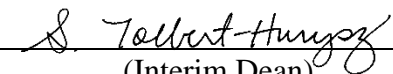


NEW RIVER COMMUNITY COLLEGE
DUBLIN, VIRGINIA

COURSE PLAN

Course Number and Title: MTT 1/MTT 2/MTT 3 Developmental Mathematics

Prepared by: Math Department Spring, 2018
(Date)

Approved by:  Spring, 2018
(Interim Dean) (Date)

I. Course Description

This course covers mathematics topics in a technology-based setting to prepare students for the study of college-level mathematics courses and curricula. It is designed for the study of one, two, or three developmental math units as prescribed by the student's placement test results and previous MTE/MTE courses. Credits are not applicable toward graduation. Prerequisite: Placement scores requiring the student to complete one or more developmental math units.

II. Introduction

This course consists of 9 separate Units of developmental math, beginning with operations with fractions, and including operations with decimals and percents, algebra basics, first-degree equations and inequalities in one variable, systems of linear equations, exponents, factoring, polynomial equations, rational expressions and equations, rational exponents and radicals, and functions, quadratic equations, and parabolas. A specific list of outcomes and objectives for each Unit is listed separately at the end of this Course Plan. Students may enroll in up to 3 credits of MTT Units (1 Unit = 1 credit) per semester, and their instructor will guide them to the Unit where they have been placed either from previous courses or placement tests. This course is technology-based.

III. Student Learning Outcomes

A specific list of outcomes and objectives for each Unit is listed separately at the end of this Course Plan.

IV. Instructional Methods

This course is taught via online e-text lessons, video lectures, homework assignments, assessments, as well as a write-in Guided Notebook using the Hawkes Learning software. In the face-to-face sections of this course, the instructor (and embedded tutors) circulate to work with students providing individualized instruction and support, as well as pacing support and encouragement.

V. Instructional Materials

Textbook: *Foundations of Mathematics for Virginia* (Guided Notebook and software access code bundle) ISBN 978-1-941552-88-9. This book/access code is required and is usable for all MTT classes at NRCC. It must be purchased through the NRCC bookstore as it is a custom edition.

Required: Internet access for lessons and assignments from Learn.HawkesLearning.com.

Calculator: No calculator is allowed in Unit 1, and for the first 4 sections of Unit 2. A four-function calculator is allowed in the rest of Unit 2 - 9. A scientific calculator is recommended for units 5 – 9. A graphing calculator will not be needed for this course. Cell phones or other electronic devices may NOT be used as a calculator.

Other Materials: Internet access is *required* in order to complete and submit assignments.

VI. Course Content

A specific list of topics for each Unit is listed separately at the end of this Course Plan. Students will complete learning materials (reading, videos, animations, examples, practice problems, quizzes) for each section of each Unit in the software to master the required learning objectives.

VII. Evaluation

Course Grade: This is a pass/fail course (S/U). Students must complete *all* of the Units they have signed up for in the semester in order to earn a grade of S (passing). If not, students will earn a grade of U (failing). Students will not have to repeat any Units they pass during this course, but if they do not finish all the Units they have signed up for, they will fail the course and need to start at the beginning of the Unit they did not complete the next time they enroll in an MTT course.

Other grading details are included in the Syllabus for the course. Students will progress through the learning materials and assignments for each Unit until reaching the Unit Exam. They must pass the Exam with a 75% or higher in order to pass the Unit.

The **Accountability in Student Learning Program (ASLP) Team** connects students to the resources they need in order to meet their educational goals. Connection Specialists intentionally engage students who may be in need of academic advising, tutoring, or help in overcoming obstacles to academic success such as lack of books, computers or internet access at home. NRCC and the ASLP program cannot solve every problem; however, they CAN connect you to various community resources that are available. The ASLP Team also creates opportunities for students with similar backgrounds, goals and/or challenges to come together to support each other. If you are in need of academic assistance or other types of support, let us know. To contact the ASLP office for any reason, including to find out who your connection specialist is, email aslp@nr.edu or call 540.674.3677 or drop by Godbey 53 (in Dublin) or room 103 at the Mall Site.

