Course: Algebra 1 Honors- 1200320

Direct link to this page:http://www.cpalms.org/Courses/CoursePagePublicPreviewCourse3677.aspx

BASIC INFORMATION

Course Title:	Algebra 1 Honors
Course Number:	1200320
Course Abbreviated Title:	ALG 1 HON
Course Path:	**Section:** Grades PreK to 12 Education Courses **Grade Group:** Grades 9 to 12 and Adult Education Courses **Subject:** Mathematics **SubSubject:** Algebra
Number of Credits:	One credit (1)
Course length:	Year (Y)
Course Type:	Core
Course Level:	3
Status:	Draft - Board Approval Pending
Honors?	Yes
Version Description:	The fundamental purpose of this course is to formalize and extend the mathematics that students learned in the middle grades. The critical areas, called units, deepen and extend understanding of linear and exponential relationships by contrasting them with each other and by applying linear models to data that exhibit a linear trend, and students engage in methods for analyzing, solving, and using quadratic functions. The Standards for Mathematical Practice apply throughout each course and, together with the content standards, prescribe that students experience mathematics as a coherent, useful, and logical subject that makes use of their ability to make sense of problem situations. **Unit 1- Relationships Between Quantities and Reasoning with Equations:** By the end of eighth grade, students have learned to solve linear equations in one variable and have applied graphical and algebraic methods to analyze and solve systems of linear equations in two variables. Now, students analyze and explain the

	process of solving an equation. Students develop fluency writing, interpreting, and translating between various forms of linear equations and inequalities, and using them to solve problems. They master the solution of linear equations and apply related solution techniques and the laws of exponents to the creation and solution of simple exponential equations. **Unit 2- Linear and Exponential Relationships:** In earlier grades, students define, evaluate, and compare functions, and use them to model relationships between quantities. In this unit, students will learn function notation and develop the concepts of domain and range. They explore many examples of functions, including sequences; they interpret functions given graphically, numerically, symbolically, and verbally, translate between representations, and understand the limitations of various representations. Students build on and informally extend their understanding of integer exponents to consider exponential functions. They compare and contrast linear and exponential functions, distinguishing between additive and multiplicative change. Students explore systems of equations and inequalities, and they find and interpret their solutions. They interpret arithmetic sequences as linear functions and geometric sequences as exponential functions. **Unit 3- Descriptive Statistics:** This unit builds upon students' prior experiences with data, providing students with more formal means of assessing how a model fits data. Students use regression techniques to describe and approximate linear relationships between quantities. They use graphical representations and knowledge of the context to make judgments about the appropriateness of linear models. With linear models, they look at residuals to analyze the goodness of fit. **Unit 4- Expressions and Equations:** In this unit, students build on their knowledge from unit 2, where they extended the laws of exponents to rational exponents. Students apply this new understanding of number and strengthen their ability to see structure in and create quadratic and exponential expressions. They create and solve equations, inequalities, and systems of equations involving quadratic expressions. **Unit 5- Quadratic Functions and Modeling:** In this unit, students consider quadratic functions, comparing the key characteristics of quadratic functions to those of linear and exponential functions. They select from among these functions to model phenomena. Students learn to anticipate the graph of a quadratic function by interpreting various forms of quadratic expressions. In particular, they identify the real solutions of a quadratic equation as the zeros of a related quadratic function. Students expand their experience with functions to include more specialized functions—absolute value, step, and those that are piecewise-defined.
General Notes:	**Fluency Recommendations** **A/G-** Algebra I students become fluent in solving characteristic problems involving the analytic geometry of lines, such as writing down the equation of a line given a point and a slope. Such fluency can support them in solving less routine mathematical problems involving linearity, as well as in modeling linear phenomena (including modeling using systems of linear inequalities in two variables). **A-APR.1-** Fluency in adding, subtracting, and multiplying polynomials supports students throughout their work in Algebra, as well as in their symbolic work with

	functions. Manipulation can be more mindful when it is fluent. **A-SSE.1b-** Fluency in transforming expressions and chunking (seeing parts of an expression as a single object) is essential in factoring, completing the square, and other mindful algebraic calculations.
Version Requirements:	During the 2013-2014 school year, Florida will be transitioning to the Common Core State Standards for Mathematics. The content standards for Algebra 1 are based upon these new standards; however, during this transition year, students will be assessed using the Algebra 1 End-of-Course Assessment aligned with the Next Generation Sunshine State Standards (NGSSS). For this reason, instruction should include the following NGSSS: **MA.912.G.1.4** Use coordinate geometry to find slopes, parallel lines, perpendicular lines, and equations of lines. (Assessed with MA.912.A.3.10.) **MA.912.D.7.2** Use Venn diagrams to explore relationships and patterns and to make arguments about relationships between sets. **MA.912.D.7.1** Perform set operations such as union and intersection, complement, and cross product.

STANDARDS (73)

LACC.910.RST.1.3:	Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
LACC.910.RST.2.4:	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.
LACC.910.RST.3.7:	Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
LACC.910.SL.1.1:	Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.

	a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas. b. Work with peers to set rules for collegial discussions and decision-making (e.g., informal consensus, taking votes on key issues, presentation of alternate views), clear goals and deadlines, and individual roles as needed. c. Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions. d. Respond thoughtfully to diverse perspectives, summarize points of agreement and disagreement, and, when warranted, qualify or justify their own views and understanding and make new connections in light of the evidence and reasoning presented.
LACC.910.SL.1.2:	Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source.
LACC.910.SL.1.3:	Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, identifying any fallacious reasoning or exaggerated or distorted evidence.
LACC.910.SL.2.4:	Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.
LACC.910.WHST.1.1:	Write arguments focused on *discipline-specific content.* a. Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence. b. Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the

	audience's knowledge level and concerns. c. Use words, phrases, and clauses to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims. d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing. e. Provide a concluding statement or section that follows from or supports the argument presented.
LACC.910.WHST.2.4:	Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
LACC.910.WHST.3.9:	Draw evidence from informational texts to support analysis, reflection, and research.
MACC.912.A-APR.1.1:	Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials. Remarks/Examples **Algebra 1 - Fluency Recommendations** Fluency in adding, subtracting, and multiplying polynomials supports students throughout their work in algebra, as well as in their symbolic work with functions. Manipulation can be more mindful when it is fluent. Focus on polynomial expressions that simplify to forms that are linear or quadratic in a positive integer power of x.
MACC.912.A-APR.2.2:	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).
MACC.912.A-APR.2.3:	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.

	Remarks/Examples **Algebra 1 Assessment Limits and Clarifications** i) Tasks are limited to quadratic and cubic polynomials in which linear and quadratic factors are available. For example, find the zeros of $(x - 2)(x^2 - 9)$. **Algebra 2 Assessment Limits and Clarifications** i) Tasks include quadratic, cubic, and quartic polynomials and polynomials for which factors are not provided. For example, find the zeros of $(x^2 - 1)(x^2 + 1)$
MACC.912.A-APR.3.4:	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.
MACC.912.A-APR.4.6:	Rewrite simple rational 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. Remarks/Examples **Algebra 2 - Fluency Recommendations** This standard sets an expectation that students will divide polynomials with remainder by inspection in simple cases.
MACC.912.A-CED.1.1:	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.* Remarks/Examples **Algebra 1, Unit 1**: Limit A.CED.1 and A.CED.2 to linear and exponential equations, and, in the case of exponential equations, limit to situations requiring evaluation of exponential functions at integer inputs. **Algebra 1, Unit 4**: Extend work on linear and exponential equations

	in Unit 1 to quadratic equations. **Algebra 1 Assessment Limits and Clarifications** i) Tasks are limited to linear, quadratic, or exponential equations with integer exponents. **Algebra 2 Assessment Limits and Clarifications** i) Tasks are limited to exponential equations with rational or real exponents and rational functions. ii) Tasks have a real-world context.
MACC.912.A-CED.1.2:	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. Remarks/Examples Algebra 1, Unit 1: Limit A.CED.1 and A.CED.2 to linear and exponential equations, and, in the case of exponential equations, limit to situations requiring evaluation of exponential functions at integer inputs. Algebra 1, Unit 4: Extend work on linear and exponential equations in Unit 1 to quadratic equations.
MACC.912.A-CED.1.3:	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. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.* Remarks/Examples Algebra 1, Unit 1: Limit A.CED.3 to linear equations and inequalities.
MACC.912.A-CED.1.4:	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law V = IR to highlight resistance R.* Remarks/Examples Algebra 1, Unit 1: Limit A.CED.4 to formulas which are linear in the variable of interest.

Course: Advanced Algebra with Financial Applications- 1200500

Direct link to this page:http://www.cpalms.org/Courses/CoursePagePublicPreviewCourse3663.aspx

BASIC INFORMATION

Course Title:	Advanced Algebra with Financial Applications
Course Number:	1200500
Grade Levels:	9,10,11,12
Course Abbreviated Title:	ADV ALG W/FIN APP
Course Path:	**Section:** Grades PreK to 12 Education Courses **Grade Group:** Grades 9 to 12 and Adult Education Courses **Subject:** Mathematics **SubSubject:** Algebra
Number of Credits:	One credit (1)
Course length:	Year (Y)
Course Type:	Core
Course Level:	2
Status:	Draft - Board Approval Pending

STANDARDS (71)

LACC.910.RST.1 Key Ideas and Details

LACC.910.RST.1.3 :	Follow precisely a complex multistep procedure when carrying out

	experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Key Ideas and Details

LACC.910.RST.2 Craft and Structure

LACC.910.RST.2.4 :	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Craft and Structure

LACC.910.RST.3 Integration of Knowledge and Ideas

LACC.910.RST.3.7 :	Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Integration of Knowledge and Ideas

LACC.910.SL.1 Comprehension and Collaboration

LACC.910.SL.1.1 :	Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively. a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas. b. Work with peers to set rules for collegial discussions and decision-making (e.g., informal consensus, taking votes on key issues, presentation of alternate views), clear goals and deadlines, and individual roles as needed. c. Propel conversations by posing and responding to questions that relate the current discussion to broader

	themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions. d. Respond thoughtfully to diverse perspectives, summarize points of agreement and disagreement, and, when warranted, qualify or justify their own views and understanding and make new connections in light of the evidence and reasoning presented. Cognitive Complexity: Level 3: Strategic Thinking & Complex Reasoning l Date Adopted or Revised: 12/10 Belongs to: Comprehension and Collaboration
LACC.910.SL.1.2 :	Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source. Cognitive Complexity: Level 3: Strategic Thinking & Complex Reasoning l Date Adopted or Revised: 12/10 Belongs to: Comprehension and Collaboration
LACC.910.SL.1.3 :	Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, identifying any fallacious reasoning or exaggerated or distorted evidence. Cognitive Complexity: Level 3: Strategic Thinking & Complex Reasoning l Date Adopted or Revised: 12/10 Belongs to: Comprehension and Collaboration

LACC.910.SL.2 Presentation of Knowledge and Ideas

LACC.910.SL.2.4 :	Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task. Cognitive Complexity: Level 3: Strategic Thinking & Complex Reasoning l Date Adopted or Revised: 12/10 Belongs to: Presentation of Knowledge and Ideas

LACC.910.WHST.1 Text Types and Purposes

LACC.910.WHST.1.1 :	Write arguments focused on *discipline-specific content.* a. Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s),

	counterclaims, reasons, and evidence. b. Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audience's knowledge level and concerns. c. Use words, phrases, and clauses to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims. d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing. e. Provide a concluding statement or section that follows from or supports the argument presented. Cognitive Complexity: Level 4: Extended Thinking &Complex Reasoning l Date Adopted or Revised: 12/10 Belongs to: Text Types and Purposes

LACC.910.WHST.2 Production and Distribution of Writing

LACC.910.WHST.2.4 :	Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. Cognitive Complexity: Level 3: Strategic Thinking & Complex Reasoning l Date Adopted or Revised: 12/10 Belongs to: Production and Distribution of Writing

LACC.910.WHST.3 Research to Build and Present Knowledge

LACC.910.WHST.3.9 :	Draw evidence from informational texts to support analysis, reflection, and research. Cognitive Complexity: Level 3: Strategic Thinking & Complex Reasoning l Date Adopted or Revised: 12/10 Belongs to: Research to Build and Present Knowledge

MA.912.F.1 Simple and Compound Interest

MA.912.F.1.1 :	Explain the difference between simple and compound interest. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 09/07 Belongs to: Simple and Compound Interest

Course: Mathematics for College Readiness-1200700

Direct link to this page:http://www.cpalms.org/Courses/CoursePagePublicPreviewCourse2906.aspx

BASIC INFORMATION

Course Title:	Mathematics for College Readiness
Course Number:	1200700
Course Abbreviated Title:	MATH COLL READINESS
Course Path:	**Section:** Grades PreK to 12 Education Courses **Grade Group:** Grades 9 to 12 and Adult Education Courses **Subject:** Mathematics **SubSubject:** Algebra
Number of Credits:	One credit (1)
Course length:	Year (Y)
Course Type:	Core
Course Level:	2
Status:	State Board Approved
General Notes:	This course is targeted for grade 12 students, whose test scores on the Postsecondary Educational Readiness Test (P.E.R.T.) are at or below the established cut scores for mathematics, indicating that they are not yet “college ready” in mathematics or simply need some additional instruction in content to prepare them for success in college level mathematics. This course incorporates the Common Core Standards for Mathematical Practices as well as the following Common Core Standards for Mathematical Content: Expressions and Equations, The Number System, Functions, Algebra, Geometry, Number and Quantity, Statistics and Probability, and the Common Core Standards for High School Modeling. The standards align with the Mathematics Postsecondary Readiness Competencies deemed necessary for entry-level college courses.

STANDARDS (57)

MACC.7.EE.2 Solve real-life and mathematical problems using numerical and algebraic expressions and equations.	
MACC.7.EE.2.4 :	Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. a. Solve word problems leading to equations of the form px + q = r and p(x + q) = r, where p, q, and r are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach. *For example, the perimeter of a rectangle is 54 cm. Its length is 6 cm. What is its width?* b. Solve word problems leading to inequalities of the form px + q > r or px + q < r, where p, q, and r are specific rational numbers. Graph the solution set of the inequality and interpret it in the context of the problem. *For example: As a salesperson, you are paid $50 per week plus $3 per sale. This week you want your pay to be at least $100. Write an inequality for the number of sales you need to make, and describe the solutions.* Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Solve real-life and mathematical problems using numerical and algebraic expressions and equations. Remarks/Examples
	Fluency Expectations or Examples of Culminating Standards In solving word problems leading to one-variable equations of the form px + q = r and p(x + q) = r, students solve the equations fluently. This will require fluency with rational number arithmetic (7.NS.1.1–1.3), as well as fluency to some extent with applying

	properties operations to rewrite linear expressions with rational coefficients (7.EE.1.1). **Examples of Opportunities for In-Depth Focus** Work toward meeting this standard builds on the work that led to meeting 6.EE.2.7 and prepares students for the work that will lead to meeting 8.EE.3.7.

MACC.7.NS.1 Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.

MACC.7.NS.1.1 :	Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram. a. Describe situations in which opposite quantities combine to make 0. *For example, a hydrogen atom has 0 charge because its two constituents are oppositely charged.* b. Understand p + q as the number located a distance |q| from p, in the positive or negative direction depending on whether q is positive or negative. Show that a number and its opposite have a sum of 0 (are additive inverses). Interpret sums of rational numbers by describing real-world contexts. c. Understand subtraction of rational numbers as adding the additive inverse, p – q = p + (–q). Show that the distance between two rational numbers on the number line is the absolute value of their difference, and apply this principle in real-world contexts. d. Apply properties of operations as strategies to add and subtract rational numbers. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers. Remarks/Examples

	Fluency Expectations or Examples of Culminating Standards Adding, subtracting, multiplying, and dividing rational numbers is the culmination of numerical work with the four basic operations. The number system will continue to develop in grade 8, expanding to become the real numbers by the introduction of irrational numbers, and will develop further in high school, expanding to become the complex numbers with the introduction of imaginary numbers. Because there are no specific standards for rational number arithmetic in later grades and because so much other work in grade 7 depends on rational number arithmetic, fluency with rational number arithmetic should be the goal in grade 7.
MACC.7.NS.1.2 :	Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers. a. Understand that multiplication is extended from fractions to rational numbers by requiring that operations continue to satisfy the properties of operations, particularly the distributive property, leading to products such as (–1)(–1) = 1 and the rules for multiplying signed numbers. Interpret products of rational numbers by describing real-world contexts. b. Understand that integers can be divided, provided that the divisor is not zero, and every quotient of integers (with non-zero divisor) is a rational number. If p and q are integers, then –(p/q) = (–p)/q = p/(–q). Interpret quotients of rational numbers by describing real-world contexts. c. Apply properties of operations as strategies to multiply and divide rational numbers. d. Convert a rational number to a decimal using long division; know that the decimal form of a rational number terminates in 0s or eventually repeats. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts I Date Adopted or Revised: 12/10 Belongs to: Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers. Remarks/Examples **Fluency Expectations or Examples of Culminating Standards**

	Adding, subtracting, multiplying, and dividing rational numbers is the culmination of numerical work with the four basic operations. The number system will continue to develop in grade 8, expanding to become the real numbers by the introduction of irrational numbers, and will develop further in high school, expanding to become the complex numbers with the introduction of imaginary numbers. Because there are no specific standards for rational number arithmetic in later grades and because so much other work in grade 7 depends on rational number arithmetic, fluency with rational number arithmetic should be the goal in grade 7.

MACC.8.NS.1 Know that there are numbers that are not rational, and approximate them by rational numbers.

MACC.8.NS.1.2 :	Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., π^2). *For example, by truncating the decimal expansion of √2, show that √2 is between 1 and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations.* Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Know that there are numbers that are not rational, and approximate them by rational numbers.
MACC.8.NS.1.1 :	Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number. Cognitive Complexity: Level 1: Recall l Date Adopted or Revised: 12/10 Belongs to: Know that there are numbers that are not rational, and approximate them by rational numbers.

MACC.8.EE.1 Work with radicals and integer exponents.

MACC.8.EE.1.1 :	Know and apply the properties of integer exponents to generate equivalent numerical expressions. *For example,* $3^2 \times 3^{-5} = 3^{-3} = 1/3^3 = 1/27$ Cognitive Complexity: Level 1: Recall l Date Adopted or Revised: 12/09 Belongs to: Work with radicals and integer exponents.

MACC.8.EE.1.4 :	Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Work with radicals and integer exponents.

MACC.8.EE.2 Understand the connections between proportional relationships, lines, and linear equations.

MACC.8.EE.2.5 :	Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. *For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.* Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Understand the connections between proportional relationships, lines, and linear equations. Remarks/Examples
	Examples of Opportunities for In-Depth Focus When students work toward meeting this standard, they build on grades 6–7 work with proportions and position themselves for grade 8 work with functions and the equation of a line.

MACC.8.F.2 Use functions to model relationships between quantities.

MACC.8.F.2.4 :	Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values. Cognitive Complexity: Level 3: Strategic Thinking & Complex Reasoning l Date Adopted or Revised: 12/10

	Belongs to: Use functions to model relationships between quantities.

MACC.912.A-APR.1 Perform arithmetic operations on polynomials

MACC.912.A-APR.1.1 :	Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials. Cognitive Complexity: Level 1: Recall l Date Adopted or Revised: 12/10 Belongs to: Perform arithmetic operations on polynomials Remarks/Examples
	Algebra 1 - Fluency Recommendations Fluency in adding, subtracting, and multiplying polynomials supports students throughout their work in algebra, as well as in their symbolic work with functions. Manipulation can be more mindful when it is fluent. Focus on polynomial expressions that simplify to forms that are linear or quadratic in a positive integer power of x.

