COMMUNITY UNIT SCHOOL DISTRICT 200
Math Curriculum Philosophy

Students need to see mathematics as a language, a tool, and an art form, with which they can communicate ideas, solve problems, and explore the world around them. By the end of twelfth grade they will have been encouraged to see multiple ways of expressing mathematical ideas, guided to make multiple connections to real life situations, and prompted to work with others as they explore possibilities. Their thinking will have become flexible, transferring mathematical knowledge from one situation to another, and they will be able to communicate their thinking in a variety of ways using any technology available to them.

Algebra 1
Middle School/High School
Advanced Level – Two Semesters

1. Subject expectation (State Goal 6)	**Demonstrate and apply a knowledge and sense of numbers, including numeration and operations (addition, subtraction, multiplication, division), patterns, ratios and proportions.**

Essential Learning 1 (Learning Standard A)		**Demonstrate knowledge and use of numbers and their representations in a broad range of theoretical and practical settings.**
Critical Content	6.A.3	Represent fractions, decimals, percentages, exponents, and scientific notations in equivalent form. • calculate functional values for a given function (f(x)) • apply the laws of exponents to simplify monomial expressions • multiply and divide monomials • find products and quotients of numbers expressed in scientific notation • express numbers in scientific and decimal notation • write two numbers as a ratio in simplest form
	6.A.4	Identify and apply the associative, commutative, distributive and identity properties of real numbers, including special numbers such as pi and square roots. • recognize and use basic properties - commutative - associative - distributive - identity - inverse - substitution • recognize and combine like terms • add, subtract, multiply and divide polynomials • synthetic division • use the GCF and the distributive property to factor polynomials

- use grouping techniques to factor polynomials with four or more terms
- simplify expressions involving
  - rationalizing denominator (no conjugates)
  - addition and subtraction
- Simplify radical expressions using laws of square roots including
  - negative values of variables
  - rationalize denominator (including conjugates)
  - add, subtract, multiply and divide with radicals (without rationalizing and denominator)

Essential Learning 2 (Learning Standard B)	**Investigate, represent and solve problems using number facts, operations (addition, subtraction, multiplication, and division) and their properties, algorithms and relationships.**

Critical Content	6.B.3a	Solve practical computation problems involving whole numbers, integers and rational numbers. • simplify expressions using rational numbers including - applying the four arithmetic operations - positive or negative numbers raised to even or odd powers - absolute value
	6.B.3b	Apply primes, factors, divisors, multiples, common factors and common multiples in solving problems. • develop fluency in operations with real numbers using mental computations or paper and pencil calculations for simple cases and technology for more complicated cases
	6.B.3c	Identify and apply properties of real numbers, including pi, square, square roots. • identify numbers as integers, rational or irrational • simplify square roots with and without variables (assume all variables are positive) • find approximate values for square roots • identify and estimate square roots with and without a calculator (including negative roots) • classify real numbers as natural, whole, integers, rational and irrational

Essential Learning 3 (Learning Standard C)	**Compute and estimate using mental mathematics, paper and pencil methods, calculators and computers.**

Critical Content	6.C.3a	Select computational procedures and solve problems with whole numbers, fractions, decimals, percents, and proportions. • solve proportions • solve percent problems including - finding the percent of a number - finding the original number from a percent - simple interest • solve problems involving percent of increase or decrease • solve problems involving discount or sales tax • solve problems involving uniform motion
	6.C.3b	Show evidence that computational results using whole numbers, fractions, decimals, percents and proportions are correct and/or that

estimates are reasonable.

6.C.4 Determine whether exact values or approximations are appropriate (e.g., bid a job, determine gas mileage for a trip).

- develop fluency in operations with real numbers using mental computations or paper and pencil computations for simple cases and technology for more complicated cases

Essential Learning 4 (Learning Standard D)	**Solve problems using comparison of quantities, ratios, proportions and percents.**

Critical Content 6.D.4 Solve problems involving recipes or mixtures, financial calculations and geometric similarity using ratios, proportions and percents.

- explain how ratios and proportions can be used to solve problems or percent, growth and error tolerance
- solve application problems by setting up a proportion
  - recipes
  - mixtures
  - scale drawings
- solve application problems
  - simple interest
  - multi-step
- investigate compound interest applications

2. Subject expectation (State Goal 7) — Estimate, make, and use measurements of objects, quantities and relationships and determine acceptable levels of accuracy.

Essential Learning 1 (Learning Standard A)	**Measure and compare quantities using appropriate units, instruments and methods.**

Critical Content 7.A.4a Apply units and scales to describe and compare numerical data and physical objects.

7.A.4b Apply formulas in a wide variety of theoretical and practical real-world measurement applications, involving perimeter, area, volume, angle, time temperature, mass speed, distance, density, and monetary values.

