Calculus I

Loyola University Chicago – Math 161.004 – Fall 2014

Course Syllabus & Ground Rules

Course Details

Class Meetings: Dumbach Hall, Room 235; MWF 12:35–2:30 p.m.
Office Hours: IC, Rm 215, Mon. 10:00 a.m.–12:10 p.m.; BVM Hall, Rm 507, Tues. 1:00–2:30 p.m.; Changes will be posted on my webpage.

FINAL EXAM:

- what: cumulative, closed-book, closed-notes, approved calculators allowed.
- when: Friday, **December 12**, 9:00–11:00 a.m.
- rescheduling: requests granted for extenuating circumstances; must be made through Dean's office.

Course Text: Thomas, G.B., et al. *Thomas' Calculus: Early Transcendentals (Single Variable)* **Packed with MyMathLab.** 13th ed. ISBN-13: 978-0321-95287-5. Pearson, 2014.

Instructor Coordinates

Dr. Aaron Lauve
BVM Hall, Room 507 lauve@math.luc.edu
773.508.3727 www.math.luc.edu/∼lauve

Contact

Communication via Piazza is *strongly encouraged.* Emails to me should include **161** in the subject line. I will make every effort to reply within 48 hours.

Course Web Page(s)

There are many. Section-specific material and announcements will be posted to one of:

- piazza.com (a discussion forum; will be used extensively)
- cloud.sagemath.com (a site for computation and composition)
- pearsonmylabandmastering.com (homework)
- sakai.luc.edu/portal/site/MATH_161_004_2949_1146 (mainly for grades; Piazza accessible)
- webpages.math.luc.edu/∼lauve/161.html (archiving docs and announcements posted elsewhere)

Important Dates

In-term exam dates are *tentative.* Scheduled dates will be announced at least a week in advance.

Exams:	**September 17, October 20, November 21**
No Class:	*9/1, 10/6, 11/26, 11/28*

The latest date to drop with a record of "W" is October 31.

Course Catalog & Syllabus

Course Catalog. **Math 161 (4 units):** *An introduction to differential and integral calculus. Functions, limits, continuity, differentiation, intermediate and mean-value theorems, curve sketching, optimization problems, related rates, definite and indefinite integrals, fundamental theorem of calculus, log and exponential functions. Applications to physics and other disciplines.*
Prerequisites: Math 118 or Math Placement Test.

Syllabus. Most of Chapters 1–5 in text. (dept. page: www.luc.edu/math/courseresources/math161/)

Technology

A *TI-84+* or equivalent graphing calculator is **optional** for this course. Use of any calculator more advanced than this **will not** be allowed during exams.

We will use *Sage* and/or *Mathematica* throughout the semester. Sage is available for free, but is a bit of a pain to install under Windows... best to stick with the cloud version (`cloud.sagemath.com`). Get Mathematica for **free** here: `myits.luc.edu/mathematica`.

A Typical Week

Manic Mondays:	Workshop Wednesdays:	FreeForAll Fridays:
homework hints ($\approx$ 5 min.); lecture ($\approx$ 45 min.); reading quiz ($\approx$ 5 min.); another lecture ($\approx$ 45 min.).	more homework hints; lecture ($\approx$ 45 min.); group work on tough problems.	homework solutions; whatever else you want.

Course Components

Exams ($4 \times 15\%$). There will be three in-term exams and one final. Your lowest score will be replaced by the average of the other three. Insofar as possible, the in-term exams will not be cumulative.

Workshops ($3 \times 5\%$). Each Wednesday, we work on tough problems to help you move beyond "rote memorization" of differentiation rules, tangent line formulas, etc., and towards a deeper understanding of and facility with calculus concepts. Detailed solutions to two of these will be written up each week and submitted for grade by student volunteers. Each student must volunteer at least three times. The best three scores will be kept in computing the final course grade. (More details later.) Grading rubric:

(8/10) *Accuracy.* I hope this is self evident.

(2/10) *Organization and Clarity.* This is to practice communicating mathematics. Use complete sentences (often) and proper mathematical grammar (always). It takes time to learn how much to say (students say too much as often as not enough). Use the textbook's solutions as a guide (e.g., Example 6 on page 45).

Reading Quizzes (15%). The best way to learn something is to see it multiple times, and to digest it actively, not passively. Hence, you will have weekly quizzes on course material every Monday. These will be partly computational and partly conceptual, and will mainly test material to be covered that Monday. Your 10 best scores will be kept for the final course grade. Grading rubric: absent (0%), $\checkmark^-$ (70%), $\checkmark$ (85%), $\checkmark^+$ (100%); graded at your seat immediately following the quiz.

