

# Math 220: Calculus I

Spring 2008: 4 credits, MWF, 1:10 – 2:00 pm, R, 1:00—1:50pm MRC 436

Instructor: Michael A Wodzak, Associate Professor of Mathematics

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Hours: Daily 8—10 am

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Final Exam: Thursday, 13 May 2010, 7:40 – 9:40 am

**Course Description:** Limits and Continuity. Derivatives and applications. Differentiation of polynomial, rational, trigonometric, logarithmic and exponential functions. L'Hopital's Rule.

Prerequisite: acceptable placement score (or ACT math score of at least 28), or at least 3 years of high school algebra and trigonometry with at least a B average, or a grade of C or better in MATH 180. General Education course: G9.

**Text:** *Calculus, Concepts and Contexts*, 3<sup>rd</sup> Ed. (Stewart, Brooks/Cole, 2005)

## **CORE SKILL OBJECTIVES**

1. **Thinking Skills:** Students engage in the process of inquiry and problem solving that involves both critical and creative thinking.
  - (a) Understands the “big problems” in the development of differential calculus, the tangent problem and the velocity problem.
  - (b) Understands the mathematical concept of Limit.
  - (c) Explores differentiation formulas for a variety of functions, including exponential and logarithmic, trigonometric and inverse trigonometric, hyperbolic and inverse hyperbolic functions.
  - (d) Investigates a wide variety of applications of differentiation, such as finding maximum and minimum values of functions, and instantaneous rates of change.
2. **Communication Skills:** Students communicate orally and in writing in an appropriate manner both personally and professionally.
  - (a) Does group work (labs and practice exams) is done throughout the course, involving both written and oral communication.
  - (b) Uses technology - graphing calculators and Maple V in the computer lab - to solve problems and to be able to communicate solutions and explore options.
  - (c) Improves one's ability to write logically valid and precise mathematical proofs and solutions.
3. **Life Values:** Students analyze, evaluate and respond to ethical issues from informed personal, professional, and social value systems.
  - (a) Develops an appreciation for the intellectual honesty of deductive reasoning.
  - (b) Understands the need to do one's own work, to honestly challenge oneself to master the material.
4. **Cultural Skills:** Students understand their own and other cultural traditions and respect the diversity of the human experience.
  - (a) Develops and appreciation of the history of calculus and the role it has played in mathematics and in other disciplines.
  - (b) Learns to use the symbolic notation correctly and appropriately.

**NCTM Goals:** The NCTM (National Council of Teachers of Mathematics) gives the following set of overall goals for mathematics education in general, which are worth including here, since I think they are such fundamental reasons for studying mathematics.

1. Learn to value mathematics.
2. Learn to reason mathematically.
3. Learn to communicate mathematically.
4. Become confident in your mathematical ability.
5. Become problem solvers and posers.

## **Course Goals:**

1. Students shall develop a solid foundation in the basic concepts and methods of Differential Calculus.
2. Students shall develop problem solving skills.

3. Students shall understand the appropriate use of technological tools in their mathematical work.
4. Students shall communicate mathematical ideas clearly and accurately.

**Outcomes:** This is a list of more specific mathematical outcomes this course should provide. The student shall...

Content:

1. ... demonstrate the knowledge of the theory and methods of Differential Calculus, specifically, limits, derivatives by definition, differentiation formulas, and applications of the derivative.

Problem-Solving:

2. ...demonstrate the ability to apply appropriate mathematical tools and methods of novel or non-routine problems.
3. ...demonstrate the ability to use various approaches in problem solving situations, and to see connections between these varied mathematical areas.

Technology:

4. ...demonstrate the basic ability to perform computational and algebraic procedures using a calculator or computer.
5. ...demonstrate the ability to efficiently and accurately graph functions using a calculator or computer.
6. ...demonstrate the knowledge of the limitations of technological tools.
7. ...demonstrate the ability to work effectively with a CAS, such as *DERIVE*, to do a variety of mathematical work.