- solve application problems by
  - defining variables
  - setting up an equation
  - applying formula
- explore the geometric mean

Essential Learning 2 (Learning Standard B)	**Estimate measurements and determine acceptable levels of accuracy.**

Critical Content 7.B.4 Estimate and measure the magnitude and directions of physical quantities (e.g., velocity, force, slope) using rulers, protractors and other scientific instruments including timers, calculators and and/or computers.

- find and estimate the slope of a line from
  - a graph
  - two points
  - an equation

- a table

Essential Learning 3 (Learning Standard C)	**Select and use appropriate technology, instruments and formulas to solve problems, interpret results and communicate findings.**

Critical Content	7.C.4a	Make indirect measurements, including heights and distances, using proportions (e.g., finding the height of a tower by its shadow). • introduce students to the use of technology (TI graphing calculators) - decimals to fractions - fractions to decimals - order of operations - absolute value - exponent key - sign change key - menus - reset memory • add and subtract rational numbers • multiply and divide rational numbers • express numbers in scientific and decimal notation
	7.C.4b	Interpret scale drawings and models using maps and blueprints. • solve applications - scale drawings - indirect measurement
	7.C.4c	Convert within and between measurement systems and monetary systems using technology where appropriate.

3. Subject expectation (State Goal 8)

Use algebraic and analytical methods to identify and describe patterns and relationships in data, solve problems and predict results.

Essential Learning 1 (Learning Standard A)	**Describe numerical relationships using variables and patterns.**

Critical Content	8.A.3a	Apply the basic properties of commutative, associative, distributive, transitive, inverse, identity, zero, equality and order of operations to solve problems. • use order of operations to evaluate expressions • recognize linear equations in standard form • transform equations - from standard to slope-intercept form - from point-slope intercept to standard form
	8.A.3b	Solve problems using linear expressions, equations and inequalities. • solve linear equations systematically using addition, subtraction, multiplication, and division - one-step problems - two-step problems - multi-step problems - check answers - translate written sentences into equations, formulas, inequalities
	8.A.4a	Using algebraic methods to convert repeating decimals to fractions.

- convert a repeating decimal to a fraction
- name the coefficient of a term

8.A.4b Represent mathematical patterns and describe their properties using variables and mathematical symbols.

- name the coefficient of a term
- arrange terms of a polynomial in descending and ascending order
- write an equation for horizontal and vertical lines
- factor trinomials in the form $x^2 + bx + c$
- factor binomials that are the difference of squares
- factor perfect square trinomials
- factor trinomials in the form $ax^2 + bx + c$
- simplify rational expressions
  - state the excluded values of the variables
- multiply and divide rational expressions
- find equations from relations (linear)
- arrange terms of a polynomial in descending and ascending order
- add and subtract rational expressions with
  - like denominators
  - unlike denominators

Essential Learning 2 (Learning Standard B)	**Interpret and describe numerical relationships using tables, graphs and symbols.**

Critical Content 8.B.3 Use graphing technology and algebraic methods to analyze and predict linear relationships and make generalizations from linear patterns.

- find the degree of a polynomial
- determine whether a given relation is a function
- inverse relation (optional)
- recognize the relationship among solutions, coordinates, graphs and equations
- determine the slope of a line from
  - a graph
  - two points
  - an equation
  - a table
- identify and graph ordered pairs on a coordinate plane

8.B.4a Represent algebraic concepts with physical materials, words, diagrams, tables, graphs, equations and inequalities and use appropriate technology.

- translate verbal expressions into mathematical expressions
- graph quadratic functions using a table
- translate verbal sentences into equations, formulas, or inequalities
- solve application problems by
  - setting up an equation
  - applying formulas
- identify domain and range of a relation
- graph lines and determine point of intersection
- graph horizontal and vertical lines given an equation
- find an equation of a line using
  - point and slope
  - two points
  - table

  - graph
  - best-fit line from data (use line to make predictions)
- solve one-variable inequalities and graph the solutions (number line)
  - compound
  - absolute value
- write an equation of a line that passes through a given point and is parallel or perpendicular to the graph of a given equation
- graph linear inequalities in one or two variables (coordinate plane)
- graph a solution to a system of inequalities (coordinate plane)
- find roots of a quadratic equation by graphing
- solve quadratic equations by using
  - completing the square
  - quadratic formula
- evaluate discriminant of a quadratic equation to determine nature of roots
- translate written sentences into equations, formulas, or inequalities
- apply the concept of domain to number line graphs
- solve applications such as
  - age
  - uniform motion
  - number
  - consecutive integer
  - coin
- define relations and functions
- different ways to represent relations and function
  - table
  - mapping
  - graph
  - equation
  - set
- discover a function rule from a real world experiment that is linear
  - communicate results and conclusions
- write linear equations given
  - a point and slope
  - two points
  - a table
  - a graph
- graph a line using
  - table
  - slope and y intercept
  - x and y intercept
  - point and slope
- identify which systems of equations have
  - one unique solution
  - infinitely many solutions
  - no solutions
- write linear inequalities from a verbal statement
- write a linear inequality from its graph
- write a system of linear inequalities from its corresponding graph
- write an equation, given the solutions
- define quadratic functions

