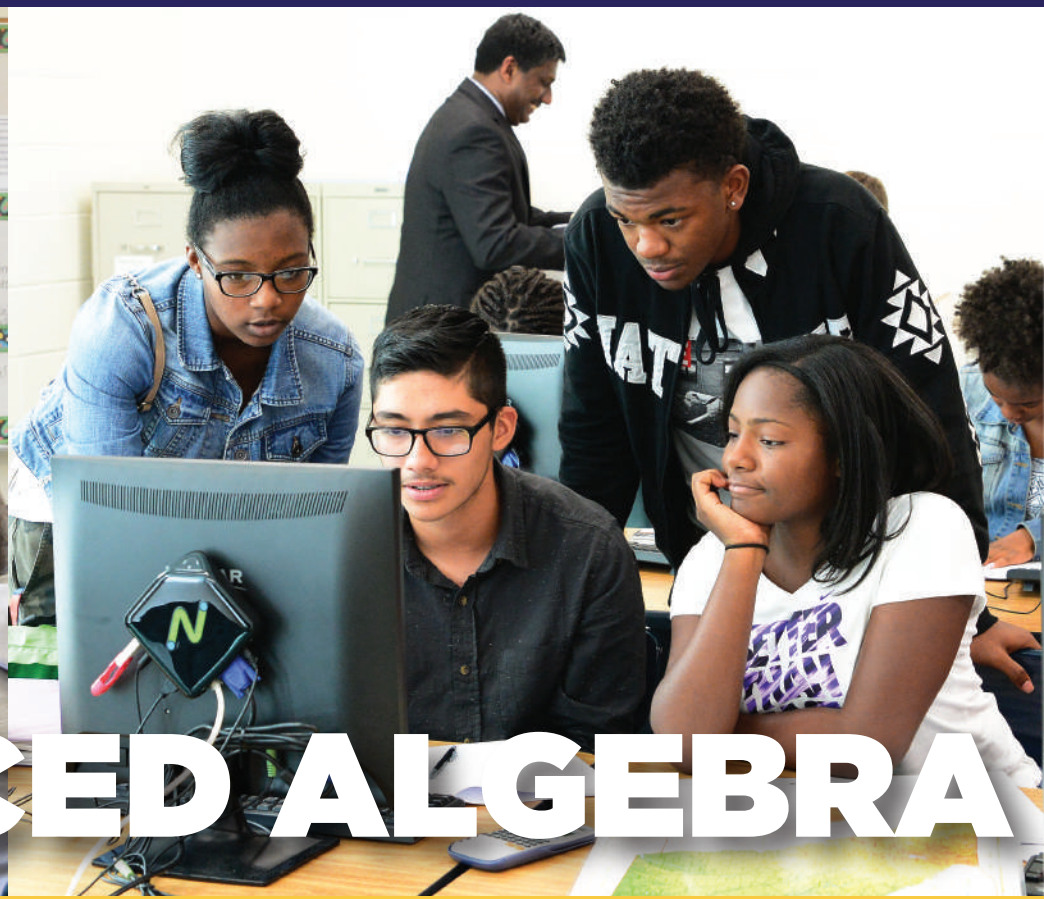
HENRY COUNTY SCHOOLS

Better Together.