MACC.912.A-APR.2 Understand the relationship between zeros and factors of polynomials

MACC.912.A-APR.2.3 :	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. Cognitive Complexity: Level 1: Recall l Date Adopted or Revised: 12/10 Belongs to: Understand the relationship between zeros and factors of polynomials Remarks/Examples
	Algebra 1 Assessment Limits and Clarifications i) Tasks are limited to quadratic and cubic polynomials in which linear and quadratic factors are available. For example, find the zeros of $(x - 2)(x^2 - 9)$. **Algebra 2 Assessment Limits and Clarifications** i) Tasks include quadratic, cubic, and quartic polynomials and

	polynomials for which factors are not provided. For example, find the zeros of $(x^2 - 1)(x^2 + 1)$

MACC.912.A-APR.3 Use polynomial identities to solve problems

MACC.912.A-APR.3.4:	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. Cognitive Complexity: Level 1: Recall l Date Adopted or Revised: 12/10 Belongs to: Use polynomial identities to solve problems

MACC.912.A-APR.4 Rewrite rational expressions

MACC.912.A-APR.4.6:	Rewrite simple rational 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. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Rewrite rational expressions Remarks/Examples
	Algebra 2 - Fluency Recommendations This standard sets an expectation that students will divide polynomials with remainder by inspection in simple cases.
MACC.912.A-APR.4.7:	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. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Rewrite rational expressions

MACC.912.A-CED.1 Create equations that describe numbers or relationships

MACC.912.A-CED.1.1:	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.*

	Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Create equations that describe numbers or relationships Remarks/Examples
	Algebra 1, Unit 1: Limit A.CED.1 and A.CED.2 to linear and exponential equations, and, in the case of exponential equations, limit to situations requiring evaluation of exponential functions at integer inputs. **Algebra 1, Unit 4**: Extend work on linear and exponential equations in Unit 1 to quadratic equations. **Algebra 1 Assessment Limits and Clarifications** i) Tasks are limited to linear, quadratic, or exponential equations with integer exponents. **Algebra 2 Assessment Limits and Clarifications** i) Tasks are limited to exponential equations with rational or real exponents and rational functions. ii) Tasks have a real-world context.
MACC.912.A-CED.1.2 :	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Create equations that describe numbers or relationships Remarks/Examples
	Algebra 1, Unit 1: Limit A.CED.1 and A.CED.2 to linear and exponential equations, and, in the case of exponential equations, limit to situations requiring evaluation of exponential functions at integer inputs. Algebra 1, Unit 4: Extend work on linear and exponential equations in Unit 1 to quadratic equations.

MACC.912.A-CED.1.3 :	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. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.* Cognitive Complexity: Level 3: Strategic Thinking & Complex Reasoning l Date Adopted or Revised: 12/10 Belongs to: Create equations that describe numbers or relationships Remarks/Examples Algebra 1, Unit 1: Limit A.CED.3 to linear equations and inequalities.
MACC.912.A-CED.1.4 :	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law V = IR to highlight resistance R.* Cognitive Complexity: Level 1: Recall l Date Adopted or Revised: 12/10 Belongs to: Create equations that describe numbers or relationships Remarks/Examples Algebra 1, Unit 1: Limit A.CED.4 to formulas which are linear in the variable of interest. Algebra 1, Unit 4: Extend A.CED.4 to formulas involving squared variables.

MACC.912.A-REI.1 Understand solving equations as a process of reasoning and explain the reasoning

MACC.912.A-REI.1.1 :	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. Cognitive Complexity: Level 3: Strategic Thinking & Complex Reasoning l Date Adopted or Revised: 12/10 Belongs to: Understand solving equations as a process of reasoning and explain the reasoning Remarks/Examples **Algebra 1, Unit 1**: Students should focus on and master A.REI.1 for linear equations and be able to extend and apply their reasoning to other types of equations in future courses. Students will solve

	exponential equations with logarithms in Algebra II. **Algebra 1 Assessment Limits and Clarification** i) Tasks are limited to quadratic equations. **Algebra 2 Assessment Limits and Clarification** i) Tasks are limited to simple rational or radical equations.
MACC.912.A-REI.1.2 :	Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise. Cognitive Complexity: Level 3: Strategic Thinking & Complex Reasoning l Date Adopted or Revised: 12/10 Belongs to: Understand solving equations as a process of reasoning and explain the reasoning

MACC.912.A-REI.2 Solve equations and inequalities in one variable

MACC.912.A-REI.2.3 :	Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Solve equations and inequalities in one variable Remarks/Examples
	Algebra 1, Unit 1: Extend earlier work with solving linear equations to solving linear inequalities in one variable and to solving literal equations that are linear in the variable being solved for. Include simple exponential equations that rely only on application of the laws of exponents, such as $5^x=125$ or $2^x=1/16$ **Algebra 1 Assessment Limits and Clarifications** i) Tasks do not require students to write solutions for quadratic equations that have roots with nonzero imaginary parts. However, tasks can require the student to recognize cases in which a quadratic equation has no real solutions.

	Note, solving a quadratic equation by factoring relies on the connection between zeros and factors of polynomials (cluster A-APR.B). Cluster A-APR.B is formally assessed in A2. **Algebra 2 Assessment Limits and Clarifications** i) In the case of equations that have roots with nonzero imaginary parts, students write the solutions as a ± bi for real numbers a and b.
MACC.912.A-REI.2.4 :	Solve quadratic equations in one variable. a. Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x – p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form. 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. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Solve equations and inequalities in one variable Remarks/Examples
	Algebra 1, Unit 4: Students should learn of the existence of the complex number system, but will not solve quadratics with complex solutions until Algebra II. **Algebra 1 Assessment Limits and Clarifications** i) Tasks do not require students to write solutions for quadratic equations that have roots with nonzero imaginary parts. However, tasks can require the student to recognize cases in which a quadratic equation has no real solutions. Note, solving a quadratic equation by factoring relies on the connection between zeros and factors of polynomials (cluster A-

	APR.B). Cluster A-APR.B is formally assessed in A2. **Algebra 2 Assessment Limits and Clarifications** i) In the case of equations that have roots with nonzero imaginary parts, students write the solutions as a ± bi for real numbers a and b.

MACC.912.A-REI.3 Solve systems of equations

MACC.912.A-REI.3.5 :	Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions. Cognitive Complexity: Level 3: Strategic Thinking & Complex Reasoning l Date Adopted or Revised: 12/10 Belongs to: Solve systems of equations Remarks/Examples
	Algebra 1, Unit 2: Build on student experiences graphing and solving systems of linear equations from middle school to focus on justification of the methods used. Include cases where the two equations describe the same line (yielding infinitely many solutions) and cases where two equations describe parallel lines (yielding no solution); connect to GPE.5 when it is taught in Geometry, which requires students to prove the slope criteria for parallel lines.
MACC.912.A-REI.3.6 :	Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. Cognitive Complexity: Level 1: Recall l Date Adopted or Revised: 12/10 Belongs to: Solve systems of equations Remarks/Examples
	Algebra 1, Unit 2: Build on student experiences graphing and solving systems of linear equations from middle school to focus on justification of the methods used. Include cases where the two equations describe the same line (yielding infinitely many solutions) and cases where two equations describe parallel lines

	(yielding no solution); connect to GPE.5 when it is taught in Geometry, which requires students to prove the slope criteria for parallel lines. **Algebra 1 Assessment Limits and Clarifications** i)i) Tasks have a real-world context. ii) Tasks have hallmarks of modeling as a mathematical practice (less defined tasks, more of the modeling cycle, etc.). Note, solving a quadratic equation by factoring relies on the connection between zeros and factors of polynomials (cluster A-APR.B). Cluster A-APR.B is formally assessed in A2. **Algebra 2 Assessment Limits and Clarifications** i) Tasks are limited to 3x3 systems.

MACC.912.A-REI.4 Represent and solve equations and inequalities graphically

MACC.912.A-REI.4.10 :	Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line). Cognitive Complexity: Level 1: Recall l Date Adopted or Revised: 12/10 Belongs to: Represent and solve equations and inequalities graphically Remarks/Examples
	Algebra 1, Unit 2: For A.REI.10, focus on linear and exponential equations and be able to adapt and apply that learning to other types of equations in future courses.
MACC.912.A-REI.4.11 :	Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect are the solutions of the equation f(x) = g(x); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where f(x) and/or g(x) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.

Cognitive Complexity: Level 2: Basic Application of Skills & Concepts | Date Adopted or Revised: 12/10
Belongs to: Represent and solve equations and inequalities graphically
Remarks/Examples

Algebra 1, Unit 2: For A.REI.11, focus on cases where f(x) and g(x) are linear or exponential.

Algebra 1 Assessment Limits and Clarifications

i) Tasks that assess conceptual understanding of the indicated concept may involve any of the function types mentioned in the standard except exponential and logarithmic functions.

ii) Finding the solutions approximately is limited to cases where f(x) and g(x) are polynomial functions.

Algebra 2 Assessment Limits and Clarifications

i) Tasks may involve any of the function types mentioned in the standard.

MACC.912.A-SSE.1 Interpret the structure of expressions

MACC.912.A-SSE.1.1 :

Interpret expressions that represent a quantity in terms of its context.

a. Interpret parts of an expression, such as terms, factors, and coefficients.
b. Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret* $P(1+r)^n$ *as the product of P and a factor not depending on P.*

Cognitive Complexity: Level 2: Basic Application of Skills & Concepts | Date Adopted or Revised: 12/10
Belongs to: Interpret the structure of expressions
Remarks/Examples

Algebra 1 - Fluency Recommendations

	A-SSE.1.1b - Fluency in transforming expressions and chunking (seeing parts of an expression as a single object) is essential in factoring, completing the square, and other mindful algebraic calculations. **Algebra 1, Unit 1**: Limit to linear expressions and to exponential expressions with integer exponents. **Algebra 1, Unit 4**: Focus on quadratic and exponential expressions. For A.SSE.1b, exponents are extended from the integer exponents found in Unit 1 to rational exponents focusing on those that represent square or cube roots.
MACC.912.A-SSE.1.2 :	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* $(x^2 – y^2)(x^2 + y^2)$*.* Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Interpret the structure of expressions Remarks/Examples **Algebra 1, Unit 4**: Focus on quadratic and exponential expressions. For A.SSE.1b, exponents are extended from the integer exponents found in Unit 1 to rational exponents focusing on those that represent square or cube roots. **Algebra 2 - Fluency Recommendations** The ability to see structure in expressions and to use this structure to rewrite expressions is a key skill in everything from advanced factoring (e.g., grouping) to summing series to the rewriting of rational expressions to examine the end behavior of the corresponding rational function. **Algebra 1 Assessment Limits and Clarifications** i) Tasks are limited to numerical expressions and polynomial expressions in one variable. ii) Examples: Recognize 532 + 472 as a difference of squares and see an opportunity to rewrite it in the

	easier-to-evaluate form (53 + 47)(53 + 47). See an opportunity to rewrite $a^2 + 9a + 14$ as (a+ 7)(a+ 2). **Algebra 2 Assessment and Limits and Clarifications** i) Tasks are limited to polynomial, rational, or exponential expressions. ii) Examples: 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 $(x^2 – y^2)(x^2 + y^2)$. In the equation $x^2 + 2x + 1 + y^2 = 9$, see an opportunity to rewrite the first three terms as $(x+1)^2$, thus recognizing the equation of a circle with radius 3 and center (-1, 0). See $(x^2 + 4)/(x^2 + 3)$ as $((x^2+3) + 1)/(x^2+3)$, thus recognizing an opportunity to write it as $1 + 1/(x^2 + 3)$.

MACC.912.A-SSE.2 Write expressions in equivalent forms to solve problems

MACC.912.A-SSE.2.3 :	Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. a. Factor a quadratic expression to reveal the zeros of the function it defines. b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines. c. Use the properties of exponents to transform expressions for exponential functions. *For example the expression* 1.15^t *can be rewritten as* $(1.15^{1/12})^{12t} \approx 1.012^{12t}$ *to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.* Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Write expressions in equivalent forms to solve problems Remarks/Examples
	Algebra 1, Unit 4: It is important to balance conceptual understanding and procedural fluency in work with equivalent expressions. For example, development of skill in factoring and completing the square goes hand-in-hand with understanding what different forms of a quadratic expression reveal.

	Algebra 1 Assessment Limits and Clarifications i) Tasks have a real-world context. As described in the standard, there is an interplay between the mathematical structure of the expression and the structure of the situation such that choosing and producing an equivalent form of the expression reveals something about the situation. ii) Tasks are limited to exponential expressions with integer exponents. **Algebra 2 Assessment Limits and Clarifications** i) Tasks have a real-world context. As described in the standard, there is an interplay between the mathematical structure of the expression and the structure of the situation such that choosing and producing an equivalent form of the expression reveals something about the situation. ii) Tasks are limited to exponential expressions with rational or real exponents.

MACC.912.F-BF.1 Build a function that models a relationship between two quantities

MACC.912.F-BF.1.1 :	Write a function that describes a relationship between two quantities. a. Determine an explicit expression, a recursive process, or steps for calculation from a context. 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.* c. Compose functions. *For example, if T(y) is the temperature in the atmosphere as a function of height, and h(t) is the height of a weather balloon as a function of time, then T(h(t)) is the temperature at the location of the weather*

	balloon as a function of time. Cognitive Complexity: Level 3: Strategic Thinking & Complex Reasoning l Date Adopted or Revised: 12/10 Belongs to: [Build a function that models a relationship between two quantities]() Remarks/Examples
	Algebra 1, Unit 2: Limit to F.BF.1a, 1b, and 2 to linear and exponential functions. **Algebra 1, Unit 5**: Focus on situations that exhibit a quadratic relationship. **Algebra 1 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Tasks are limited to linear functions, quadratic functions, and exponential functions with domains in the integers. **Algebra 2 Assessment Limits and Clarifications** i) Tasks have a real-world context ii) Tasks may involve linear functions, quadratic functions, and exponential functions.

MACC.912.F-BF.2 Build new functions from existing functions

MACC.912.F-BF.2.3 :	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.* Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: [Build new functions from existing functions]() Remarks/Examples
	Algebra 1, Unit 2: Focus on vertical translations of graphs of linear

	and exponential functions. Relate the vertical translation of a linear function to its y-intercept. While applying other transformations to a linear graph is appropriate at this level, it may be difficult for students to identify or distinguish between the effects of the other transformations included in this standard. **Algebra 1, Unit 5**: For F.BF.3, focus on quadratic functions, and consider including absolute value functions. **Algebra 1 Assessment Limit and Clarifications** i) Identifying 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) is limited to linear and quadratic functions. ii) Experimenting with cases and illustrating an explanation of the effects on the graph using technology is limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers. iii) Tasks do not involve recognizing even and odd functions. The function types listed in note (ii) are the same as those listed in the Algebra I column for standards F-IF.4, F-IF.6, and F-IF.9. **Algebra 2 Assessment Limits and Clarifications** i) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions ii) Tasks may involve recognizing even and odd functions. The function types listed in note (i) are the same as those listed in the Algebra II column for standards F-IF.4, F-IF.6, and F-IF.9.

MACC.912.F-IF.1 Understand the concept of a function and use function notation

MACC.912.F-IF.1.1 :	Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is

	an element of its domain, then f(x) denotes the output of f corresponding to the input x. The graph of f is the graph of the equation y = f(x). Cognitive Complexity: Level 1: Recall l Date Adopted or Revised: 12/10 Belongs to: Understand the concept of a function and use function notation Remarks/Examples
	Algebra 1, Unit 2: Students should experience a variety of types of situations modeled by functions. Detailed analysis of any particular class of functions at this stage is not advised. Students should apply these concepts throughout their future mathematics courses. Draw examples from linear and exponential functions.

MACC.912.F-IF.2 Interpret functions that arise in applications in terms of the context

MACC.912.F-IF.2.4 :	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.* Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Interpret functions that arise in applications in terms of the context Remarks/Examples
	Algebra 1, Unit 2: For F.IF.4 and 5, focus on linear and exponential functions. **Algebra 1 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Tasks are limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers. Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra I column for

	standards F-IF.6 and F-IF.9. **Algebra 2 Assessment Limits and Clarifications** i) Tasks have a real-world context ii) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions. Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra II column for standards F-IF.6 and F-IF.9.
MACC.912.F-IF.2.5 :	Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.* Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Interpret functions that arise in applications in terms of the context Remarks/Examples Algebra 1, Unit 2: For F.IF.4 and 5, focus on linear and exponential functions.
MACC.912.F-IF.2.6 :	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. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Interpret functions that arise in applications in terms of the context Remarks/Examples **Algebra 1, Unit 2**: For F.IF.6, focus on linear functions and exponential functions whose domain is a subset of the integers. Unit 5 in this course and the Algebra II course address other types of functions. **Algebra 1 Assessment Limits and Clarifications** i) Tasks have a real-world context.

	ii) Tasks are limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers. The function types listed here are the same as those listed in the Algebra I column for standards F-IF.4 and F-IF.9. **Algebra 2 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions. The function types listed here are the same as those listed in the Algebra II column for standards F-IF.4 and F-IF.9.

MACC.912.F-IF.3 Analyze functions using different representations

MACC.912.F-IF.3.7 :	Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. a. Graph linear and quadratic functions and show intercepts, maxima, and minima. b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior. e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 10/10

	Belongs to: Analyze functions using different representations Remarks/Examples Algebra 1, Unit 2: For F.IF.7a, 7e, and 9 focus on linear and exponentials functions. Include comparisons of two functions presented algebraically. For example, compare the growth of two linear functions, or two exponential functions such as $y=3^n$ and $y=100^2$
MACC.912.F-IF.3.8 :	Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. a. 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. b. Use the properties of exponents to interpret expressions for exponential functions. *For example, identify percent rate of change in functions such as y =* $(1.02)^t$*, y =* $(0.97)^t$*, y =* $(1.01)^{12t}$*, y =* $(1.2)^{t/10}$*, and classify them as representing exponential growth or decay.* Cognitive Complexity: Level 2: Basic Application of Skills & Concepts I Date Adopted or Revised: 12/10 Belongs to: Analyze functions using different representations Remarks/Examples Algebra 1, Unit 5: Note that this unit, and in particular in F.IF.8b, extends the work begun in Unit 2 on exponential functions with integer exponents.

MACC.912.G-GPE.2 Use coordinates to prove simple geometric theorems algebraically

MACC.912.G-GPE.2.5 :	Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point).

	Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Use coordinates to prove simple geometric theorems algebraically Remarks/Examples **Geometry - Fluency Recommendations** Fluency with the use of coordinates to establish geometric results, calculate length and angle, and use geometric representations as a modeling tool are some of the most valuable tools in mathematics and related fields.
MACC.912.G-GPE.2.6 :	Find the point on a directed line segment between two given points that partitions the segment in a given ratio. Cognitive Complexity: Level 1: Recall l Date Adopted or Revised: 12/10 Belongs to: Use coordinates to prove simple geometric theorems algebraically
MACC.912.G-GPE.2.7 :	Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula. Cognitive Complexity: Level 1: Recall l Date Adopted or Revised: 12/10 Belongs to: Use coordinates to prove simple geometric theorems algebraically Remarks/Examples **Geometry - Fluency Recommendations** Fluency with the use of coordinates to establish geometric results, calculate length and angle, and use geometric representations as a modeling tool are some of the most valuable tools in mathematics and related fields.

MACC.912.N-Q.1 Reason quantitatively and use units to solve problems.

MACC.912.N-Q.1.1 :	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10

	Belongs to: Reason quantitatively and use units to solve problems. Remarks/Examples
	Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions.
MACC.912.N-Q.1.2 :	Define appropriate quantities for the purpose of descriptive modeling. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Reason quantitatively and use units to solve problems. Remarks/Examples
	Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. **Algebra 1 Content Notes:** Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. **Algebra 1 Assessment Limits and Clarifications** This standard will be assessed in Algebra I by ensuring that some modeling tasks (involving Algebra I content or securely held content from grades 6-8) require the student to create a quantity of interest in the situation being described (i.e., a quantity of interest is not selected for the student by the task). For example, in a situation involving data, the student might autonomously decide that a measure of center is a key variable in a situation, and then choose to work with the mean. **Algebra 2 Assessment Limits and Clarifications** This standard will be assessed in Algebra II by ensuring that some modeling tasks (involving Algebra II content or securely held content from previous grades and courses) require the student to create a quantity of interest in the situation being described (i.e.,

	this is not provided in the task). For example, in a situation involving periodic phenomena, the student might autonomously decide that amplitude is a key variable in a situation, and then choose to work with peak amplitude.
MACC.912.N-Q.1.3 :	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Reason quantitatively and use units to solve problems. Remarks/Examples
	Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions.

MACC.912.N-RN.1 Extend the properties of exponents to rational exponents.

MACC.912.N-RN.1.1 :	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.* Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Extend the properties of exponents to rational exponents. Remarks/Examples
	Algebra 1, Unit 2: In implementing the standards in curriculum, these standards should occur before discussing exponential functions with continuous domains.
MACC.912.N-RN.1.2 :	Rewrite expressions involving radicals and rational exponents using the properties of exponents. Cognitive Complexity: Level 1: Recall l Date Adopted or Revised: 12/10 Belongs to: Extend the properties of exponents to rational exponents. Remarks/Examples
	Algebra 1, Unit 2: In implementing the standards in curriculum, these standards should occur before discussing exponential

	functions with continuous domains.

MACC.912.N-RN.2 Use properties of rational and irrational numbers.

MACC.912.N-RN.2.3 :	Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Use properties of rational and irrational numbers. Remarks/Examples
	Algebra 1 Unit 5: Connect N.RN.3 to physical situations, e.g., finding the perimeter of a square of area 2.

MACC.912.S-ID.2 Summarize, represent, and interpret data on two categorical and quantitative variables

MACC.912.S-ID.2.5 :	Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Summarize, represent, and interpret data on two categorical and quantitative variables
MACC.912.S-ID.2.6 :	Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. 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.* b. Informally assess the fit of a function by plotting and analyzing residuals. c. Fit a linear function for a scatter plot that suggests a linear association.

	Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Summarize, represent, and interpret data on two categorical and quantitative variables Remarks/Examples
	Students take a more sophisticated look at using a linear function to model the relationship between two numerical variables. In addition to fitting a line to data, students assess how well the model fits by analyzing residuals. S.ID.6b should be focused on linear models, but may be used to preview quadratic functions in Unit 5 of this course. **Algebra 1 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Exponential functions are limited to those with domains in the integers. **Algebra 2 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Tasks are limited to exponential functions with domains not in the integers and trigonometric functions.

MACC.912.S-ID.3 Interpret linear models

MACC.912.S-ID.3.7 :	Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Interpret linear models Remarks/Examples
	Build on students' work with linear relationships in eighth grade and introduce the correlation coefficient. The focus here is on the computation and interpretation of the correlation coefficient as a measure of how well the data fit the relationship. The important distinction between a statistical relationship and a cause-and-effect relationship arises in S.ID.9.

MACC.K12.MP.1 Make sense of problems and persevere in solving them.

MACC.K12.MP.1.1 :	**Make sense of problems and persevere in solving them.** Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, "Does this make sense?" They can understand the approaches of others to solving complex problems and identify correspondences between different approaches. Cognitive Complexity: Level 3: Strategic Thinking & Complex Reasoning l Date Adopted or Revised: 12/10 Belongs to: Make sense of problems and persevere in solving them.

MACC.K12.MP.2 Reason abstractly and quantitatively.

MACC.K12.MP.2.1 :	**Reason abstractly and quantitatively**. Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their

	own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects. Cognitive Complexity: Level 3: Strategic Thinking & Complex Reasoning l Date Adopted or Revised: 12/10 Belongs to: Reason abstractly and quantitatively.

MACC.K12.MP.3 Construct viable arguments and critique the reasoning of others.

MACC.K12.MP.3.1 :	**Construct viable arguments and critique the reasoning of others.** Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments. Cognitive Complexity: Level 3: Strategic Thinking & Complex Reasoning l Date Adopted or Revised: 12/10

	Belongs to: Construct viable arguments and critique the reasoning of others.

MACC.K12.MP.4 Model with mathematics.

MACC.K12.MP.4.1 :	**Model with mathematics.** Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose. Cognitive Complexity: Level 3: Strategic Thinking & Complex Reasoning l Date Adopted or Revised: 12/10 Belongs to: Model with mathematics.

MACC.K12.MP.5 Use appropriate tools strategically.

MACC.K12.MP.5.1 :	**Use appropriate tools strategically.** Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their

	limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Use appropriate tools strategically.

MACC.K12.MP.6 Attend to precision.

MACC.K12.MP.6.1 :	**Attend to precision.** Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions. Cognitive Complexity: Level 3: Strategic Thinking & Complex Reasoning l Date Adopted or Revised: 12/10 Belongs to: Attend to precision.

MACC.K12.MP.7 Look for and make use of structure.

MACC.K12.MP.7.1 :	**Look for and make use of structure.** Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see 7 × 8 equals the well remembered 7 × 5 + 7 × 3, in preparation for learning about the distributive property. In the expression $x^2 + 9x + 14$, older students can see the 14 as 2 × 7 and the 9 as 2 + 7. They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see $5 – 3(x – y)^2$ as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers x and y. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts I Date Adopted or Revised: 12/10 Belongs to: Look for and make use of structure.

MACC.K12.MP.8 Look for and express regularity in repeated reasoning.

MACC.K12.MP.8.1 :	**Look for and express regularity in repeated reasoning.** Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation $(y – 2)/(x – 1) = 3$. Noticing the regularity in the way terms cancel when expanding $(x – 1)(x + 1)$, $(x – 1)(x^2 + x + 1)$, and $(x – 1)(x^3 + x^2 + x + 1)$ might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate

	results. Cognitive Complexity: Level 3: Strategic Thinking & Complex Reasoning l Date Adopted or Revised: 12/10 Belongs to: Look for and express regularity in repeated reasoning.

	Remarks/Examples Example: Compare the similarities and differences for calculating the final amount of money in your savings account based on simple interest or compound interest.
MA.912.F.1.2 :	Solve problems involving compound interest. Cognitive Complexity: Level 3: Strategic Thinking & Complex Reasoning l Date Adopted or Revised: 09/07 Belongs to: Simple and Compound Interest Remarks/Examples 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. Example: Joe won $25,000 in the lottery. How many years will it take at 6% interest compounded yearly for his money to double?
MA.912.F.1.3 :	Demonstrate the relationship between simple interest and linear growth. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 09/07 Belongs to: Simple and Compound Interest Remarks/Examples Example: Find the account balance at the end of each month for a 5 month span for $1500 @ 3 % interest based on simple interest for 1 year. Graph this scenario and explain if this is a linear or exponential problem.
MA.912.F.1.4 :	Demonstrate the relationship between compound interest and exponential growth. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 09/07 Belongs to: Simple and Compound Interest Remarks/Examples Example: Using an exponential function, find the account balance at the end of 4 years if you deposited $1300 in an account paying 3.5% interest compounded annually. Graph the scenario.

MA.912.F.2 Net Present and Net Future Value (NPV and NFV)

MA.912.F.2.1 :	Calculate the future value of a given amount of money with and without technology. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 09/07 Belongs to: Net Present and Net Future Value (NPV and NFV) Remarks/Examples
	Example: Suppose you have $750 on January 1, 2007. If you deposit this in an account paying 5% interest, compounded quarterly, how much money will be in the account on January 1, 2012? Example: Suppose you deposit $400 into an account at the beginning of each year, starting Jan 1, 2007. If the account pays 6% interest, compounded annually, how much will be in the account at the end of 5 years?
MA.912.F.2.2 :	Calculate the present value of a certain amount of money for a given length of time in the future with and without technology. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 09/07 Belongs to: Net Present and Net Future Value (NPV and NFV) Remarks/Examples
	Example: A five year, zero-coupon bond pays 5% annual interest, and has a face value of $1,000. If the bond matures on Dec 31, 2010, what was the original purchase price of the bond? Example: Find the present value of an annuity paying $500 per year for 10 years at 6% annual interest.

MA.912.F.3 Loans and Financing

MA.912.F.3.1 :	Compare the advantages and disadvantages of using cash versus a credit card. Cognitive Complexity: Level 3: Strategic Thinking & Complex Reasoning l Date Adopted or Revised: 09/07 Belongs to: Loans and Financing Remarks/Examples
	Example: Compare paying for a tank of gasoline in cash or paying with a credit card over a period of time.
MA.912.F.3.10 :	Calculate the effects on the monthly payment in the change of interest rate based on an adjustable rate mortgage. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date

	Adopted or Revised: 09/07 Belongs to: Loans and Financing Remarks/Examples
	Example: You would like to borrow $245,000 using a 30-year, 1-year ARM indexed to the 1-year Treasury security with a 2.75 percent margin and 2/6 caps (2 percent per year and 6 percent lifetime). The initial interest rate on this loan is 2.75 percent. The lender is charging you 1.50 points and $1,200 in miscellaneous fees to close the loan. a) What is the initial payment on this mortgage? b) If the 1- year Treasury security is yielding 2.25 percent at the first adjustment date, what is your payment on this loan during the second year? c) Suppose that the 1-year Treasury is yielding 2.75 percent at the second adjustment date. What is the new payment on this loan during the third year? d) Assuming that you pay of the loan at the end of the third year, what yield did the lender earn on this loan? Now resolve all four parts of the last problem assuming that the loan has a 20 percent payment cap instead of 2/6 interest rate caps. a) What is the initial payment on this mortgage? b) If the 1- year Treasury security is yielding 2.25 percent at the first adjustment date, what is your payment on this loan during the second year? c) Suppose that the 1-year Treasury is yielding 2.75 percent at the second adjustment date. What is the new payment on this loan during the third year? d) Assuming that you pay of the loan at the end of the third year, what yield did the lender earn on this loan?
MA.912.F.3.11 :	Calculate the final pay out amount for a balloon mortgage. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts I Date Adopted or Revised: 09/07 Belongs to: Loans and Financing Remarks/Examples
	Example: If you have a 5-year balloon mortgage with a 15 year

	amortization schedule, a rate of 6.5%, and a $100,000 loan what would the remaining balance be after the end of the fifth year?
MA.912.F.3.12 :	Compare the cost of paying a higher interest rate and lower points versus a lower interest rate and more points. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 09/07 Belongs to: Loans and Financing Remarks/Examples
	Example: Assuming all of the following were originally 15 year mortgages, which fixed rate mortgage cost the mortgagor the least? a) 7.375% interest + 0 points paid off in 10 years b) 7.375% interest + 0 points paid off in 7 years c) 7 % interest + 3 points paid off in 10 years d) 7 % interest + 3 points paid off in 7 years
MA.912.F.3.13 :	Calculate the total amount paid for the life of a loan for a house including the down payment, points, fees, and interest. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 09/07 Belongs to: Loans and Financing Remarks/Examples
	Example: Calculate the total amount paid for a $100,000 house with a 15 year fixed rate loan at 5.65% if the mortgagor pays a $25,000 down payment; 2 points; 1% origination fee; maximum brokerage fee on a net loan; and State Documentary Stamps on the deed at a tax rate of $.70 per $100, the mortgage note at a tax rate of $.35 per $100, a and Intangible Tax at a rate of .002.
MA.912.F.3.14 :	Compare the total cost for a set purchase price using a fixed rate, adjustable rate, and a balloon mortgage. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 09/07 Belongs to: Loans and Financing Remarks/Examples
	Example: Find the total cost for a $225,000 mortgage for the following options:

	a) 30 year fixed rate mortgage with a rate of 6.35 % b) 3/1 ARM with a rate of 6.75% with a maximum adjustment of 2 points per year with a cap of 6 points for 30 years c) 10 year balloon mortgage with a 30 year amortization schedule with a rate of 5.5% Next describe the benefits and detriments of each mortgage option.
MA.912.F.3.17 :	Compare interest rate calculations and annual percentage rate calculations to distinguish between the two rates. Cognitive Complexity: Level 3: Strategic Thinking & Complex Reasoning l Date Adopted or Revised: 09/07 Belongs to: Loans and Financing
MA.912.F.3.2 :	Analyze credit scores and reports. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 09/07 Belongs to: Loans and Financing Remarks/Examples
	Example: Explain how each of the following categories affects a credit score: 1) past payment history, 2) amount of debt, 3) public records information, 4) length of credit history, and 5) the number of recent credit inquiries.
MA.912.F.3.3 :	Calculate the finance charges and total amount due on a credit card bill. Cognitive Complexity: Level 1: Recall l Date Adopted or Revised: 09/07 Belongs to: Loans and Financing Remarks/Examples
	Example: Calculate the finance charge each month and the total amount paid for 5 months if you charged $500 on your credit card but you can only afford to pay $100 each month. Your credit card has a monthly periodic finance rate of .688% and an annual finance rate of 8.9%.
MA.912.F.3.4 :	Compare the advantages and disadvantages of deferred payments. Cognitive Complexity: Level 3: Strategic Thinking & Complex Reasoning l Date Adopted or Revised: 09/07 Belongs to: Loans and Financing Remarks/Examples

	Example: Compare paying on a college loan between a Stafford loan or a PLUS loan two years after graduation
MA.912.F.3.5 :	Calculate deferred payments. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts I Date Adopted or Revised: 09/07 Belongs to: Loans and Financing Remarks/Examples Example: You want to buy a sofa that cost $899. Company A will let you pay $100 down and then pay the remaining amount over 3 years at 22% interest. Company B will not make you pay a down payment and they will defer payments for one year. However, you will accrue interest at a rate of 20 % interest during that first year. Starting the second year you will have to pay the new amount for 2 years at a rate of 26 % interest. Which deal is better and why? Calculate the total amount paid for both deals. Example: An electronics company advertises that you don't have to pay anything for 2 years. If you bought a big screen TV for $2999 on January 1st what would your balance be two years later if you haven't made any payments assuming an interest rate of 23.99%? What would your monthly payments be to pay the TV off in 2 years? What did the TV really cost you?
MA.912.F.3.6 :	Calculate total cost of purchasing consumer durables over time given different down payments, financing options, and fees. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts I Date Adopted or Revised: 09/07 Belongs to: Loans and Financing Remarks/Examples Example: Find the actual cost of a car and interest charged with a showroom price of $15,999, down payment of $1,600, rate of interest of 12%, and 30 monthly payments.
MA.912.F.3.7 :	Calculate the following fees associated with a mortgage: • discount points • origination fee • maximum brokerage fee on a net or gross loan • documentary stamps • prorated expenses (interest, county and/or city property

	taxes, and mortgage on an assumed mortgage) Cognitive Complexity: Level 1: Recall l Date Adopted or Revised: 09/07 Belongs to: Loans and Financing Remarks/Examples
	Example: 1) Calculate the total amount of fees on a $230,000 mortgage if the lender: charges 2 points and a 0.5% origination fee. 2) Calculate the maximum brokerage fee on a net loan of $184,000, 3) A seller has agreed to pay the Documentary Stamps on a property worth $150,000 (selling price). The purchaser is responsible for the Documentary Stamps on the $75,000 mortgage being assumed and the new $25,000 second mortgage. Calculate all applicable amounts. 4) A $185,340 loan carries at a 5.625% annual interest rate. Using the 365 day method, how much interest would a buyer owe for the 22 days remaining for a May closing.
MA.912.F.3.9 :	Calculate the total amount to be paid over the life of a fixed rate loan. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 09/07 Belongs to: Loans and Financing Remarks/Examples
	Example: Calculate the total amount to be paid for a $275,000 loan at 5.75% interest over 30 years

MA.912.F.4 Individual Financial Planning

MA.912.F.4.1 :	Develop personal budgets that fit within various income brackets. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 09/07 Belongs to: Individual Financial Planning Remarks/Examples
	Example: Develop a budget worksheet that includes typical expenses such as housing, transportation, utilities, food, medical expenses, and miscellaneous expenses. Add categories for savings toward your own financial goals, and determine the monthly income needed, before taxes, to meet the requirements of your

	budget.
MA.912.F.4.10 :	Analyze diversification in investments. Cognitive Complexity: Level 3: Strategic Thinking & Complex Reasoning l Date Adopted or Revised: 09/07 Belongs to: Individual Financial Planning
MA.912.F.4.11 :	Purchase stock with a set amount of money, and follow the process through gains, losses, and selling. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 09/07 Belongs to: Individual Financial Planning Remarks/Examples Example: At the beginning of the year, Mary invests $3000, buying $1500 of Stock A at $30 per share, $1000 of Stock B at $40 per share, and putting $500 in a money market account paying 5% interest. At the end of the year, stock A is priced at $34 per share, and stock B is priced at $38 per share. What is the overall rate of return for the year on Mary's investments?
MA.912.F.4.12 :	Compare and contrast income from purchase of common stock, preferred stock, and bonds. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 09/07 Belongs to: Individual Financial Planning Remarks/Examples Example: Explain the difference between common and preferred stock. What are some reasons people might choose common stock over preferred stock? Which type of stock is more prevalent in the market today? Example: Compare corporate bonds, government bonds, and common stock as investments with respect to the following attributes: rates of return, price risk, default risk, and taxability of earnings
MA.912.F.4.13 :	Given current exchange rates be able to convert from one form of currency to another. Cognitive Complexity: Level 1: Recall l Date Adopted or Revised: 09/07 Belongs to: Individual Financial Planning Remarks/Examples

	Example: Suppose you are traveling in Europe, and while there you withdraw 150 Euros to pay for expenses. If the exchange rate at the time was $1.27 per Euro, how much money (in dollars) was charged to your bank account?
MA.912.F.4.2 :	Explain cash management strategies including debit accounts, checking accounts, and savings accounts. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 09/07 Belongs to: Individual Financial Planning Remarks/Examples Example: Explain the difference between a checking account and a savings account. Why might you want to have both types of accounts? Why might you want to have only one or the other type? Why is it rare to find someone who has a savings account but no checking account?
MA.912.F.4.3 :	Calculate net worth. Cognitive Complexity: Level 1: Recall l Date Adopted or Revised: 09/07 Belongs to: Individual Financial Planning Remarks/Examples Example: Jose is trying to prepare a balance sheet for the end of the year. His balances and details for the year are given in the table below. Write a balance sheet of Jose's liabilities and assets, and compute his net worth.
MA.912.F.4.4 :	Establish a plan to pay off debt. Cognitive Complexity: Level 3: Strategic Thinking & Complex Reasoning l Date Adopted or Revised: 09/07 Belongs to: Individual Financial Planning Remarks/Examples Example: Suppose you currently have a balance of $4500 on a credit card that charges 18% annual interest. What monthly payment would you have to make in order to pay off the card in 3 years, assuming you do not make any more charges to the card?
MA.912.F.4.5 :	Develop and apply a variety of strategies to use tax tables, and to determine, calculate, and complete yearly federal income tax. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date

	Adopted or Revised: 09/07 Belongs to: Individual Financial Planning Remarks/Examples Example: Suppose that Joe had income of $40,000 in 2005, and had various deductions totaling $6,240. If Joe filed as a single person, how much income tax did he have to pay that year?
MA.912.F.4.6 :	Compare different insurance options and fees. Cognitive Complexity: Level 3: Strategic Thinking & Complex Reasoning l Date Adopted or Revised: 09/07 Belongs to: Individual Financial Planning
MA.912.F.4.7 :	Compare and contrast the role of insurance as a device to mitigate risk and calculate expenses of various options. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 09/07 Belongs to: Individual Financial Planning Remarks/Examples Example: Explain why a person might choose to buy life insurance. Are there any circumstances under which one might not want life insurance?
MA.912.F.4.8 :	Collect, organize, and interpret data to determine an effective retirement savings plan to meet personal financial goals. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 09/07 Belongs to: Individual Financial Planning Remarks/Examples Example: Investigate historical rates of return for stocks, bonds, savings accounts, mutual funds, as well as the relative risks for each type of investment. Organize your results in a table showing the relative returns and risks of each type of investment over short and long terms, and use these data to determine a combination of investments suitable for building a retirement account sufficient to meet anticipated financial needs.
MA.912.F.4.9 :	Calculate, compare, and contrast different types of retirement plans, including IRAs, ROTH accounts, and annuities. Cognitive Complexity: Level 3: Strategic Thinking & Complex Reasoning l Date Adopted or Revised: 09/07 Belongs to: Individual Financial Planning

	Remarks/Examples Example: Suppose you put $5000 per year into an IRA for 40 years. If the account pays 6% per year interest, how much would you have at the end of the 40 years? If, at that time, you are in the 15% income tax bracket, how much would this be after taxes? Suppose that, instead, you paid the tax each year on the $5000 at your current rate of 28% and put the remaining funds in a ROTH account paying 6% interest. How much would you then have after 40 years? Which appears to be the better option? What are some of the risks of deferring tax payments until retirement? Example: Explain the difference between an Individual Retirement Account (IRA) and a ROTH account. Why might somebody choose to put retirement funds in a ROTH account rather than an IRA?

MACC.912.A-CED.1 Create equations that describe numbers or relationships

MACC.912.A-CED.1.1 :	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.* Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Create equations that describe numbers or relationships Remarks/Examples **Algebra 1, Unit 1**: Limit A.CED.1 and A.CED.2 to linear and exponential equations, and, in the case of exponential equations, limit to situations requiring evaluation of exponential functions at integer inputs. **Algebra 1, Unit 4**: Extend work on linear and exponential equations in Unit 1 to quadratic equations. **Algebra 1 Assessment Limits and Clarifications**

	i) Tasks are limited to linear, quadratic, or exponential equations with integer exponents. **Algebra 2 Assessment Limits and Clarifications** i) Tasks are limited to exponential equations with rational or real exponents and rational functions. ii) Tasks have a real-world context.
MACC.912.A-CED.1.2 :	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Create equations that describe numbers or relationships Remarks/Examples
	Algebra 1, Unit 1: Limit A.CED.1 and A.CED.2 to linear and exponential equations, and, in the case of exponential equations, limit to situations requiring evaluation of exponential functions at integer inputs. Algebra 1, Unit 4: Extend work on linear and exponential equations in Unit 1 to quadratic equations.
MACC.912.A-CED.1.3 :	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. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.* Cognitive Complexity: Level 3: Strategic Thinking & Complex Reasoning l Date Adopted or Revised: 12/10 Belongs to: Create equations that describe numbers or relationships Remarks/Examples
	Algebra 1, Unit 1: Limit A.CED.3 to linear equations and inequalities.
MACC.912.A-CED.1.4 :	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law V = IR to highlight resistance R.*

	Cognitive Complexity: Level 1: Recall l Date Adopted or Revised: 12/10 Belongs to: Create equations that describe numbers or relationships Remarks/Examples
	Algebra 1, Unit 1: Limit A.CED.4 to formulas which are linear in the variable of interest. Algebra 1, Unit 4: Extend A.CED.4 to formulas involving squared variables.

