



UNIVERSITY OF NORTHERN COLORADO

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## Extended Campus

College of Natural & Health Sciences  
School of Mathematical Sciences

UNC Dual Enrollment at Greeley Central High School

MATH 131-658: Calculus I (4 credits, LAC, gtP\*)  
Fall 2020 & Spring 2021

**Instructor:** Sean Miller

BA, Education with emphasis in Mathematics, University of Northern Colorado 2011

MA, Mathematics, University of Northern Colorado 2014

University of Northern Colorado Adjunct Math Instructor, 2014 - present

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**Office Phone:** 970-348-5102

**Office Hours:** Wednesday/Thursday 10:45-11:15

### Stay Connected:

I will post daily/weekly reminders regarding upcoming assessments and homework on the free app Remind.

To Join:

- Text @7bd1f5 to 81010
- Or visit <https://www.remind.com/join/7bd1f5>

### **Prerequisite for UNC Dual Enrollment:**

- Junior or Senior status
- 3.0 cumulative GPA
- Grade of “C” or better in Plane Trigonometry. A grade of C- is not acceptable. Is it B or C?
- Counselor/Instructor approval prior to taking the course
- Parent consent
- Special Exemptions to these qualifications may be made on an individual basis through written request to UNC Extended Campus

### **Course Description:**

First course in a three-course sequence in calculus. Differentiation and related concepts, applications of derivatives, including exponential, logarithmic and trigonometric functions. (LAC, gtP)

### Course Objectives:

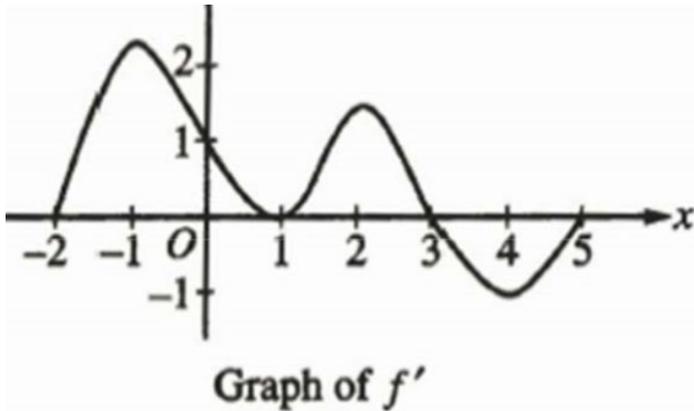
The student will be able to:

- Analyze and Investigate various functions using the rule of 3:
  - Investigate functions analytically, graphically, numerically, and verbally.
  - Students are expected to relate the various representations to each other.
  - Each exam will include questions in which involve only graphs or numerical data.
- Communicate their ideas using proper vocabulary and terms.
  - You will be expected to justify your solutions with well-written sentences.

- You will be expected to justify your solutions orally with group worthy tasks so that I can gauge your comprehension of various tasks.
- Model and solve real world problems
- Analyze and solve problems in an organized manner
- Understand as well as apply algebraic algorithms
- Interpret and solve problems represented analytically, graphically, numerically, and verbally
- Apply appropriate technology as an integral part of problem solving
- Use graphing calculators to experiment, interpret their results, and support their conclusions.

### Writing in Calculus

It is a minimal expectation that students will use well written sentences to justify and reason their mathematics in this course. A specific example in which students will be required to write complete sentences to justify their work is included below when students use the graph of  $f'(x)$  to determine various characteristics of  $f(x)$ .



- a.) On which intervals is  $f(x)$  increasing? Explain your reasoning.
  
- b.) On which intervals if  $f(x)$  decreasing? Explain your reasoning.
  
- c.) On which intervals is  $f(x)$  concave up? Explain your reasoning.
  
- d.) What are the critical numbers of  $f(x)$ ? Are any of these not a relative extrema? Explain your reasoning.

This is an activity taken out of unit V, in which students are required to determine various characteristics of  $f(x)$  while justifying/explaining their reasoning. In the activity above students learn how to write complete and accurate responses relating  $f'(x)$  to  $f(x)$ . A sentence which students can use to justify their solution in problem “a”,  $f(x)$  is increasing when  $f'(x)$  is positive. Since  $f'(x)$  is positive on the intervals  $(-2,1) \cup (1,3)$ , then  $f(x)$  is increasing on the intervals  $(-2,1) \cup (1,3)$ . Being able to write complete sentences to explain your mathematical thoughts helps me understand that you fully comprehend the content, but also helps you achieve maximum points on Free Response Questions on the AP Calculus exam.

## Calculator Ideas

In this class the graphing calculator is used to help students develop and enhance concepts that they approach through algebraic techniques. Calculators will be used to illustrate ideas and make discoveries about functions in calculus. The four required functionalities of graphing technologies are:

- Finding a root
- Sketching a function in a specified window
- Approximating the derivative at a point using numerical methods
- Approximating the value of a definite integral using numerical methods
- Your calculator will be used to zoom in on a limit numerically through its “table” feature
- Estimate the slope of a tangent line at various x-values and plot the slope values as a function of the x

Students are required to make connections between the graphs of functions and their analysis and draw conclusions about the behavior of functions when using a graphing calculator.

