MAT 108-03 MATHEMATICS FOR THE NATURAL SCIENCES
Spring 2008

Instructor: Ross Gingrich
Office: EN D-132
Office Phone: (203) 392-5581 (You may leave voice-mail messages.)
E-mail address: GingrichR1@SouthernCT.edu
Fax: (203) 392-6808
Web URL: http://www.southernct.edu/~gingrich/

Office Hours:

Monday	No scheduled office hours
Tuesday	11:00 - 12:00 and 4:30 – 5:45 pm
Wednesday	2:00 – 3:00 pm
Thursday	11:00 - 12:00 and 4:30 – 5:45 pm
Friday	No scheduled office hours

Also by appointment or chance, particularly on Mondays and Fridays. I will be available (at least briefly) after each class, and I am willing to make appointments for days, evenings, and Saturdays.

Course website: http://www.southernct.edu/~gingrich/mat10803spring2008/ . The webpage will not go online until January 27. You will be able to access this page by directly typing in the URL, by going through my webpage, or by going into MyCourses in your MySCSU account. In MyCourses, click on our course, and then on Links. Note that this site is NOT part of the WebCT/Vista system. Once the semester has begun, I will be posting assignments, etc., either to this webpage or to our MySCSU course website.

Course e-mail: I will expect everyone to be able to read e-mail sent through the MySCSU system. That means that either you will need to check your MySCSU e-mail account regularly, or you will need to forward the e-mail from your Southern account to another personal account that you do check regularly. If you do not know how to access your Southern e-mail account or you do not know how to forward mail from that account to another account, please see me.

Course Description: Numerical and algebraic manipulation of data, curve sketching, and curve fitting. Examples from the natural sciences.

Credits: 3 semester-hours.

Course Prerequisites: Satisfactory score on the Mathematics Placement Exam or successful completion of MAT 100 *Intermediate Algebra A and B* (preferably with a C- or better), or MAT 102 *Intermediate Algebra B* (preferably with a C- or better).

Course Text: Explorations in College Algebra, Third Edition, Linda Almgren Kime, Judith Clark, and Beverly Michael, John Wiley & Sons, Inc. (Note that this is a correction of the syllabus originally distributed in on the first day of class.)

References and Supplementary Readings: Additional references and readings will be announced in class. They will usually be handed out in class, be available on the Web, or be put on reserve in the library.

Equipment: Students should have a graphing calculator comparable to the TI-83 or TI-84. Your calculator must be able to graph multiple functions, must be capable of doing scientific notation, powers, roots, and logarithms to the base 10 and the base *e*, as well as the corresponding exponential functions, and must be capable of doing linear regression (least squares). .If you do not already own one, I would recommend either the TI-83 Plus or the TI-84 for several reasons, including the fact that I will be demonstrating operations in class using those. More information will be given in class. See the instructor if you have questions or already have a graphing calculator other than one of the ones listed. If you decide to buy one other than a TI-83 or TI-84, please show it to me before you open it; that way, if it will not suffice for the course, you will be able to return it.

Students will also need a supply of graph paper. Details will be given in class.

"Mathematics as an expression of the human mind reflects the active will, the contemplative reason, and the desire for aesthetic perfection. Its basic elements are logic and intuition, analysis and construction, and generality and individuality. Though different traditions may emphasize different aspects, it is only the interplay of these antithetic forces and the struggle for their synthesis that constitute the life, usefulness, and supreme value of mathematical science."

-- *Richard Courant and Herbert Robbins*

The main topics to be covered in this course are as follows:

1. Mathematical modeling.
2. Measurement, approximate numbers, error analysis.
3. Functions and their graphs.
4. Linear functions.
5. Logarithmic and exponential functions.
6. Power functions.
7. Variation.
8. Interpretation of deterministic data.
9. Curve fitting - the least squares method.
10. More curve fitting and use of semi-log and log-log graph paper.
11. Additional topics as time permits.

