Math 1560 Course Outline

Fall 2018

1   Basic course information

Course title: **Math 1560**, Calculus I

Course instructor: Sean Fitzpatrick. Email: sean.fitzpatrick@uleth.ca

Tutorial instructor: Arie Bomhof. Email: a.bomhof@uleth.ca

Course website: via Moodle

Course textbook: a free, custom **Open Education Resource**. There will be a PDF copy of the textbook available on Moodle, and you can also find it in the OER Textbooks section of my website.

Class schedule: Tuesday and Thursday, in L1060. Section A meets at 10:50 am, and Section B meets at 1:40 pm.

Tutorials: see Moodle or your class timetable for details. There are *no tutorials* in the first week of class.

Grading: see Section 2.2 in the FAQ.

2   Course FAQ

As you embark upon your study of calculus in this course (Math 1560), you likely have many questions, such as: "What is Calculus, anyway?" and "Is this on the test?" This FAQ will attempt to answer your questions, along with many others you did not think to ask.

2.1   Organizational questions

Questions related to the general operation of the course.

2.1.1   Can I get a print copy of the textbook?

Yes. I recommend using the Print-on-Demand service from the Campus Bookstore. They will print and bind copy of the book for you. It usually takes no more than a day to get a print copy from the Bookstore.

You can also print it yourself. The open license for our textbook means that you are free to do whatever you want with your electronic copy, and this includes printing it.

2.1.2   What do we do in the tutorials?

The tutorials provide an additional opportunity for you to get help with course material. You will also be able to complete work contributing toward your in-class assignment grade. In a typical tutorial, you will get to see some worked examples, and work on problems.

2.1.3   How do I find you if I need help with something?

My (that is, Sean's) office is C540, in University Hall. Arie Bomhof is down the hall, in C510

Office hours will be available on Moodle and maybe even on our office doors.

2.1.4 Do I need to make an appointment for office hours? What if I have class at that time?

You don't need an appointment – just drop in. **Office hours** are the times that I promise to be available for consultation. If the times I choose don't work, you can email me for an appointment.

2.1.5 What if it's not related to the course?

Come see me anyway, or send an email. If I can't help you myself, I'll direct you to someone who can. There's some great general advice for first year students on the U of L website. They've got some great answers to related questions there.

2.1.6 OK, but what if it's kind of personal?

If it affects your ability to participate in the course (or even if it doesn't), you can come talk to me. In many cases, you might be best off seeing Academic Advising or Counselling Services. Links to these services, and general advice, can be found on the U of L website.

You may also want to visit the University's Health and Safety website for information on other resources on campus.

2.1.7 What do we learn in Math 1560?

We'll be dealing with all your favourite functions from high school: polynomials, logarithms, exponentials, trig functions, etc. while learning about limits, derivatives, and integrals.

- **Limits** tell us about the value of a function near a point. A limit is simultaneously approximate and precise. In fact, most of calculus could be described as "the art of precise approximation"

- **Derivatives** tell us about how a function is *changing* near a point. Most rates of change in the sciences, from speed to population growth, are quantified using derivatives.

- **Integrals** will be defined in the context of calculating area, but they also appear whenever aggregates or averages are being considered.

Both derivatives and integrals are defined using limits, and the two are related in a (possibly) surprising way.

2.1.8 I'm fairly sure I won't need calculus in my other courses. What should I expect to get out of this course?

To be fair, most of the learning outcomes are tied to the material, but there are some fringe benefits.

1. If this is your first semester, you'll learn how to organize your time.

2. You'll learn how to *write*. Really. Technical writing is a skill that must be learned. Solving a mathematical problem, and knowing how to communicate your results, are two different skills. You'll learn to do both in this course.

