MATH 1151 - CALCULUS I, AUTUMN 2019

Contents

1. General course outline and what this is about

You can find the general course outline of the main campus course here. I only recommend that you look at the additional material and the sample exams there, as assessments and course policies are specific to this course section. You can find this information below, together with a brief course description, and a few tips on how to succeed in this class. Check out the "Course resources" section as well.

I will refer you to this syllabus whenever you have a question that can find an answer here. I have put effort in trying to make this syllabus helpful and useful for you, so you should try to read it.

2. Course information

Course Instructor: Marco Vergura
Email: vergura.1@osu.edu

Course Period: the course runs from August 20 to December 4. The first class will be on August 21 and the last one on December 4.
Time & Place: classes will be **MW 3.05 - 4.55 pm and F 4.15-5.10 pm** in **Hopewell Hall 112**. I will start on time every time.
Office hours: **MW 11.05 am - 12 pm and F 2-3 pm in FH 2111 H**. Office hours will start on August 23.

Prerequisites: A grade of C- or higher in Math 1150, or in both Math 1148 and 1149, or Math Skills Assessment level A.

Textbook: Ximera, *Calculus 1, with free online interactive materials*. This is a free, open-source textbook, that you can find on Carmen. It has, however, no exercises. To make up for this, I have put together a list of exercises that you will find on Carmen (see the "Course resources" section below). You can also find exercises in other open-source textbooks on Calculus. This book can be a good choice, for example.

GEC Information: This course can be used, depending on your degree program, to satisfy the Quantitative and Logical Skills category of the General Education Requirement (GEC). The goals and learning objectives for this category are the following.

- **Goals**: to master the essentials of differential Calculus and its applications, to develop the computational and problem solving skills for that purpose, and to introduce the students to integral Calculus.
- **Learning Objectives**: to **recall, recognize and apply** the basic concepts and techniques of Calculus. These include: the notions of limit and continuity; the definition of the derivative of a function, and how to compute the derivative of any elementary function (polynomial, exponential, logarithmic, trigonometric, or any combination of such); how to determine maxima and minima, and how these techniques apply to real-life situations; the definition and some applications of definite integrals; the Fundamental Theorem of Calculus, and the substitution rule.

3. Course description

Loosely speaking, **Calculus is the Mathematics of change**. Its **objects of study are** (continuous) **functions**. These mathematical gadgets formalize the idea of a quantity, $f(x)$, that depends on another quantity, x, which is allowed to vary within a certain range of interest. In this setting, it makes sense to ask *how* the quantity $f(x)$ changes when x takes different values. For example, the position at the time x of the proverbial apple which fell from a tree branch and hit Newton's head can be described by the formula:

$$f(x) = \frac{1}{2}gx^2$$

where g is a fixed negative number, called gravitational acceleration. (Sir Isaac Newton, one of the inventors of Calculus, discovered the existence of this constant.)

Our first goal in this course will be **familiarizing ourselves with properties and examples of functions**.

Sometimes we might be able to access a function $f(x)$ *around* a specific value $x = a$, but not *at* $x = a$. We would like to *predict* what the value of $f(x)$ should be at $x = a$, using the information we have for the values around a. To do this, we use **limits**. Our next major goal will be **studying limits, their properties and how to compute them**.

Calculus studies change by considering "instantaneous" change. This is how the quantity $f(x)$ changes when x varies over very tiny ranges of values. If you drove for 2 hours and 150 mi, you might conclude that you drove at an average velocity of 75 mi/h. But the speedometer on your car never displays the average velocity, only the instantaneous one! **Derivatives** of functions are the mathematical tools to **compute instantaneous change**: if the function $f(x)$ describes the position of an object at time x, its derivative will describe precisely the velocity at time x of that object. We will then **focus on derivatives and on techniques to compute them**.

Finally, in many real-life situations it is easier to find information about the instantaneous change of an unknown quantity rather than about the quantity itself. This happens all the time in Physics where one might find an equation that describes the velocity of an object and would like to use this information to understand its trajectory. In these situations one needs an operation that takes as input a function describing the instantaneous change of a quantity and gives back as output that quantity itself. This is what **integrals** do, thanks to the **Fundamental Theorem of Calculus**. Our last topic will be the **study of integrals, and how to compute them**.

4. Assessments

The assessments for this course will be as follows. (You can find more details about the various assessments after the grade scale.)

Assessment	**Description**	**Points**
In-class exams	Six in-class exams.	100 per exam, for a maximum of 400 points: the grades from the two lowest-scored exams will be dropped.
Final exam	One comprehensive final exam, covering all the topics of the course.	150
Total	**Four in-class exams + Final Exam**	**550**

This is the tentative **grading scale** that we will use. The scale already takes into account all the rounding up that I am willing to do. **Grades are final, non-negotiable and will not be discussed, in any case, via email**.

Grade	**Range**	**Grade**	**Range**
A	$493 - 550$ (90%)	A-	$478 - 492$ (87%)
B+	$454 - 477$ (83%)	B	$438 - 453$ (80%)
B-	$419 - 437$ (77%)	C+	$399 - 418$ (73%)
C	$383 - 398$ (70%)	C-	$366 - 382$ (67%)
D+	$344 - 365$ (63%)	D	$323 - 343$ (59%)
E	$0 - 322$		

Here are more details about the various assessments.

