Introduction to Mathematical Modeling (CRN 81041) Fall 2008

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Office hours: MW 3:30-4:30pm or by appointment.
          There is a MATH 1101 Academic Assistance (for questions of all math 1101 students) held
          MW 12:00pm-1:15pm at GCB 401
Course Location & Time: Classroom South 107, MWF 10:00-10:50

Textbook: Explorations In College Algebra, 4th Edition, by Kime, Clark and Michael, John Wiley & sons.
ISBN: 9780470281482, and Wiley Plus.

Wiley Plus Class Section URL:

 http://edugen.wiley.com/edugen/class/cls68120/

Note: This course syllabus provides a general plan for the course; deviations may be necessary.

1. COURSE DESCRIPTION. Mathematical modeling uses graphical, numerical, symbolic, and verbal techniques to describe and explore real-world data and phenomena. Emphasis is on the use of elementary functions to investigate and analyze applied problems and questions, on the use of appropriate supporting technology, and on the effective communication of quantitative concepts and results. THIS COURSE IS NOT AN APPROPRIATE PREREQUISITE FOR PRECALCULUS OR CALCULUS. Students who must take pre-calculus must understand the implications of taking MATH 1101 (See the instructor immediately if you have any questions).

2. PREREQUISITE. Knowledge of high school algebra II, or equivalent, is expected. This includes algebraic expressions, first degree equations and inequalities, exponents, radicals, solving and graphing linear equations, factoring quadratic expressions, and other topics.

3. COURSE OBJECTIVES.

    <u>Algebra</u>. Students will demonstrate the ability to:

a.   Graph points.
b.   Graph linear, piecewise linear, exponential, logarithmic, and quadratic equations and functions, as well as identify horizontal asymptotes.
c.   Determine the equation of a line given two points or one point and the slope.
d.   Determine the absolute value of a quantity.
e.   Solve and estimate solutions to linear, quadratic, exponential, and logarithmic equations, including use of the properties of exponents and common and natural logarithms.
f.   Solve linear systems of two equations by substitution and elimination, including systems that have a unique solution, no solution, or many solutions.
g.   Simplify expressions using the laws of exponents and logarithms.
h.   Calculate average rate of change of any function.
i.   Perform arithmetic calculations to answer questions regarding two-variable data presented in tabular, graphical, or equation form.
j.   Express and compare very large and very small numbers using scientific notation and orders of magnitude.
k.   Factor quadratic expressions.
l.   Complete the square of quadratic expressions.

m.   Express the square root of negative numbers in terms of the imaginary unit, *i*.
n.   Given conversion factors, convert units of measure.
o.   Use the quadratic formula to solve quadratic equations

Functions. Students will demonstrate:

a.   The understanding of the definitions of function, domain, range, independent and dependent variables, and input and output.
b.   The ability to determine if tables, graphs, and equations represent functions.
c.   The ability to determine the domain and range of functions as mathematical abstractions or in a physical context.
d.   The ability to determine from the graph of a function the values of the independent variable for which the function increases, decreases, or remains constant.

Linear and piecewise linear functions. Students will demonstrate the ability to:

a.   Determine when two real-world variables are related by a linear or piecewise linear function.
b.   Calculate, and interpret average rate of change as slope.
c.   Model the behavior of two real-world variables that are directly proportional or are related by a linear or piecewise linear function using tables, graphs, equations.
d.   Evaluate linear and piecewise linear functions.
e.   Use a linear function to approximate the value of a non-linear function.
f.   Interpret the intersection of the graphs of linear functions as equilibrium points.

Exponential Functions. Students will demonstrate the ability to:

a.   Determine when two real-world variables are related by an exponential function.
b.   Model the behavior of two real-world variables that are related by an exponential function using tables, graphs, equations, or combinations thereof including such applications as population growth and decay, radioactive decay, simple and compound interest, inflation, the Malthusian dilemma, musical pitch, and the Rule of 70.
c.   Change the base of an exponential function to determine rate of growth/decay, growth/decay factor, and effective and nominal interest rate.
d.   Express continuous growth/decay in terms of the number *e*.
e.   Evaluate exponential functions.
f.   Determine the exponential equation model from the table or graphical model.
g.   Compare linear to exponential growth.

