University of New England

Faculty of Arts and Sciences

School of Science and Technology

Unit Code: PMTH212
Unit name: Multi-variable Calculus

Unit Information

Lecturer's name: Gerd Schmalz
Semester 1, 2012
# Table of Contents

University of New England .......................................................................................... 1

**Unit Code:** PMTH212 .......................................................................................... 1

**Unit name:** Multi-variable Calculus ..................................................................... 1

Unit Information ........................................................................................................ 1

Table of Contents .................................................................................................... 2

Welcome .................................................................................................................... 4

Unit coordinator ....................................................................................................... 4

Contact details .......................................................................................................... 4

Administrative contact ............................................................................................. 4

  School of Science and Technology ..................................................................... 4

  Student Centre ..................................................................................................... 4

Introduction ............................................................................................................... 4

Learning outcomes .................................................................................................. 5

Prescribed text .......................................................................................................... 5

Recommended reading ............................................................................................ 5

UNE graduate attributes ......................................................................................... 6

Intensive school ....................................................................................................... 6

How to study the unit ............................................................................................... 6

  Assessment ............................................................................................................ 6

Examination .............................................................................................................. 6

Assignments ............................................................................................................. 7

Submission method ................................................................................................. 7

TurnItIn ....................................................................................................................... 7

AskUNE ..................................................................................................................... 8

Plagiarism declaration .............................................................................................. 8

Assignment cover sheets .......................................................................................... 8

Assessment details .................................................................................................. 9

  Overview of assessment requirements ................................................................. 9

  Assessment details ............................................................................................... 9

  Presentation .......................................................................................................... 9

  Plagiarism ............................................................................................................ 9

  Assessment preview ............................................................................................. 9

  Study timetable .................................................................................................... 10

UNEonline ................................................................................................................ 10

  Accessing the online site for this unit................................................................. 11
Welcome
Welcome to PMTH212, Multi-variable Calculus

Unit coordinator
Dr Gerd Schmalz

Contact details
Please contact the unit coordinator for any matter relating to the academic content of this unit:

Email: gerd@turing.une.edu.au

Administrative contact
School of Science and Technology
Phone: 02) 6773 5022
Email: admin-st@une.edu.au
Fax: (02) 6773 5011

Student Centre
The Student Centre provides you with a focal point of contact for all your administrative enquiries during your study at UNE, including selecting units and managing your enrolment. If you have administrative enquiries relating to your study at UNE, go to the Student Centre page at http://www.une.edu.au/studentcentre.

Alternatively, you can go to AskUNE and submit a question by clicking on the ‘Contact Us’ tab.

You can also find information on all aspects of studying at UNE on the Current Students page at http://www.une.edu.au/for/current-students/.

Introduction
Math101 and Math102 are pre-requisite for this unit. Topics in this unit include: partial derivatives; the chain rule; basic geometrical topics on curves and surfaces in relation to multi-variable functions; extreme values; double and triple integrals; change of variables; vector functions; line integrals; Green's theorem; divergence theorem; Stokes theorem.
As a guide, you should allocate ten hours per week private study time for this unit.
Learning outcomes

Learning outcomes of PMTH212 include

• understanding of coordinates in 2 and 3-dimensional space; applying dot and cross products to compute distances, areas and volumes; linear and quadratic curves and surfaces, their names, equations and shapes; understanding curves, surfaces and regions given by equations and inequalities; sketching curves surfaces and regions in 2 and 3 dimensions, level curves and contour diagrams

• understanding vector functions, curves in 2 and 3-dimensional space; computing tangents, normal vectors, arc length, normal parameter, curvature;

• understanding the concept of limit and continuity in several variables; detecting divergence by restriction to lines and curves, proving convergence; properties of limits and continuous functions

• understanding the concept of differentiability in several variables; partial derivatives; properties of partial derivatives and their relation to differentiability; total differential and its application for approximate computations; chain rules

• multivariate Taylor’s formula, maxima and minima of multivariable functions; the method of Lagrange multipliers

• evaluating double and triple integrals by reducing them to iterated integrals; changing the order of integration; understanding the underlying geometry of the domains of integration; evaluating double and triple integrals using polar, cylindrical and spherical coordinates; application of double and triple integrals in geometry and physics

• using Green’s theorem, Divergence theorem and Stokes’s theorem to compute double and triple integrals, understanding their applications to physics

Prescribed text

Lecture notes will be provided.