3. You'll also learn how to read and digest technical material.

Hint: you can't read your textbook like a novel – it's a hands-on experience.
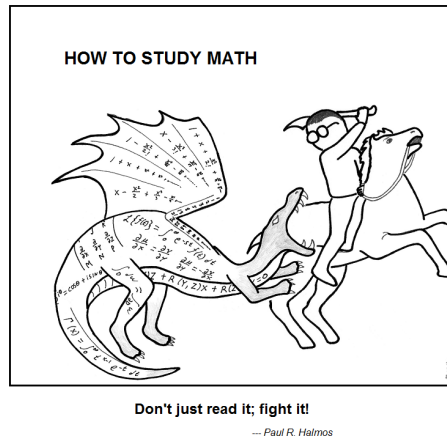
HOW TO STUDY MATH

Don't just read it; fight it!

— Paul R. Halmos

Figure 2.1: Source: Abstruse Goose

2.2 Coursework and evaluation

2.2.1 What kind of work am I going to have to do in this course?

Like any course, you'll be expected to devote time each week to learning content. In addition to the textbook, there will videos for each topic. I'll post the videos on YouTube and link to them on Moodle. You'll be expected to arrive in class having read the book, or watched the videos, or both.

2.2.2 What are your expectations of students?

- I expect you to make your best effort to arrive prepared for each class. I'm also aware that this is not always possible.

- I expect quality writing: complete sentences, proper use of notation, and clear exposition. I don't expect this right away, but I do expect you to work at improving.

- I expect you to treat your classmates with respect, and to contribute to group activities to the best of your ability.

- I expect you to ask for help when you need it. (Everyone does at some point.)

2.2.3 How will I know which part of the book to read, or which videos to watch?

Every week on Moodle I'll provide an outline of what we're covering in class, and what resources you should be accessing.

2.2.4 Thanks, but what I really meant is, how do I earn my grade?

Oh, right. The most frequently asked question of all. There are several different evaluation components that contribute to your grade:

Component	Number	Total Weight
Online homework	12	10
In-class activities	18	20
Chapter tests	5	35
Final exam	1	35

Table 2.2: Relative weights of graded activities for Math 1560

2.2.5   Whoa. That looks like a lot of work.

That's not really a question, but okay... First, it's not as bad as it looks. You'll be able to do most of it during class time, with help from classmates. Also, you've probably heard the adage: "Mathematics is not a spectator sport!" The best way to learn calculus is by doing calculus. The workload has been chosen carefully to ensure that a typical student gets enough practice to succeed in the course.

2.2.6   Okay, so what is involved with each of the graded components?

Here are brief descriptions of each one.

- Online homework: we use the **WeBWorK** online homework system. A new problem set will be posted each week. The system gives you immediate feedback on your answer, and you usually have unlimited attempts to get it right.

- In-class activities: the last 30 minutes of each lecture will be spent working on problems. Each problem will be tied to of the **standards** outlined in Section 3. Your grade for these activities will be based on the number of standards you complete by the end of the semester. See Section 3 for more details.

- Tests: there will be one test for each chapter of the textbook. The tests will be *two-stage* tests. Stage one is an individual test. This is immediately followed by stage two, which is the same test, but done in groups.

- Final exam: a traditional, cumulative, three-hour exam. Note that final exams are no longer scheduled according to the timetable, so the date of the final exam will not be known until sometime in October. You should plan to remain on campus for the entire exam period. The Registrar's Office *will not* allow you to reschedule due to travel conflicts.

2.2.7   How do I access the online homework?

You will log in directly from Moodle. As long as you have access to a computer and an internet connection, you have access to WeBWorK.

2.2.8   Two-stage tests? How does that work?

The group stage allows for immediate peer feedback on the results of the test. The tests are meant to be a *learning* opportunity, not simply a grading obstacle.

Each test is worth 7% of your grade: either 5% individual, plus 2% group, or 7% individual, whichever is better.

2.2.9   Wait, does that mean I can just skip the group stage and take my individual score?

Technically, yes. But I don't advise it. It's very rare that a student's group score is less, and the group discussion helps to ensure you've nailed down all the concepts, even if you think you got it all right the first time.

