MAT 125 - Calculus A
Spring 2003

Prerequisites - Each student must have taken MAT 122, MAT 123, or have received a 4 or better on the Mathematics Placement Exam.

Textbook - The required textbook is *Calculus, Concepts and Contexts, Second Edition* by James Stewart. It is strongly recommended that you read the relevant sections of the textbook before attending class.

Recitations - In addition to the lectures, each student is required to attend one recitation section per week. Recitations will focus primarily on problem solving. However, the recitation instructors occasionally may introduce new material or ideas. In addition, there will be quizzes given in recitation, approximately one every other week.

Sources of help - The mathematics department has many resources availble to help students. First, each instructor hold several office hours every week. The schedule of office hours is posted [here](#). In addition, the Math Learning Center, located in room A-127 of the Physics building, is open Monday through Friday. More information about the Math Learning Center is available at their [website](#).

Homework - Math is not a spectator sport. The only way to learn calculus is to do it. Therefore, homework will be assigned every week and must be turned in at your recitation. Late homework will not be accepted.

Exams - There will be four exams this semester: an "early exam", two midterms, and a final. The schedule of exams is as follows:

Early exam	Wednesday, February 5	8:30 - 10:00 pm
Midterm #1	Tuesday, February 25	8:30 - 10:00 pm
Midterm #2	Tuesday, April 8	8:30 - 10:00 pm
Final exam	Friday, May 16	2:00 - 4:30 pm

Note that the exams are **not** held during normal class times. Make sure that you will be able to take all of the exams. Any conflicts with other courses must be resolved during the first week. No make-up exams will be given. The locations of the exams will be announced in class and posted to the [announcement page](#) as soon as they have been determined.

The early exam covers the background material that is required to learn calculus. More information about the exam, including practice exams, is available [here](#).

Grading - The final grade for this class will be computed from your

exam scores, quiz scores, and homework, weighted by the following amounts:

Early exam	10%
Midterm #1	20%
Midterm #2	20%
Recitation	20%
Final exam	30%

Your recitation grade consists of homework and quiz scores. The lowest quiz will be dropped.

Calculators - You will not be allowed to use a calculator on any exam or quiz.

Students with disabilities - If you have a physical, psychological, medical, or learning disability that may impact on your ability to carry out assigned course work, you are strongly urged to contact the staff in the Disabled Student Services (DSS) office: Room 133 in the Humanities Building; 632-6748v/TDD. The DSS office will review your concerns and determine, with you, what accommodations are necessary and appropriate. A written DSS recommendation should be brought to your lecturer who will make a decision on what special arrangements will be made. All information and documentation of disability is confidential. Arrangements should be made early in the semester (before the first exam) so that your needs can be accommodated.

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May 14

There is no sample exam.

May 9

Ibrahim Unal will hold a review session on Tuesday, May 13th, at 2:00 pm in the Physics building. There is no room reserved. Instead, he will meet in the lobby of the building and find an available room.

May 8

There will be a review session on Monday, May 12th, at 11:00 am in Javits 102.

The final exam will be on Friday, May 16th, from 2:00 - 4:30 pm in the Gym. I will post a sample exam in the next day or two.

May 5

The [homework page](#) has been updated to include several problems from section 4.6.

April 22

The grade breakdown for the second midterm is as follows:

A	85-100
B	75-84
C	60-74
D	50-59
F	0-49

April 7

Ibrahim Unal has graciouly agreed to hold a review session this evening at 5:00 pm. We do not have a room reserved. Instead, we will meet in the lobby of the physics building and commandeer one of the classrooms. If you have any questions about the sample exam, you should ask them at the review.

April 6

Here are the room assignments for the second midterm.

Rec 01 - 03	Javits 102
Rec 05 - 07	Javits 110
Rec 08 - 10	Harriman 137
Rec 11 - 16	Javits 100
Lec 4	Javits 103

April 3

The second midterm is on Tuesday, April 8th, at 8:30 pm. The room

locations will be posted here as soon as they have been determined. The exam will cover everything that has been discussed in class, up to and including section 3.6 of the textbook (implicit differentiation). Of course, the exam will focus primarily on material covered since the first midterm. However, all topics are fair game.

A sample midterm from a couple of years ago is available here. Almost everything on that exam will appear on this year's exam (except for increasing/decreasing and concave up/concave down functions). However, this is not necessarily an accurate guide of what will appear on this year's exam. Our midterm will cover considerably more material, including the second half of chapter 2. You will get a more accurate idea of what will be on the exam by looking at the assigned homework.