Communication:

8. ...use the language of mathematics accurately and appropriately.
9. ...present mathematical content and argument in written form.

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## **COURSE POLICIES AND PROCEDURES:**

Probably the best single piece of wisdom I can pass on to you as you begin this course is: “*Mathematics is not a spectator sport!*” You need to view yourself as the LEARNER – and “learn” is an active verb, not a passive verb. I will do what I can to help structure things so that you have an appropriate sequence of topics and a useful collection of problems, but it is up to YOU to DO the problems and to READ the book and THINK ABOUT the topics.

You must develop a system that works for you, but let me suggest that it might include finding a study group or coming to me with your questions or going to tutoring sessions in the learning center. In any case you should expect to spend at least the traditional expectation of 2 hours outside of class for each hour in class – this is important! Class time is for exploring the topics and answering questions you might have, but you simply can’t master the material without putting in the time alone to really engage in the mathematics. We are in the process of phasing in a new textbook and more than ever it is important that you actually READ the BOOK! The authors attempt to force the reader to think about the material and to develop an intuitive sense of what is going on; there is much emphasis on solving problems and much reliance on graphing technology as well as on symbolic manipulation.

In general, I think students can benefit greatly by **WORKING TOGETHER** on problems. While there is some danger of the “blind leading the blind” syndrome, or of students deceiving themselves into thinking they understand the material better than they actually do, for the most part grappling with ideas and trying to explain them to another student or learning to listen to others explain an idea is a wonderful way to see that you really do understand the material. In class we will spend an occasional day working on a group “lab”, and we will also typically have a group “practice exam” before the individual exams, and I also encourage you to find a “learning group” outside of class.

**HOMEWORK:** In a nutshell, working problems is one of the key ways you will learn Calculus. Attending class is important, of course, but without doing problems you will not develop a solid foundation in the material. I will give you daily assignments and will expect that you will do as many as time allows (which I take to be roughly 2 hours per class period). I will not generally collect these assignments but I do see them as testing your understanding and as raising questions for you to ask in class.

**PORTFOLIO**. The portfolio will be collected at the end of exam week. This “portfolio” should be a representative collection of your work during the semester, and should include 5 problems, written up in a finished form, along with a brief discussion of why you chose to include that particular problem. These problems should represent work you are proud of, or problems that brought you to a breakthrough point. These problems will be worth 40 points, 8 points per problem. Presumably you will hand in 5 sheets of paper, each of which will include a nicely organized solution to the problem, which might be from homework, or from a lab or worksheet, or from an exam, along with that reflection mentioned above. The portfolio will also contain all of your lab work and the labs are worth a total of 60 points. As a general rule, I will not collect homework for grading. The exception will be homeworks that I have written and handed out in class. Each of these will be considered a “lab” as far as grading is concerned.

**EXAMS**: There will be exams after each of the 4 chapters we will cover – these will be in two parts, a group practice problem set worth 20 points and then an individual exam worth 80 points, 100 points in total. The final exam will be cumulative and worth 200 points (40 on the group part, 160 on the individual part). By the way, I do not expect you to memorize the various formulas – you are allowed a page of notes for each exam, and you can bring all four pages in for the final exam.

**GRADING POLICY**: If you have been keeping score, you will have calculated a total of 700pts available. In general I use the rather traditional 90% of possible points for an “A”, 80% for a “B”, 70% for a “C”, and 60% for a “D”. I will try to make enough points available in non-test situations that “test-anxiety” should not entirely kill your chances for success, but I am a very firm believer in putting students through the exam experience so that I can see whether you, not your study group, understand the material.

**AMERICANS WITH DISABILITIES ACT**: If you have a disability and require auxiliary aids, services, or accommodations for this class, please inform me and Jane Eddy, the disabilities (ADA) coordinator (MRC 332; 796-3194) within 10 days to discuss your needs for the semester.

