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**Course Outline for MATH 30**

**COLLEGE ALGEBRA FOR STEM**

**Effective: Fall 2019**

I. CATALOG DESCRIPTION:
MATH 30 — COLLEGE ALGEBRA FOR STEM — 4.00 units

College algebra core concepts relating to Science, Technology, Engineering and Mathematics (STEM) and Business fields are explored, such as: polynomial, rational, radical, exponential, absolute value, and logarithmic functions; systems of equations; theory of polynomial equations; and analytic geometry. Multiple representations, applications and modeling with functions are emphasized throughout. May not receive credit if Mathematics 20 or 45 have been completed.

4.00 Units Lecture

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

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

NMAT 255 - Intermediate Algebra for BSTEM
with a minimum grade of C

**Grading Methods:**
Letter Grade

**Discipline:**
- Mathematics

| | MIN |
|---|---|
| **Lecture Hours:** | 72.00 |
| **Expected Outside of Class Hours:** | 144.00 |
| **No Unit Value Lab** | 18.00 |
| **Total Hours:** | 234.00 |

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. Solve systems of linear equations in three variables;
6. 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.
7. Solve compound inequalities, sketch the graph of the solution and use appropriate set and interval notation to express the solution;
8. Solve absolute value equations and inequalities and, where appropriate, sketch the graph of the solution and use set or interval notation to express the solution;
9. Factor polynomials, including using the sum and difference of cubes;
10. Use the properties of radicals, complex numbers, exponents and logarithms;
11. Sketch the graphs of nonlinear relations, including parabolas and circles, and identify key components of the graphs;

B. MATH55B

1. Solve polynomial, rational, absolute value, radical, linear, exponential, and logarithmic equations;
2. Apply basic operations on functions, including composition of functions and finding inverse functions;
3. Solve systems of linear equations in three variables;
4. 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.
5. Use the properties of radicals, complex numbers, exponents and logarithms;
6. Sketch the graphs of nonlinear relations, including parabolas and circles, and identify key components of the graphs.

C. NMAT255
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. Solve systems of linear equations in three variables;
6. 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.
7. Solve compound inequalities, sketch the graph of the solution and use appropriate set and interval notation to express the solution;
8. Solve absolute value equations and inequalities and, where appropriate, sketch the graph of the solution and use set or interval notation to express the solution;
9. Factor polynomials, including using the sum and difference of cubes;
10. Use the properties of radicals, complex numbers, exponents and logarithms;
11. Sketch the graphs of nonlinear relations, including parabolas and circles, and identify key components of the graphs;

## IV. MEASURABLE OBJECTIVES:

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

A. Solve rational, linear, polynomial, radical, absolute value, exponential, and logarithmic equations;
B. Solve linear, nonlinear and absolute value inequalities;
C. Explore and apply rational, linear, polynomial, radical, absolute value, exponential, and logarithmic equations in context of applications;
D. Analyze functions graphically and investigate properties of functions;
E. Apply functions and other algebraic techniques to model real world applications in science, technology, engineering and mathematics;
F. Graph linear and nonlinear functions, including functions with radicals, exponential functions, absolute value functions, and logarithmic functions;
G. Apply transformations to the graphs of functions;
H. Synthesize results from the graphs and/or equations of functions;
I. Recognize the relationship between functions and their inverses graphically and algebraically;
J. Determine if a function has an inverse and find the inverse when it exists;
K. Apply techniques for finding real and complex zeros of polynomials and roots of equations.
L. Solve systems of equations and inequalities;
M. Use Gaussian elimination to put a matrix into echelon form and to solve a system of linear equations;
N. Explore applications and modeling with conics.
O. Analyze conics algebraically and graphically;
P. Find the terms of a sequence and the partial sums of a series;
Q. Use formulas to find sums of finite and infinite series;

## V. CONTENT:

A. Functions
1. Definition of function; domain and range; evaluation
    a. Types & graphs of families of functions, including linear, polynomial, rational, radical, exponential, absolute value and logarithmic
2. Analysis of functional behavior
    a. Increasing and decreasing functions
    b. Extreme values of functions
    c. End (asymptotic) behavior
    d. Intercepts, vertices
    e. Average rate of change
    f. Transformations of graphs, including quadratic, absolute value, radical, rational, logarithmic, and exponential
3. Applications of functions
4. One-to-one functions and inverse of a function
5. Algebra of functions

B. Equations and inequalities
1. Algebraic and graphical solutions of equations
2. Modeling and applications
3. Real and complex solutions of quadratic equations and applications
    a. Solving other types of equations, including polynomial, rational, absolute value, exponential, and logarithmic
    b. Linear and nonlinear inequalities, including polynomial, rational and absolute value

C. Systems of equations and inequalities
1. Systems of linear and nonlinear equations
2. Modeling with linear systems
3. Gaussian elimination and echelon form of a matrix
4. Solution of linear systems using Gaussian elimination

D. Polynomial and rational functions
1. Graphs of polynomial functions
2. Division of polynomials, including synthetic division
3. Real and complex zeros of a polynomial function
4. The Fundamental Theorem of Algebra
5. Rational functions and asymptotic behavior
6. Properties and applications of Complex numbers;

E. Exponential and logarithmic functions
1. Definitions of exponential and logarithmic functions
2. Laws of logarithms
3. Exponential and logarithmic equations
4. Applications of exponential and logarithmic functions

F. Analytic Geometry - Conic sections with translations

1. Parabolas
2. Circles
3. Ellipses
4. Hyperbolas
5. Applications and modeling with conics

G. Sequences and series
1. Sequences and summation notation
2. Arithmetic and geometric sequences and geometric series

## VI. METHODS OF INSTRUCTION:

A. **Classroom Activity** -
B. **Lab** - Assignments incorporating modeling real-world STEM applications
C. **Individualized Instruction** -
D. Any of the following at the discretion of the instructor 1. Individual problem solving 2. Group work 3. Student presentations
E. **Discussion** -
F. Reading
G. **Lecture** -

## 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 applications and modeling 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: Students explore concepts related to quadratic and rational functions, given a function that models a situation solving and interpreting the result.

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 may be asked to present their results on the board.
2. Sample collaborative learning assignment: To introduce exponential growth and decay, the class in break into groups of 2 - 3 students complete different tables and graph different exponential growth functions with a base greater than 1; have each group present their tables and graphs on a transparency with a graphing grid. Using an overhead projector, discuss what you notice about the graphs (domain, range, y-intercepts, horizontal asymptote, etc.). Repeat this same process with different exponential decay functions with a base between 0 and 1. This same idea can be repeated for introduction of logarithmic bases.

## VIII. EVALUATION:

**Methods/Frequency**

A. Exams/Tests
Minimum of four examinations plus a comprehensive final exam

B. Quizzes
Number of quizzes are at the discretion of the instructor.

C. Class Work
Each day time should be allowed in class for students to apply the concepts being covered

D. Home Work
Daily

E. Lab Activities
weekly

## IX. TYPICAL TEXTS:


1. Stewart, James, Lothar Redlin, and Saleem Watson. *College Algebra.* 7th ed., Cengage Learning, 2016.
2. Rockswold, Gary. *College Algebra with Modeling & Visualization.* 6th ed., Pearson, 2018.
3. Sullivan, Michael. *College Algebra.* 10th ed., Pearson, 2016.


## X. OTHER MATERIALS REQUIRED OF STUDENTS:

A. A scientific or graphing calculator may be required to complete labs.