Math 2580 Course Outline

Sean Fitzpatrick
University of Lethbridge

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Abstract

As you continue your study of calculus in this course (Math 2580), you likely have many questions, such as: "What is Calculus, anyway?" and "Is this on the test?"

The transition to online teaching prompts even more questions. This outline is intended to serve as a roadmap, to guide you through the various components of the course.

1 Introduction to Math 2580

Welcome to Math 2580, Calculus IV. I'm happy to have you here with me as we complete the final semester of calculus. In my opinion, the last chapters in the calculus sequence are the most interesting, so you're in for a treat!

There are many of us in this class, coming from many different backgrounds and situations. If the "default settings" for the class don't work for you, please don't hesitate to ask for accommodation. Not everyone has reliable high speed internet. Not everyone is able to attend scheduled classes without work/family/ life getting in the way. But everyone deserves a fulfilling, enjoyable learning experience in each class.

We begin with some introductions: to the university, to the staff, and to the course.

1.1 Welcome to the University of Lethbridge

Oki, and welcome to the University of Lethbridge. Our University's Blackfoot name is Iniskim, meaning Sacred Buffalo Stone. The University of Lethbridge acknowledges and deeply appreciates the Siksikaitsitapii peoples' connection to their traditional territory. We, as people living and benefiting from Blackfoot Confederacy traditional territory, honour the traditions of people who have cared for this land since time immemorial. We recognize the diverse population of Aboriginal peoples who attend the University of Lethbridge and the contributions these Aboriginal peoples have made in shaping and strengthening the University community in the past, present, and in the future.

Unless you took a pass on the last semester, this is not your first crack at learning online. Making connections as we learn remotely will be a challenge, but somehow we'll do our best to make this happen. One of the ways we'll try to encourage community is by having regular group work, where you'll be able to interact with other students in the class. Another is by having an active discussion platform. This year we're trying out a new system, called **Campuswire**.

As usual, everything you need to know for the course will flow through our Moodle learning management system. Make sure you check in regularly to keep on top of what's happening in the course. (Possibly the hardest part of learning online is keeping track of deadlines.)

Don't hesitate to reach out if you have questions. I'll do my best to answer all of your course-related questions as quickly as possible. (See Section 3 for details on how to get in touch.) If you have questions that are not related to the course, you can ask those too, and I'll try to answer, or to direct you to someone who can. Some resources can be found on the University's Health and Safety website.

1.2 Course staff and contact information

Math 2580 is running for Spring 2021 with a single section of 40-50 students. My name is Sean Fitzpatrick. I can be reached via email at sean.fitzpatrick@uleth.ca.

Office hours: I'll do my best to arrive a few minutes early for class. If you do too, that's a great time to get in some questions (or attempt to influence the content of that day's lesson). Check Moodle for the most up to date information on office hours. I will also use Moodle's **Scheduler** booking system to let you book individual appointments.

1.3 Course description

Math 2580 deals with functions of several variables. We pick up where Math 2570 left off, with partial derivatives. One of our first topics will be differentiability. Just like in one variable, differentiability corresponds to the existence of a linear approximation. We'll then explore multivariable versions of familiar topics, like critical points, extrema, and optimization.

Since Math 1410 is a prerequisite for this course, we can do a few things that don't always make it into a standard calculus course. (At many universities, linear algebra is taken *after* the calculus sequence is complete.) In particular, we'll be able to make better sense of the notion of linear approximation: the linear approximation to a surface is a plane; the linear approximation to a differentiable function is a matrix transformation!

We'll then move on to double and triple integrals, and finally, to vector calculus. Most of what we see in the standard curriculum for vector calculus was developed to deal with problems in Physics, and in particular, electrodynamics. Those of you who have done a course or two in Physics will hopefully be able to make some connections.

1.4 And what about the whole online thing?

Ah, right! More details on that throughout the outline. But to get us started: what changes?

- More emphasis on:

  - Conceptual understanding
  - Discussion
  - Context (the whole "what is this good for?" routine)
  - Being generally swell human beings

- Less emphasis on:

- Memorization (because how am I gonna stop you from looking stuff up, anyway?)
- Routine computational proficiency (let's be honest: the computer can do this better than us most of the time)
- Tests and exams (so I can spend more time teaching and less time as the Math Police)

The course is set up with synchronous meetings (via Zoom) that follow the original timetable. It's great if you can come to these. There will be opportunities for discussion, and to work on problems (including ones you'll be handing in) with your classmates.