- graph quadratic functions using a table
- find the roots of a quadratic equation by graphing
- write the equation of a quadratic function given its roots
- graph circles by completing the square
- relate the sum and product of roots to the coefficients of a quadratic equation

8.B.4b Use the basic functions of absolute value, square root, linear, quadratic and step to describe numerical relationships.

- find and estimate the slope of a line from
  - graph
  - two points
  - equation
  - table
- graph a line using
  - table
  - x and y intercept
  - point and a slope

Essential Learning 3 (Learning Standard C)	**Solve problems using systems of numbers and their properties.**

Critical Content

8.C.4.a Analyze and report the effects of changing coefficients, exponents and other parameters on functions and their graphs.

- solve a system of equations using
  - graphing
  - elimination
  - substitution
- explore a variety of functions including
  - linear
  - exponential
  - quadratic
  - inverse
  - absolute value
- analyze the effect of changing slope and y intercept of a linear function
- find the vertex and the equation of the axis of symmetry
- solve application problems including
  - numbers-digits problems
  - wind and current problems
  - mixtures problems
  - rental fees

8.C.4.b Apply algebraic properties and procedures with matrices, vectors, functions and sequences using data found in business, industry and consumer situations.

- find the vertex and the equation of the axis of symmetry
- solve application problems
  - projectile motion
  - area
  - volume

Essential Learning 4 (Learning Standard D)	**Use algebraic concepts and procedures to represent and solve problems.**

Critical Content	8.D.3a	Solve problems using numeric, graphic or symbolic representations of variables, expressions, equations and inequalities. • solve a system of equations using - graphing - elimination - substitution • solve radical equations • investigate and solve problems involving direct variation • solve systems with three variables • graph inequalities on number lines
	8.D.3b	Propose and solve problems using proportions, formulas and linear functions.
	8.D.3c	Apply properties of power, perfect squares and square roots.
	8.D.4	Formulate and solve linear and quadratic equations and linear inequalities algebraically and investigate nonlinear inequalities using graphs, tables, calculators and/or computers. • solve linear equations involving - absolute values - variables on both sides of equation - grouping symbols - identity or no solution - more than one variable for a specific variable - fractions or decimals - write an integral equation for an equation involving fractions and decimals • solve one-variable inequalities using addition, subtraction, multiplication, and division and graph the solutions (number line) - one-step problems - two-step problems - multi-step problems - compound inequalities - absolute value inequalities • solve application problems - inverse variation - perimeter and area - product of integers • solve quadratic equations by - graphing - completing the square - quadratic formula - factoring - check answers • use factoring and zero product property to solve quadratic equations • explore exponential functions

4. Subject expectation (State Goal 10)	**Collect, organize and analyze data using statistical methods; predict results; and interpret uncertainty using concepts of probability.**

Essential Learning 1 (Learning Standard A)	**Organize, describe and make predictions from existing data.**

Critical Content	10.A.4a	Represent and organize data by creating lists, charts, tables, frequency distributions, graphs, scatterplots, and box-plots
	10.A.4b	Analyze data using mean, median, mode, range, variance and standard deviation of a data set, with and without the use of technology. • calculate and interpret the mean, median, mode range, variance, and standard deviation of a set of data
	10.A.4c	Predict from data using interpolation, extrapolation and trend lines, with and without the use of technology. • find an equation of a line using - best-fit line from data (use line to make predictions) - y = key - two points - table • write the equation of the line of best fit from data - make predictions from the graph

Essential Learning 2 (Learning Standard B)	**Formulate questions, design data collection methods, gather and analyze data and communicate findings.**

Critical Content	10.B.4	Design and execute surveys or experiments, gather data to answer relevant questions, and communicate results and conclusions to an audience using traditional methods and contemporary technology. • gather, organize, and interpret data - communicate results and conclusions

Essential Learning 3 (Learning Standard C)	**Determine, describe and apply the probabilities of events.**

	10.C.4a	Solve problems of chance using the principles of probability including conditional settings. • solve problems with or without replacement
	10.C.4b	Design and conduct simulations (e.g., waiting times at restaurant, probabilities of births, likelihood of game prizes), with and without the use of technology.