

# Honors Calculus I - Math 1181H (Autumn 2021)

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## 1 Course overview

**Office Hours:** Thursdays 4:00-6:00pm on Zoom (and by appointment if necessary)

**Text:** G.F. Simmons: *Calculus with Analytic Geometry*, 2nd edition, McGraw-Hill, ISBN: 9780070576424.

**Course Description:** This course gives an in depth introduction to the concepts and results of differential and integral calculus, as well as infinite series. Focus will be given on understanding why statements are true (i.e. to their proofs) rather than solely on computations.

Calculus is a very old branch of mathematics, with ideas going back at least to Archimedes. We think of calculus being formalized as a subject by Newton (1642-1727) and Leibniz (1646-1716). Since then, it has become part of the basic language of science. Beginning in the 17th century, physical sciences such as Physics and Engineering, were expressed in terms of Calculus. But increasingly, Calculus is the fundamental language of sciences as diverse as Biology and Economics. One of the strengths of Calculus, and Mathematics in general, is its ability to describe phenomena in a wide range of subjects by concentrating on their underlying structures, independent of the trapping of the specific field.

**Course Topics:** We will cover Chapters 2-10 and 12-14 of the textbook (see above).

**Prerequisites:** 1151 or 151.xx, and permission of department. GE quant reason math and logic course. Not open to students with credit for any higher numbered math class.

**Websites:** Important class information will be available on the class website and Carmen:

<https://people.math.osu.edu/cueto.5/teaching/1181H/Au21> ; <https://carmen.osu.edu>

**Lectures:** Mon-Tue-Wed-Thu-Fri 9:10AM-10:05AM in Baker Systems (BE) 130.

**Grading:** Your final raw score for this course will be computed using the following weights:

Final Exam (Monday Dec. 13, 10:00AM-11:45AM (to be confirmed))	35%
Midterm 1 (Tuesday, Sept. 21, in class)	15%
Midterm 2 (Tuesday, Oct. 26, in class)	15%
Midterm 3 (Tuesday, Nov. 23, in class)	15%
Homework	20%

Your course letter grade will then be determined based on

1. Your **course percentile** (your relative rank among your peers).
2. My determination of the overall class performance level.

For example, if your final raw score is 70/100 and exactly half of the class has a lower raw score, then your course percentile will be 50%. It is impossible to give the final percentile-to-letter-grade correspondence *a priori*. A reasonable percentile-to-letter-grade **estimate** is the following:

Letter grade	A	A-	B+	B	B-	C+	C	C-	D	E
Percentile range	100-95	95-90	90-87	87-84	84-80	80-77	77-74	74-70	70-60	60-0

If your degree program requires a certain letter grade in this course, it is a good idea to think about the likelihood of you ending up in each of the above ranges early in this semester.

**Class Participation and Attendance:** Doing math is a human activity. We will cover the material in an interactive fashion each lecture. It is important to stay actively engaged with the material and connected with both instructors and classmates, e.g. by attending lectures and using Carmen's discussion board. Lectures will be approached as active learning sessions.

To accommodate special situations (e.g. isolation/quarantine due to COVID-19 exposure or positive test), lecture notes will be posted on the course's website. I expect students to attend the daily lectures. Frequent absences are likely to be noted and may factor into the grade in borderline cases.

**Homework:** Homework is an essential component of this course. Problems will be assigned from the course's textbook. **The goal of each homework set is to help you understand the material and to prepare you for the tests.** It is thus imperative that you start working on each assignment as soon as we view the material in class. Take time to understand the questions and think about how to solve each problem before seeking help from the instructor and your classmates. Feel free to post questions on Carmen discussion board if you are stuck on a problem.

**Assignments will be submitted electronically via Carmen in pdf format.** You can submit pdf-files of your legible handwritten notes in two ways which will not cause major disruptions. For those of you who have access to a tablet, this should be simple (e.g. by using Notability on an Ipad). Otherwise, you can scan your handwritten solutions with your smartphone and generate a pdf. There are several apps and tutorials online for this (see, e.g. [this one](#)).

You are strongly encouraged to discuss the problems with me and your classmates, but your write ups must be your own. If you use other people's ideas, including from an online source, you must state this explicitly. Active participation on Carmen discussion forum will contribute towards your homework grade.

**There will a total of 13 homeworks** (see the course schedule for due dates). Only three problems from each set will be graded. Each homework set will be worth 20 points (5 points per problem graded plus up to 5 extra points for completion of the assignment). Always justify your answers and calculations!