Class Participation (5%). Each student is expected to contribute in a meaningful way at least once a week. Be this through good questions during class or on Piazza, good answers, volunteering to present a problem on Friday, critiquing others' workshop write-ups, etc. When pondering your contributions each week, I'll use the $\checkmark^-, \checkmark, \checkmark^+$ rubric above. Your best 12 scores will be kept for the final course grade.

Homework (5%). Students will submit homework using the online learning system MyMathLab, which has the following nice pedagogical features: (i) instant feedback if your solution is incorrect; (ii) multiple chances to get the correct answer; (iii) videos and worked out sample problems; and (iv) lesson plans and chapter (pre-)tests to help you organize your studies. See "Odd and Ends" below for details.

Homework will be due roughly once a week (Thursdays, at midnight), and discussed in-depth during class on Fridays. Your best 12 scores will be kept for the final grade.

Course Grade

Final grades will be assigned as follows (all numbers are in %):

A (92) A- (90) B+ (88) B (82) B- (80) C+ (78) C (72) C- (70) D+ (68) D (60)

Course Etiquette

Please set your cell phones to "silent" upon entering class; phone noises are a distraction to everyone. Likewise, talking with your neighbor while I am lecturing or leading a discussion is **unacceptable** behavior. Reading newspapers, surfing the web, or texting your friends is *impolite* and is a distraction to your instructor; please find a better use for your time.

Finally, and most importantly, respect for others is *stressed* above all else; please allow me the first chance to answer your fellow students' questions. I expect everybody to participate in class discussions, but that begins by fostering an environment where we do not hesitate to ask our questions.

Getting Help

It may take awhile to adjust to the different style and pace of the course. My first piece of advice is to use your book well: learn the definitions and read the examples' solutions; do not be satisfied with the MyMathLab assignments, but instead work the "Guide Your Review" problems at the end of each chapter.

Please, **SEEK HELP** if you are falling behind. Form study groups, visit the Tutoring Center [a] (www.luc.edu/tutoring/), come to my office hours, meet me outside of my office hours, use the Piazza forum, find online resources (e.g., patrickjmt.com or https://www.khanacademy.org), etc.

Escape Routes

At any time, even after the last date for W-dropping the course, students who are experiencing medical or personal difficulties should not hesitate to consult their advisors or the Student Development Office or their dean. Don't allow yourself to be overwhelmed by such problems; Loyola has resource persons who may be able to help you (www.luc.edu/wellness www.luc.edu/bct)

[a] Learn more under "The Tutoring Center" below.

Academic Integrity

The Academic Standards and Regulations web page

www.luc.edu/academics/catalog/undergrad/reg.shtml

outlines the definition and ramifications of cheating at Loyola University (the "Academic Integrity" link) as well as the recourses available to you should you be accused of cheating (the "Academic Grievance Procedure" link). By attending this course, you agree to uphold the high standards of Loyola. If you are found cheating on an exam, you will receive a zero (0) for the exam and the incident will be reported to your academic dean and recorded in your permanent file.

Disability Services

The Americans with Disabilities Act (ADA) is a federal statute that provides comprehensive civil rights protection for persons with disabilities. It requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring accommodation, please contact the SSWD office: in the Sullivan Center, suite 117, phone 773.508.3700, fax 773.508.3810, or online at www.luc.edu/sswd/.

The Tutoring Center

The Center for Tutoring & Academic Excellence (CTAE) offers two varieties of tutoring services for Calculus: free Small Group Tutoring as well as Tutor-Led Study Hall. To learn more or request tutoring services, visit the center online at http://www.luc.edu/tutoring.

Small Group Tutoring Students will meet weekly with their small tutoring group, which will include other students from the same course, to enhance their exposure to and interaction with course material. These sessions will be guided by a trained peer tutor. These groups are most successful when students join early in the semester. Students can request small group tutoring on the CTAE website after August 11th.

Tutor-Led Study Hall Beginning shortly after the start of the semester, Tutor-Led Study Hall for intro-level classes in our high-demand subjects (accounting, biology, chemistry, economics, mathematics, select nursing classes, physics, and statistics) will be offered several hours a week to provide additional assistance to students with questions that arise between small group and class meetings. Students can find our Tutor-Led Study Hall hours on the CTAE website. Sessions begin on August 25th.

Odds and Ends

Make-Up Quizzes/Exams. Make-up quizzes and exams will only be given for real emergencies, documented illnesses, or university-sponsored events. Students must notify me of their absense **prior** to the next regularly scheduled class (and before the examination if possible). If a student fails to appear for a make-up at the mutually arranged time, no further opportunities will be extended. **Failure** to contact me as stated above or inability to sufficiently document the extenuating circumstances of students' absence will result in a grade of zero on the examination.

Loyola Email. On the occasion that I need to contact students outside of class, this is the only sensible way to proceed. If you would rather not use your `@luc.edu` email account, ... tough!