## Limits:

Using your calculators “table” feature can be used to zoom in on a limit numerically.

For example, to find

$$\lim_{x \rightarrow 2} \frac{x - 2}{x^2 - 4}$$

Using the “table” feature you can see that at  $x=2$  the table records “error” or “undefined”. If you set your table to start at  $x=1.5$  with an increment step of 0.1. Students can now predict what value the function is approaching when  $x$  is approaching 2. By redoing this process with smaller and smaller incremental steps students can begin to support their conclusion about what value the function is approaching when  $x$  is approaching 2. Doing experiments such as this with their graphing calculators can lead to L’Hopital’s rule or Pre-Calculus topics such as factoring out  $(x-2)$  and substituting in  $x=2$  to determine what value the function is approaching. Graphing Calculator experiments like this can give students the opportunity to use the graphing calculator to support their conclusions and interpret their results.

## Required Materials:

- Text book: Calculus: Graphical, Numerical, Algebraic 3<sup>rd</sup> Edition.  
Finney, Demana, Waits, Kennedy, 2007, Pearson-Prentice Hall
- Graphing Calculator. Acceptable models include TI-83, TI-83+, TI-84, TI-84+, all other models please ask. (Instructor will be using a TI-83+).
  - Sharing of calculators during quizzes or exams will not be permitted.
  - Bring calculators to class. We will be using them throughout the semester.

## Grading Scale:

A	90 – 100%	Weighted 5.0 (on a 4.0 scale)
B	80 – 89.99%	Weighted 4.0
C	70 – 79.99%	Weighted 3.0
D	60 – 69.99%	NOT Weighted 1.0
F	below 60%	0

## Summative Assessments - 75% of course grade:

- Tests are given at the end of each unit of study.
- If you miss a test due to an absence, you must make arrangements to take it immediately upon your return. Please be aware you will be given an alternate version of the test!
- **There are no opportunities for retaking tests in university courses!** However, the lowest UNIT test score will be dropped each semester.
  - **Not Including Final**
- A cumulative midterm will be given in December and the AP Exam (“final”) will be given in May.

### **Formative Assessments – 10% of course grade:**

- Formative Assessments “Quizzes” will be given frequently to assess your progress with the daily material.
- There are no retakes on formative assessments, because there will be multiple opportunities to demonstrate mastery of topics.
- If you miss a quiz due to an absence, you must make arrangements to take it immediately upon your return to school.

### **Self-Directed Learning – 15% of course grade:**

- Homework Assignments are given daily and will require a significant commitment of time at home to complete.
- Deadlines/due dates will be announced during class.
- Homework Assignments will **NOT** be accepted after the day of the unit exam.

### **Attendance:**

Attendance is critical to success in a university mathematics course. It is imperative that you are present in class every day prepared to learn. Furthermore, if you are absent it is YOUR RESPONSIBILITY to learn the missed content. This means getting notes from classmates, reading the textbook, Khan Academy, YouTube, etc. Please note the instructor will NOT reteach the entire lesson that was missed! All class assignments will be posted on Greeley Central High School’s website.

### **Portable Electronic Devices:**

Please extend courtesy to your instructor and fellow students by turning off your portable electronic devices such as: cell phones, pagers, and iPods. Although not an audio issue, text-messaging is a distraction to other students and prevents you from full participation in class. You should keep your portable electronic devices in your backpack or purse during class. Your personal electronic devices should not be on your desks. If you know that you may need to accept an emergency phone call during class, please let the instructor know. If you need to take a phone call during class, please step out of the classroom while you complete your call. Thank you for your cooperation.

### **Students with Disabilities**

Any student requesting disability accommodation for this class must inform the instructor giving appropriate notice. Students are encouraged to contact Disability Support Services at Greeley Central High School to certify documentation of disability and to ensure appropriate accommodations are implemented in a timely manner.

### **Changes**

The instructor reserves the right to amend, adjust, or otherwise modify the outline and syllabus at any time during the course. Changes will be announced in class and posted online on blackboard. The new syllabus will be available under the ‘Syllabus’ link, and I will post an announcement on blackboard to make everyone aware of the changes.

### **UNC’s Policies**

#### **Honor Code**

All members of the University of Northern Colorado community are entrusted with the responsibility to uphold and promote five fundamental values: Honesty, Trust, Respect, Fairness, and Responsibility. These core elements foster an atmosphere, inside and outside of the classroom, which serves as a foundation and guides the UNC community’s academic, professional, and personal growth. Endorsement of these core elements by students, faculty, staff, administration, and trustees strengthens the integrity and value of our academic climate.

