MAT 103   Mathematics for Liberal Arts

Department of Mathematics
Southern Connecticut State University

I. Catalog Description

Intended for the student whose major field of study requires no specific mathematical preparation. Topics include probability, statistics, and aspects of consumer mathematics. Other Other topics chosen by the instructor could include critical thinking / problem solving, geometry, graph theory, linear and exponential models, and voting theory. Prerequisite: MAT 100 or 100P or 102, or appropriate mathematics placement. 3 credits.

II. Purpose

Mathematical literacy is vital to advanced study and to lifelong learning. Mathematics has wide-ranging applications in many fields of study; however, quantitative skills are also important for students that enter a field which makes little direct use of mathematics. The informed citizen must be aware of the role of mathematics in the natural and social sciences and must be an intelligent user of quantitative information.

Although intermediate algebra is a prerequisite for the course, this course is not intended to be another algebra course. Rather students taking this course should gain an appreciation of the beauty of mathematics and how mathematics applies to their lives. This course has as its primary goal the development of (a) analytic skills, (b) problem solving skills, (c) inductive and deductive reasoning ability, and as secondary goals to develop the ability to (d) use mathematical algorithms and manipulate formulas, (e) apply mathematics to other areas, and (f) appreciate mathematics in its historical and cultural context. Irrespective of the text used, all of the above should be touched on, and the student should be actively involved in using these skills, e.g. through a series of homework exercises, projects, group projects, use of the computer, or the acquisition and analysis of data.

III. Credit

(A) MAT 103 carries three semester-hours of university credit.

(B) MAT 103 satisfies the University Requirement (Tier 1 LEP-QR) in mathematics.

IV. Prerequisites

The student must satisfy one of the following two prerequisites:

(A) passed MAT 100 or 100P or 102;

(B) establish a mathematics placement level appropriate for the course.

V. Format

MAT 103 meets for 3 contact hours per week throughout a standard academic semester and is conducted primarily in a lecture and discussion format; however, discovery-based learning and group work are highly encouraged.

VI. Liberal Education Program

This course satisfies the University's Liberal Education Program (LEP) requirement in Quantitative Reasoning (QR). It addresses the key elements of the QR requirement as indicated in Section IX: Course Objectives. Further, as a Tier 1 LEP course, it will do the following:

(A) Address at least one *Area of Knowledge and Experience* through the choice of data sets or word problems that are applied to one of the sciences, *Natural World I: Physical Realm* or *Natural World II: Life and the Environment.* Examples of data could also be chosen to introduce other *Areas of Knowledge* such as *American Experience* (for example, data measuring population changes in America) or *Global Awareness* (for example, data measuring poverty levels in different countries).

(B) Incorporate at least one *Discussion of Values.* For example, *Environmental Awareness* could be discussed through modeling data that comes from an environmental issues such as global warming trends. *Rational Thought* can be emphasized by asking students to interpret and make predictions from a given mathematical model. For example, students might be asked to interpret the meaning of slope in context or they might be asked about the limitations of the model. *Civic Engagement* is another area that could be discussed by choosing to model data that directly affects students' local communities.

(C) Address at least one *Embedded Competency* in a significant manner. Instructors may choose to address this requirement by incorporating one of the following requirements into their course: *Oral Communication* by requiring students to present the results of their work through oral presentations, *Interpersonal Effectiveness* by requiring students to work in group settings, *Information Literacy* by requiring students to locate and evaluate their own information and/or data for a project, or *Creative Thinking* by requiring students to create a model for a set of data or scenario in which they have not already been told what type of model is most appropriate.

(D) Present the Quantitative Reasoning aspects of Mathematics for Liberal Arts in context. The key elements QR1–Quantitative Situations, QR2–Quantitative Data, QR3–Methods, QR4–Reliability of Data and Solutions, and QR5–Mathematical Process are addressed in the course objectives listed below.

VII. Outline

Core Topics: The following topics must be covered by each instructor, and it is expected that at least 40% of class time will be spent covering these topics. Some topics could be integrated into other material that is covered throughout the semester, and instructors may cover additional topics in probability, statistics, and/or personal finance.

