

UBC Math 102

2019 WT1

ACKNOWLEDGEMENT

UBC's Point Grey Campus is located on the traditional, ancestral, and unceded territory of the $x^w m \theta k^w \acute{o} y \acute{o} m$ (Musqueam). The land it is situated on has always been a place of learning for the Musqueam people, who for millennia have passed on in their culture, history, and traditions from one generation to the next on this site.

If you would like to know more about the joint history of UBC and Musqueam, one place to start is at UBC's aboriginal portal.

COURSE INFORMATION

Course Title	Course Code Number	Credit Value
Differential Calculus with Applications to Life Sciences	MATH 102	3

Differential calculus is the study of rates of change. We can study them in a literal way: for example, how fast is a population growing? We can also apply them to solve problems that might at first seem unrelated: for example, finding an efficient method for foraging.

UBC has a variety of first-semester calculus courses: 100/180, 104/184, 110, and 102. They are all interchangeable as prerequisites for other UBC courses.

In addition to the core content shared by all UBC calculus courses, Math 102 presents models particular to life-science applications. It includes a computing component using spreadsheet software (like Excel or Google Sheets) to approximate functions and analyse data. It also covers differential equations more thoroughly than the other courses.

PREREQUISITES

High-school calculus and one of (a) a grade of 80% or higher in BC Principles of Mathematics 12 or Pre-calculus 12, or (b) a satisfactory score in the UBC Mathematics Basic Skills Test.

If you do not satisfy the course prerequisites, you may find yourself automatically de-registered from the course once the term begins. The fact that you were able to register does not mean you satisfy the prerequisites.

CONTACTS

To contact your section's instructor, go to the Canvas inbox, start a new message, and select your section. Then click on the "to" field. You can either start typing your instructor's name, or click the field and select "teachers," then choose your instructor from the drop-down menu.

Instructors may be away from course email evenings and weekends, but during the work week a response time of about a day is typical. Homework questions are best sent to Piazza.

Section instructors:

101: Eric Cytrynbaum

105: Brian Freidin

108: Lianne Rens

102: Parham Hamidi

106: Jun Wang

110: Christoph Hauert

103, 104: Elyse Yeager

107: Keegan Boyle

111: Andreas Buttenschoen

For office hours and locations, please see your section's page, linked to Canvas.

OTHER INSTRUCTIONAL STAFF

Each section has a dedicated TA for grading homework. Our Head TA will moderate Piazza. Our WeBWorK TA will respond to the "email instructor" button on WeBWorK to help you with technical issues.

COURSE STRUCTURE

Math 102 is a coordinated class consisting of many different sections. The sections are taught by different instructors, but they share homework and exams. The instructors coordinate to teach roughly the same topics at roughly the same time. The course consists of in-person lectures with no labs or workshops. Lecture styles may differ between instructors.

To encourage distributed studying (studying frequently in small bursts, rather than infrequently in long cram sessions) there are assessments due every few days. See Learning Activities for more information.

SCHEDULE OF TOPICS

Lectures will naturally diverge somewhat from any schedule, so the schedule below may change slightly.

Week	Topics	Textbook Sections
1	Power functions, polynomials	1.1-1.4
2	Rational functions, limits at infinity, rates of change (average and instantaneous), continuity	1.4-2.5,3.2
3	Derivatives: geometric and computational interpretation; computing approximations; sketching; rules	3.1-4.1
4	More derivatives rules, antiderivatives of power functions, linear approximation and Newton's method	4.1-5.5
5	Newton's method, function sketching	6.1-6.3
6	Optimization	6.3-7.2
7	Least squares	7.4-8
8	Related rates, implicit differentiation, exponential functions	9.1-10.2
9	inverse functions, logarithms, exponential growth and decay, introduction to differential equations	10.3-11.3, 13.1
10	slope field, state-space diagrams, linear differential equations	13.2
11	linear differential equations, Newton's Law of Cooling, Euler's Method	12.1-12.4
12	disease dynamics, trigonometric functions, periodic functions	13.3-14.3
13	derivatives of trigonometric functions, inverse trig functions	15.1-15.3

LEARNING OUTCOMES

Students should understand concepts such as rate of change, and be able to apply them in a wide variety of situations. Students should be able to perform multi-step computations accurately. Students should be able to use their understanding of a concept to solve an unfamiliar problem. Students should be able to implement basic functions in a computer spreadsheet, and understand how the computer's calculations relate to the course concepts.

Students should be able to clearly and accurately communicate technical information.

LEARNING ACTIVITIES

Lecture

Classes may consist of some mix of lecture, discussion, group work, and individual work. Administrative information may be communicated during class.

During lecture, you should try your best to be present and thoughtful. If you find yourself lost because you struggle to pay attention, reading the text before class can help you form an outline of the coming lecture in your head, making it easier to come back from a short lapse in attention. When you are asked to work alone or in groups, stay on-task. Your instructor may ask you to participate with iclickers or similar polling tools.

WeBWork (and the 5% Rule)

WeBWork is an online homework system that offers instant, automatic feedback. It is a good way to reinforce computational skills.