VIII. Attendance

Regular attendance at classes is required. When absence from a class becomes necessary, it is the responsibility of the student to inform the instructor prior to the absence whenever possible. The student is responsible for the subsequent completion of all study missed during an absence. Any instruction missed and not subsequently completed will necessarily affect the grade of the student regardless of the reason for the absence.

IX. Cheating Policy

Students caught cheating on a Unit Exam will receive a zero for that attempt. They will be allowed their next attempt at the exam, but if caught cheating again they will have to start that Unit over again from the beginning.

X. Withdrawal Policy

Student Initiated Withdrawal Policy

A student may drop or withdraw from a class without academic penalty during the first 60 percent of a session. For purposes of enrollment reporting, the following procedures apply:

- a. If a student withdraws from a class prior to the termination of the drop/add period for the session, the student will be removed from the class roll and no grade will be awarded.
- b. After the drop/add period, but prior to completion of 60 percent of a session, a student who withdraws from a class will be assigned a grade of “W.” A grade of “W” implies that the student was making satisfactory progress in the class at the time of withdrawal, that the withdrawal was officially made before the deadline published in the college calendar, or that the student was administratively transferred to a different program.
- c. After that time, if a student withdraws from a class, a grade of “U” will be assigned. Exceptions to this policy may be made under documented mitigating circumstances if the student was passing the course at the last date of attendance.

A retroactive grade of “W” may be awarded only if the student would have been eligible under the previously stated policy to receive a “W” on the last date of class attendance. The last date of attendance for a distance education course will be the last date that work was submitted.

Late withdrawal appeals will be reviewed and a decision made by the Coordinator of Admissions and Records.

No-Show Policy

A student must either attend face-to-face courses or demonstrate participation in distance learning courses by the last date to drop for a refund. A student who does not meet this deadline will be reported to the Admissions and Records Office and will be withdrawn as a no-show student. No refund will be applicable, and the student will not be allowed to attend/participate in the class or submit assignments. Failure to attend or participate in a course will adversely impact a student’s financial aid award.

Instructor Initiated Withdrawal

A student who adds a class or registers after the first day of class is counted absent from all class meetings missed. Each instructor is responsible for keeping a record of student attendance (face-to-face classes) or performance/participation (DE classes) in each class throughout the semester.

When a student’s absences equal twice the number of weekly meetings of a class (equivalent amount of time for summer session), the student may be dropped for unsatisfactory attendance in the class by the instructor.

Since attendance is not a valid measurement for Distance Education (DE) courses, a student may be withdrawn due to non-performance. A student should refer to his/her DE course plan for the instructor's policy.

In accordance with the No-Show Policy, a student who has not attended class or requested/accessed distance learning materials by the last day to drop the class and receive a refund must be withdrawn by the instructor during the following week. No refund will be applicable.

When an instructor withdraws a student for unsatisfactory attendance (face-to-face class) or non-performance (DE class), the last date of attendance/participation will be documented. Withdrawal must be completed within five days of a student's meeting the withdrawal criteria. A grade of "W" will be recorded during the first sixty percent (60%) period of a course. A student withdrawn after the sixty percent (60%) period will receive a grade of "U" except under documented mitigating circumstances when a letter of appeal has been submitted by the student. A copy of this documentation must be placed in the student's academic file.

The student will be notified of the withdrawal by the Admissions and Records Office. An appeal of reinstatement into the class may be approved only by the instructor.

XI. Disability and Diversity Statements

If you are a student with a documented disability who will require accommodation in this course, please register with the Disability Services Office located in the Advising Center for assistance in developing a plan to address your academic needs.

The NRCC community values the pluralistic nature of our society. We recognize diversity including, but not limited to, race ethnicity, religion, culture, social class, age, gender, sexual orientation and physical or mental capability. We respect the variety of ideas, experiences and practices that such diversity entails. It is our commitment to ensure equal opportunity and to sustain a climate of civility for all who work or study at NRCC or who otherwise participate in the life of the college.

