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Course Outline for MATH 47

MATHEMATICS FOR LIBERAL ARTS

Effective: Fall 2018

I. CATALOG DESCRIPTION:
MATH 47 — MATHEMATICS FOR LIBERAL ARTS — 3.00 units

An introduction to a variety of mathematical concepts for students interested in liberal arts. Intended to cultivate an appreciation of the significance of mathematics in daily life and help develop students' mathematical reasoning. Topics include personal finance, probability & statistics, logic, exponential growth, and graph theory.

3.00 Units Lecture

Prerequisite
MATH 55 - Intermediate Algebra for STEM
with a minimum grade of C
or

MATH 55B - Intermediate Algebra for STEM B
with a minimum grade of C
or

MATH 50 - Core Intermediate Algebra
with a minimum grade of C

Grading Methods:
Letter Grade

Discipline:
- Mathematics

	MIN
Lecture Hours:	54.00
No Unit Value Lab	18.00
Total Hours:	72.00

II. NUMBER OF TIMES COURSE MAY BE TAKEN FOR CREDIT: 1

III. PREREQUISITE AND/OR ADVISORY SKILLS:

Before entering the course a student should be able to:

A. MATH55
1. Recognize and determine the distinctions between relations and functions, numerically, graphically, symbolically, and verbally;
2. Given a function, determine the domain and range and express them in interval notation;
3. Solve polynomial, rational, absolute value, radical, linear, exponential, and logarithmic equations;
4. Apply basic operations on functions, including composition of functions and finding inverse functions;
5. Develop and use equations or function models to analyze and solve applied problems involving linear, quadratic, rational, radical, exponential or logarithmic expressions. Topics should minimally include growth, decay, geometry, optimization and uniform motion.
6. Factor polynomials, including using the sum and difference of cubes;
7. Use the properties of radicals, complex numbers, exponents and logarithms;

B. MATH55B

C. MATH50
1. Explain and/or justify their solution process orally or in writing
2. Use algebraic operations to simplify polynomial, rational and radical expressions
3. Simplify radicals and use properties of exponents to simplify expressions with integer or rational exponents
4. Create equations in one variable and use them to solve problems. (Include equations arising from linear and quadratic functions, and simple rational, radical, exponential and logarithmic functions.)
5. Solve a formula for a specified variable
6. Determine whether a mathematical structure is a relation or function, find the domain and range and express them in interval, inequality or set notation (includes: linear, quadratic, cubic, absolute value, square root, cube root, rational, exponential, and logarithmic functions)
7. Represent functions verbally, symbolically, numerically and graphically and use function notation

8. Perform operations with functions, including composition of functions (includes: linear, quadratic, cubic, absolute value, square root, cube root, rational, exponential, and logarithmic functions)
9. Solve applied problems with functions (includes: linear, quadratic, cubic, absolute value, square root, cube root, rational, exponential, and logarithmic functions)
10. Construct, use and interpret mathematical models (includes: linear, quadratic, cubic, absolute value, square root, cube root, rational, exponential, and logarithmic functions)
11. Compare linear, quadratic and exponential change
12. Construct and interpret data charts, tables and graphs with appropriate labels and scales
13. Calculate the probability of an event using the equally likely probability formula, the properties of probability, the sum rule, the product rule or a tree diagram
14. Find and use a probability distribution

IV. MEASURABLE OBJECTIVES:

Upon completion of this course, the student should be able to:

A. Find unions, intersections and complements of sets;
B. Use Venn diagrams to solve problems
C. Demonstrate an understanding of the basic definitions of elementary probability
D. Determine the probability distribution for a sample space (uniform or nonuniform)
E. Determine the probability that a specified event will occur
F. Find the conditional probability of an event
G. Solve applied problems involving simple and compound interest
H. Solve applied problems involving annuities, sinking funds and amortization
I. Apply an algorithm to find an Euler path or circuit in a connected graph
J. Solve the traveling salesman problem when given a small weighted graph, using the brute force algorithm and the nearest neighbor algorithm
K. Construct truth tables to determine validity of an argument
L. Identify logically equivalent statements
M. Translate an English statement into symbolic notation
N. Organize raw data into tables, charts, and/or graphs
O. Calculate and understand the meaning of the mean, median, mode range, variance, and standard deviation as they relate to a population, sample or distribution
P. Develop an appropriate (linear or exponential) model for a real-world problem