MACC.912.A-REI.3 Solve systems of equations

MACC.912.A-REI.3.8 :	Represent a system of linear equations as a single matrix equation in a vector variable. Cognitive Complexity: Level 1: Recall l Date Adopted or Revised: 12/10 Belongs to: Solve systems of equations
MACC.912.A-REI.3.9 :	Find the inverse of a matrix if it exists and use it to solve systems of linear equations (using technology for matrices of dimension 3 × 3 or greater). Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Solve systems of equations

MACC.912.A-SSE.1 Interpret the structure of expressions

MACC.912.A-SSE.1.1 :	Interpret expressions that represent a quantity in terms of its context. a. Interpret parts of an expression, such as terms, factors, and coefficients. b. Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret* $P(1+r)^n$ *as the product of P and a factor not depending on P.* Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Interpret the structure of expressions Remarks/Examples
	Algebra 1 - Fluency Recommendations

	A-SSE.1.1b - Fluency in transforming expressions and chunking (seeing parts of an expression as a single object) is essential in factoring, completing the square, and other mindful algebraic calculations. **Algebra 1, Unit 1**: Limit to linear expressions and to exponential expressions with integer exponents. **Algebra 1, Unit 4**: Focus on quadratic and exponential expressions. For A.SSE.1b, exponents are extended from the integer exponents found in Unit 1 to rational exponents focusing on those that represent square or cube roots.

MACC.912.A-SSE.2 Write expressions in equivalent forms to solve problems

MACC.912.A-SSE.2.4 :	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.* Cognitive Complexity: Level 3: Strategic Thinking & Complex Reasoning l Date Adopted or Revised: 12/10 Belongs to: Write expressions in equivalent forms to solve problems

MACC.912.F-BF.1 Build a function that models a relationship between two quantities

MACC.912.F-BF.1.1 :	Write a function that describes a relationship between two quantities. a. Determine an explicit expression, a recursive process, or steps for calculation from a context. 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.* c. Compose functions. *For example, if T(y) is the temperature in the atmosphere as a function of height, and h(t) is the height of a weather balloon as a function of time, then T(h(t)) is the temperature at the location of the weather balloon as a function of time.*

	Cognitive Complexity: Level 3: Strategic Thinking & Complex Reasoning l Date Adopted or Revised: 12/10 Belongs to: Build a function that models a relationship between two quantities Remarks/Examples
	Algebra 1, Unit 2: Limit to F.BF.1a, 1b, and 2 to linear and exponential functions. **Algebra 1, Unit 5**: Focus on situations that exhibit a quadratic relationship. **Algebra 1 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Tasks are limited to linear functions, quadratic functions, and exponential functions with domains in the integers. **Algebra 2 Assessment Limits and Clarifications** i) Tasks have a real-world context ii) Tasks may involve linear functions, quadratic functions, and exponential functions.
MACC.912.F-BF.1.2 :	Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Build a function that models a relationship between two quantities Remarks/Examples
	Algebra 1 Honors, Unit 4: In F.BF.2, connect arithmetic sequences to linear functions and geometric sequences to exponential functions. Algebra 2, Unit 3: In F.BF.2, connect arithmetic sequences to linear functions and geometric sequences to exponential functions. [Please note this standard is not included in the Algebra 1 course; the remarks should reference Algebra 1 Honors/Unit 4 and Algebra 2/Unit 3 Instructional Notes.]

MACC.912.F-BF.2 Build new functions from existing functions

MACC.912.F-BF.2.5 :	Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Build new functions from existing functions

MACC.912.F-IF.2 Interpret functions that arise in applications in terms of the context

MACC.912.F-IF.2.4 :	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.* Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Interpret functions that arise in applications in terms of the context Remarks/Examples
	Algebra 1, Unit 2: For F.IF.4 and 5, focus on linear and exponential functions. **Algebra 1 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Tasks are limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers. Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra I column for standards F-IF.6 and F-IF.9. **Algebra 2 Assessment Limits and Clarifications** i) Tasks have a real-world context ii) Tasks may involve polynomial, exponential, logarithmic, and

	trigonometric functions. Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra II column for standards F-IF.6 and F-IF.9.
MACC.912.F-IF.2.5 :	Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.* Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Interpret functions that arise in applications in terms of the context Remarks/Examples
	Algebra 1, Unit 2: For F.IF.4 and 5, focus on linear and exponential functions.
MACC.912.F-IF.2.6 :	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. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Interpret functions that arise in applications in terms of the context Remarks/Examples
	Algebra 1, Unit 2: For F.IF.6, focus on linear functions and exponential functions whose domain is a subset of the integers. Unit 5 in this course and the Algebra II course address other types of functions. **Algebra 1 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Tasks are limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers. The function types listed here are the same as those listed in the

	Algebra I column for standards F-IF.4 and F-IF.9. **Algebra 2 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions. The function types listed here are the same as those listed in the Algebra II column for standards F-IF.4 and F-IF.9.

MACC.912.F-IF.3 Analyze functions using different representations

MACC.912.F-IF.3.7 :	Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. a. Graph linear and quadratic functions and show intercepts, maxima, and minima. b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior. e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts I Date Adopted or Revised: 10/10 Belongs to: Analyze functions using different representations Remarks/Examples
	Algebra 1, Unit 2: For F.IF.7a, 7e, and 9 focus on linear and exponentials functions. Include comparisons of two functions presented algebraically. For example, compare the growth of two linear functions, or two exponential functions such as $y=3^n$ and

	$y=100^2$
MACC.912.F-IF.3.8 :	Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. a. 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. b. Use the properties of exponents to interpret expressions for exponential functions. *For example, identify percent rate of change in functions such as y =* $(1.02)^t$*, y =* $(0.97)^t$*, y =* $(1.01)^{12t}$*, y =* $(1.2)^{t/10}$*, and classify them as representing exponential growth or decay.* Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Analyze functions using different representations Remarks/Examples
	Algebra 1, Unit 5: Note that this unit, and in particular in F.IF.8b, extends the work begun in Unit 2 on exponential functions with integer exponents.

MACC.912.F-LE.1 Construct and compare linear, quadratic, and exponential models and solve problems

MACC.912.F-LE.1.4 :	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. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Construct and compare linear, quadratic, and exponential models and solve problems

MACC.912.S-IC.2 Make inferences and justify conclusions from sample surveys, experiments, and observational studies

MACC.912.S-IC.2.6 :	Evaluate reports based on data. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Make inferences and justify conclusions from sample surveys, experiments, and observational studies

MACC.912.S-ID.2 Summarize, represent, and interpret data on two categorical and quantitative variables

MACC.912.S-ID.2.6 :	Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. 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.* b. Informally assess the fit of a function by plotting and analyzing residuals. c. Fit a linear function for a scatter plot that suggests a linear association. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Summarize, represent, and interpret data on two categorical and quantitative variables Remarks/Examples
	Students take a more sophisticated look at using a linear function to model the relationship between two numerical variables. In addition to fitting a line to data, students assess how well the model fits by analyzing residuals. S.ID.6b should be focused on linear models, but may be used to preview quadratic functions in Unit 5 of this course. **Algebra 1 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Exponential functions are limited to those with domains in the integers. **Algebra 2 Assessment Limits and Clarifications**

	i) Tasks have a real-world context. ii) Tasks are limited to exponential functions with domains not in the integers and trigonometric functions.

MACC.912.S-MD.2 Use probability to evaluate outcomes of decisions

MACC.912.S-MD.2.5 :	Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values. a. Find the expected payoff for a game of chance. *For example, find the expected winnings from a state lottery ticket or a game at a fast-food restaurant.* b. Evaluate and compare strategies on the basis of expected values. *For example, compare a high-deductible versus a low-deductible automobile insurance policy using various, but reasonable, chances of having a minor or a major accident.* Cognitive Complexity: Level 2: Basic Application of Skills & Concepts I Date Adopted or Revised: 12/10 Belongs to: Use probability to evaluate outcomes of decisions

MACC.K12.MP.1 Make sense of problems and persevere in solving them.

MACC.K12.MP.1.1 :	**Make sense of problems and persevere in solving them.** Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between

	equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches. Cognitive Complexity: Level 3: Strategic Thinking & Complex Reasoning l Date Adopted or Revised: 12/10 Belongs to: Make sense of problems and persevere in solving them.

MACC.K12.MP.2 Reason abstractly and quantitatively.

MACC.K12.MP.2.1 :	**Reason abstractly and quantitatively**. Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects. Cognitive Complexity: Level 3: Strategic Thinking & Complex Reasoning l Date Adopted or Revised: 12/10 Belongs to: Reason abstractly and quantitatively.

MACC.K12.MP.3 Construct viable arguments and critique the reasoning of others.

MACC.K12.MP.3.1 :	**Construct viable arguments and critique the reasoning of others.**

	Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments. Cognitive Complexity: Level 3: Strategic Thinking & Complex Reasoning l Date Adopted or Revised: 12/10 Belongs to: Construct viable arguments and critique the reasoning of others.

MACC.K12.MP.4 Model with mathematics.

MACC.K12.MP.4.1 :	**Model with mathematics.** Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need

	revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose. Cognitive Complexity: Level 3: Strategic Thinking & Complex Reasoning l Date Adopted or Revised: 12/10 Belongs to: Model with mathematics.

MACC.K12.MP.5 Use appropriate tools strategically.

MACC.K12.MP.5.1 :	**Use appropriate tools strategically.** Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Use appropriate tools strategically.

MACC.K12.MP.6 Attend to precision.

MACC.K12.MP.6.1 :	**Attend to precision.** Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions. Cognitive Complexity: Level 3: Strategic Thinking & Complex Reasoning l Date Adopted or Revised: 12/10 Belongs to: Attend to precision.

MACC.K12.MP.7 Look for and make use of structure.

MACC.K12.MP.7.1 :	**Look for and make use of structure.** Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see 7 × 8 equals the well remembered 7 × 5 + 7 × 3, in preparation for learning about the distributive property. In the expression $x^2 + 9x + 14$, older students can see the 14 as 2 × 7 and the 9 as 2 + 7. They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see $5 – 3(x – y)^2$ as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers x and y.

	Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Look for and make use of structure.

MACC.K12.MP.8 Look for and express regularity in repeated reasoning.

MACC.K12.MP.8.1 :	**Look for and express regularity in repeated reasoning.** Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation $(y – 2)/(x – 1) = 3$. Noticing the regularity in the way terms cancel when expanding $(x – 1)(x + 1)$, $(x – 1)(x^2 + x + 1)$, and $(x – 1)(x^3 + x^2 + x + 1)$ might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results. Cognitive Complexity: Level 3: Strategic Thinking & Complex Reasoning l Date Adopted or Revised: 12/10 Belongs to: Look for and express regularity in repeated reasoning.

RELATED GLOSSARY TERM DEFINITIONS (15)

Attribute:	A quality or characteristic, such as color, thickness, size, and shape.
Compound Interest:	A method of computing interest in which interest is computed from the up-to-date balance. That is, interest is earned on the interest and not just on original balance.

Difference:	A number that is the result of subtraction
Discount:	An amount that is subtracted from the regular price of an item.
Face:	One of the plane surfaces bounding a three-dimensional figure.
Gross:	A quantity made of 144 items.
Length:	A one-dimensional measure that is the measurable property of line segments.
Net:	A two-dimensional diagram that can be folded or made into a three-dimensional figure.
Percent:	Per hundred; a special ratio in which the denominator is always 100. The language of percent may change depending on the context. The most common use is in part-whole contexts, for example, where a subset is 40 percent of another set. A second use is change contexts, for example, a set increases or decreases in size by 40 percent to become 140% or 60% of its original size. A third use involves comparing two sets, for example set A is 40% of the size of set B, in other words, set B is 250 percent of set A.
Point:	A specific location in space that has no discernable length or width.
Rate:	A ratio that compares two quantities of different units.
Set:	A set is a finite or infinite collection of distinct objects in which order has no significance.
Similarity:	A term describing figures that are the same shape but are not necessarily the same size or in the same position.
Table:	A data display that organizes information about a topic into categories using rows and columns.
Exponential Function:	A function of the form $y = ab^{cx+b} + e$, where a,b,c,d,e,x are real numbers, a, b, c are nonzero, b≠1, and b>0.

Course: Mathematics for College Success- 1200410

Direct link to this page:http://www.cpalms.org/Courses/CoursePagePublicPreviewCourse2904.aspx

BASIC INFORMATION

Course Title:	Mathematics for College Success
Course Number:	1200410
Course Abbreviated Title:	MATH COLL SUCCESS
Course Path:	**Section:** Grades PreK to 12 Education Courses **Grade Group:** Grades 9 to 12 and Adult Education Courses **Subject:** Mathematics **SubSubject:** Algebra
Number of Credits:	Half credit (.5)
Course length:	Semester (S)
Course Type:	Core
Course Level:	2
Status:	State Board Approved
General Notes:	This course is targeted for grade 12 students, whose test scores on the Postsecondary Educational Readiness Test (P.E.R.T.) are below the established cut scores for mathematics, indicating that they are not yet "college ready" in mathematics. This course incorporates the Common Core Standards for Mathematical Practices as well as the following Common Core Standards for Mathematical Content: Expressions and Equations, The Number System, Ratios and Proportional Relationships, Functions, Algebra, Geometry, Number and Quantity, Statistics and Probability, and the Common Core Standards for High School Modeling. The standards align with the Mathematics Postsecondary Readiness Competencies deemed necessary for entry-level college courses.

STANDARDS (55)

MACC.6.EE.1 Apply and extend previous understandings of arithmetic to algebraic expressions.

MACC.6.EE.1.2 :	Write, read, and evaluate expressions in which letters stand for numbers. a. Write expressions that record operations with numbers and with letters standing for numbers. *For example, express the calculation "Subtract y from 5" as 5 – y.* b. Identify parts of an expression using mathematical terms (sum, term, product, factor, quotient, coefficient); view one or more parts of an expression as a single entity. *For example, describe the expression 2 (8 + 7) as a product of two factors; view (8 + 7) as both a single entity and a sum of two terms.* c. Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems. Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations). *For example, use the formulas* $V = s^3$ *and* $A = 6 s^2$ *to find the volume and surface area of a cube with sides of length s = 1/2.* Cognitive Complexity: Level 2: Basic Application of Skills & Concepts I Date Adopted or Revised: 12/09 Belongs to: Apply and extend previous understandings of arithmetic to algebraic expressions.

MACC.7.EE.2 Solve real-life and mathematical problems using numerical and algebraic expressions and equations.

MACC.7.EE.2.3 :	Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply

	properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. *For example: If a woman making $25 an hour gets a 10% raise, she will make an additional 1/10 of her salary an hour, or $2.50, for a new salary of $27.50. If you want to place a towel bar 9 3/4 inches long in the center of a door that is 27 1/2 inches wide, you will need to place the bar about 9 inches from each edge; this estimate can be used as a check on the exact computation.* Cognitive Complexity: Level 2: Basic Application of Skills & Concepts I Date Adopted or Revised: 12/10 Belongs to: [Solve real-life and mathematical problems using numerical and algebraic expressions and equations.] Remarks/Examples
	Fluency Expectations or Examples of Culminating Standards Students solve multistep problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. This work is the culmination of many progressions of learning in arithmetic, problem solving and mathematical practices. **Examples of Opportunities for In-Depth Focus** This is a major capstone standard for arithmetic and its applications.
MACC.7.EE.2.4 :	Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. a. Solve word problems leading to equations of the form px + q = r and p(x + q) = r, where p, q, and r are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach. *For example, the perimeter of a rectangle is 54 cm. Its length is 6 cm. What is its width?*

	b. Solve word problems leading to inequalities of the form px + q > r or px + q < r, where p, q, and r are specific rational numbers. Graph the solution set of the inequality and interpret it in the context of the problem. *For example: As a salesperson, you are paid $50 per week plus $3 per sale. This week you want your pay to be at least $100. Write an inequality for the number of sales you need to make, and describe the solutions.* Cognitive Complexity: Level 2: Basic Application of Skills & Concepts I Date Adopted or Revised: 12/10 Belongs to: Solve real-life and mathematical problems using numerical and algebraic expressions and equations. Remarks/Examples
	Fluency Expectations or Examples of Culminating Standards In solving word problems leading to one-variable equations of the form px + q = r and p(x + q) = r, students solve the equations fluently. This will require fluency with rational number arithmetic (7.NS.1.1–1.3), as well as fluency to some extent with applying properties operations to rewrite linear expressions with rational coefficients (7.EE.1.1). **Examples of Opportunities for In-Depth Focus** Work toward meeting this standard builds on the work that led to meeting 6.EE.2.7 and prepares students for the work that will lead to meeting 8.EE.3.7.

MACC.7.NS.1 Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.

MACC.7.NS.1.1 :	Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram. a. Describe situations in which opposite quantities combine to make 0. *For example, a hydrogen atom has 0 charge*

	because its two constituents are oppositely charged. b. Understand p + q as the number located a distance |q| from p, in the positive or negative direction depending on whether q is positive or negative. Show that a number and its opposite have a sum of 0 (are additive inverses). Interpret sums of rational numbers by describing real-world contexts. c. Understand subtraction of rational numbers as adding the additive inverse, p – q = p + (–q). Show that the distance between two rational numbers on the number line is the absolute value of their difference, and apply this principle in real-world contexts. d. Apply properties of operations as strategies to add and subtract rational numbers. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts I Date Adopted or Revised: 12/10 Belongs to: Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers. Remarks/Examples
	Fluency Expectations or Examples of Culminating Standards Adding, subtracting, multiplying, and dividing rational numbers is the culmination of numerical work with the four basic operations. The number system will continue to develop in grade 8, expanding to become the real numbers by the introduction of irrational numbers, and will develop further in high school, expanding to become the complex numbers with the introduction of imaginary numbers. Because there are no specific standards for rational number arithmetic in later grades and because so much other work in grade 7 depends on rational number arithmetic, fluency with rational number arithmetic should be the goal in grade 7.
MACC.7.NS.1.2 :	Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers. a. Understand that multiplication is extended from fractions to rational numbers by requiring that operations continue to satisfy the properties of operations, particularly the

	distributive property, leading to products such as (–1)(–1) = 1 and the rules for multiplying signed numbers. Interpret products of rational numbers by describing real-world contexts. b. Understand that integers can be divided, provided that the divisor is not zero, and every quotient of integers (with non-zero divisor) is a rational number. If p and q are integers, then –(p/q) = (–p)/q = p/(–q). Interpret quotients of rational numbers by describing real-world contexts. c. Apply properties of operations as strategies to multiply and divide rational numbers. d. Convert a rational number to a decimal using long division; know that the decimal form of a rational number terminates in 0s or eventually repeats. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts I Date Adopted or Revised: 12/10 Belongs to: Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers. Remarks/Examples
	Fluency Expectations or Examples of Culminating Standards Adding, subtracting, multiplying, and dividing rational numbers is the culmination of numerical work with the four basic operations. The number system will continue to develop in grade 8, expanding to become the real numbers by the introduction of irrational numbers, and will develop further in high school, expanding to become the complex numbers with the introduction of imaginary numbers. Because there are no specific standards for rational number arithmetic in later grades and because so much other work in grade 7 depends on rational number arithmetic, fluency with rational number arithmetic should be the goal in grade 7.

MACC.7.RP.1 Analyze proportional relationships and use them to solve real-world and mathematical problems.

MACC.7.RP.1.3 :	Use proportional relationships to solve multistep ratio and percent problems. *Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error.*

	Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Analyze proportional relationships and use them to solve real-world and mathematical problems.

MACC.8.EE.1 Work with radicals and integer exponents.

MACC.8.EE.1.1 :	Know and apply the properties of integer exponents to generate equivalent numerical expressions. *For example,* $3^2 \times$ = $=1/3^3=1/27$ Cognitive Complexity: Level 1: Recall l Date Adopted or Revised: 12/09 Belongs to: Work with radicals and integer exponents.
MACC.8.EE.1.4 :	Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Work with radicals and integer exponents.

MACC.8.EE.2 Understand the connections between proportional relationships, lines, and linear equations.

MACC.8.EE.2.5 :	Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. *For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.* Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Understand the connections between proportional relationships, lines, and linear equations. Remarks/Examples
	Examples of Opportunities for In-Depth Focus When students work toward meeting this standard, they build on grades 6–7 work with proportions and position themselves for grade 8 work with functions and the equation of a line.

MACC.8.F.2 Use functions to model relationships between quantities.

MACC.8.F.2.4 :	Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values. Cognitive Complexity: Level 3: Strategic Thinking & Complex Reasoning l Date Adopted or Revised: 12/10 Belongs to: Use functions to model relationships between quantities.

MACC.8.NS.1 Know that there are numbers that are not rational, and approximate them by rational numbers.

