



**UNIVERSITY OF
NORTHWESTERN**
ST. PAUL

OFFICE OF DUAL ENROLLMENT

MAT2122

Calculus and Analytic Geometry II

SPRING 2023

SYLLABUS

Version: OLG v10:07/22

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MAT2122 Calculus and Analytic Geometry II

University of Northwestern – St. Paul

COURSE DESCRIPTION

Continued study of calculus to include antiderivatives, integration techniques, applications of definite integrals such as volumes of revolution, polar coordinates, series, sequences and power series.

Credits: 4

Prerequisites: C- or better in MAT2121

INSTRUCTOR INFORMATION

Please see “Contacting the Instructor” on the course site.

COURSE OUTCOMES

At the end of this course, a successful student will be able to

- CO-1. Integrate functions using various methods.
- CO-2. Solve applications using integration techniques.
- CO-3. Compare rectangular and polar coordinates.
- CO-4. Analyze series and sequences.
- CO-5. Approximate functions.

LICENSING APPROVED STANDARDS

8710.4600 Mathematics

The teacher of mathematics must demonstrate knowledge of the following mathematical concepts and procedures and the connections among them:

3.A.2 : - analyze the interaction between quantities and variables to model patterns of change and use appropriate representations including tables, graphs, matrices, words, ordered pairs, algebraic expressions, algebraic equations, and verbal descriptions;

3.A.3 : - represent and solve problem situations that involve variable quantities and use appropriate technology;

3.A.5 : - apply properties of boundedness and limits to investigate problems involving sequences and series;

3.A.7 : - apply concepts and standard mathematical representations from differential, integral, and multivariate calculus; linear algebra, including vectors and vector spaces; and transformational operations to solve problems;

3.C.8 : - numerical approximation techniques as a basis for numerical integration, numerical-based proofs, and investigation of fractals;

3.G.2.c : - using intuitive, informal exploration, and formal proof.

MATERIALS

Required Textbooks and Materials

This course uses the following open textbook at no cost to students. A link to a digital copy of the open textbook is provided on the course site.

Strang, G. and Herman, E., *Calculus Volume 2*. OpenStax. 30 March 2016.

Provided by Student

For this course, students will need access to Microsoft Office (available at no cost to students through the University of Northwestern-St. Paul), a PDF reader, and a standard internet browser. Please refer to the Tech Requirements found in the Technology Help section at the top of the course site for the full requirements.

In addition, students may need access to either a scanner or digital camera (for scanning written computation work as digital images to add to assignments).

GRADING POLICIES AND PROCEDURES

Course Grade Explanation

Assignments	Grade Weight
Practice Problems (12)	10
Discussion Forums (8)	10
Essay	5
Quizzes (13)	25
Midterm Exam	25
<u>Final Exam</u>	<u>25</u>
Total	100

Grading Scale Percentages

A	≥ 93	B	≥ 83	C	≥ 73	D	≥ 63
A-	≥ 90	B-	≥ 80	C-	≥ 70	D-	≥ 60
B+	≥ 87	C+	≥ 77	D+	≥ 67	F	< 60

Late Work

All assignments are due as described in the course syllabus and the course site. Students are responsible for meeting assignment deadlines. Late assignments will be automatically deducted one letter grade. The assignments will drop an additional grade per day it is late, up to a 50% deduction in grade; late assignments will not be accepted for a grade beyond one week past the original deadline. Forum discussion activities must be completed on time to earn points. Late forum posts will earn zero points. Students should contact the instructor via e-mail if an extenuating circumstance exists.

Feedback Expectations

Students should expect feedback for their submitted assignments within 5 days of the assignment due date or the time of their submission, whichever is later.

INSTITUTIONAL POLICIES AND SERVICES

Guidelines and Information

Students are responsible for all content of the DE Student Handbook. The most recent version of the DE Student Handbook is located on confluence.unwsp.edu and includes the following policies and procedures:

- Deadlines for Dropping or Withdrawing
- Student/instructor Communication
- Appeals, Exceptions, Disciplinary Process, & Grievances
- Assignments (late work and plagiarism)
- Examinations
- Grading System

Instructors may have course-related expectations that further detail the policies and procedures outlined in the DE Student Handbook. Any such expectations must be provided to students in writing (e.g., handout, course site posting) prior to or at the beginning of the class.

