UNIVERSITY OF SASKATCHEWAN

Course Outline
Math 116.3, Calculus II

2023-2024 Term 2
Jan to Apr 2024

Sections	CRN	**Meetings** (see PAWS and our Canvas announcements**)**	Instructors	Office	Email
Lecture Section **02**	20511	MWF 08:30-09:20 (in Physics 103)	Mohamad Alwan	McLean Hall 212	m.alwan@math.usask.ca
Lecture Section **W04**	20513	MWF 09:30-10:20 (fully online)	Abid Ali	McLean Hall 238	abid.ali@usask.ca
Lecture Section **06**	20514	MWF 10:30-11:20 (in Physics 165)	Jiun-Chau Wang	McLean Hall 208	jcwang@math.usask.ca
Lab Section **L03**	22463	lab sections fully online via Zoom; see Canvas announcements	Amos Lee, Manuela Golban	138 McLean Hall, 139 McLean Hall	lee@math.usask.ca golban@math.usask.ca
Lab Section **L07**	22467				
Lab Section **L11**	22471				

Land Acknowledgement

We would like to acknowledge that the Saskatoon campus of the University of Saskatchewan is on Treaty Six Territory and the Homeland of the Métis. We pay our respects to the First Nation and Métis ancestors of this place and reaffirm our relationship with one another. We would also like to recognize that some of us may be attending this course from other traditional Indigenous lands. We ask that you take a moment to make your own Land Acknowledgement to the peoples of those lands. In doing so, we are actively participating in reconciliation as we navigate our time in this course, learning and supporting each other.

Course Description

Definite and indefinite integrals, the Fundamental Theorem of Calculus, techniques of integration, approximate integration, indeterminate forms & L'Hospital's rule, improper integrals, applications of integration, and introduction to differential equations.

Prerequisites

MATH 110 or equivalents

Course Sites (Canvas and WebAssign)

Common to all sections of Math 116, our Math 116 main course container is on **Canvas** [**PAWS ► Canvas ► My Courses ► MATH-116 (02,W04,06)(202401)**]. All information about this course, this document, absence and regrading policy, course announcements, lecture videos, instructor course notes, and any scheduled live meetings via Zoom will be posted on Canvas. In addition, we will be using the online course management system known as **WebAssign** for delivering our *online assignments*: https://webassign.com. Solutions to homework assignments will also be released there. Access to WebAssign is mandatory since all assignments will be delivered and graded there. On the *first* day of class, please read our announcements on Canvas for detailed instructions on how to access & self-enroll in Math 116 on WebAssign.

Textbook & WebAssign Access

"Etext & Webassign For Stewart's Calculus Ed: 09 (options: *single-term* access or *multi-term* access)", available for purchase via https://shop.usask.ca/Course/campus. This access code is needed for accessing the online assignments and exams on WebAssign as well as the online version of Stewart's text (Single Variable Calculus—Early Transcendentals, 9th edition). The minimum to buy is just a *single-term* WebAssign Access Code for Math 110/116 (aka the *eText*), which is available for purchase online from the Bookstore (with *single-term* or *multi-term* access options): https://shop.usask.ca/Course/campus. If you had already bought a *multi-term* WebAssign Access Code when you took Math 110 in the Fall, your WebAssign code should continue to work for Math 116.

Evaluation and Graded Components

Your course grade will be computed using the following *graded components* and their associated weights:

Homework Assignments (online assignments via WebAssign): 15%
Midterm Test 1 (*on campus* in *designated locations*): 15%
Midterm Test 2 (*on campus* in *designated locations*): 15%
Comprehensive Final Exam (*on campus* in *designated locations*): 55%

To pass this course, the student must achieve a course grade of at least 50%.

Class Lectures & Lab Tutorials

Please see the last page for a detailed timetable of lecture and lab topics. Class lectures for Section 02 (Professor Alwan) and Section 06 (Professor Wang) will be delivered *in person* on campus. Class lectures for Section W04 (Professor Ali) will be delivered entirely *online* via Zoom. Professor Ali will provide the details of his Zoom meeting link and any needed passcode for joining his class meetings. Our weekly *lab tutorial sessions* will also be delivered entirely online via Zoom only. Please check the lab meeting schedule shown under [**Zoom Meetings**] in our Math 116 course container on Canvas regularly as our course progresses.

Online Homework Assignments

Eleven online homework assignments will be released and ***graded*** on WebAssign. Please read our announcements on Canvas for detailed instructions on how to access Math 116 on WebAssign. These assignments would be released online usually on a Friday, and they are normally due in about 7 days. Please see the *assignment timetable* at the bottom of page 4 of this document for details. In addition to these online homework, those *non-online* homework sets that are listed on the last page of this document are recommended for exam preparation, but those will neither be handed in nor marked. To fully master the material, the student should do more problems than just those that are released online on WebAssign.