Logarithmic Functions. Students will demonstrate:

a.   The ability to determine when two real-world variables are related by a logarithmic function.
b.   The ability to model the behavior of two real-world variables that are related by a logarithmic function using tables, graphs, equations, or combinations thereof including such applications as pH and the decibel system.
c.   The understanding of the natural logarithm.
d.   The ability to graph logarithmic functions.

Quadratic Functions. Students will demonstrate the ability to:

a.   Estimate horizontal intercepts of quadratic functions from their graphs.
b.   Determine the horizontal intercepts of quadratic functions in factored form.
c.   Determine the vertex, axis of symmetry, and horizontal and vertical intercepts of quadratic functions in either the a-b-c or a-h-k forms.

      d.   Convert quadratic functions from the a-b-c form to the a-h-k form and vice versa.
      e.   Determine when two real-world variables are related by a quadratic function by calculating the average rate of change of the average rates of change.
      f.   Model the behavior of two real-world variables that are related by a quadratic function using tables, graphs, equations, or combinations thereof including such applications as maximum area for fixed perimeter, minimum perimeter for fixed area, free fall, maximum profit, and break-even analysis.

4. COURSE COVERAGE. We will cover the following sections from the text:

Chapter 1	Making Sense of Data and Function (1.1 - 1.5)
Chapter 2	Rates of Change and Linear Functions (2.1 - 2.8)
Chapter 3	When Lines Meet: Linear Systems (3.1 - 3.2, 3.4)
Chapter 4	The Laws of Exponents and Logarithms: Measuring the Universe (4.1 - 4.7)
Chapter 5	Growth and Decay: An Introduction to Exponential Functions (5.1 - 5.6)
Chapter 6	Logarithmic Links: Logarithmic and Exponential Functions (6.1 - 6.5)
Chapter 8	Quadratic and Other Polynomial Functions (8.1 - 8.4)

IMPORTANT NOTE: Georgia State University and its faculty are not responsible for outcomes due to individual technical issues, nor scheduled WileyPlus downtimes. It is expected that the students will be responsible for completing their work in a timely fashion as to alleviate any pressures these scheduled downtimes occur. All students will be notified of these downtimes by WileyPlus through the announcements page of the course.

5. COURSE EVALUATION. Your course grade will be determined as follows:

    a. Tests (Three close book, close notes tests)   45%

    b. WileyPlus online homework and quizzes 15%

    c. Excel Projects 10%

    d. In Class Activities 5%

    e. Final Exam (Comprehensive, close book, close notes final exam) 25%

Example of Course Grade Computation:
Test Grades: T1 = 88, T2 = 72, T3 = 68,
WileyPlus online homeworks and quizzes average = 85
Excel Project average = 90
In Class Activities =80
Final Exam=76
Course Grade: $0.15*(88+72+68) +0.15*85+ 0.10*90 + 0.05*80+0.25*76 = 79$

6. GRADING SCALE. We will use the following grading scale:

A: 90 - 100, B+: 87 - 89, B: 80 -86, C+: 77 - 79, C: 70 - 76, D: 60 - 69, F: Below 60

 7. Makeup Policy: No make-up exams will be given unless in some extreme situations. Absence from the final exam will result in a grade of F for the course unless arrangements are made PRIOR (at least one week before the final exam) to its administration.

8. CALCULATOR Policy. You are recommended to have a scientific calculator or a graphing calculator. If you are not strong in mathematics, I <u>strongly</u> recommend you obtain a graphing calculator. You are not allowed to share calculator with any other party in your class during any in class quiz or exam, unless permitted by your instructor.

