CALCULUS I
Math S1101X(3)
TR 6:15-7:50 PM in 417 MATH
MAY 21 – AUGUST 10

Instructor:  Sandro Fusco, PhD - Email: fusco@math.columbia.edu
Office hours: Tue, Thu (after class), or by appointment

TAs:  Jiaqi Liu – E-mail: jl3615@columbia.edu
Office hours: Mon 10AM–12PM and 2PM-6PM (Calculus Help Room, 406 Math)

Textbook:  Calculus, Early Transcendentals, 7th Edition by J. Stewart (ISBN# 0538497904). We will be covering the first six chapters, at a rate of roughly four sections per week.

Overview:  Calculus I is the first half of an introductory course on differential and integral calculus. No previous experience with calculus is assumed, although a solid foundation of high-school algebra and trigonometry is required.

Topics:  We will begin with a brief discussion of what functions are and then move on to study some of their basic properties (week 1-2). In particular we will discuss limits and continuity. We will then discuss the first major tool of calculus: the Derivative (week 3-4). We will spend some time learning techniques for computing derivatives and applications of differentiation. Topics to be included here are tangents, the chain rule, product rule, quotient rule, higher derivatives (week 5-6), L'Hopital's rule, finding maxima and minima using derivatives, implicit differentiation and related rates (week 7-8). The last part of the course will focus on the other major tool of calculus: Integration. We will define the Reimann integral and learn the associated rules for computation (week 9-10), as well as the interpretation of the integral as the area under a curve. All of this will be leading up to the Fundamental Theorem of Calculus (week 11-12), which shows that differentiation and integration are, in a sense, inverse operations.

Requirements:  There will be two midterm exams (Thu June 14, and Thu July 12) and a cumulative final exam (Thu Aug 9). There will be weekly homework covering course materials from the previous week, which will be due in class every Tuesday.

Help:  My office hours are Tuesday and Thursday (after class), or by appointment (e-mail is the best way to contact me). I will have additional hours before the in-class exams. The Calculus Help Room (a wonderful resource) is located in 406 Math and is open five days: Monday through Thursday, 10am-6pm; Friday, 1-5pm.
Policies:

Exam Policy:
No make-up exams will be given except in the following situations:
- Arrangements are made with the instructor prior to the date of the exam.
- A written excuse for missing the exam is provided from either a doctor in the case of illness or from the dean of the student's school in all other circumstances.

Homework Policy:
Since this course covers a lot of material, it is imperative that students keep up on their weekly homework. Thus, homework will be collected one week after it is assigned. **No late homework will be accepted!**

Grading Policy:
The grade for the course will be based on the exams, homework assignments, and class participation. The final will be worth 35% of the final grade; the midterm exams will be worth 20% each, homework 20%, class participation 5%.

Attendance Policy:
Attendance in this course is **IMPERATIVE**, as we will be covering a vast amount of material in a short time. While I will not be basing any part of your grade directly on your attendance, the homework policy outlined above do not really allow for absences.

Calculator Policy:
Calculators are not required for this course. If you have a graphing calculator, you might find it helpful when you are working on your homework. However, you will not be allowed to use a calculator during the exams.

**Important Dates:**
- Tue May 22nd: First Class
- Fri June 1st: Makeup date for Memorial Day
- Thu June 14th: Midterm Exam 1
- Fri July 6th: Makeup date for Independence Day
- Thu July 12th: Midterm Exam 2
- Fri July 13th: Last day to drop individual classes and change to pass/fail option
- Thu Aug 9th: Final Exam