In addition to knowing specific concepts and techniques, you also need to meet some general course objectives. By the end of the semester, a successful student should be able to do the following:

1. Understand the role of mathematics as a language with which to express physical laws and scientific concepts. You should also learn to use terminology and notation correctly. Your knowledge is devalued if you cannot properly communicate it to others. In particular, notation provides us with precise and succinct identification of concepts, objects, and processes, and in its clearest forms, a path to follow.
2. Set up and use simple mathematical models. In particular, students should be able to translate "word problems" into corresponding mathematical problems and then interpret the results in terms of the conditions of the word problems.
3. Recognize variational relationships among quantities. Students should be able to express these relationships both in words and in formulas using symbolic notation.
4. Know and work with a standard core of functions, including linear functions, the power functions, exponential functions, and logarithmic functions. Students should understand the relationship between these functions and their graphs and be proficient at working with these graphs. Students should also be able to recognize these basic graphs and related graphs from their shapes and other key characteristics.
5. Analyze and interpret deterministic data through various means, including curve-fitting, the method of least squares, and the use of special types of graph paper. Students should know the strengths and weaknesses of each of these techniques.
6. Work with approximate numbers, the kinds of numbers usually produced from measurements in applications. Students should understand the concepts of precision and accuracy and be able to interpret both in terms of significant digits. Students should also be able to interpret the results of arithmetic operations using approximate numbers.
7. Use scientific calculators to aid in the computations done in the course. Students should know the advantages and disadvantages of using the calculator to produce solutions and should be able to interpret those solutions properly with respect to the use of approximate numbers.

Further, MAT 108 is also a course that satisfies Southern's general education requirement in mathematics. Hence, there are university-wide objectives that are appropriate for this course. Those objectives are listed below, along with typical outcomes that would indicate that the objective had been met.

A. Prepare students who are able to speak and listen well.

Students must be able to:

A.1. State, interpret or apply precise definitions and techniques.

A.2. Communicate ideas accurately in the language of mathematics.

A.3. Contribute to class discussions, by responding orally to questions raised in class, and listening and reacting to each other's responses.

B. Influence students to develop a sense of responsibility to self for their own intellectual growth.

Students must be able to:

B.1. Read and understand appropriate sections of the text or other relevant written materials.

B.2. Complete related assignments in a timely fashion.

B.3. Ask relevant questions.

C. Influence students to develop willingness for intellectual exploration and the risk this involves.

Students must be able to:

C.1. Experiment (individually or in a group setting) in order to discover new ideas, solve problems, and explore various methods and approaches to solutions.

C.2. Be willing to answer exploratory questions and defend their answers in class.

D. Impart useful knowledge, skills, and understandings to students to develop the ability to think critically and analytically. This includes a willingness to provide and demand reasons and supporting evidence to back up statements.

Students must be able to:

D.1. Distinguish between making conjecture and producing formal analytic (deductive) arguments.

D.2. Apply deductive arguments.

D.3. Justify steps of a deductive argument by referring to relevant definitions, assumptions, theorems, and properties.

D.4. Recognize what kind of evidence supports or refutes a given assertion.

E. Impart useful knowledge, skills, and understandings to students to develop a sense of the interconnectedness of ideas and knowledge, such that living as liberally educated human beings is possible.

Students must be able to:

E.1. Relate and apply mathematical formulas and processes they study to other areas such as physics, chemistry, biology, economics, sociology, philosophy, and the arts.

E.2. Recognize the interconnectedness among mathematical ideas.

E.3. See the usefulness of the mathematical thought process as a mode of thinking about problems in general.

F. The development of analytic skills.

Students should be able to:

F.1. Recognize that complex mathematical problems and concepts can often be broken down into simpler sub-problems and concepts.

F.2. Determine where two similar but not identical problems/arguments differ in their respective assumptions and solutions.

G. The development of problem solving skills.

Given a mathematical problem, students should be able to:

G.1. Show that they understand the problem by restating the problem in their own words, by identifying what is given and what they are to do, by checking relevant definitions, organizing data, drawing diagrams, and introducing appropriate notation.