There are two categories of WeBWork assignments. The weekly assignments are meant to review most of the course content from a week. The pre-lecture assignments are based on pre-lecture readings and videos. They are short, meant to encourage you to actively preview material that will be coming up in lecture.

The “email instructor” button on WeBWork should only be used for technical issues with the WeBWork software. It does not, as the name unfortunately suggests, connect to your instructor. For questions about the mathematical content of a homework question, you can go to Piazza, office hours, or the MLC.

The 5% Rule: Each problem submitted to WeBWork is given a point-weight and your total WeBWork score will be counted out of 95% of the total number of WeBWork points. Thus, if there are a total of 400 WeBWork points this term, you can get 20 points worth of them wrong and still get the full 10% allocated to WeBWork problems. This is not intended as a point give-away. It is intended to account for the fact that, early in the semester, you will take some time to master using WeBWork and we do not have the resources to evaluate every request for accommodation for every technical glitch you run into. Any requests for accommodation regarding WeBWork points due to alleged WeBWork glitches, formatting errors, computer crashes etc. are by default covered by the 5% rule.

Old-School Homework (OSH)

An important goal in this course that may not be familiar from your high school math experience is learning how to communicate mathematics. Much of the work you do in this course will be submitted electronically through the WeBWork interface. This automated system gives students the opportunity to get instant feedback on their work which can accelerate the learning process. Unfortunately, it does not help students build their communication skills, mathematical or otherwise. To address this issue, you have another type of homework: Old-School Homework, or OSH. OSH problems are typically open-ended, giving you experience with problem solving and with mathematical communication.

Part of your mark on the OSH will involve clear communication. This means using words and sentences in grammatically correct ways to help the reader make sense of your mathematical symbols and equations. Examples that illustrate our expectations are posted next to some early assignments. These examples should serve as guides to help you build a clear picture of what we mean by mathematical communication. There are two errors that students make with regard to this expectation of clear communication: saying too little and saying too much. Look over the examples carefully to gauge whether you are making one of these errors. For comments and examples of barely or unacceptable quality submissions, see these notes and images. Messy, disorderly, low resolution or poorly exposed submissions may be rejected at the discretion of your marker.

LEARNING MATERIALS

Our course materials are linked to UBC's learning management system, Canvas.

Our textbook, *Differential Calculus for the Life Sciences* by Leah Keshet, is available for free online. If you choose to purchase a hard copy, you may do so from Copy Smart (5784 University Blvd., 604-222-3189) for \$30 + tax.

Some homework will be hosted on WeBWork, a free online homework platform that you can access through Canvas. Other homework will be submitted electronically.

Some instructors may make a copy of their personal lecture notes available online. In some cases, these might be printable, or available from a bookstore as a bound notebook. Some instructors may require you to use clickers, which can be purchased at the UBC Bookstore for about \$45 and used in other classes.

ASSESSMENTS OF LEARNING

WeBWork

WeBWork is more formative than evaluative. WeBWork focuses on the computational learning goals of the course. All WeBWork assignments taken together will account for 10% of your overall grade.

OSH

OSH is meant to develop your problem-solving skills and your mathematical communication. OSH is also a formative assessment, but doing it well requires a lot of time and effort. Reflecting this, OSH is worth 20% of your overall grade.

Midterm Examination

The midterm examination will take place outside of class, because in-class examinations are extremely time constrained. The midterm examination will evaluate your problem solving skills, computational skills, and communication skills. Your midterm accounts for 20% of our overall grade.

Final Examination

The final examination will take place at a time and place determined by the university. Usually the date is not known until October. (It is important that you do not make travel plans that might conflict with the final exam.) The final exam is cumulative, covering material from the entire term. It accounts for 50% of your overall grade.

Assigning Marks

Assessments fall into two categories: formative and evaluative. A formative assessment is meant to help you learn something. OSH and WeBWork are good examples of this. Completing them should help you develop your understanding of course content. The midterm and the final, on the other hand, aren't there to teach you — their role is to evaluate your understanding.

The points attached to formative assessments are an inducement for you to try hard while you're studying, and then to pay attention to the feedback you receive.

Points on an evaluative assessment are good-faith attempts to certify student understanding. Keep this in mind when you're writing your exams: coming up with a correct final answer is only a consequence of you demonstrating that you know how to solve problems in general. So, the final answer is often less important than the steps you took to get there.

If you come across a fact from outside of class that makes a question trivial, using it may give you a correct answer, but it won't demonstrate that you've learned what we've been teaching, so it may not get you full credit. Similarly, writing something correct and then stopping shows better understanding than writing something correct and then following it with something incorrect.

Simplification

Simplification of your answers in an assessment should reflect a cost/benefit analysis, and is context-dependent.

WeBWork accepts calculator-ready answers. So, you can write (say) " $12e^{\sin 5}$ " rather than using a decimal approximation. This is the preferred way to enter answers into WeBWork, because it needs a high degree of accuracy to accept your answer.

