Southern Cayuga Central School District – Curriculum Map

Subject: **Algebra II** School Year: 2021-2022

Title or Topics w/ NYS Standards	Essential Questions & Vocabulary	Content Skills (Activities to cover Essential Questions)	Major Assessments (Tests, Project, etc.)	Time Frame
Algebraic Essentials Review • **A-CED.1** Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions. • **N-RN.2** Rewrite expressions involving radicals and rational exponents using the properties of exponents. • **A-SSE.2** Use the structure of an expression to identify ways to rewrite it. 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 $(x^2 - y^2)(x^2 + y^2)$.	• What are basic algebraic rules that must be followed? • How can I manipulate expressions? • What are the different ways of solving linear equations? • How can I use my calculator in an effective way that will reveal further information about the problem? • Variables • Solve • Algebraically • Exponent • Base • Polynomial • Distribution	• Variables, Terms, and Expressions • Solving Linear Equations • Common Algebraic Expressions • Basic Exponent Manipulation • Multiplying Polynomials • Using Tables on Your Calculator	• eMath Homework assignments • Warm Ups • Exit Tickets • Quiz	September
Functions as the Cornerstone of Algebra • **F-BF.4** Find inverse functions. • **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 quadratic function and an algebraic expression for another, say which has the larger maximum. • **F-IF.4** For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key	• What information can I gain by manipulating functions? • What are ways that I can describe a function? • What are different ways of combining two or more functions and why might this be useful? • How can I use my calculator in an effective way that will reveal further information about the problem? • Functions • Composition • Domain • Input • Range • Output	• Introduction to Functions • Function Notation • Function Composition • The Domain and Range of a Function • One to One Functions • Inverse Functions • Key Features of Functions	• eMath Homework assignments • Warm Ups • Exit Tickets • Quiz	September

features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.*	• One-to-one • Inverse			
Linear Functions, Equations, and Their Algebra • **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.* • **F-LE.2** Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table). • **F-LE.5** Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table). • **F-BF.4** Find inverse functions. • **A-REI.6** Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.	• What are the different ways of solving linear equations (or systems of linear equations)? • How can I manipulate the form of a linear function to gain more information about said function? • How can I use a linear function to model real world behavior and what can I learn or predict from that model? • How can I use my calculator in an effective way that will reveal further information about the problem? • Slope • Y-Intercept • Average Rate of Change • Slope-Intercept • Point-Slope • Inverse • Piecewise • Interval • System	• Direct Variation • Average Rate of Change • Forms of a Line • Linear Modeling • Inverses of Linear Functions • Piecewise Linear Functions • Systems of Linear Equations (Primarily 3 by 3)	• eMath Homework assignments • Warm Ups • Exit Tickets • Quiz • Marking Period Exam (Covers Units 1-3)	September - October
Exponential and Logarithmic Functions • **N-RN.2** Rewrite expressions involving radicals and rational exponents using the properties of exponents. • **N-RN.1** Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. For example, we define $5^{1/3}$ to be the cube root of 5 because we want	• How do I manipulate exponents to give me the information that I need? • What are the best ways of solving an exponential function? • How can I model real world scenarios with exponential functions and what can I learn from those models? • How can I use logarithms to make solving exponential equations easier? • How can I manipulate logarithms to give	• Integer Exponents • Rational Exponents • Exponential Function Basics • Finding Equations of Exponentials • The Method of Common Bases • Exponential Modeling with Percent Growth and	• eMath Homework assignments • Warm Ups • Exit Tickets • 2 Quizzes	October - November

$(5^{1/3})^3 = 5(^{1/3})^3$ to hold, so $(5^{1/3})^3$ must equal 5. • **F-LE.5** Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table). • **F-LE.2** Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table). • **A-CED.2** Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. • **A-CED.1** Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions. • **A-SSE.3** Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.* • **F-IF.4** For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.* • **F-IF.7(e)** Graph exponential and logarithmic functions, showing intercepts	me the information that I need? • How can I use my calculator in an effective way that will reveal further information about the problem? • Exponent • Rational • Square Root • Cube Root • Exponential • Exponential Growth • Exponential Decay • Common Base • Percent Growth • Percent Decay • Logarithm • Natural Logarithm • Exponential Form • Logarithmic Form • Compound Interest • Principal • Half-life • Radioactive Decay	Decay • Mindful Percent Manipulations • Introduction to Logarithms • Graphs of Logarithms • Logarithms Laws • Solving Exponential Equations Using Logarithms • The Number e and the Natural Logarithm • Compound Interest • Newton's Law of Cooling		

and end behavior, and trigonometric functions, showing period, midline, and amplitude. • **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. • **F-IF.8** Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. • **F-BF.1(a)** Determine an explicit expression, a recursive process, or steps for calculation from a context. • **F-BF.1(b)** Combine standard function types using arithmetic operations. For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.				
Sequences and Series • **F-IF.3** Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. For example, the Fibonacci sequence is defined recursively by f(0) = f(1) = 1, f(n+1) = f(n) + f(n-1) for n ≥ 1. • **F-BF.2** Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.* • **F-LE.2** Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).	• Can I identify arithmetic and geometric sequences? • What are the different ways of writing a sequence? • How can I find the sum of many numbers? • How can I apply series to real world situations to make problem solving easier? • How can I use my calculator in an effective way that will reveal further information about the problem? • Sequence • Series • Summation • Summation Notation • Arithmetic • Geometric • Interest Rate	• Sequences • Arithmetic and Geometric Sequences • Summation Notation • Arithmetic Series • Geometric Series • Mortgage Payments	• eMath Homework assignments • Warm Ups • Exit Tickets • Quiz • Marking Period Exam (Covers Units 4-5)	November

