

# Algebra II Honors Course Overview

Content Area: **Math**  
Course(s): **ALGEBRA II H, ALG. II-H**  
Time Period:  
Length: **Full Year**  
Status: **Published**

## Cover

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### **EAST BRUNSWICK PUBLIC SCHOOLS**

**East Brunswick New Jersey**

**Superintendent of Schools**

Dr. Victor P. Valeski

**Mathematics**

**Algebra II Honors-Course Number: 1162**

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**Course Adoption:** 4/21/1986

**Curriculum Adoption:** 11/2/17

**Date of Last Revision Adoption:** 9/1/2017

## **Course Overview**

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### **COURSE DESCRIPTION:**

Algebra is a symbolic language used to express mathematical relationships. Students need to understand how quantities are related to one another, and how algebra can be used to concisely express and analyze those relationships. Modern technology provides tools for supplementing the traditional focus on algebraic procedures, such as solving equations, with a more visual perspective, with graphs of equations displayed on a screen. Students can then focus on understanding the relationship between the equation and the graph, and on what the graph represents in a real-life situation. This course includes the study of patterns involving whole numbers, rational numbers, and integers using tables, rules, graphs and expressions. Appropriate algebraic methods used to solve linear and quadratic equations and linear inequalities will be studied. The focus of the course will center around the ability to graph functions and understand and describe the general behavior of functions. This is one of three courses in which students are enabled and expected to demonstrate mastery of some of the algebraic standards for mathematical content, the other course being Algebra II Accelerated and Algebra II. The Standards for Mathematical Practices are embedded within the instructional strategies, and not delineated specifically by unit.

## **Textbooks and other resources**

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**Textbook:** Big Ideas ALgebra 2 by Larson and Boswell 2019

- Teacher's Resource Package and online resources accompanying text
- TI – 84 graphing calculators



## SCOPE AND SEQUENCE

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UNIT NAME	LEARNING GOALS
	<p><b>Learning Goal 1:</b></p> <p>Solve quadratic equations with real coefficients that have complex solutions by taking square roots, completing the square, factoring, and the quadratic formula.</p> <hr/> <p><b>Learning Goal 2:</b></p> <p>Add, subtract, and multiply complex numbers using the commutative, associative and distributive properties.</p> <hr/>
<p><b>UNIT 1:</b></p> <p><b>Quadratic Equations</b></p>	<p><b>Learning Goal 3:</b></p> <p>Solve simple systems consisting of a linear and quadratic equation in two variables algebraically and graphically.</p> <hr/> <p><b>Learning Goal 4:</b></p> <p>Solve algebraically a system of three linear equations.</p> <hr/> <p><b>Learning Goal 5:</b></p> <p>Graph quadratic functions expressed symbolically and show key features of the graph (including intercepts).</p>
<p><b>UNIT 2:</b></p> <p><b>Families of Functions</b></p>	<p><b>Learning Goal 1:</b></p> <p>Graph absolute value, greatest integer, cubic, piece-wise, and sine and cosine functions.</p> <hr/>

**Learning Goal 2:**

Identify the effect on the graph of replacing  $f(x)$  by  $f(x)+k$ ,  $kf(x)$ ,  $f(kx)$ , and  $f(x+k)$ , including absolute val

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**Learning Goal 3:**

Graph trigonometric functions (sine and cosine specifically) expressed symbolically, showing key feature complicated.

**Learning Goal 1:**

Use an appropriate factoring technique to factor polynomials. Explain the relationship between zeros and function defined by the polynomial.

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**Learning Goal 2:**

Rewrite rational expressions in different forms using inspection, long division, or, for the more complicat

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**UNIT 3:**

**Polynomial Functions**

**Learning Goal 3:**

Apply the Remainder Theorem in order to determine the factors of a polynomial.

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**Learning Goal 4:**

Graph polynomial functions from equations; identify zeros when suitable factorizations are available; sho

**Learning Goal 1:**

Perform operations on rational expressions, including addition, subtraction, multiplication, and division.

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**UNIT 4:**

**Rational Functions**

**Learning Goal 2:**

Solve rational equations and inequalities in one variable, use them to solve problems and show how extrar one variable and use them to solve problems.

