MATH231
Calculus of functions of one variable I

Summary. Calculus is the study of continuous change. Building upon knowledge of functions, algebra, and trigonometry, this course introduces the fundamental calculus concept of a limit and its application to definition of derivatives and integrals. These calculus constructs are subsequently applied to a large variety of problems from the sciences.

Course syllabus

Times	TuTh 9:30-10:45AM, Phillips 215
Office hours	We 3:30-4:30PM Chapman 451, Th 3:30-4:30PM, Fr 2:30-3:30PM, Zoom
Instructor	Sorin Mitran
Assistants	Jake Grdadolnik, Kaitlyn Hohmeier, Aaron Jacobson

(*The instructor reserves the right to make changes to the syllabus. Any changes will be announced as early as possible.*)

1 Course description

1.1 Prerequisites

Students must have satisfied at least one of the following in order to enroll in MATH 231:

- Score of at least 640 on the SAT 2 Subject Test, Mathematics Level 2
- Score of at least 29 on the ACT Mathematics Test
- Score of at least 4 on the International Baccalaureate Mathematics High Level
- Score of at least 5 on the International Baccalaureate Mathematics Standard Level
- Grade of at least C- in MATH 130

1.2 Corequisite

MATH 231L is a one-hour course that offers just-in-time instruction and practice on algebra and trigonometry to support MATH 231 students. Students who meet the prerequisite above but are near the cut-off scores, should strongly consider enrolling in the corequisite course.

1.3 Course outcomes

Upon course completion students should acquire the following concepts and skills:

- the need for a framework for infinite number of operations;

- the idea of a limit and its application to limits of functions;
- relationship between function graphs and function limits at a point;
- derivatives of functions and their applications;
- integrals of functions and their applications;
- geometric significance of derivatives and integrals;
- relationship between derivatives and integrals expressed in the Fundamental Theorem of Calculus

1.4 Bibliography

Course textbook: *Calculus: Early Transcendentals (3rd edition)* by S. Briggs, L. Cochran, B. Gillet, E. Schulz.

MyLab Math student registration instructions.

1.5 Coursework

1.5.1 Activities

Course activities are meant to ensure understanding of calculus concepts and are detailed in Tabel 1. Students should:

- read relevant textbook sections before each class;
- self-assess understanding of concepts through recommended exercises;
- complete homework meant to build proficiecy in calculus techniques;
- study practical applications of calculus by drafting solutions to recitation problems;
- demonstrate mastery of both concepts and technqiues in scheduled tests and final examination.

Activity	Recitation R	Homework H	Tests T	Extra Credit E	Final examination F
Points	$13 \times 1 = 13$	$13 \times 1 = 13$	$3 \times 15 = 45$	6	33

Table 1. $P = R + H + F + E + \max(T, \min(T, 30) + F/3)$

1.5.2 Policies

- Late homework is not accepted, except for university-approved absences.

- All tests are in-class, 45 minutes, closed-book, and with no calculation aids. Test dates are posted in the leson plan below. If unable to attend due to an university-approved absence, taking the test early is possible.

- Active participation in all course activities (lectures, recitations, office hours) is required to attain course outcomes. There is no need to inform instructors of absences due to personal circumstances. Students are required to inform themselves of topics covered during absences. Various extra credit activities are announced to encourage active class participation.

- Unless explicitly stated otherwise, all work is individual. You may discuss various approaches to homework problems with students, instructors, but must draft your answers by yourself. Students implicitly accept this honor code by submission of any work for grading.

1.5.3 Grading, missed work

A total of 104 assignment/test grade points are offered to allow sufficient flexibility for personal circumstances that might require student absence from courses activities, e.g., two recitation and two homework assignments can be missed. Also, the point total formula for the course allows a missed or failed test to be substituted with good performance in the final examination (see Tabel 1). Course points are mapped to grades as shown in Table 2. Various in-class course participation activities are rewarded with up to 6 grade points for a total of 110 possible grade points.