You are strongly encourage to work out the homework problems in teams, but before you do so, try to solve the exercises on your own. No matter how you choose to do the homework, *individual solutions* must be turned in for grading. **No late homework will be accepted. Your two lowest homework grades will be dropped.**

**Showing Your Work:** Mathematics is not just about deriving the correct numerical solution to a problem. It is also about convincing others that your method of calculation is appropriate. *Insufficiently supported answers may receive partial or no credit on quizzes and exams.*

**Calculators etc.:** Calculators, cell phones and other electronic devices **will not be permitted.**

**Missed Coursework:** No late exams will be accepted without prior written permission. All requests for rescheduling (e.g. due to sickness, athlete duties or unforeseen circumstances) must be made in writing at least 48 hours before the regularly scheduled time. Within 48 hours of an exam or quiz only documented legitimate family or medical emergencies will be considered as excuses.

**Course topics:** We will cover Chapters 2-10 and 12-14 of the textbook (see above). This will include:

**Ch. 2 The derivative of a function**

- 2.1 What is Calculus? The problem of tangents.
- 2.2 How to calculate the slope of a tangent.
- 2.3 The definition of the derivative.
- 2.4 Velocity and rates of change.
- 2.5 The concept of a limit. Two trig. limits.
- 2.6 Continuous funcs. The Mean Value Theorem.
- A2 Theorems about limits.

**Ch. 3 The computation of derivatives**

- 3.1 Derivatives of polynomials.
- 3.2 The product and quotient rules.
- 3.3 Composite functions and the Chain Rule.
- 3.4 Some trigonometric derivatives.
- 3.5 Implicit functions and Fractional exponents.
- 3.6 Derivatives of higher order.

**Ch. 4 Applications of derivatives**

- 4.1 Increasing and decreasing funcs. Max/min.
- 4.2 Concavity and points of inflection.
- 4.3 Applied maximum and minimum problems.
- 4.4 Max-min problems. Reflection and refraction.
- 4.5 Related rates.

**Ch. 5 Definite integrals and differential equations**

- 5.2 Differentials and tangent line approximations.
- 5.3 Indefinite integrals. Substitution.
- 5.4 Differential eqns. Separation of variables.
- 5.5 Motion, escape velocity, black holes.

**Ch. 6 Definite Integrals**

- 6.2 The problem of areas.
- 6.3 The Sigma notation and certain special sums.
- 6.4 The area under a curve. Definite integrals.
- 6.5 The computation of areas as limits.
- 6.6 The Fundamental Theorem of Calculus.
- 6.7 Properties of definite integrals.

**Ch. 7 Applications of integration**

- 7.1 The intuitive meaning of integration.
- 7.2 The area between two curves.
- 7.3 Volumes: The disk method.
- 7.4 Volumes: The method of cylindrical shells.
- 7.5 Arc length.
- 7.6 The area of a surface of revolution.
- 7.7 Work and energy.

**Ch. 8 Exponential and Logarithmic functions**

- 8.2 Review of exponents and Logarithms.
- 8.3 The number  $e$  and the function  $y = e^x$ .

- 8.4 The natural logarithm function  $y = \ln x$ .

- 8.5 Popularity growth and radioactive decay.

**Ch. 9 Trigonometric functions**

- 9.1 Review of Trigonometry.
- 9.2 The derivatives of the sine and cosine.
- 9.3 Integrals of sin and cos. The needle problem.
- 9.4 The derivatives of the other four functions.
- 9.5 The inverse trigonometric functions.
- 9.6 Simple harmonic motion. The Pendulum.

**Ch. 10 Methods of integration**

- 10.1 The basic formulas.
- 10.2 The method of substitution.
- 10.3 Certain trigonometric integrals.
- 10.4 Trigonometric substitutions.
- 10.5 Completing the square.
- 10.6 The method of partial fractions.
- 10.7 Integration by parts.
- 10.8 A mixed bag: Integrals of miscellaneous types.

**Ch. 12 Indefinite forms and improper integrals**

- 12.1 The Mean Value Thm (revisited).
- 12.2 The indeterminate  $0/0$ . L'Hospital's Rule.
- 12.3 Other indeterminate forms.
- 12.4 Improper integrals.

**Ch. 13 Infinite series of constants**

- 13.1 What is an infinite series?
- 13.2 Convergent sequences.
- 13.3 Convergent and divergent series.
- 13.4 General properties of convergent series.
- 13.5 Series of nonneg. terms. Comparison tests.
- 13.6 The integral test. Euler's constant.
- 13.7 The ratio test and root test.
- 13.8 The alternating series test. Abs. convergence.
- A13 Absolute vs. conditional convergence.
- A14 Dirichlet's test.

