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Course Outline for MATH 50

CORE INTERMEDIATE ALGEBRA

Effective: Fall 2018

I. CATALOG DESCRIPTION:
MATH 50 — CORE INTERMEDIATE ALGEBRA — 4.00 units

Core concepts of intermediate algebra are explored within the context of the function. Function concepts covered include: distinction between functions and relations, domain and range, function notation, multiple representation of functions, behavior of functions, operations with functions (including composition) and, one-to-one and invertible functions. Types of functions considered: linear, absolute value, polynomial, rational, radical, exponential and logarithmic functions. The course includes an introduction to probability, counting and quantitative data. Standards for mathematical practice, applications of functions, and modeling with functions are emphasized throughout.

3.00 Units Lecture 1.00 Units Lab

Prerequisite
MATH 110 - Elementary Algebra
with a minimum grade of C
or

MATH 110B - Elementary Algebra B
with a minimum grade of C

Grading Methods:
Letter or P/NP

Discipline:
- Mathematics

	MIN
Lecture Hours:	54.00
Lab Hours:	54.00
Total Hours:	108.00

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. MATH110
1. Perform arithmetic operations on real numbers and polynomial expressions;
2. Simplify and evaluate algebraic expressions;
3. Translate a verbal statement into an algebraic expression;
4. Solve linear equations in one variable;
5. Solve a formula for a specified variable;
6. Solve and graph a linear inequality in one variable and express the solution using correct interval or set notation;
7. Find the equation of a line;
8. Develop and graph linear equations in two variables using various methods;
9. Apply concepts of slopes and rates of change;
10. Apply the rules for integer exponents;
11. Factor polynomials completely;
12. Solve polynomial and quadratic equations;
13. Solve, justify, and interpret the solution in the context of a modeling problem.

B. MATH110B

IV. MEASURABLE OBJECTIVES:

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

A. Explain and/or justify their solution process orally or in writing
B. Use algebraic operations to simplify polynomial, rational and radical expressions
C. Simplify radicals and use properties of exponents to simplify expressions with integer or rational exponents
D. 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.)

E. Solve quadratic equations using factoring, the square root property or the quadratic formula
F. Represent and solve equations graphically. (includes: linear, quadratic, cubic, absolute value, square root, cube root, rational, exponential, and logarithmic functions; by hand or using technology)
G. Explain and use the relationship between zeros and factors of polynomials
H. Solve a formula for a specified variable
I. 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)
J. Represent functions verbally, symbolically, numerically and graphically and use function notation
K. Analyze the behavior of a function (e.g., intercepts, intervals of increase/decrease) and sketch its graph with appropriate labels and scales (includes: linear, quadratic, cubic, absolute value, square root, cube root, rational, exponential, and logarithmic functions)
L. Apply transformations to the graphs of relations and functions (horizontal and vertical translation, reflection in the x - or y -axis, dilation and contraction) (includes: linear, quadratic, cubic, absolute value, square root, cube root, rational, exponential, and logarithmic functions)
M. Perform operations with functions, including composition of functions (includes: linear, quadratic, cubic, absolute value, square root, cube root, rational, exponential, and logarithmic functions)
N. Determine whether or not a function is one-to-one
O. Find the inverse of an invertible function, state its domain and range, and sketch its graph
P. Select and use the appropriate technology to represent and analyze graphs and functions
Q. Solve applied problems with functions (includes: linear, quadratic, cubic, absolute value, square root, cube root, rational, exponential, and logarithmic functions)
R. Construct, use and interpret mathematical models (includes: linear, quadratic, cubic, absolute value, square root, cube root, rational, exponential, and logarithmic functions)
S. Compare linear, quadratic and exponential change
T. Construct and interpret data charts, tables and graphs with appropriate labels and scales
U. Apply linear regression to a scatter plot and interpret the result
V. 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
W. Find and use a probability distribution

V. CONTENT:

A. Numerical Literacy
    1. Quantitave reasoning and units of measure
        a. formulas and units of measure
        b. scale and the origin in graphs and data displays
        c. appropriate quantities for the purpose of descriptive modeling
        d. appropriate levels of accuracy and precision
    2. Real number system
        a. operations with real numbers
        b. properties of real numbers
        c. negative exponents
        d. simplifying square and cube roots
        e. intervals, inequalties and set notation
B. Mathematical Literacy
    1. Reading
        a. reading effectively in mathematics
        b. reflecting on, and responding in writing to, assigned mathematical readings
    2. Explaining reasoning
        a. explaining and justifying solutions to others verbally
        b. explaining and justifying solutions in writing
C. Algebra
    1. Expressions
        a. simplification of polynomial, rational,and radical expressions
        b. properties of exponents
        c. simplification of exponential expressions with integer or rational exponents
        d. equivalent forms of expressions
    2. Solving Equations
        a. reasoning about the problem solving process
        b. solving equations in one variable: creating equations; using them to solve problems
        c. Types of equations considered: linear, absolute value, quadratic, cubic, rational, radical, exponential, logarithmic
        d. solving quadratic equations by: factoring, square root property, quadratic formula
        e. representing and solving equations graphically by hand or using technology; types of equations considered: linear, absolute value, quadratic, cubic, rational, radical, exponential, logarithmic
        f. relationship between zeros and factors of polynomials (symbolically and graphically)
        g. solving a formula for a specified variable
D. Function Concepts
    1. Functions and relations
        a. fundamental definitions
        b. distinction between functions and relations
    2. Multiple representations: represent functions verbally, symbolically, numerically, and graphically
    3. Types of representations considered
        a. mapping diagrams
        b. sets of ordered pairs
        c. tables
        d. graphs
        e. symbolic
        f. verbal
    4. use function notation
    5. finding domain and range given a
        a. mapping diagram
        b. set of ordered pairs
        c. table
        d. graph
        e. symbolic representation
    6. express domain and range using inequality or interval notation
    7. operations with functions
        a. addition, subtraction, multiplication, division
        b. composition
        c. building new functions from existing functions

