Math 110 Syllabus

Course content

(i) Review of high school pre-calculus including functions, graphing, exponents and logarithms.

(ii) Review of high school calculus including rules for differentiation, chain rule, fundamental theorem of calculus, max-min problems, linear approximation, Riemann sums, the definite integral and integration by substution. Particular emphasis will be given to word problems and applications.

(iii) Taylor series, exactly summable series, convergence of infinite series.

(iv) Introduction to differential equations including modeling, dimensional analysis, exactly solvable equations, numerical and qualitative analysis.

(v) Introduction to multivariable calculus including multiple integrals, partial derivatives, multivariate linear approximation, gradients and constrained optimization.

Pre-requisites

High school calculus at least at the level of AB Calculus, or Math 103 at Penn.

Restricted to Wharton students.

Text

The textbook is the same as for Math 103-104-114, namely Thomas' *Calculus Early Transcendentals* (Custom Edition for U. Penn), Pearson 2013, ISBN: 978-1-269-95070-1.

The textbook includes access to MyMathLab, a web-based set of educational materials. MyMathLab access is mandatory and therefore students should be careful if obtaining the textbook in any way other than via the purchase of a new copy.

Pedagogy and Workload

There are three mandatory contact hours of lecture per week, one mandatory contact hour of recitation and one contact hour of optional recitation/tutorial. The class will be taught in an active learning format. Consequently, attendance and participation will be a factor in the grade. In class activities will center around small group problem solving activities but will also include some large group activities ranging from lectures to interactive discussions.

In keeping with university and department policy, the outside of class workload will be estimated at two to three times the number of contact hours. As a rough guideline, we expect three hours for reading the textbook and/or viewing lectures, five hours on homework, and two hours on other study and review.

Assessment Criteria

Instances may vary but a typical grading scheme will be as follows.

Attendance / participation	10%
Quizes	10%
Homework	30%
Midterm I	10%
Midterm II	10%
Midterm III	10%
Final	20%

Course Philosophy

In addition to the issue of aliging the the curriculum to the needs of Wharton students there is a question of what type of learning is needed. There is a sense that many Wharton students who pass 104 have become good at symbolic manipulation but remain weak at interpretation, mathematical modeling, problem solving and verbal communication. Together, these represent a component of the calculus curriculum that Wharton faculty believe have equal or greater importance to many of the computational skills involved.

The active learning format is designed to combat these weaknesses and to increase long term retention of the material. The efficacy of these methods has been established to some degree by recent studies and is a part of a university-wide effort to use evidence-based pedagogical practices.

Detailed syllabus

I: Using the math you already know

- How big is that?
- How can I easily compute that?
- How do I write that / How do I say that?
- Can I estimate that by something simpler?
- How does it behave in the long run?

2.5 weeks: Functions, graphs, approximations, exponents and logarithms

Functions and graphs
Linear approximations and convexity
Review of exponential functions and logarithms
Limits, limiting ratios and L'Hôpital's rule

II: New material on integration

3 weeks: Sums and integrals

Finite sums and Riemann sums
Integration techniques
Improper integrals
Probability densities

III: Differential equations and Taylor series

1.5 weeks: Taylor series

Taylor polynomials and remainders

Convergence of infinite series

Power series and Taylor series

2 weeks: Differential equations

Concepts, qualitative behavior, slope fields and Euler iteration

Modeling and word problems

Exact solutions: separable equations and first order linear equations

IV: Multivariable calculus

3 weeks: Multivariable functions and partial derivatives

Multivariate graphing

Multivariate integration

Partial derivatives
Gradients

2 weeks: Optimization

Extreme values

Constrained optimization and Lagrange multipliers

Optimization with inequality constraints

Modeling and word problems