Traditional undergraduate students enrolled in DE courses are subject to the traditional undergraduate student handbook for all non-course-specific policies and procedures.

Academic Integrity

Plagiarism is theft—steal of someone else’s words or ideas. It is claiming another’s work as one’s own. This would also include the following:

- Using the words or work of a former or current student in this class
- Recycling previously submitted assignments from a previous course attempt
- Using outside literature support sites such as, but not limited to, SparkNotes, Enotes or Schmoop that provide literary analysis of the texts we read throughout the semester

Students found plagiarizing are subject to discipline. The standard response ranges from loss of credit for the plagiarized assignment to earning an immediate “F” for the course to being placed on disciplinary probation. We should be committed to conducting ourselves with integrity in all things. Please refer to the DE Student Handbook for more detailed information about UNW’s honesty and integrity policies.

In every course, students are required to view the Understanding Plagiarism video and complete the Understanding Plagiarism Quiz prior to completing any of the course content. These items are part of the course orientation.

Academic Achievement

UNW students requesting academic accommodations in association with the Americans with Disabilities Act (ADA) are directed to notify [Disability Services](#) to begin the application process. Academic Achievement also provides the following: [Writing Tutoring](#), [Subject Tutoring](#), advocating, transitional skill building, [Academic Coaching](#) (organization, time management, test taking, etc.).

Contact Academic Achievement for more information: AcademicAchievement@unwsp.edu | 651-628-3316 | N4012 (Revised 07/21).

Support Services

Links to support services are available found in the Student Services section at the top of the course site.

COURSE POLICIES AND INFORMATION

Email and Announcements

Students are responsible to regularly check their Northwestern student email and the announcements in the course site in order to receive updates and information.

Attendance

Students are expected to participate in all course activities. Students must contact the faculty member in advance or as soon as possible if unable to participate in all or part of the course activities for a given week because of a medical (which includes having to quarantine or isolate due to COVID-19 exposure or confirmed illness), family, or work-related emergency. Students should refer to their course syllabus and/or faculty member for specific requirements. Students who do not participate in course activities and fail to withdraw from the course will receive a failing "F" grade.

Submission Standards

All written assignments should adhere to the following DE guidelines. Documents should be in the following format **unless directed differently by the syllabus or course instructor**:

- Submitted on the course site in Microsoft Word document format (.doc or .docx)
- Set in a traditional typeface 12-point font
- Double-spaced (unless the syllabus instructs otherwise)
- Set with one-inch margins
- Formatted in APA style for in-text citations and reference page (LIT1100 may ask for MLA documentation style)
- Labeled and submitted with the following information (APA papers require this information on a cover sheet, as detailed in A Pocket Style Manual): Student Name, Course Code and Title, Instructor Name, and Date.

Critical Response to Alternate Viewpoints

When students are reading or viewing course materials, they may encounter viewpoints, words, or images that their instructors would not use or endorse. Students should know that materials are chosen for their value in learning to read, write, and view critically, not because the materials are necessarily Christian.

ASSIGNMENTS

See the course site for complete details on the assignments.

Interactive Reading

The course textbook offers both descriptive text and numerous interactive activities. Try the interactive example problems with paper and pencil first. Then click on the link to see how well you did. This kind of in-the-moment skill practice both helps to track your understanding of the basic concepts for the week and to help you actually internalize the concepts.

Exercises (13)

Exercises give you opportunities to practice Calculus ideas without being graded, and they are located in the weekly activities section on the course site. You can practice as many problems as you want. The answers for most of the problems are given.

Practice Problems (12)

The online practice problems are an intensive training session on solving many types of problems in Calculus. Each problem usually has multiple parts to emphasize various aspects of the same concept or computational technique. Some items have videos you may view to help explain appropriate problem solving techniques. You should select alternate problems for items that you answer incorrectly. This way you will get training on specific content, and can incrementally improve your score. When you are satisfied with your score and feel ready to discuss the material with other student or take a quiz, you should proceed to any weekly Interactions.

Discussion Forums (8)

In your posts, you will address questions that demonstrate your current understanding of and insights about Integral Calculus. These forums will allow you to begin thinking about the overall context of Integral Calculus, to identify your working knowledge of basic terms and concepts, and to share insights you have gained in technology-assisted short research assignments.