OSH is meant to be practice for clear communication, and you have a lot of time to work on it, so it should be a polished product. That means expressions should be written in the form that is clearest to the reader. For example, $\frac{1}{6}$ is clearer than $0.16\overline{66}$, and e^2 is clearer than $7.389\dots$

In a timed assessment (the midterm and final exam), make a cost-benefit analysis. If something can be written much simpler with very little work, do that. If you leave the term $\ln 1$ unsimplified, we will assume you do not know that it is equal to zero. Zero is much clearer, and it should take you no time at all to use it instead of a logarithm. On the other hand, suppose you come up with an answer of $\frac{627}{1463}$. A simpler form would be $\frac{3}{7}$, but finding that form would take a while. We sympathize, and would not expect you to simplify this unless we specifically instructed you to. The cost is too high (in a timed environment) to justify the benefit.

Similarly, leaving answers with terms like $\frac{100}{10}$, $\ln(e^2)$, $e^{\ln 2}$, $\sqrt{x^2 + 2xy + y^2}$, $\frac{1}{x-1}$, $\sin\left(\frac{\pi}{2}\right)$, $\arctan(0)$, etc. will cause us to question your understanding. You should be able to simplify these quickly and easily to forms that are much, much clearer. (If not, check out the review material linked to the last question of the diagnostic test.)

Remarking

If you feel that a returned assessment is incorrectly marked, you can appeal that mark by filling out a regrade request form, attaching it to a printout of the assignment, and submitting it to the instructor within one week of the return of the marked assignment. The form should include a summary of what you feel was incorrectly evaluated with some justification of the claim. Your work will be re-evaluated in accordance with the established grading procedures, and re-marked if necessary. Note in unusual circumstances, if you mistakenly received a higher grade than earned, your final grade might decrease upon re-marking.

Concessions

There will be no make-up midterms, and no late homework accepted. Students with concessions (e.g. for illness or family emergencies) will have the weight of a midterm transferred to the final exam; the weight of an OSH transferred to the other OSH; and the weight of a WeBWork assignment transferred to the other WeBWork assignments.

Final Exam Requirements

A minimum mark of 40% on the final exam is required to pass the course, independent of all others marks in the course. A student who has a total term average of above 50%, but scores lower than 40% on the final exam, will receive a maximum term grade of 45%.

For a full description of the final exam regulations, see the UBC Calendar page on Student Conduct during Examinations. In particular, notes, calculators, cell phones and other electronic devices are strictly prohibited from use during the exam. This includes use of cell phones for checking the time. The same regulations apply for the midterm.

Scaling

Term marks may be scaled, and the scaling may differ between sections. No scaling will be decided upon until all assessments are marked. Because WeBWork and OSH historically have very high averages, the midterm and final are written to have lower averages.

Average marks for assessments are not always shared with students. If you are unhappy with your mark, rather than comparing it to your classmates, consult with your instructor about ways to improve your studying.

Sections will not necessarily be scaled so their averages match other sections. Differences between sections are often an indirect consequence of their meeting times.

UNIVERSITY POLICIES

UBC provides resources to support student learning and to maintain healthy lifestyles but recognizes that sometimes crises arise and so there are additional resources to access including those for survivors of sexual violence. UBC values respect for the person and ideas of all members of the academic community. Harassment and discrimination are not tolerated nor is suppression of academic freedom. UBC provides appropriate accommodation for students with disabilities and for religious observances. UBC values academic honesty and students are expected to acknowledge the ideas generated by others and to uphold the highest academic standards in all of their actions. Details of the policies and how to access support are available on the UBC Senate website.

OTHER COURSE POLICIES

Professional Ethics

You are encouraged to work in groups on homework assignments, while recognizing that independent effort is also crucial to learning. However, any misrepresentation of another persons work as your own is considered to be academic dishonesty. In particular, directly copying someone elses homework will be treated as a violation of UBCs Academic Integrity Code. See UBC's policy on plagiarism for details.

Cases of suspected academic misconduct will be reported to the undergraduate chair.

LEARNING ANALYTICS

Data from Piazza might be used to make course decisions, e.g. spending more time on a topic many students struggle with. Your participation in (or absence from) Piazza and the MLC will not affect your course grade.

You will be asked to complete several surveys (Diagnostic Test, MAPS). You will be graded on completion, but not on the answers you give. This data has been collected at UBC for a number of years, and is used to give us a picture of our incoming classes: knowing their mathematical strengths, weaknesses, and attitudes helps us decide what we should be teaching. This data is also used in some research, for example correlating prerequisite knowledge with university performance.

LEARNING RESOURCES

Text

This course closely follows the textbook.

MLC

The Math Learning Centre is a place to go for in-person help with course content. There is a table designated for Math 102 students. You can sit there to work with other students in the class. Graduate students circulate to answer questions. If the whole group gets stuck on something, they can wait for one of the graduate student staff members to come around and give them a hint.

Piazza

Piazza is a space for you to interact with your fellow students. Instructors may sometimes contribute to the discussion, but this is not the main purpose of the message board. Participation is not required.

Before posting on Piazza, read the stickied notes about searching and contributing.

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