• **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.*	• Principal • Down Payment • Monthly Payment			
Quadratic Functions and Their Algebra • **F-IF.4** For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.* • **A-SSE.2** Use the structure of an expression to identify ways to rewrite it. 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 $(x^2 - y^2)(x^2 + y^2)$. • **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. • **A-REI.4** Solve quadratic equations in one variable. • **A-CED.1** Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions. • **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	• What are the different ways that I can manipulate a quadratic function? • How can I come up with a quadratic function that models a real world scenario and how do I use that model to learn more information about the situation? • How can I use my calculator in an effective way that will reveal further information about the problem? • Quadratic • Zeros • Roots • X-Intercepts • Factors • Trinomial • Factoring by Grouping • Quadratic Formula • Inequality • Greater than • Less than • Completing the Square • Vertex Form • Vertex • Minimum • Maximum • Center • Radius • Directrix • Focus	• Quadratic Function Review • Factoring • Factoring Trinomials • Complete Factoring • Factoring by Grouping • The Zero Product Law • Quadratic Inequalities in One Variable • Completing the Square and Shifting Parabolas • Modeling with Quadratic Functions • Equations of Circles • The Locus Definition of a Parabola	• eMath Homework assignments • Warm Ups • Exit Tickets • Quiz	December

on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them. • **A-REI.7** Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. For example, find the points of intersection between the line y = -3x and the circle $x^2 + y^2 = 3$. • **G-GPE.2** Derive the equation of a parabola given a focus and directrix.				
Transformations of Functions • **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.	• How do I mathematically indicate that a function has been transformed? • How can I use my calculator in an effective way that will reveal further information about the problem? • Function • Translation • Reflection • Horizontal Stretch • Horizontal Compression • Vertical Stretch • Vertical Compression • Even Function • Odd Function	• Shifting Functions • Reflecting Parabolas • Vertically Stretching Functions • Horizontally Stretching Functions • Even and Odd Functions	• eMath Homework assignments • Warm Ups • Exit Tickets • Quiz • Midterm Exam (Covers Units 1-7)	December – January
Radicals and the Quadratic Formula • **F-IF.4** For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.* • **A-REI.2** Solve simple rational and radical	• How can I solve quadratic equations that cannot be factored or solved via completing the square? • How can I use my calculator in an effective way that will reveal further information about the problem? • Square Root • Quadratic Formula • Exponent • Cube Root • Root	• Square Root Functions • Solving Square Root Equations • The Basic Exponent Properties • Fractional Exponent Properties • More Exponent Practice • The Quadratic Formula • More Work with the Quadratic Formula	• eMath Homework assignments • Warm Ups • Exit Tickets • Quiz	January

equations in one variable, and give examples showing how extraneous solutions may arise. • **N-RN.2** Rewrite expressions involving radicals and rational exponents using the properties of exponents. • **N-RN.1** Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. For example, we define $5^{1/3}$ to be the cube root of 5 because we want $(5^{1/3})^3 = 5(^{1/3})^3$ to hold, so $(5^{1/3})^3$ must equal 5. • **A-REI.4(b)** Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as a ± bi for real numbers a and b.				
Complex Numbers • **N-CN.1** Know there is a complex number i such that $i^2 = -1$, and every complex number has the form a + bi with a and b real. • **N-CN.2** Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers. • **A-REI.4** Solve quadratic equations in one variable. • **N-CN.7** Solve quadratic equations with real coefficients that have complex solutions.	• How do I work with solutions that fall outside of the real number system? • What mathematical properties do imaginary numbers follow? • How can I use my calculator in an effective way that will reveal further information about the problem? • Imaginary Number • Imaginary Unit • Complex Number • Quadratic Formula • Complex Solution • Discriminant • Real • Imaginary • Irrational	• Imaginary Numbers • Complex Numbers • Solving Quadratic Equations with Complex Solutions • The Discriminant of a Quadratic	• eMath Homework assignments • Warm Ups • Exit Tickets • Quiz	January – February