ADVANCED ALGEBRA

| MATH |

HENRY

Teaching & Learning Standards

Teaching & Learning Standards

Math

Advanced Algebra

ENRY LEARNING PROGRESSIONS

Advanced Algebra
Math

Quarter 1		Quarter 2	Quarter 3		Quarter 4	
Unit 1	**Unit 2**	**Unit 3**	**Unit 4**	**Unit 5**	**Unit 6**	**Unit 7**
4 Weeks	*4 Weeks*	*5 Weeks*	*8 Weeks*	*5 Weeks*	*5 Weeks*	*5 Weeks*
Quadratics Revisited	**Operations with Polynomials**	**Polynomial Functions**	**Rational and Radical Relationships**	**Exponential and Logarithms**	**Mathematical Modeling**	**Inferences and Conclusions from Data**
Perform arithmetic operations with complex numbers. MGSE9-12.N.CN.1 (Complex numbers) MGSE9-12.N.CN.2 (Complex numbers & properties) MGSE9-12.N.CN.3 (Conjugate of complex numbers) Use complex numbers in polynomial identities and equations. MGSE9-12.N.CN.7 (Solve quadratics with complex solutions)	Perform arithmetic operations on polynomials MGSE9-12.A.APR.1 (Add, subtract & multiply polynomials) MGSE9-12.A.APR.5 (Binomial Theorem) Rewrite rational expressions MGSE9-12.A.APR.6 (Rewrite rational expressions) Build a function that models a relationship between two quantities MGSE9-12.F.BF.1 (Write a function) MGSE9-12.F.BF.1b	Use complex numbers in polynomial identities and equations. MGSE9-12.N.CN.9 (Fundamental Theorem of Algebra) Interpret the structure of expressions MGSE9-12.A.SSE.1 MGSE9-12.A.SSE.1a MGSE9-12.A.SSE.1b (Interpret expressions; Interpret parts & terms of expressions) MGSE9-12.A.SSE.2 (Equivalent expressions) Understand the relationship between zeros and factors of polynomials MGSE9-12.A.APR.2 (Remainder Theorem) MGSE9-12.A.APR.3 (Identify zeros) Use polynomial identities to solve problems MGSE9-12.A.APR.4 (Polynomial Identities) Interpret functions that arise in applications in terms of the context MGSE9-12.F.IF.4	Rewrite rational expressions MGSE9-12.A.APR.7 (Rewrite rational expressions) Write expressions in equivalent forms to solve problems MGSE9-12.A.CED.1 (Create equations & inequalities-1 variable) MGSE9-12.A.CED.2 (Create equations & inequalities-2 variables) Understand solving equations as a process of reasoning and explain the reasoning MGSE9-12.A.REI.2 (Solve simple radical & rational equations) Interpret functions that arise in applications in terms of the context MGSE9-12.F.IF.4 (Characteristics of functions)	Write expressions in equivalent forms to solve problems MGSE9-12.A.SSE.3 (Equivalent expressions) MGSE9-12.A.SSE.3c (Properties of exponents) Analyze functions using different representations MGSE9-12.F.IF.7 (Graph functions) MGSE9-12.F.IF.7e (Graph exponential & logarithmic functions) MGSE9-12.F.IF.8 (Write a function) MGSE9-12.F.IF.8b (Interpret expressions) Build new functions from existing functions MGSE9-12.F.BF.5 (Inverse relationships) Construct and compare linear, quadratic, and	Write expressions in equivalent forms to solve problems MGSE9-12.A.SSE.4 (Derive formula for sum of finite geometric series) MGSE9-12.A.CED.1 (Create equations & inequalities-1 variable) MGSE9-12.A.CED.2 (create equations & inequalities-2 variables) MGSE9-12.A.CED.3 (Represent constraints) MGSE9-12.A.CED.4 (Rearrange formulas) Represent and solve equations and inequalities graphically MGSE9-12.A.REI.11 (Solutions to equations) Interpret functions that arise in applications in terms of the context	Summarize, represent, and interpret data on a single count or measurement variable MGSE9-12.S.ID.2 (Shape and data distribution) MGSE9-12.S.ID.4 (Fit to a normal distribution) Understand and evaluate random processes underlying statistical experiments MGSE9-12.S.IC.1 (Inferences from a random sample) MGSE9-12.S.IC.2 (Using simulations) Make inferences and justify conclusions from sample surveys, experiments, and observational studies MGSE9-12.S.IC.3 (Randomization)