### **MATH 220: Spring 2008 Schedule**

18 Jan	Review	
20 Jan	Review	
21 Jan	Review	
22 Jan	Simple max/min questions	assigned work
25 Jan	Simple max/min questions	assigned work
27 Jan	Simple max/min questions	assigned work
28 Jan	Simple max/min questions	assigned work
29 Jan	<1.5> Exponential Functions	p 59 # 7-19 odd
01 Feb	<1.6> Logarithms	p 69 # 3-53 odd
03Feb	<1.7> Parametric Curves	p 76 # 1-27 odd
04 Feb	<b>Lab 1</b>	
05 Feb	<b>Practice Exam #1</b>	
08 Feb	<b>EXAM #1</b>	
10 Feb	<2.1> The Tangent and Velocity Problems	p 94 # 1-7 odd
11 Feb	<2.2> The Limit of a Function	p 102 # 1-15 odd
12 Feb	<2.3> Limit Laws	p 111 # 1-33 odd
15 Feb	<2.4> Continuity	p 121 # 1-29 odd
17 Feb	<2.5> Limits and Infinity.	p 132 # 3-37 odd
18 Feb	<2.6> Rates of Change	p 142 # 1-21 odd
19 Feb	<2.6> The Derivative	p 142 # 27-39 odd

22 Feb	<2.7> Derivatives as Functions	p 155 # 1--41 odd
24 Feb	<2.8> $f$ and $f'$	p 162 # 1--23 odd
25 Feb	<b>Lab 2</b>	
26 Feb	<b>Group Practice Exam #2</b>	
01 Mar	<b>EXAM #2</b>	
03 Mar	<3.1> Derivatives of Polyn. & Exp. Functions	p 181 # 1-31 odd, 41-49 odd
04 Mar	<3.2> Product and Quotient Rules	p 188 # 1-31 odd, 41, 43
05 Mar	Derivative Applications	assigned problems
8 Mar – 12 Mar	<b>Spring Break</b>	
15 Mar	<3.3> Derivatives of Trigonometric Functions	p 195 # 1-17 odd, 37, 41
17 Mar	<3.4> The Chain Rule	p 205 # 1-35 odd, 47, 49, 53
18 Mar	<b>Lab 3</b>	
19 Mar	<3.5> Implicit Differentiation	p 214 # 1--33 odd, 43
22 Mar	<3.6><3.7> Derivatives of Inverse Functions	p220 eoo p226 # 3-47eoo
24 Mar	<3.9> Linear Approximation and Differentials	p 245 # 1-13 odd
25 Mar	<b>Lab 4</b>	
26 Mar	<b>Group Practice Exam #3</b>	
29 Mar	<b>EXAM #3</b>	
31 Mar	<4.1> Related Rates	p 260 # 1-41 eeo
01 Apr – 05 Apr	<b>Easter Holiday</b>	
07 Apr	<4.2> Maximum and Minimum Values	p 268 # 1-53 odd
08 Apr	<b>Lab 5</b>	
09 Apr	<4.3> Derivatives and Shapes of Curves	p 279 # 1-19 odd
12 Apr	<4.4> Calculators and Graphing Functions	p 288# 1-17 odd
14 Apr	<4.5> l'Hospital's Rule	p296 # 1-47 odd
15 Apr	<4.6> Optimization Problems	p 311 # 7-59 eoo
16 Apr	more on <4.6>	
19 Apr	<b>Lab 6</b>	
21 Apr	<4.7> Newton's Method	p 315 # 1-33 odd
22 Apr	<4.8> Antiderivatives	p 332 # 1-35 odd
23 Apr	<b>Group Practice EXAM #4</b>	
26 Apr	<b>EXAM #4</b>	
28 Apr	Buffer	
29 Apr	Buffer	
30 Apr	<b>Undergraduate Research Day</b>	
03 May	Buffer	
05 May	Buffer	
06 May	<b>Final Review</b>	
07May	<b>Final Review</b>	

**FINAL EXAM:** Thursday, 13 May 2010, 7:40-9:40