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**Learning Goal 3:**

For rational functions, interpret key features of graphs, including intercepts and asymptotes, and sketch gr

**Learning Goal 1:**

**UNIT 5:**

**Inverses and Radicals**

Perform operations on functions, including addition, subtraction, multiplication, division, and compositor

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**Learning Goal 2:**

Determine the inverse function for a function.

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**Learning Goal 3:**

Use properties of integer exponents to explain and convert between expressions involving radicals and rat

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**Learning Goal 4:**

For radical functions, interpret key features of graphs and tables in terms of the quantities, and sketch graf

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**Learning Goal 5:**

Solve radical equations and inequalities in one variable, use them to solve problems and show how extran

**Learning Goal 1:**

Use the mean and standard deviation of a data set to fit it to a normal distribution, estimate population per appropriate (use calculators, spreadsheets, and tables to estimate areas under the normal curve).

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**Learning Goal 2:**

Identify and evaluate random sampling methods.

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**UNIT 6:**

**Statistics**

**Learning Goal 3:**

Identify the differences among and purposes of sample surveys, experiments, and observational studies, e:

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**Learning Goal 4:**

Use two-way frequency tables to determine if events are independent and to calculate conditional probabi in real-world situations.

**Learning Goal 1:**

Graph exponential functions expressed symbolically and show key features of the graph (including interce

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**UNIT 7:**

**Exponential and  
Logarithmic Functions**

**Learning Goal 2:**

Use the properties of exponents to transform expressions for exponential functions, explain properties of t

function.

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**Learning Goal 3:**

Express as a logarithm the solution to  $ab^{ct} = d$  where  $a$ ,  $c$ , and  $d$  are numbers and the base  $b$  is a real number.

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**Learning Goal 4:**

Graph logarithmic functions expressed symbolically and show key features of the graph (including intercepts).

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**Learning Goal 5:**

Solve exponential and logarithmic equations and inequalities using properties of exponents and logarithms.

**Learning Goal 1:**

Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations.

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**Learning Goal 2:**

Use the formula for the sum of a finite and infinite geometric series to solve problems [for example, calculate the sum of a series (when the common ratio is not 1)].

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**UNIT 8: Sequences and Series**

**Learning Goal 3:**

Use the formula for the sum of an arithmetic series to solve problems; derive the formula for the sum of an arithmetic series.

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**Learning Goal 4:**

Use Pascal's Triangle for binomial expansion. (Time Permitting)

**Learning Goal 1:**

Derive the equation of a parabola given a focus and directrix; graph a parabola, identifying the vertex, focus, and directrix.

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**Learning Goal 2:**

Derive the equation of a circle given features of the graph; graph a circle, identifying the radius and center.

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**UNIT 9:  
Conic Sections**

**Learning Goal 3:**

Derive the equation of an ellipse given features of the graph; graph an ellipse, identifying the vertices, co-vertices, and foci.

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#### Learning Goal 4:

Derive the equation of a hyperbola given features of the graph; graph a hyperbola, identifying vertices, co

## NJ Student Learning Standards

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MA.F-BF.A.1b	Combine standard function types using arithmetic operations.
MA.F-BF.B.3	Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$ , $kf(x)$ , $f(kx)$ , 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.
MA.F-BF.B.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.
MA.F-IF.B.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.
MA.F-IF.C.9	Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).
MA.F-IF.C.7b	Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.
MA.F-IF.C.7c	Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.
MA.F-IF.C.7e	Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.
MA.F-IF.C.8a	Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.
MA.F-IF.C.8b	Use the properties of exponents to interpret expressions for exponential functions.
MA.F-LE.A.4	Understand the inverse relationship between exponents and logarithms. For exponential models, express as a logarithm the solution to $ab$ to the $ct$ power = $d$ where $a$ , $c$ , and $d$ are numbers and the base $b$ is 2, 10, or $e$ ; evaluate the logarithm using technology.
MA.F-TF.A.1	Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.
MA.F-TF.C.8	Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and use it to find $\sin(\theta)$ , $\cos(\theta)$ , or $\tan(\theta)$ given $\sin(\theta)$ , $\cos(\theta)$ , or $\tan(\theta)$ and the quadrant of the angle.
MA.N-CN.C.7	Solve quadratic equations with real coefficients that have complex solutions.
MA.N-CN.C.9	Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.
MA.N-RN.A.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.
MA.N-RN.A.2	Rewrite expressions involving radicals and rational exponents using the properties of

exponents.