MGSE9-12.N.CN.8 (Factoring with complex solutions) Solve equations and inequalities in one variable MGSE9-12.A.REI.4 (Solve quadratics in 1 variable) MGSE9-12.A.REI.4b (Solve quadratic equations by inspection) Extend the properties of exponents to rational exponents. MGSE9-12.N.RN.1 (Rational exponents) MGSE9-12.N.RN.2 (Expressions with radicals & rational exponents)	(Combine standard functions) MGSE9-12.F.BF.1c (Compose functions) Build new functions from existing functions MGSE9-12.F.BF.4 (Inverse functions) MGSE9-12.F.BF.4a (f(x)=c & inverse) MGSE9-12.F.BF.4b (Use composition to verify inverses) MGSE9-12.F.BF.4c (Values of inverse function from graph or table)	(Characteristics of functions) Analyze functions using different representations MGSE9-12.F.IF.7 (Graph functions) MGSE9-12.F.IF.7c (Graph polynomial functions)	MGSE9-12.F.IF.5 (Domains of functions) Analyze functions using different representations MGSE9-12.F.IF.7 (Graph Functions) MGSE9-12.F.IF.7b (Graph square rt, cube rt, piecewise, step & absolute value functions) MGSE9-12.F.IF.7d (Graph rational functions)	exponential models and solve problems MGSE9-12.F.LE.4 (Express exponential models as logarithmic)	MGSE9-12.F.IF.6 (Average rate of change) MGSE9-12.F.IF.9 (Compare 2 functions) Build new functions from existing functions MGSE9-12.F.BF.3 (Build new functions from existing functions)	MGSE9-12.S.IC.4 (Population mean) MGSE9-12.S.IC.5 (Compare 2 treatments) MGSE9-12.S.IC.6 (Evaluate reports based on data)

Collaboration, Communication, Creativity, and Critical Thinking skills are embedded within the language of the Henry Teaching and Learning Standards

HCS Graduate Learner Outcome	***As a Henry County graduate, I will be able to use mathematical practices to help make sense of the real world.***

GA Standard Code

MP.1 **Make sense of problems and persevere in solving them.**

MP.2 **Reason abstractly and quantitatively.**

MP.3 **Construct viable arguments and critique the reasoning of others.**

MP.4 **Model with mathematics.**

MP.5 **Use appropriate tools strategically.**

MP.6 **Attend to precision.**

MP.7 **Look for and make use of structure.**

MP.8 **Look for and express regularity in repeated reasoning.**

HCS Graduate Learner Outcome	***As a Henry County graduate, I will be able to reason, describe, and analyze quantitatively using units and number systems to make sense of and solve problems.***

GA Standard Code

MGSE9-12.N.CN **Perform arithmetic operations with complex numbers.**

MGSE9-12.N.CN.1 Understand there is a complex number i such that $i^2 = -1$, and every complex number has the form a + bi where a and b are real numbers.

MGSE9-12.N.CN.2 Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.

MGSE9-12.N.CN.3 Find the conjugate of a complex number; use the conjugate to find the quotient of complex numbers.

MGSE9-12.N.CN **Use complex numbers in polynomial identities and equations.**

MGSE9-12.N.CN.7 Solve quadratic equations with real coefficients that have complex solutions by (but not limited to) square roots, completing the square, and the quadratic formula.

MGSE9-12.N.CN.8 Extend polynomial identities to include factoring with complex numbers. *For example, rewrite $x^2 + 4$ as $(x + 2i)(x – 2i)$.*

MGSE9-12.N.CN.9 Use the Fundamental Theorem of Algebra to find all roots of a polynomial equation

MGSE9-12.N.RN **Extend the properties of exponents to rational exponents.**

MGSE9-12.N.RN.1 Explain how the meaning of rational exponents follows from extending the properties of integer exponents to rational numbers, allowing for a notation for radicals in terms of rational exponents. For example, we define $5^{\frac{1}{3}}$ to be the cube root of 5 because we want $[5^{\frac{1}{3}}]^3 = 5^{\frac{1}{3}x3}$ to hold, so $[5^{\frac{1}{3}}]^3$ must equal 5.

HCS Graduate Learner Outcome	***As a Henry County graduate, I will be able to create, interpret, use, and analyze patterns of algebraic structures to make sense of problems.***

GA Standard Code

MGSE9-12.A.REI **Understand solving equations as a process of reasoning and explain the reasoning.**

MGSE9-12.A.REI.2 Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.

MGSE9-12.A.REI **Solve equations and inequalities in one variable.**

MGSE9-12.A.REI.4 Solve quadratic equations in one variable.

