MTH 121–301: Concepts and Applications of Mathematics (CT)

Intersession 2012 (May 7–June 1) Meets: MTWRF, 1030a - 1245p SH 514.

I. General Information

- Instructor: Dr. Suman Sanyal
- Office phone: 304-696-3049
- Office/e-Mail: Morrow Library 103 / sanyal@marshall.edu
- Office Hours: 1:00 - 1:50 MTWRF (or by appointment)
- Text: Using and Understanding Mathematics – A Quantitative Reasoning Approach – 5th Edition by Jeffrey Bennett and William Briggs. ISBN-13: 978-0-321-65294-2.

II. Course Description and Objectives

A. Description: Concepts and Applications of Mathematics. (3 credit hours.)

A course for non-majors that develops quantitative reasoning skills. Topics include logical thinking, problem solving strategies, linear modeling, beginning statistics and probability, exponential and logarithmic modeling, formula use. **This course is a critical thinking course and meets a Core I "CT" requirement. This course also meets a Core II: Mathematics requirement.** Prerequisites: ACT 19 or SAT 460 or MAT 097 or Plac 100 or MAT 097E or MAT 087 or Math 100 or MAT 095.

B. Course Objectives:

1. To prepare students for the mathematics that they will encounter in other college courses, particularly core courses in social and natural sciences.
2. To develop the students' ability to reason with quantitative information in a way that help the students achieve success in their careers.
3. To provide students with the critical thinking and quantitative reasoning skills needed to understand major issues in life.

III. Learning Outcomes

1. **Reasoning.** This course begins with a chapter on logic. The topics include fallacies, inductive reasoning, deductive reasoning, truth tables, and Venn diagrams. These basic concepts are carried through the course as we analyze different topics in mathematics.

2. **Representation.** In this course students will research four different project topics that go beyond the material in the textbook. They will present their findings either in written (papers or posters) or oral form.
3. **Information Literacy.** Students will use a variety of sources to research the four projects required for this class. Their projects will require them to use books, scholarly journals, and the Web to find the latest developments in their assigned topics.

IV. Core Domains of Critical Thinking (CT) Addressed

1. Mathematic/Abstract
2. Scientific

V. Topics Covered

1. Introduction to Quantitative Literacy
2. Logical Thinking
3. Fallacies of Relevance
4. Fallacies of Numbers and Statistics
5. Problem Solving through Unit Analysis
6. Problem Solving Strategies
7. Systems of Standardized Units; Rounding Numbers
8. Scientific Notation; Order of Magnitude
9. Scaling Factors
10. Uncertainty
11. Applications in Large Numbers and Unit Analysis
12. Relations; Rates of Change
13. Linear Equations; Creating Linear Models
14. Counting Techniques
15. Probability Theory
16. Expected Values and Binomial Probability Formula
17. Statistics; Graphing Statistical Data
18. Measures of Central Tendency; Normal Distribution
19. Sample Issues in Statistical Research
20. Exponential Growth
21. Applications of Exponential Models

22. Using Formulas
23. Logarithmic Scales
24. Financial Formulas
25. Concepts in Geometry[1]
26. Figures in the Plane[1]

VI. Learning Goals

1. Introduction

   Students should be able to

   (a) define quantitative literacy;
   (b) recognize the importance of quantitative literacy in their lives;
   (c) discuss several misconceptions about mathematics.

2. Logical Thinking

   Students should

   (a) know the difference between a deductive and inductive argument;
   (b) be able to test if a deductive argument is valid or invalid;
   (c) determine if a valid argument is sound or unsound.

   Students should be able to

   (a) determine if an inductive argument is weak or strong;
   (b) use truth tables to determine the truth value of a compound proposition;
   (c) use Venn diagrams to determine the validity of a deductive argument.

3. Fallacies of Relevance

   Students should be able to

   (a) define "fallacy" and recognize many different common fallacies.

4. Fallacies of Numbers and Statistics

   Students should be able to

   (a) distinguish between necessary and sufficient cause;
   (b) define and use the concepts of absolute and relative change.

5. Problem Solving through Unit Analysis

   Students should be able to

   (a) use appropriate units to assist them in problem solving;
   (b) apply Polya's four-step procedure for solving problems.

[1]To be covered if time permits.

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6. Problem Solving Strategies

   Students should recognize that

   (a) not every problem can be solved using the four-step procedure;

   Students should be able to

   (a) solve certain problems that they haven't seen before by carefully thinking them through.

7. Systems of Standardized Units; Rounding Numbers

   Students should be able to

   (a) convert commonly used units from the US Customary System to Metric System and vice versa;

   (b) round numbers

8. Scientific Notation; Order of Magnitude

   Students should be able to

   (a) change large or small numbers to scientific notation;

   (b) make simple estimates using the four-step procedure for problem solving;

   (c) determine order of magnitude estimates.

9. Scaling Factors

   Students should be able to

   (a) measure a distance on a map or model and determine the actual distance or size using the given scale;

   (b) put large numbers in perspective using different techniques.

10. Uncertainty

    Students should be able to

    (a) determine uncertainty ranges that derive from measurements and be able to state a level of confidence in the measurement;

    (b) determine the number of significant digits for measurements and exact numbers;

    (c) combine approximate numbers;

    (d) interpret the graphs that are commonly found in weekly news magazines.

11. Applications in Large Numbers and Unit Analysis

    Students should be able to

    (a) use the quantitative skills developed earlier to solve problems

12. Relations; Rates of Change

    Students should be able to

    (a) identify the independent and dependent variables in a relation;

    (b) draw the graphs of relations and use relations as models of real world problems;

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(c) determine the slope of a linear relation and be able to graph a linear relation.

