



## Algebra 2 Honors

### Version Description

In Algebra 2 Honors, instructional time will emphasize six areas:

- (1) developing understanding of the complex number system, including complex numbers as roots of polynomial equations;
- (2) extending arithmetic operations with algebraic expressions to include polynomial division, radical and rational expressions;
- (3) graphing and analyzing functions including polynomials, absolute value, radical, rational, exponential and logarithmic;
- (4) extending systems of equations and inequalities to include non-linear expressions;
- (5) building functions using compositions, inverses and transformations and
- (6) developing understanding of probability concepts.

Curricular content for all subjects must integrate critical-thinking, problem-solving, and workforce-literacy skills; communication, reading, and writing skills; mathematics skills; collaboration skills; contextual and applied-learning skills; technology-literacy skills; information and media-literacy skills; and civic-engagement skills.

*All clarifications stated, whether general or specific to Algebra 2 Honors, are expectations for instruction of that benchmark.*

### General Notes

Honors and Accelerated Level Course Note: Accelerated courses require a greater demand on students through increased academic rigor. Academic rigor is obtained through the application, analysis, evaluation, and creation of complex ideas that are often abstract and multi-faceted. Students are challenged to think and collaborate critically on the content they are learning. Honors level rigor will be achieved by increasing text complexity through text selection, focus on high-level qualitative measures, and complexity of task. Instruction will be structured to give students a deeper understanding of conceptual themes and organization within and across disciplines. Academic rigor is more than simply assigning to students a greater quantity of work.

Florida's Benchmarks for Excellent Student Thinking (B.E.S.T.) Standards: This course includes Florida's B.E.S.T. ELA Expectations (EE) and Mathematical Thinking and Reasoning Standards (MTRs) for students. Florida educators should intentionally embed these standards within the content and their instruction as applicable. For guidance on the implementation of the EEs and MTRs, please visit [https://www.cpalms.org/Standards/BEST\\_Standards.aspx](https://www.cpalms.org/Standards/BEST_Standards.aspx) and select the appropriate B.E.S.T. Standards package.

English Language Development ELD Standards Special Notes Section: Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Mathematics. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and



discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL’s need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link:

<https://cpalmsmediaproduct.blob.core.windows.net/uploads/docs/standards/eld/ma.pdf>.

**General Information**

Course Number: 1200340	Course Type: Core Academic Course
Course Length: Year (Y)	Course Level: 3
Course Attributes: Honors	Grade Level(s): 9, 10, 11, 12
Graduation Requirement: Mathematics	Number of Credits: One (1) credit
Course Path: Section   Grades PreK to 12 Education Courses > Grade Group   Grades 9 to 12 and Adult Education Courses > Subject   Mathematics > SubSubject   Algebra > Abbreviated Title   ALG 2 H	
Educator Certification: Mathematics (Grades 6-12)	

**Course Standards and Benchmarks**

**Mathematical Thinking and Reasoning**

***MA.K12.MTR.1.1 Actively participate in effortful learning both individually and collectively.***

Mathematicians who participate in effortful learning both individually and with others:

- Analyze the problem in a way that makes sense given the task.
- Ask questions that will help with solving the task.
- Build perseverance by modifying methods as needed while solving a challenging task.
- Stay engaged and maintain a positive mindset when working to solve tasks.
- Help and support each other when attempting a new method or approach.

Clarifications:

Teachers who encourage students to participate actively in effortful learning both individually and with others:

- Cultivate a community of growth mindset learners.
- Foster perseverance in students by choosing tasks that are challenging.
- Develop students’ ability to analyze and problem solve.
- Recognize students’ effort when solving challenging problems.



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***MA.K12.MTR.2.1 Demonstrate understanding by representing problems in multiple ways.***

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Mathematicians who demonstrate understanding by representing problems in multiple ways:

- Build understanding through modeling and using manipulatives.
- Represent solutions to problems in multiple ways using objects, drawings, tables, graphs and equations.
- Progress from modeling problems with objects and drawings to using algorithms and equations.
- Express connections between concepts and representations.
- Choose a representation based on the given context or purpose.