It's also understandable if you can't. Bad internet. Bosses who don't understand that online classes still have, well, classes. Maybe you have to share your computer with your little brother. Maybe travel restrictions mean that when class meets, it's 2 am where you are.

Fortunately, I'll do my best to also support asynchronous learning. Lots can be done on your own time, even if you do make it to class. The textbook is free, online, and full of videos. We'll run an online Q&A forum you can use to ask questions any time of day. Tests **are not** during class time. You'll have a 24 hour window.

In Subsection 2.4 you're going to see that there are lots of pieces to your grade. And yes, most of them have deadlines. But don't worry! Most of those pieces are small: designed to be done in class, or to take up no more than an hour or so of your time. Learning any kind of math is a marathon, not a sprint. So I'm giving you a little bit to do every day. Keep at it, and you'll do well. (Also, many deadlines are flexible, so don't hesitate to ask if you need more time.)

2 Essential course information

This section covers essential course information, including the meeting times, textbook, and grading scheme.

2.1 Course website

The primary course website is Moodle. On Moodle, you can expect to find:

1. Links to important resources, like this syllabus, and the textbook.

2. Links to key course activities, including the online homework, and the discussion forum. (The links will log you into those services automatically.)

3. Details about your grades and assessments.

4. A weekly topics schedule.

As you learn to navigate online learning (and as I learn how to guide you), the weekly topics schedules will be key to staying on top of your course material. Every week you can expect to receive details on readings, videos, homework, and assessments, as well as information on what will be taking place in class, and how to access those classes.

In case there's a day when Moodle isn't working properly and you need access to course materials, you can find some of them (like this syllabus) on my personal website. The textbook for this course (and many others) is available on our Open Textbook Server.

2.2 Scheduled classes

Math 2580 will be taught using a blend of synchronous and asynchronous instruction. Asynchronous components are explained in later sections. We have maintained the originally scheduled class meeting times, which are Monday and Wednesday, from 4:30 — 5:45 pm. (I can assure you that I had nothing to do with the class being at this annoyingly late time of day.)

Classes will be a mixture of Q&A (where I do examples by request) and group work (using Zoom's **breakout room** feature). Sometimes I will provide a problem for discussion that you will work on as a group, and then we'll reconvene as a class to compare group responses. You will also have time in class to work on group assignments, and after each test there will be a group test that takes place in class.

For the Q&A portion:

- You can use the discussion forum to recommend problems for us to discuss. (See Section 3.) You can also make requests using the Zoom chat.

- Once we choose a question to solve, I'll give the class an opportunity for input on how to solve it.

- I will record my solution (based on your input) and upload later to YouTube. Recording will be done so that only my video is captured. (That is: if you all want to turn on your cameras so I can see your smiling/frowning faces, I promise not to record you and put it on YouTube.)

2.3 Course textbook

Our course textbook is APEX Calculus, by Greg Hartman. This book is an **open education resource** (OER). That means that the book is fully free, both in terms of cost, your freedom to use and share the book however you see fit.

If getting the book for free somehow feels wrong, or you worry you're missing out by not buying anything, here are two great books you can buy:

1. Mathematics for Human Flourishing, by Francis Su.

2. Change is the Only Constant, by Ben Orlin.

Neither of these books are in any way needed for the course. But they're cool books, and they're about math. (The second is even about Calculus!) So if you feel like you need to spend money on a book, you can. (Or I don't know, go to the library or something.)

About APEX: For the last year or so, I've been working with Greg and others to convert the textbook to a system called PreTeXt. The PreTeXt language allows us to write a book that can be produced in a variety of formats.

There is a PDF version, which will be available on Moodle in both colour and black and white versions. The PDF version is useful if you want to print the book, or simply want to be able to read when there is no access to internet.

The real advantage of PreTeXt is that we can output to HTML format. The HTML version of the textbook can be found at https://opentext.uleth.ca/apex-standard/part-calculus-I.html. This version of the book can be read on both desktop and mobile web browsers. It also contains a number of nice features, including embedded videos, interactive graphics, and annotation tools.