Recommended reading


The lecture notes you have received cover all the material required for this unit. While the booklet of lecture notes is more concise, the above-mentioned textbook contains
more material and also many exercise questions. Therefore the lecture notes and the textbook can be used to complement each other.

**UNE graduate attributes**

UNE has a policy that identifies the special attributes of a UNE graduate. The policy can be found at [http://www.une.edu.au/gamanual/](http://www.une.edu.au/gamanual/). It is expected that, during the course of your undergraduate degree, you will develop these attributes in conjunction with your discipline knowledge. Those addressed by this unit are reflected in the unit learning outcomes and assessment tasks. You can assess your developing skill level after each unit by using the self-reflection guide and resources located at [http://www.une.edu.au/gamanual/students](http://www.une.edu.au/gamanual/students).

**Intensive school**

There is no intensive school for this unit.

**How to study the unit**

It is essential that you read carefully the lecture notes and try to understand everything presented there. It may be necessary to reread the lecture notes several times. Through the unit web-site video recordings of the on-campus lectures and tutorials from last year are available. I will replace these recordings by the actual ones when they become available. While I hope that these recording are helpful, they cannot replace the careful study of the lecture notes.

Some students also find the MIT OpenCourseWare video recordings at [http://ocw.mit.edu/courses/mathematics/18-02-multivariable-calculus-fall-2007/](http://ocw.mit.edu/courses/mathematics/18-02-multivariable-calculus-fall-2007/)

useful.

Assignments are an essential part of this unit. Through doing the assignments and through the feedbacks from your marked assignments, you can check your understanding of the material in a timely fashion. Do not get too far behind and do not leave important materials unfinished before going to the next step.

The examination problems will be similar to the assignment problems.

**Assessment**

**Examination**

Weight of the examination: 70%.
The examination will be of three hours duration, preceded by 15 minutes to read the examination paper. You are allowed to bring with you three A4 sized pieces of paper of hand-written notes. Both sides can be used. No printed and photocopied materials are allowed.

The examination questions will be concerned with basic concepts and general methods. The style will be similar to the examples in the lecture notes, and the questions in the assignments and the past examination papers.

Assignments

Submission method

Assessment tasks for this unit can be submitted electronically via the University's e-Submission system, or be posted to

The Assignments Section, The Teaching and Learning Centre
University of New England, Armidale, NSW 2351

e-Submission is accessible through moodle.

Once your assignment has been e-submitted for marking, it will be submitted to TurnItIn for final checking by UNE. This will generate a report for the unit coordinator.

Assignments must be submitted by 23.59. Your assignment’s receipt date/time is recorded automatically. You must take into account time zone differences to avoid penalties for late submission.

If you require assistance with the e-submission of your assignment, contact the IT Service Desk on 02 6773 5000 or email servicedesk@une.edu.au.

TurnItIn

UNE uses a software application to determine the originality of assessable work submitted by its students. This software is called TurnItIn and it is part of the e-submission process.
AskUNE

If you require further clarification regarding e-Submission or TurnItIn, you can browse the frequently asked questions at AskUNE, or ask a question of your own by clicking on the ‘Contact Us’ tab.

Plagiarism declaration

When you submit an assignment via e-Submission, you will be deemed, in effect, to have agreed to the UNE plagiarism policy.

Assignments submitted in hard copy must include a signed plagiarism declaration form, which is included on the assignment cover sheet.

Assignment cover sheets

e-Submitted assignments do not require assignment cover sheets as these are generated automatically by the e-Submission system when you submit your assignment.

All assignments that are submitted in hard copy must have an assignment cover sheet attached. These can be accessed from moodle.