Minimum Requirements: Provide an initial post consisting of two paragraphs (at least 200 words) in which you articulate your current understanding or position on the topic as supported by course materials. These initial posts are due by 11:59 p.m. on Wednesday each week. Then reply in at least 100 constructive words to the thoughts of another colleague by 11:59 p.m. on Friday each week. You may choose to post more in order to generate further discussion or elicit responses and reflections from other learners (as indicated in the rubric)

For further specific grading criteria, view the Discussion Forum Rubric on the course site.

Essay

Complete an essay related to a video presentation. Find the prompts to be addressed on the course site. Use at least 500 words and answer all the provided prompt question(s).

Quizzes (13)

For most weeks throughout the course, you will complete various quizzes related to weekly material, most of which are drawn from the online textbook. These will help you gain and practice the skills necessary for Integral Calculus problem solving. Beyond just seeking the correct answer, quizzes invite you to practice until Calculus concepts, methods, and perspectives become nearly automatic and intuitive as you grow in expertise.

For each week's Quiz, download and complete the Quiz Word document from the course site. Then submit your completed document in the respective assignment submission area.

Exercises may require you to write equations, produce graphs and charts, and make computations. You may be required to use technology resources like spreadsheets, online graphing calculators, and online computer algebra systems. All your work and solutions for all exercises in a given week should be submitted as one Word document with screen shots showing how you used technology resources to reach your conclusions. Any written or sketched work should be scanned in and added to the Word

document as images. Most equation computations should be made with a word processing equation editor.

Most quiz and exam questions will be graded using the following five-point scale.

- 5 pts:** The response is a complete and full answer. All work is shown including necessary graphs and computer code, if applicable.
- 4 pts:** The response shows a proper process; however, there is a single logical or computational error.
- 3 pts:** The response shows overall work that is correct; however, the response shows a minor process error that results in one or more computational errors.
- 2 pts:** The response shows a completed subtask; however, the response shows a major error in reasoning or does not answer the question.
- 1 pt:** The response shows minimal work or lack of understanding of the process necessary to solve the problem.
- 0 pts:** The problem is omitted or is completely on the wrong track.

Midterm and Final Exams

Complete the midterm exam during week 8 and the final exam during week 15. The exams are open-book and not timed. You may use your online textbook (including formula sheets), graphing calculator, student notes, course website(s), video(s), Desmos, and other course materials, but you may not have assistance by any person or any other website (including www.wolframalpha.com) in completing the exam. You may submit your work either scanned in a PDF file or entered in Microsoft Word using the Equation Editor. Scanned documents should be submitted online all in one file. A late exam receives a 10% deduction.

The final exam will emphasize concepts and computations from the second half of the course, but be prepared for some problems from the first half of the course. Make sure that you are fully prepared for this exam before attempting it.

COURSE SCHEDULE

Format

Everything needed to successfully complete this course in fifteen weeks is explained on the course site. Each assignment has been designed to work together during each week. When studying, be sure to follow the suggested format explained for each lesson.

For this course, students will receive access to each week's work as the semester progresses. There will be due dates during the week, but most weekly assignments will be due by 11:59 p.m. on Friday. Please refer to the schedule for the due dates of assignments.

Generally, for college-level work, students should expect to have an average of 9.5 hours of homework per week.

The last official class day in Week 15 varies from semester to semester. Please refer to the Semester Calendar found in the Academic Information section at the top of the course site for the actual last day of class. All course work must be completed and submitted by that day.

Due Dates

All written assignments (outlined below) are to be submitted on the course site by 11:59 p.m. CT on Sundays at the end of each week in which they are assigned, unless otherwise noted.

For any questions regarding these assignments, contact the instructor.

Orientation

- Read the Getting Started Page
- Participate in the Introductions Forum
- View and Complete Understanding Plagiarism Presentation and Quiz
- Complete Student Responsibilities Exercise

Week 1: How can I understand the accumulation of quantities?

Introductory Activities

- View Video: Introduction to the Definite Integral (9:21)
- View Video: Introduction to Infinite Series (8:16)
- View Video: Introduction to Your Textbook (4:30)
- View Video: Graphing with DESMOS (4:09)
- View Video: Definite Integrals with DESMOS (1:35)

Week 1 Activities

- Complete Interactive Reading: The Definite Integral
- Complete Interactive Reading: The Fundamental Theorem of Calculus
- Complete Integrals Exercises (not graded)

Interaction

- Participate in the Week 1 Discussion (**post initially by Wednesday 11:55 pm and reply by Friday 11:55 pm**)
- Submit Integrals Quiz (**due Friday 11:55 pm**)

Week 2: How can I compute integrals for a vast number of functions (part one)?