9. Academic assistance at GSU:
1. Attend academic assistance session, MW 12:00-1:15pm, GCB 401
2. Visit the Math Assistance Complex (MAC), Kell Hall 122 (phone: 404-413-6462).
3. Visit the Counseling Center for Learning assistance, Test anxiety classes, and Student support services (phone: 404-413-1641)
4. African American Student Services (phone: 404-413-1530)
5. A private tutor list is available at Math Assistance Complex and Math Department

10. ACADEMIC HONESTY: Cheating/plagiarism will not be tolerated on any work. A first occurrence will result in a grade of 0 on the assignment for all concerned parties as well as an Academic Dishonesty form being filed with the Dean of Students. A second occurrence will result in a grade of F for the course for the concerned parties and a second Academic Dishonesty form being filed. During in-class quizzes, tests, and the final exam you will be instructed to do your own work, talk to nobody, and not share calculators. Violations of these instructions constitute dishonesty and will be handled in accordance with University policy. The instructor has the option of withholding or denying credit for answers not adequately supported by you.

11. Inclement Weather Policy: If the University is closed due to inclement weather, any exam that may have been scheduled for that date will be administered on the next available class date. If an assignment is due that day it will be due the next class.

12. Attendance Policy: Attending class is of utmost importance and is your responsibility and yours alone (Attendance will be taken daily). During class I can clarify important or complex points for you, observe you working problems, and answer your questions. Much, and perhaps most, of what you learn during the course will occur outside of class; approximately two hours preparation for each hour in class over is the norm.

13. Conduct Policy: Turn off all pagers and cell phones before entering the classroom – having these items "go off" in class is considered disruptive behavior and can result in your being administratively dropped from the course. In fact, any type of inappropriate conduct may result in your being administratively dropped from the course. See the University's Policy on Disruptive Behavior in the *General Catalog*, p. 19 (www.gsu.edu/images/Downloadables/UG_05_06.pdf) or *On Campus*, the official student handbook (www2.gsu.edu/~wwwdos/codeofconduct_adminpol_a.html).

14. Withdrawal Policy: You cannot withdraw from the course simply by ceasing to attend class; you must formally withdraw. If you intend to withdraw, do so before **midpoint (Wednesday, Oct 1, 2008)** to be able to avoid a grade of "F" or "WF."
> `If you do not attend class during the first two weeks you will` `be administratively dropped.`

15. ASSIGNMENTS. We will basically follow the attached schedule. Note deviations might be necessary. I will assume that you have read the corresponding lesson prior to arriving in class and do the homework assignments posted on the ULEARN after attending class.

MATH 1101 Homework Assignments
Kime, Clark and Michael 4th Edition

Section	Assignment
1.1	AA (Algebra Aerobics) 1, 2, 3, 4, 6, 9, 10 E (Exercise) 2, 5, 7, 9, 11, 12, 22
1.2	AA 1.2a 2, 3; 1.2b 1, 3, 4 E 10, 11, 12, 14, 15, 17
1.3	AA 1, 2, 3, 4, 5, 6, 7, 8 E 1, 2, 3, 4, 5, 6, 7, 11
1.4	AA 1.4a 1, 2, 3, 4, 5, 6, 7, 8, 9; 1.4b 1, 2 E 1-18 (all)
1.5	E 1, 4, 5
Chapter 1 Review	11, 15, 22, 23, 24
2.1	AA (Algebra Aerobics) 1, 2, 3, 4, 5, 6 E (Exercise) 1, 7, 8, 9, 14, 15, 16
2.2	AA 1, 3 E 1, 2, 3, 5
2.3	AA 1, 4, 5, 6 E 2, 3, 6, 7, 9, 10, 11, 13, 15
2.4	AA 1, 2 E 2, 3
2.5	AA 3, 5, 6, 7, 8, 9, 10, 11 E 1, 5, 7, 9, 11, 14, 19, 21, 23
2.6	AA 1, 3, 5, 7 E 1, 3, 5, 6, 7, 11
2.7	AA 1, 3, 5, 7, 9, 11, 15, 17 E 1, 3, 5, 7, 9, 11, 13, 15, 19
2.8	AA 2.8a 1, 3, 5; 2.8b 1, 2, 3, 5, 7, 9, 11, 13, 15; 2.8c 3, 4 E 1, 7, 9, 13, 17, 19, 21, 27, 28
Chapter 2 Review	3, 9, 13, 14, 21
3.1	AA (Algebra Aerobics) 2, 3, 4 E (Exercise) 1, 2, 6, 7, 8, 9
3.2	AA 3.2a 1, 2, 3, 4; 3.2b 1, 2, 4, 5, 6 E 2, 3, 4, 5, 6, 7, 8, 9, 13, 15, 17, 18, 19, 20
3.4	AA 1, 2, 3, 4 E 1, 3, 4, 5, 7, 10
Chapter 3 Review	2, 3

