

Course Title:	Algebra II (H)
Grade(s):	9 - 12

Course Description

Students entering this course should have a foundation of linear and quadratic functions from Algebra I. This course is the continuation and extension of Algebra I and Geometry and students will initially build on their work with linear and quadratic functions and apply their understanding of these functions to contextual problems. Students will be introduced to several new functions in this course. They will study the characteristics of these functions both graphically and analytically and use them to model and solve a variety of problems. Functions and topics that will be studied include: functions and their inverses, polynomial functions, rational functions, radical functions, exponential and logarithmic functions, and conic sections. The course will also include some work with data analysis.

Honors Level (H)

Honors-level courses are designed to challenge the advanced learner. Students should expect to reach a deeper scope of skills than the academic class: a higher reading stamina, the motivation to revise work, critical thinking skills, and the propensity to finish complex tasks in a timely manner. Students in honors-level classes are expected to have a solid foundation of skills from previous courses, an ability to connect these skills to new learning, and the ability to apply them in problem-solving. Students taking an honors-level class have demonstrated the ability to take responsibility for their own learning and work fluidly both independently and collaboratively. These students should consistently aspire to achieve higher-level quality work through self-reflection and self-advocacy. These classes are recommended to students by teachers who have evaluated a student's past practice and achievement.

Course Units:

1. Functions
2. Linear Systems
3. Matrices
4. Piecewise and Absolute Value Functions
5. Quadratic Functions
6. Complex Numbers
7. Polynomial Functions
8. Rational Functions
9. Radical Functions

10. Exponential and Logarithmic Functions
11. Conic Sections

Approved Curricular Materials/Textbook(s)

enVision Algebra II Common Core 2018

Unit Title	Unit Description (Include Unit Objectives)	Unit Pacing
Unit 1: FUNCTIONS	This unit will address the following Domains: Interpreting functions and analyzing functions. Students will interpret functions that arise in applications in terms of the context; analyze functions using different representations and build new functions from existing functions. Students will expand their understanding and skills related to functions, equations and graphs. This is a prerequisite of the course that was addressed in Algebra 1, and thus will be reviewed based on students' needs from the pre-assessment. Unit Topics Include: • Relations and Functions • Graph Analysis • Operations with Functions • Composition of Functions • Inverse Relations & Functions	1 week - 2 weeks (August - September)
Unit 2: LINEAR SYSTEMS	This unit addresses the following Domains: Creating Equations and Reasoning with Equations and Inequalities. Students will create equations that describe numbers and relationships; solve systems of equations, represent and solve equations and inequalities graphically. In this unit, students will review the different ways of solving systems of equations graphically and algebraically, and they will learn how to use matrices to solve systems of equations. Most of this unit is a prerequisite of the Algebra 2 course that was addressed in Algebra 1, and thus will be reviewed based on students' needs from the pre-assessment. Unit Topics Include:	2 weeks (September)

	• Solving Systems of Two Equations Graphically (By hand and with a graphing utility) • Solving Systems of Two Equations Algebraically - by Elimination • Solving Systems of Two Equations Algebraically - by Substitution • Applications of Systems of Equations • Solving Systems of Three Equations in Three Variables Algebraically • Solving Systems of Inequalities in Two Variables • Linear Programming	
Unit 3: MATRICES & SOLVING SYSTEMS OF EQUATIONS	Students understand that matrices use rows and columns to organize and represent data. They will learn methods to add, subtract, and multiply matrices, and to solve systems of linear equations with matrices. Unit Topics Include: • Adding and Subtracting Matrices • Multiplying Matrices • Solving Systems of Equations using Matrices	1 week - 2 weeks (October)
Unit 4: PIECEWISE FUNCTIONS & ABSOLUTE VALUE FUNCTIONS	The focus on this topic is extending the concept of functions to include absolute value functions and other piecewise-defined functions. Students identify the characteristics of each of these types of functions and understand that transformations can be applied to these functions. Unit Topics Include: • Piecewise Functions • Absolute Value Equations • Absolute Value Inequalities • Graphing and Analyzing Absolute Value Functions	2 weeks - 3 weeks (October-November)
Unit 5: QUADRATIC FUNCTIONS & EQUATIONS	Students will study quadratic functions represented algebraically in several forms: standard/polynomial form, $f(x) = ax^2 + bx + c$; factored form, $f(x) = a(x - b)(x - c)$; and vertex form, $f(x) = a(x - h)^2$. They will use graphing utilities to analyze the graphs and tables for each of these forms and identify what each form reveals about the function. Once they understand the usefulness of different forms, students will employ algebraic skills to generate equivalent forms. Students will	4 weeks (November - December)

