

# MATH 180: DIFFERENTIAL CALCULUS

Course outline for section 101

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## BASICS

**The teaching team and types of teaching.** This course is taught by a team consisting of the professor and graduate and undergraduate instructors. Contact information is on the Canvas course page.

Most weeks will include the following classes.

1. One 2-hour *lecture* taught by the professor, normally split into two parts. The first part (mandatory) introduces theoretical frameworks and main results. The second part (optional) is an office hour where you can ask questions and discuss mathematics with the professor.
2. One 2-hour *small class*, taught by the graduate and undergraduate instructors, normally split into two parts. The first part (mandatory) introduces new material that extends concepts introduced in the lecture. You are required to participate actively. The second part is reserved for oral group assignments (see the ASSESSMENTS section below).

**Textbook.** There is no required textbook. Many free online textbooks are suitable. The best is the CLP textbook, written by the UBC mathematicians Joel Feldman, Andrew Rechnitzer and Elyse Yeager. There is a link to this textbook in the “Additional resources” section of the Canvas course page.

**Piazza.** Piazza is an online forum where you may post and respond to questions. If you ask a question about homework, you must indicate what work you have already done and where you think you have gone wrong. If you respond to a question, you may not give away the answer. Bonus marks may be given for especially insightful questions and responses.

There is a link to Piazza on the Canvas course page.

**Office hours.** Office hours are opportunities to discuss questions about course material or mathematics in general with the professor. The second part of every lecture is reserved for office hours. You are also welcome to book appointments over email.

**Tips for success.** This course is difficult but doable. Your efforts will be rewarded not only in this course, but in upper-year mathematics and non-mathematics courses. Here are some tips for success.

*Work in your groups.* Most high school math courses are mainly about technical mastery. This course adds the goals of conceptual understanding and mathematical communication. The latter two are best learned in groups. Be in frequent communication with your assigned group throughout the term.

*Put in the time and effort.* Math is transparent: you learn by doing, and the more you do, the better you will get. The expectation is that you spend at least eight hours per week outside the classroom on this course.

*Keep up.* For six days a week, schedule some time to work on math. Don't fall behind. If you are struggling with some material, make sure to seek help, either from your classmates or from a member of the teaching team. However...

*Don't be too hard on yourself.* Some struggle is good and necessary. Learning mathematics, like learning anything else worthwhile, can be frustrating. Failing to get something on the first, or second, or even the third try is completely normal! Aim for progress.

## ASSESSMENTS

To achieve success in this course, assigned work is necessary but not sufficient. You must work through extra problems, some of which will be provided to you. *The expectation is that you spend at least eight hours per week outside the classroom on this course.*

**WeBWorK assignments.** There are weekly WeBWorK assignments consisting of 20 problems each. WeBWorK assignments are used to achieve technical and computational mastery. They are graded out of 15, so that you have 5 “free problems” of your choice that you need not complete. However, it is strongly encouraged that you complete all 20 problems.

**Written group assignments.** There are three group assignments. Written group assignments are used to develop your ability to synthesize information and construct arguments. Your answers must be in the form of explanations written in plain English with mathematical notations. You will be graded on the mathematical, logical and grammatical coherence of your explanations, as well as on their economy and creativity. Written problems are much more challenging than WeBWorK problems; it is normal to spend many hours working on them.

Each group will submit one assignment through Canvas. Your solutions must be typed. It is strongly recommended that you use L<sup>A</sup>T<sub>E</sub>X, a document preparation system widely used in mathematics and the sciences. The course webpage has a link to a free online L<sup>A</sup>T<sub>E</sub>X compiler. Improperly formatted assignments may not be accepted. Late assignments will not be accepted. Every participating member of the group will receive the same grade. Group members who do not participate will receive a grade of zero.

**Oral group assignments.** Each group will be asked at least once to do an oral group assignment. This consist of a single challenging problem to be solved live in a Zoom chat. Oral group assignments are used to assess your ability to work together to solve mathematics problems.

Following some lectures and small classes, some groups will be asked to remain for their oral group assignment. The instructors will assess your group for how well you understand the math, communicate with each other, and present your solution. Every participating member of the group will receive the same grade. Group members who do not attend or participate will receive a grade of zero.

**Tests.** There will be three 90-minute tests. Test 1 is on October 8. Test 2 is on November 5. Test 3 will take place during this course’s scheduled exam time in December. All tests are cumulative.

**Participation.** Some grades will be assigned for participation. To attain these grades, you must attend every class; participate actively, especially in small classes; and work with academic integrity.

**Grade summary.** Your final grade is based on your best 10 WeBWorK assignments (10%), written and oral group assignments (20%), three tests (60%) and participation (10%).

## SCHEDULE

Important information is contained in the course calendar on the Canvas course page. Download that calendar and display it prominently.

An approximate schedule of topics is below.

Dates	Topics
Sept. 10 - 28	Limits, asymptotes and the derivative
Sept. 29 - Oct. 5	Derivatives of sums, products and quotients
Oct. 6 - 12	Derivatives of trigonometric functions
Oct. 13 - 19	Derivatives of exponential and logarithmic functions
Oct. 20 - Nov. 2	The Chain Rule, implicit and logarithmic differentiation, inverse trigonometric functions and related rates
Nov. 3 - Nov. 9	Curve sketching
Nov. 10 - 23	Optimization
Nov. 24 - Dec. 3	Linear and higher degree approximations