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Calculus 1B (001 LEC) Spring 2019

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In Math 1A or elsewhere, you studied functions of a single variable, limits, and continuity. You learned about derivatives, which describe how functions change, and which can be used to help find maxima and minima of functions. You also learned about integrals which describe the aggregate behavior of a function over an interval, such as the area under a curve or the average of a varying quantity. The derivative and the integral are tied together in the fundamental theorem of calculus, one version of which relates the integral of the derivative of a function over an interval to the values of the function at the endpoints of the interval.

In this course we will continue the study of calculus in three parts as follows:

- The first part of the course is about techniques of integration (sections 7.1 to 7.8 of the book). As you should already know, differentiation is relatively straightforward: if you know the derivatives of elementary functions, and rules such as the product rule and the chain rule, then you can differentiate just about any function you will ever come across. Integration, on the other hand, is hard. Sometimes it is even impossible to integrate a given function explicitly in terms of known functions. We will introduce a collection of useful tricks with which you can integrate many functions. The hard part is to figure out which trick(s) to use in a given situation. For integrals which we cannot evaluate explicitly, we will learn how to find good approximations to the answer.
- The second part of the course is about sequences and series (chapter 11 of the book). This can be regarded as the general theory of approximating things. This part of the course is subtle and involves new ways of thinking. It may be a lot harder than the first part, especially if you have seen some of the first part before.
- The third part of the course is an introduction to ordinary differential equations (chapters 9 and 17 of the book). Here one tries to understand a function, given an equation involving the function and its derivatives. ("Ordinary" means that we consider functions of a single variable. Functions of several variables enter into "partial" differential equations, which you can learn about in a more advanced course.) The theory of differential equations is perhaps

the most interesting part of calculus, is the subject of much present-day research, and has many real-world applications. Our study of differential equations will make use of most of the calculus we have done so far.

When	What	Where
Week 1 (1/21 - 1/25)	Integration by Parts	7.1
Week 2 (1/28 - 2/1)	Integration of Rational Functions	7.4
	Trigonometric Integrals	7.2
	Trigonometric Substitution	7.3
Week 3 (2/4 - 2/8)	Strategies of Integration	7.5
	Approximate Integration	7.7
Week 4 (2/11 - 2/15)	Improper Integrals	7.8
	Arc Length	8.1
	Surface of Revolution	8.2
Week 5 (2/18 - 2/22)	Review 1	
	Midterm 1 (2/20 in class)	
	Sequences	11.1
Week 6 (2/25 - 3/1)	Series	11.2
	The Integral Test	11.3
	Comparison Tests	11.4
Week 7 (3/4 - 3/8)	Alternating Series	11.5
	Absolute Convergence and the Ration and Root Tests	11.6
	Strategies for Series Testing	11.7
Week 8 (3/11 - 3/15)	Power Series	11.8
	Representing Functions as Power Series	11.9
	Taylor and Maclaurin Series	11.10
Week 9 (3/18 - 3/22)	Taylor and Maclaurin Series (continued)	11.10
	Review 2	

	Midterm 2 (3/22 in class)	
Week 10 (3/25 - 3/29)	Spring Break!	
Week 11 (4/1 - 4/5)	Modelling with Differential Equations	9.1
	Direction Fields and Euler's Method	9.2
Week 12 (4/8 - 4/12)	Separable Equations	9.3
	Models of Population Growth	9.4
	Linear Equations	9.5
Week 13 (4/15 - 4/19)	Predator-Prey Systems	9.6
	Second-Order Homogeneous Linear Equations	17.1
Week 14 (4/22 - 4/26)	Second-Order Nonhomogeneous Linear Equations	17.2
Week 15 (4/29 - 5/3)	Series Solutions	17.4
Week 16 (5/6 - 5/10)	Review 3	
	Practice Problems	
Week 17 (5/13 - 5/17)	Final Exam: Tuesday May 14 (11.30am - 2.30pm)	

Grading and Course Policy
External Support