MA.S-IC.A.1	Understand statistics as a process for making inferences about population parameters based on a random sample from that population.
MA.S-IC.A.2	Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation.
MA.S-IC.B	Make inferences and justify conclusions from sample surveys, experiments, and observational studies
MA.S-IC.B.3	Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.
MA.S-IC.B.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.
MA.S-IC.B.5	Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.
MA.S-IC.B.6	Evaluate reports based on data.
MA.S-ID.A.1	Represent data with plots on the real number line (dot plots, histograms, and box plots).
MA.S-ID.A.2	Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.
MA.S-ID.A.3	Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).
MA.S-ID.A.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.
MA.A-APR.B.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 $p(x)$ .
MA.A-APR.B.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.
MA.A-APR.C.5	Know and apply the Binomial Theorem for 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.
MA.A-APR.D.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.
MA.A-CED.A.1	Create equations and inequalities in one variable and use them to solve problems.
MA.A-CED.A.2	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
MA.A-CED.A.3	Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context.
MA.A-CED.A.4	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.
MA.A-REI.A.2	Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.
MA.A-SSE.A.1	Interpret expressions that represent a quantity in terms of its context.
MA.A-SSE.A.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 $(x^2 - y^2)(x^2 + y^2)$ .



MA.A-SSE.A.1a	Interpret parts of an expression, such as terms, factors, and coefficients.
MA.A-SSE.A.1b	Interpret complicated expressions by viewing one or more of their parts as a single entity.
MA.A-SSE.B.4	Derive and/or explain the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems.

## **Standards for Mathematical Practices**

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MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.K-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.K-12.8	Look for and express regularity in repeated reasoning.

## **Grading and Evaluation Guidelines**

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### **GRADING GUIDELINES:**

As per Math Department Policy, grades will be determined by a variety of assessment strategies, including Major Assessments, Minor Assessments, and Performance Assessments. In addition to tests and quizzes, students will be evaluated on a combination of performance assessment instruments, including homework completions, cooperative group participation, note-taking, open ended question responses, lab reports and/or supplemental projects.

### **GRADING PROCEDURES:**

Grading procedures must be described in sufficient detail so that a pupil will understand, the minimal to advanced proficiency, expected of him/her as the outcome of each unit, for the marking period and for the course as a whole. Benchmark level assessments associated with the course also need to be identified. While assessments of proficiency levels must be valid and reliable they do not need be the same for all students. Other criteria to be considered in grading must be identified and the degree to which such criteria will be considered in a grade. Each pupil must receive a copy of the grading procedures, proficiencies and criteria for each unit and/or marking period.

### **COURSE EVALUATION:**

Course achievement will be evaluated as the percent of all pupils who achieve the minimum level of proficiency (final average grade) in the course. Student achievement levels above minimum proficiency will also be reported. Final grades, and where relevant mid-term and final exams, will be analyzed by staff for the total cohort and for sub-groups of students to determine course areas requiring greater support or modification.

**In terms of proficiency the East Brunswick grades are as follows:**

<b>A</b>	<b>Excellent</b>	<b>Advanced Proficient</b>
<b>B</b>	<b>Good</b>	<b>Above Average Proficient</b>
<b>C</b>	<b>Fair</b>	<b>Proficient</b>
<b>D</b>	<b>Poor</b>	<b>Minimally Proficient</b>
<b>F</b>	<b>Failing</b>	<b>Partially Proficient</b>

In this course the goal is that a minimum of 95% of the pupil's will meet at least the minimum proficiency level (D or better) set for the course. The department will analyze the achievement of students on Unit Assessments, Mid-term and Final Exams and Final Course Grades, and for Final Course Grades the achievement of sub-groups identified by the state to determine if modifications in the curriculum and instructional methods are needed.

**Course evaluation requires the answering of the following questions:**

1. Are course content, instruction and assessments aligned with the required NJSLs?
2. Is instruction sufficient for students to achieve the Standards?
3. Do all students achieve the set proficiencies/benchmarks set for the course?

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**Other Details**

**SCED**

**02056 Algebra II Honors**

Algebra II course topics typically include field properties and theorems; set theory; operations with rational and irrational expressions; factoring of rational expressions; in-depth study of linear equations and inequalities; quadratic equations; solving systems of linear and quadratic equations; graphing of constant, linear, and quadratic equations; properties of higher degree equations; and operations with rational and irrational exponents.