Grade	Points	Grade	Points	Grade	Points	Grade	Points
		B+	88-91	C+	76-79	D+	64-67
A	96-104	B	84-87	C	72-75	D	60-63
A-	92-95	B-	80-83	C-	68-71	F	0-59

Table 2. Point-to-grade mapping

1.6 Technology

Students are required to have a laptop, that conforms to CCI minimal standards. Software investigation of calculus concepts will be interspersed throughout the course.

2 Course schedule

2.1 Lesson plan

Test dates are indicated in **bold red**. Practice tests and solutions:

PracticeTest1	PracticeSolution1	Test1	Solution1
PracticeTest2	PracticeSolution2	Test2	Solution2
PracticeTest3	PracticeSolution3	Test3	Solution3
PracticeMakeupTest1	PracticeMakeupTest2	PracticeMakeupTest3	

All students are offered the chance to retake Test1-3 on **Nov. 29**. These make-up or re-tests will be 35 minutes long, allowing students to attempt two tests during class time. Tests will not be returned, but the higher of your original test or the retest will be used for grade calculations. Grade calculations are sent to students on 12/06 to include final examination. Any errors noticed in grade calculations must be signaled by email by noon 12/07. Grades are sent to Registrar at 3:00PM on 12/07.

Week	Notes	Date	Textbook	Topic
01	L01	08/16	§2.1	Limit concept
	L02	08/18	§2.2	Limit techniques
02	L03	08/23	§2.3	MyLab Math. Limit techniques
	L04	08/25	§2.4-5	Infinity & limits
03	L05	08/30	§2.6-7	Continuity
	L06	09/01	§3.1-2	Derivative
04		-		Derivative function
	L07	09/08	§3.2-3	Differentiation rules
05	L08	09/13	§3.4	Derivatives of products, quotients
	L09	09/15	§3.5	Derivatives of trigonometric functions
06	L10	**09/20**	§3.6	Test 1 (§2.1-6, §3.1-3). Rate of change
	L11	09/22	§3.7	Differentiation chain rule
07	L12	09/27	§3.8	Implicit differentiation
	L13	09/29	§3.9	Derivatives of logarithm/exponentials
08	L14	10/04	§3.10	Derivatives of inverse functions
	L15	10/06	§3.11	Related rates
09	L16	10/11	§4.1-2	Extrema, mean value theorem
	L17	10/13	§4.3	Derivatives information
11	L18	10/18	§4.4	Function graphs
		-		
12	L19	**10/25**	§4.5	Test 2 (§3.4-11, §4.1-3). Optimization
	L20	10/27	§4.6	Linear approximation
13	L21	11/01	§4.7-8	L'Hôpital rule. Newton method
	L22	11/03	§4.9	Anti-derivative
14	L23	11/08	§5.1	Areas under curve
	L24	11/10	§5.2	Definite integral
15	L25	**11/15**	§5.3	Test 3 (§4.4-9, §5.1) Fundamental theorem of calculus
	L26	11/17	§5.4-5	Integral techniques
16	CourseReview	11/22		Final preparation
		11/29		Test1-3 retake (you may retake 2)
		12/05	4:00PM	Common Final Examination (Coker Hall-0201)
				Sections: §2.1 to §5.5

2.2 Homework, recitation assignments

Homework is generally assigned and graded through the online MyLab Math system at 5PM on Tuesdays, and due the following Tuesday. The schedule is modified for UNC holidays. Thirteen homework assignments are scheduled.