March 15
The grade breakdown for the first midterm is as follows:

A	80-100
B	65-79
C	50-64
D	40-49
F	0-39

February 24
Several students have asked whether or not there will be a review session for the midterm. Although there is nothing formally scheduled, I (Matthew Kudzin) will be holding additional office hours today starting at 6:30 pm. Students from all lectures and recitations are welcome to come by.

If you want to check your answers to the practice midterm, here are the answers.

February 23
Since most classes are slightly behind schedule, the homework from section 2.5 will not be due until next week. The homework page has been updated accordingly.

February 21
Here are the room assignments for the first midterm.

Rec 01 - 03	Javits 102
Rec 05 - 07	Javits 110
Rec 08 - 10	Harriman 137
Rec 11 - 16	Javits 100
Lec 4	Javits 103

February 20
Remember that the first midterm is Tuesday, February 25th, at 8:30 pm. The exam will cover everything up to (and including) section 2.4 of the text. The room assignments will be posted here as soon as they have been determined. In the meantime, last semester's midterm is available for practice.

February 15

The homework schedule has been slightly modified. Section 2.3 has been divided into two parts. The first part, up through problem 20, is due next week. The second half is not due until the week after.

February 11

The grades for the early exam are [here](). The score is the number of correct answers, out of a possible 15. There are a couple of grades that have not been posted, because people filled out the opscan form incorrectly. I will post those grades as soon as possible. If you took the exam, but your grade does not appear, contact your instructor immediately.

February 7

Because of the snow day, many classes have not covered section 2.2. Therefore, the homework from that section has been pushed back a week. The problems from section 2.1 are still due in recitation next week, but section 2.2 has been moved to the week of February 17th. See the [homework page]() for the updated schedule.

February 6

I will post the early exam grades as soon as I get the Opscan forms back from the Computer Center. In the meantime, here is the answer key:

1. c	4. a	7. d	10. c	13. a
2. c	5. a	8. e	11. d	14. c
3. d	6. b	9. d	12. b	15. b

February 3

The early exam is this wednesday. You must bring the following items to the exam.

1. Your student ID
2. An opscan form (which can be purchased in the bookstore)
3. A pencil (Not a pen. The opscan reader cannot read ink.)

January 30

Here are the room assignments for the Early Exam.

Rec 01,02,03,05,08,09,12	Javits 100
Rec 06,07,10,11	ESS 001
Rec 13,14	Javits 101
Rec 15,16	Javits 109
Lec 4	ESS 131

January 24

Some of the recitations have been changed. Recitation 04, which was scheduled for Tuesday at 8:20 am, has been cancelled. Anyone registered for that section has been moved into recitation 03, which meets on Thursday at 8:20 am. In addition, the location of recitation 02 has changed. It will now meet in room P127 of the physics building.

January 15

Welcome to MAT 125. The first day of the semester is Wednesday,

January 22nd. All scheduled classes, even recitations, will meet on that day.

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Homework must be turned in at (or before) your recitation each week. There are two exceptions. On the week of April 14th, some recitations will be cancelled for Passover. That assignment will be due on April 15th, regardless of when your recitation meets. Also, the final assignment of the semester is due on Monday, May 12th.

Late homework will not be accepted.

Week	Assignment
January 27	1.1 # 2,8,14,24,36,40,42 1.2 # 4,6,10
February 3	1.3 # 4,12,16,18,26,32,38,42,53,54 1.5 # 10,16,18,19,24 1.6 # 6,13,22,26,28,36,50
February 10	2.1 # 2,4,6
February 17	2.2 # 3,4,6,10,12,17a,18 2.3 # 2,3,4,8,12,14,20
February 24	2.3 # 26,28,30,42 2.4 # 3,6,8,14,18,31,34,36
March 3	2.5 # 2,4,8,14,15,21,22,24,42 2.6 # 5ab,8,9,14,16,20
March 10	2.7 # 2,4,6,14,26,28,36 2.8 # 3,10,14,21,22,36,40,46
March 17	Spring Break - no homework
March 24	3.1 # 3-22,32,41,46,54 3.2 # 3-19,28,31
March 31	3.4 # 1-10,14,33,37,38 3.5 # 2,4,6,7-20,30,32,38,41,48
April 7	3.6 # 3-12,16,28,34,45
April 14	3.7 # 2-14,27,28,35,36 3.8 # 2,4,6,7,8,16 This assignment is due on or before Tuesday, April 15
April 21	4.1 # 6,7,10,12,14,19,25,34
April 28	4.2 # 4,10,25,26,28,36,40,42 4.3 # 2,8,10,11,20,24,45
May 5	4.5 # 2,3,6,7,22,30,32,42,54

	May 12	4.6 # 2,6,10,19,28,36,38 This assignment is due on or before Monday, May 12

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The following people will be teaching MAT 125 this semester.

