MATH 152-01: CALCULUS I (4 cr.)

SYLLABUS & COURSE POLICIES

DORDT UNIVERSITY

SPRING 2023

Instructor:	Dr. Mike Janssen, Associate Professor of Mathematics
Email:	`Mike.Janssen@dordt.edu`; I will endeavor to reply to every email within one school day.
Classroom:	SB 2736
Class time:	8:10–9:25 AM MWF
Office:	SB 1612
Office Phone:	(712) 722-6398
Student Hours:	By appointment.
Required Resources:	Access to the free textbook, *Active Calculus*, found at `https://activecalculus.org/single` *Active Calculus* Dordt bundle, containing the activities workbook and Edfinity access code Regular access to our Canvas page and the Edfinity homework system
Prerequisite:	Math ACT of 27 or better; or ALEKS PPL score of 70 or better; or Math 115/116
Calculator:	A graphing calculator feature equivalent to a TI-84+ will likely come in handy, but is not required. We will make regular use of Desmos for in-class work.

Catalog course description: A study of the basic concepts and techniques of calculus for students in all disciplines. Topics include limits, differentiation, integration, and applications.

COURSE OVERVIEW

Welcome to Calculus I! I am glad you are here. This semester, we will embark on an exploration of one of the more fascinating areas of Creation. Indeed, some have said that no area of human inquiry has been more influential in creating our modern technological society than calculus. As Christians, it is therefore our responsibility to understand it and apply it well in obedience to the cultural mandate.

LEARNING OBJECTIVES

In this course, students will:

be *learners* of mathematics by demonstrating mastery of the mathematical concepts that have driven the development of our understanding of the inner working of creation and technology over the past 400 years. (RO, CD)

be *explorers* of mathematics by actively inquiring into/working with and applying the techniques of limits, differentiation, and integration using standard methods of calculus. (CS)

be *connectors* of mathematics by applying these tools and concepts to mathematical and real-world problems in a variety of settings. (CS, CR)

be *ambassadors* of mathematics by applying these tools and concepts to mathematical and real-world problems in a variety of settings. (CS, CR)

COURSE LITURGIES

In this section, we briefly describe the basic rhythms of the course. It is a truism that the best way to learn mathematics is to *do* mathematics, and this course is designed with that in mind.

BEFORE CLASS

In order to maximize your learning, it is important that you regularly attend class, and come prepared. For days on which we start a new section, this means that you should:

- read over the relevant section of the book (especially the Motivating Questions and introduction), and
- complete the Preview Activity (done on Desmos) and submit it by 8:00am.

Each timely submission of a Desmos Preview Activity on which you have made a good-faith effort to be correct will earn one Engagement Point (EP).

DURING CLASS

Unlike many "traditional" courses in mathematics, *you* will drive the in-class work, not me. A typical class period will begin with a brief reminder of a big idea or two from the pre-class work. We'll spend the majority of the time working in small groups on activities from our course materials, with occasional interruptions to discuss new insights and confirm that we're all on the same page.

AFTER CLASS

In order to build toward proficiency with the fundamental concepts and skills of the course, you will be assigned regular post-section homework, to be accessed on our Canvas site and completed on the Edfinity platform. See the due dates in the tentative schedule below.

ASSESSED WORK

Your fluency of the main concepts of calculus (and thus your final grade) will be assessed via the following items of work.

ENGAGEMENT

Your progress on this aspect of the course will be based on the number of Engagement Points (EPs) earned. You will earn one (1) EP by: submitting a Desmos Preview Activity by 8:00am Central on the assigned due date (see the schedule below); and one (1) EP for attending one class meeting. Preview Activity assignments and class attendance may not be made up/revised after the fact.

EDFINITY HOMEWORK

The online homework (done on Edfinity and accessed via Canvas) consists of regular problems due by 11:59pm Central on the listed due dates, typically the class day after we finish covering the relevant section. Your average on all of the homework sets will affect your final grade. You have an unlimited number of attempts on each problem, so your overall homework average should reflect not only your knowledge of the material but also your perseverance and commitment to finishing the work.