- You should receive an email from me before the start of our third class period.
- *If you do not receive this message, please let me know as soon as possible.*

Sage/LaTeX on the Cloud. You are responsible for creating an account on `cloud.sagemath.com`, after which time I will invite you to join our class "project." (Please do this as soon as possible, and please use your Loyola email to register; this can always be changed later.)

Accessing Piazza. Look for the "Piazza" button on the left panel under your MATH 161 course in Sakai, or head to `piazza.com/luc/fall2014/math161004f14/home` directly. I expect that we will all be spending A LOT of time here: asking questions, answering questions, browsing through posted sample exams, pointing to sage/latex code on the cloud you're needing help with, etc.
Samples of successful Piazza forums are available for browsing (`piazza.com/class/gw9jakygzvs616`)[1] and apps for Piazza use on smart phones or tablets are available (Apple and Android). I will enroll you in the Piazza forum. Let me know if you cannot get access it.

Accessing MyMathLab. From `pearsonmylabandmastering.com`, click on "Student" under "Register." Enter our course ID: **lauve39477**. Next, sign in with an existing Pearson account, or create a new one. Finally:

- use the access code that came with your textbook or that you purchased separately;
- buy access using a credit card;
- choose 14 days of temporary access, but know that you'll eventually be locked out if you don't purchase a code. (Let me if this isn't an option!)

More Math. The department maintains a BLOG (`blogs.luc.edu/mathstats`) and a FACEBOOK page (`www.facebook.com/lucmathstats`) that will contain interesting math/stats related tidbits throughout the semester. Feel free to join the conversation. (Indeed, if there is a topic that you'd like to see discussed, send an email to `webadmin@math.luc.edu` and we'll try to get a post up about it.)

Extra Credit: There will be Challenge Problems littered throughout the course. (There are two in this document!) Each problem is worth a point on a reading quiz, and is due two weeks after it appears.

[1] It will complain, "Action not allowed for unknown users," but you can get around it. Just click "OK."

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Workshop Write-ups: Guidelines & Hints

Your workshop write-ups will be graded on correctness of the mathematical content and *the manner in which it is presented*. The framework I have set up for the assignments and their grading should allow for perfect scores each time (good luck):

- Two problems will be chosen each **Wednesday,** to be typeset carefully using LaTeX.[1]
- Each problem will be completed (collaboratively) by three student volunteers.
- Rough drafts (*informally*) due by *midnight Tuesday*—to be posted to our class "project" on cloud.sagemath.com—after which time your cohort and I will make comments, questions, and suggestions that could improve the solutions' content or exposition.
- Final solutions are due **noon** on **Friday** (9 days after first assigned).

Typesetting help. I have provided a sample LaTeX document in the "latex demos" folder in our cloud project (`cloud.sagemath.com`) that you should use as a template. Finally, don't hesitate to ask the Piazza forum for help if you cannot figure out how to do something you'd like to do.

Since you may never have been graded on how you present your ideas in math, here are some guidelines.

Look at one of the examples in the book. The authors begin by writing **a statement of the problem.** They use **complete English sentences.** They explain those steps which are **not obvious** to a calculus student (and don't explain the steps that are). If there is a graph, they **label it,** and they **discuss** what can be deduced from the graph in the context of the example. At the end, they **state the conclusion.**

Don't be discouraged if your initial write-ups receive low grades because of poor exposition. Writing solutions with explanations is probably not something you have done in a math class before. You will improve. Because mathematics is used to solve problems *and explain the solutions to others*, writing clear solutions is a good habit to develop. Creating a good write-up forces you to think more carefully about how you did the problem—and therefore helps you learn calculus.

Precision, part I. Here is a joke:

> A mathematician, a physicist, and an engineer are visiting Scotland for the first time and riding through the countryside by train. "Oh!" the engineer says upon seeing a sheep on a hill, "the sheep in Scotland are black!" The physicists chimes in, "no, no, that sheep is black." "Well," the mathematician adds, "*that side* of that sheep is black."

It may not be very funny to you, but it is because you don't know many mathematicians yet. Like physicists and engineers, we develop tools and ideas to solve problems. Unlike these individuals, we like to know things *for certain* and only claim things we certainly know. Precision is our bread-and-butter. We take care to be very precise—both with our language and with our reasoning. This is reflected in our grammar. Consider the following example:

$$\pi = 3.14159 \quad \text{FALSE!} \qquad \pi \approx 3.14159 \quad \text{TRUE.}$$

Take Away: *Don't say things that aren't true when solving a mathematical problem.*

[1] There are many *Introduction to LaTeX* guides on the web. In the past, I have turned to one by Tobias Oetiker farely often. (Ask me if you want a copy.) These days, I just google a phrase like "latex square root" or "latex include graphics" to more quickly find what I need. If you want to draw a figure natively (using LaTeX code), then google "tikz examples."