XII. Evacuation Procedure

Evacuation Procedure: Please note the evacuation route posted at the classroom doorway. Two routes are marked in case one route might be blocked.

MTT Developmental Math Units
Broad Learning Outcomes & Specific Objectives

Unit 1 – Operations with Positive Fractions

Unit Description

The student will solve application problems using proper fractions, improper fractions, and mixed numbers. All student learning outcomes for this unit must be completed without the use of a calculator. Emphasis should be placed on applications throughout the unit. Applications will use U.S. customary units of measurement. All fractions in this unit should be expressed in simplest form, unless otherwise indicated.

Broad Learning Outcomes

Upon completion of Unit 1 students will be able to:

- 1.1 Write, simplify, and compare fractions.
- 1.2 Perform operations with fractions.
- 1.3 Solve applications using U.S. customary units of measurement.

Specific Objectives

Upon completion of Unit 1 students will be able to:

- 1.1 Write, simply and compare fractions.**
 - 1.1.1 Express parts of a whole using fraction notation.
 - 1.1.2 Convert between improper fractions and mixed numbers.
 - 1.1.3 Express repeated factors using exponents.
 - 1.1.4 Find the prime factorization of a given number.
 - 1.1.5 Write fractions in simplest form.
 - 1.1.6 Compare two quantities in the form of a ratio or rate in simplest form.
 - 1.1.7 Find the least common multiple (LCM) of two or more whole numbers.
 - 1.1.8 Find the least common denominator (LCD) of two or more fractions.
 - 1.1.9 Determine the relationship (<, >, =) between two fractions with unlike denominators.
- 1.2 Perform operations with fractions.**
 - 1.2.1 Add and subtract fractions and mixed numbers with like denominators.
 - 1.2.2 Add and subtract fractions and mixed numbers with unlike denominators.
 - 1.2.3 Multiply fractions and mixed numbers.
 - 1.2.4 Divide fractions and mixed numbers.
 - 1.2.5 Simplify expressions involving fractions using order of operation.
- 1.3 Solve application using U.S. customary units of measurement.**

Unit 2 – Operations with Positive Decimals and Percents

Unit Description

The student will solve problems using decimals and percents. Emphasis should be placed on applications throughout the unit. Applications will use U.S. customary and metric units of measurement.

Broad Learning Outcomes

Upon completion of Unit 2 students will be able to:

- 2.1 Demonstrate the meaning of decimal numbers.
- 2.2 Perform operations with decimals.
- 2.3 Estimate decimals.
- 2.4 Demonstrate the relationship among fractions, decimals, and percents.

- 2.5 Solve basic percent problems.
- 2.6 Read and interpret basic graphs.
- 2.7 Convert units of measure.
- 2.8 Solve application problems using U.S. customary and metric units of measurement.

Specific Objectives

Upon completion of Unit 2 students will be able to:

- 2.1 Demonstrate the meaning of decimal numbers.**
 - 2.1.1 Convert decimals between standard notation and word notation.
 - 2.1.2 Identify place values in decimals.
- 2.2 Perform operations with decimals.**
 - 2.2.1 Add and Subtract decimals.
 - 2.2.2 Multiply decimals.
 - 2.2.3 Divide decimals.
 - 2.2.4 Simplify expressions using order of operations.
- 2.3 Estimate decimals.**
 - 2.3.1 Round decimals to a specific place value.
 - 2.3.2 Estimate sums, differences, products, and quotients with decimals.
- 2.4 Demonstrate the relationship among fractions, decimals, and percents.**
 - 2.4.1 Write parts of a whole using percent notation.
 - 2.4.2 Convert among fractions, decimals and percents.
 - 2.4.3 Order a list of fractions and decimals from smallest to largest.
- 2.5 Solve basic percent problems.**
 - 2.5.1 Calculate all values in the basic percent problem (percent, amount /part, and base).
 - 2.5.2 Calculate percent increase and percent decrease.
 - 2.5.3 Calculate sales tax and commission.
 - 2.5.4 Calculate simple interest.
- 2.6 Read and interpret basic graphs.**
 - 2.6.1 Read and interpret information from a pie graph.
 - 2.6.2 Calculate the percentage denoted by a pie graph.
 - 2.6.3 Read and interpret information from a bar graph.
 - 2.6.4 Read and interpret information from a line graph.
- 2.7 Convert units of measure.**
 - 2.7.1 Convert within the U.S. system.
 - 2.7.2 Convert within the metric system.
 - 2.7.3 Convert between U.S. and metric units using conversion tables.
 - 2.7.4 Convert units of time.
 - 2.7.5 Convert between Fahrenheit and Celsius temperatures.
- 2.8 Solve application problems using U.S. customary and metric units of measurement.**