8. one-to-one functions
9. inverse of a function
    a. invertibility
    b. finding the inverse graphically
    c. finding the inverse symbolically
    d. composition test

E. Analysis of function behavior
1. graphing functions as equations in two variables
    a. coordinate axes, labels and scales
    b. types of equations considered: linear, absolute value, quadratic, cubic, rational, radical, exponential, logarithmic
2. analysis of function behavior
    a. domain
    b. intercepts
    c. vertex (absolute value and quadratic functions)
    d. intervals of increase or decrease
    e. asymptotic behavior (rational, exponential and logarithmic functions)
    f. explaining/interpreting the meaning of such behavior in context
    g. types of functions considered: linear, absolute value, quadratic, cubic, rational, radical, exponential, logarithmic
    h. use of graphing software to represent and and analyze graphs of functions
3. interpreting functions that arise in applications in terms of a context
4. transformations graphically and symbolically
    a. horizontal and vertical translation
    b. reflection in the *x*- or *y*-axis
    c. dilation and contraction
5. modeling with functions
    a. construction, using and interpreting mathematical models to solve problems
    b. constructing and comparing linear, quadratic, and exponential models

F. Quantitative Data and Probability
1. representation and interpretation of data
    a. charts, tables graphs
    b. margin of error
    c. linear regression
2. Introduction to probability and counting
    a. equally likely outcomes formula
    b. properties of probability
    c. sum and product rules
    d. tree diagrams
    e. probability distributions

VI. METHODS OF INSTRUCTION:

A. **Lecture** -
B. **Student Presentations** - presenting viable arguments in support of their solutions
C. assigned reading with questions to be answered in writing
D. **Classroom Activity** - Collaborative learning activities
E. homework
F. **Audio-visual Activity** - web-based tutorials and/or videos embedded in e-text
G. **Critique** - critiquing the reasoning of others
H. **Lab** - assignments
I. writing exercises to explain their reasoning and justify their solutions

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. In-Class
1. Students may work singly or in groups on short exercise sets related to content being introduced during lecture.
2. Students present findings from laboratory assignments.
3. Group discussion about the results of laboratory assignments.

C. Laboratory Assignments
1. Lab assignments can be used to to introduce new concepts or to explore certain concepts in more depth, to reinforce fundamental concepts and skills, to teach problem solving, to encourage discussion, or to provide opportunities to explain reasoning and critique the reasoning of others. They may be designated for individual or group work.can be used Students may be asked to present their results on the board during the lecture portion of the class.
2. Sample Lab Assignments.
    a. Students work with multiple representations of relations and functions to determine whether the described mathematical object is a relation or function. They determine the domain and range of the relation or function and use appropriate mathematical notation to express the domain and range.
    b. Students apply transformations to graphs of functions and relations and discuss in writing the effect of the transformations on the graph.
    c. Graphing technology is used to explore different versions of the quadratic function and describe how changes to the constants and the inclusion of a linear term changes the graph. The connections between the algebraic form, the graph and transformation are explored.
    d. Using data plots, students determine whether the data can be modeled exactly or approximately by a linear function. The appropriate linear model is constructed, with linear regression being used where needed. Each group presents their model to the class, explains their solution and discusses how the model is to be interpreted and can be used to make predictions.

VIII. EVALUATION:

A. **Methods**

1. Exams/Tests
2. Quizzes

3. Oral Presentation
4. Class Work
5. Home Work
6. Lab Activities
7. Other:
    a. Written response to assigned videos and/or reading assignments

B. **Frequency**

1. Recommend a minimum of three exams plus a comprehensive final exam
2. Homework should be assigned for each unit
3. Weekly laboratory assignments
4. Number of quizzes, oral presentations and written responses are at the discretion of the instructor

IX. TYPICAL TEXTS:

1. Lehmann, Jay. *Intermediate Algebra*. 5th ed., Pearson, 2015.
2. Rockswold, G., and T. Krieger. *Beginning and Intermediate Algebra*. 4th ed., Pearson, 2018.
3. *Math in Action: Algebraic, Graphical, and Trigonometric Problem Solving.* 5th ed., Pearson Higher Education, Inc., 2016.

X. OTHER MATERIALS REQUIRED OF STUDENTS:

A. Students will be required to buy a graphing calculator.
B. For purposes of doing comparative graphing by hand, it will be recommended, though not required, that students have a set of colored erasable pencils and a ruler.