#### **Academic Conduct**

UNC’s policies and recommendations for academic misconduct will be followed. For additional information, please see the Dean of Student’s website, Student Handbook link <http://www.unco.edu/dos/pdf/StudentCodeofConduct.pdf>

**\*Liberal arts core & Colorado gtPathways.** This course satisfies 4 credits of Area 2. (Mathematics) of the UNC Liberal Arts Core. This course has been approved by the Colorado Commission on Higher Education for inclusion in the Colorado Guaranteed Transfer Program, gtP. gtP courses automatically transfer to any public institution in Colorado and will continue to count toward general education or other graduation requirements for any liberal arts or science associate or bachelor's degree program IF a grade of C- or higher is recorded. Statewide articulation agreements prescribe specific general education and degree requirements in the following professional degree programs: business, early childhood, elementary education, engineering and nursing. Most other courses not approved for the gtP designation will also be accepted in transfer by other institutions but may not fulfill general education or degree requirements. For more information on the GT Pathways program, go to <http://highered.colorado.gov/academics/transfers/gtpathways/curriculum.html>.

*Students who successfully complete the Area 2 Liberal Arts Core requirement in mathematics will have developed an understanding of fundamental mathematical concepts and their applications, will have developed their quantitative problem-solving skills, and will have developed a level of quantitative literacy that provides a foundation for success in their programs of study, careers, and citizenship.*

*Specifically, they will be able to:*

- a) Demonstrate good problem-solving habits, including:
  - estimating solutions and recognizing unreasonable results
  - considering a variety of approaches to a given problem, and selecting one that is appropriate
  - interpreting solutions correctly
- b) Generate and interpret symbolic, graphical, numerical, and verbal (written or oral) representations of mathematical ideas
- c) Communicate mathematical ideas in written and/or oral form using appropriate mathematical language, notation, and style
- d) Apply mathematical concepts, procedures, and techniques appropriate to the course
- e) Recognize and apply patterns or mathematical structure
- f) Utilize and integrate appropriate technology
- g) Demonstrate competency in Quantitative Literacy by being able to:
  - 1) Interpret Information
    - a. Explain information presented in mathematical forms (e.g., equations, graphs, diagrams, tables, words).
  - 2) Represent Information
    - a. Convert information into and between various mathematical forms (e.g., equations, graphs, diagrams, tables, words).
  - 3) Perform Calculations
    - a. Solve problems or equations at the appropriate course level.
    - b. Use appropriate mathematical notation.
    - c. Solve a variety of different problem types that involve a multi-step solution and address the validity of the results.
  - 4) Apply and Analyze Information
    - a. Make use of graphical objects (such as graphs of equations in two or three variables, histograms, scatterplots of bivariate data, geometrical figures, etc.) to supplement a solution to a typical problem at the appropriate level.
    - b. Formulate, organize, and articulate solutions to theoretical and application problems at the appropriate course level.
    - c. Make judgments based on mathematical analysis appropriate to the course level.
  - 5) Communicate Using Mathematical Forms
    - a. Express mathematical analysis symbolically, graphically, and in written language that clarifies/justifies/summarizes reasoning (may also include oral communication).

## ***UNITS OF STUDY:***

### **I. Prerequisites of Calculus**

- Functions and Graphs
- Exponential Functions
- Parametric Functions
- Inverse Functions and Logarithms
- Trigonometric Functions

### **II. Limits and Continuity**

- Rates of Change and Limits
- Limits Involving Infinity
- Continuity
- Rates of Change and Tangent Lines

### **III. Derivatives**

- Derivatives of a Function
- Differentiability
- Rules for Differentiation
- Velocity and Other Rates of Change
- Derivatives of Trigonometric Functions
- Chain Rule
- Implicit Differentiation
- Derivatives of Inverse Trigonometric Functions
- Derivatives of Exponential and Logarithmic Functions

- L'Hopital's rule

### **IV. Applications of Derivatives**

- Extreme Values of Functions
- Mean Value Theorem
- Connecting  $f'$  and  $f''$  with the Graph of  $f$
- Modeling and Optimization
- Linearization and Newton's Method
- Related Rates

### **V. The Definite Integral**

- Estimating with Finite Sums
- Definite Integrals
- Antiderivatives
- Fundamental Theorem of Calculus

### **VI. Differential Equations and Modeling**

- Slope Fields and Euler's Method
- Antidifferentiation by Substitution
- Exponential Growth and Decay

### **VII. Applications of the Definite Integral**

- Integral as Net Change
- Areas in the Plane
- Volumes
- Lengths of Curves

## AP/Dual Enrollment Calculus Contract

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Student Name (Please Print)

*I have read and agree to comply with the policies for this course.*

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Student Signature

Date

**I have read and agree to support my student in complying with the policies for this course.**

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Parent/Guardian Signature

Date

EMAIL ADDRESS: (please print)

**Parent/guardians: You can view your student's grades AND sign up for automated email notification of your student's grade status by logging on to <http://central.greelevschools.org/home.aspx> I highly suggest that you visit this site regularly. Also, please feel free to contact me at any time for any reason.**