LEARNING TARGETS

There are 30 learning targets in this course; they are listed below. Each learning target will be assessed on at least two exams, and *may* be assessed on Friday quizzes. Each problem will earn a grade of either **M** (*meets expectations*) or **R** (*reassessment needed*). The number of learning targets assessed at **M** will affect your final grade.

If you are gone on the day of a learning target assessment, you will only be allowed to make it up if you missed for a Dordt-sponsored activity **and** I was notified ahead of time. The nature of these assessments means that you'll have ample opportunities to pass a given learning target even if you miss one of them.

DERIVATIVE CALCULATION EXAM

Our main topic of study this semester is the derivative of a function. In order to properly explore and answer questions about applications, it is important that you are able calculate derivatives efficiently and precisely. To this end, you will take an exam on which your score will be the number of functions (out of 10) that you *perfectly* differentiate. As described below, you may reassess the calculation exam numerous times over the course of the semester. Your **best score** over the course of the semester will affect your final grade as shown below.

If you are gone on the day of a calculation exam attempt, you will only be allowed to make it up if you missed for a Dordt-sponsored activity **and** I was notified ahead of time. The nature of these assessments means that you'll have ample opportunities to pass a given it even if you miss one of them.

REFLECTIONS

Dordt University places itself squarely in the Reformed tradition of the Protestant Christian faith. We affirm, as Abraham Kuyper said, that there is not a square inch in all of Creation over which Christ does not claim lordship—not even the abstract aspects of Creation commonly associated with mathematics. You will write three reflection papers this semester. These reflection assignments will be due as described below and assessed on a Pass/Not Yet scale. More details are available on each assignment's Canvas page.

FINAL EXAM

The final exam will be comprehensive and will be used to determine how your base grade is modified (round up 2/3 of a letter, round up 1/3 of a letter, leave unchanged, round down 1/3 of a letter, or drop a full letter grade).

GRADING POLICY

BASE GRADE

Your Base Grade will be determined by your work on the assignments described above. In general, the **highest fully completed row** in Table 1 will determine your base grade.

Base Grade	Learning Targets	Homework Average	Engagement Points	Calculation Exam	Reflections
A	28	92%	57	8/10	3
B	25	80%	47	7/10	3
C	21	67%	37	6/10	2
D	16	55%	30	4/10	1

Table 1: Base grade requirements.

FINAL EXAM MODIFIER

The final exam will consist of 10 problems (each graded out of 10 points) corresponding to the **bold** learning targets shown below. The final exam will modify your base grade in the following way:

> If you earn 95 points or more, your base grade will round up 2/3 of a letter (e.g., from a B to an A–). Note that an A is the highest possible final grade.
>
> If you earn 85–94 points or more, your base grade will round up 1/3 of a letter (e.g., from a B to a B+). Again, note that an A is the highest possible final grade.
>
> If you earn 65–84 points, your base grade will be unmodified.
>
> If you earn 50–64 points, your base grade will be rounded down 1/3 of a letter (e.g., from a B to a B–).
>
> If you earn 49 points or less, your base grade will drop by a full letter (e.g., from a B to a C).

Note that if your base grade is an F, your course grade will be an F regardless of your performance on the final exam.

REASSESSMENTS AND REVISIONS

There are two goals of the assessments in this course. **The first goal** is to hold you accountable for being an active and engaged member of our classroom learning community. This is where the Preview Activities come into play. Since these are intended to keep you on pace with the course material, **late submissions will not be accepted**.

The second goal of the assessments is to measure how well you are meeting the learning outcomes of the course. However, I am primarily concerned with your ability to *eventually* demonstrate fluency of the learning targets, so the opportunity to reattempt or to revise and resubmit is available for the other assessment categories.

If you do not pass the Calculation Exam or a learning target during the scheduled exam times in class, you will be able to reattempt them during weekly quiz reassessments. During non-exam weeks, you will be allowed to **sign up by Tuesday at 11:59pm** to reassess up to two learning targets on Friday; starting Friday, March 17, the calculation exam may be substituted for one of these learning targets. **If you do not submit a reassessment request on time, there will be no reassessment for you to take.**

The schedule of available learning targets is available below.