Sentences (Symbols, part I). When reducing a mathematical expression, use the "=" sign only when two things are equal, and the " $\Longrightarrow$ " sign only when the second statement is a direct consequence of the first:

Good Uses	**Bad Uses**
$n^2 + n^2$ $= 2n^2$	$n^2 + n^2$ $2n^2$
$7x = 3 \implies x = \frac{3}{7}$	$7x = 3 = x = \frac{3}{7}$

Here are two english-language sentence analogs of the bad uses above:

Apples and apples, two apples. Alexis is the name of the cat is named sophie.

Take Away: *Practice good mathematical grammar; know what the elements of your sentence mean.*

Symbols, part II. Mathematicians invented algebra so we wouldn't have to write sentences like this:

> If thou art diligent and wise, O stranger, compute the **number of cattle of the Sun**, who once upon a time grazed on the fields of the Thrinacian isle of Sicily, divided into four herds of different colours, one **milk white,** another a **glossy black,** a third **yellow** and the last **dappled.** In each herd were bulls, mighty in number according to these proportions: Understand, stranger, that **the white bulls were equal to a half and a third of the black together with the whole of the yellow,** while **the black were equal to the fourth part of the dappled and a fifth, together with, once more, the whole of the yellow.** ... But come, understand also all these conditions regarding the cattle of the Sun. **When the white bulls mingled their number with the black, they stood firm, equal in depth and breadth,** and the plains of Thrinacia, stretching far in all ways, were filled with their multitude. ...—Archimedes, 200 B.C.
>
> Full text available www.math.nyu.edu/∼crorres/Archimedes/Cattle/Statement.html

Instead we write something like,

> Let W, B, Y, D be the number of cattle coloured white, black, yellow, and dappled, respectively. Let w, b, y, d be the number of bull in each herd. The numbers satisfy:
>
> $$w = \tfrac{5}{6}b + y$$
> $$b = \tfrac{9}{20}d + y$$
> $$\vdots$$
> $$w + b = N^2$$
> $$\vdots$$
>
> where N is some positive integer. **Challenge Problem #1:** find N.

Take Away: *If you have a quantity you're considering, don't be afraid to give it a variable name if it will help with the clarity of your exposition.* (With that said, PLEASE don't leave variables undefined, it is sloppy and confusing... though rarely as confusing as the passage above.)

Consistency. Regarding symbol choices, if you name the hypotenuse of a triangle C at some point, do not later on refer to it as c (or x!).

Take Away: *Give every quantity one name (symbol) and one name only.*

Catching Your Breath. The language of mathematics packs a lot of information into a small space. This makes reading a half-page of equations fairly difficult. The conscientious writer recognizes this.

Take Away: *Pause from time to time and write a sentence.* That sentence should **tell the reader where he is heading NEXT,** not what he just slogged through.

Clarity, part I. Note the use of Y and y in the cattle problem above. These are related quantities so they are given related names. Also, they are *codes* in the sense that, as best as possible, the symbols chosen reflect something essential about what they represent ("yellow" things). Similarly, a formula for the volume of a box in terms of its height should begin "$V(h) = \ldots$," not "$f(x) = \ldots$."

Take Away: *Reserve similar symbols for related quantities and choose your symbols well.*

Clarity, part II How would you feel listening to the news if every time someone mentioned Vladimir Putin, they suffixed it with the phrase "the nefarious KGB agent turned president of Russia who once seduced George W. Bush using only his eyes?" Pretty insulting right? We all know this, get to the point! Similarly, when using some (well-labeled) figure to setup a related-rates problem, don't write

$$\tan\theta = \frac{\text{opposite}}{\text{adjacent}} = \frac{h}{y}\,.$$

Omit the middle step; we all know this and saying it just detracts from the readability of your presentation. Another example: instead of writing

we have

$$\begin{aligned} 32x^7(x+2)^3 &= 6\frac{(x+2)(x-2)}{x^2} && \text{clear denominator} \\ 32x^9(x+2)^3 &= 6(x+2)(x-2) && \text{cancel the 2} \\ 16x^9(x+2)^3 &= 3(x+2)(x-2) && \text{cancel a factor of } (x+2) \\ 16x^9(x+2)^2 &= 3(x-2)\,, \end{aligned}$$

simply write

we have

$$\begin{aligned} 32x^7(x+2)^3 &= 6\frac{(x+2)(x-2)}{x^2} \\ 16x^9(x+2)^2 &= 3(x-2)\,. \end{aligned}$$

Or, if you really feel like the reader won't follow you, write

we have

$$32x^7(x+2)^3 = 6\frac{(x+2)(x-2)}{x^2}$$

or, after clearing denominator and canceling like terms,

$$16x^9(x+2)^2 = 3(x-2)\,.$$

Take Away: *Clutter does not engender clarity.*

Challenge Problem #2: I threw away a potential solution just now. Catch my mistake.