2.4 Grading scheme

Our assessment principles this year:

- No big high stakes assessments: lots of little ones instead.

- More concepts, and less rote computation. (Less — not none. Your follow-on courses will still assume you know how to take a derivative.)

- Classes (the synchronous part) will be used for work, not lecture. (Nobody wants to sit though a 75 minute Zoom lecture on Calculus, including your instructor.)

- Group work is good for you. (Even if you don't always like it!)

The various graded components of the course are explained below. At first it will seem like there's a lot to do! But most items are small, and many can be done during class time.

Online Homework (10%) The homework will focus on building fluency with the computational procedures of calculus. You can expect a new problem set every week. Homework will be delivered through the **WeBWorK** online homework system. See Subsection 4.1 for details. Homework sets will be due each Tuesday, but extensions will usually be granted. (Due dates can be considered as "best before" dates, as in, it will be best for you if you are done before the indicated date.)

Assignments (25%) Assignments will be done in groups, and there will be time set aside in each class to work on them every Wednesday. Each assignment have only one or two problems, but these will typically involve multiple steps, and you will be graded as much on the quality of your explanation as on the validity of your mathematics.

Typically a written assignment is expected, but interested students are encouraged to explore alternative formats. For example, if a group wants to submit a video presentation instead of written work, that sounds like fun, and I will totally be on board with that.

Here is a fictitious (but possibly informative) grading rubric for assignments:

- A: wow, they clearly discussed this as a group, and nailed down all the key points! I also appreciate how the work is legible and relatively free of frustrated scribbling.

- B: everyone had something to say, but I'm not sure they all agreed. There's an obvious mistake that someone should have caught, suggesting that nobody thought to read it over before submitting.

- C: most of the details are there but this was clearly done in the last hour before the deadline. Also, it looks suspiciously like one person did all the work.

- D: looks like parts (a), (b), (c), and (d) were each done by a different person, and then arranged randomly on the page.

- F: nothing submitted. Or work is a crude drawing of what appears to be an integral attacking a kitten.

Review activities (15%) Prior to each test, there will be a review assignment. This will be facilitated though Moodle, using the **Workshop** activity. In a Moodle Workshop, you submit work like you would for a Moodle assignment. But once the submission phase closes, the workshop moves on to a peer feedback phase.

Typically, any reasonable effort at completing these activities will receive full credit. Any peer score over 75% will be automatically rounded up to 100%. I will review anything below 75% to see if the lower score is deserved.

Review activities will be posted the week before each test; your submission will be due at 10 pm on the Monday of the test week, and your feedback will be due by midnight on the Thursday of the test week.

Tests (30%) There will be a total of six tests. (Or if you prefer, quizzes.) Tests will take place every second week. Each test will open after class on Wednesday, and close at midnight that Friday, except for the last test. Closing dates for the tests will be January 22, February 5, February 26, March 12, March 26, and April 14.[1]

You will write the test *individually*, and submit via **Crowdmark**. The test will be a take-home test: open book, and open notes. The primary restriction is that you are not allowed to hire someone else to write your test for you. (This includes using certain subscription-based websites that offer "homework help".)

Exam wrappers (10%) After your test has been graded, you will be asked to submit a short reflection piece, where you comment on your performance and the feedback you receive.

Typically, you will be asked to comment on the following:

1. What did you do to prepare for the test?
2. What types of mistakes did you make on the test?
3. What (if anything) could you do differently next time?

Project, or Participation (10%) You can earn participation credit by asking and answering questions on our discussion forum, or by annotating the textbook.

Near the end of the semester, I will ask you to submit a report detailing your participation in the course. In the report, you will indicate what grade (out of 10) you think you deserve for participation.

If you choose not to participate regularly, but don't want to miss out on this part of your grade, you may contact me at any time after the Reading Week break, and arrange to do a project in lieu of participation.

Regrading policy: for both individual tests and group assignments, once your work has been evaluated, you will have an opportunity to address the feedback you received. You can get back up to 50% of the points you lost by explaining what you did wrong, and how to correct it. Your explanation should reflect the fact that you have read and considered your feedback, and thought about steps you can take to avoid similar mistakes on the next test.

