21-120: Differential and Integral Calculus Syllabus

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1 Overview

Calculus is often described as the mathematics of change, growth, and movement. This isn't all that calculus is, but it's a good start. Calculus today includes many important abstract concepts (allowing us to give mathematical descriptions and models of real-world situations) and also a huge body of practical problem-solving techniques (to answer the questions that arise in these models). In this course we will introduce some of the most important of these concepts, along with techniques for calculating with them, and some examples of applications. I hope you will find this course both practically useful and intellectually interesting.

More specifically, we will cover functions (the mathematical descriptions of curves and processes), including exponential/logarithmic functions and trig functions, limits and continuity; derivatives/differentiation (speeds, rates of growth or change), the derivatives of important functions, the product and chain rules, application of differentiation to optimisation problems, and l'Hôpitals rule; integrals (area under a curve, growth or accumulation over time), definite and indefinite, integrals of important functions, the fundamental theorem of calculus, applications to area and volume, integration by parts and by substitution.

This is essentially the material of Stewart "Essential Calculus: Early Transcendentals", chapters 2 to 5, plus sections 6.1, 7.1, and 7.2, and without sections 3.6 and 4.6. The lectures won't follow the order of Stewart precisely, but all the examinable material is in these chapters. To relieve the concentration of a very intense schedule, lectures will include irregular interludes on topics of related interest—historical background, related areas of mathematics, and the like. These will *not* be examinable, though they will hopefully be helpful in understanding the examinable material.

2 Schedule

Lectures will be every weekday, 10:30–11:50am, in Wean Hall 8427. The rough schedule of topics will be:

Week 1	Setting the scene: Functions and continuity
Week 2	Derivatives: introduction; first techniques
Week 3	Derivatives: applications; further techniques
Week 4	Integrals: introduction, first techniques, the Fundamental Theorem (high point!)
Week 5	Integrals: applications; further techniques
Week 6	Padding; loose ends; review.

I will probably hold regular office hours for queries; details will be decided in the first week. In any case, if you have any course-related questions at any point, please feel free email me at plumsdai@andrew.cmu.edu (with 21-120 in the subject line so it's not in danger of getting eaten by my spam filter).

Homework will be set in small daily doses, in class and on my website `www.math.cmu.edu/~plumsdai`. There will be frequent small in-class quizzes. There will two exams, a mid-term and a final, both in class, at the ends of weeks 3 and 6 respectively. The final will cover material from the whole course.

3 Policies

Final grade: since different people have different strengths and preferences, I don't want to choose one weighting for all students. Please choose your own, by Friday 29 May (the end of week 2), within the following constraints: the weightings must be in the following ranges:

Homework	30–50%
Quizzes	10–25%
Midterm	10–25%
Final	20–50%

and must add to 100%.

All Carnegie Mellon policies and standards of academic policy, as given in the student handbook, will be enforced. Working together on homework is encouraged—collaboration is a great way to understand tricky and deep material—but you should be able to write up your homework independently later, not copied from group notes, and to recall it after doing unrelated activity. (The "Gilligan's Island rule".)

Students with relevant special needs should let me know as soon as possible.