	also explore how changing the parameters in algebraic forms affects the graphs and/or tables of these functions. These are prerequisite skills covered in Algebra 1. • Factoring • Solving Quadratic Equations by Factoring • Solving Quadratic Equations by Square Roots / Simplifying Radicals • Completing the Square and Rewriting Quadratic Expressions • The Quadratic Formula & The Nature of Solutions / Simplifying Radicals • Vertex Form of a Quadratic Function • Intercept Form or Factored Form of a Quadratic Function • Standard Form of a Quadratic Function • Applications of Quadratic Functions • Solving Linear - Quadratic Systems	
Unit 6: COMPLEX NUMBERS	The imaginary unit 'i' is defined as the square root of negative one. Using the imaginary unit i, we can express the square root of any negative number as a real multiple of i. The set of all numbers in the form $a + bi$, with real numbers a and b, and the imaginary unit i, is called the set of complex numbers. Complex numbers can be broken into a real part and an imaginary part. Unit Topics Include: • Introduction to Complex Numbers • Operations with Complex Numbers • Solving Quadratic Equations with Complex Solutions • Writing Quadratic Expressions given Complex Zeros	1 week (December)
Unit 7: POLYNOMIAL FUNCTIONS	This unit addresses the following domains: The complex number system, Seeing structure in expressions, and Arithmetic with polynomials and Rational Expressions. Students will use complex numbers in polynomial identities and equations, interpret the structure of expressions, understand the relationship between zeros and factors of polynomials, and use polynomial identities to solve problems. Polynomial functions are the sum of power functions and can be represented	4 weeks - 5 weeks (January - February)

	symbolically by: $a_n x^n + a_{n-1} x^{n-1} + a_{n-2} x^{n-2} + \dots + a_1 x + a_0$ where n is a whole number, and the coefficients are real numbers. Looking for patterns in tables, graphs, and equations will help develop an understanding of the characteristics of odd and even degree polynomial functions as an extension to power functions. These patterns show the relationship of the degree of the polynomial function to the possible number of zeroes and the general shape of the graphs. The key features of the graph and the relationship to the equation and table provide the basis for developing an understanding of this broader class of polynomial functions. Students will also perform arithmetic operations on polynomials. They will rewrite polynomials in factored form to reveal the zeroes using clues from the tables, graphs, and structures in equations of the functions. They extend their understanding of the relationship between zeroes and factors from quadratics to polynomial functions. They see that for a polynomial $P(x)$, and a number a, $P(a) = 0$ if and only if $(x - a)$ is a factor of $P(x)$. This unit could also include an introduction to the Binomial Theorem and Pascal's Triangle to demonstrate expansion of $(x + a)^n$. Unit Topics Include: • Polynomials - Zeros and End Behaviors • Graphing Polynomial Functions - Intercept or Factored Form • Adding, Subtracting, and Multiplying Polynomials • Factored Form / Standard Form of Polynomials - Finding Zeros • Dividing Polynomials • Zeros of Polynomial Functions / Rational Root Theorem • Graphing Polynomial Functions in Standard Form • Writing Polynomial Functions	
Unit 8: RATIONAL FUNCTIONS	This unit addresses the following domains: Seeing structure in expression; Creating equations; Arithmetic with Polynomial and Rational Expressions; Reasoning with equations and inequalities. Students will interpret the structure of expressions; create equations that describe numbers or relationships; examine the relationship between zeros and factors of a polynomial; use polynomial identities to solve problems; understand solving equations as a process of	3 weeks - 4 weeks (February-March)