Clarifications:

Teachers who encourage students to demonstrate understanding by representing problems in multiple ways:

- Help students make connections between concepts and representations.
- Provide opportunities for students to use manipulatives when investigating concepts.
- Guide students from concrete to pictorial to abstract representations as understanding progresses.
- Show students that various representations can have different purposes and can be useful in different situations.

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***MA.K12.MTR.3.1 Complete tasks with mathematical fluency.***

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Mathematicians who complete tasks with mathematical fluency:

- Select efficient and appropriate methods for solving problems within the given context.
- Maintain flexibility and accuracy while performing procedures and mental calculations.
- Complete tasks accurately and with confidence.
- Adapt procedures to apply them to a new context.
- Use feedback to improve efficiency when performing calculations.

Clarifications:

Teachers who encourage students to complete tasks with mathematical fluency:

- Provide students with the flexibility to solve problems by selecting a procedure that allows them to solve efficiently and accurately.
  - Offer multiple opportunities for students to practice efficient and generalizable methods.
  - Provide opportunities for students to reflect on the method they used and determine if a more efficient method could have been used.
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***MA.K12.MTR.4.1 Engage in discussions that reflect on the mathematical thinking of self and others.***

Mathematicians who engage in discussions that reflect on the mathematical thinking of self and others:

- Communicate mathematical ideas, vocabulary and methods effectively.
- Analyze the mathematical thinking of others.
- Compare the efficiency of a method to those expressed by others.
- Recognize errors and suggest how to correctly solve the task.
- Justify results by explaining methods and processes.
- Construct possible arguments based on evidence.

Clarifications:

Teachers who encourage students to engage in discussions that reflect on the mathematical thinking of self and others:

- Establish a culture in which students ask questions of the teacher and their peers, and error is an opportunity for learning.
- Create opportunities for students to discuss their thinking with peers.
- Select, sequence and present student work to advance and deepen understanding of correct and increasingly efficient methods.
- Develop students' ability to justify methods and compare their responses to the responses of their peers.

***MA.K12.MTR.5.1 Use patterns and structure to help understand and connect mathematical concepts.***

Mathematicians who use patterns and structure to help understand and connect mathematical concepts:

- Focus on relevant details within a problem.
- Create plans and procedures to logically order events, steps or ideas to solve problems.
- Decompose a complex problem into manageable parts.
- Relate previously learned concepts to new concepts.
- Look for similarities among problems.
- Connect solutions of problems to more complicated large-scale situations.

Clarifications:

Teachers who encourage students to use patterns and structure to help understand and connect mathematical concepts:

- Help students recognize the patterns in the world around them and connect these patterns to mathematical concepts.
- Support students to develop generalizations based on the similarities found among problems.
- Provide opportunities for students to create plans and procedures to solve problems.
- Develop students' ability to construct relationships between their current understanding and more sophisticated ways of thinking.



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***MA.K12.MTR.6.1 Assess the reasonableness of solutions.***

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Mathematicians who assess the reasonableness of solutions:

- Estimate to discover possible solutions.
- Use benchmark quantities to determine if a solution makes sense.
- Check calculations when solving problems.
- Verify possible solutions by explaining the methods used.
- Evaluate results based on the given context.

Clarifications:

Teachers who encourage students to assess the reasonableness of solutions:

- Have students estimate or predict solutions prior to solving.
- Prompt students to continually ask, “Does this solution make sense? How do you know?”
- Reinforce that students check their work as they progress within and after a task.
- Strengthen students’ ability to verify solutions through justifications.

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***MA.K12.MTR.7.1 Apply mathematics to real-world contexts.***

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Mathematicians who apply mathematics to real-world contexts:

- Connect mathematical concepts to everyday experiences.
- Use models and methods to understand, represent and solve problems.
- Perform investigations to gather data or determine if a method is appropriate.
- Redesign models and methods to improve accuracy or efficiency.