2.2.10   How do the in-class activities work?

You will choose which problems you want to work on, from a list I provide. At the end of class, you submit your work to be graded. Work is graded on a 3 point scale. A 3 means you've mastered that standard, and you're done with it. A 2 means there are minor errors. You can make corrections and resubmit your work. Fixing the errors bumps you up to a 3. A 1 means there are more significant issues with your work. You can attempt that standard again, with a new problem.

2.2.11   Does that mean I can keep resubmitting until I get it right?

Well, almost. I'll make most standards available for three classes. After that, if you want to try again, you'll have to come to my office.

2.2.12 How do I get my feedback and submit my revisions?

We'll be using the **Crowdmark** online grading system to streamline the grading process. As soon as your work has been graded, you'll receive an email with a link you can use to access your work. If revisions are required, you can print off your work, make corrections *on the same* page, and resubmit.

2.2.13 What if I lose the email with the link to my assignment?

You'll still be able to access it through Moodle.

2.2.14 How are letter grades calculated?

Each of the grade components above will be assigned a numerical score. These will be added to get a score out of 100 using Table 2.2. Your score out of 100 is converted into a letter grade according to the following table.

A+	A	A-	B+	B	B-	C+	C	C-	D+	D	F
97-100	91-96	88-90	85-87	79-84	76-78	73-75	67-72	64-66	61-63	55-60	0-54

2.3 Course policies

This section deals with questions about accommodations, missed tests, and other exceptional (yet common) cases.

2.3.1 One of the tests conflicts with something else in my schedule. What are my options?

If you know in advance that you will not be able to attend a test for a "reasonable reason", like varsity athletics, a conference, tea with the Queen, etc., send me an email. We will try to arrange an alternate sitting of the test. (Individual stage only.)

2.3.2 I missed a test because I was sick. What do I do? Do I get a zero?

Whoa, two questions at once! If you're sick, contact me as soon as you're able to. If your illness persists more than a day, it's unlikely we can make alternate arrangements. However, you ***do not*** receive a zero. That test is simply removed from your grade calculation.

2.3.3 Do I need a doctor's note?

No. This wastes health care resources and your time. Just email me to say you were sick. However, if you skip more than one test due to illness, we'll need to meet to discuss how to adjust your grade.

2.3.4 What if my car breaks down?

Same thing, for this, or other circumstances beyond your control. Send me an email, and we'll sort something out. But if there's a snowstorm forecast for the night before, maybe don't plan a trip to Calgary.

2.3.5 I'm on one of the Pronghorns teams.

Good for you!

Oh, you probably have some scheduling issues. Your coach should be providing you with a letter. Plan to meet with me during office hours one day and we'll sort something out.

2.3.6 I receive learning accommodations. What arrangements can I make?

First, make sure that you have registered with the University's Accommodated Learning Centre. If you have exam accommodations, you'll need to schedule your exams with them. No need to let me know: they'll contact me to request a copy of your exam.

If you require any in-class accommodations, or if there are any adjustments I can make to facilitate your learning, please do not hesitate to get in touch with me.

2.3.7 I write my tests with Accommodated Exams. How do I participate in the group stage?

Make sure to meet with me early in the semester, and we'll figure out what works for you. In the past, some students have chosen to write the individual stage with Accommodated Exams, and then join the class prior to the group state. Others chose to write both stages with the class.

2.3.8 Do we get to have calculators for the tests?

I guess... Officially, you're only supposed to use a "basic calculator" – one that can add, subtract, multiply, and divide. Graphing calculators are definitely not allowed. Note that decmial approximations are rarely preferred over exact values. Questions are usually designed so that no calculator is needed. Try not to rely on yours.

2.3.9 Life intervened and I can't keep up this week. What do I do?

Send me an email. Extensions are usually granted as long as they're granted ahead of time. (E.g. Online homework extensions need to be in place before solutions become available.) See me if you're having trouble, or take a look at the other resources mentioned in Question 2.1.6.