Section	Assignment
4.1	AA (Algebra Aerobics) 1, 6, 7, 9, 10 E (Exercise) 1, 5, 7, 9, 11, 13
4.2	AA 4.2a 1, 2, 3, 4, 5, 7; 4.2b 2, 3 E 1, 3, 5, 7, 9, 11, 13, 15, 19, 21
4.3	AA 1, 3, 4, 5 E 1, 3, 5, 7, 9, 11, 15
4.4	AA 3, 4, 5, 6, 7, 8 E 1, 2, 3, 7, 8, 9, 11, 12, 19
4.5	AA 4.5a 1, 2, 4, 5, 6, 8, 9; 4.5b 1, 2, 4, 5 E1, 3, 5, 6, 7, 9, 10, 15, 17, 18
4.6	AA 1, 2, 3, 4, 5, 6 E 1, 3, 10, 11
4.7	AA 4.7a 1, 3, 4, 5; 4.7b 1, 3, 4, 5 E 3, 7, 9, 11, 13, 19
Chapter 4 Review	2, 5, 7, 8, 15, 19
5.1	AA (Algebra Aerobics) 1, 2, 3, 4 E (Exercise) 1, 3, 5, 7, 9, 10, 11
5.2	AA 1, 2, 3, 4, 5, 6 E 1, 5, 7, 9, 10, 14
5.3	AA 1, 2, 3, 4, 5 E 1, 2, 3, 5, 7, 8a), 12, 13, 16
5.4	AA 1 E 1, 3
5.5	AA 1, 2, 3 E 1, 3, 5, 7, 9, 10, 11, 12, 13
5.6	AA 5.6a 1, 2, 3, 4; 5.6b 1, 3, 7; 5.6c 1 E 1, 3, 5, 10, 11, 14, 16, 23
Chapter 5 Review	1, 3, 7, 8

Section	Assignment
6.1	AA (Algebra Aerobics) 6.1a 1, 4; 6.1b 1, 2, 4, 5, 6; 6.1c 1, 2, 3, 5, 6 E (Exercise) 5, 6, 7, 8, 9, 13, 16, 17, 18
6.2	AA 1, 2, 6, 7, 9, 10 E 1, 2, 3, 4, 5, 9, 10, 11, 15, 16
6.3	AA 1, 2, 3, 4, 5, 6, 8 E 1, 3, 5, 7, 8, 9, 11, 12, 13, 17, 19, 21
6.4	AA 5, 6
6.5	AA 1, 2, 3, 4 E1, 3, 4, 5, 6, 8, 13
Chapter 6 Review	1, 3, 10, 11, 16
8.1	AA (Algebra Aerobics) 1, 3, 6 E (Exercise) 2, 6, 9, 17, 19
8.2	AA 8.2b 7; 8.2c 1, 2, 3, 5, 6, 9, 10, 11, 12 E 1, 6, 7, 8, 15, 18, 21a), 25, 29
8.3	AA 8.3b 1, 2, 3, 4 E 3, 7, 9
8.4	AA 1, 2 E 2, 4, 5, 11
Chapter 8 Review	1, 8, 13, 15