Disability Services:
Students with disabilities requiring special accommodation should contact Office Disability Services promptly to discuss appropriate arrangements. [https://www1.columbia.edu/sec/cu/health/docs/services/ods/index.html](https://www1.columbia.edu/sec/cu/health/docs/services/ods/index.html)
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| **Week 1** | May 22   | Introduction  
1.1: Four ways to represent a function  
1.2: A catalog of essential functions  
1.3: New functions from old functions | HW 1 due in class on June 5  
Sect. 1.1: # 28, 44, 62  
Sect. 1.2: # 4, 6, 8  
Sect. 1.3: # 36, 48, 54, 60 | Problem Set 1  
Sect. 1.1: # 7, 31, 42, 48, 63, 70  
Sect. 1.2: # 3, 9, 10  
Sect. 1.3: # 2, 13, 26, 29, 35, 55 |
|       | May 24    |                                             |                                               |                       |
| **Week 2** | May 29   | 1.5: Exponential functions  
1.6: Inverse functions and logarithms  
2.1: The tangent and velocity problems  
2.2: The limit of a function | HW 2 due in class on June 12  
Sect. 1.5: # 10, 18  
Sect. 1.6: # 10, 18, 28, 38, 56  
Sect. 2.1: # 2, 6, 8 | Problem Set 2  
Sect. 1.5: # 13, 29 (a)-(c)  
Sect. 1.6: # 11, 17, 26, 35, 39, 67  
Sect. 2.1: # 3, 5, 7 |
|       | May 31    |                                             |                                               |                       |
| **Week 3** | June 5   | 2.3: Calculating limits using limit laws  
2.5: Continuity (Part 1)  
2.5: Continuity (Part 2)  
2.6: Limits at infinity: horizontal asymptotes | HW 3 due in class on June 19  
Sect. 2.2: # 6, 30  
Sect. 2.3: # 30, 42, 50  
Sect. 2.5: # 22, 38, 46  
Sect. 2.6: # 26, 46 | Problem Set 3  
Sect. 2.2: # 1, 4, 8, 11, 26, 38  
Sect. 2.3: # 1, 5, 17, 29, 37, 48, 51  
Sect. 2.5: # 9, 19, 23, 34, 35, 42, 47  
Sect. 2.6: # 3, 7, 17, 23, 28, 35 |
|       | June 7    |                                             |                                               |                       |
| **Week 4** | June 12   | 2.7: Derivatives and rates of change  
2.8: The derivative as a function  
Midterm Exam 1 | HW 4 due in class on June 26  
Sect. 2.7: # 8, 16, 20, 22, 32  
Sect. 2.8: # 22, 26, 30, 38, 44 | Problem Set 4  
Sect. 2.7: # 4, 9, 14, 45  
Sect. 2.8: # 8, 13, 22, 24, 31, 52 |
|       | June 14   |                                             |                                               |                       |
| **Week 5** | June 19   | 3.1: Derivatives of polynomials and exponentials  
3.2: The product and quotient rules  
3.3: Derivatives of trigonometric functions  
3.4: The chain rule | HW 5 due in class on July 3  
Sect. 3.1: # 30, 44, 54  
Sect. 3.2: # 16, 26, 32, 46  
Sect. 3.3: # 16, 32, 48 | Problem Set 5  
Sect. 3.1: # 10, 24, 27, 35, 37, 51  
Sect. 3.2: # 4, 11, 14, 28, 33, 50  
Sect. 3.3: # 2, 22, 28, 35, 39, 40 |
|       | June 21   |                                             |                                               |                       |
| **Week 6** | June 26   | 3.5: Implicit differentiation  
3.6: Derivatives of logarithmic functions  
3.6: Derivatives of logarithmic functions (cont.)  
3.8: Exponential Growth and Decay  
3.9: Related Rates | HW 6 due in class on July 10  
Sect. 3.4: # 8, 28, 54, 62  
Sect. 3.5: # 6, 20, 46  
Sect. 3.6: # 12, 38, 44 | Problem Set 6  
Sect. 3.4: # 5, 13, 31, 40  
Sect. 3.5: # 4, 13, 24, 28, 29, 34, 54  
Sect. 3.6: # 3, 24, 36, 46, 50 |
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| Week 7 | July 3 | 3.10: Linear approximation and differentials   
        |       | 4.1: Maximum and minimum values                  | HW 7 due in class on July 17               | Problem Set 7                                   |
|       | July 5 | 4.1: Maximum and minimum values (cont.)             | Sect. 3.9: # 6, 14                          | Sect. 3.9: # 4, 11, 12, 15, 18                 |
|       |       | 4.2: Rolle's Theorem                                | Sect. 3.10: # 4, 24, 34                      | Sect. 3.10: # 5, 9, 15, 28, 33                |
|       |       |                                                      | Sect. 4.1: # 6, 34, 36, 52, 60              | Sect. 4.1: # 5, 32, 44                        |