**Ch. 14 Power series**

- 14.2 The interval of convergence.
- 14.3 Derivatives and integrals of power series.
- 14.4 Taylor series and Taylor's formula.
- 14.5 Computations using Taylor's formula.
- 14.6 Applications to Differential Equations.
- 14.7 Operations on Power series.
- 14.8 Complex numbers and Euler's formula.
- A15 Uniform convergence for power series.
- A16 Division of power series.

## 2 Health and safety policies

All students, faculty and staff are required to comply with and stay up to date on all university safety and health guidance (see <https://safeandhealthy.osu.edu>), which includes following university mask policies. Non-compliance will be warned first and disciplinary actions will be taken for repeated offenses.

Everyone is strongly encouraged to get vaccinated against COVID-19 as soon as they are able to do so. The vaccine has been proven to be safe and effective. The university has and will always base decisions on evidence-based public health guidance and the state of the pandemic, and a high vaccination rate will only increase the chances of normality.

Unvaccinated students will be required to test weekly as the academic year begins. Students who have been vaccinated against COVID-19 and reported their status to the university will not have to test. Once [House Bill 244](#) goes into effect on October 14, all students will be tested with the same protocols, regardless of vaccination status.

Regardless of vaccination status, masks must be worn **at all times** during in-person classes (unless otherwise indicated by University policy). Social distancing will be encouraged, whenever possible. Face masks must be worn in indoor settings, including, but not limited to: classrooms, residence halls, conference rooms, shared office spaces, hallways, buses, shared vehicles and common areas such as lobbies, study spaces and laundry facilities on all Ohio State campuses.

Free face masks are available for students, faculty and staff at a variety of campus locations including: all recreation facilities, most university libraries and the Ohio Union information desk. Masks can be picked up during business hours. A list of pick-up locations around campus can be found at

<https://safeandhealthy.osu.edu/personal-protection-hygiene>

## 3 Additional resources

The Ohio State University Wexner Medical Center's [Coronavirus Outbreak site](#) includes the latest information about COVID-19 as well as guidance for students, faculty and staff.

The [Office of Student Life's 'We Are Here For You'](#) page includes several resources to support your mental, physical and financial health.

## 4 Course technology

Course announcements will be made regularly through Carmen. **It is strongly encouraged that you connect to Carmen regularly (at least three times a week).**

For help with your password, university e-mail, Carmen, or any other technology issues, questions, or requests, contact the OSU IT Service Desk. Standard support hours are available at

<https://ocio.osu.edu/help/hours>.

Support for urgent issues is available 24x7.

- *Self-Service and Chat support:* <http://ocio.osu.edu/selfservice>
- *Email:* [8help@osu.edu](mailto:8help@osu.edu); *Phone:* 614-688-HELP (4357); *TDD:* 614-688-8743.

## 5 General policies

**Academic Misconduct Statement:** It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term academic misconduct includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-48.7). For additional information, see the Code of Student Conduct at <http://studentlife.osu.edu/csc/>.

**Statement on Title IX:** Title IX makes it clear that violence and harassment based on sex and gender are Civil Rights offenses subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories (e.g., race). If you or someone you know has been sexually harassed or assaulted, you may find the appropriate resources at <http://titleix.osu.edu> or by contacting the Ohio State Title IX Coordinator, Kellie Brennan, at [titleix@osu.edu](mailto:titleix@osu.edu)

**Disability Statement:** The university strives to make all learning experiences as accessible as possible. In light of the current pandemic, students seeking to request COVID-related accommodations may do so through the university's request process, managed by Student Life Disability Services. More information can be found on [this website](#).

If you anticipate or experience academic barriers based on your disability (including mental health, chronic, or temporary medical conditions), please let me know immediately so that we can privately discuss options. To establish reasonable accommodations, I may request that you register with Student Life Disability Services. After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion. SLDS contact information: [slds@osu.edu](mailto:slds@osu.edu); 614-292-3307; <http://www.ods.osu.edu/>; 098 Baker Hall, 113 W. 12th Ave.

**Your mental health:** As a student you may experience a range of issues that can cause barriers to learning such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. The Ohio State University offers services to assist you with addressing these and other concerns you may be experiencing. If you or someone you know are suffering from any of the aforementioned conditions, you can learn more about the broad range of confidential mental health services available on campus via the Office of Student Life's Counseling and Consultation Service (CCS) by visiting <https://ccs.osu.edu> or calling 614-292-5766. CCS is located on the 4th Floor of the Younkin Success Center and 10th Floor of Lincoln Tower. You can reach an on-call counselor when CCS is closed at 614-292-5766. Emergency help is also available through the 24/7 National Suicide Prevention Hotline at 1-800-273-TALK or at <https://suicidepreventionlifeline.org>