Activities

- Complete Interactive Reading: Substitution
- View Video: Indefinite Integrals Using Substitution (11:04)
- View Video: Definite Integrals Using Substitution (9:29)
- Complete Interactive Reading: Exponential/Log Functions
- Complete Interactive Reading: Inverse Trig Functions
- Complete Integral Techniques Exercises (not graded)

Practice

- Complete Substitution Etc. Practice Problems (**by Friday 11:55 pm**)

Interaction

- Participate in the Week 3 Discussion (**post initially by Wednesday 11:55 pm and reply by Friday 11:55 pm**)
- Submit Integral Techniques Quiz (**due Friday 11:55 pm**)

Week 3: How can I make exact geometric computations (like length, area, and volume) for complicated shapes?

Activities

- Complete Interactive Reading: Areas Between Curves
- View Video: Area Between Curves (4:39)
- Complete Interactive Reading: Determining Volumes by Slicing
- View Video: Volume of Revolution (6:30)
- Complete Interactive Reading: Arc Length and Surface Area
- View Video: Arc Length (7:07)
- View Video: Surface Area of Revolution (10:09)
- Complete Analytic Geometry Exercises (not graded)

Practice

- Complete Area/Len/Vol Practice Problems (**by Friday 11:55 pm**)

Interaction

- Submit Analytic Geometry Quiz (**due Friday 11:55 pm**)

Week 4: How do I apply integrals to physics?

Activities

- Complete Interactive Reading: Physical Applications
- View Video: Work to Pump Water (8:47)
- Complete Interactive Reading: Moments and Centers of Mass
- View Video: Center of Mass (9:22)
- Complete Interactive Reading: Functions including Hyperbolic (Chapter from [Calculus 1](#) book)
- Complete Physics Exercises (not graded)

Practice

- Complete Physics Apps Practice Problems (**by Friday 11:55 pm**)

Interaction

- Submit History Essay (**due Friday 11:55 pm**)
- Submit Physics Quiz (**due Friday 11:55 pm**)

Week 5: How do I compute integrals for a vast number of functions (part two)?

Activities

- Complete Interactive Reading: Calculus of Hyperbolic Functions
- Complete Interactive Reading: Integration by Parts
- View Video: Integration by Parts (4:37)
- Complete Interactive Reading: Trigonometric Integrals
- Complete Integral Techniques II Exercises (not graded)

Interaction

- Participate in the Week 5 Discussion (**post initially by Wednesday 11:55 pm and reply by Friday 11:55 pm**)
- Submit Integral Techniques II Quiz (**due Friday 11:55 pm**)

Week 6: How do I compute integrals for a vast number of functions (part three)?

Activities

- Save/Print the Table of Integrals
- Complete Interactive Reading: Tables of Integrals
- Complete Interactive Reading: Trigonometric Substitutions
- View Video: Trig Substitution Ex 1 (7:11)
- View Video: Trig Substitution Ex 2 (6:50)
- Complete Advanced Methods Exercises (not graded)

Practice

- Complete Rational Functions Practice Problems **(by Friday 11:55 pm)**

Interaction

- Participate in the Week 6 Discussion **(post initially by Wednesday 11:55 pm and reply by Friday 11:55 pm)**
- Submit Advanced Methods Quiz **(due Friday 11:55 pm)**

Week 7: How do I compute integrals for a vast number of functions (part four)?

Activities

- Complete Interactive Reading: Partial Fractions
- View Video: Partial Fractions (5:40)
- View Video: Partial Fractions with Long Division (9:13)
- View Video: Partial Fraction with Long Division Adv (9:04)
- Complete Partial Fractions Exercises (not graded)

Practice

- Complete Partial Fractions Practice Problems **(by Friday 11:55 pm)**

Interaction

- Participate in the Week 7 Discussion **(post initially by Wednesday 11:55 pm and reply by Friday 11:55 pm)**
- Submit Advanced Methods Quiz **(due Friday 11:55 pm)**

Week 8: How do I put together my knowledge of integrals?