13. Linear Equations; Creating Linear Models

    Students should be able to

    (a) solve linear equations with numbers;

    (b) solve literal linear equations;

    (c) make a linear model from two or more data points.

14. Counting Techniques

    Students should be able to

    (a) use the Multiplication Principle;

    (b) compute the number of arrangements possible allowing repetition;

    (c) compute simple permutations;

    (d) compute simple combinations;

    (e) know when to apply each idea.

15. Probability Theory

    Students should be able to

    (a) compute probabilities for independent events, dependent events, mutually exclusive events, non-mutually events using a priori techniques.

16. Expected Values and Binomial Probability Formula

    Students should be able to

    (a) compute the expected value;

    (b) compute the probability of success in an experiment.

17. Statistics; Graphing Statistical Data

    Students should be able to

    (a) explain the difference between inferential and descriptive statistics;

    (b) interpret data from different type of graphs.

18. Measures of Central Tendency; Normal Distribution

    Students should be able to

    (a) use the properties of the normal distribution and be able to decide if it is an appropriate model of given data;

    (b) explain how standard deviation and margin of error relate to statistical surveys.

19. Sample Issues in Statistical Research

    Students should be able to

    (a) recognize abuses of statistics after studying many examples.

20. Exponential Growth

    Students should be able to

(a) explain the difference between exponential growth and linear growth;

(b) explain why exponential growth cannot continue indefinitely in real world situations;

(c) solve and interpret doubling time and half-life problems.

21. Applications of Exponential Models

    Students should be able to

    (a) use exponential growth and decay models to predict a quantity after any time t;

    (b) use exponential growth and decay models to find the time t given the other variables;

    (c) create models of exponential growth or decay from given data points.

22. Using Formulas

    Students should be able to

    (a) use given formulas;

    (b) tell if a formula makes sense when described in words or pictures;

    (c) determine the correct units when manipulating a formula.

23. Logarithmic Scales

    Students should be able to

    (a) give two examples of natural phenomena whose models are logarithmic;

    (b) solve simple logarithmic equations;

    (c) manipulate common logarithms.

24. Financial Formulas

    Students should be able to

    (a) make a personal budget;

    (b) compute compound interest for the discrete and continuous cases;

    (c) compute the amount in a retirement account;

    (d) compute the monthly car house payments and understand how accelerating a loan will save on interest.

25. Concepts of Geometry[2]

    Students should be able to

    (a) state the dimensions of points, lines, and planes;

    (b) measure angles.

26. Figures in the Plane[2]

    Students should be able to

    (a) compute perimeters and areas of several plane figures;

    (b) use these techniques for solving problems;

[2]Material should be covered if time permits.

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(c) use similar triangles to determine missing lengths.

VII. Technology Component

Students are required to have scientific calculators with a y^x or x^y or ^ key. Students may be required to use the Internet for research.

VIII. Assessment Instruments

Students will be assessed by a combination of in-class examinations, Basic Skills Quizzes, homework assignments, and research projects assigned by the instructor.

IX. Attendance Policy

Attendance records will not be used to compute grades (except possibly in borderline cases). However, missing class can be expected to significantly reduce your chances of success.

X. Testing and Grading

A. The following grades will be taken:

Quiz/Project	100 points	
Exam 1	100 points	Friday, May 11
Exam 2	100 points	Friday, May 18
Exam 3	100 points	Friday, May 25
Final Exam	100 points	Friday, June 1
Total	500 points	

B. The course grade will be based on the percentage of the total possible points. The following scale will be used:

450+ for A	400–449 for B	350–399 for C	300–349 for D	0–299 for F

C. Missing Exams

1. If you miss a test due to an unexcused absence, you will receive a grade of 0 for that test.
2. If you miss a test due to an excused absence, you must provide verification within one week of the test.
3. If you cannot be at the final exam, let me know as soon as you know. A missing final exam score means an automatic grade of F for the course.

D. Electronic Devices

Remember to turn off all electronic communication devices at the beginning of each class. No electronic devices other than a calculator will be allowed during exams. If this creates a problem for you, please let me know so that accommodations can be arranged.

XI. DATES TO REMEMBER:

1. May 4, Friday, 8 a.m. - 5 p.m., Regular Registration.

2. May 7, Monday, First Day of Classes.
3. May 7, Monday, 8 a.m. - 5 p.m., Late Registration/Schedule Adjustment Closes.
4. May 8, Tuesday, "W" Withdrawal Period Begins.
5. **May 11, Friday, Exam 1.**
6. **May 18, Friday, Exam 2.**
7. **May 25, Friday, Exam 3.**
8. May 25, Friday, Last Day to Drop an Individual Course.
9. May 26, Saturday – May 28, Monday, University Computer Services Unavailable.
10. May 28, Monday, Memorial Day Holiday - University Closed.
11. May 29, Tuesday – May 31, Thursday, Complete Withdrawals Only.
12. May 31, Thursday, Last Class Day - Last Day to Completely Withdraw from Intersession.
13. **June 1, Friday, Final Examination Day.**
14. June 4, Monday, Noon, Deadline for Submitting Final Grades.

XII. University Policies

You can access all the university wide policies pertaining to

1. Academic Dishonesty
2. Excused Absence Policy for Undergraduates
3. University Computing Service Acceptable Use
4. Inclement Weather
5. Dead Week
6. Students with Disabilities
7. Academic Dismissal
8. Academic Forgiveness
9. Academic Probation and Suspension
10. Academic Rights and Responsibilities of Students
11. Affirmative Action
12. Sexual Harassment

at http://www.marshall.edu/academic-affairs/?page id=802

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