In-class exams. The six in-class exams are scheduled on the following days.

- **Exam 1: Friday, September 6.** Book sections covered: $1-3$, $4.1-4.2$.
- **Exam 2: Friday, September 20.** Book sections covered: 4.3, $5-6$.
- **Exam 3: Friday, October 4.** Book sections covered: $7-12$, 13.3.
- **Exam 4: Friday, October 18.** Book sections covered: 13.2, $15-17$.
- **Exam 5: Friday, November 1.** Book sections covered: $18-22$.
- **Exam 6: Friday, November 15.** Book sections covered: $23,\ 25-29$.

(Book sections covered per midterm might change, depending on the actual lectures' pace.) Each in-class exam will be **50-minute long**. The exams will consist of exercises similar to the ones you will find in the list of suggested exercises. Thus, the best way to prepare for these midterms is to **do the suggested exercises**. There might be both **multiple-choice** questions, and **short-answer questions**. You are **not** allowed to use a calculator during these exams (see the "Course policies" section below). You will receive the exams' papers back within the Monday class after the exam date. See the "Course policies" section for missed exams policies.

Final Exam. The final exam will cover all the topics of the course, with an emphasis on the topics not covered by the six in-class exams (that is, sections $30-36$). You are **not** allowed to use a calculator during the final exam (see the "Course policies" section below). The final exam will be on **December 9, 3 pm - 4.45 pm**. **Please, let me know as soon as possible if you can not make it to the final exam.**

5. Weekly outline

You can find below a tentative weekly breakdown of the course content. Changes to this schedule are likely to happen. I will keep a lecture diary with the topics covered in each class on Carmen/Canvas, and with an indication of the exercises from the suggested exercises file that you can attempt after each class. One of the reasons why this outline is here is to give you an idea of the anticipated course pace. One point is particularly worth mentioning with respect to the **course load**. As you can see, there is a lot covered in this course. Moreover, the topics heavily build one on the other, more so than what you may have experienced in other courses. Therefore, it is paramount that you **keep up with the course material and the suggested exercises week by week**.

Week #	**Description**	**Assessments**	**Book sections**
1 (Aug 20-23)	Review of functions and famous functions.	None	$1-2$
2 (Aug 26-30)	Limits and continuity. Limit laws.	None	$3,\ 4.1-4.2$
3 (Sep 3-6)	Squeeze theorem.	First exam (Sep 6)	4.3
4 (Sep 9-13)	Indeterminate forms. Asymptotes and limits at infinity.	None	$5-6$

Week #	**Description**	**Assessments**	**Book sections**
5 (Sep 16-20)	Piecewise continuous functions and Intermediate Value Theorem. Tangent lines and definition of derivatives.	Second exam (Sep 20)	$7-9$
6 (Sep 23-27)	Derivative as a function. Basic derivatives and rules of differentiation.	None	$10-12,\ 13.3$
7 (Sep 30-Oct 4)	Chain rule. Implicit differentiation.	Third exam (Oct 4)	$13.2,\ 15$
8 (Oct 7-9)	Logarithmic differentiation. Derivative of inverse (trigonometric) functions. Related rates.	None	$16-19$
9 (Oct 14-18)	Related rates. Higher order derivatives. Maximum and minimum: increasing test and first derivative test.	Fourth exam (Oct 18)	$19-20$
10 (Oct 21-25)	Maximum and minimum: concavity test and second derivative test. Sketching graphs of functions. Absolute extrema.	None	$20-22,\ 23.2$
11 (Oct 28-Nov 1)	Mean Value Theorem. Optimazion. L'Hopital's rule.	Fifth exam (Nov 1)	$23.3,\ 25-27$
12 (Nov 4-8)	Antiderivatives. Sigma Notation. Area under a curve.	None	$28-29$
13 (Nov 12-15)	Area under a curve. Definite integrals.	Sixth exam (Nov 15)	$29-31$
14 (Nov 18-22)	Fundamental Theorem of Calculus. Application of integrals.	None	$32-34$
15 (Nov 25)	Substitution rule.	None	35
16 (Dec 2-4)	Substitution rule. Work-Energy theorem. Final review.	None	$35-36$

6. Course policies

Devices. During **the in-class exams and the final exam you will not be allowed to use a calculator**. For this reason, I highly advise you to never use a calculator when you solve exercises for this course. During exams, you will also **not be allowed to use any other device**, like cell phones, tablets or smartwatches, nor **the textbook or lecture notes**.

In-class expectations. Class attendance is not compulsory, but I highly suggest you to come to classes. **Bring pen(cil) and paper** to classes. You need them not only to take notes (you should take notes), but also because you will be doing Math problems in most classes. You **are responsible for the content of every class you miss**: ask lecture notes to your classmates, check the lecture notes online, and come talk to me in office hours only after you have put some serious effort to make up for the topics you missed. In class you need

to **speak respectfully**. Incidents will be reported.