Clarifications:

Teachers who encourage students to apply mathematics to real-world contexts:

- Provide opportunities for students to create models, both concrete and abstract, and perform investigations.
- Challenge students to question the accuracy of their models and methods.
- Support students as they validate conclusions by comparing them to the given situation.
- Indicate how various concepts can be applied to other disciplines.

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**ELA Expectations**

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***ELA.K12.EE.1.1 Cite evidence to explain and justify reasoning.***

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***ELA.K12.EE.2.1 Read and comprehend grade-level complex texts proficiently.***

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***ELA.K12.EE.3.1 Make inferences to support comprehension.***

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***ELA.K12.EE.4.1 Use appropriate collaborative techniques and active listening skills when engaging in discussions in a variety of situations.***

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***ELA.K12.EE.5.1 Use the accepted rules governing a specific format to create quality work.***

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***ELA.K12.EE.6.1 Use appropriate voice and tone when speaking or writing.***

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## English Language Development

***ELD.K12.ELL.MA Language of Mathematics***

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**ELD.K12.ELL.MA.1** English language learners communicate information, ideas and concepts necessary for academic success in the content area of Mathematics.

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## Number Sense and Operations

***MA.912.NSO.1 Generate equivalent expressions and perform operations with expressions involving exponents, radicals or logarithms.***

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**MA.912.NSO.1.3** Generate equivalent algebraic expressions involving radicals or rational exponents using the properties of exponents.

Benchmark Clarifications:

*Clarification 1:* Within the Algebra 2 course, radicands are limited to monomial algebraic expressions.

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**MA.912.NSO.1.5** Add, subtract, multiply and divide algebraic expressions involving radicals.

Benchmark Clarifications:

*Clarification 1:* Within the Algebra 2 course, radicands are limited to monomial algebraic expressions.

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**MA.912.NSO.1.6** Given a numerical logarithmic expression, evaluate and generate equivalent numerical expressions using the properties of logarithms or exponents.

Benchmark Clarifications:

*Clarification 1:* Within the Mathematics for Data and Financial Literacy Honors course, problem types focus on money and business.

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MA.912.NSO.1.7 Given an algebraic logarithmic expression, generate an equivalent algebraic expression using the properties of logarithms or exponents.

Benchmark Clarifications:

*Clarification 1:* Within the Mathematics for Data and Financial Literacy Honors course, problem types focus on money and business.

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***MA.912.NSO.2 Represent and perform operations with expressions within the complex number system.***

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MA.912.NSO.2.1 Extend previous understanding of the real number system to include the complex number system. Add, subtract, multiply and divide complex numbers.

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***MA.912.NSO.4 Represent and perform operations with matrices.***

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MA.912.NSO.4.1 Given a mathematical or real-world context, represent and manipulate data using matrices.

MA.912.NSO.4.2 Given a mathematical or real-world context, represent and solve a system of two- or three-variable linear equations using matrices.

MA.912.NSO.4.3 Solve mathematical and real-world problems involving addition, subtraction and multiplication of matrices.

Benchmark Clarifications:

*Clarification 1:* Instruction includes identifying and using the additive and multiplicative identities for matrices.

MA.912.NSO.4.4 Solve mathematical and real-world problems using the inverse and determinant of matrices.

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## Algebraic Reasoning

### **MA.912.AR.1 Interpret and rewrite algebraic expressions and equations in equivalent forms.**

MA.912.AR.1.1 Identify and interpret parts of an equation or expression that represent a quantity in terms of a mathematical or real-world context, including viewing one or more of its parts as a single entity.

*Algebra 1 Example:* Derrick is using the formula  $P = 1000(1 + .1)^t$  to make a prediction about the camel population in Australia. He identifies the growth factor as  $(1 + .1)$ , or 1.1, and states that the camel population will grow at an annual rate of 10% per year.