MACC.8.NS.1.1 :	Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number. Cognitive Complexity: Level 1: Recall l Date Adopted or Revised: 12/10 Belongs to: Know that there are numbers that are not rational, and approximate them by rational numbers.
MACC.8.NS.1.2 :	Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., π^2). *For example, by truncating the decimal expansion of √2, show that √2 is between 1 and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations.* Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Know that there are numbers that are not rational, and approximate them by rational numbers.

MACC.912.A-APR.1 Perform arithmetic operations on polynomials

MACC.912.A-APR.1.1 :	Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.

	Cognitive Complexity: Level 1: Recall l Date Adopted or Revised: 12/10 Belongs to: [Perform arithmetic operations on polynomials] Remarks/Examples
	Algebra 1 - Fluency Recommendations Fluency in adding, subtracting, and multiplying polynomials supports students throughout their work in algebra, as well as in their symbolic work with functions. Manipulation can be more mindful when it is fluent. Focus on polynomial expressions that simplify to forms that are linear or quadratic in a positive integer power of x.

MACC.912.A-APR.2 Understand the relationship between zeros and factors of polynomials

MACC.912.A-APR.2.3 :	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. Cognitive Complexity: Level 1: Recall l Date Adopted or Revised: 12/10 Belongs to: [Understand the relationship between zeros and factors of polynomials] Remarks/Examples
	Algebra 1 Assessment Limits and Clarifications i) Tasks are limited to quadratic and cubic polynomials in which linear and quadratic factors are available. For example, find the zeros of $(x - 2)(x^2 - 9)$. **Algebra 2 Assessment Limits and Clarifications** i) Tasks include quadratic, cubic, and quartic polynomials and polynomials for which factors are not provided. For example, find the zeros of $(x^2 - 1)(x^2 + 1)$

MACC.912.A-APR.3 Use polynomial identities to solve problems

MACC.912.A-APR.3.4 :	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. Cognitive Complexity: Level 1: Recall I Date Adopted or Revised: 12/10 Belongs to: Use polynomial identities to solve problems

MACC.912.A-APR.4 Rewrite rational expressions

MACC.912.A-APR.4.7 :	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. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts I Date Adopted or Revised: 12/10 Belongs to: Rewrite rational expressions

MACC.912.A-CED.1 Create equations that describe numbers or relationships

MACC.912.A-CED.1.1 :	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.* Cognitive Complexity: Level 2: Basic Application of Skills & Concepts I Date Adopted or Revised: 12/10 Belongs to: Create equations that describe numbers or relationships Remarks/Examples
	Algebra 1, Unit 1: Limit A.CED.1 and A.CED.2 to linear and exponential equations, and, in the case of exponential equations, limit to situations requiring evaluation of exponential functions at integer inputs. **Algebra 1, Unit 4**: Extend work on linear and exponential equations in Unit 1 to quadratic equations. **Algebra 1 Assessment Limits and Clarifications** i) Tasks are limited to linear, quadratic, or exponential equations with integer exponents. **Algebra 2 Assessment Limits and Clarifications** i) Tasks are limited to exponential equations with rational or real exponents and rational functions.

	ii) Tasks have a real-world context.
MACC.912.A-CED.1.2 :	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts I Date Adopted or Revised: 12/10 Belongs to: Create equations that describe numbers or relationships Remarks/Examples
	Algebra 1, Unit 1: Limit A.CED.1 and A.CED.2 to linear and exponential equations, and, in the case of exponential equations, limit to situations requiring evaluation of exponential functions at integer inputs. Algebra 1, Unit 4: Extend work on linear and exponential equations in Unit 1 to quadratic equations.
MACC.912.A-CED.1.3 :	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. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.* Cognitive Complexity: Level 3: Strategic Thinking & Complex Reasoning I Date Adopted or Revised: 12/10 Belongs to: Create equations that describe numbers or relationships Remarks/Examples
	Algebra 1, Unit 1: Limit A.CED.3 to linear equations and inequalities.
MACC.912.A-CED.1.4 :	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law V = IR to highlight resistance R.* Cognitive Complexity: Level 1: Recall I Date Adopted or Revised: 12/10 Belongs to: Create equations that describe numbers or relationships Remarks/Examples
	Algebra 1, Unit 1: Limit A.CED.4 to formulas which are linear in the variable of interest. Algebra 1, Unit 4: Extend A.CED.4 to formulas involving squared variables.

MACC.912.A-REI.1 Understand solving equations as a process of reasoning and explain the reasoning

MACC.912.A-REI.1.1 :	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. Cognitive Complexity: Level 3: Strategic Thinking & Complex Reasoning l Date Adopted or Revised: 12/10 Belongs to: Understand solving equations as a process of reasoning and explain the reasoning Remarks/Examples
	Algebra 1, Unit 1: Students should focus on and master A.REI.1 for linear equations and be able to extend and apply their reasoning to other types of equations in future courses. Students will solve exponential equations with logarithms in Algebra II. **Algebra 1 Assessment Limits and Clarification** i) Tasks are limited to quadratic equations. **Algebra 2 Assessment Limits and Clarification** i) Tasks are limited to simple rational or radical equations.
MACC.912.A-REI.1.2 :	Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise. Cognitive Complexity: Level 3: Strategic Thinking & Complex Reasoning l Date Adopted or Revised: 12/10 Belongs to: Understand solving equations as a process of reasoning and explain the reasoning

MACC.912.A-REI.2 Solve equations and inequalities in one variable

MACC.912.A-REI.2.3 :	Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

	Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Solve equations and inequalities in one variable Remarks/Examples
	Algebra 1, Unit 1: Extend earlier work with solving linear equations to solving linear inequalities in one variable and to solving literal equations that are linear in the variable being solved for. Include simple exponential equations that rely only on application of the laws of exponents, such as 5^x=125 or 2^x=1/16 **Algebra 1 Assessment Limits and Clarifications** i) Tasks do not require students to write solutions for quadratic equations that have roots with nonzero imaginary parts. However, tasks can require the student to recognize cases in which a quadratic equation has no real solutions. Note, solving a quadratic equation by factoring relies on the connection between zeros and factors of polynomials (cluster A-APR.B). Cluster A-APR.B is formally assessed in A2. **Algebra 2 Assessment Limits and Clarifications** i) In the case of equations that have roots with nonzero imaginary parts, students write the solutions as a ± bi for real numbers a and b.
MACC.912.A-REI.2.4 :	Solve quadratic equations in one variable. a. Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x – p)^2$ = q that has the same solutions. Derive the quadratic formula from this form. 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.

	Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Solve equations and inequalities in one variable Remarks/Examples
	Algebra 1, Unit 4: Students should learn of the existence of the complex number system, but will not solve quadratics with complex solutions until Algebra II. **Algebra 1 Assessment Limits and Clarifications** i) Tasks do not require students to write solutions for quadratic equations that have roots with nonzero imaginary parts. However, tasks can require the student to recognize cases in which a quadratic equation has no real solutions. Note, solving a quadratic equation by factoring relies on the connection between zeros and factors of polynomials (cluster A-APR.B). Cluster A-APR.B is formally assessed in A2. **Algebra 2 Assessment Limits and Clarifications** i) In the case of equations that have roots with nonzero imaginary parts, students write the solutions as a ± bi for real numbers a and b.

MACC.912.A-REI.3 Solve systems of equations

MACC.912.A-REI.3.5 :	Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions. Cognitive Complexity: Level 3: Strategic Thinking & Complex Reasoning l Date Adopted or Revised: 12/10 Belongs to: Solve systems of equations Remarks/Examples
	Algebra 1, Unit 2: Build on student experiences graphing and solving systems of linear equations from middle school to focus on justification of the methods used. Include cases where the two equations describe the same line (yielding infinitely many solutions) and cases where two equations describe parallel lines (yielding no solution); connect to GPE.5 when it is taught in

	Geometry, which requires students to prove the slope criteria for parallel lines.
MACC.912.A-REI.3.6 :	Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. Cognitive Complexity: Level 1: Recall l Date Adopted or Revised: 12/10 Belongs to: Solve systems of equations Remarks/Examples
	Algebra 1, Unit 2: Build on student experiences graphing and solving systems of linear equations from middle school to focus on justification of the methods used. Include cases where the two equations describe the same line (yielding infinitely many solutions) and cases where two equations describe parallel lines (yielding no solution); connect to GPE.5 when it is taught in Geometry, which requires students to prove the slope criteria for parallel lines. **Algebra 1 Assessment Limits and Clarifications** i)i) Tasks have a real-world context. ii) Tasks have hallmarks of modeling as a mathematical practice (less defined tasks, more of the modeling cycle, etc.). Note, solving a quadratic equation by factoring relies on the connection between zeros and factors of polynomials (cluster A-APR.B). Cluster A-APR.B is formally assessed in A2. **Algebra 2 Assessment Limits and Clarifications** i) Tasks are limited to 3x3 systems.

MACC.912.A-REI.4 Represent and solve equations and inequalities graphically

MACC.912.A-REI.4.10 :	Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often

	forming a curve (which could be a line). Cognitive Complexity: Level 1: Recall l Date Adopted or Revised: 12/10 Belongs to: Represent and solve equations and inequalities graphically Remarks/Examples
	Algebra 1, Unit 2: For A.REI.10, focus on linear and exponential equations and be able to adapt and apply that learning to other types of equations in future courses.
MACC.912.A-REI.4.11 :	Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect are the solutions of the equation f(x) = g(x); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where f(x) and/or g(x) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Represent and solve equations and inequalities graphically Remarks/Examples
	Algebra 1, Unit 2: For A.REI.11, focus on cases where f(x) and g(x) are linear or exponential. **Algebra 1 Assessment Limits and Clarifications** i) Tasks that assess conceptual understanding of the indicated concept may involve any of the function types mentioned in the standard except exponential and logarithmic functions. ii) Finding the solutions approximately is limited to cases where f(x) and g(x) are polynomial functions. **Algebra 2 Assessment Limits and Clarifications** i) Tasks may involve any of the function types mentioned in the standard.

MACC.912.A-SSE.1 Interpret the structure of expressions

MACC.912.A-SSE.1.1 :

Interpret expressions that represent a quantity in terms of its context.

a. Interpret parts of an expression, such as terms, factors, and coefficients.
b. Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret as the product of P and a factor not depending on P.*

Cognitive Complexity: Level 2: Basic Application of Skills & Concepts I Date Adopted or Revised: 12/10
Belongs to: Interpret the structure of expressions
Remarks/Examples

Algebra 1 - Fluency Recommendations

A-SSE.1.1b - Fluency in transforming expressions and chunking (seeing parts of an expression as a single object) is essential in factoring, completing the square, and other mindful algebraic calculations.

Algebra 1, Unit 1: Limit to linear expressions and to exponential expressions with integer exponents.

Algebra 1, Unit 4: Focus on quadratic and exponential expressions. For A.SSE.1b, exponents are extended from the integer exponents found in Unit 1 to rational exponents focusing on those that represent square or cube roots.

MACC.912.A-SSE.1.2 :

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 $(x^2 – y^2)(x^2 + y^2)$.*

Cognitive Complexity: Level 2: Basic Application of Skills & Concepts I Date Adopted or Revised: 12/10
Belongs to: Interpret the structure of expressions
Remarks/Examples

Algebra 1, Unit 4: Focus on quadratic and exponential expressions.

For A.SSE.1b, exponents are extended from the integer exponents found in Unit 1 to rational exponents focusing on those that represent square or cube roots.

Algebra 2 - Fluency Recommendations

The ability to see structure in expressions and to use this structure to rewrite expressions is a key skill in everything from advanced factoring (e.g., grouping) to summing series to the rewriting of rational expressions to examine the end behavior of the corresponding rational function.

Algebra 1 Assessment Limits and Clarifications

i) Tasks are limited to numerical expressions and polynomial expressions in one variable. ii) Examples: Recognize 532 + 472 as a difference of squares and see an opportunity to rewrite it in the easier-to-evaluate form (53 + 47)(53 + 47). See an opportunity to rewrite $a^2 + 9a + 14$ as $(a+ 7)(a+ 2)$.

Algebra 2 Assessment and Limits and Clarifications

i) Tasks are limited to polynomial, rational, or exponential expressions. ii) Examples: 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 $(x^2 – y^2)(x^2 + y^2)$. In the equation $x^2 + 2x + 1 + y^2 = 9$, see an opportunity to rewrite the first three terms as $(x+1)^2$, thus recognizing the equation of a circle with radius 3 and center (-1, 0). See $(x^2 + 4)/(x^2 + 3)$ as $((x^2+3) + 1)/(x^2+3)$, thus recognizing an opportunity to write it as $1 + 1/(x^2 + 3)$.

MACC.912.A-SSE.2 Write expressions in equivalent forms to solve problems

MACC.912.A-SSE.2.3 :	Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. a. Factor a quadratic expression to reveal the zeros of the function it defines. b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.

c. Use the properties of exponents to transform expressions for exponential functions. *For example the expression can be rewritten as ≈ to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.*

Cognitive Complexity: Level 2: Basic Application of Skills & Concepts | Date Adopted or Revised: 12/10

Belongs to: Write expressions in equivalent forms to solve problems

Remarks/Examples

Algebra 1, Unit 4: It is important to balance conceptual understanding and procedural fluency in work with equivalent expressions. For example, development of skill in factoring and completing the square goes hand-in-hand with understanding what different forms of a quadratic expression reveal.

Algebra 1 Assessment Limits and Clarifications

i) Tasks have a real-world context. As described in the standard, there is an interplay between the mathematical structure of the expression and the structure of the situation such that choosing and producing an equivalent form of the expression reveals something about the situation.

ii) Tasks are limited to exponential expressions with integer exponents.

Algebra 2 Assessment Limits and Clarifications

i) Tasks have a real-world context. As described in the standard, there is an interplay between the mathematical structure of the expression and the structure of the situation such that choosing and producing an equivalent form of the expression reveals something about the situation.

ii) Tasks are limited to exponential expressions with rational or real exponents.

MACC.912.F-BF.1 Build a function that models a relationship between two quantities

MACC.912.F-BF.1.1 :	Write a function that describes a relationship between two quantities. a. Determine an explicit expression, a recursive process, or steps for calculation from a context. 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.* c. Compose functions. *For example, if T(y) is the temperature in the atmosphere as a function of height, and h(t) is the height of a weather balloon as a function of time, then T(h(t)) is the temperature at the location of the weather balloon as a function of time.* Cognitive Complexity: Level 3: Strategic Thinking & Complex Reasoning l Date Adopted or Revised: 12/10 Belongs to: Build a function that models a relationship between two quantities Remarks/Examples
	Algebra 1, Unit 2: Limit to F.BF.1a, 1b, and 2 to linear and exponential functions. **Algebra 1, Unit 5**: Focus on situations that exhibit a quadratic relationship. **Algebra 1 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Tasks are limited to linear functions, quadratic functions, and exponential functions with domains in the integers. **Algebra 2 Assessment Limits and Clarifications** i) Tasks have a real-world context ii) Tasks may involve linear functions, quadratic functions, and exponential functions.

MACC.912.F-BF.2 Build new functions from existing functions

MACC.912.F-BF.2.3 :	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.* Cognitive Complexity: Level 2: Basic Application of Skills & Concepts I Date Adopted or Revised: 12/10 Belongs to: Build new functions from existing functions Remarks/Examples
	Algebra 1, Unit 2: Focus on vertical translations of graphs of linear and exponential functions. Relate the vertical translation of a linear function to its y-intercept. While applying other transformations to a linear graph is appropriate at this level, it may be difficult for students to identify or distinguish between the effects of the other transformations included in this standard. **Algebra 1, Unit 5**: For F.BF.3, focus on quadratic functions, and consider including absolute value functions. **Algebra 1 Assessment Limit and Clarifications** i) Identifying 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) is limited to linear and quadratic functions. ii) Experimenting with cases and illustrating an explanation of the effects on the graph using technology is limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers. iii) Tasks do not involve recognizing even and odd functions. The function types listed in note (ii) are the same as those listed in the Algebra I column for standards F-IF.4, F-IF.6, and F-IF.9.

	Algebra 2 Assessment Limits and Clarifications i) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions ii) Tasks may involve recognizing even and odd functions. The function types listed in note (i) are the same as those listed in the Algebra II column for standards F-IF.4, F-IF.6, and F-IF.9.

MACC.912.F-IF.1 Understand the concept of a function and use function notation

MACC.912.F-IF.1.1 :	Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then f(x) denotes the output of f corresponding to the input x. The graph of f is the graph of the equation y = f(x). Cognitive Complexity: Level 1: Recall l Date Adopted or Revised: 12/10 Belongs to: Understand the concept of a function and use function notation Remarks/Examples
	Algebra 1, Unit 2: Students should experience a variety of types of situations modeled by functions. Detailed analysis of any particular class of functions at this stage is not advised. Students should apply these concepts throughout their future mathematics courses. Draw examples from linear and exponential functions.

MACC.912.F-IF.2 Interpret functions that arise in applications in terms of the context

MACC.912.F-IF.2.4 :	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.* Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10

	Belongs to: Interpret functions that arise in applications in terms of the context Remarks/Examples
	Algebra 1, Unit 2: For F.IF.4 and 5, focus on linear and exponential functions. **Algebra 1 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Tasks are limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers. Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra I column for standards F-IF.6 and F-IF.9. **Algebra 2 Assessment Limits and Clarifications** i) Tasks have a real-world context ii) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions. Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra II column for standards F-IF.6 and F-IF.9.
MACC.912.F-IF.2.5 :	Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.* Cognitive Complexity: Level 2: Basic Application of Skills & Concepts I Date Adopted or Revised: 12/10 Belongs to: Interpret functions that arise in applications in terms of the context Remarks/Examples
	Algebra 1, Unit 2: For F.IF.4 and 5, focus on linear and exponential functions.
MACC.912.F-IF.2.6 :	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. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts I Date Adopted or Revised: 12/10 Belongs to: Interpret functions that arise in applications in terms of the context Remarks/Examples
	Algebra 1, Unit 2: For F.IF.6, focus on linear functions and exponential functions whose domain is a subset of the integers. Unit 5 in this course and the Algebra II course address other types of functions. **Algebra 1 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Tasks are limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers. The function types listed here are the same as those listed in the Algebra I column for standards F-IF.4 and F-IF.9. **Algebra 2 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions. The function types listed here are the same as those listed in the Algebra II column for standards F-IF.4 and F-IF.9.

MACC.912.F-IF.3 Analyze functions using different representations

MACC.912.F-IF.3.7 :	Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. a. Graph linear and quadratic functions and show intercepts, maxima, and minima.

b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.
c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.
d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.
e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.

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Belongs to: Analyze functions using different representations

Remarks/Examples

Algebra 1, Unit 2: For F.IF.7a, 7e, and 9 focus on linear and exponentials functions. Include comparisons of two functions presented algebraically. For example, compare the growth of two linear functions, or two exponential functions such as $y=3^n$ and $y=100^2$

MACC.912.F-IF.3.8 :

Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

a. 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.
b. Use the properties of exponents to interpret expressions for exponential functions. *For example, identify percent rate of change in functions such as y = , y = , y = , y = , and classify them as representing exponential growth or decay.*

Cognitive Complexity: Level 2: Basic Application of Skills & Concepts | Date

	Adopted or Revised: 12/10 Belongs to: Analyze functions using different representations Remarks/Examples
	Algebra 1, Unit 5: Note that this unit, and in particular in F.IF.8b, extends the work begun in Unit 2 on exponential functions with integer exponents.

MACC.912.G-GPE.2 Use coordinates to prove simple geometric theorems algebraically

MACC.912.G-GPE.2.5 :	Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point). Cognitive Complexity: Level 2: Basic Application of Skills & Concepts I Date Adopted or Revised: 12/10 Belongs to: Use coordinates to prove simple geometric theorems algebraically Remarks/Examples
	Geometry - Fluency Recommendations Fluency with the use of coordinates to establish geometric results, calculate length and angle, and use geometric representations as a modeling tool are some of the most valuable tools in mathematics and related fields.

MACC.912.N-Q.1 Reason quantitatively and use units to solve problems.

MACC.912.N-Q.1.1 :	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts I Date Adopted or Revised: 12/10 Belongs to: Reason quantitatively and use units to solve problems. Remarks/Examples
	Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions,

	equations, and functions.
MACC.912.N-Q.1.2 :	Define appropriate quantities for the purpose of descriptive modeling. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts I Date Adopted or Revised: 12/10 Belongs to: Reason quantitatively and use units to solve problems. Remarks/Examples
	Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. **Algebra 1 Content Notes:** Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. **Algebra 1 Assessment Limits and Clarifications** This standard will be assessed in Algebra I by ensuring that some modeling tasks (involving Algebra I content or securely held content from grades 6-8) require the student to create a quantity of interest in the situation being described (i.e., a quantity of interest is not selected for the student by the task). For example, in a situation involving data, the student might autonomously decide that a measure of center is a key variable in a situation, and then choose to work with the mean. **Algebra 2 Assessment Limits and Clarifications** This standard will be assessed in Algebra II by ensuring that some modeling tasks (involving Algebra II content or securely held content from previous grades and courses) require the student to create a quantity of interest in the situation being described (i.e., this is not provided in the task). For example, in a situation involving periodic phenomena, the student might autonomously decide that amplitude is a key variable in a situation, and then choose to work with peak amplitude.