Assignments that are being submitted in hard copy should be mailed to:

Assignment Section
Teaching & Learning Centre
University of New England
Ardimale NSW 2351
Assessment Details and Marking Policy

Assessment details

Overview of assessment requirements

Attempting the assignments is a crucial part of mastering the materials of this unit. It provides a necessary training in the development of your skills in using mathematics to solve problems. The final examination will test your understanding of the whole materials presented in the lecture notes.

Assessment details

The 12 assignments contribute 30% of the final assessment. The student must submit reasonable attempts on at least 8 assignments.

The final examination is compulsory contributes 70% of the final assessment. The student must achieve at least 40% in the examination.

Presentation

Write the answers in details and show your working.

Plagiarism

You must comply with the University’s policy on Plagiarism and Academic Misconduct. The next section in this booklet directs you to the policy, outlines your responsibilities in connection with academic writing, and gives advice on how to avoid plagiarism.

Assessment preview

Asking unit coordinators for preliminary review of any assessment tasks prior to formal submission is inappropriate.
# Study timetable

<table>
<thead>
<tr>
<th>Week</th>
<th>Topics/events</th>
<th>Assessment due</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1</td>
<td>Coordinates and graphs in 3-space, Vectors, Lines and planes, Quadric surfaces</td>
<td>Assignment 1 due on 5/3</td>
</tr>
<tr>
<td>Week 2</td>
<td>Vector valued functions, Integration of vector valued function and arc length, Unit tangent and normal vectors, Curvature</td>
<td>Assignment 2 due on 12/3</td>
</tr>
<tr>
<td>Week 3</td>
<td>Multi-variable functions, Limits and continuity</td>
<td>Assignment 3 due on 19/3</td>
</tr>
<tr>
<td>Week 4</td>
<td>Differentiability of functions of two variables, Partial derivatives, The chain rule</td>
<td>Assignment 4 due on 26/3</td>
</tr>
<tr>
<td>Week 5</td>
<td>Tangent planes and the total differentials, Directional derivatives and gradients, Functions of three and n variables</td>
<td>Assignment 5 due on 2/4</td>
</tr>
<tr>
<td>Week 6</td>
<td>Taylor’s formula, Maxima and minima, Extrema over a given region, Lagrange multipliers</td>
<td>Assignment 6 due on 10/4</td>
</tr>
<tr>
<td>Week 7</td>
<td>Double integrals, Iteration of double integrals, Double integrals in polar coordinates, Surface area</td>
<td>Assignment 7 due on 30/4</td>
</tr>
</tbody>
</table>

**Mid trimester break (two weeks)**

| Week 8| Triple integrals, Change of variables, Triple integrals in cylindrical and spherical coordinates | Assignment 8 due on 7/5 |
| Week 9| Line integrals, Line integrals independent of path, Green’s Theorem                      | Assignment 9 due on 14/5 |
| Week 10| Surface integrals, Surface integrals of vector functions, The divergence Theorem         | Assignment 10 due on 21/5 |
| Week 11| Stokes, Theorem, Applications                                                          | Assignment 11 due on 28/5 |
| Week 12| Revision                                                                              |                         |

**UNEonline**

UNEonline is UNE’s online teaching system. As a current student you have access to the student portal myUNE, through which you can access your online units, manage your enrolment, change personal information and access many useful functions. Log in
to myUNE from the UNE homepage using your UNE username and password. All units have an online site at http://moodle.une.edu.au that may include features such as a message board, a discussion forum and electronic downloads of teaching material.

Alternatively, all teaching material can be accessed online from the web-site:

http://turing.une.edu.au/~pmth212

**Accessing the online site for this unit**

To access the online site for this unit, log in to moodle from the UNE homepage (or http://moodle.une.edu.au) using your UNE username and password. A list of the units in which you are currently enrolled will be displayed. You can access the online unit by clicking on the corresponding link. Please note that most online units will not be available until the first day of teaching.

If you have any problems related to accessing myUNE or the online site for your unit, contact the IT Service Desk on 02 6773 5000, via AskUNE or by emailing servicedesk@une.edu.au.