Name	Sections	Office Hours
Je-Wei Chen	Recitation 15 Recitation 16	Th 12:00 - 2:00 pm, MLC
Satyaki Dutta	Recitation 6 Recitation 7	
William Hooper	Recitation 12	Tu 1:00 - 2:00 pm, Math 2-115 We 1:00 - 2:00 pm, MLC Fr 1:00 - 2:00 pm, MLC
Youngdeuk Kim	Recitation 3 Recitation 5	We 1:00 - 3:00 pm, MLC
Matthew Kudzin	Lecture 1	Tu 9:00 - 10:00 am , Math 2-118 We 9:00 - 10:00 am , Math 2-118
Li Li	Recitation 2 Recitation 8	Mo 6:00 - 8:00 pm, MLC
Tao Li	Lecture 2	Mo 1:00 - 2:00 pm, MLC Mo 2:00 - 3:00 pm, Math 2-112
Michael Munn	Recitation 1 Recitation 9	
Yu-Jen Shu	Lecture 4	Tu 2:30 - 3:30 pm, Math 2-114 We 3:00 - 4:00 pm, MLC
Ioana Suvaina	Recitation 13 Recitation 14	Tu 5:00 - 7:00 pm, MLC
Ibrahim Unal	Lecture 3	Th 2:30 - 3:30 pm, MLC Fr 3:20 - 5:20 pm, Math 3-118
Kwan Kiu Yau	Recitation 10 Recitation 11	Tu 11:00 am - 12:00 pm, MLC Th 11:00 am - 12:00 pm, MLC

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January 22 - First day of classes

February 4 - Last day to add the class

February 5 - Early exam at 8:30 pm. The location of the exam will be announced. More information, including practice exams, can be found [here](#).

February 25 - Midterm #1 at 8:30 pm. The location of the exam will be announced.

March 28 - Last day to withdraw

April 8 - Midterm #2 at 8:30 pm. The location of the exam will be announced.

May 9 - Last day of classes

May 16 - Final exam 2:00 - 4:30 pm. The location of the exam will be announced.

MAT 125: Midterm 2 Info Sheet

When: Thursday, November 16, 8:30–10:00 pm

Where: sections 1,3,4 go to Javits 110; section 2 goes to ESS 069; sections 5 thru 11 go to Javits 100; section 13 goes to Humanities 101; section 14 goes to Javits 111. Students with disablilities will take the exam in the DSS office (you should register with them in advance).

Calculators: allowed (except for calculators with symbolic manipulation capabilities, such as TI-89 or TI-92), but mostly useless: your answers should be justified using calculus methods, not the graph plotted by your calculator.

Topics covered: derivative as a function; rules for taking derivatives (e.g., sum, difference, product, quotient, chain rules); computing derivatives of algebraic functions, trigonometric functions, exponential functions and combinations of these functions; using $f'(x)$ and $f''(x)$ to discover increasing-decreasing and concavity properties for the graph of $f(x)$; tangent lines and linear approximations; rates of change word problems. (These are topics covered in sections 2.7–2.10 and 3.1–3.5 of the textbook.)

Tips: same as for Midterm 1. In particular, **always write solution**, not just an answer, and cross out anything the grader should ignore.

Practice Exam

1. For $f(x) = 2\sqrt{x} + x^3 - 2$ compute the following:
   (a) $f'(x)$
   (b) Find the equation for the tangent line to the graph of $f(x)$ at the point $(1, 1)$.
   (c) Use the linear approximation for $f(x)$ near $x = 1$ to approximate $f(1.1)$.

2. Let $f(x)$ and $g(x)$ be two given functions satisfying $f(2) = 1$, $f'(2) = 3$, $g(2) = \sqrt{2}$ and $g'(2) = \sqrt{3}$. Define a function $h(x)$ by
   $$h(x) = \frac{f(x)g(x)}{2f(x) - 3g(x)}$$
   (a) Compute $h'(2)$
   (b) Is $h(x)$ increasing or decreasing near $x = 2$?

3. Let $f(x) = 2e^x - 5\sin(x) + 7x^5$. Find $f^{(n)}(x)$ for $n = 1, 2, 99$.

4. Graph the function $f(x) = x^3 - 3x + 2$, indicating in the graph the following data: y-intercept; the points on graph where the tangent line is horizontal; intervals over which $f(x)$ is increasing and over which it is decreasing; intervals over which $f(x)$ is concave up and over which it is concave down. All of this should be found using the methods of calculus — not your calculator.