*Example:* The expression  $1.15^t$  can be rewritten as  $\left(1.15^{\frac{1}{12}}\right)^{12t}$  which is approximately equivalent to  $1.012^{12t}$ . This latter expression reveals the approximate equivalent monthly interest rate of 1.2% if the annual rate is 15%.

#### Benchmark Clarifications:

*Clarification 1:* Parts of an expression include factors, terms, constants, coefficients and variables.

*Clarification 2:* Within the Mathematics for Data and Financial Literacy course, problem types focus on money and business.

MA.912.AR.1.3 Add, subtract and multiply polynomial expressions with rational number coefficients.

#### Benchmark Clarifications:

*Clarification 1:* Instruction includes an understanding that when any of these operations are performed with polynomials the result is also a polynomial.

*Clarification 2:* Within the Algebra 1 course, polynomial expressions are limited to 3 or fewer terms.

MA.912.AR.1.5 Divide polynomial expressions using long division, synthetic division or algebraic manipulation.

MA.912.AR.1.6 Solve mathematical and real-world problems involving addition, subtraction, multiplication or division of polynomials.

MA.912.AR.1.8 Rewrite a polynomial expression as a product of polynomials over the real or complex number system.

#### Benchmark Clarifications:

*Clarification 1:* Instruction includes factoring a sum or difference of squares and a sum or difference of cubes.



MA.912.AR.1.9 Apply previous understanding of rational number operations to add, subtract, multiply and divide rational algebraic expressions.

**Benchmark Clarifications:**

*Clarification 1:* Instruction includes the connection to fractions and common denominators.

MA.912.AR.1.11 Apply the Binomial Theorem to create equivalent polynomial expressions.

**Benchmark Clarifications:**

*Clarification 1:* Instruction includes the connection to Pascal's Triangle and to combinations.

**MA.912.AR.3 Write, solve and graph quadratic equations, functions and inequalities in one and two variables.**

MA.912.AR.3.2 Given a mathematical or real-world context, write and solve one-variable quadratic equations over the real and complex number systems.

**Benchmark Clarifications:**

*Clarification 1:* Within this benchmark, the expectation is to solve by factoring techniques, taking square roots, the quadratic formula and completing the square.

MA.912.AR.3.3 Given a mathematical or real-world context, write and solve one-variable quadratic inequalities over the real number system. Represent solutions algebraically or graphically.

MA.912.AR.3.4 Write a quadratic function to represent the relationship between two quantities from a graph, a written description or a table of values within a mathematical or real-world context.

*Algebra I Example:* Given the table of values below from a quadratic function, write an equation of that function.

$x$	-2	-1	0	1	2
$f(x)$	2	-1	-2	-1	2

**Benchmark Clarifications:**

*Clarification 1:* Within the Algebra 1 course, a graph, written description or table of values must include the vertex and two points that are equidistant from the vertex.

*Clarification 2:* Instruction includes the use of standard form, factored form and vertex form.

*Clarification 3:* Within the Algebra 2 course, one of the given points must be the vertex or an  $x$ -intercept.



MA.912.AR.3.8 Solve and graph mathematical and real-world problems that are modeled with quadratic functions. Interpret key features and determine constraints in terms of the context.

*Algebra 1 Example:* The value of a classic car produced in 1972 can be modeled by the function  $V(t) = 19.25t^2 - 440t + 3500$ , where  $t$  is the number of years since 1972. In what year does the car's value start to increase?

**Benchmark Clarifications:**

*Clarification 1:* Key features are limited to domain; range; intercepts; intervals where the function is increasing, decreasing, positive or negative; end behavior; vertex; and symmetry.

*Clarification 2:* Instruction includes the use of standard form, factored form and vertex form.

*Clarification 3:* Instruction includes representing the domain, range and constraints with inequality notation, interval notation or set-builder notation.

*Clarification 4:* Within the Algebra 1 course, notations for domain and range are limited to inequality and set-builder.

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MA.912.AR.3.9 Given a mathematical or real-world context, write two-variable quadratic inequalities to represent relationships between quantities from a graph or a written description.