	reasoning and explain the reasoning; and represent and solve equations graphically. This unit introduces students to the family of rational functions by building on knowledge of linear, quadratic, and polynomial functions studied extensively in previous units. These familiar function families are used as expressions and combined using the four arithmetic operations in a way that is similar to how integers are combined to form rational numbers. This leads to a general form for rational functions: $f(x) = \frac{g(x)}{h(x)}$, where $g(x)$ and $h(x)$ are polynomial functions. The study of rational functions also creates opportunities for students to engage with beginning concepts of limits, which will be studied in future courses, as they examine the end behavior and behavior near asymptotes. Students should experience both during this unit and be provided with multiple opportunities to use and make connections among graphic, tabular, and symbolic representations of rational functions. In this unit, students also learn to operate on rational expressions and relate to experiences with rational operations. The analogous set of properties with rational numbers provides the rationale for the use of synthetic division and polynomial long division. Operations on rational expressions are presented as tools to better understand features and behaviors of rational functions (e.g., zeros, asymptotes, and end behaviors). Students should have experiences that drive home these ideas and foster both a need for and understanding of procedures. Unit Topics Include: • Simplifying, Multiplying & Dividing Rational Expressions • Adding and Subtracting Rational Expressions • Solving Rational Equations • Inverse Variation and the Reciprocal Function • Graphing Rational Functions	
Unit 9: RADICAL FUNCTIONS & RATIONAL EXPONENTS	This unit addresses the following domains: Seeing structure in expressions, Creating equations, Reasoning with equations and inequalities, Interpreting functions, and Building functions. Students will interpret the structure of expressions; create equations that describe numbers or relationships; analyze functions using different representations; build functions that model the relationship between two quantities; and build new functions from existing	3 weeks - 4 weeks (March - April)

	functions. Unit Topics Include: • Properties of Exponents and Radicals • Roots, Radicals and Rational Exponents / Simplifying Radicals • Multiplication & Division of Radical Expressions and Expressions with Rational Exponents • Addition & Subtraction of Radical Expressions and Expressions with Rational Exponents • Solving Radical Equations & Equations with Rational Exponents • Graphing Radical Functions	
Unit 10: EXPONENTIAL & LOGARITHMIC FUNCTIONS	This unit addresses the following domains: Seeing structure in expression, Creating equations, Reasoning with equations and inequalities. Students will interpret the structure of expressions; write expressions in equivalent forms to solve problems; create equations that describe numbers; and represent and solve equations graphically. What is the connection between exponential and logarithmic functions? What patterns of change are modeled by logarithmic functions as seen in real-world situations, and what tables, graphs, and function rules represent these situations? The study of exponential functions begins in grade 8 and is a key component of the Algebra I curriculum. In Algebra II, students use their understanding of exponential functions with the definition of inverse functions to explore logarithms. The concept of function inverses is linked to the composition of functions. Introducing and using the composition of functions in this unit provides the opportunity to verify whether one function is the inverse of another. Recognizing the inverse relationship between exponential and logarithmic functions will help students to understand the definition of a logarithm; to know and be able to use the properties of logarithms; to make graphical connections between the two functions; and to solve exponential equations not only by using graphs and tables, but also by using the properties of logarithms. Connections to real-world situations are found in looking at situations that use a logarithmic scale to report values such as the Richter scale, the pH scale and the measurement of sound intensity using	3 weeks - 4 weeks (April - May)

	a decibel scale. Unit Topics Include: • Graphing Exponential Functions • Inverse Functions & Logarithms • Graphing Logarithmic Functions • Properties of Logarithms • Exponential and Logarithmic Equations • Exponential Models - Growth & Decay / Geometric Series	
Unit 11: CONIC SECTIONS	This unit addresses the following domains: Interpreting functions and Expressing geometric properties with equations. Students will analyze functions using different representations, and translate between the geometric description and the equation of a conic section. This unit is an extension of the Quadratic Units from Algebra 1. Students will build on prior experiences with quadratic functions (parabolas), graphing, factoring, completing the square, solving and transforming parabolas graphically and algebraically. They will also explore quadratic relations, more commonly known as conic sections, by making connections between algebraic and geometric relationships. Conic sections are all considered quadratic curves because the highest power of any variable is two. Students explore the locus of points that determine the four conic sections and use the distance formula along with geometric descriptions to generate equations for each of the conic sections. Observing the equations (both standard and transformation form) and the resulting graphs should include identifying the type of conic section shown and all of its special properties. Unit Topics Include: • Parabolas • Circles • Ellipses • Hyperbolas	2 weeks - 3 weeks (May - June)