Interaction

- Complete and submit the Midterm Exam **(due Friday 11:55 pm)**

Week 9: How do I keep track of very complex motion?

Activities

- Complete Interactive Reading: Parametric Equations
- Complete Interactive Reading: Calculus of Parametric Curves
- View Video: Parametric Equations with DESMOS (5:34)
- Complete Parametric Equations Exercises (not graded)

Practice

- Complete Parametric Equations Practice Problems **(by Friday 11:55 pm)**

Interaction

- Participate in the Week 9 Discussion (**post initially by Wednesday 11:55 pm and reply by Friday 11:55 pm**)
- Submit Parametric Quiz (**by Friday 11:55 pm**)

Week 10: How do I track complex motion that cycles around a fixed point?

Activities

- Complete Interactive Reading: Polar Coordinates
- Complete Interactive Reading: Area and Arc Length in Polar
- View Video: Polar Coordinates with DESMOS (4:20)
- Complete Interactive Reading: Conic Sections (read part on Polar Equations)
- Complete Polar Coordinates Exercises (not graded)

Practice

- Complete Polar Coordinates Practice Problems (**by Friday 11:55 pm**)

Interaction

- Participate in the Week 10 Discussion (**post initially by Wednesday 11:55 pm and reply by Friday 11:55 pm**)
- Submit Polar Quiz (**by Friday 11:55 pm**)

Week 11: Infinity ... Can an integral go on forever? Can a sequence go on forever?

Activities

- Complete Interactive Reading: Infinite Integrals
- View Video: Limit To Infinity (4:20)
- View Video: Limit At Infinity (7:48)
- Complete Interactive Reading: Sequences
- View Video: Arithmetic Sequences (7:36)
- View Video: Geometric Sequences (8:05)
- View Video: Limit of Sequence (5:01)
- View Video: Limit of Sequence Using L'Hopital (2:49)
- View Sequences & Series with DESMOS (4:14)
- Complete Infinite Integrals/Sequences Exercises (not graded)

Practice

- Complete Sequences Practice Problems (**by Friday 11:55 pm**)

Interaction

- Participate in the Week 11 Discussion (**post initially by Wednesday 11:55 pm and reply by Friday 11:55 pm**)
- Submit Infinite Integrals/Sequences Quiz (**by Friday 11:55 pm**)

Week 12: Infinity ... Can you add an infinite quantity of numbers?

Activities

- Complete Interactive Reading: Infinite Series
- View Video: Infinite Geometric Series (10:01)
- View Video: Telescoping Series (6:04)
- Complete Interactive Reading: The Divergence and Integral Tests
- View Video: Integral Test (5:37)

- Complete Interactive Reading: Comparison Tests
- View Video: Direct Comparison Test (5:04)
- View Video: Limit Comparison Test (4:16)
- Complete Interactive Reading: Alternating Series
- View Video: Alternating Series Test (5:12)
- Complete Infinite Series Exercises (not graded)

Practice

- Complete Infinite Series Practice Problems **(by Friday 11:55 pm)**

Interaction

- Submit Infinite Series Quiz **(by Friday 11:55 pm)**

Week 13: Infinity ... Can an algebraic expression have an infinite quantity of terms?

Activities

- Complete Interactive Reading: Power Series and Functions
- Complete Interactive Reading: Properties of Power Series
- View Video: Interval of Convergence Ex 1 (7:05)
- View Video: Interval of Convergence Ex 2 (8:22)
- View Presentation on Figurative Numbers (9:37)
- Complete Power Series Exercises (not graded)

Practice

- Complete Power Series Practice Problems **(by Friday 11:55 pm)**

Interaction

- Submit Power Series Quiz **(by Friday 11:55 pm)**

Week 14: How does Calculus relate to infinite polynomials?

Activities

- Complete Interactive Reading: Taylor Series
- Complete Interactive Reading: Working with Taylor Series
- Complete Taylor Series Exercises (not graded)

Practice

- Complete Taylor Series Practice Problems **(by Friday 11:55 pm)**

Interaction

- Submit Taylor Series Quiz **(by Friday 11:55 pm)**

Week 15: Finals Week

The final week varies in length based on the semester. Please refer to the Semester Calendars found in the Academic Information section at the top of the course site for details.

Interaction

- Complete and submit the Final Exam **(due on the last day of the semester by 11:55 pm)**