**Benchmark Clarifications:**

*Clarification 1:* Instruction includes the use of standard form, factored form and vertex form where any inequality symbol can be represented.

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MA.912.AR.3.10 Given a mathematical or real-world context, graph the solution set to a two-variable quadratic inequality.

**Benchmark Clarifications:**

*Clarification 1:* Instruction includes the use of standard form, factored form and vertex form where any inequality symbol can be represented.

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***MA.912.AR.4 Write, solve and graph absolute value equations, functions and inequalities in one and two variables.***

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MA.912.AR.4.2 Given a mathematical or real-world context, write and solve one-variable absolute value inequalities. Represent solutions algebraically or graphically.

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MA.912.AR.4.4 Solve and graph mathematical and real-world problems that are modeled with absolute value functions. Interpret key features and determine constraints in terms of the context.

**Benchmark Clarifications:**

*Clarification 1:* Key features are limited to domain; range; intercepts; intervals where the function is increasing, decreasing, positive or negative; vertex; end behavior and symmetry.

*Clarification 2:* Instruction includes representing the domain, range and constraints with inequality notation, interval notation or set-builder notation.

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**MA.912.AR.5 Write, solve and graph exponential and logarithmic equations and functions in one and two variables.**

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MA.912.AR.5.2 Solve one-variable equations involving logarithms or exponential expressions. Interpret solutions as viable in terms of the context and identify any extraneous solutions.

MA.912.AR.5.4 Write an exponential function to represent a relationship between two quantities from a graph, a written description or a table of values within a mathematical or real-world context.

**Benchmark Clarifications:**

*Clarification 1:* Within the Algebra 1 course, exponential functions are limited to the forms  $f(x) = ab^x$ , where  $b$  is a whole number greater than 1 or a unit fraction, or  $f(x) = a(1 \pm r)^x$ , where  $0 < r < 1$ .

*Clarification 2:* Within the Algebra 1 course, tables are limited to having successive nonnegative integer inputs so that the function may be determined by finding ratios between successive outputs.

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MA.912.AR.5.5 Given an expression or equation representing an exponential function, reveal the constant percent rate of change per unit interval using the properties of exponents. Interpret the constant percent rate of change in terms of a real-world context.

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MA.912.AR.5.7 Solve and graph mathematical and real-world problems that are modeled with exponential functions. Interpret key features and determine constraints in terms of the context.

*Example:* The graph of the function  $f(t) = e^{5t+2}$  can be transformed into the straight line  $y = 5t + 2$  by taking the natural logarithm of the function's outputs.

**Benchmark Clarifications:**

*Clarification 1:* Key features are limited to domain; range; intercepts; intervals where the function is increasing, decreasing, positive or negative; constant percent rate of change; end behavior and asymptotes.

*Clarification 2:* Instruction includes representing the domain, range and constraints with inequality notation, interval notation or set-builder notation.

*Clarification 3:* Instruction includes understanding that when the logarithm of the dependent variable is taken and graphed, the exponential function will be transformed into a linear function.

*Clarification 4:* Within the Mathematics for Data and Financial Literacy course, problem types focus on money and business.

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MA.912.AR.5.8 Given a table, equation or written description of a logarithmic function, graph that function and determine its key features.

**Benchmark Clarifications:**

*Clarification 1:* Key features are limited to domain; range; intercepts; intervals where the function is increasing, decreasing, positive or negative; end behavior; and asymptotes.

*Clarification 2:* Instruction includes representing the domain and range with inequality notation, interval notation or set-builder notation.

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MA.912.AR.5.9 Solve and graph mathematical and real-world problems that are modeled with logarithmic functions. Interpret key features and determine constraints in terms of the context.

**Benchmark Clarifications:**

*Clarification 1:* Key features are limited to domain; range; intercepts; intervals where the function is increasing, decreasing, positive or negative; end behavior; and asymptotes.

*Clarification 2:* Instruction includes representing the domain, range and constraints with inequality notation, interval notation or set-builder notation.