Unit 3 – Algebra Basics

Unit Description

The student will perform basic operations with algebraic expressions and solve simple algebraic equations using signed numbers. Emphasis should be placed on applications throughout the unit.

Broad Learning Outcomes

Upon completion of Unit 3 students will be able to:

- 3.1 Determine the absolute value of a number.
- 3.2 Demonstrate proper use of exponents.
- 3.3 Find the principal square root of a perfect square.
- 3.4 Simplify expressions involving signed numbers.
- 3.5 Write numbers in scientific notation.
- 3.6 Simplify algebraic expressions.
- 3.7 Evaluate a formula or algebraic expression for given values of the variables.
- 3.8 Solve one-step equations using the addition and multiplication properties.

- 3.9 Solve problems using proportions.
- 3.10 Solve application problems including finding perimeter, area and volume.

Specific Objectives

Upon completion of Unit 3 students will be able to:

- 3.1 Determine the absolute value of a number.**
- 3.2 Demonstrate proper use of exponents.**
 - 3.2.1 Express repeated factors using exponents.
 - 3.2.2 Evaluate powers of numbers.
- 3.3 Find the principal square root of a perfect square.**
- 3.4 Simplify expressions involving signed numbers.**
 - 3.4.1 Add and subtract signed numbers.
 - 3.4.2 Multiply and divide signed numbers.
 - 3.4.3 Use the proper order of operations to simplify expressions containing multiple operations on signed numbers, including powers and square roots.
- 3.5 Write numbers in scientific notation.**
 - 3.5.1 Convert between integer powers of 10 and equivalent decimal numbers.
 - 3.5.2 Convert numbers between scientific notation and standard notation.
- 3.6 Simplify algebraic expressions.**
 - 3.6.1 Identify the properties of real numbers (Commutative, Associative, Distributive, Identity and Inverse Properties).
 - 3.6.2 Simplify an algebraic expression by combining like terms.
 - 3.6.3 Simplify algebraic expressions using the order of operations.
- 3.7 Evaluate a formula or algebraic expression for given values of the variables.**
- 3.8 Solve one-step equations using the addition and multiplication properties.**
 - 3.8.1 Solve one-step equations using rational numbers.
 - 3.8.2 Solve one-step equations using percents.
- 3.9 Solve problems using proportions.**
- 3.10 Solve application problems including finding perimeter, area, and volume.**

Unit 4 – First Degree Equations and Inequalities in One Variable

Unit Description

The student will solve first degree equations and inequalities containing one variable, and use them to solve application problems. Emphasis should be on learning the steps to solving the equations and inequalities, applications and problem solving.

Broad Learning Outcomes

Upon completion of Unit 4 students will be able to:

- 4.1 Solve first degree equations in one variable.
- 4.2 Solve a formula or equation for one of its variables.
- 4.3 Solve first degree absolute value equations containing a single absolute value.
- 4.4 Solve first degree inequalities in one variable.
- 4.5 Solve application problems using a single first degree equation or inequality.