Midterm Tests

Two 80-minute midterm tests will be scheduled and delivered on campus outside of class time in the following two evenings:

Midterm Test 1[††]: **Wednesday February 14,** 7:00pm-8:20pm
Midterm Test 2[††]: **Wednesday March 20,** 7:00pm-8:20pm

We will announce locations for the two midterm tests approximately 7 days before each test. Please stay tuned to our announcements on Canvas. See the bottom table on page 4 for more details about topics coverage for each midterm test.

Final Examination

We will deliver a three-hour *comprehensive* final examination at a time and location that the University will announce. The final examination must be written *in person* on the *date and at the time* as scheduled by the University. Final examinations may be scheduled at any time during the University's *examination period*; therefore, students must avoid making prior travel, employment, or other commitments for this exam period. If a student is unable to write a final exam through no fault of his or her own for medical or other valid reasons, documentation must be provided and an opportunity to write a regular deferred exam may be given. Regular deferred exams for the Winter term are usually written during the third week of June. Students are encouraged to review all examination policies and procedures: http://students.usask.ca/academics/exams.php

Core Topics

the definite integral as a limit of a Riemann sum, the Fundamental Theorem of Calculus, basic techniques of integration (including integration by substitution, integration by parts, trigonometric integrals, trigonometric substitution, and integration by partial fractions), approximate integration (midpoint rule, trapezoidal rule, Simpson's rule), indeterminate forms & L'Hospital's Rule, improper integrals, some applications of integration (including areas, volumes, work, average values, arc lengths, areas arising from surfaces of revolution), and separable differential equations.

Learning Objectives

On successful completion of this course, students are expected to be able to:

- Formulate the *definite* integral as a *limit of a Riemann sum*.
- Demonstrate correctness in handling integral notations, and recognize the difference between a *definite* integral and an *indefinite* integral.
- Understand and recognize the importance of *the Fundamental Theorem of Calculus* which ties the concept of integration with that of differentiation.
- Verify whether an *indefinite integral* has been determined correctly using differentiation.
- Demonstrate proficiency in applying anti-differentiation techniques to evaluate common types of indefinite integrals with integrands such as polynomials, rational functions, exponential functions, logarithmic functions, trigonometric functions, inverse trigonometric functions, and some composites of these functions.
- Identify contexts where the methods of integration *by substitution, by parts, by partial fractions,* or *by inverse trigonometric substitution* may be useful, and carry them out efficiently. Identify contexts where these techniques may not be helpful.
- Recognize contexts where trigonometric identities are useful when faced with some basic *trigonometric integrals*.
- Demonstrate proficiency in using various techniques to formulate and compute *area, volume, work, arc length, and area of a surface of revolution* in terms of definite integrals.
- Recognize different types of *indeterminate forms* and contexts where *L'Hospital's Rule* may be applicable and useful when evaluating some types of limits
- Determine whether an improper integral is *convergent* or *divergent*, and demonstrate proficiency in evaluating the integral if it is convergent.
- Identify the *order* of a differential equation and verify whether a proposed *solution* to the differential equation is correct.
- Demonstrate proficiency in solving *separable differential equations* using basic integration techniques.

Absences
Missing an assignment or an exam without a legitimate and verifiable reason may result in a *zero* for that activity. Do not wait till the last five minutes or last five seconds to submit your online assignment. The cutoff time on the due date will be stated on each assignment and determined precisely by the computer clock on WebAssign, *not* on your own personal computer. If you miss an assignment or a midterm exam for legitimate reasons (such as sickness), you must email your Lab Coordinator (*Amos Lee: lee@math.usask.ca*) with verifiable documentation for absence approval. You will be asked to fill out a short ***Absence Form***. Subject to approval, the weight of the missed activity would then be transferred and added to the weight of your final examination. Please read the document titled **Absence Policy** posted on our common course site for Math 116 on Canvas. See the paragraph on Final Examination above for policies governing absences from the final exam.

Access and Equity Services (AES) for Students
Students who are in need of academic accommodations to lessen the impact of their disability must register with AES (Access and Equity Services). To access AES programs and supports, students must follow the policies, procedures, and deadlines set by AES. See https://students.usask.ca/health/centres/access-equity-services.php for details.

Math & Stats Help
Student Learning Services (formerly "University Learning Centre") provides a "Math & Stats Help" service for registered students. Its current mode and hours of *online* operation are posted on the following page: https://library.usask.ca/studentlearning/math-help.php

Copyright
Course materials are provided to you based on your registration in a class. Anything created by your professors and instructors is their intellectual property, unless the materials are designated as open education resources. This includes lecture videos, exams, PowerPoint or PDF slides and other course notes. Additionally, other copyright-protected materials created by textbook publishers and authors may be provided to you based on the license terms and educational exceptions in the Canadian Copyright Act (see http://laws-lois.justice.gc.ca/eng/acts/C-42/index.html). Before you copy or distribute others' copyright-protected materials, please ensure that your use of the materials is covered under the University's Fair Dealing Copyright Guidelines available at https://library.usask.ca/copyright/general-information/fair-dealing-guidelines.php. For example, posting others' copyright-protected materials on the open web or social media is *not* covered under the University's Fair Dealing Copyright Guidelines, and doing so requires permission from the copyright holder.