ADVICE

> I am generally fairly accepting of late work, with a built-in 24-hour grace period for any non-classroom activities. Additional time beyond the 24-hour grace period must be approved ahead of time.
>
> **Student hours** are your time to ask questions about all aspects of the class and college life. If the posted hours do not work in your schedule, send me an email! I will do my very best to accommodate your you.
>
> **Email Policy**: I check my email twice per school day: once in the morning, where I'll deal with any emergencies, and once in the afternoon, when I'll respond to other emails (including any that have come in since the morning). If you require a more immediate response, you're welcome to come find me in my office.

INSTITUTIONAL POLICIES

DORDT UNIVERSITY STUDENT'S RIGHT TO ACCOMODATIONS POLICY

Dordt University is committed to providing reasonable accommodations for students with documented qualifying disabilities in accordance with federal laws and university policy. Any student who needs access to accommodations based on the impact of a documented disability should contact the Coordinator for Service for Students with Disabilities: Sharon Rosenboom, Academic Enrichment Center, 712 (722-6490), Email: Sharon.Rosenboom@dordt.edu.

DORDT UNIVERSITY ACADEMIC HONESTY POLICY

Dordt University is committed to developing a community of Christian scholars where all members accept the responsibility of practicing personal and academic integrity in obedience to biblical teaching. For students, this means not lying, cheating, or stealing others' work to gain academic advantage; it also means opposing academic dishonesty. Students found to be academically dishonest will receive academic sanctions from their professor (from a failing grade on the particular academic task to a failing grade in the course) and will be reported to the Student Life Committee for possible institutional sanctions (from a warning to dismissal from the college). Appeals in such matters will be handled by the student disciplinary process. For more information, see the Student Handbook at https://www.dordt.edu/student-life/residential-life/student-services/student-handbook.

DORDT UNIVERSITY ATTENDANCE POLICY

As we begin the spring 2023 semester, class attendance policies and procedures as outlined in the Student Handbook are in place. To paraphrase the Student Handbook, Dordt University as an institution remains committed to in person instruction for face-to-face courses. As a result, you are expected to be present for every class period and laboratory period. Should you need to miss class for any reason, contact your instructor as soon as possible (either prior to the absence or immediately following). Absences for Dordt-sponsored curricular or co-curricular activities will be communicated by the activity sponsor and are considered excused. You are responsible to contact your instructor to make arrangements for missed work. Your instructor is not required to provide real time (synchronous) learning for you should you be absent for class for any reason (ex. Zooming into your real time class). Your instructor is also not required to provide asynchronous virtual learning materials for you (ex. recordings of missed classes, powerpoints, other materials on Canvas). While some instructors might utilize some of the synchronous/asynchronous methods of making up work on occasion, you should not expect all instructors to provide these experiences automatically. Methods of making up missed work might include: contacting a fellow student to get notes from class, extensions on assignments or labs, or other methods as determined by your instructor. Making arrangements for missed class work is your responsibility!

Please see your instructor's specific attendance policy.

I reserve the right to make changes to this syllabus/course policies document as the need arises.