2.3.10 I missed class. What do I do?

If it's a one-time thing, don't worry about it. Bring any work you needed to submit during office hours. If circumstances are conspiring to keep you from class on a regular basis, you'll need to meet with me to come up with alternate arrangements.

2.3.11 I have a question that isn't answered here. How do I contact you?

Short answer: you can send me an email. There are a few caveats, however:

- First, check the course page (and the announcements forum) on Moodle. Any information I need to communicate to the class will be posted on Moodle, or emailed to the class as an announcement via Moodle.

- Is the question about homework? Email is not a good medium for discussing math. Your best option is to ask me in person. If that doesn't work, we have a class discussion forum, on Piazza.com. You'll be able to access the forum via Moodle.

2.3.12 I sent you an email. Why haven't you answered it yet?

Here's a short troubleshooting guide:

- Your email was not sent from a ULeth account and had no subject line: It went to my spam folder.

- Your email sent between 10 pm and 6 am: I'm asleep. I'll answer when I get to work in the morning.

- Your email sent during office hours: I'm busy helping the students who are here in person. Perhaps you should drop by yourself.

- Your email asked for help on a specific homework problem: Direct your question to the online forum.

- Your email was about something already addressed in this FAQ: I need time to come up with a polite reply.

3   Outcome standards for Math 1560

This page outlines the list of standards each student is expected to achieve in Math 1560. There are five "big themes," corresponding to the five chapters of the textbook. Each theme comes with several standards you'll be asked to demonstrate by the end of the course. In every class (except test days) and tutorial, you'll be given an opportunity to attempt some of these standards.

A standard is considered **mastered** if you have:

- Correctly solved two problems associated with that standard.

  (Minor arithmetic errors are not penalized.)

- Used correct notation throughout your solution.

- Explained your work using complete sentences.

Standards will be graded according to the following scale:

- M: standard has been mastered.

- R: revisions required. This usually means your mathematics is mostly correct, but your writing needs improvement. Once you've fixed your errors, you can resubmit a corrected solution.

- I: there are issues with your solution. This usually means there are significant errors in your mathematics, or the level of writing is not acceptable. You can submit another attempt with a new problem.

- F: you have failed to demonstrate the standard, likely because you have not attempted it.

Note: these standards also serve as your outline for the final exam. For each standard there will be a collection of associated problems. Some subset of these problems (or variants of them) will constitute your final exam.

By the end of the course, you should be able to:

Chapter 1: Limits and continuity

1) Explain the concept of a limit using graphical and numerical information.
2) Apply limit laws in an abstract setting (explicit functions not given).
3) Use algebraic manipulation to evaluate limits.
4) Evaluate limits involving trigonometric functions.
5) Algebraically and graphically determine one-sided limits of piecewise-defined functions.
6) Evaluate limits involving infinity and determine asymptotic behaviour of a function.
7) Demonstrate continuity of a function using the definition.
8) Understand and apply the **Intermediate Value Theorem**.

Chapter 2: Derivatives

1) Understand and apply the limit definition of the derivative.
2) Understand and apply basic derivative rules (sum, constant, power).
3) Calculate derivatives using the product rule.
4) Calculate derivatives using the quotient rule.
5) Calculate derivatives using the chain rule.
6) Symbolically apply derivative rules in an abstract setting (explicit functions not given).
7) Use implicit differentiation to compute the equation of a tangent line.
8) Compute derivatives using logarithmic differentiation.
9) Compute derivatives of trigonometric and inverse trigonometric functions.

Chapter 3: Graphical behaviour of functions

1) Determine maximum and minimum values of a continuous function on a closed interval.

2) State the **Mean Value Theorem** and apply it to theoretical problems.

3) Determine intervals on which a function is increasing/decreasing, and classify critical points.

4) Use the second derivative to determine concavity, and understand its significance.

5) Produce an accurate sketch of the graph of a function without the use of technology.

Chapter 4: Applications of the derivative

1) Solve word problems involving related rates of change.

