Introductory Mathematics 2 (11.ILB2)

1 Introduction

This course (Introductory Mathematics 2) follows on from Introductory Mathematics 1. Much of the course is concerned with an introduction to differential calculus. There are also units on logarithms and vectors. All of the material that you need for this course is included in the printed notes and the web site. Details of how you should use this information is given in the section *How the Course Works*. It is important for you to make use of the lectures and tutorials and for you to work steadily through the material in the notes. We hope that you will find the course of value and that you will enjoy it.

2 Lectures and Tutorials

Each week each student should attend two lectures and one tutorial. Lectures are on Mondays at 2.15 in LT3 and Thursdays at 12.15 in LT1 and tutorials are on Tuesdays at 11.15 in DB113 and Thursdays at 11.15 in EM182.

- 3 This Term's Package
- Units
 - 8. Logarithms and Exponentials
 - 9. Differentiation 1
 - 10 Differentiation 2
 - 11 Differentiation 3
 - 12 Vectors
- Answers and full solutions to exercises for each unit.
- Answers to extra exercises for each unit.
- 2002 and 2003 examination papers
- Formula sheet

Note that the same formula sheet is provided in the final exam.

4 Timetable

Week 1	Logarithms and Exponentials
Week 2	Differentiation 1
Week 3	Differentiation 2
Week 4	Differentiation 3
Week 5	Differentiation 3
Week 6	Vectors
Week 7	Vectors
Week 8	Revision
Week 9	Revision
Week 10	Examination

5 How the Course Works

The course notes give all of the information that you will need to complete the course. The course is organised into five units. Your weekly schedule is listed in the timetable section. Each week you should work through the unit specified. You must read your lecture notes in an active way: with pen and paper to hand. After reading through the worked examples and solutions it is a good idea for you to work through the examples yourself (with the solution covered up).

At the end of each section attempt the exercises. It is important to try these questions: mathematics is not a passive activity, and it is learnt by making attempts, succeeding, and sometimes failing. Some people worry about getting stuck, especially when the ideas are new, but being stuck is an honourable state, and an unavoidable one. Getting unstuck usually means you have learned something worthwhile (perhaps only to be a bit smarter next time). Answers to each of the problems are given at the end of the unit. Full solutions are given in a separate section at the end of the course notes. For each unit more exercises are given in the 'Further Exercises' section at the end. These give additional questions for you to practice with. There is no need to complete this section on the first pass.

You may have covered some of the material in other courses. The methods given in the notes might be different to those you have used before. Do not feel that you have to use the techniques presented. If your method works, then continue to use it. The lectures will give an overview of each unit and clarify what is required, while the tutorials give students the opportunity to obtain help on the coursework.

Most of the printed material given out in lectures will be available from the module's website. You can access this by going to www.macs.hw.ac.uk/~jphillips

6 Examination

There is a 2 hour examination in the final week of term 2. The examination mark will form 100% of the assessment of the module. Specimen examinations will be included with the notes. Note that the formulae sheet is provided in the final exam.

7 Books

The course notes give all of the information that you will need to complete the course. However you may find it useful to refer to a textbook, for extra study and more examples to follow. You certainly do not have to buy a book immediately, and you should be able to complete the course successfully without using one. Each book will suit different students, so we give a brief summary of some possible books below. This is not an exhaustive list, many other books that you may have access to will also be useful.

Core Maths for A level. Bostock and Chandler, Stanley Thomes 1990, £15.45. This covers the course well, though some of the examples are a bit too complicated.

Countdown to Mathematics, Volume 2. Lynne Graham and David Sargent, Open University Press, £10.95. This is useful for students who need to consolidate elementary mathematical techniques.

Advanced GNVQ Engineering Mathematics, Volume 1. J.C. Yates, Macmillan 1995, £13.99. Covers almost all of the material in this course, obviously geared towards engineers, but generally useful.

Foundation Maths. Croft and Davison, Longmans, £11.99. This covers most of the earlier material in a reasonable way, but some of the more advanced topics are not covered.

Introductory Mathematics For The Life Sciences. Taylor and Francis, £13.95. This is probably the book to buy if you are in the Biological Sciences.

8 Contact Points

Mr. John Phillips is the course organiser. You can contact John directly on 0131 451 4376 or by email : j.phillips@hw.ac.uk. His office is ME2.16.

Trignometrical Formulae

sin(A + B) = sin A cos B + cos A sin Bsin(A - B) = sin A cos B - cos A sin Bcos(A + B) = cos A cos B - sin A sin Bcos(A - B) = cos A cos B + sin A sin B $sin^{2} A + cos^{2} A = 1, \quad sin 2A = 2 sin A cos A$ $cos 2A = 2 cos^{2} A - 1 = 1 - 2 sin^{2} A$ 2 sin A cos B = sin(A + B) + sin(A - B)2 cos A sin B = sin(A + B) - sin(A - B)2 cos A cos B = cos(A + B) + cos(A - B)2 sin A sin B = cos(A - B) - cos(A - B)

Hyperbolic Functions

 $\sinh x = \frac{e^x - e^{-x}}{2}, \quad \cosh x = \frac{e^x + e^{-x}}{2}$

Standard Derivatives

f(x)	$f^{\prime}(x)$.
x ⁿ	nx^{n-1}
$\sin ax$	$a\cos ax$
$\cos ax$	$-a\sin ax$
tan ax	$a \sec^2 a x$
e ^{ax}	ae^{ax}
$\ln x$	$\frac{1}{x}$
sinh ax	$a\cosh ax$
$\cosh ax$	$a\sinh ax$
u v	u'v+uv'
$\frac{u}{v}$	$\frac{u'v-uv'}{v^2}$

Standard Integrals

f(x)	$\int f(x) dx$
$(ax+b)^n$	$\frac{(ax+b)^{n+1}}{a(n+1)} n \neq -1$
$\sin x$	$-\cos x$
$\cos x$	$\sin x$
e^x	e^x
$\frac{1}{ax+b}$	$\frac{1}{a}\ln(ax+b)$
$\sinh x$	$\cosh x$
$\cosh x$	$\sinh x$
u v'	$uv - \int u'vdx$
$\frac{1}{x^2 + a^2}$	$\frac{1}{a} \tan^{-1}\left(\frac{x}{a}\right)$
$\frac{1}{a^2 - x^2}$	$\frac{1}{2a}\ln\left(\frac{a+x}{a-x}\right)$
$\frac{1}{x^2 - a^2}$	$\frac{1}{2a}\ln\left(\frac{x-a}{x+a}\right)$
$\frac{1}{\sqrt{a^2 - x^2}}$	$\sin^{-1}\left(\frac{x}{a}\right)$
$\frac{1}{\sqrt{x^2 + a^2}}$	$\ln\left(x+\sqrt{x^2+a^2}\right)$
$\frac{1}{\sqrt{x^2 - a^2}}$	$\ln\left(x+\sqrt{x^2-a^2}\right)$