Calculus II
MATH 1700

Syllabus

Contacting your instructor

For information on contacting your instructor as well as other important information from your instructor see the Instructor Letter link in your course website.

Course description

The *Undergraduate Calendar* of The University of Manitoba describes MATH 1700 as follows:

> Theory and techniques of integration, curve sketching, volume, arc length, surface area and partial derivatives. Not to be held with MATH 1690 (or 136.169), MATH 1710 (or 136.171), MATH 1730 (or 136.173) or 006.126, 013.149, or 013.159. Prerequisite: MATH 1500, MATH 1501 (or 136.150) (C), MATH 1510 (or 136.151) (C), MATH 1520 (or 136.152) (C), MATH 1530 (or 136.153) (C) or MATH 1680 (or 136.168) (C), or a grade of "C" in the former 006.125, 010.115, 013.128, 013.129, or 013.139.

This course is a continuation of MATH 1500 Introduction to Calculus, and its main topic is **integrals**. Integrals are limits of special sums of numbers that we associate to a given function: they occur in virtually all sciences. We find them as *areas, volumes,* and *lengths*, then as *work* (Physics), but also in such seemingly unrelated topics as *cardiac output* (Biology), and *consumer surplus* (Economics).

The Fundamental Theorem of Calculus provides the main tool for calculating integrals. The largest part of the course is devoted to describing, studying, and applying various integration techniques stemming from the Fundamental Theorem of Calculus.

Course goals

The two main goals of this course are to:

a. study various integration techniques, and
b. apply integrals to various problems.

Of course, a) is a prerequisite for b). The integration methods we shall encounter are far from being comprehensive. Nevertheless, they do cover a large class of useful functions, including those needed in various applications.

Studying techniques of integration involves three steps. The first step is reading and understanding the descriptions of the techniques. In the second step you need to solve as many problems related to a specific method. The textbook provides exercises sorted according to the methods you need to use. The third step may be the most difficult: trying to solve the unclassified problems, when you may not be sure which method(s) should be used. That involves a mini-research in the form of a guess that you should subsequently try to verify.

Course materials

Required textbook

The following required materials are available for purchase from the University of Manitoba Bookstore. Please order your materials immediately, if you have not already done so. See your *Distance and Online Education Student Handbook* for instructions on how to order your materials.

Required textbook

Stewart, James. (2013). *Single Variable Calculus: Early Transcendentals,* Metric International Version (Packaged with students Solutions Manual). 7th edition. Nelson Education.

The material we cover is standard and may be found in almost every calculus textbook. The content of the textbook is integrated into the course materials. If you need a review of basic calculus, then you should browse through the earlier chapters of the textbook.

Course overview

The course starts with a review of the definition of (definite) integral and of the Fundamental Theorem of Calculus. The rest of the course is focused on integration techniques and application of integrals. There are several digressions, notably L'Hospital's Rule, Parametrically Defined Curves, and Polar Coordinates.

Following the sections of the textbook, these topics will be discussed (the numbers in parentheses refer to pages in the textbook).

5.1. **Areas and distances (review):** Slowly introducing definite integrals.

5.2. **Definite integral (review):** Definition and some properties.

5.3. **Fundamental theorem of calculus (review):** The link between definite integrals and (anti) derivatives.

5.5. **The substitution rule:** A basic integration technique.

6.1. **Areas between curves:** The first, and the most elementary application of integrals.

6.2. **Volumes:** Introducing techniques for computing volumes of solids and solids of revolution by means of integrals.

6.3. **Volumes by cylindrical shells:** Another method for computing volumes of solids of revolution.

6.5. **Average value of a function:** Average value of a function.

7.1. **Integration by parts:** An integration technique.

7.2. **Trigonometric integrals:** Solving integrals involving trigonometric functions.

7.3. **Trigonometric substitution:** A method for integrating irrational functions.

7.4. **Integration of rational functions by partial fractions:** A method for integrating rational functions.

7.5. **Strategy for integration**: What to do when you are not told which technique is suitable, and thus have to find it by yourself.

4.4. **L'Hospital's rule:** A very useful rule for evaluating limits (301-307).

7.8. **Improper integrals:** Integrals over unbounded regions.

8.1. **Arc length:** Applying integrals in arc length computations.

8.3. **Area of a surface of revolution:** Area of a surface of revolution by means of integrals.

10.1. **Curves defined by parametric equations:** Another way to specify curves.

10.2. **Tangents and areas:** Tangents of parametrically defined curves; areas between parametrically defined curves.

10.3. **Arc length and surface area:** Arc length of curves defined parametrically; surface area of solids obtained by revolving parametrically defined curves.

10.4. **Polar coordinates:** A new way to describe points by pairs of numbers.

10.5. **Areas and lengths in polar coordinates:** A part of calculus done in the setting of polar coordinates.

Organization of the units

At the beginning of each unit, which covers a selected topic, are the learning objectives, followed the topics from the textbook. That part ends with a reference to the sets of exercises that follow sections in the textbook; you will be asked to do as many of them as you need. The problems for which graphing software is required are optional.

It is important to realize that reading mathematics is very different from reading novels: to read mathematics means primarily to **do** it. This includes absorbing and understanding the definitions and the statements and studying and solving the examples. Active learning also includes asking (and answering) as many reasonable questions as you can pose, and thus opening up other perspectives. Hence, interpret appropriately the word “read” in the manual.