You may submit corrections in writing, or in person during office hours.

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[1] April 5 is Easter Monday, and there is no class. Our last class is on Monday, April 12. The last test will open April 12 and close April 14.

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

Table 2.1 Conversion of percentage scores to letter grades in Math 2580

A+	A	A-	B+	B	B-	C+	C	C-	D+	D	F
98-100	93-97	90-92	86-89	80-85	77-79	73-76	68-72	64-67	60-63	50-59	0-49

3 Communication

The following communication channels are available in this course:

1. *Forums.*

   There will be a primary course Q&A forum using Campuswire. We are switching to Campuswire for the first time this semester, because the forum we used to use (Piazza) has switched to a paid/ad-supported model. Use of Campuswire is not mandatory (some of you may have privacy concerns) but it is strongly encouraged.

   As far as I can tell, Campuswire provides a better product in any case. We still get a Q&A forum, and the forum still has useful features, like support for mathematical notation, and the ability for students to remain anonymous to their peers.

   What's better is that the forum uses individual replies, rather than a single wiki-style reply, where one student ends up overwriting the reply of another. You can also upvote questions and answers that you like.

   Another useful feature is the availability of chat rooms. Students have the ability to set up chat rooms, and you can make these private. (Yes, a private chat room can even exclude your instructor.)

   Campuswire should be your primary communication channel. In particular, any questions about homework and course content should be asked there, since I can reply there with mathematical notation. You will also get a much faster reply on the forum than you will from email. If you have a question you don't want to ask publicly, you can send a direct message instead.

   To access Campuswire, use the signup link and PIN code provided on Moodle. But note that to sign up this way, you will need to use your U of L email address. If you prefer not to provide your school email address to a third party company, you can ask me to send you an invite to a different email address.

2. *WeBWorK.*

   There is one exception to the "put all homework questions on Campuswire" rule: in our WeBWorK online homework system, there is an "Email Instructor" button you can click to send feedback. This is useful if you think there's an error in the question, or if you've tried it several times and can't figure out why you're wrong. That email comes with a link I can use to jump directly to your version of the question, and see what answers you've tried. See Subsection 4.1 for details.

3. *Email.*

You can email me for questions that aren't related to course content. For example, if you have to miss class, or a test, you can email me to let me know.

4 Technology elements

To facilitate online teaching, our course will rely on several technological solutions. This section provides details on navigating the technology.

4.1 Online homework

Online homework is delivered via WeBWorK. WeBWorK is an open source homework system that I maintain on a local server. This service is provided to you free of charge, and your data never leaves campus. [1]

The value of WeBWorK is that questions are automatically graded, providing you with immediate feedback on your work. This is an excellent source of guided practice.

To access WeBWorK: simply click the relevant link in Moodle. You will be signed in automatically — there is no user name or password. But keep in mind that if your session times out due to inactivity, you have to return to Moodle to log in again.

Submitting answers: WeBWorK has an automatic preview feature. The mathematics in your answer will be rendered as you type. (You can turn this off in the user settings if you don't like it.) If everything looks good, click the Submit button. The system will immediately respond with "Correct" or "Incorrect". If your answer is correct, there is nothing more to do: your answer has been recorded, and you have credit for that problem. If your answer is incorrect, you get to try again. (*Exception*: I typically do not give unlimited attempts for true/false and multiple choice questions.)

Other notes:

- Some questions are "scaffolded" — there are multiple parts, and you need to complete one part before being allowed to access the next. For these, you want to click the Preview Answers button, rather than Submit, to check your work and move on to the next step.

- If you need to include scientific units in an answer, the automatic equation rendering can cause trouble. There's a little tool bar on the right hand side that lets you switch to *text mode* to enter units.

- At the bottom of each page is an "Email Instructor" button. If you are stuck on a problem, or if you think there is an error in the programming (it happens!) you can use this to let me know. WeBWorK will send me an email with your message, along with a link to the exact version of the problem you were working on. Often I can figure out where you're going wrong by looking at your answer.

  Please *do not* use the email button to ask me how to solve a problem. That's what the discussion forum is for. It should only be used after you've made several attempts at the problem, or if you see an error message of some sort.