MGSE9-12.A.REI.4b Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, factoring, completing the square, and the quadratic formula, as appropriate to the initial form of the equation.

MGSE9-12.A.REI **Represent and solve equations and inequalities graphically.**

MGSE9-12.A.REI.11 Using graphs, tables, or successive approximations, show that the solution to the equation f(x) = g(x) is the x-value where the y-values of f(x) and g(x) are the same.

MGSE9-12.N.RN **Extend the properties of exponents to rational exponents.**

MGSE9-12.N.RN.2 Rewrite expressions involving radicals and rational exponents using the properties of exponents.

MGSE9-12.A.SSE **Interpret the structure of expressions.**

MGSE9-12.A.SSE.1 Interpret expressions that represent a quantity in terms of its context.

MGSE9-12.A.SSE.1a Interpret parts of an expression, such as terms, factors, and coefficients, in context.

MGSE9-12.A.SSE.1b Given situations which utilize formulas or expressions with multiple terms and/or factors, interpret the meaning (in context) of individual terms or factors.

MGSE9-12.A.SSE.2 Use the structure of an expression to rewrite it in different equivalent forms. For example, see $x^4 – y^4$ as $(x^2)^2 - (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 – y^2)(x^2 + y^2)$.

MGSE9-12.A.SSE **Write expressions in equivalent forms to solve problems.**

MGSE9-12.A.SSE.3 Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.

MGSE9-12.A.SSE.3c Use the properties of exponents to transform expressions for exponential functions. *For example, the expression* 1.15^t *, where t is in years, can be rewritten as* $[1.15^{\frac{1}{12}}]^{(12t)} \approx 1.012^{(12t)}$ *to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.*

MGSE9-12.A.SSE.4 Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. *For example, calculate mortgage payments.*

MGSE9-12.A.CED **Write expressions in equivalent forms to solve problems.**

MGSE9-12.A.CED.1 Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear, quadratic, simple rational, and exponential functions.

MGSE9-12.A.CED.2 Create linear, quadratic, and exponential equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. (The phrase "in two or more variables" refers to formulas like the compound interest formula, in which $A = P(1 + \frac{r}{n})^{(nt)}$ has multiple variables.)

MGSE9-12.A.CED.3 Represent constraints by equations or inequalities, and by systems of equation and/or inequalities, and interpret data points as possible (i.e. a solution) or not possible (i.e. a non-solution) under the established constraints.

MGSE9-12.A.CED.4 Rearrange formulas to highlight a quantity of interest using the same reasoning as in solving equations. *Examples: Rearrange Ohm's law V = IR to highlight resistance R; Rearrange area of a circle formula* $A = \pi r^2$ *to highlight the radius r.*

MGSE9-12.A.APR **Perform arithmetic operations on polynomials.**

MGSE9-12.A.APR.1 Add, subtract, and multiply polynomials; understand that polynomials form a system analogous to the integers in that they are closed under these operations.

MGSE9-12.A.APR.5 Know and apply that the Binomial Theorem gives the expansion of $(x + y)^n$ in powers of x and y for a positive integer n, where x and y are any numbers, with coefficients determined for example by Pascal's Triangle.

MGSE9-12.A.APR **Rewrite rational expressions.**

MGSE9-12.A.APR.6 Rewrite simple rational expressions in different forms using inspection, long division, or a computer algebra system; write a(x)/b(x) in the form q(x) + r(x)/b(x), where a(x), b(x), q(x), and r(x) are polynomials with the degree of r(x) less than the degree of b(x).

MGSE9-12.A.APR.7 Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.

MGSE9-12.A.APR **Understand the relationship between zeros and factors of polynomials.**

MGSE9-12.A.APR.2 Know and apply the Remainder Theorem: For a polynomial p(x) and a number a, the remainder on division by x – a is p(a), so p(a) = 0 if and only if (x – a) is a factor of p(x).

MGSE9-12.A.APR.3 Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.