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***MA.912.AR.6 Solve and graph polynomial equations and functions in one and two variables.***

MA.912.AR.6.1 Given a mathematical or real-world context, when suitable factorization is possible, solve one-variable polynomial equations of degree 3 or higher over the real and complex number systems.



MA.912.AR.6.2 Explain and apply the Remainder Theorem to solve mathematical and real-world problems.

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MA.912.AR.6.5 Sketch a rough graph of a polynomial function of degree 3 or higher using zeros, multiplicity and knowledge of end behavior.

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***MA.912.AR.7 Solve and graph radical equations and functions in one and two variables.***

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MA.912.AR.7.1 Solve one-variable radical equations. Interpret solutions as viable in terms of context and identify any extraneous solutions.

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MA.912.AR.7.2 Given a table, equation or written description of a square root or cube root function, graph that function and determine its key features.

Benchmark Clarifications:

*Clarification 1:* Key features are limited to domain; range; intercepts; intervals where the function is increasing, decreasing, positive or negative; end behavior; and relative maximums and minimums.

*Clarification 2:* Instruction includes representing the domain and range with inequality notation, interval notation or set-builder notation.

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MA.912.AR.7.3 Solve and graph mathematical and real-world problems that are modeled with square root or cube root functions. Interpret key features and determine constraints in terms of the context.

Benchmark Clarifications:

*Clarification 1:* Key features are limited to domain; range; intercepts; intervals where the function is increasing, decreasing, positive or negative; end behavior; and relative maximums and minimums.

*Clarification 2:* Instruction includes representing the domain, range and constraints with inequality notation, interval notation or set-builder notation.

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***MA.912.AR.8 Solve and graph rational equations and functions in one and two variables.***

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MA.912.AR.8.1 Write and solve one-variable rational equations. Interpret solutions as viable in terms of the context and identify any extraneous solutions.

Benchmark Clarifications:

*Clarification 1:* Within the Algebra 2 course, numerators and denominators are limited to linear and quadratic expressions.

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MA.912.AR.8.2 Given a table, equation or written description of a rational function, graph that function and determine its key features.

Benchmark Clarifications:

*Clarification 1:* Key features are limited to domain; range; intercepts; intervals where the function is increasing, decreasing, positive or negative; end behavior; and asymptotes.

*Clarification 2:* Instruction includes representing the domain and range with inequality notation, interval notation or set-builder notation.

*Clarification 3:* Within the Algebra 2 course, numerators and denominators are limited to linear and quadratic expressions.

MA.912.AR.8.3 Solve and graph mathematical and real-world problems that are modeled with rational functions. Interpret key features and determine constraints in terms of the context.

Benchmark Clarifications:

*Clarification 1:* Key features are limited to domain; range; intercepts; intervals where the function is increasing, decreasing, positive or negative; end behavior; and asymptotes.

*Clarification 2:* Instruction includes representing the domain, range and constraints with inequality notation, interval notation or set-builder notation.

*Clarification 3:* Instruction includes using rational functions to represent inverse proportional relationships.

*Clarification 4:* Within the Algebra 2 course, numerators and denominators are limited to linear and quadratic expressions.

**MA.912.AR.9 Write and solve a system of two- and three-variable equations and inequalities that describe quantities or relationships.**

MA.912.AR.9.2 Given a mathematical or real-world context, solve a system consisting of a two-variable linear equation and a non-linear equation algebraically or graphically.

MA.912.AR.9.3 Given a mathematical or real-world context, solve a system consisting of two-variable non-linear equations algebraically or graphically.

Benchmark Clarifications:

*Clarification 1:* Within the Algebra 2 course, non-linear equations are limited to quadratic equations.

MA.912.AR.9.5 Graph the solution set of a system of two-variable inequalities.

Benchmark Clarifications:

*Clarification 1:* Within the Algebra 2 course, two-variable inequalities are limited to linear and quadratic.



- MA.912.AR.9.7 Given a real-world context, represent constraints as systems of linear and non-linear equations or inequalities. Interpret solutions to problems as viable or non-viable options.