G.2. Devise a plan for solving the problem using such problem-solving strategies as selecting an appropriate mathematical model, looking for patterns, constructing examples, arguing by analogy, solving simpler but related problems, approximating or estimating the answer, reasoning backwards from the desired conclusion.

G.3. Carry out the plan, and check to see if the conditions have been met or satisfied.

G.4. Look back at the solution, consider alternate approaches, and attempt to generalize the solution.

H. The development of the ability to reason abstractly and to generalize.

Students should be able to:

H.1. Reason inductively to formulate appropriate and precise (not necessarily true) generalizations from given data/observations.

H.2. Recognize features common to a group of varied problems/applications that can be modeled by the same mathematical process and transfer that understanding to solve similar problems not directly covered in class.

H.3. Describe and/or utilize the relationship between specific mathematical concepts covered in the course.

I. The development of the ability to use mathematical algorithms and formulas.

Students should be able to:

I.1. Select and use an appropriate mathematical formula to solve a particular computational problem.

I.2. Select a mathematical algorithm and accurately perform its steps in order to solve a particular computational problem.

Course Guidelines:

"One must learn by doing the thing;
for though you think you know it,
you have no certainty until you try."
-- Sophocles

You are responsible for any material covered in lecture, the text, and other assigned readings, as well as concepts, techniques, examples, counterexamples, etc., covered in assigned homework problems and projects. Some course material is not covered in the text; your main source for that will be your class notes and related materials.

Reading assignments and written assignments will be given in class. A first reading of material should be done prior to the class in which it will be discussed. You should come to class prepared to ask and answer questions about the readings and the written assignments. You should also bring your textbook and calculator with you to each class.

An average student should expect to work on course material at least two to three hours outside of class for each hour spent in class – that is, six to nine hours per week. If you are spending significantly less time and not doing well, do not be surprised. If you are spending significantly more time and not doing well, see me; you may not be studying the material correctly.

Some of the coursework may require working in groups, both in class and outside of class. In some cases, I will assign the groups; in others, I will permit you to form your own groups. For the work outside of class, it is the responsibility of the members of each group to set aside sufficient meeting times for the group to work on the assignments. It is also the responsibility of group members to participate in and contribute to the work of the group.

At least once between January 30 and February 22, each student in the course must meet with me in my office for a short informal conversation. These meetings may be done during office hours or by appointment. Failure to do so will result in the student's final course average being lowered by one percentage point (or its equivalent).

Students are encouraged to seek help when needed from the instructor. Office hours have been established for that purpose. **You do not need an appointment to see me during office hours.** Even if no assistance is needed, students are welcome to stop by to discuss the course material, course policies, courses to take after this one, mathematical applications in your field, interesting mathematics problems, and mathematics and life in general.

Because I believe that your education at Southern should be more than just what occurs in the classroom, I will also give you the opportunity to earn one extra credit percentage point on your final grade. To earn that point, you must attend two meetings or events chosen from any combination of the following: meetings of any academic club at

Southern, events sponsored by the Cultural Affairs Club, Crescent Player productions, and performances by any student musical group recognized as an activity by the University. You may attend more than one meeting/event of the same type; for example, you could attend more than one meeting of the Biology Club. Within one week of any meeting/event to be applied toward the extra credit, you must submit a one-page typed report, including the date, the time, the sponsoring organization, and a summary/review/critique of the meeting/event. For meetings of clubs, include the name of the presiding officer and/or faculty advisor. If I consider your report incomplete or poorly written, I will ask you to rewrite it. As with any work to be submitted, these reports should be your own work.

Continuing the thought of participation in campus activities, I will be happy to announce in class upcoming meetings or events in which you are members or participants. Write the information down on a 3×5 index card, and give it to me before class.

Accommodations for Disabilities:

If you are a student with a disability, before you may receive accommodations or course adaptations in this class, you will need to make an appointment with the Disability Resource Center, located in EN C-105A. If you need to speak with me about accommodations or other concerns, such as emergency medical information or arrangements in case the building must be evacuated, please see me as soon as possible. My office location and hours are on the first page of this syllabus.