5. Find $f'(x)$ if $f(x) = \tan(e^{g(x)})$ and $g(x) = \frac{x+1}{x^2-1}$.

6. Suppose that $f''(x) = (|x| + 2)^3$ and $f'(0) = 0$. Find the intervals over which $f(x)$ is increasing and over which $f(x)$ is decreasing.

7. Let $n(t)$ denote the number of bacteria at time equal t hours which are contained in a specific colony of bacteria. This colony doubles in size every 30 minutes, and at time $t = 0$ hours there are 35 bacteria.
   (a) Find a formula for $n(t)$.
   (b) Find a formula for the average rate of growth of the colony over the time interval $[t, t + h]$.
   (c) Find a formula for the instantaneous rate of growth of the colony at time t.

8. Set
   $$f(x) = \begin{cases} |x| & \text{if } x \leq 1 \\ 2x^2 - 1 & \text{if } 1 < x < 2 \\ e^{x-2} & \text{if } 2 \leq x \end{cases}$$
   (a) For which values of x does $f'(x)$ not exist?
   (b) Compute $f'(x)$ as a function of x.

1a. 1/4
1b. does not exist
1c. 1
1d. 1/(2 sqrt(2))

2. 0
3. You need to verify the following facts:
    f(x) = e^x - (2-x) is a continuous function.
    f(0) = -1
    f(1) = e-1 > 0

Now, by the intermediate value theorem, there is an x in the interval
0<= x <= 1, such that f(x) = 0. But the equation f(x) = 0 means
e^x - (2-x) =0 , or e^x = 2-x

4. 0

5. This problem involves material from section 2.5, and will not be on the
  exam

6. y - 1 = (1/2)(x-2)

7. The function is not continuous at x=0 and x=1.

  lim   f(x) = - infinity
  x -> 0-

  lim   f(x) = infinity
  x -> 0+

  lim   f(x) does not exist
  x -> 0

  lim   f(x) = 1
  x -> 1-

  lim   f(x) = 2
  x -> 1+

  lim   f(x) does not exist
  x -> 1

Midterm 1 — Version 1
MAT 125
October 9, 2002   8:30-10:00 PM

Name:	**ID #:**	**Section:**

(Section number is your **recitation** number, e.g. 01, 02, etc. Evening lecture 3 (MW 7-8:20) should use number 13; evening lecture 4 (Tu Th 5:30-6:50) should use number 14)

DO NOT OPEN THIS EXAM UNTIL INSTRUCTED

Please answer each question in the space provided. Please write full **solutions**, not just answers. Unless otherwise marked, **answers without justification will get little or no partial credit**. Cross out anything the grader should ignore and circle or box the final answer. Graphing calculators are allowed but not required; graph plotted by your graphing calculator can not be considered as a justification of your solution.

When calculating limits, please distinguish between the cases $\lim f(x) = \infty$, $\lim f(x) = -\infty$ and "$\lim f(x)$ does not exist even allowing for infinite values".

Problem	1	2	3	4	5	6	7	**Total:**
Max	20	10	10	15	15	15	15	100
Scores								

(1) (*20 points*) Calculate the following limits

(a) $\lim\limits_{x \to 2} \dfrac{x^2 - 3x + 2}{x^2 - 4}$

(b) $\lim\limits_{x \to -2+} \dfrac{x^2 - 3x + 2}{x^2 - 4}$

(c) $\lim\limits_{t \to 1} \dfrac{t^2 + 1}{t + 1}$

(d) $\lim\limits_{t \to 2} \dfrac{\sqrt{t} - \sqrt{2}}{t - 2}$

(2) (*10 points*) Calculate
$$\lim\limits_{x \to \pi} \ln(\cos 2x)$$

(3) (*10 points*) Explain why the equation
$$e^x = 2 - x$$
has a solution on the interval $0 \le x \le 1$. Explanation "it is clear from the graph" is not sufficient.

(4) (*15 points*) Calculate
$$\lim_{x \to 1_-} e^{\frac{1}{x-1}}$$

(5) (*15 points*) For the function
$$f(x) = \frac{2x^2 + 4x + 2}{x(x - 2)}$$
find the horizontal and vertical asymptotes and write their equations.

(6) (*15 points*) Find the equation of the tangent line to the graph of $f(x) = \frac{2}{x}$ at the point $P = (2, 1)$.

(7) (*15 points*) Let $f(x)$ be given by the formula

$$f(x) = \begin{cases} 1/x, & \text{for } x < 1 \\ x + 1, & \text{for } x \geq 1 \end{cases}$$

Find all points where $f(x)$ is not continuous; for each such point a, find $\lim_{x \to a_+} f(x)$, $\lim_{x \to a_-} f(x)$ and $\lim_{x \to a} f(x)$.