(A) Probability and Statistics

1. Basic Set Theory
2. Basic Probability Concepts and Rules
3. Conditional Probability
4. Counting Methods
5. Measures of Central Tendency and Measures of Spread
6. Interpreting Graphical Displays of Data

(B) Personal Finance

1. Saving Money (Compound Interest, Stocks, and/or Annuities)
2. Borrowing money (Credit Cards, College Loans, and/or Mortgages)

Other Topics / Themes: Each instructor must choose at least one other theme / topic for the course. The following are examples of possible themes / topics that may chosen for the remaining portion of the course (up to 60%):

(A) Critical Thinking/Problem Solving

1. Problem Solving Strategies
2. Inductive Reasoning
3. Sets and Venn Diagrams
4. Formal Logic and Truth Tables
5. Statements, Quantifiers, and Conjunctions

(B) Geometry

1. Perimeter and Area
2. Surface Area and Volume
3. Transformational Geometry
4. Symmetry
5. Tessellation
6. Fractals

(C) Graph Theory

1. Definitions and Terminology
2. Trees
3. Euler Circuits and Trails
4. Hamilton Circuits and Paths
5. Planar Graphs
6. Graph Colorings and 4-Color Theorem
7. Traveling Salesman and Minimum Weight Spanning Tree

(D) Linear and Exponential Models

1. Linear Data and Trend Lines

2. Linear Growth and Interpreting Slope

3. Exponential Growth and Constant Percent Change

4. Doubling-Time and Half-Life

5. Population Growth

(E) Voting Theory

1. Voting Methods

2. Voting Theory and Fairness

3. Apportionment

4. Models of Voting Power and Shapley-Shubik Power Index

VIII. Quantitative Reasoning Key Elements

(A) **QR1**: Quantitative Situations - Identifying the essential quantitative elements in both routine and novel situations and understanding the relationships between those quantitative elements, and producing mathematical models appropriate for the intended analysis (e.g., writing equation(s) to represent the situation).

(B) **QR2**: Quantitative Data - Representing quantitative information in both technical and common language by using symbolic, graphical, and tabular formats, and drawing correct inferences from quantitative information through the interpretations of such representations.

(C) **QR3**: Methods - Acquiring the tools and methods necessary to resolve both routine and novel quantitative questions, including a correct sequencing of procedures, and using them appropriately, given the nature and constraints of a situation. In addition to using knowledge previously acquired in intermediate algebra, students will demonstrate proficiency with information presented in numerical or statistical form and mathematical concepts of growth and decay with their applications (e.g., linear, quadratic, exponential, etc.).

(D) **QR4**: Reliability of Data and Solutions - Correctly evaluating the level of accuracy stated or implied for given data, and assessing the correctness and accuracy of an analysis, including the assessment of the method and model used and the reasonableness of the solution.

(E) **QR5**: Mathematical Process - Using discovery (e.g., exploration and pattern-recognition), conjecture, and testing to develop mathematical formulas, theorems, and then giving persuasive mathematical arguments to establish their validity.

IX. Course Objectives
In addition to satisfying LEP Tier 1 requirements, MAT 103 has specific course objectives. By the end of the course, a successful student should be able to do the following:
The following objectives relate to the core topics of probability, statistics, and aspects of consumer mathematics. Each additional topic will have its own set of objectives and will be left up to the instructor.:

(A) Use mathematical models of finance to be able to make critically informed judgements about investing (compound interest, annuities and/or stocks) and borrowing money (college loans, mortgages, and/or credit cards) (QR1, QR3)

(B) Calculate and interpret the mean, median, and standard deviation of a data set.

(C) Create and interpret a histogram. (QR2)

(D) Comprehend the concepts of probability and randomness. (QR2, QR3)

(E) Calculate the probability of unions, intersections and complements. (QR2, QR3, QR5)

(F) Understand the meaning of conditional probability and apply it. (QR2, QR3)

(G) Solve and interpret the results probability problems using counting techniques. (QR3)

(H) 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. (QR1, QR2, QR3, QR4)

X. Assessment

Individual instructors may vary assessment modes, but typically grades will be based on a combination of homework assignments, quizzes, and exams.

	QR 1 Quantitative Situations	QR 2 Quantitative Data	QR 3 Methods	QR 4 Reliability of Data and Solutions	QR 5 Mathematical Process
Homework	Individual instructors decide which QR will be assessed appropriately.				
Quizzes	Individual instructors decide which QR will be assessed appropriately.				
Tests	✓	✓	✓	✓	✓
Final Exam	✓	✓	✓	✓	✓

XI. Recommended Texts

(A) *Quantitative Literacy: Thinking Between the Lines*, Crauder, Evans, Johnson, and Noell, Worth Publishers, 2011

(B) *A Survey of Mathematics with Applications*, Angel, Abbott, and Runde, Pearson Prenctice Hall, 2012

(C) *Using and Understanding Mathematics: A Quantitative Reasoning Approach*, Bennett and Briggs, Pearson Prenctice Hall, 2010

XII. Waiver Policy

This course may be waived.

XIII. Bibliography

(A) *The Heart of Mathematics: An Invitation to Effective Thinking*, Burger and Starbird, Wiley Publishing, 2012.

(B) *Quantitative Reasoning: Tools for Today's Informed Citizen*, Sevilla and Somers, Wiley Publishing, 2012.

XIV. Preparation

Proposed outline prepared by MDCC, Fall 2013.

Approved by the MDCC, September 10, 2013

Approved by the Mathematics Department, September 19, 2013