2) Solve word problems involving optimization.

3) Use linear approximations to estimate function values.

4) Compute the Taylor polynomial of a function to a specified degree.

5) Quantify the error involved in a Taylor polynomial approximation.

Chapter 5: Integration

1) Compute antiderivatives and solve initial value problems.

2) Understand and apply properties of definite integrals.

3) Use a left- or right-endpoint Riemann sum to approximate area under a curve.

4) Calculate a definite integral using the Riemann sum definition.

5) Use Part I of the FTC to compute derivatives of functions defined as integrals.

6) Use Part II of the FTC to evaluate simple definite integrals.

7) Use the method of substitution to evaluate definite and indefinite integrals.

8) Set up and evaluate a definite integral to compute area between curves.

4   Standards in the textbook

This is a reference section which indicates how to find each standard in the textbook, and which exercises in the textbook provide suitable practice for each standard.

Standard	Section	Exercises
1.1	1.1	7 - 16
1.2	1.3	7 - 18
1.3	1.3	19 - 34
1.4	1.3	39 - 40
1.5	1.4	5 - 21
1.6	1.5	9 - 28
1.7	1.6	11 -34
1.8	1.6	35 - 38
2.1	2.1	7 - 22
2.2	2.3	11 - 32
2.3	2.4	7 - 10, 15 - 36 (as applicable)
2.4	2.4	11 - 14, 15 - 36 (as applicable)
2.5	2.5	7 - 42
2.6	N/A	via WeBWorK
2.7	2.6	13 - 32
2.8	2.6	37 - 42
2.9	2.7	15 - 29
3.1	3.1	7, 8, 17 - 26
3.2	3.2	11 -20
3.3	3.3	15 - 24
	3.4	29 - 56
3.4	3.4	15 - 28
3.5	3.5	13 - 26
4.1	4.2	3 - 15
4.2	4.3	3 - 17
4.3	4.4	7 - 34
4.4	4.5	5 - 20
4.5	4.5	21 - 28
5.1	5.1	9 - 27, 29 - 39
5.2	5.2	5 - 16, 19 - 26
5.3	5.3	29 - 34
5.4	5.3	35 - 40
5.5	5.4	55 - 58
5.6	5.4	5 - 30
5.7	5.5	3 - 42, 53 - 83
5.8	5.6	5 - 21

Table 4.1: Mapping of standards to the textbook and exercises

5   Course schedule

I will do my best to stick to the following course schedule. Test dates are fixed, but outcomes available for in class work may vary slightly. Up to date information will be maintained on Moodle.

Thursday, September 6	Course introduction
Tuesday, September 11	Standards 1.1 - 1.4
Thursday, September 13	Standards 1.1 - 1.6
Tuesday, September 18	Standards 1.3 - 1.8
Thursday, September 20	Standards 1.5 - 2.2
Tuesday, September 25	Test # 1
Thursday, September 27	Standards 1.7 - 2.4
Tuesday, October 2	Standards 2.3 - 2.8
Thursday, October 4	Standards 2.5 - 2.9
Tuesday, October 9	Standards 2.7 - 3.1
Thursday, October 11	Test # 2
Tuesday, October 16	Standards 2.8 - 3.3
Thursday, October 18	Standards 3.1 - 3.5
Tuesday, October 23	Standards 3.3 - 4.1
Thursday, October 25	Test # 3
Tuesday, October 30	Standards 4.1 - 4.2
Thursday, November 1	Standards 4.1 - 4.4
Tuesday, November 6	Standards 4.2 - 5.2
Thursday, November 8	Test # 4
Tuesday, November 20	Standards 4.3 - 5.4
Thursday, November 22	Standards 5.1 - 5.7
Tuesday, November 27	Standards 5.4 - 5.8
Thursday, November 29	Test # 5
Tuesday, December 4	Review, Standards 5.7 - 5.8

Table 5.1: Math 1560 lecture schedule for Fall 2018