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[1]Okay, this is not entirely true. Since faculty are expected to teach from home, your data does travel from campus to my house via the university VPN.

Finally, some general advice: WeBWorK is not a new addition for the online environment. I've used it for awhile. The students who do well in this course are the ones who start their problem sets early. Please do not wait until the due date to begin: it leaves you no time to ask questions! The most effective way to use WeBWorK is to read the relevant portion of the textbook, try the problems, and then ask for help on the ones you're stuck on.

Oh, and please do not wait until you've made 50 unsuccessful attempts at a problem to ask for help. If you haven't figured out a question after 5 or 6 attempts, set it aside, and come back to it a bit later. If you still can't figure it out, go the discussion forum.

4.2 Crowdmark

Tests and assignments will be submitted through Crowdmark. Like WeBWorK, Crowdmark is connected to Moodle, so you just have to click a link in Moodle to access your assessment and submit your work. Unlike WeBWorK, Crowdmark lets you do your work using pencil and paper. For ease of reference, I've placed advice for using Crowdmark on a separate page.

Basic advice:

- Start each question on a clean sheet of paper.

- Use a scanner, or a scanning app on your smartphone. PDF is best, but JPG and PNG files are also supported.

- When you submit, make sure your pages are in order, and rotated correctly.

4.3 Zoom and other video

Classes and tutorials will meet using Zoom. This is the officially supported meeting app for U of L classes, so you'll very quickly become familiar with (and tired of) Zoom.

We will *not* use Zoom for "content delivery". This is the job of the textbook and the prerecorded videos. Those videos are embedded into the textbook, so you can watch them as you read. Alternatively, you can subscribe to my channel on YouTube.

List 4.1 Zoom guidelines and etiquette

- Sign on using your U of L email and your proper name. I'm hoping to be able to put you into "breakout rooms" using pre-assigned groups. This will not work if your name doesn't match what's on the class list.

- Please **do** mute your microphone when everyone is together in the main room. You can unmute if you want to ask a question.

- Please **don't** mute your microphone while in a breakout room. (With reasonable exceptions: some of you might be in noisy environments, such as a construction site, or a house with kids.)

- About cameras. I will never require you to turn your camera on. Some of you may have very good reasons why you do not want to turn your camera on, and some of you may not even have a camera to turn on. But if you are willing to turn your camera on, it does help me, since I can use the visual cues you provide to tell

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if you understand what we're discussing.

When you are working with your group, in a breakout room, please consider turning on your camera, even if you otherwise don't. It makes it much easier to work as a group if you can see each other.

List 4.2 Asking questions during class

1. Using the chat box in Zoom. This is probably most useful to quickly ask for clarification on something I just said.

2. Using your voice! There is a "raise hand" feature if you don't want to interrupt, but it's often perfectly reasonable to interrupt, especially if you notice me getting something wrong!

Group work in Zoom. During most Zoom sessions, you will be put into smaller breakout rooms to work on problems. Breakout rooms are not recorded, and I cannot actively monitor the breakout rooms — these are essentially private working sessions for your group. I *do* have the ability to join a breakout room temporarily, but will only do so when invited. If you need my help during a breakout session, there is an "Ask for help" button you can use to get my attention.

You will be encouraged to use Microsoft OneNote to collaborate with your group. OneNote lets you type notes, insert photos, and use handwriting, if you have a touch-enabled device. Unlike the Zoom chat and whiteboard features, your OneNote notebook will remain available after class for you to refer to. See Subsection 4.4 for more details.

Recording. First of all: I do not intend to record entire Zoom meetings. I will record parts of class where I am presenting an example or exercise. However, I will not do this using Zoom's recording feature. Instead, I will record the same screen that I am sharing with you in Zoom using other software. This way, student images and voices will not be captured in the videos. Any videos I record will be uploaded to Moodle using the **YuJa** platform.

Please be aware that it is an ***academic offence*** to record a class, or anyone in it, without prior authorization. If all members of a breakout room agree to having someone record your discussion, this is fine. When are in the "main room" of Zoom, recording is not permitted.

