provided by the School of Mathematics must only be used for doing tasks and assignments related to the mathematics subject(s) for which your computing account has been created.**

Misuse of computers is a serious offence and will be treated as a case of academic misconduct. This includes damage to or theft of any part of the equipment, however small. A breach of security will be treated as a case of serious academic misconduct. Breach of security includes but is not limited to

- deliberately providing a password to another person (student or otherwise);
- attempting to gain unauthorised access to files within the system ("hacking");
- deliberately introducing computer viruses;
- copying of assignments (by email or any other means).

Electronic mail (**email**) facilities are provided by the University so that you can communicate with lecturers and tutors. All use of email is monitored and action will be taken against anyone who makes excessive use of email or uses it to send annoying, obscene, sexist or racist messages to other users or to engage in academic misconduct. For further details, see the University's Code of Conduct.

Internet and other electronic communication services are provided to allow you to access our computer from other parts of the campus and from home and to transfer assignments which have been completed on other computers. These services are NOT provided so that you can access other computers to play games or indulge in other activities not related to university studies. All electronic communications using the School's facilities are monitored to ensure that these facilities are being used in a responsible manner.

At the beginning of the semester, an **account** is made for you on the computer. This gives you, among other things, enough disk space to allow you to do your allocated tasks and assignments and nothing else should be stored. The system administrator may remove any files which are not associated with University work.

These restrictions are imposed because computing time and memory are limited and there are real costs involved in providing off-campus access. There are thousands of other users of the system

(over 5000 students have accounts) and we all have to live and work together. You are expected to be *considerate to other users* and this is the “bottom line” when it comes to acceptable behaviour. If you have any doubts about whether an action is acceptable, don’t do it.

## Health and Safety Issues

Students should be aware that using a keyboard or performing any repetitive task for a long uninterrupted period may be associated with physical discomfort and/or muscular or other injury. To lessen the risk of such problems, a break from typing should be taken at regular intervals, a good body position adopted, wrists should be kept straight as much as possible and not rested on a sharp edge.

If you feel pain, numbness, tingling, weakness, cramping, or stiffness in your hands, wrists, arms, shoulder, neck, or back, see a qualified health professional. For further information see the web site

<http://www.facilities.unsw.edu.au/FOHS>

or email [ohsreport@maths.unsw.edu.au](mailto:ohsreport@maths.unsw.edu.au) or contact the School of Mathematics and Statistics General Office.

Maple is a registered trademark of Waterloo Maple Inc.

Microsoft Windows is a registered trademark of the Microsoft Corporation.

## SOME BASIC FORMULAS

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$\theta$ in radians	0	$\frac{\pi}{6}$	$\frac{\pi}{4}$	$\frac{\pi}{3}$	$\frac{\pi}{2}$	$\pi$	$\frac{3\pi}{2}$	$2\pi$
$\theta$ in degrees	0	30	45	60	90	180	270	360
$\sin \theta$	0	$\frac{1}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$	1	0	-1	0
$\cos \theta$	1	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$	0	-1	0	1
$\tan \theta$	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$	$\infty$	0	$\infty$	0

### Basic Identities

$$\cos^2 x + \sin^2 x = 1$$

$$1 + \tan^2 x = \sec^2 x$$

$$1 + \cot^2 x = \operatorname{cosec}^2 x$$

$$\tan x = \frac{\sin x}{\cos x}$$

### Addition and Subtraction Laws

$$\cos(A + B) = \cos A \cos B - \sin A \sin B$$

$$\cos(A - B) = \cos A \cos B + \sin A \sin B$$

$$\sin(A + B) = \sin A \cos B + \cos A \sin B$$

$$\sin(A - B) = \sin A \cos B - \cos A \sin B$$

$$\tan(A + B) = \frac{\tan A + \tan B}{1 - \tan A \tan B}$$

### Double Angle Formulae

$$\cos 2A = 2 \cos^2 A - 1 = 1 - 2 \sin^2 A$$

$$\sin 2A = 2 \sin A \cos A$$

$$\tan 2A = \frac{2 \tan A}{1 - \tan^2 A}$$

## 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	$\alpha$		Nu	$\nu$	
Beta	$\beta$		Xi	$\xi$	
Gamma	$\gamma$	$\Gamma$	Pi	$\pi$	$\Pi$
Delta	$\delta$	$\Delta$	Rho	$\rho$	
Epsilon	$\epsilon$		Sigma	$\sigma$	$\Sigma$
Zeta	$\zeta$		Tau	$\tau$	
Eta	$\eta$		Phi	$\varphi$ or $\phi$	$\Phi$
Theta	$\theta$	$\Theta$	Chi	$\chi$	
Kappa	$\kappa$		Psi	$\psi$	$\Psi$
Lambda	$\lambda$	$\Lambda$	Omega	$\omega$	$\Omega$
Mu	$\mu$				