Nr.	Issue Date	Due Date	Problems	Solution
HW00	08/22	09/20	Algebra review	Not graded
HW01	08/23	08/30	§2.2: 4, 5, 23, 33, 34, 36, 38, 39, 41, 53	S01
HW02	08/30	09/06	§2.4: 26, 27, 34, 35, 54 §2.5: 37, 39, 57, 59, 71	S02
HW03	09/06	09/13	§3.2: 25, 29, 36, 49, 59 §3.3: 27, 28, 33, 68, 71	S03
HW04	09/14	09/20	§3.4: 20, 22, 25, 46, 55 §3.5: 26, 29, 40, 48, 59	S04
HW05	09/19	09/27	§3.6: 15, 18, 19, 37, 39 §3.7: 17, 20, 23, 44, 49	S05
HW06	09/26	10/04	§3.8: 15, 17, 18, 45, 46 §3.9: 36, 37, 40, 77, 78	S06
HW07	10/3	10/11	§3.10: 15, 19, 21, 23, 29 §3.11: 11, 13, 23, 29, 35	S07
HW08	10/11	10/18	§4.1: 25, 27, 31, 39, 72,73 §4.2: 25, 26, 39, 45,	S08
HW09	10/20	10/27	§4.3: 15, 22, 25, 48, 50 §4.4: 7, 8, 17, 19, 23	S09
HW10	10/28	11/03	§4.5: 22, 27, 33, 40, 45 §4.7: 21, 25, 31, 35, 39	S10
HW11	11/03	11/10	§5.1: 7, 9, 15, 19, 27, 31, 40, 45, 49, 64	S11
HW12	11/10	11/17	§5.2: 26, 28, 34, 43, 51, 69, 71, 72, 75, 94	S12
HW13	11/17	11/29	§5.3: 5, 13, 18, 24, 41, 46, 52, 64, 67, 78	S13

One handwritten problem will be submitted in recitation in weeks 2-15, excepting UNC holidays and wellness days for a total of 13 recitation problems. Model solutions will be posted that show:

- proper problem formulation
- motivated solution procedure
- calculation organization

- procedure used by recitation leaders to grade the problem

Nr.	Issue Date	Due Date	Choose 1 from problems	Model Solution
R01	08/23	08/29	§2.3: 73-76, 88-94	R01
R02	08/30	09/12	§2.5: 52-56, 72-81	R02
R03	08/30	09/12	§2.6: 42-48, 68-72	R03
R04	09/14	09/19	§3.4: 48-54, §3.5: 42-47	R04
R05	09/19	10/03	§3.6: 23-27, §3.7: 50-60	R05
R06	09/22	10/03	§3.8: 29-40	R06
R07	10/03	10/10	§3.11: 30-34, 36-45	R07
R08	10/11	10/17	§4.1: 30-34, 36-45	R08
R09	10/20	10/24	§4.4: 50-54	R09
R10	10/28	10/31	§4.5: 28-31, 50-53, Q01	R10
R11	10/31	11/7	§4.7: 84-86, §4.8: 9-12, Q02	R11
R12	11/7	11/14	§4.9: 30-34, §5.1: 18-21, Q03	R12
R13	11/14	11/21	§5.3: 34-40, §5.5: 24-28, Q04	R13

3 University policies

Accessibility resources and services. The University of North Carolina at Chapel Hill facilitates the implementation of reasonable accommodations, including resources and services, for students with disabilities, chronic medical conditions, a temporary disability or pregnancy complications resulting in barriers to fully accessing University courses, programs and activities.

Accommodations are determined through the Office of Accessibility Resources and Service (ARS) for individuals with documented qualifying disabilities in accordance with applicable state and federal laws. See the ARS Website for contact information: https://ars.unc.edu or email ars@unc.edu.

Counseling and psychological services (CAPS). CAPS is strongly committed to addressing the mental health needs of a diverse student body through timely access to consultation and connection to clinically appropriate services, whether for short or long-term needs. Go to their website: https://caps.unc.edu/ or visit their facilities on the third floor of the Campus Health Services building for a walk-in evaluation to learn more.

Title IX resources. Any student who is impacted by discrimination, harassment, interpersonal (relationship) violence, sexual violence, sexual exploitation, or stalking is encouraged to seek resources on campus or in the community. Reports can be made online to the EOC at https://eoc.unc.edu/report-an-incident/. Please contact the University's Title IX Coordinator (Elizabeth Hall, interim – titleixcoordinator@unc.edu), Report and Response Coordinators in the Equal Opportunity and Compliance Office (reportandresponse@unc.edu), Counseling and Psychological Services (confidential), or the Gender Violence Services Coordinators (gvsc@unc.edu; confidential) to discuss your specific needs. Additional resources are available at safe.unc.edu.