**Benchmark Clarifications:**

*Clarification 1:* Instruction focuses on analyzing a given function that models a real-world situation and writing constraints that are represented as non-linear equations or non-linear inequalities.

*Clarification 2:* Within the Algebra 2 course, non-linear equations and inequalities are limited to quadratic.

- MA.912.AR.9.10 Solve and graph mathematical and real-world problems that are modeled with piecewise functions. Interpret key features and determine constraints in terms of the context.

*Example:* A mechanic wants to place an ad in his local newspaper. The cost, in dollars, of an ad  $x$  inches long is given by the following piecewise function. Find the cost of an ad that would be 16 inches long.

$$C(x) = \begin{cases} 12x, & x < 5 \\ 60 + 8(x - 5), & x \geq 5 \end{cases}$$

**Benchmark Clarifications:**

*Clarification 1:* Key features are limited to domain, range, intercepts, asymptotes and end behavior.

*Clarification 2:* Instruction includes representing the domain, range and constraints with inequality notation, interval notation or set-builder notation.

**MA.912.AR.10 Solve problems involving sequences and series.**

- MA.912.AR.10.1 Given a mathematical or real-world context, write and solve problems involving arithmetic sequences.

*Example:* Tara is saving money to move out of her parent's house. She opens the account with \$250 and puts \$100 into a savings account every month after that. Write the total amount of money she has in her account after each month as a sequence. In how many months will she have at least \$3,000?

- MA.912.AR.10.2 Given a mathematical or real-world context, write and solve problems involving geometric sequences.

*Example:* A bacteria in a Petri dish initially covers 2 square centimeters. The bacteria grows at a rate of 2.6% every day. Determine the geometric sequence that describes the area covered by the bacteria after 0, 1, 2, 3 ... days. Determine, using technology, how many days it would take the bacteria to cover 10 square centimeters.



## Functions

### **MA.912.F.1 Understand, compare and analyze properties of functions.**

- MA.912.F.1.1 Given an equation or graph that defines a function, determine the function type.  
Given an input-output table, determine a function type that could represent it.

Benchmark Clarifications:

*Clarification 1:* Within the Algebra 1 course, functions represented as tables are limited to linear, quadratic and exponential.

*Clarification 2:* Within the Algebra 1 course, functions represented as equations or graphs are limited to vertical or horizontal translations or reflections over the  $x$ -axis of the following parent functions:

$$f(x) = x, f(x) = x^2, f(x) = x^3, f(x) = \sqrt{x}, f(x) = \sqrt[3]{x}, f(x) = |x|, f(x) = 2^x \text{ and } f(x) = \left(\frac{1}{2}\right)^x.$$

- MA.912.F.1.7 Compare key features of two functions each represented algebraically, graphically, in tables or written descriptions.

Benchmark Clarifications:

*Clarification 1:* Key features include domain; range; intercepts; intervals where the function is increasing, decreasing, positive or negative; end behavior and asymptotes.

- MA.912.F.1.9 Determine whether a function is even, odd or neither when represented algebraically, graphically or in a table.

### **MA.912.F.2 Identify and describe the effects of transformations on functions. Create new functions given transformations.**

- MA.912.F.2.2 Identify the effect on the graph of a given function of two or more transformations defined by adding a real number to the  $x$ - or  $y$ -values or multiplying the  $x$ - or  $y$ -values by a real number.

- MA.912.F.2.3 Given the graph or table of  $f(x)$  and the graph or table of  $f(x) + k$ ,  $kf(x)$ ,  $f(kx)$  and  $f(x + k)$ , state the type of transformation and find the value of the real number  $k$ .

Benchmark Clarifications:

*Clarification 1:* Within the Algebra 1 course, functions are limited to linear, quadratic and absolute value.

- MA.912.F.2.5 Given a table, equation or graph that represents a function, create a corresponding table, equation or graph of the transformed function defined by adding a real number to the  $x$ - or  $y$ -values or multiplying the  $x$ - or  $y$ -values by a real number.