Homework and Projects:

Homework will be assigned daily. You should be prepared to discuss, or at least ask questions about, the homework the class after it is assigned. The purpose of homework is to help you understand concepts by working with them and to provide practice in using techniques and solving problems. Homework is a "means", not an "end". Being able to do all the homework problems will not guarantee that you will know the material or do well in the course, but it will certainly help. You should understand both what you are doing and why you are doing it. Think about each problem; do not do it just to get it done.

Do your best to develop a clear style for your work, so that your solutions and arguments are expressed in a neat, readable, and exact way. It is important that you learn how to communicate results, as well as being able to derive them.

Some written assignments will be designated to be submitted for grading. Those assignments will be divided into two categories, Projects and Homework. In general, "Homework" problems will be somewhat routine, while "Projects" will be of a more sophisticated nature. Some Projects may be short homework-type problems; most will be more extensive. Projects will be specifically designated as such and will be given specific due dates. Also, some projects will be designated as group projects.

Unless otherwise stated, "Homework" problems should be submitted the class after they have been assigned; such problems will be specifically identified in the assignment. Unless special due dates have been set, those assignments may be turned in one class late without penalty but will not be accepted later than that unless you have talked to me about that assignment and received specific permission. Even in such cases, penalties may be imposed.

Additional policy on written assignments will be announced in class.

Examinations:

Three (or possibly four) examinations will be given during the semester, with dates and coverage to be announced in class. There will also be a cumulative final exam at the end of the semester.

Grading:

In grading your work, I will consider *technique*, *style*, *form*, *proper use of terminology and symbols*, *computations*, and *final results*. I am as interested, perhaps more interested, in your reasoning as your final results, so show work and provide descriptive explanation. In general, full credit will not be given without sufficient supporting work or explanation. Also, legibility and organization of your work is important. If I cannot read it or understand it, it is wrong. Further, I expect your explanations to be written in a literate manner, using proper grammar and punctuation.

Written assignments will not be accepted after announced deadlines, except with the specific permission of the instructor. Even in such cases, penalties may be imposed.

Your final course grade will be computed based on the following weights:

Class Exams	50%
Final Exam	20%
Projects	25%
Homework	5%
	100%

I reserve the right to make adjustments to these weights at the end of the course; such adjustments will be no more than 5%. Further, if you turn in at least 90% of the Homework assignments, I will use the Homework grade only if it helps you; if I drop your Homework grade, the other three parts will be adjusted proportionately. Finally, when deciding your course grade, particularly in borderline cases, I reserve the right to consider class participation and my subjective evaluation of your commitment and general ability in working with the course material.

Although I reserve the right to lower these at the end of the semester, my initial cutoffs for the major grade divisions are as follows:

A-, A, A+	90-100	Exceptional work
B-, B, B+	80-89.9	Superior work
C-, C, C+	70-79.9	Satisfactory work
D-, D, D+	60-69.9	Unsatisfactory but passing work
F	Below 60	Failing work

Academic Honesty:

Students are expected to do their own work on examinations and submitted work, unless such work is specifically designated as a group project. In the case of group projects, the work should only be that of people in the group. You must neither give nor receive answers during testing times. You may not use crib sheets or other assists during exams unless specifically authorized by the instructor. Lying about reasons for missing classes or tests will also be considered academic dishonesty, as will any kind of deception that results in raising a student's grade or decreasing his or her workload.

Academic dishonesty is not a victimless crime. Every time that a student cheats on an exam or plagiarizes in writing a paper, that student cheapens the value of the degree of every other student. You should be familiar with the SCSU policy on Academic Honesty, which appears in the current Student Handbook, which should be available online. Potential consequences of academic dishonesty are also listed in that section.