Academic Integrity
Regardless of the mode of course delivery, the rules and principles governing *academic integrity* remain the same. If you ever have questions about what may or may not be permitted, ask your instructor. The University of Saskatchewan is committed to the *highest standards* of academic integrity and honesty. Students are expected to be familiar with these standards regarding academic honesty and to uphold the policies of the University in this respect. Students are particularly urged to familiarize themselves with the provisions of the *Student Conduct & Appeals* section of the University Secretary Website and avoid any behavior that could potentially result in suspicions of *cheating*, *plagiarism*, *misrepresentation of facts* and/or *participation in an offence*. Academic dishonesty is a serious infraction that can result in suspension or expulsion from the University.

Academic Misconduct and Appeal Procedures
All students should read and be familiar with the Regulations on Academic Student Misconduct (https://secretariat.usask.ca/student-conduct-appeals/academic-misconduct.php) as well as the Standard of Student Conduct in Non-Academic Matters and Procedures for Resolution of Complaints and Appeals (https://secretariat.usask.ca/student-conduct-appeals/academic-misconduct.php#IXXIIAPPEALS). To understand the fundamental values of *academic integrity* and how to be *a responsible scholar* and *member of the USask* community, students are encouraged to complete the Academic Integrity Tutorial located at the following site: https://library.usask.ca/academic-integrity.php#AcademicIntegrityTutorial

For more information, please see the *Academic Integrity* section of the University Library website: https://library.usask.ca/academic-integrity#AboutAcademicIntegrity

MATH 116.3 (2023-2024 Term 2)
Tentative Lecture and Lab Schedule for All Sections (*subject to change*)

Lecture Week	2024 Dates	Topics	Description	Suggested Practice Problems
1	Jan 3 Jan 5	App E 5.1	Sigma Notation The Area & Distance Problems	App E: 3,5,9,13,15,17,19,27,31,39,41,43,45,47,48 5.1: 3,5,9,11,17,19,25,31a,34
2	Jan 8 – Jan 12	5.2 5.2 5.3	The Definite Integral The Definite Integral The Fundamental Theorem of Calculus	5.2: 1,5,19,21,23,25,31,35,43,45,… 5.2: …,57,59,67,68,73,75,83 5.3: 3,7,9,13,15,25,…
3	Jan 15 – Jan 19	5.3 5.3 5.4	The Fundamental Theorem of Calculus The Fundamental Theorem of Calculus Indefinite Integrals & the Net Change Theorem	5.3: …,33,37,41,45,47,49,… 5.3: …,53,63,67,69,73,80,86 5.4: 3,9,13,21,27,35,45,51,57,61,69,71,73
4	Jan 22 – Jan 26	5.5 6.1 6.2	The Substitution Rule Area Between Curves Volumes	5.5: 3,9,13,22,25,27,31,51,61,65,75,89,93,97. Ch5 Review: 73,77 6.1: 1,3,5,7,13,15,19,21,27,35,41,43,59,69 6.2: 11,13,15,19,21,27,…
5	Jan 29 – Feb 2	6.2 6.3 6.3	Volumes Volumes by Cylindrical Shells Volumes by Cylindrical Shells	6.2: …37,39,43(set up only),49,59,61,63,85 6.3: 1,3,5,7,15,17,19,25,27,29… 6.3: …31a,35a,53,57,61,63
6	Feb 5 – Feb 9	6.4 6.5 7.1	Work Average Value of a Function Integration by Parts	6.4: 1,3,7,9,11,15,19,21,23,25,35 6.5: 1,3,5,7,9,13,17,19,20 7.1: 1,3,5,11,13,15,19,23,33,37,43,…
7	Feb 12 – Feb 16 **Feb 14: Midterm 1**	7.1 7.2 7.2	Integration by Parts Trigonometric Integrals Trigonometric Integrals	7.1: …47,53,57,59,63,67,69,73,75,77,79 7.2: 1,5,9,11,19,21,25,29,… 7.2: …31,37,41,43,45,55,71,73
	Feb 19 – Feb 23	This week is Term 2 Break (no classes, no labs)		
8	Feb 26–Mar 01	7.3 7.4 7.4	Trigonometric Substitution Integration of Rational Functions ... ... by Partial Fractions	7.3: 5,7,11,13,15,17,21,23,29,31,37a,41,45,46,47 7.4: 1,3,5,9,11,15,17,23,25,29… 7.4: …31,41,43,47,53,55,63,65,69,71
9	Mar 04–Mar 08	7.5 7.7 7.7	Strategy for Integration Approximate Integration Approximate Integration	7.5: 11,13,16,18,24,25,31,39,49,57,65,71,79,89,95 7.7: 5,7,9,11,13,… 7.7: …15,17,29,47
10	Mar 11–Mar 15	4.4 4.4 7.8	Indeterminate Forms and ... ... L'Hospital's Rule Improper Integrals	4.4: 9,27,31,35,47,51,… 4.4: …61,77,81,85,87 7.8: 1,3,7,9,19,29,35,43,47,57,61,63…
In addition to keeping up with the topics of (Lecture) Week 11, start reading Section 3.8 and Section 9.1 to prepare for the topics of Week 12.				
11	Mar 18–Mar 22 **Mar 20: Midterm 2**	7.8 8.1 8.2	Improper Integrals Arc Length Area of a Surface of Revolution	7.8: …67,69,71,77,85,89,93 Ch7 Review: 11,12,13,59,71,79 8.1: 1,7,9,13,13,17,23,39,41,45 8.2: 3,5,9,15,17,19,21,23,33,41
12	Mar 25–Mar 29	3.8 9.1 –	Exponential Growth & Decay Modeling with Differential Equations March 29 is Good Friday (no classes, no labs)	3.8: 3,9,11,13,15,17,21 9.1: 7,15,16,21,23 –
13	Apr 01–Apr 05	9.3 TBD TBD	Separable Differential Equations To Be Determined (discretion/review) To Be Determined (discretion/review)	9.3: 1,3,5,7,9,11,13,15,17,19,33,35,41,49,57 To Be Determined To Be Determined