MACC.912.N-Q.1.3 :	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts I Date Adopted or Revised: 12/10 Belongs to: Reason quantitatively and use units to solve problems. Remarks/Examples
	Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions.

MACC.912.N-RN.1 Extend the properties of exponents to rational exponents.

MACC.912.N-RN.1.2 :	Rewrite expressions involving radicals and rational exponents using the properties of exponents. Cognitive Complexity: Level 1: Recall I Date Adopted or Revised: 12/10 Belongs to: Extend the properties of exponents to rational exponents. Remarks/Examples
	Algebra 1, Unit 2: In implementing the standards in curriculum, these standards should occur before discussing exponential functions with continuous domains.

MACC.912.S-ID.2 Summarize, represent, and interpret data on two categorical and quantitative variables

MACC.912.S-ID.2.5 :	Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts I Date Adopted or Revised: 12/10 Belongs to: Summarize, represent, and interpret data on two categorical and quantitative variables
MACC.912.S-ID.2.6 :	Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. 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. b. Informally assess the fit of a function by plotting and analyzing residuals. c. Fit a linear function for a scatter plot that suggests a linear association. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Summarize, represent, and interpret data on two categorical and quantitative variables Remarks/Examples
	Students take a more sophisticated look at using a linear function to model the relationship between two numerical variables. In addition to fitting a line to data, students assess how well the model fits by analyzing residuals. S.ID.6b should be focused on linear models, but may be used to preview quadratic functions in Unit 5 of this course. **Algebra 1 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Exponential functions are limited to those with domains in the integers. **Algebra 2 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Tasks are limited to exponential functions with domains not in the integers and trigonometric functions.

MACC.912.S-ID.3 Interpret linear models

MACC.912.S-ID.3.7 :	Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Interpret linear models Remarks/Examples

	Build on students' work with linear relationships in eighth grade and introduce the correlation coefficient. The focus here is on the computation and interpretation of the correlation coefficient as a measure of how well the data fit the relationship. The important distinction between a statistical relationship and a cause-and-effect relationship arises in S.ID.9.

MACC.K12.MP.1 Make sense of problems and persevere in solving them.

MACC.K12.MP.1.1 :	**Make sense of problems and persevere in solving them.** Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, "Does this make sense?" They can understand the approaches of others to solving complex problems and identify correspondences between different approaches. Cognitive Complexity: Level 3: Strategic Thinking & Complex Reasoning I Date Adopted or Revised: 12/10 Belongs to: Make sense of problems and persevere in solving them.

MACC.K12.MP.2 Reason abstractly and quantitatively.

MACC.K12.MP.2.1 :	**Reason abstractly and quantitatively**. Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects. Cognitive Complexity: Level 3: Strategic Thinking & Complex Reasoning I Date Adopted or Revised: 12/10 Belongs to: Reason abstractly and quantitatively.

MACC.K12.MP.3 Construct viable arguments and critique the reasoning of others.

MACC.K12.MP.3.1 :	**Construct viable arguments and critique the reasoning of others.** Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even

	though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments. Cognitive Complexity: Level 3: Strategic Thinking & Complex Reasoning l Date Adopted or Revised: 12/10 Belongs to: Construct viable arguments and critique the reasoning of others.

MACC.K12.MP.4 Model with mathematics.

MACC.K12.MP.4.1 :	**Model with mathematics.** Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose. Cognitive Complexity: Level 3: Strategic Thinking & Complex Reasoning l Date Adopted or Revised: 12/10 Belongs to: Model with mathematics.

MACC.K12.MP.5 Use appropriate tools strategically.

MACC.K12.MP.5.1 :	**Use appropriate tools strategically.** Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts I Date Adopted or Revised: 12/10 Belongs to: Use appropriate tools strategically.

MACC.K12.MP.6 Attend to precision.

MACC.K12.MP.6.1 :	**Attend to precision.** Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach

	high school they have learned to examine claims and make explicit use of definitions. Cognitive Complexity: Level 3: Strategic Thinking & Complex Reasoning I Date Adopted or Revised: 12/10 Belongs to: Attend to precision.

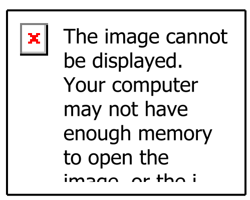
MACC.K12.MP.7 Look for and make use of structure.

MACC.K12.MP.7.1 :	**Look for and make use of structure.** Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see 7 × 8 equals the well remembered 7 × 5 + 7 × 3, in preparation for learning about the distributive property. In the expression $x^2 + 9x + 14$, older students can see the 14 as 2 × 7 and the 9 as 2 + 7. They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see $5 – 3(x – y)^2$ as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers x and y. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts I Date Adopted or Revised: 12/10 Belongs to: Look for and make use of structure.

MACC.K12.MP.8 Look for and express regularity in repeated reasoning.

MACC.K12.MP.8.1 :	**Look for and express regularity in repeated reasoning.** Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention

	to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation (y – 2)/(x – 1) = 3. Noticing the regularity in the way terms cancel when expanding (x – 1)(x + 1), (x – 1)(x^2 + x + 1), and (x – 1)(x^3 + x^2 + x + 1) might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results. Cognitive Complexity: Level 3: Strategic Thinking & Complex Reasoning | Date Adopted or Revised: 12/10 Belongs to: Look for and express regularity in repeated reasoning.



Course: Intensive Mathematics- 1200400

Direct link to this page:http://www.cpalms.org/Courses/CoursePagePublicPreviewCourse2438.aspx

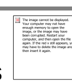
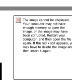
BASIC INFORMATION

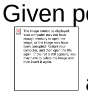
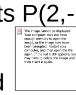
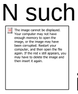
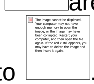
Course Title:	Intensive Mathematics
Course Number:	1200400
Course Abbreviated Title:	INTENS MATH
Course Path:	**Section:** Grades PreK to 12 Education Courses **Grade Group:** Grades 9 to 12 and Adult Education Courses **Subject:** Mathematics **SubSubject:** Remedial Mathematics
Number of Credits:	Multiple Credit (more than 1 credit)
Course Type:	Elective
Course Level:	2
Status:	State Board Approved
Version Description:	For each year in which a student scores at Level 1 on FCAT 2.0 Mathematics, the student must receive remediation by completing an intensive mathematics course the following year or having the remediation integrated into the student's required mathematics course. This course should be tailored to meet the needs of the individual student. Appropriate benchmarks from the following set of standards should be identified to develop an appropriate curriculum.

STANDARDS (109)

LACC.910.RL.1.3:	Analyze how complex characters (e.g., those with multiple or conflicting motivations) develop over the course of a text, interact with other characters, and advance the plot or develop the theme.
LACC.910.RL.2.4:	Determine the meaning of words and phrases as they are used in the text, including figurative and connotative meanings; analyze the

	cumulative impact of specific word choices on meaning and tone (e.g., how the language evokes a sense of time and place; how it sets a formal or informal tone).
LACC.910.RL.3.7:	Analyze the representation of a subject or a key scene in two different artistic mediums, including what is emphasized or absent in each treatment (e.g., Auden's "Musée des Beaux Arts" and Breughel's Landscape with the Fall of Icarus).
LACC.910.SL.1.1:	Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively. a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas. b. Work with peers to set rules for collegial discussions and decision-making (e.g., informal consensus, taking votes on key issues, presentation of alternate views), clear goals and deadlines, and individual roles as needed. c. Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions. d. Respond thoughtfully to diverse perspectives, summarize points of agreement and disagreement, and, when warranted, qualify or justify their own views and understanding and make new connections in light of the evidence and reasoning presented.
LACC.910.SL.1.2:	Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source.
LACC.910.SL.1.3:	Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, identifying any fallacious reasoning or exaggerated or distorted evidence.
LACC.910.SL.2.4:	Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of

	reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.
LACC.910.WHST.1.1:	Write arguments focused on *discipline-specific content.* a. Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence. b. Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audience's knowledge level and concerns. c. Use words, phrases, and clauses to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims. d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing. e. Provide a concluding statement or section that follows from or supports the argument presented.
LACC.910.WHST.2.4:	Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
LACC.910.WHST.3.9:	Draw evidence from informational texts to support analysis, reflection, and research.
MA.912.D.6.2:	Find the converse, inverse, and contrapositive of a statement Remarks/Examples Example: Determine the inverse, converse and contrapositive of the statement, "If it is Thursday, there will be rain."
MA.912.D.6.3:	Determine whether two propositions are logically equivalent. Remarks/Examples Example: Determine whether the propositions  and  are logically equivalent.

MA.912.D.6.4:	Use methods of direct and indirect proof and determine whether a short proof is logically valid. Remarks/Examples Example: If somebody argues, “If it’s Thursday, it is raining.” along with “It is raining” implies that "it is Thursday.", is this a valid or invalid argument? Explain your answer.
MA.912.D.7.1:	Perform set operations such as union and intersection, complement, and cross product. Remarks/Examples Example: Let A={1,2,3} and B={2,4,5} be two sets in universe U={1,2,3,4,5,6}. Find the union of A and B and the complement of B. Find AXB.
MA.912.D.7.2:	Use Venn diagrams to explore relationships and patterns and to make arguments about relationships between sets. Remarks/Examples Example: Use a Venn diagram to give an argument that the intersection of A and B is a subset of the union of A and B.
MA.912.G.1.4:	Use coordinate geometry to find slopes, parallel lines, perpendicular lines, and equations of lines. Remarks/Examples Example 1: Given points P(2,-1), Q(-4, 2), and M(5,3), find the coordinates of a point N such that  and  are parallel. Find coordinates of a point K such that  is perpendicular to .
MACC.912.A-APR.1.1:	Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials. Remarks/Examples **Algebra 1 - Fluency Recommendations** Fluency in adding, subtracting, and multiplying polynomials supports students throughout their work in algebra, as well as in their symbolic work with functions. Manipulation can be more mindful when it is fluent. Focus on polynomial expressions that simplify to forms that are linear or quadratic in a positive integer power of x.

[MACC.912.A-APR.2.3:](#)	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. Remarks/Examples
	Algebra 1 Assessment Limits and Clarifications i) Tasks are limited to quadratic and cubic polynomials in which linear and quadratic factors are available. For example, find the zeros of $(x - 2)(x^2 - 9)$. **Algebra 2 Assessment Limits and Clarifications** i) Tasks include quadratic, cubic, and quartic polynomials and polynomials for which factors are not provided. For example, find the zeros of $(x^2 - 1)(x^2 + 1)$
[MACC.912.A-CED.1.1:](#)	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.* Remarks/Examples
	Algebra 1, Unit 1: Limit A.CED.1 and A.CED.2 to linear and exponential equations, and, in the case of exponential equations, limit to situations requiring evaluation of exponential functions at integer inputs. **Algebra 1, Unit 4**: Extend work on linear and exponential equations in Unit 1 to quadratic equations. **Algebra 1 Assessment Limits and Clarifications** i) Tasks are limited to linear, quadratic, or exponential equations with integer exponents. **Algebra 2 Assessment Limits and Clarifications** i) Tasks are limited to exponential equations with rational or real

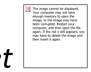
	exponents and rational functions. ii) Tasks have a real-world context.
MACC.912.A-CED.1.2:	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. Remarks/Examples
	Algebra 1, Unit 1: Limit A.CED.1 and A.CED.2 to linear and exponential equations, and, in the case of exponential equations, limit to situations requiring evaluation of exponential functions at integer inputs. Algebra 1, Unit 4: Extend work on linear and exponential equations in Unit 1 to quadratic equations.
MACC.912.A-CED.1.3:	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. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.* Remarks/Examples
	Algebra 1, Unit 1: Limit A.CED.3 to linear equations and inequalities.
MACC.912.A-CED.1.4:	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law V = IR to highlight resistance R.* Remarks/Examples
	Algebra 1, Unit 1: Limit A.CED.4 to formulas which are linear in the variable of interest. Algebra 1, Unit 4: Extend A.CED.4 to formulas involving squared variables.
MACC.912.A-REI.1.1:	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.

	Remarks/Examples
	Algebra 1, Unit 1: Students should focus on and master A.REI.1 for linear equations and be able to extend and apply their reasoning to other types of equations in future courses. Students will solve exponential equations with logarithms in Algebra II. **Algebra 1 Assessment Limits and Clarification** i) Tasks are limited to quadratic equations. **Algebra 2 Assessment Limits and Clarification** i) Tasks are limited to simple rational or radical equations.
MACC.912.A-REI.2.3:	Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters. Remarks/Examples
	Algebra 1, Unit 1: Extend earlier work with solving linear equations to solving linear inequalities in one variable and to solving literal equations that are linear in the variable being solved for. Include simple exponential equations that rely only on application of the laws of exponents, such as $5^x=125$ or $2^x=1/16$ **Algebra 1 Assessment Limits and Clarifications** i) Tasks do not require students to write solutions for quadratic equations that have roots with nonzero imaginary parts. However, tasks can require the student to recognize cases in which a quadratic equation has no real solutions. Note, solving a quadratic equation by factoring relies on the connection between zeros and factors of polynomials (cluster A-APR.B). Cluster A-APR.B is formally assessed in A2. **Algebra 2 Assessment Limits and Clarifications**

	i) In the case of equations that have roots with nonzero imaginary parts, students write the solutions as a ± bi for real numbers a and b.
MACC.912.A-REI.2.4:	Solve quadratic equations in one variable. a. Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x – p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form. 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. Remarks/Examples **Algebra 1, Unit 4**: Students should learn of the existence of the complex number system, but will not solve quadratics with complex solutions until Algebra II. **Algebra 1 Assessment Limits and Clarifications** i) Tasks do not require students to write solutions for quadratic equations that have roots with nonzero imaginary parts. However, tasks can require the student to recognize cases in which a quadratic equation has no real solutions. Note, solving a quadratic equation by factoring relies on the connection between zeros and factors of polynomials (cluster A-APR.B). Cluster A-APR.B is formally assessed in A2. **Algebra 2 Assessment Limits and Clarifications** i) In the case of equations that have roots with nonzero imaginary parts, students write the solutions as a ± bi for real numbers a and b.
MACC.912.A-REI.3.5:	Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.

	Remarks/Examples Algebra 1, Unit 2: Build on student experiences graphing and solving systems of linear equations from middle school to focus on justification of the methods used. Include cases where the two equations describe the same line (yielding infinitely many solutions) and cases where two equations describe parallel lines (yielding no solution); connect to GPE.5 when it is taught in Geometry, which requires students to prove the slope criteria for parallel lines.
MACC.912.A-REI.3.6:	Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. Remarks/Examples **Algebra 1, Unit 2**: Build on student experiences graphing and solving systems of linear equations from middle school to focus on justification of the methods used. Include cases where the two equations describe the same line (yielding infinitely many solutions) and cases where two equations describe parallel lines (yielding no solution); connect to GPE.5 when it is taught in Geometry, which requires students to prove the slope criteria for parallel lines. **Algebra 1 Assessment Limits and Clarifications** i)i) Tasks have a real-world context. ii) Tasks have hallmarks of modeling as a mathematical practice (less defined tasks, more of the modeling cycle, etc.). Note, solving a quadratic equation by factoring relies on the connection between zeros and factors of polynomials (cluster A-APR.B). Cluster A-APR.B is formally assessed in A2. **Algebra 2 Assessment Limits and Clarifications** i) Tasks are limited to 3x3 systems.
MACC.912.A-REI.4.10:	Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a

	curve (which could be a line). Remarks/Examples
	Algebra 1, Unit 2: For A.REI.10, focus on linear and exponential equations and be able to adapt and apply that learning to other types of equations in future courses.
MACC.912.A-REI.4.11:	Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect are the solutions of the equation f(x) = g(x); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where f(x) and/or g(x) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions. Remarks/Examples
	Algebra 1, Unit 2: For A.REI.11, focus on cases where f(x) and g(x) are linear or exponential. **Algebra 1 Assessment Limits and Clarifications** i) Tasks that assess conceptual understanding of the indicated concept may involve any of the function types mentioned in the standard except exponential and logarithmic functions. ii) Finding the solutions approximately is limited to cases where f(x) and g(x) are polynomial functions. **Algebra 2 Assessment Limits and Clarifications** i) Tasks may involve any of the function types mentioned in the standard.
MACC.912.A-REI.4.12:	Graph the solutions to a linear inequality in two variables as a halfplane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.
MACC.912.A-SSE.1.1:	Interpret expressions that represent a quantity in terms of its context.

a. Interpret parts of an expression, such as terms, factors, and coefficients.
b. Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret*  *as the product of P and a factor not depending on P.*

Remarks/Examples

Algebra 1 - Fluency Recommendations

A-SSE.1.1b - Fluency in transforming expressions and chunking (seeing parts of an expression as a single object) is essential in factoring, completing the square, and other mindful algebraic calculations.

Algebra 1, Unit 1: Limit to linear expressions and to exponential expressions with integer exponents.

Algebra 1, Unit 4: Focus on quadratic and exponential expressions. For A.SSE.1b, exponents are extended from the integer exponents found in Unit 1 to rational exponents focusing on those that represent square or cube roots.

MACC.912.A-SSE.1.2:

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* $(x^2 – y^2)(x^2 + y^2)$*.*

Remarks/Examples

Algebra 1, Unit 4: Focus on quadratic and exponential expressions. For A.SSE.1b, exponents are extended from the integer exponents found in Unit 1 to rational exponents focusing on those that represent square or cube roots.

Algebra 2 - Fluency Recommendations

The ability to see structure in expressions and to use this structure to rewrite expressions is a key skill in everything from advanced

	factoring (e.g., grouping) to summing series to the rewriting of rational expressions to examine the end behavior of the corresponding rational function. **Algebra 1 Assessment Limits and Clarifications** i) Tasks are limited to numerical expressions and polynomial expressions in one variable. ii) Examples: Recognize 532 + 472 as a difference of squares and see an opportunity to rewrite it in the easier-to-evaluate form (53 + 47)(53 + 47). See an opportunity to rewrite $a^2 + 9a + 14$ as (a+ 7)(a+ 2). **Algebra 2 Assessment and Limits and Clarifications** i) Tasks are limited to polynomial, rational, or exponential expressions. ii) Examples: 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 $(x^2 – y^2)(x^2 + y^2)$. In the equation $x^2 + 2x + 1 + y^2 = 9$, see an opportunity to rewrite the first three terms as $(x+1)^2$, thus recognizing the equation of a circle with radius 3 and center (-1, 0). See $(x^2 + 4)/(x^2 + 3)$ as $((x^2+3) + 1)/(x^2+3)$, thus recognizing an opportunity to write it as $1 + 1/(x^2 + 3)$.
MACC.912.A-SSE.2.3:	Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. a. Factor a quadratic expression to reveal the zeros of the function it defines. b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines. c. Use the properties of exponents to transform expressions for exponential functions. *For example the expression* *can be rewritten as* ≈ *to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.* Remarks/Examples
	Algebra 1, Unit 4: It is important to balance conceptual understanding and procedural fluency in work with equivalent expressions. For example, development of skill in factoring and completing the square goes hand-in-hand with understanding what

	different forms of a quadratic expression reveal. **Algebra 1 Assessment Limits and Clarifications** i) Tasks have a real-world context. As described in the standard, there is an interplay between the mathematical structure of the expression and the structure of the situation such that choosing and producing an equivalent form of the expression reveals something about the situation. ii) Tasks are limited to exponential expressions with integer exponents. **Algebra 2 Assessment Limits and Clarifications** i) Tasks have a real-world context. As described in the standard, there is an interplay between the mathematical structure of the expression and the structure of the situation such that choosing and producing an equivalent form of the expression reveals something about the situation. ii) Tasks are limited to exponential expressions with rational or real exponents.
MACC.912.F-BF.1.1:	Write a function that describes a relationship between two quantities. a. Determine an explicit expression, a recursive process, or steps for calculation from a context. 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.* c. Compose functions. *For example, if T(y) is the temperature in the atmosphere as a function of height, and h(t) is the height of a weather balloon as a function of time, then T(h(t)) is the temperature at the location of the weather balloon as a function of time.* Remarks/Examples