Specific Objectives

Upon completion of Unit 4 students will be able to:

- 4.1 Solve first degree equations in one variable.**
 - 4.1.1 Solve first degree equations in one variable using the Addition Property of Equality.
 - 4.1.2 Solve first degree equations in one variable using the Multiplication Property of Equality.
 - 4.1.3 Solve first degree equations in one variable using the Addition Property of Equality and the Multiplication Property of Equality.
 - 4.1.4 Solve first degree equations in one variable that contain parentheses.
 - 4.1.5 Solve first degree equations in one variable with the variable on both sides of the equal sign.
 - 4.1.6 Solve first degree equations in one variable and identify the solution to an equation as finite, the empty set or all real numbers.
- 4.2 Solve a formula or equation for one of its variables.**
 - 4.2.1 Solve a formula or equation for one of its variables using the Addition Property of Equality.

- 4.2.2 Solve a formula or equation for one of its variables using the Multiplication Property of Equality.
- 4.2.3 Solve a formula or equation for one of its variables using the Addition Property of Equality and the Multiplication Property of Equality.
- 4.3 Solve first degree absolute value equations containing a single absolute value.**
- 4.4 Solve first degree inequalities in one variable.**
 - 4.4.1 Solve first degree inequalities in one variable stating the solution using inequality notation.
 - 4.4.2 Solve first degree inequalities in one variable stating the solution using interval notation.
 - 4.4.3 Solve first degree inequalities in one variable and graph the solution on a real number line.
- 4.5 Solve application problems using a single first degree equation or inequality.**

Unit 5 – Linear Equations, Inequalities and Systems of Linear Equations in Two Variables

Unit Description

The student will learn how to find the equation of a line, graph linear equations and inequalities in two variables and solve a system of two linear equations. Emphasis should be on writing and graphing equations using the slope of the line and points on the line, and applications.

Broad Learning Outcomes

Upon completion of Unit 5 students will be able to:

- 5.1 Define the properties of the rectangular coordinate system.
- 5.2 Graph a linear equation in two variables.
- 5.3 Graph a linear inequality in two variables.
- 5.4 Find the slope of a line.
- 5.5 Write an equation of a line.
- 5.6 Solve systems of linear equations.
- 5.7 Use function notation.
- 5.8 Solve application problems that require linear equations, inequalities and systems of linear equations in two variables.

Specific Objectives

Upon completion of Unit 5 students will be able to:

- 5.1 Define the properties of the rectangular coordinate system.**
 - 5.1.1 Determine the coordinates of a point plotted on the coordinate plane.
 - 5.1.2 Determine whether an ordered pair is a solution to an equation in two variables.
 - 5.1.3 Graph a linear equation by finding and plotting ordered pair solutions.
- 5.2 Graph a linear equation in two variables.**
 - 5.2.1 Identify the x and y intercepts of a graph.
 - 5.2.2 Graph a linear equation by plotting intercepts.
 - 5.2.3 Graph an equation given in slope-intercept form.
 - 5.2.4 Graph a horizontal line given its equation.
 - 5.2.5 Graph a vertical line given its equation.
- 5.3 Graph a linear inequality in two variables.**
- 5.4 Find the slope of a line.**
 - 5.4.1 Find the slope of a line given two points on the line.
 - 5.4.2 Find the slope of a line given its equation in slope-intercept form.
 - 5.4.3 Find the slope of a line given its equation by converting to slope-intercept form.
 - 5.4.4 Find the slope of a line given its graph.
 - 5.4.5 Find the slope of horizontal and vertical lines.
- 5.5 Write an equation of a line.**
 - 5.5.1 Write an equation of a line in slope-intercept form given the slope and the y-intercept.
 - 5.5.2 Use point-slope form to write an equation of a line in slope intercept form given the slope and a point on the line.
 - 5.5.3 Use point-slope form to write an equation of a line in slope intercept form given two points on the line.
 - 5.5.4 Write the equation of a vertical line.
 - 5.5.5 Write the equation of a horizontal line.
 - 5.5.6 Find the equation of a line that is parallel or perpendicular to a given line and passes through a given point.