**MA.912.F.3 Create new functions from existing functions.**

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MA.912.F.3.2 Given a mathematical or real-world context, combine two or more functions, limited to linear, quadratic, exponential and polynomial, using arithmetic operations. When appropriate, include domain restrictions for the new function.

**Benchmark Clarifications:**

*Clarification 1:* Instruction includes representing domain restrictions with inequality notation, interval notation or set-builder notation.

*Clarification 2:* Within the Mathematics for Data and Financial Literacy course, problem types focus on money and business.

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MA.912.F.3.4 Represent the composition of two functions algebraically or in a table. Determine the domain and range of the composite function.

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MA.912.F.3.6 Determine whether an inverse function exists by analyzing tables, graphs and equations.

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MA.912.F.3.7 Represent the inverse of a function algebraically, graphically or in a table. Use composition of functions to verify that one function is the inverse of the other.

**Benchmark Clarifications:**

*Clarification 1:* Instruction includes the understanding that a logarithmic function is the inverse of an exponential function.

**Financial Literacy****MA.912.FL.3 Describe the advantages and disadvantages of short-term and long-term purchases.**

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MA.912.FL.3.1 Compare simple, compound and continuously compounded interest over time.

**Benchmark Clarifications:**

*Clarification 1:* Instruction includes taking into consideration the annual percentage rate (APR) when comparing simple and compound interest.



MA.912.FL.3.2 Solve real-world problems involving simple, compound and continuously compounded interest.

*Example:* Find the amount of money on deposit at the end of 5 years if you started with \$500 and it was compounded quarterly at 6% interest per year.

*Example:* Joe won \$25,000 on a lottery scratch-off ticket. How many years will it take at 6% interest compounded yearly for his money to double?

Benchmark Clarifications:

*Clarification 1:* Within the Algebra 1 course, interest is limited to simple and compound.

MA.912.FL.3.4 Explain the relationship between simple interest and linear growth. Explain the relationship between compound interest and exponential growth and the relationship between continuously compounded interest and exponential growth.

Benchmark Clarifications:

*Clarification 1:* Within the Algebra 1 course, exponential growth is limited to compound interest.

## Data Analysis and Probability

### **MA.912.DP.2 Solve problems involving univariate and bivariate numerical data.**

MA.912.DP.2.8 Fit a quadratic function to bivariate numerical data that suggests a quadratic association and interpret any intercepts or the vertex of the model. Use the model to solve real-world problems in terms of the context of the data.

Benchmark Clarifications:

*Clarification 1:* Problems include making a prediction or extrapolation, inside and outside the range of the data, based on the equation of the line of fit.

MA.912.DP.2.9 Fit an exponential function to bivariate numerical data that suggests an exponential association. Use the model to solve real-world problems in terms of the context of the data.

Benchmark Clarifications:

*Clarification 1:* Instruction focuses on determining whether an exponential model is appropriate by taking the logarithm of the dependent variable using spreadsheets and other technology.

*Clarification 2:* Instruction includes determining whether the transformed scatterplot has an appropriate line of best fit, and interpreting the  $y$ -intercept and slope of the line of best fit.

*Clarification 3:* Problems include making a prediction or extrapolation, inside and outside the range of the data, based on the equation of the line of fit.

**MA.912.DP.4 Use and interpret independence and probability.**

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MA.912.DP.4.1	Describe events as subsets of a sample space using characteristics, or categories, of the outcomes, or as unions, intersections or complements of other events.
MA.912.DP.4.2	Determine if events A and B are independent by calculating the product of their probabilities.
MA.912.DP.4.3	Calculate the conditional probability of two events and interpret the result in terms of its context.
MA.912.DP.4.4	Interpret the independence of two events using conditional probability.
MA.912.DP.4.9	Apply the addition and multiplication rules for counting to solve mathematical and real-world problems, including problems involving probability.
MA.912.DP.4.10	Given a mathematical or real-world situation, calculate the appropriate permutation or combination.

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