	Algebra 1, Unit 2: Limit to F.BF.1a, 1b, and 2 to linear and exponential functions. **Algebra 1, Unit 5**: Focus on situations that exhibit a quadratic relationship. **Algebra 1 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Tasks are limited to linear functions, quadratic functions, and exponential functions with domains in the integers. **Algebra 2 Assessment Limits and Clarifications** i) Tasks have a real-world context ii) Tasks may involve linear functions, quadratic functions, and exponential functions.
MACC.912.F-LE.2.5:	Interpret the parameters in a linear or exponential function in terms of a context. Remarks/Examples **Algebra 1, Unit 2**: Limit exponential functions to those of the form $f(x) = b^x + k$. **Algebra 1 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Exponential functions are limited to those with domains in the integers. **Algebra 2 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Tasks are limited to exponential functions with domains not in the integers.
MACC.912.G-C.1.1:	Prove that all circles are similar.
MACC.912.G-C.1.2:	Identify and describe relationships among inscribed angles, radii, and

	chords. *Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle.*
MACC.912.F-BF.2.3:	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.* Remarks/Examples
	Algebra 1, Unit 2: Focus on vertical translations of graphs of linear and exponential functions. Relate the vertical translation of a linear function to its y-intercept. While applying other transformations to a linear graph is appropriate at this level, it may be difficult for students to identify or distinguish between the effects of the other transformations included in this standard. **Algebra 1, Unit 5**: For F.BF.3, focus on quadratic functions, and consider including absolute value functions. **Algebra 1 Assessment Limit and Clarifications** i) Identifying 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) is limited to linear and quadratic functions. ii) Experimenting with cases and illustrating an explanation of the effects on the graph using technology is limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers. iii) Tasks do not involve recognizing even and odd functions. The function types listed in note (ii) are the same as those listed in the Algebra I column for standards F-IF.4, F-IF.6, and F-IF.9. **Algebra 2 Assessment Limits and Clarifications**

	i) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions ii) Tasks may involve recognizing even and odd functions. The function types listed in note (i) are the same as those listed in the Algebra II column for standards F-IF.4, F-IF.6, and F-IF.9.
MACC.912.F-IF.1.1:	Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then f(x) denotes the output of f corresponding to the input x. The graph of f is the graph of the equation y = f(x). Remarks/Examples
	Algebra 1, Unit 2: Students should experience a variety of types of situations modeled by functions. Detailed analysis of any particular class of functions at this stage is not advised. Students should apply these concepts throughout their future mathematics courses. Draw examples from linear and exponential functions.
MACC.912.F-IF.1.2:	Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context. Remarks/Examples
	Algebra 1, Unit 2: Students should experience a variety of types of situations modeled by functions. Detailed analysis of any particular class of functions at this stage is not advised. Students should apply these concepts throughout their future mathematics courses. Draw examples from linear and exponential functions.
MACC.912.F-IF.1.3:	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. Remarks/Examples
	Algebra 1, Unit 2: In F.IF.3, draw connection to F.BF.2, which requires students to write arithmetic and geometric sequences. Emphasize arithmetic and geometric sequences as examples of linear and

	exponential functions. **Algebra 1 Assessment Limits and Clarifications** i) This standard is part of the Major work in Algebra I and will be assessed accordingly. **Algebra 2 Assessment Limits and Clarifications** i) This standard is Supporting work in Algebra II. This standard should support the Major work in F- BF.2 for coherence. **Algebra 2 - Fluency Recommendations** Fluency in translating between recursive definitions and closed forms is helpful when dealing with many problems involving sequences and series, with applications ranging from fitting functions to tables to problems in finance.
MACC.912.F-IF.2.4:	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.* Remarks/Examples
	Algebra 1, Unit 2: For F.IF.4 and 5, focus on linear and exponential functions. **Algebra 1 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Tasks are limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers. Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra I column for standards F-

	IF.6 and F-IF.9. **Algebra 2 Assessment Limits and Clarifications** i) Tasks have a real-world context ii) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions. Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra II column for standards F-IF.6 and F-IF.9.
MACC.912.F-IF.2.5:	Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.* Remarks/Examples
	Algebra 1, Unit 2: For F.IF.4 and 5, focus on linear and exponential functions.
MACC.912.F-IF.2.6:	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. Remarks/Examples
	Algebra 1, Unit 2: For F.IF.6, focus on linear functions and exponential functions whose domain is a subset of the integers. Unit 5 in this course and the Algebra II course address other types of functions. **Algebra 1 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Tasks are limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers. The function types listed here are the same as those listed in the

	Algebra I column for standards F-IF.4 and F-IF.9. **Algebra 2 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions. The function types listed here are the same as those listed in the Algebra II column for standards F-IF.4 and F-IF.9.
MACC.912.F-IF.3.7a:	a. Graph linear and quadratic functions and show intercepts, maxima, and minima.
MACC.912.F-IF.3.7b:	b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.
MACC.912.F-IF.3.7c:	c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.
MACC.912.F-IF.3.7e:	e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.
MACC.912.F-IF.3.8:	Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. a. 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. b. Use the properties of exponents to interpret expressions for exponential functions. *For example, identify percent rate of change in functions such as y = , y = , y = , y = , and classify them as representing exponential growth or decay.* Remarks/Examples Algebra 1, Unit 5: Note that this unit, and in particular in F.IF.8b, extends the work begun in Unit 2 on exponential functions with integer exponents.

MACC.912.F-IF.3.9:	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.* Remarks/Examples
	Algebra 1, Unit 2: For F.IF.7a, 7e, and 9 focus on linear and exponentials functions. Include comparisons of two functions presented algebraically. For example, compare the growth of two linear functions, or two exponential functions such as $y=3^n$ and $y=100^2$ **Algebra 1, Unit 5**: For F.IF.9, focus on expanding the types of functions considered to include, linear, exponential, and quadratic. Extend work with quadratics to include the relationship between coefficients and roots, and that once roots are known, a quadratic equation can be factored. **Algebra 1 Assessment Limits and Clarifications** i) Tasks are limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers. The function types listed here are the same as those listed in the Algebra I column for standards F-IF.4 and F-IF.6. **Algebra 2 Assessment Limits and Clarifications** i) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions. The function types listed here are the same as those listed in the Algebra II column for standards F-IF.4 and F-IF.6.
MACC.912.F-LE.1.1:	Distinguish between situations that can be modeled with linear functions and with exponential functions.

	a. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals. b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.
MACC.912.F-LE.1.2:	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). Remarks/Examples
	Algebra 1, Unit 2: In constructing linear functions in F.LE.2, draw on and consolidate previous work in Grade 8 on finding equations for lines and linear functions (8.EE.6, 8.F.4). **Algebra 1 Assessment Limits and Clarifications** i) Tasks are limited to constructing linear and exponential functions in simple context (not multi- step). **Algebra 2 Assessment Limits and Clarifications** i) Tasks will include solving multi-step problems by constructing linear and exponential functions.
MACC.912.F-LE.1.3:	Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function. Remarks/Examples
	Algebra 1, Unit 2: For F.LE.3, limit to comparisons between linear and exponential models. Algebra 1, Unit 5: Compare linear and exponential growth to quadratic growth.
MACC.912.G-C.1.3:	Construct the inscribed and circumscribed circles of a triangle, and

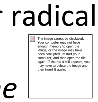
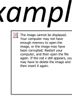
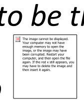
	prove properties of angles for a quadrilateral inscribed in a circle.
MACC.912.G-C.2.5:	Derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius, and define the radian measure of the angle as the constant of proportionality; derive the formula for the area of a sector.
MACC.912.G-CO.1.1:	Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.
MACC.912.G-CO.1.2:	Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch).
MACC.912.G-CO.1.3:	Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.
MACC.912.G-CO.1.4:	Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.
MACC.912.G-CO.1.5:	Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.
MACC.912.G-CO.2.6:	Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent.
MACC.912.G-CO.2.7:	Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent.
MACC.912.G-CO.2.8:	Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions.
MACC.912.G-CO.3.10:	Prove theorems about triangles. *Theorems include: measures of interior angles of a triangle sum to 180°; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point.*
MACC.912.G-CO.3.11:	Prove theorems about parallelograms. *Theorems include: opposite*

	sides are congruent, opposite angles are congruent, the diagonals of a parallelogram bisect each other, and conversely, rectangles are parallelograms with congruent diagonals.
MACC.912.G-CO.3.9:	Prove theorems about lines and angles. *Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.*
MACC.912.G-CO.4.12:	Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). *Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.* Remarks/Examples
	Geometry - Fluency Recommendations Fluency with the use of construction tools, physical and computational, helps students draft a model of a geometric phenomenon and can lead to conjectures and proofs.
MACC.912.G-CO.4.13:	Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.
MACC.912.G-GMD.1.1:	Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. *Use dissection arguments, Cavalieri's principle, and informal limit arguments.*
MACC.912.G-GMD.1.3:	Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.
MACC.912.G-GMD.2.4:	Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.
MACC.912.G-GPE.1.1:	Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation.

MACC.912.G-GPE.2.4:	Use coordinates to prove simple geometric theorems algebraically. *For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle; prove or disprove that the point (1, √3) lies on the circle centered at the origin and containing the point (0, 2).* Remarks/Examples **Geometry - Fluency Recommendations** Fluency with the use of coordinates to establish geometric results, calculate length and angle, and use geometric representations as a modeling tool are some of the most valuable tools in mathematics and related fields.
MACC.912.G-GPE.2.5:	Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point). Remarks/Examples **Geometry - Fluency Recommendations** Fluency with the use of coordinates to establish geometric results, calculate length and angle, and use geometric representations as a modeling tool are some of the most valuable tools in mathematics and related fields.
MACC.912.G-GPE.2.6:	Find the point on a directed line segment between two given points that partitions the segment in a given ratio.
MACC.912.G-GPE.2.7:	Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula. Remarks/Examples **Geometry - Fluency Recommendations** Fluency with the use of coordinates to establish geometric results, calculate length and angle, and use geometric representations as a modeling tool are some of the most valuable tools in mathematics

	and related fields.
MACC.912.G-MG.1.1:	Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).
MACC.912.G-MG.1.2:	Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).
MACC.912.G-MG.1.3:	Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios)
MACC.912.G-SRT.1.1:	Verify experimentally the properties of dilations given by a center and a scale factor: a. A dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged. b. The dilation of a line segment is longer or shorter in the ratio given by the scale factor.
MACC.912.G-SRT.1.2:	Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.
MACC.912.G-SRT.1.3:	Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.
MACC.912.G-SRT.2.4:	Prove theorems about triangles. *Theorems include: a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle similarity.*
MACC.912.G-SRT.2.5:	Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures. Remarks/Examples
	Geometry - Fluency Recommendations

	Fluency with the triangle congruence and similarity criteria will help students throughout their investigations of triangles, quadrilaterals, circles, parallelism, and trigonometric ratios. These criteria are necessary tools in many geometric modeling tasks.
MACC.912.G-SRT.3.6:	Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.
MACC.912.G-SRT.3.7:	Explain and use the relationship between the sine and cosine of complementary angles.
MACC.912.G-SRT.3.8:	Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.
MACC.912.N-Q.1.1:	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. Remarks/Examples Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions.
MACC.912.N-Q.1.2:	Define appropriate quantities for the purpose of descriptive modeling. Remarks/Examples **Algebra 1, Unit 1**: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. **Algebra 1 Content Notes:** Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. **Algebra 1 Assessment Limits and Clarifications**

	This standard will be assessed in Algebra I by ensuring that some modeling tasks (involving Algebra I content or securely held content from grades 6-8) require the student to create a quantity of interest in the situation being described (i.e., a quantity of interest is not selected for the student by the task). For example, in a situation involving data, the student might autonomously decide that a measure of center is a key variable in a situation, and then choose to work with the mean. **Algebra 2 Assessment Limits and Clarifications** This standard will be assessed in Algebra II by ensuring that some modeling tasks (involving Algebra II content or securely held content from previous grades and courses) require the student to create a quantity of interest in the situation being described (i.e., this is not provided in the task). For example, in a situation involving periodic phenomena, the student might autonomously decide that amplitude is a key variable in a situation, and then choose to work with peak amplitude.
MACC.912.N-Q.1.3:	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. Remarks/Examples
	Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions.
MACC.912.N-RN.1.1:	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*  *to be the cube root of 5 because we want*  =  *to hold, so*  *must equal 5.* Remarks/Examples
	Algebra 1, Unit 2: In implementing the standards in curriculum, these standards should occur before discussing exponential functions with continuous domains.
MACC.912.N-RN.1.2:	Rewrite expressions involving radicals and rational exponents using

	the properties of exponents. Remarks/Examples
	Algebra 1, Unit 2: In implementing the standards in curriculum, these standards should occur before discussing exponential functions with continuous domains.
MACC.912.N-RN.2.3:	Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational. Remarks/Examples
	Algebra 1 Unit 5: Connect N.RN.3 to physical situations, e.g., finding the perimeter of a square of area 2.
MACC.912.S-ID.1.1:	Represent data with plots on the real number line (dot plots, histograms, and box plots). Remarks/Examples
	In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points.
MACC.912.S-ID.1.2:	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. Remarks/Examples
	In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points.
MACC.912.S-ID.1.3:	Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers). Remarks/Examples
	In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the

	distribution or the existence of extreme data points.
MACC.912.S-ID.2.5:	Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.
MACC.912.S-ID.2.6:	Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. 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.* b. Informally assess the fit of a function by plotting and analyzing residuals. c. Fit a linear function for a scatter plot that suggests a linear association. Remarks/Examples
	Students take a more sophisticated look at using a linear function to model the relationship between two numerical variables. In addition to fitting a line to data, students assess how well the model fits by analyzing residuals. S.ID.6b should be focused on linear models, but may be used to preview quadratic functions in Unit 5 of this course. **Algebra 1 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Exponential functions are limited to those with domains in the integers. **Algebra 2 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Tasks are limited to exponential functions with domains not in the integers and trigonometric functions.

MACC.912.S-ID.3.7:	Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data. Remarks/Examples Build on students' work with linear relationships in eighth grade and introduce the correlation coefficient. The focus here is on the computation and interpretation of the correlation coefficient as a measure of how well the data fit the relationship. The important distinction between a statistical relationship and a cause-and-effect relationship arises in S.ID.9.
MACC.912.S-ID.3.8:	Compute (using technology) and interpret the correlation coefficient of a linear fit. Remarks/Examples Build on students' work with linear relationships in eighth grade and introduce the correlation coefficient. The focus here is on the computation and interpretation of the correlation coefficient as a measure of how well the data fit the relationship. The important distinction between a statistical relationship and a cause-and-effect relationship arises in S.ID.9.
MACC.912.S-ID.3.9:	Distinguish between correlation and causation. Remarks/Examples Build on students' work with linear relationships in eighth grade and introduce the correlation coefficient. The focus here is on the computation and interpretation of the correlation coefficient as a measure of how well the data fit the relationship. The important distinction between a statistical relationship and a cause-and-effect relationship arises in S.ID.9.
MACC.K12.MP.1.1:	**Make sense of problems and persevere in solving them.** Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the

	problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, "Does this make sense?" They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.
MACC.K12.MP.2.1:	**Reason abstractly and quantitatively**. Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.
MACC.K12.MP.3.1:	**Construct viable arguments and critique the reasoning of others.** Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making

	plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.
MACC.K12.MP.4.1:	**Model with mathematics.** Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.
MACC.K12.MP.5.1:	**Use appropriate tools strategically.** Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or

	dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.
MACC.K12.MP.6.1:	**Attend to precision.** Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.
MACC.K12.MP.7.1:	**Look for and make use of structure.** Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see 7×8 equals the well remembered $7 \times 5 + 7 \times 3$, in preparation for learning about the distributive property. In the expression $x^2 + 9x + 14$, older students

	can see the 14 as 2 × 7 and the 9 as 2 + 7. They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see $5 - 3(x - y)^2$ as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers x and y.
MACC.K12.MP.8.1:	**Look for and express regularity in repeated reasoning.** Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation $(y - 2)/(x - 1) = 3$. Noticing the regularity in the way terms cancel when expanding $(x - 1)(x + 1)$, $(x - 1)(x^2 + x + 1)$, and $(x - 1)(x^3 + x^2 + x + 1)$ might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

RELATED GLOSSARY TERM DEFINITIONS (16)

Contrapositive:	Switching the hypothesis and conclusion of a conditional statement and negating both. “If p, then q.” becomes “If not q, then not p.” The contrapositve has the same truth value as the original statement.

Converse:	Switching the hypothesis and conclusion of a conditional statement. “If p, then q.” becomes “If q, then p.”
Coordinate:	Numbers that correspond to points on a coordinate plane in the form (x, y), or a number that corresponds to a point on a number line.
Equation:	A mathematical sentence stating that the two expressions have the same value. Also read the definition of equality.
Equivalent:	Having the same value.
Geometry:	The branch of mathematics that explores the position, size, and shape of figures.
Intersection:	The intersection of two sets A and B is the set of elements common to A and B. For lines or curves, it is the point at which lines or curves meet; for planes, it is the line where planes meet.
Line:	A collection of an infinite number of points in a straight pathway with unlimited length and having no width.
Operation:	Any mathematical process, such as addition, subtraction, multiplication, division, raising to a power, or finding the square root.
Parallel lines:	Two lines in the same plane that are a constant distance apart. Parallel lines have equal slopes.
Pattern:	A predictable or prescribed sequence of numbers, objects, etc. Patterns and relationships may be described or presented using multiple representations such as manipulatives, tables, graphics (pictures or drawings), or algebraic rules (functions).
Perpendicular:	Two lines, two line segments, or two planes are said to be perpendicular when they intersect at a right angle.
Point:	A specific location in space that has no discernable length or width.
Product:	The result of multiplying numbers together.
Proof:	A logical argument that demonstrates the truth of a given statement. In a formal proof, each step can be justified with a reason; such as a given, a definition, an axiom, or a previously proven property or theorem. A mathematical statement that has been proven is called a theorem.
Set:	A set is a finite or infinite collection of distinct objects in which order has no significance.

	Algebra 1, Unit 4: Extend A.CED.4 to formulas involving squared variables.
MACC.912.A-REI.1.1:	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. Remarks/Examples
	Algebra 1, Unit 1: Students should focus on and master A.REI.1 for linear equations and be able to extend and apply their reasoning to other types of equations in future courses. Students will solve exponential equations with logarithms in Algebra II. **Algebra 1 Assessment Limits and Clarification** i) Tasks are limited to quadratic equations. **Algebra 2 Assessment Limits and Clarification** i) Tasks are limited to simple rational or radical equations.
MACC.912.A-REI.1.2:	Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.
MACC.912.A-REI.2.3:	Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters. Remarks/Examples
	Algebra 1, Unit 1: Extend earlier work with solving linear equations to solving linear inequalities in one variable and to solving literal equations that are linear in the variable being solved for. Include simple exponential equations that rely only on application of the laws of exponents, such as $5^x=125$ or $2^x=1/16$ **Algebra 1 Assessment Limits and Clarifications**

	i) Tasks do not require students to write solutions for quadratic equations that have roots with nonzero imaginary parts. However, tasks can require the student to recognize cases in which a quadratic equation has no real solutions. Note, solving a quadratic equation by factoring relies on the connection between zeros and factors of polynomials (cluster A-APR.B). Cluster A-APR.B is formally assessed in A2. **Algebra 2 Assessment Limits and Clarifications** i) In the case of equations that have roots with nonzero imaginary parts, students write the solutions as a ± bi for real numbers a and b.
MACC.912.A-REI.2.4:	Solve quadratic equations in one variable. a. Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x – p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form. 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. Remarks/Examples **Algebra 1, Unit 4**: Students should learn of the existence of the complex number system, but will not solve quadratics with complex solutions until Algebra II. **Algebra 1 Assessment Limits and Clarifications** i) Tasks do not require students to write solutions for quadratic equations that have roots with nonzero imaginary parts. However, tasks can require the student to recognize cases in which a quadratic equation has no real solutions. Note, solving a quadratic equation by factoring relies on the connection between zeros and factors of polynomials (cluster A-

	APR.B). Cluster A-APR.B is formally assessed in A2. **Algebra 2 Assessment Limits and Clarifications** i) In the case of equations that have roots with nonzero imaginary parts, students write the solutions as a ± bi for real numbers a and b.
MACC.912.A-REI.3.5:	Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions. Remarks/Examples Algebra 1, Unit 2: Build on student experiences graphing and solving systems of linear equations from middle school to focus on justification of the methods used. Include cases where the two equations describe the same line (yielding infinitely many solutions) and cases where two equations describe parallel lines (yielding no solution); connect to GPE.5 when it is taught in Geometry, which requires students to prove the slope criteria for parallel lines.
MACC.912.A-REI.3.6:	Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. Remarks/Examples **Algebra 1, Unit 2**: Build on student experiences graphing and solving systems of linear equations from middle school to focus on justification of the methods used. Include cases where the two equations describe the same line (yielding infinitely many solutions) and cases where two equations describe parallel lines (yielding no solution); connect to GPE.5 when it is taught in Geometry, which requires students to prove the slope criteria for parallel lines. **Algebra 1 Assessment Limits and Clarifications** i)i) Tasks have a real-world context. ii) Tasks have hallmarks of modeling as a mathematical practice (less defined tasks, more of the modeling cycle, etc.).