5.6 Solve systems of linear equations.

- 5.6.1 Determine if an ordered pair is a solution of system of equations in two variables.
- 5.6.2 Solve systems of linear equations by graphing.
- 5.6.3 Solve by elimination using substitution.
- 5.6.4 Solve by elimination using addition.
- 5.6.5 Identify a system of linear equations as consistent and independent, consistent and dependent, or inconsistent.

5.7 Use function notation.

- 5.7.1 Evaluate $y = f(x)$ for specific values of x .
- 5.7.2 Given the graph of $y = f(x)$, evaluate $f(x)$ for specific values of x .
- 5.7.3 Given the graph of $y = f(x)$, find x for specific values of $f(x)$.

5.8 Solve applications problems that require linear equations, inequalities and systems of linear equations in two variables.**Unit 6 - Exponents, Factoring and Polynomial Equations****Unit Description**

The student will learn to perform operations on exponential expressions and polynomials. Students will also learn techniques to factor polynomials and use these techniques to solve polynomial equations. Emphasis should be on learning all the different factoring methods, and solving application problems using polynomial equations.

Broad Learning Outcomes

Upon completion of Unit 6 students will be able to:

- 6.1 Perform operations on exponential expressions using the rules of exponents.
- 6.2 Define, add, subtract, multiply and divide polynomials.
- 6.3 Factor polynomials.
- 6.4 Solve polynomial equations using factoring techniques.
- 6.5 Solve application problems involving polynomial equations and factoring.

Specific Objectives

Upon completion of Unit 6 students will be able to:

6.1 Perform operations on exponential expressions using the rules of exponents.

- 6.1.1 Evaluate the product of two exponential expressions.
- 6.1.2 Evaluate the quotient of two exponential expressions.
- 6.1.3 Evaluate the power of a power of an exponential expression.
- 6.1.4 Evaluate exponential expressions that contain negative exponents.
- 6.1.5 Evaluate exponential expressions that contain combinations of products, quotients, power of a power and negative exponents.
- 6.1.6 Multiply and divide numbers in Scientific Notation.

6.2 Define, add, subtract, multiply and divide polynomials.

- 6.2.1 Identify an expression as a monomial, binomial, trinomial or polynomial.
- 6.2.2 Add, subtract, multiply and divide monomials using the rules of exponents.
- 6.2.3 Add, subtract, and multiply binomials.
- 6.2.4 Add, subtract, and multiply trinomials.
- 6.2.5 Add, subtract, and multiply combinations of binomials and trinomials.

6.3 Factor polynomials.

- 6.3.1 Find the greatest common factor from a list of terms.
- 6.3.2 Find the greatest common factor from a polynomial.
- 6.3.3 Factor a polynomial by grouping.
- 6.3.4 Factor trinomials of the form $x^2 + bx + c$.
- 6.3.5 Factor trinomials of the form $ax^2 + bx + c$, $a \neq 1$.
- 6.3.6 Factor a difference of squares.
- 6.3.7 Factor a sum of two cubes.
- 6.3.8 Factor a difference of two cubes.

6.4 Solve polynomial equations using factoring techniques.**6.5 Solve application problems involving polynomial equations and factoring.**

Unit 7: Rational Expressions and Equations

Unit Description

The student will simplify rational algebraic expressions, solve rational algebraic equations and use them to solve application problems.

Broad Learning Outcomes

Upon completion of Unit 7 students will be able to:

- 7.1 Identify a rational algebraic expression.
- 7.2 Simplify rational algebraic expressions.
- 7.3 Perform arithmetic operations with rational algebraic expressions.
- 7.4 Solve rational algebraic equations.
- 7.5 Solve application problems using rational algebraic equations.

Specific Objectives

Upon completion of Unit 7 students will be able to:

7.1 Identify a rational algebraic expression.

- 7.1.1 Identify the real value of the variable for which a rational algebraic expression having a denominator of the form $ax + b$ is undefined.
- 7.1.2 Identify all real values of the variable for which a rational algebraic expression having a denominator of the form $ax^2 + bx + c$ is undefined.
- 7.1.3 Express a rational algebraic expression having negative exponents as an equivalent rational expression without negative exponents.