I encourage you to work together while studying and am willing to assist you in setting up study groups. However, any work submitted should be primarily your own work, unless specifically assigned as part of a group project. It should not duplicate verbatim the work of any other student or source, including solution manuals. In particular, you should not copy someone else's homework or project solution word-for-word, even if you worked on it together. **You should not ask others, particularly tutors working for the University, to do problems for you that will be submitted for credit.** However, you may discuss those problems and projects with the instructor.

Most importantly, you should be able to explain your solutions if asked to do so. An inability to give a satisfactory explanation will be interpreted as your having submitted work other than your own. The lightest penalty for such action will be a zero on that assignment. Flagrant, excessive, or repeated violations will result in more severe penalties.

Attendance Policy:

Students are expected to attend classes regularly, as attendance is an essential component of class participation. Absences will have no automatic effect on your grade, but may have an effect on borderline cases at the end of the semester. It is your responsibility to contact me as soon as possible after missing any work (before, when possible); you can always leave a voice-mail message for me at 392-5581. You are responsible for any material developed during class whether or not you are present. It is a good idea to get to know at least one other person in the class, so that if you do miss a class, there is someone whose notes you can copy and from whom you can get assignments if you can not talk to me first. In general, assignments will be posted on the course webpage.

During the first part of the semester, we may have to worry about snow days. I live sufficiently close to campus that if the University is open, I will be here. To check on the University's status, you can listen to an appropriate radio station or call **Southern's emergency closing number, (203) 392-SNOW (392-7669)**. Calling the Southern number is probably better. On days the University is going to delay opening or close, there should be a message at that number no later than 7 a.m., and perhaps earlier. If the University is open but you feel that you can not make it in from where you live, you should call and leave me a message. I will try to get back to you later that day or the next with the assignment, unless it is already posted on the website.

Make-up Policy:

Students are expected to take exams and quizzes on the dates announced in class. If you miss an exam due to an emergency or other extenuating circumstance, you must contact me as soon as possible; do not wait until the next class. You can always call me and leave a voice-mail message, or you may send an e-mail.. Make-up exams and deadline extensions will be given at the discretion and convenience of the instructor, the decision to be made on a case-by-case basis. Factors in that decision will include the student's overall performance in the course and the nature of the absence. If you know in advance that you will be unable to take an exam, you must inform me prior to the date of the exam so that we can discuss appropriate arrangements. As before, I will decide what constitutes a valid reason for missing the exam.

Withdrawal policy:

The last day for regular course withdrawals is March 24. Late withdrawals from the course after this date require the approval of the instructor. Such withdrawals will not be granted unless there are extenuating circumstances. By themselves poor grades will not be considered extenuating circumstances.

SOME SUGGESTIONS FOR STUDYING MATHEMATICS

1. Read thoroughly the assigned sections in the text. As needed, review any earlier or prerequisite material needed to understand the new material. Work completely through every example, filling in missing steps and details. Be sure that you know what is done at each step and why. Further, think about how the new material fits into what you already know.

2. Do the same with any notes that you have taken.

3. Before trying any homework problems and without looking at the text or notes, try to outline in your mind the main ideas in what you have just read. If you do not know the basic concepts, go back and read the material again.

4. Now go on to the homework problems. Work on them in the order given. Don't jump ahead to those to be turned in, since you may need insights that will be gained by doing the earlier problems. Try to do the problems, particularly the earlier ones, without looking back at examples. If you are stuck on a problem after having given it a reasonable amount of thought, then refer back to the text and notes. Do not just mimic earlier examples. Figure out why the approach/methods/techniques used in a given example might work in your problem.

   If you find yourself having to refer back to examples for almost every problem, you probably need to go back and study the key ideas in the section again before continuing with the homework.

5. If after doing the above you are still having problems, discuss the material with some of your peers and/or seek help from people with a more advanced knowledge of the material, such as your course instructor. When getting help, be sure that you are told **why**, not just how.

6. You should have a systematic plan for reviewing the material; do not wait until the night before an exam. One approach would be to review material a week after it was originally covered. Another would be to take time each weekend to review what had been covered in class the preceding week.