SCHEDULE

Date	Day of week	Lec. #	Daily Plan	PA Due	Other Work Due
January 13, 2023	F	1	Course Intro/1.1: How do we measure velocity?		
January 16, 2023	M	2	1.1 How do we measure velocity/1.2 The notion of a limit	1.2	
January 18, 2023	W	3	1.3 The derivative of a function at a point	1.3	1.1 Homework, 1.2 Homework
January 20, 2023	F	4	1.4 The derivative function	1.4	Quiz LTs 1-2; 1.3 Homework
January 23, 2023	M	5	1.5 Interpreting, estimating, and using the derivative	1.5	1.4 Homework
January 25, 2023	W	6	1.6 The second derivative	1.6	1.5 Homework; Reflection 1 (Math Autobiography)
January 27, 2023	F	7	1.7 Limits, Continuity, and Differentiability	1.7	Quiz LTs 1-5; 1.6 Homework
January 30, 2023	M	8	1.8 Tangent line approximation	1.8	1.7 Homework
February 1, 2023	W		Review/catch-up		1.8 Homework
February 3, 2023	F		**Exam 1: LTs 1-9**		
February 6, 2023	M	9	2.1 Elementary Derivative rules	2.1	
February 8, 2023	W	10	2.2 Sine and cosine	2.2	2.1 Homework
February 10, 2023	F	11	2.3 Product and Quotient rules	2.3	Quiz LTs 1-9; 2.2 Homework
February 13, 2023	M	12	2.4 Derivatives of other trig functions	2.4	2.3 Homework
February 15, 2023	W	13	2.5 Chain rule I	2.5	2.4 Homework
February 17, 2023	F		2.5 Chain rule II		Quiz, LTS 1-11
February 20, 2023	M	14	2.6 Derivatives of inverse functions	2.6	2.5 Homework; Reflection 2 (Beauty)
February 22, 2023	W	15	2.7 Implicit differentiation	2.7	2.6 Homework
February 24, 2023	F	16	2.8 Using derivatives to evaluate limits	2.8	Quiz LTs 1-11; 2.7 Homework
February 27, 2023	M		Derivative Practice/Review		2.8 Homework
March 1, 2023	W		**Exam 2: LTs 1-13, Calculation Exam**		
March 3, 2023	F	17	3.1 Using derivatives to identify extreme values	3.1	
March 15, 2023	W	18	3.1 Using derivatives to identify extreme values/3.2: Using derivatives to describe families of functions	3.2	
March 17, 2023	F	18	3.2: Using derivatives to describe families of functions		Quiz LTs 1-17/CE; 3.1 Homework
March 20, 2023	M	19	3.3: Global optimization	3.3	3.2 Homework
March 22, 2023	W	20	3.4: Applied optimization	3.4	3.3 Homework
March 24, 2023	F	20	3.4: Applied optimization		Quiz LTs 1-19/CE
March 27, 2023	M	21	3.5: Related Rates	3.5	3.4 Homework
March 29, 2023	W	21	3.5 Related Rates		
March 31, 2023	F		**Exam 3: Learning Targets 10-21/CE**		3.5 Homework
April 3, 2023	M	22	4.1: Distance from velocity	4.1	
April 5, 2023	W	23	4.2: Riemann sums	4.2	4.1 Homework
April 12, 2023	W	24	4.3: The definite integral	4.3	4.2 Homework
April 14, 2023	F	25	4.4: FTC I	4.4	Quiz LTs 10-25/CE; 4.3 Homework
April 17, 2023	M	26	5.1: Constructing graphs of antiderivatives		4.4 Homework
April 19, 2023	W	27	5.2: FTC II	5.2	5.1 Homework
April 21, 2023	F		**Exam 4: LTs 14-29/CE**		
April 24, 2023	M	28	5.3: Substitution	5.3	5.2 Homework; Reflection 3 (Creational development)
April 26, 2023	W	28	5.3: Substitution		Quiz LTs 14-29/CE
April 28, 2023	F		**Exam 5: LTs 14-30/CE**		5.3 Homework
May 1, 2023	M		Catch up and Review		
May 3, 2023	W		Catch up and Review		Quiz LTs 22-30/CE
May 5, 2023	F		Catch up and Review		Quiz LTs 22-30/CE
May 9, 2023	T		**Final Exam: 8:00am**		Quiz LTs 1-30/CE

LEARNING TARGETS

Learning Targets in **bold** will be covered on the Final Exam. Representative textbook problems appear in parentheses, though note that you should not expect exam problems to look exactly like one of these.