| Week 8 | July 10 | 4.2: The Mean Value Theorem                        | HW 8 due in class on July 24               | Problem Set 8                                   |
|       | July 12 | Review for Midterm 2                               | Sect. 4.2: # 18, 28, 34                      | Sect. 4.2: # 4, 13, 17, 24, 25                |
|       |       | Midterm Exam 2                                      | Sect. 4.3: # 22, 32, 36, 46                 | Sect. 4.3: # 6, 14, 15, 16, 32, 52            |
|       |       |                                                      | Sect. 4.5: # 10, 24, 34                      | Sect. 4.5: # 1, 9, 16, 26, 36                 |
| Week 9 | July 17 | 4.3: How derivatives affect the shape of a graph  | HW 9 due in class on July 31               | Problem Set 9                                   |
|       | July 19 | 4.5: Summary of curve sketching                    | Sect. 4.5: # 46                            | Sect. 4.5: # 31, 36, 44, 50                   |
|       |       |                                                      | Sect. 4.4: # 2, 18, 26, 40, 50              | Sect. 4.4: # 4, 12, 17, 28, 34, 52, 53, 56    |
|       |       |                                                      | Sect. 4.7: # 8, 34, 40                      | Sect. 4.7: # 10, 16, 24, 36, 42               |
| Week 10 | July 24 | 4.4: Indeterminate forms and L'Hospital            | HW 10 due in class on Aug 7                 | Problem Set 10                                  |
|       | July 26 | 4.7: Optimization problems                         | Sect. 4.9: # 12, 30, 42                     | Sect. 4.9: # 2, 6, 15, 20, 38, 46             |
|       |       | 4.8: Newton-Raphson Method                          | Sect. 5.2: # 18, 24, 34, 40                 | Sect. 5.2: # 8, 18, 22                        |
|       |       | 4.9: Antiderivatives                               | Sect. 5.3: # 14, 24, 32                     | Sect. 5.3: # 8, 12, 22, 38, 44, 52, 68        |
|       |       | 5.4: Indefinite integrals                           |                                               |                                                |
|       |       | 5.1: Areas and distances                            |                                               |                                                |
|       |       | (cont.)                                             |                                               |                                                |
|       |       | 5.2: The definite integral                          |                                               |                                                |
|       |       | 5.3: The fundamental theorem of calculus           |                                               |                                                |
|       |       | 5.5: The substitution rules                         |                                               |                                                |
|       |       | 6.1: Areas between curves                           |                                               |                                                |
|       |       | 6.2: Volumes                                         |                                               |                                                |
| Week 11 | July 31 | 5.1: Areas and distances (cont.)                    | NO HOMEWORK (hooray!!!)                     | Problem Set 11                                  |
|       | August 2 | 5.2: The definite integral                          | Sect. 5.4: # 2, 12, 38, 42, 46              | Sect. 5.4: # 2, 12, 38, 42, 46                |
|       |       | 5.3: The fundamental theorem of calculus            | Sect. 5.5: # 6, 10, 24, 30, 42, 48, 68, 70   | Sect. 5.5: # 6, 10, 24, 30, 42, 48, 68, 70     |
|       |       | 6.1: Areas between curves                           | Sect. 6.1: # 4, 12, 24, 50                  | Sect. 6.1: # 4, 12, 24, 50                    |

(*) These extra credit problems will count towards your "class participation" score. If you choose to hand them in for practice, then they will be graded via WebAssign. "class key" is columbia 5823 1342