7.2 Simplify rational algebraic expressions.

- 7.2.1 Simplify a rational algebraic expression.
- 7.2.2 Evaluate a rational algebraic expression given specific integral values for each variable.

7.3 Perform arithmetic operations with rational algebraic expressions.

- 7.3.1 Perform addition and subtraction of rational algebraic expressions having like denominators.
- 7.3.2 Find the Least Common Denominator (LCD) of two or more rational algebraic expressions.
- 7.3.3 Perform addition and subtraction of rational algebraic expressions having denominators that have no common factors.
- 7.3.4 Perform addition and subtraction of rational algebraic expressions having denominators that have a common monomial factor.
- 7.3.5 Perform addition and subtraction of rational algebraic expressions having denominators that have a common binomial factor.
- 7.3.6 Perform multiplication of rational algebraic expressions and express the product in simplest terms.
- 7.3.7 Use factorization to divide rational algebraic expressions and express the quotient in simplest terms.
- 7.3.8 Simplify complex fractions.
- 7.3.9 Divide a polynomial by a monomial.
- 7.3.10 Perform polynomial long division having binomial divisors of the form $ax + b$.

7.4 Solve rational algebraic equations.

7.5 Solve application problems using rational algebraic equations.

- 7.5.1 Write a rational equation to match the information given in an application problem.
- 7.5.2 Solve an application problem using rational equations.

Unit 8: Rational Exponents and Radicals

Unit Description

The student will simplify radical expressions, and use rational exponents. The student will solve radical equations and use them to solve application problems.

Broad Learning Outcomes

Upon completion of Unit 8 students will be able to:

- 8.1 Demonstrate the equivalence of radical and rational exponent forms.
- 8.2 Compute and estimate radicals.

- 8.3 Simplify radicals and radical expressions.
- 8.4 Perform operations (add, subtract, multiply) on radicals and radical expressions.
- 8.5 Rationalize the denominator (one term and two terms).
- 8.6 Solve radical equations.
- 8.7 Define the imaginary unit and imaginary numbers.
- 8.8 Simplify square roots of negative numbers using the imaginary unit.
- 8.9 Solve application problems involving radicals.

Specific Objectives

Upon completion of Unit 8 students will be able to:

- 8.1 Demonstrate the equivalence of radical and rational exponent forms.**
 - 8.1.1 Convert between square root and $a^{\frac{1}{2}}$ forms.
 - 8.1.2 Convert between nth root and $a^{\frac{1}{n}}$ forms.
 - 8.1.3 Convert between combinations of nth root and mth power and $a^{m/n}$ forms.
- 8.2 Compute and estimate radicals.**
 - 8.2.1 Calculate square roots via calculator.
 - 8.2.2 Estimate square roots.
 - 8.2.3 Calculate nth roots via calculator.
- 8.3 Simplify radicals and radical expressions.**
 - 8.3.1 Simplify using the properties of rational exponents.
 - 8.3.2 Simplify square roots.
 - 8.3.3 Simplify nth roots of variable expressions.
 - 8.3.4 Simplify radicals by using the multiplication property of radicals.
 - 8.3.5 Simplify radicals by using the division property of radicals.
- 8.4 Perform operations (add, subtract, multiply) on radicals and radical expressions.**
 - 8.4.1 Define like radicals.
 - 8.4.2 Combine and simplify like radicals.
 - 8.4.3 Multiply and simplify radicals.
- 8.5 Rationalize the denominator (one term and two terms).**
 - 8.5.1 Simplify radicals by rationalizing a denominator with one term.
 - 8.5.2 Simplify radicals by rationalizing a denominator with two terms.
- 8.6 Solve radical equations.**
- 8.7 Define the imaginary unit and imaginary numbers.**
 - 8.7.1 Define $i = \sqrt{-1}$.
 - 8.7.2 Define imaginary numbers (e.g. $\sqrt{-25}$).
- 8.8 Simplify square roots of negative numbers using the imaginary unit.**
- 8.9 Solve application problems involving radicals.**
 - 8.9.1 Solve problems involving right triangles.
 - 8.9.2 Solve problems involving the Pythagorean Theorem.
 - 8.9.3 Solve problems involving the distance formula.