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Basic integrals

$$\int x^a dx = \frac{1}{a+1} x^{a+1} + C, \quad a \neq -1$$

$$\int \frac{1}{x} dx = \ln |x| + C = \ln |kx|, \quad C = \ln k$$

$$\int e^{ax} dx = \frac{1}{a} e^{ax} + C$$

$$\int a^x dx = \frac{1}{\ln a} a^x + C, \quad a \neq 1$$

---

$$\int \sin ax dx = -\frac{1}{a} \cos ax + C$$

$$\int \cos ax dx = \frac{1}{a} \sin ax + C$$

$$\int \sec^2 ax dx = \frac{1}{a} \tan ax + C$$

$$\int \operatorname{cosec}^2 ax dx = -\frac{1}{a} \cot ax + C$$

---

$$\int \tan ax dx = \frac{1}{a} \ln |\sec ax| + C$$

$$\int \cot ax dx = \frac{1}{a} \ln |\sin ax| + C$$

$$\begin{aligned} \int \sec ax dx &= \frac{1}{a} \ln |\sec ax + \tan ax| + C \\ &= \frac{1}{a} \ln \left| \frac{1 + \tan \frac{ax}{2}}{1 - \tan \frac{ax}{2}} \right| + C \end{aligned}$$

$$\begin{aligned} \int \operatorname{cosec} ax dx &= \frac{1}{a} \ln |\operatorname{cosec} ax - \cot ax| + C \\ &= \frac{1}{a} \ln \left| \tan \frac{ax}{2} \right| + C \end{aligned}$$

---

$$\int \sinh ax \, dx = \frac{1}{a} \cosh ax + C$$

$$\int \cosh ax \, dx = \frac{1}{a} \sinh ax + C$$

$$\int \operatorname{sech}^2 ax \, dx = \frac{1}{a} \tanh ax + C$$

$$\int \operatorname{cosech}^2 ax \, dx = -\frac{1}{a} \coth ax + C$$

$$\int \frac{dx}{a^2 + x^2} = \frac{1}{a} \tan^{-1} \frac{x}{a} + C$$

$$\int \frac{dx}{a^2 - x^2} = \frac{1}{a} \tanh^{-1} \frac{x}{a} + C, \quad |x| < a$$

$$= \frac{1}{a} \coth^{-1} \frac{x}{a} + C, \quad |x| > a > 0$$

$$= \frac{1}{2a} \ln \left| \frac{a+x}{a-x} \right| + C, \quad x^2 \neq a^2$$

$$\int \frac{dx}{\sqrt{a^2 - x^2}} = \sin^{-1} \frac{x}{a} + C$$

$$= -\cos^{-1} \frac{x}{a} + C + \frac{\pi}{2}, \quad |x| \leq a$$

$$\int \frac{dx}{\sqrt{x^2 + a^2}} = \sinh^{-1} \frac{x}{a} + C$$

$$= \ln(x + \sqrt{x^2 + a^2}) + (C - \ln a)$$

$$\int \frac{dx}{\sqrt{x^2 - a^2}} = \cosh^{-1} \frac{x}{a} + C, \quad x \geq a > 0$$

$$= \ln(x + \sqrt{x^2 - a^2}) + (C - \ln a)$$

$$\int \frac{dx}{x\sqrt{x^2 - a^2}} = \frac{1}{a} \sec^{-1} \frac{x}{a} + C$$

$$= \frac{1}{a} \cos^{-1} \frac{a}{x} + C, \quad |x| \geq a > 0$$

$$\int \frac{dx}{x\sqrt{a^2 + x^2}} = -\frac{1}{a} \sinh^{-1} \frac{a}{x} + C$$

$$= -\frac{1}{a} \ln \left| \frac{a + \sqrt{a^2 + x^2}}{x} \right| + C$$

$$\int \frac{dx}{x\sqrt{a^2 - x^2}} = -\frac{1}{a} \cosh^{-1} \frac{a}{x} + C, \quad 0 < x \leq a$$

$$= -\frac{1}{a} \ln \left| \frac{a + \sqrt{a^2 - x^2}}{x} \right| + C$$