Accommodations and make-ups. You will be accommodated for a missed exam (be it one of the in-class or the final exam) if and only if **you have a valid and documented excuse** (illness, compassionate reasons, etc.). A missed assessment without a valid and documented excuse will result in a score of zero for that assessment. (Remember that the lowest two scores from the in-class exams are dropped.) If a valid and documented reason applies, you can obtain approval for a **make-up** exam. Make-ups will usually be before the main exam, except in case of emergency.

As soon as you know there is an issue with taking an exam at the scheduled time (including the final), please notify me. In particular, it should be before the exam in question, except in case of emergency.

Office hours. Office hours give you an opportunity to **ask questions about the course material and about exercises**. You should feel free to ask me about anything related to the course that is unclear to you. When it comes to exercises, if you approach me by asking: "How do I do this exercise?", I will tell you to come back when you have thought about an answer yourself. The idea is that when you first try to solve an exercise by yourself and show me your work, my explanations can be more focused and targeted.

Communications. I will only reply to OSU email addresses. Write "Math 1151" on the subject line. I will send out communications about the course to your OSU email address as well, so you should check your account every day.

7. University policies

Disability Statement. Students with disabilities that have been certified by Student Life Disabilities Services (SLDS) will be appropriately accommodated and should inform the instructor as soon as possible of their needs. SLDS contact information: (740) 366-9441; Warner Center 226.

Academic Misconduct. It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term "academic misconduct" includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-48.7). For additional information, see the Code of Student Conduct.

8. Course resources

There is a webpage for the course on Carmen/Canvas. The main resources you will find there are the following.

(1) **A copy of this syllabus.**

(2) **The free online textbook for the course.**

(3) **A lecture diary**, containing information about what is covered during each class, what I expect to cover in the next class (so that you can read up topics in advance), and the exercises you should try to solve from the exercise list.

(4) **Lecture notes**. I will upload lecture notes on the topics we cover in class. (Each lecture note might include the topics of more than one class.) Due to in-class time constraints, these lecture notes are likely to be more comprehensive than in-class notes. For example, they might contain written remarks that I only say out loud in class, or they might explain a concept more extensively than what we do in class. There will also be many **"Practice problems"** in these notes: you will do some of them in class, while the remaining problems are simply more exercises for you. Finally, these notes will not simply be a rewriting of the textbook, even though they will present the same topics. This is because lecturing is not about reading a textbook out loud. Here is how you should approach these notes.

   (a) **First, you come to class and take notes**. Taking notes helps your learning process, and you can organize the material in a way that makes the most sense to you.
   (b) At home, you **compare and integrate your notes with the online ones**, paying particular attention to the parts of your notes that you find less clear or more confusing, and to the solved exercises. As you go through the online notes, you can do the **practice problems** that were not done in class.
   (c) Finally, you **compare and integrate your revised notes with the textbook**, to see if there is anything missing, or anything that makes more sense to you as written in the book rather than as done in class.

(5) A **list of suggested exercises**. You need to **first review your lecture notes** as established above, and **then attempt the exercises** for the corresponding sections. Do not reverse the order of these operations, at least if you care about doing well in this course. The exercises come with an answer key for selected exercises (as a separate file). I encourage you to talk about these exercises among yourselves, and with me. I will be happy to guide you through the exercises (including a full solution) once you have shown me enough effort in trying them.

(6) The **text and solution of each in-class exam** (after the exam, and possibly the make-up exam, has been written).

9. How to Help Yourself Learn

Learning new topics in Math is often challenging, but no worries, you will get through it! Here are some tips that can help your learning process.

- **Keep up with classes.** The topics that will be covered in this course build one on the other and they can easily feel overwhelming if you do not dedicate enough time to **study these topics as you encounter them**. If you do not keep up, you will not be able to follow lectures. Students that work at a consistent pace throughout

the term and do self-directed exploration of topics tend to achieve better results in university-level mathematics courses. Coming to classes as well as being attentive and asking for explanations during lectures are great ways to make sure you **dedicate profitable time to your learning**.

- **Do the suggested exercises.** In order for you to accumulate enough expertise in the various topics and consolidate your understanding, it is fundamental that you do enough exercises to test your knowledge. This is the reason why you should do as many exercises as needed to make sure you are comfortable with the material — and, after that, do a few more of them. Note that the point is not for you to learn how to solve exercises by heart, but to gain sufficient experience in finding solutions.
- **Learn from your mistakes.** Learning does not come without misconceptions and mistakes. Not only mistakes are completely fine (I make them too!), but overcoming them often leads to a deeper level of knowledge. Learning to understand why a mistake is such is also the reason why **you should try to solve an exercise by yourself before asking for help** (see below), so that the answers and the feedback you receive can be targeted to solve the specific problems you encountered.
- **Seek Help.** There is no reason to struggle with topics on your own when there are plenty of options to help you in your studying! First of all, you are more than welcome to ask me questions about specific aspects of a class during the class itself or at the end of it. For more general concerns or questions that require longer explanations, you can come see me during my office hours. On top of the help I can give you, you can check out the **drop-in Math center** located in Warner Center 202/206.