

# Math 2580 Course Outline

Spring 2019

## 1 Basic course information

Course title: *Math 2580*, Calculus IV

Course instructor: [Sean Fitzpatrick](#).

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Office hours: Tuesday, Wednesday, and Thursday, 3:00-4:30 pm in C540.

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, 1:40 - 2:55 pm, in W514.

Grading: see [Section 3](#).

## 2 Course Description

### 2.1 Overview

Math 2580 is the last course in our calculus sequence. It deals with the calculus of functions of several variables, including vector calculus. In Math 2570, you learned about the calculus of vector-valued functions of a single variable, which looks a lot like regular calculus, but wrapped up in vector notation. You probably also saw an introduction to functions of several variables (limits, continuity, and partial derivatives), but since coverage of these topics varies in Math 2570, we'll review them.

Calculus IV culminates in vector calculus, which is the calculus of vector-valued functions of several variables. Before we get there, we have to introduce the cast of supporting characters: curves and surfaces in  $\mathbb{R}^3$ , and integral and differential calculus in two and three variables. Most of the results in Calculus IV are analogous to the ones you're familiar with from Calculus I, although some of them will look more complicated. Where the challenge lies for many people is that since Calculus IV takes place primarily in three-dimensional space, a certain amount of spacial visualization is needed to correctly set up some problems.

Most of Calculus IV (or for that matter, calculus generally) can be understood according to the following credo: *Smooth objects are locally linear*. Here, "smooth" can refer to (differentiable) functions, curves, surfaces, and so on. With this point of view, a lot of calculus becomes the translation of problems in geometry and analysis (hard) into problems in linear algebra (easy, relatively speaking). While derivatives and integrals will still occupy most of our time, we'll encounter the occasional guest appearance by matrices and determinants, and of course, vectors will play a role throughout.

## 2.2 List of topics

We will attempt to cover the course textbook in its entirety, following the order of topics found there. In particular, we will see the following in Math 2580:

- Surfaces in  $\mathbb{R}^3$ . Visualization via traces and level curves.
- Quadric surfaces and cylinders: equations and images.
- Functions of several variables: review of limits and continuity.
- Partial derivatives: review of basic principles.
- Differentiability: conceptualization via tangent planes, and general definition.
- Differentiability: the Jacobian matrix of partial derivatives.
- Differentiability: the function classes  $C^1$  and  $C^2$ .
- The multivariable chain rule (including an interpretation via matrix multiplication)
- Gradients and directional derivatives
- Extreme values: classifying critical points
- Extreme values: multivariable optimization (Lagrange multipliers)
- The derivative as a linear map.
- Iterated integrals: volume by cross-section.
- Riemann sums for multiple integrals.
- Double integrals in rectangular coordinates.
- Double integrals in polar coordinates.
- Applications of double integrals.
- Triple integrals.
- Triple integrals in cylindrical and spherical coordinates.
- General change of variables in multiple integrals.
- Review of parametric curves in space.
- Vector fields.
- Line integrals.
- Fundamental Theorem of Calculus for line integrals.
- Green's Theorem.
- Parametric surfaces.
- Surface integrals.
- Divergence theorem and Stokes' theorem.

## 3 Coursework and evaluation

### 3.1 Course components

There are several different evaluation components that contribute to your grade. The ones you see right now are place-holders until we decide on a grading scheme.

Component	Number	Total Weight
Online Homework	12	10
Assignments	8	20
Quizzes	20	20
Tests	3	50

**Table 3.1:** Relative weights of graded activities for Math 2580

### 3.2 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 3.1](#). 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
96-100	90-95	86-89	82-85	76-81	72-75	69-72	63-68	60-62	56-59	50-55	0-50

### 3.3 Description of course components

- The **online homework** will be delivered via our WeBWorK online homework server, and accessed via Moodle. There will be a new problem set every week.
- **Assignments** will be a combination of work done in class and on your own time.
- Each class will start with a short quiz. **Quizzes** will consist of a reading question (provided in advance) and an exercise. You can expect the exercise to be similar to a suggested homework problem. The exercise portion of each quiz will be completed once individually, and once as a group. Each quiz will receive a grade out of 10, as follows: 3 points for the reading question, 5 points for the individual solution to the exercise, and 2 points for the group solution.
- There will be three **tests**. The first two tests are tentatively scheduled for January 31st and March 7th, respectively. The third test will take place during the exam period. The relative weights of the test will be 15%, 15%, and 20%, with the highest weight assigned to the test with your best score.

**Note:** There will be 20 quizzes in total, and I will count your best 16. So if you miss the occasional class (for whatever reason) this should not impact your quiz grade. If illness or other circumstances conspire to keep you out of class more than 20% of the time, you will need to see me to make alternate arrangements.

## 4 Course policies

This section deals with questions about day-to-day operation of the course, accommodations, missed tests, and other exceptional (yet common) cases.

### 4.1 How do I find you if I need help with something?

My office is C540, in University Hall.

Office hours will be available on Moodle and maybe even on my office door.

### 4.2 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.

### 4.3 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 students](#) on the U of L website. They've got some great answers to related questions there.

### 4.4 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.

### 4.5 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.

### 4.6 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.

### 4.7 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.

#### **4.8 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.

#### **4.9 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.

#### **4.10 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.

#### **4.11 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.

#### **4.12 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 4.4](#).

#### **4.13 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.

#### **4.14 What are the policies regarding plagiarism and cheating?**

Our course conforms to the University policy on academic conduct, which can be found in the [Academic Calendar](#), beginning on page 61.

#### **4.15 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.

#### **4.16 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.