The main part of each unit consists of examples, comments, solutions, and somewhat unsuccessful attempts to solve the problems where we point out some typical errors. Almost all of the incorrect solutions are authentic. We introduce a fictional character, called Mark Markless, to whom we mercilessly attribute almost all of the errors. The goal, of course, is not to scorn, but rather to point to possible pitfalls. Some of the correct solutions are illustrated with pictures or graphs. In some instances these are part of the solution; in others they are just visualization of the solution. To avoid misunderstanding, the end of each solution is indicated by $\Diamond$**.**

Each unit ends with a self-test; most of the questions are taken from old exams or assignments.

Evaluation and grading

Assignments

There are five assignments for this course. The solutions are to be sent to the Student Services office. They will be marked by your instructor and returned to you with the correct solutions. Each unit corresponds to approximately two week’s work in the regular session of the University day course. You are encouraged to set your own pacing for the course in order to meet all due dates.

Assignment due dates

Assignment due dates are designed to help you pace your coursework, as well as to enable you to receive valuable feedback on completed assignments for subsequent termwork and the exam. Deadlines for the submission of assignments can be found in the “Assignment Due Dates” document in your course.

Please be sure to submit assignments on time. We cannot guarantee an instructor will accept late assignments. If you do find that you are not able to complete an assignment on time, please be sure to contact your instructor well in advance of the due date in case your request is denied.

Occasionally students, under extenuating circumstances, (e.g., medical, military assignments, family difficulties, unexpected business travel), are unable to complete all assignments by the final deadline. Formal time extensions (beyond the date of close of term) must be directed to the instructor, and result in the assignment of a temporary grade of "Incomplete." Students must request these extensions in writing by the last assignment due date and in addition to obtaining the instructor's approval, must meet the following criteria:

> Students should be able do demonstrate that they have completed at least 50% of their half-course course term work to be eligible for the Incomplete grade classification.

Complete the assignment for the unit and submit it to the designated UMLearn Dropbox. For instructions on submitting your assignment, click on the "How to submit" link in the Instruction for Assignment widget in UMLearn.

Due dates

Assignment	Sept.–Dec.	Jan.–Apr.	May–Aug.
1	Sept. 19	Jan. 16	May 22
2	Oct. 3	Jan. 30	June 5
3	Oct. 17	Feb. 13	June 19
4	Oct. 31	Feb. 27	July 3
5	Nov. 14	Mar. 13	July 17

Final examination

Students are required to obtain a minimum grade of 40% on the final exam in order to pass the course regardless of term work grades.

The final two-hour exam will consist of approximately 9 long-answer problems, similar to those in the assignments.

The final exam will be written at the University of Manitoba (UM), Fort Garry campus or at an approved off-campus location. **Students needing to write at an off-campus location must declare a location by the specified deadline date** (see off-campus declaration and policy under Student Resources on course homepage). **Students writing at the UM Fort Garry campus do not need to declare an exam location.**

The Registrar's Office is responsible for the final exam schedule which is available approximately one month after the start of the course.

A word of caution about the assignments and the final examination

Some students find that they do very well on the assignments, but they do not do nearly as well on the final examination. While your grades on the assignments will give you some idea of how well you are mastering the material, they may not indicate how well you will do on the examination, because the examination is written under very different circumstances. Because the assignments are open book, they do not require the amount of memorization that a closed-book examination requires nor are they limited to a specific time period. Some students have told us that, based on the high marks they received on the assignments, they were overconfident and underestimated the time and effort needed to prepare for the final examination.

Please keep all this in mind as you prepare for the examination. If your course has a sample exam or practice questions, use them to practice for the examination by setting a time limit and not having any books available. Pay careful attention to the description of the type of questions that will be on your final examination. Preparing for multiple choice questions involves a different type of studying than preparing for essay questions. Do not underestimate the stress involved in writing a time-limited examination.

Distribution of marks

Assignments		35%
Final exam		65%
	Total	100%

Note: minimum requirement of 40% on the final exam in order to pass the entire course regardless of term work.

Please note: All final grades are subject to departmental review.

Guidelines for preparing assignments

Solutions to the assigned problems must be carefully prepared, justifying each step. Follow these procedures in solving assignment problems:

1. Read the assigned text as indicated in every unit. This gives you the basis for understanding new topics and helps you develop the necessary techniques for problem solving.

2. Read the course materials, paying special attention to sections where problems together with the complete solutions are presented. You should attempt to solve the problems from the course materials before you look at their solutions.
3. Try to solve the practice problems provided in the course materials. The answers in these problems are found at the end of each lesson.
4. Solve the some of the assignment problems. If you have difficulty, review the text and course materials for solution procedures. If difficulties persist, contact your instructor for help.

Plagiarism, cheating, and examination impersonation

You should acquaint yourself with the University's policy on plagiarism, cheating, and examination impersonation as detailed in the General Academic Regulations and Policy section of the University of Manitoba *Undergraduate Calendar*. Note: These policies are also located in your *Distance and Online Education Student Handbook* or you may refer to Student Affairs at http://www.umanitoba.ca/student.

Distance and Online Education (DE) Student Resources

In your course website there are links for the following:

- Contact Distance and Online Education Staff
- Distance and Online Student Handbook
- Distance and Online Education Website

Acknowledgments

Content specialist: Sasho Kalajdzievski, Ph.D.
Department of Mathematics and Astronomy
University of Manitoba

Sasho Kalajdzievski was born in Skopje, Macedonia, where he received his bachelor's and master's degrees in mathematics. He completed his doctoral studies at the University of Toronto, specializing in algebra/group theory, which remains his primary research field. He has taught numerous courses in mathematics in Skopje, Toronto, and Winnipeg.

Editor: James B. Hartman, Ph.D.
Distance and Online Education
University of Manitoba

Desktop publisher: Lorna Allard
Distance and Online Education
University of Manitoba