Math 110, Fall 2018
Wharton Calculus

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Textbook

- Thomas: *Calculus Early Transcendentals* Second Custom Edition for U. Penn), Pearson 2014, cover art: Godzilla. Important: obtain new from bookstore with valid access code to My Math Lab.
- Course notes available on Canvas.
- Selected lecture videos, linked from Canvas.

Course content

Please read the more detailed description in your syllabus.

I Using stuff you already know.
- Pre-calculus: functions, graphing, exponents and logarithms, limits and continuity;
- Calculus: linear approximation, optimization, chain rule, FTC, applications.

II Taylor polynomials and series.

III Differential equations.

IV Introduction to multivariable calculus.

Meta-content

- **Number sense**
- **Verbal skills**

- Problem-solving heuristics
- Estimating and bounding
- Word problems, applications, use of units
- Orders of growth
- Functions and relationships
- Syntax, grammar, free and bound variables

Active learning: Come prepared to participate.

Comparison with Math 104: problems from recent final

- Compute
$$\int_0^{1/2} \frac{\arcsin(x)}{\sqrt{1-x^2}}\, dx\,.$$
- Find the area of the region between the curves $x = 4 - y^2$ and $x = -3y$.
- Find the value of $\int_0^1 \ln(1+x^2)\, dx$.
- An ant travels in the plane on a curve satisfying
$$\frac{dy}{dx} = \sqrt{4x^2 + 2x - \frac{3}{4}}$$
when measured in inches. If the ant begins at the point $(1, 1)$ and stops when the x-coordinate reaches 2, what total number of inches does the ant travel?

Math 110: Oriented toward applications

Some final exam problems:

- Describe how $\ln x$ changes when x increases by 50%.
- Suppose you wish to maximize the utility function $xy + 2x$ on the region $2x + y \leq 30$ in the first quadrant. Find the maximum value and the point (x, y) at which the maximum occurs.
- Write a differential equation corresponding to the following word problem. **Do not** solve the differential equation. **Do** give interpretations and units of all variables and constants. Money is deposited in a bank account, earning interest continuously at the rate of 6% per year...

Why active learning?

Mostly we have to spend class time on math, not pedagogy, so we have made you a video on this topic. For now, some short "sound bite" reasons:

- Value added
- Broader learning goals
- Studies show greater retention

Everything you learn, you should be able to:

- Explain
- Remember
- Apply
- and even . . . Generalize

A short skit illuminating some vital points

A complaint from a previous course evaluation: "We are expected to solve questions at an entire different level than what is taught or in the course notes."

SKIT: Bill Gates is talking to three consultants he has just hired...

Bill Gates: Thanks for consulting on this project, highly paid recent Wharton graduates.

Consultant A: We read your memo. The projected increase you wanted us to estimate is not covered in our methods textbook.

Consultant B: That's right, but for most of these problems you set the derivative equal to zero you get the answer. The computation is messy but in the end your 2018 revenue from PROJECT APPLEF**K should be

$$\int_0^\infty K e^{t/(1+t^2)} \ln(1+t^2)\, dt\,.$$

A: That's about as far as we got. When can we pick up our check for a zillion dollars?

Gates: Whoa! How is this useful to me? What's K? Why should I believe your computation.

A: (whispers to B): I **told** you you should have paid attention when Dr. Pemantle was teaching you about units and constants of proportionality!

B (to Gates): I see your point. But the hard part of the computation is completely correct. I think we should get at least 3/4 credit on this one. When can we get our check for \$0.75 zillion?

C: Mr. Gates, I think I see the problem here. You need a model that takes into account attrition from the social network. I have here a pretty simple differential equation that captures what you're really looking for. The math isn't hard, but you need to plug in the estimates we got from your cookies that spy on consumer behavior. When you do that, just multiply by the factor computed by my equation of \$95.42 per estimated person-year and you will have a pretty reliable estimate.

Gates: That's great, Conultant C, you have saved Microsoft! I'm writing the check out to you personally and hiring you back to work on our secret world domination project.

Student responsibilities

- Pre-requisite knowledge: High school calculus at least at the level of AB Calculus, or Math 103 at Penn.
- Obtain the course materials ASAP.
- Get the exam times on your schedule now and let us know of any conflicts by next Tuesday (see next slide).
- Come to class and to recitations.
- Do the pre-class reading.
- Complete individual assignments on time.
- Work well with group-mates.

Exam times

Midterm #1:	Tuesday October 3	6:00PM
Midterm #2:	Thursday November 2	6:00PM
Midterm #3:	Tuesday December 5	6:00PM
Final exam:	Thursday December 14	9:00-11:00AM (common final time)

Weekly work flow

Sunday night (11:59PM): reading and pre-lesson homework due.

Monday classes: intro activities, Q & A.
    Tuesday recitations: concept explication, Q & A, quiz.
Weds. in class: problem set due from week ending 5 days prior
Wednesday classes: group work, problem-solving activities.
    Thursday recitations: activities, tutorials, etc.
Friday classes: wrap-up, student presentations, discussion.

Occasional, usually FRI: group homework due.

Assessment criteria

Attendance / participation	10%
Quizzes	5%
Homework	37%
Midterm I	12%
Midterm II	12%
Midterm III	12%
Final	12%

$$90.0 - 91.9 = A^-$$
$$80.0 - 81.9 = B^-$$
$$70.0 - 71.9 = C^-$$

Another quote from course evals...

> *Decent course; weighted too heavily on homework sets and attendance that did not help for tests.*

There is a part of what we teach that can't be captured on tests. We can't ask you to be creative or go much beyond plug and chug on a timed exam.

But we need to teach you these things!

Part of the homework gives you practice on stuff that will occur on tests, but the other part is about longer problems, taking what you've learned, putting it together, and following through on a multi-step analysis.

This part of the homework is an end goal, it is not test prep.

Assessment criteria

In other words: you earn nearly half your grade by showing up and doing what you're supposed to. (N.B.: The problem sets will often be difficult.)

There should be no major surprises at the time of the final course grade.

To facilitate student cooperation, the course is not curved. On the exams, if performance is uniformly low I will curve the score for that exam.

Makeup work (see Canvas for full policy)

Quizzes cannot be **made up**, but may be **excused** for a legitimate reason (illness, Penn sponsored activities, etc.).

For attendance in class, you get four free absences. In other words, 38 or more times present out of 42 is equal to 100% (you can't get more than 100% on attendance).

If you come in after roll is taken, you will be given half credit for that day's attendance, provided you check in with the TA.

Classes missed for a legitimate reason may be made up by submitting worked solutions to the worksheet and study packet corresponding to that class day.

Academic integrity

Homework assignments may be done collaboratively. All the work that you turn in, however, must be handwritten by you, or typed in by you.

Some assignments are group assignments. In that case, there is no need to turn in separate assignments, but please limit your collaboration to your group.

Exams are strictly individual and subject to the usual rules.

Miscellaneous stuff

We will skip around in the book. A lot. There's no way around that. This book is written for Math 103–104–114, as are most decent calculus books.

Especially at the beginning, when reviewing AB calculus and pre-calculus while tying it into applications and more advanced topics, we will have to take what looks like a very chaotic tour through Chapters 1–5 and parts of 7 and 8.

That's why there are course notes. Treat them as a second text. The pre-homework asks you to read them. We can't enforce compliance with this, but it's really a good idea!

Canvas

To emphasize the purpose of this course, I will show you a short clip from the 2013 student commencement speaker, Stephanie Lamb.

Lastly, I will show you the most important things you will find on this year's Canvas page.