Dates	Lab Tutorial Dates	HW† Assignment Due Dates/Topics/Remarks
Week of Jan 1	No labs on January 4th (labs will begin next week)	
Week of Jan 8	Lab 1 on Jan 11	HW1 released on Jan 5; HW1 on App E, Sec 5.1 HW1 due on Jan 12
Week of Jan 15	Lab 2 on Jan 18	HW2 released on Jan 12; HW2 on Sec 5.2, 5.3 HW2 due on Jan 19
Week of Jan 22	Lab 3 on Jan 25	HW3 released on Jan 19; HW3 on Sec 5,4 5.5 HW3 due on Jan 26
Week of Jan 29	Lab 4 on Feb 1	HW4 released on Jan 26; HW4 on Sec 6.1, 6.2 HW4 due on Feb 2
Week of Feb 5	Lab 5 on Feb 8	HW5 released on Feb 2; HW5 on Sec 6.3, 6.4 HW5 due on Feb 9
Week of Feb 12	Lab 6 on Feb 15	HW6 released on Feb 9; HW6 on Sec 6.5, 7.1 Hw6 due on Feb 16
Midterm 1 on **Feb 14**	Extra Help Session on Feb 13 (see Zoom Meetings on Canvas)	**Midterm 1††**: Wednesday **Feb 14th 7:00pm–8:20pm**; covers **App E, Sec 5.1 through Sec 6.3**

Dates	Lab Tutorial Dates	HW† Assignment Due Dates/Topics/Remarks
Week of Feb 19	This week is Term 2 Break (no classes, no labs)	
Week of Feb 26	Lab 7 on Feb 29	HW7 released on Feb 16; HW7 on Sec 7.2, 7.3 HW7 due on Mar 1
Week of Mar 4	Lab 8 on Mar 7	HW8 released on Mar 1; HW8 on Sec 7.4, 7.5 HW8 due on Mar 8
Week of Mar 11	Lab 9 on Mar 14	HW9 released on Mar 8; HW9 on Sec 7.7, 4.4 HW9 due on Mar 15
Week of Mar 18	Lab 10 on Mar 21	HW10 released on Mar 15; HW10 on Sec 7.8, 8.1 HW10 due on Mar 22
Midterm 2 on **Mar 20**	Extra Help Session on Mar 18 (see Zoom Meetings on Canvas)	**Midterm 2††**: Wednesday **Mar 20th 7:00pm–8:20pm**; covers **Sec 6.4 through Sec 7.7**
Week of Mar 25	Lab 11 on Mar 28	HW11 (last HW set) released on Mar 22; HW11 on Sec 8.2, 3.8, 9.1, 9.3 HW11 due on Apr 5
Week of Apr 1	Lab 12 on Apr 4	Reminder: HW11 (last HW set) due on Apr 5

† "HW" means "homework". Each online homework assignment is normally **released on a Friday** on our course site **on *WebAssign***, and each is *usually* due in 7 days. Students are responsible for keeping track of assignment release dates and due dates on our Math 116 site on WebAssign.
††These two Midterm dates have been approved by the College.