	• Rational • Equal • Unequal			
Polynomial and Rational Functions • **F-IF.4** For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.* • **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. • **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. • **F-IF.7** Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.* • **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. • **A-APR.6** Rewrite simple rational	• How do I generalize the behavior of polynomial functions? • How can I manipulate complex fractions? • How do I divide, or know if I can divide, a polynomial if it is not easily factorable? • How can I use my calculator in an effective way that will reveal further information about the problem? • Power Function • End Behavior • Polynomial Function • Rational Function • Domain • Asymptote • Factoring • Factor • Common Denominator • Least Common Multiple • Complex Fractions • Remainder Theorem • Long Division • Equation • Inequality	• Power Functions • Graphs and Zeroes of a Polynomial • Creating Polynomial Functions • Polynomial Identities • Introduction to Rational Functions • Simplifying Rational Expressions • Multiplying and Dividing Rational Expressions • Combining Rational Expressions Using Addition and Subtraction • Complex Fractions • Polynomial Long Division • The Remainder Theorem • Solving Rational Equations • Solving Rational Inequalities • Reasoning About Radical and Rational Equations	• eMath Homework assignments • Warm Ups • Exit Tickets • 2 Quizzes • Marking Period Exam (Covers Units 9-10)	February – March

expressions in different forms; 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), using inspection, long division, or, for the more complicated examples, a computer algebra system. • **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). • **A-REI.2** Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise. • **A-CED.1** Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions. • **A-REI.1** Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.				
The Circular Functions • **F-TF.1** Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle. • **F-TF.2** Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle. • **F-TF.8** Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and use it to find	• What is a radian and how does that relate to the arc length of circles in the real world? • How do the various trigonometric functions relate to one another? • How can I come up with a trigonometric function that describes a real world scenario and use that function to gain more information about that scenario? • How can I use my calculator in an effective way that will reveal further information about the problem?	• Rotations and Angle Terminology • Radian Angle Measurement • The Unit Circle • The Definition of the Sine and Cosine Functions • More Work with the Sine and Cosine Functions • Basic Graphs of Sine and Cosine	• eMath Homework assignments • Warm Ups • Exit Tickets • 2 Quizzes	March – Apri

sin(θ), cos(θ), or tan(θ) given sin(θ), cos(θ), or tan(θ) and the quadrant of the angle. • **F-TF.5** Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.* • **F-IF.7(e)** Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.	• Sine • Cosine • Tangent • Angle • Degree • Radian • Arc Length • Radius • Unit Circle • Trigonometric • Amplitude • Period • Frequency • Midline • Phase Shift • Cosecant • Secant • Cotangent • Reciprocal	• Vertical Shifting of Sinusoidal Graphs • The Frequency and Period of a Sinusoidal Graph • Sinusoidal Modeling • The Tangent Function • The Reciprocal Functions		
Probability • **S-CP.1** Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events ("or," "and," "not"). • **S-CP.7** Apply the Addition Rule, P(A or B) = P(A) + P(B) - P(A and B), and interpret the answer in terms of the model. • **S-CP.3** Understand the conditional probability of A given B as P(A and B)/P(B), and interpret independence of A and B as saying that the conditional probability of A given B is the same as the probability of A, and the conditional probability of B given A is the same as the probability of B. • **S-CP.4** Construct and interpret two-way frequency tables of data when two categories are associated with each object	• How can I calculate different probabilities and how to they relate to one another? • How can I determine if two events have a relation with one another? • How can I use data to make inferences about connections? • How can I use my calculator in an effective way that will reveal further information about the problem? • Probability • Sets • And • Or • Given • Conditional • Independent • Dependent	• Introduction to Probability • Sets and Probability • Adding Probabilities • Conditional Probability • Independent and Dependent Events • Multiplying Probabilities	• eMath Homework assignments • Warm Ups • Exit Tickets • Quiz • Marking Period Exam (Covers Units 11-12)	April

being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results. • **S-CP.5** Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer. • **S-CP.6** Find the conditional probability of A given B as the fraction of B's outcomes that also belong to A, and interpret the answer in terms of the model. • **S-CP.2** Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent.				
Statistics • **S-IC.3** Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each. • **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	• How can I effectively collect data? • What can I learn from collecting data? • What can I calculate to describe the data that I have collected? • How can I mathematically manipulate my data to learn more information about the topic that I am studying? • Can I say, with statistical confidence, that two variables have a relationship (not necessarily a cause-and-effect	• Variability and Sampling • Population Parameters • The Normal Distributions • The Normal Distributions and Z-Scores • Sample Means • Sample Proportions • The Difference in Samples Means	• eMath Homework assignments • Warm Ups • Exit Tickets • Quiz • Marking Period Exam (Covers Units 1-13)	May

data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve. • **S-IC.1** Understand statistics as a process for making inferences about population parameters based on a random sample from that population. • **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? • **S-IC.5** Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant. • **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. • **S-ID.6(a)** Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models.	relationship)? • Can I determine if two groups of individuals are different? • Can I examine the relationship between two variables in such a way that I learn more information about how those two variables relate (or don't relate) to one another? • How can I use my calculator in an effective way that will reveal further information about the problem? • Sample • Population • Study • Experiment • Mean • Median • Mode • Standard Deviation • Interquartile Range • Outlier • Normal Distribution • Z-Scores • Normalcdf • Percentile • Invnorm • Sample Mean • Sample Proportion • Linear Regression • Exponential Regression • Trigonometric Regression • R-value	• Linear Regression and Lines of Best Fit • Other Types of Regression		