MGSE9-12.A.APR **Use polynomial identities to solve problems.**

MGSE9-12.A.APR.4 Prove polynomial identities and use them to describe numerical relationships. *For example, the polynomial identity* $(x^2 + y^2)^2 = (x^2 – y^2)^2 + (2xy)^2$ *can be used to generate Pythagorean triples.*

HCS Graduate Learner Outcome ***As a Henry County graduate, I will be able to use functions to interpret and analyze a variety of contexts.***

GA Standard Code

MGSE9-12.F.IF **Interpret functions that arise in applications in terms of the context.**

MGSE9-12.F.IF.4 Using tables, graphs, and verbal descriptions, interpret the key characteristics of a function which models the relationship between two quantities. Sketch a graph showing key features including: intercepts; interval where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior.

MGSE9-12.F.IF.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.*

MGSE9-12.F.IF.6 Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.

MGSE9-12.F.IF.9 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one function and an algebraic expression for another, say which has the larger maximum.*

MGSE9-12.F.IF **Analyze functions using different representations.**

MGSE9-12.F.IF.7 Graph functions expressed algebraically and show key features of the graph both by hand and by using technology.

MGSE9-12.F.IF.7b Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.

MGSE9-12.F.IF.7c Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.

MGSE9-12.F.IF.7d Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.

MGSE9-12.F.IF.7e Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.

MGSE9-12.F.IF.8 Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

MGSE9-12.F.IF.8b Use the properties of exponents to interpret expressions for exponential functions. *For example, identify percent rate of change in functions such as* $y = (1.02)^t$, $y = (0.97)^t$, $y = (1.01)^{(12t)}$, $y = (1.2)^{(t/10)}$, *and classify them as representing exponential growth and decay.*

MGSE9-12.F.BF Build a function that models a relationship between two quantities.

MGSE9-12.F.BF.1 Write a function that describes a relationship between two quantities.

MGSE9-12.F.BF.1b Combine standard function types using arithmetic operations in contextual situations (Adding, subtracting, and multiplying functions of different types).

MGSE9-12.F.BF.1c Compose functions. *For example, if T(y) is the temperature in the atmosphere as a function of height, and h(t) is the height of a weather balloon as a function of time, then T(h(t)) is the temperature at the location of the weather balloon as a function of time.*

MGSE9-12.F.BF Build new functions from existing functions.

MGSE9-12.F.BF.3 Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.

MGSE9-12.F.BF.4 Find inverse functions.

MGSE9-12.F.BF.4a Solve an equation of the form f(x) = c for a simple function f that has an inverse and write an expression for the inverse. For example, f(x) =2(x3) or f(x) = $\frac{(x+1)}{(x-1)}$ for x ≠ 1.

MGSE9-12.F.BF.4b Verify by composition that one function is the inverse of another.

MGSE9-12.F.BF.4c Read values of an inverse function from a graph or a table, given that the function has an inverse

MGSE9-12.F.BF.5 Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents.

MGSE9-12.F.LE Construct and compare linear, quadratic, and exponential models and solve problems.

MGSE9-12.F.LE.4 For exponential models, express as a logarithm the solution to ab(ct) = d where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.

HCS Graduate Learner Outcome	***As a Henry County graduate, I will be able to use a variety of data analysis and statistics strategies to analyze, develop, and evaluate inferences based on data.***

GA Standard Code		
MGSE9-12.S.ID	**Summarize, represent, and interpret data on a single count or measurement variable.**	
	MGSE9-12.S.ID.2	Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, mean absolute deviation, standard deviation) of two or more different data sets.
	MGSE9-12.S.ID.4	Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.
MGSE9-12.S.IC	**Understand and evaluate random processes underlying statistical experiments.**	
	MGSE9-12.S.IC.1	Understand statistics as a process for making inferences about population parameters based on a random sample from that population.
	MGSE9-12.S.IC.2	Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. *For example, a model says a spinning coin falls heads up with probability 0. 5. Would a result of 5 tails in a row cause you to question the model?*
MGSE9-12.S.IC	**Make inferences and justify conclusions from sample surveys, experiments, and observational studies.**	
	MGSE9-12.S.IC.3	Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.
	MGSE9-12.S.IC.4	Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.
	MGSE9-12.S.IC.5	Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.
	MGSE9-12.S.IC.6	Evaluate reports based on data. For example, determining quantitative or categorical data; collection methods; biases or flaws in data.