4.4 Using OneNote

OneNote will be used both for class presentations, and for student collaboration. Details here will include how to access class notebooks, how to edit collaboratively, how to print, etc..

Students will have access to OneNote through their Office 365 accounts. There were early promises of Moodle integration that don't seem to have worked out. What we got instead are class "teams" on Microsoft Teams. There's one team per section, and each team has a class notebook attached to it.

5 Course policies (an FAQ)

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

1. *I don't think I can attend the classes regularly. Can I still take the course?*

   Short answer: yes. I recognize that not all students have access to the same technology. If your home internet is unreliable, attending Zoom sessions could be a challenge. If you can't attend synchronous sessions, I will arrange alternatives for graded work done asynchronously. I will also try to connect you with other students in the same situation, so that you still have a group you can work with.

2. *What happens if I get sick?*

   I'll do my best to be accommodating of any illness that interrupts your studies. There is no need to provide details of the illness. If you miss a week or more of work, please get in touch to make a plan for catching up. One of the biggest challenges in math is that once you fall behind, it's difficult to catch up on your own.

3. *What exactly does academic honesty mean?*

   In short, that any work you represent as your own, is your own. Much of your work can be done in groups, but not all of it. I will assume that you have access to a calculator, including online tools (like Symbolab) that give you step-by-step solutions.

   Use of these tools is acceptable, but take care that you are not overly reliant on them. What is not acceptable is having someone else do your work for you. This includes tutors, classmates, friends, family members, and online "homework help" sites. If you are paying money in exchange for answers to graded work, you are committing an academic offence.

   Penalties for academic dishonesty are outlined in the Academic Calendar. Depending on the severity of the offence, penalties for a first offence can range from a grade of zero on an assessment, to an F in the courses. Academic offences are also reported to the Dean of Arts & Sciences. They keep a record of each offence, and students with multiple offences can be subject to supplementary discipline.

4. *Does that mean I'm not allowed to get help with my homework?*

   Not at all! But keep in mind that your course instructors will be available for help, free of charge. (OK, maybe not free of charge, but you've already paid for it with your tuition.) We will be responding on the discussion forum regularly, There will be time to ask questions in every class, and there will be online office hours. The Student Success Centre will also be running free help sessions (details TBA).

   Some of you may still decide to pay for tutoring, and that's fine. But you have a duty to disclose sources of help on an assignment, and the individual tests are still tests, even if you won't have someone watching over your shoulder.

   You should probably avoid the various paid "homework help" websites. Most of these don't offer help. They offer worked solutions for a price. Getting those solutions won't help with your understanding. More importantly, the people working for these sites are paid (poorly) per solution,

and they often provide incorrect and/or badly written work. (We saw plenty of examples of this last Spring, and yes, all those students now have discipline reports on file.)

5. *I missed a test! What do I do? Do I get a zero?*

   First, contact me as soon as possible for any missed test. There are *five* tests, and I only count *four* towards your grade. As long as you only miss one test, there is no penalty. This is true regardless of your reason for missing the test.

6. *What if I really wanted to write that test?*

   Inform me of this when you contact me to explain your absence. There's no guarantee that I can schedule a makeup test, but I'll try. You're more likely to get a makeup test if you've contacted me in advance.

7. *Do I need a doctor's note?*

   No. This wastes health care resources and your time. (That was my answer before the pandemic, and it's doubly so now.) Just email me to say you were sick. However, if you miss more than one test due to illness, we'll need to meet to discuss how to adjust your grade.

8. *I receive learning accommodations. What arrangements can I make?*

   First, make sure that you have registered with the University's Accommodated Learning Centre. No need to let me know: they notify me of every student with accommodations.

   Some accommodations will look a bit different this year, but exam accommodations such as extra time are still possible.

   If there are any adjustments I can make to facilitate your learning, please do not hesitate to get in touch with me. All students deserve an equal opportunity to learn. Note that the HTML textbook is designed with accessibility in mind, and should work with screen readers. However, I regret that we have not had the time (or paid help) necessary to add elements such as alt-text descriptions for images. It's on the to-do list, but that list is long, and growing.

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. Online homework extensions need to be in place before solutions become available. Book an appointment with me as soon as you feel like you're falling behind and I'll do my best to get you up to speed.