Unit 9 – Functions, Quadratic Equations, and Parabolas

Unit Description

In this unit the student will have an introduction to functions in ordered pair, graph, and equation form. The student will engage in a thorough introduction to quadratic functions and their properties as they complete preparation for entering STEM or business-administration college-level mathematics courses.

Broad Learning Outcomes

Upon completion of Unit 9 students will be able to:

- 9.1 Determine if a relation is a function and identify the domain and range of the function.
- 9.2 Find all roots of quadratic equations using both the square root method and the quadratic formula.
- 9.3 Analyze a quadratic function to determine its vertex by completing the square and using the formula.
- 9.4 Graph a quadratic function, using the vertex form, indicating the intercepts and vertex.
- 9.5 Apply knowledge of quadratic functions to solve application problems from geometry, economics, applied physics, and other disciplines.

Specific Objectives

Upon completion of Unit 9 students will be able to:

9.1 Determine if a relation is a function and identify the domain and range of the function.

- 9.1.1 Determine if a list of ordered pairs, graph, or equation is a function.
- 9.1.2 Determine the domain and range of a function given as a list of ordered pairs.
- 9.1.3 Determine the domain and range of a function given as a graph.
- 9.1.4 Determine the domain of a function given as an equation.
- 9.1.5 Evaluate $y = f(x)$ for constant values of x and for specific monomials and binomials.

9.2 Find all roots of quadratic equations using both the square root method and the quadratic formula.

- 9.2.1 Find the roots of quadratic equations of the form $ax^2 + c = 0$.
- 9.2.2 Find the roots of quadratic equations of the form $ax^2 + bx + c = 0$ when the discriminant is a positive perfect square, (i.e. the quadratic is factorable).
- 9.2.3 Find the roots of quadratic equations of the form $ax^2 + bx + c = 0$ when the discriminant is positive, but not a perfect square.
- 9.2.4 Find the roots of quadratic equations of the form $ax^2 + bx + c = 0$ when the discriminant is zero.
- 9.2.5 Find the roots of quadratic equations of the form $ax^2 + bx + c = 0$ when the discriminant is negative.
- 9.2.6 Describe the roots of a quadratic based upon the discriminant in all cases.

9.3 Analyze a quadratic function to determine its vertex by completing the square and using the formula.

- 9.3.1 Write a quadratic function in vertex form $y = a(x - h)^2 + k$ by completing the square for quadratics with $a = 1$ and identify the vertex (h, k) .
- 9.3.2 Write a quadratic function in vertex form $y = a(x - h)^2 + k$ by completing the square for quadratics with $a \neq 1$ and identify the vertex (h, k) .
- 9.3.3 Find the vertex of a quadratic equation $y = ax^2 + bx + c$ using the formula method $(\frac{-b}{2a}, f(\frac{-b}{2a}))$.

9.4 Graph a quadratic function, using the vertex form, indicating the intercepts and vertex.

- 9.4.1 Determine whether the parabola opens upward or downward.
- 9.4.2 Plot the vertex of the parabola.
- 9.4.3 Determine the axis of symmetry for the parabola.
- 9.4.4 Plot the x-intercepts of the parabola, if they exist.
- 9.4.5 Plot the y-intercept of the parabola and complete the graph with additional points as needed.

9.5 Apply knowledge of quadratic functions to solve application problems from geometry, economics, applied physics, and other disciplines.

- 9.5.1 Solve problems involving area optimization.
- 9.5.2 Solve problems involving revenue optimization.
- 9.5.3 Solve problems involving the motion of falling objects.