V. CONTENT:

A. Logic
    1. Concepts of Set Theory
        a. Subsets, set equality, union, intersection, complement
        b. DeMorgan's Laws
        c. Venn Diagrams
    2. Simple and Compound Statements
        a. Tautologies, contradictions
        b. Negations
        c. Conditional, converse, inverse, contrapositive
    3. Connectives
    4. Symbolic Notation
    5. Validity of an Argument
    6. Truth Tables
B. Finance
    1. Simple and compound interest
    2. Future value and present value
    3. Annuities, sinking funds and amortization
C. Probability
    1. Basics of probability
    2. Complement and union of events
    3. Conditional probability
    4. Counting Techniques
D. Statistics
    1. Organizing and visualizing data
        a. Frequency Distributions
        b. Histograms
        c. Bar graphs, circle graphs, line graphs
    2. Measures of central tendency
        a. Mean
        b. Median
        c. Mode
        d. Five-number summary
        e. Boxplot
    3. Measures of variation
        a. Range
        b. Standard Deviation
        c. Variance
        d. Coefficient of variation
    4. Normal Distribution
E. Exponential growth and linear growth
    1. Linear Functions
        a. Slope and rate of change
        b. Applications and models
    2. Exponential Functions
        a. Applications and models
        b. Logarithms
F. Graph Theory
    1. Basic Concepts
        a. Walks, paths, circuits
        b. complete graphs
    2. Special Graphs
        a. Euler circuits
        b. Hamilton circuits
        c. Trees

3. Graph Algorithms
    a. Fleury
    b. Nearest Neighbor
    c. Brute Force
4. Traveling Salesman Problem

VI. METHODS OF INSTRUCTION:
A. Laboratory assignments
B. Homework
C. Group and individual activities in class
D. Assigned readings in the text
E. Lecture and classroom discussion

VII. TYPICAL ASSIGNMENTS:
A. Homework
1. Problems from the text should be assigned for each section covered. The number of problems assigned may vary from section to section and from instructor to instructor, but the homework assignments should include a sufficient number and variety of problems to develop both skill and conceptual understanding. A typical assignment should take an average student 1 to 2 hours for each hour in class.
2. The majority of the problems assigned should be those for which answers are readily available (e.g., from the answer appendix in the text), so that students may obtain immediate feedback on their work.
3. Homework assignments may include reading the text. Students may be asked to read sections in advance of the lecture and then to re-read them after the lecture to reinforce important concepts and skills. An instructor may require written work in conjunction with the reading assignments (e.g, have students complete a Q & A sheet related to the assigned reading).

B. Laboratory
1. Lab assignments can be used to reinforce fundamental concepts and skills or to explore certain concepts in more depth than is possible in class. They may be designated for individual or group work. Lab assignments are completed in the Open Math Lab where students have access to assistance with the assignments.
2. Sample lab assignment: Find the website for a candidate or initiative (for or against) in an upcoming or recent election. Study the arguments given on the site, looking for examples of fallacies. Write a brief summary of the fallacies. Overall, does the site make a strong or weak case for its candidate or position? Explain.

C. In-Class
1. Collaborative learning, done in small groups of 2-4 students, can be used to introduce new concepts, build skills, or teach problem-solving. Students can be asked to present their results on the board.
2. Sample collaborative learning assignment: (Traveling Salesman Problem) Given a set of 7 cities and their distances from each other, in your group, determine the shortest route connecting all 7 cities and returning to the starting city. Then as a class, determine the shortest route by considering each group's answer. Is it possible to find a shorter route?

VIII. EVALUATION:
A. **Methods**

1. Exams/Tests
2. Quizzes
3. Research Projects
4. Class Work
5. Home Work
6. Lab Activities

B. **Frequency**

1. Recommended minimum of 3 exams plus final
2. Homework should be assigned for each section covered
3. Recommend minimum of eight laboratory assignments over the semester
4. Number of quizzes, collaborative activities, and research projects are at the discretion of the instructor

IX. TYPICAL TEXTS:
1. *Mathematics A Practical Odyssey.* 8 ed., Cengage, 2016.
2. Miller, C., V. Heeren, J. Hornsby *Mathematical Ideas.* 13 ed., Addison-Wesley, 2016.
3. Pirnot, T.. *Mathematics All Around.* 6th ed., Pearson, 2018.

X. OTHER MATERIALS REQUIRED OF STUDENTS:
A. Scientific Calculator