1. Given information about a function (either a table of data or a graph), answer questions about its average and/or instantaneous rates of change. (Exercises, 1.1.1, 1.1.2, 1.1.4, 1.1.5, 1.6.3)
2. **Sketch a graph that has specific behaviors at indicated points and intervals.** (Exercise 1.2.7, 1.6.9)
3. Given the graph of a function, answer questions about the function, its derivative, and its second derivative. (Exercises 1.3.1, 1.3.2, 1.3.3, 1.4.3, 1.4.4, 1.6.1, 1.6.2)
4. Use the limit definition to find the derivative function. (Exercises 1.4.2, 1.4.5)
5. Use the central difference and other estimation techniques to answer questions about applications of the derivative. (Exercises 1.5.1, 1.5.2, 1.5.3, 1.5.4, 1.6.8)
6. Given the graph of the derivative, answer questions about the function, the first derivative, and the second derivative. (Exercise 1.6.5, 1.6.7)
7. Given the graph of a function, determine the values of indicated limits. (Exercises 1.2.1, 1.2.2, 1.2.3, 1.7.1, 1.7.2)
8. **Given the graph of a function, determine the x-values where the function is not continuous and the points where it is not differentiable.** (Exercises 1.7.3, 1.7.5)
9. **Find a local linearization, use it to estimate the function at a nearby point, and answer questions about the accuracy of that estimate.** (Exercises 1.8.1, 1.8.2, 1.8.3, 1.8.4)
10. Find the equation of a tangent line. (Exercises 2.1.8, 2.2.2, 2.3.12b, 2.4.5)
11. **Given information about two or more functions (either graphs or values, but not the equations), answer questions about new functions involving those functions and their derivatives.** (Exercises 2.1.10, 2.1.11. 2.3.8, 2.3.9, 2.3.12a,d, 2.5.5, 2.5.6, 2.6.5, 2.8.1)
12. Find dy/dx for a function given implicitly. (Exercises 2.7.1, 2.7.2, 2.7.3, 2.7.4, 2.7.5)
13. **Use L'Hopital's Rule to evaluate limits involving indeterminate forms.** (Exercises 2.8.3, 2.8.4, 2.8.5)
14. Find the intervals where a function is increasing/decreasing and identify the relative maximums and minimums of the function. (Exercises 3.1.1, 3.1.4)
15. Find the intervals where a function is concave up/down and identify the inflection points of the function. (Exercises 3.1.1, 3.1.2)
16. Use the second derivative test to identify the local maximums and minimums of a function.
17. **Given information about a function (but not its equation), answer questions about the function, its first derivative, and its second derivative.** (Exercise 1.6.6, 3.1.5)
18. Given a family of functions, answer questions about the function and its derivative.(Exercises 3.2.3, 3.2.4)
19. Given a function and a closed interval, identify the absolute maximum and minimum on that interval. (Exercises 3.4.2, 3.4.4)
20. Solve an applied optimization problem. (Exercises 3.4.1, 3.4.2, 3.4.3, 3.4.4, 3.4.5)

21. Solve a related rates problem. (Exercises 3.5.1, 3.5.2, 3.5.3, 3.5.4, 3.5.5)
22. **Use antiderivatives to answer questions involving total distance traveled, change in position, velocity, and acceleration.** (Exercises 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.1.5)
23. Use Riemann sums to estimate the area between a positive function and the horizontal axis. (Exercises 4.2.1, 4.2.2, 4.2.3, 4.2.4)
24. Given a Riemann sum, identify the function and interval it is approximating to the area under the curve for. (Exercise 4.2.5)
25. **Use graphs of functions and properties of definite integrals to evaluate definite integrals.** (Exercises4.3.1, 4.3.2, 4.3.3, 4.3.4, 4.3.6, 4.3.7)
26. **Use the fundamental theorem of calculus to evaluate definite integrals.** (Exercises 4.4.2, 4.4.3, 4.4.4, 4.4.5)
27. Given the graph of a function, answer questions about its antiderivatives. (Exercises 5.1.1, 5.1.4, 5.1.5
28. Given the graph of a function, sketch a specified accumulation function of that function. (Exercises5.1.3, 5.2.4)
29. Use the second fundamental theorem of calculus to determine the derivative of an accumulation function. (Exercise 5.2.2)
30. **Use substitution to evaluate definite and indefinite integrals.** (Exercises 5.3.1, 5.3.2, 5.3.3, 5.3.4, 5.3.5, 5.3.6)