Course: Algebra 2 for Credit Recovery- 1200335

Direct link to this page:http://www.cpalms.org/Courses/CoursePagePublicPreviewCourse3651.aspx

BASIC INFORMATION

Course Title:	Algebra 2 for Credit Recovery
Course Number:	1200335
Course Abbreviated Title:	ALG 2 CR
Course Path:	**Section:** Grades PreK to 12 Education Courses **Grade Group:** Grades 9 to 12 and Adult Education Courses **Subject:** Mathematics **SubSubject:** Algebra
Number of Credits:	One credit (1)
Course Type:	Elective
Course Level:	2
Status:	Draft - Board Approval Pending
Version Description:	Special notes: Credit Recovery courses are credit bearing courses with specific content requirements defined by Next Generation Sunshine State Standards and/or Common Core State Standards. Students enrolled in a Credit Recovery course must have previously attempted the corresponding course (and/or End-of-Course assessment) since the course requirements for the Credit Recovery course are exactly the same as the previously attempted corresponding course. For example, Geometry (1206310) and Geometry for Credit Recovery (1206315) have identical content requirements. It is important to note that Credit Recovery courses are not bound by Section 1003.436(1)(a), Florida Statutes, requiring a minimum of 135 hours of bona fide instruction (120 hours in a school/district implementing block scheduling) in a designed course of study that contains student performance standards, since the students have previously attempted successful completion of the corresponding course. Additionally, Credit Recovery courses should ONLY be used for credit recovery, grade forgiveness, or remediation for students needing to prepare for an End-of-Course assessment retake.
General Notes:	Building on their work with linear, quadratic, and exponential functions, students extend their repertoire of functions to include

	polynomial, rational, and radical functions.2 Students work closely with the expressions that define the functions, and continue to expand and hone their abilities to model situations and to solve equations, including solving quadratic equations over the set of complex numbers and solving exponential equations using the properties of logarithms. The Standards for Mathematical Practice apply throughout each course and, together with the content standards, prescribe that students experience mathematics as a coherent, useful, and logical subject that makes use of their ability to make sense of problem situations. The critical areas for this course, organized into four units, are as follows: **Unit 1- Polynomial, Rational, and Radical Relationships:** This unit develops the structural similarities between the system of polynomials and the system of integers. Students draw on analogies between polynomial arithmetic and base-ten computation, focusing on properties of operations, particularly the distributive property. Students connect multiplication of polynomials with multiplication of multi-digit integers, and division of polynomials with long division of integers. Students identify zeros of polynomials, including complex zeros of quadratic polynomials, and make connections between zeros of polynomials and solutions of polynomial equations. The unit culminates with the fundamental theorem of algebra. A central theme of this unit is that the arithmetic of rational expressions is governed by the same rules as the arithmetic of rational numbers. **Unit 2- Trigonometric Functions:** Building on their previous work with functions, and on their work with trigonometric ratios and circles in Geometry, students now use the coordinate plane to extend trigonometry to model periodic phenomena. **Unit 3- Modeling with Functions:** In this unit students synthesize and generalize what they have learned about a variety of function families. They extend their work with exponential functions to include solving exponential equations with logarithms. They explore the effects of transformations on graphs of diverse functions, including functions arising in an application, in order to abstract the general principle that transformations on a graph always have the same effect regardless of the type of the underlying function. They identify appropriate types of functions to model a situation, they adjust parameters to improve the model, and they compare models by analyzing appropriateness of fit and making judgments about the domain over which a model is a good fit. The description of modeling

	as “the process of choosing and using mathematics and statistics to analyze empirical situations, to understand them better, and to make decisions” is at the heart of this unit. The narrative discussion and diagram of the modeling cycle should be considered when knowledge of functions, statistics, and geometry is applied in a modeling context. **Unit 4- Inferences and Conclusions from Data:** In this unit, students see how the visual displays and summary statistics they learned in earlier grades relate to different types of data and to probability distributions. They identify different ways of collecting data—including sample surveys, experiments, and simulations—and the role that randomness and careful design play in the conclusions that can be drawn. **Unit 5- Applications of Probability:** Building on probability concepts that began in the middle grades, students use the languages of set theory to expand their ability to compute and interpret theoretical and experimental probabilities for compound events, attending to mutually exclusive events, independent events, and conditional probability. Students should make use of geometric probability models wherever possible. They use probability to make informed decisions.
Verion Requirements:	**Fluency Recommendations** **A-APR.6** This standard sets an expectation that students will divide polynomials with remainder by inspection in simple cases. For example, one can view the rational expression as = = . **A-SSE.2** The ability to see structure in expressions and to use this structure to rewrite expressions is a key skill in everything from advanced factoring (e.g., grouping) to summing series to the

	rewriting of rational expressions to examine the end behavior of the corresponding rational function. **F-IF.3** Fluency in translating between recursive definitions and closed forms is helpful when dealing with many problems involving sequences and series, with applications ranging from fitting functions to tables to problems in finance.

STANDARDS (74)

LACC.1112.RST.1.3:	Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.
LACC.1112.RST.2.4:	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics.
LACC.1112.RST.3.7:	Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.
LACC.1112.SL.1.1:	Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively. a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned

	exchange of ideas. b. Work with peers to promote civil, democratic discussions and decision-making, set clear goals and deadlines, and establish individual roles as needed. c. Propel conversations by posing and responding to questions that probe reasoning and evidence; ensure a hearing for a full range of positions on a topic or issue; clarify, verify, or challenge ideas and conclusions; and promote divergent and creative perspectives. d. Respond thoughtfully to diverse perspectives; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research is required to deepen the investigation or complete the task.
LACC.1112.SL.1.2:	Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data.
LACC.1112.SL.1.3:	Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, assessing the stance, premises, links among ideas, word choice, points of emphasis, and tone used.
LACC.1112.SL.2.4:	Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks.
LACC.1112.WHST.1.1:	Write arguments focused on *discipline-specific content.* a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence. b. Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that

	anticipates the audience's knowledge level, concerns, values, and possible biases. c. Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims. d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing. e. Provide a concluding statement or section that follows from or supports the argument presented.
LACC.1112.WHST.2.4:	Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
LACC.1112.WHST.3.9:	Draw evidence from informational texts to support analysis, reflection, and research.
MACC.912.A-APR.1.1:	Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials. Remarks/Examples **Algebra 1 - Fluency Recommendations** Fluency in adding, subtracting, and multiplying polynomials supports students throughout their work in algebra, as well as in their symbolic work with functions. Manipulation can be more mindful when it is fluent. Focus on polynomial expressions that simplify to forms that are linear or quadratic in a positive integer power of x.
MACC.912.A-APR.2.2:	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).
MACC.912.A-APR.2.3:	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.

	Remarks/Examples
	Algebra 1 Assessment Limits and Clarifications i) Tasks are limited to quadratic and cubic polynomials in which linear and quadratic factors are available. For example, find the zeros of $(x - 2)(x^2 - 9)$. **Algebra 2 Assessment Limits and Clarifications** i) Tasks include quadratic, cubic, and quartic polynomials and polynomials for which factors are not provided. For example, find the zeros of $(x^2 - 1)(x^2 + 1)$
MACC.912.A-APR.3.4:	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.
MACC.912.A-APR.4.6:	Rewrite simple rational 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. Remarks/Examples
	Algebra 2 - Fluency Recommendations This standard sets an expectation that students will divide polynomials with remainder by inspection in simple cases.
MACC.912.A-CED.1.1:	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.* Remarks/Examples
	Algebra 1, Unit 1: Limit A.CED.1 and A.CED.2 to linear and exponential equations, and, in the case of exponential equations, limit to situations requiring evaluation of exponential functions at integer inputs.

	Algebra 1, Unit 4: Extend work on linear and exponential equations in Unit 1 to quadratic equations. **Algebra 1 Assessment Limits and Clarifications** i) Tasks are limited to linear, quadratic, or exponential equations with integer exponents. **Algebra 2 Assessment Limits and Clarifications** i) Tasks are limited to exponential equations with rational or real exponents and rational functions. ii) Tasks have a real-world context.
MACC.912.A-CED.1.2:	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. Remarks/Examples
	Algebra 1, Unit 1: Limit A.CED.1 and A.CED.2 to linear and exponential equations, and, in the case of exponential equations, limit to situations requiring evaluation of exponential functions at integer inputs. Algebra 1, Unit 4: Extend work on linear and exponential equations in Unit 1 to quadratic equations.
MACC.912.A-CED.1.3:	Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.* Remarks/Examples
	Algebra 1, Unit 1: Limit A.CED.3 to linear equations and inequalities.
MACC.912.A-CED.1.4:	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law V = IR to highlight resistance R.* Remarks/Examples
	Algebra 1, Unit 1: Limit A.CED.4 to formulas which are linear in the

	variable of interest. Algebra 1, Unit 4: Extend A.CED.4 to formulas involving squared variables.
MACC.912.A-REI.1.1:	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. Remarks/Examples **Algebra 1, Unit 1**: Students should focus on and master A.REI.1 for linear equations and be able to extend and apply their reasoning to other types of equations in future courses. Students will solve exponential equations with logarithms in Algebra II. **Algebra 1 Assessment Limits and Clarification** i) Tasks are limited to quadratic equations. **Algebra 2 Assessment Limits and Clarification** i) Tasks are limited to simple rational or radical equations.
MACC.912.A-REI.1.2:	Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.
MACC.912.A-REI.2.4:	Solve quadratic equations in one variable. a. Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x – p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form. 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 $a \pm bi$ for real numbers a and b.

	Remarks/Examples
	Algebra 1, Unit 4: Students should learn of the existence of the complex number system, but will not solve quadratics with complex solutions until Algebra II. **Algebra 1 Assessment Limits and Clarifications** i) Tasks do not require students to write solutions for quadratic equations that have roots with nonzero imaginary parts. However, tasks can require the student to recognize cases in which a quadratic equation has no real solutions. Note, solving a quadratic equation by factoring relies on the connection between zeros and factors of polynomials (cluster A-APR.B). Cluster A-APR.B is formally assessed in A2. **Algebra 2 Assessment Limits and Clarifications** i) In the case of equations that have roots with nonzero imaginary parts, students write the solutions as a ± bi for real numbers a and b.
MACC.912.A-REI.3.6:	Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. Remarks/Examples
	Algebra 1, Unit 2: Build on student experiences graphing and solving systems of linear equations from middle school to focus on justification of the methods used. Include cases where the two equations describe the same line (yielding infinitely many solutions) and cases where two equations describe parallel lines (yielding no solution); connect to GPE.5 when it is taught in Geometry, which requires students to prove the slope criteria for parallel lines. **Algebra 1 Assessment Limits and Clarifications** i)i) Tasks have a real-world context. ii) Tasks have hallmarks of modeling as a mathematical practice (less

	defined tasks, more of the modeling cycle, etc.). Note, solving a quadratic equation by factoring relies on the connection between zeros and factors of polynomials (cluster A-APR.B). Cluster A-APR.B is formally assessed in A2. **Algebra 2 Assessment Limits and Clarifications** i) Tasks are limited to 3x3 systems.
MACC.912.A-REI.3.7:	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* $x^2 + y^2 = 3$. Remarks/Examples
	Algebra 1 Honors, Unit 4: Include systems consisting of one linear and one quadratic equation. Include systems that lead to work with fractions. For example, finding the intersections between $x^2+y^2= 1$ and y = (x+1)/2 leads to the point (3/5, 4/5) on the unit circle, corresponding to the Pythagorean triple $3^2+4^2=5^2$. Algebra 2, Unit 1: Include systems consisting of one linear and one quadratic equation. Include systems that lead to work with fractions. For example, finding the intersections between $x^2+y^2= 1$ and y = (x+1)/2 leads to the point (3/5, 4/5) on the unit circle, corresponding to the Pythagorean triple $3^2+4^2=5^2$.
MACC.912.A-REI.4.11:	Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect are the solutions of the equation f(x) = g(x); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where f(x) and/or g(x) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions. Remarks/Examples
	Algebra 1, Unit 2: For A.REI.11, focus on cases where f(x) and g(x) are linear or exponential. **Algebra 1 Assessment Limits and Clarifications**

i) Tasks that assess conceptual understanding of the indicated concept may involve any of the function types mentioned in the standard except exponential and logarithmic functions.

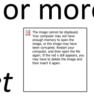
ii) Finding the solutions approximately is limited to cases where f(x) and g(x) are polynomial functions.

Algebra 2 Assessment Limits and Clarifications

i) Tasks may involve any of the function types mentioned in the standard.

MACC.912.A-SSE.1.1:

Interpret expressions that represent a quantity in terms of its context.

a. Interpret parts of an expression, such as terms, factors, and coefficients.
b. Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret*  *as the product of P and a factor not depending on P.*

Remarks/Examples

Algebra 1 - Fluency Recommendations

A-SSE.1.1b - Fluency in transforming expressions and chunking (seeing parts of an expression as a single object) is essential in factoring, completing the square, and other mindful algebraic calculations.

Algebra 1, Unit 1: Limit to linear expressions and to exponential expressions with integer exponents.

Algebra 1, Unit 4: Focus on quadratic and exponential expressions. For A.SSE.1b, exponents are extended from the integer exponents found in Unit 1 to rational exponents focusing on those that represent square or cube roots.

MACC.912.A-SSE.1.2:	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 $(x^2 – y^2)(x^2 + y^2)$.* Remarks/Examples
	Algebra 1, Unit 4: Focus on quadratic and exponential expressions. For A.SSE.1b, exponents are extended from the integer exponents found in Unit 1 to rational exponents focusing on those that represent square or cube roots. **Algebra 2 - Fluency Recommendations** The ability to see structure in expressions and to use this structure to rewrite expressions is a key skill in everything from advanced factoring (e.g., grouping) to summing series to the rewriting of rational expressions to examine the end behavior of the corresponding rational function. **Algebra 1 Assessment Limits and Clarifications** i) Tasks are limited to numerical expressions and polynomial expressions in one variable. ii) Examples: See an opportunity to rewrite $a^2 + 9a + 14$ as (a+7)(a+2). Recognize 53^2-47^2 as a difference of squares and see an opportunity to rewrite it in the easier-to-evaluate form (53+47)(53-47). **Algebra 2 Assessment and Limits and Clarifications** i) Tasks are limited to polynomial, rational, or exponential expressions. ii) Examples: 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 $(x^2 – y^2)(x^2 + y^2)$. In the equation $x^2 + 2x + 1 + y^2 = 9$, see an opportunity to rewrite the first three terms as $(x+1)^2$, thus recognizing the equation of a circle with radius 3 and center (-1, 0). See $(x^2 + 4)/(x^2 + 3)$ as $((x^2+3) + 1)/(x^2+3)$, thus recognizing an opportunity to write it as $1 + 1/(x^2 + 3)$.
MACC.912.A-SSE.2.3:	Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. a. Factor a quadratic expression to reveal the zeros of the

	function it defines. b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines. c. Use the properties of exponents to transform expressions for exponential functions. *For example the expression* *can be rewritten as* ≈ *to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.* Remarks/Examples
	Algebra 1, Unit 4: It is important to balance conceptual understanding and procedural fluency in work with equivalent expressions. For example, development of skill in factoring and completing the square goes hand-in-hand with understanding what different forms of a quadratic expression reveal. **Algebra 1 Assessment Limits and Clarifications** i) Tasks have a real-world context. As described in the standard, there is an interplay between the mathematical structure of the expression and the structure of the situation such that choosing and producing an equivalent form of the expression reveals something about the situation. ii) Tasks are limited to exponential expressions with integer exponents. **Algebra 2 Assessment Limits and Clarifications** i) Tasks have a real-world context. As described in the standard, there is an interplay between the mathematical structure of the expression and the structure of the situation such that choosing and producing an equivalent form of the expression reveals something about the situation. ii) Tasks are limited to exponential expressions with rational or real exponents.
MACC.912.A-SSE.2.4:	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.*
MACC.912.F-BF.1.1:	Write a function that describes a relationship between two quantities. a. Determine an explicit expression, a recursive process, or steps for calculation from a context. 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.* c. Compose functions. *For example, if T(y) is the temperature in the atmosphere as a function of height, and h(t) is the height of a weather balloon as a function of time, then T(h(t)) is the temperature at the location of the weather balloon as a function of time.* Remarks/Examples
	Algebra 1, Unit 2: Limit to F.BF.1a, 1b, and 2 to linear and exponential functions. **Algebra 1, Unit 5**: Focus on situations that exhibit a quadratic relationship. **Algebra 1 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Tasks are limited to linear functions, quadratic functions, and exponential functions with domains in the integers. **Algebra 2 Assessment Limits and Clarifications** i) Tasks have a real-world context ii) Tasks may involve linear functions, quadratic functions, and exponential functions.
MACC.912.F-BF.1.2:	Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.

	Remarks/Examples
	Algebra 1 Honors, Unit 4: In F.BF.2, connect arithmetic sequences to linear functions and geometric sequences to exponential functions. Algebra 2, Unit 3: In F.BF.2, connect arithmetic sequences to linear functions and geometric sequences to exponential functions. [Please note this standard is not included in the Algebra 1 course; the remarks should reference Algebra 1 Honors/Unit 4 and Algebra 2/Unit 3 Instructional Notes.]
MACC.912.F-BF.2.3:	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.* Remarks/Examples
	Algebra 1, Unit 2: Focus on vertical translations of graphs of linear and exponential functions. Relate the vertical translation of a linear function to its y-intercept. While applying other transformations to a linear graph is appropriate at this level, it may be difficult for students to identify or distinguish between the effects of the other transformations included in this standard. **Algebra 1, Unit 5**: For F.BF.3, focus on quadratic functions, and consider including absolute value functions. **Algebra 1 Assessment Limit and Clarifications** i) Identifying 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) is limited to linear and quadratic functions. ii) Experimenting with cases and illustrating an explanation of the effects on the graph using technology is limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers.

	iii) Tasks do not involve recognizing even and odd functions. The function types listed in note (ii) are the same as those listed in the Algebra I column for standards F-IF.4, F-IF.6, and F-IF.9. **Algebra 2 Assessment Limits and Clarifications** i) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions ii) Tasks may involve recognizing even and odd functions. The function types listed in note (i) are the same as those listed in the Algebra II column for standards F-IF.4, F-IF.6, and F-IF.9.
MACC.912.F-BF.2.4:	Find inverse functions. a. Solve an equation of the form f(x) = c for a simple function f that has an inverse and write an expression for the inverse. *For example, $f(x) = 2x^3$ or $f(x) = (x+1)/(x-1)$ for $x \neq 1$.* b. Verify by composition that one function is the inverse of another. c. Read values of an inverse function from a graph or a table, given that the function has an inverse. d. Produce an invertible function from a non-invertible function by restricting the domain. Remarks/Examples Algebra 1 Honors, Unit 4: For F.BF.4a, focus on linear functions but consider simple situations where the domain of the function must be restricted in order for the inverse to exist, such as $f(x) = x^2$, $x>0$. Algebra 2, Unit 3: For F.BF.4a, focus on linear functions but consider simple situations where the domain of the function must be restricted in order for the inverse to exist, such as $f(x) = x^2$, $x>0$.
MACC.912.F-IF.2.4:	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. Remarks/Examples
	Algebra 1, Unit 2: For F.IF.4 and 5, focus on linear and exponential functions. **Algebra 1 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Tasks are limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers. Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra I column for standards F-IF.6 and F-IF.9. **Algebra 2 Assessment Limits and Clarifications** i) Tasks have a real-world context ii) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions. Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra II column for standards F-IF.6 and F-IF.9.
MACC.912.F-IF.2.5:	Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.* Remarks/Examples
	Algebra 1, Unit 2: For F.IF.4 and 5, focus on linear and exponential functions.
MACC.912.F-IF.2.6:	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. Remarks/Examples
	Algebra 1, Unit 2: For F.IF.6, focus on linear functions and exponential functions whose domain is a subset of the integers. Unit 5 in this course and the Algebra II course address other types of functions. **Algebra 1 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Tasks are limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers. The function types listed here are the same as those listed in the Algebra I column for standards F-IF.4 and F-IF.9. **Algebra 2 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions. The function types listed here are the same as those listed in the Algebra II column for standards F-IF.4 and F-IF.9.
MACC.912.F-IF.3.7:	Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. a. Graph linear and quadratic functions and show intercepts, maxima, and minima. b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end

behavior.

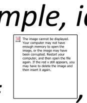
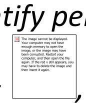
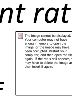
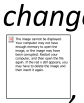
e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.

Remarks/Examples

Algebra 1, Unit 2: For F.IF.7a, 7e, and 9 focus on linear and exponentials functions. Include comparisons of two functions presented algebraically. For example, compare the growth of two linear functions, or two exponential functions such as $y=3^n$ and $y=100^2$

MACC.912.F-IF.3.8:

Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

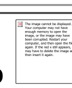
a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.
b. Use the properties of exponents to interpret expressions for exponential functions. *For example, identify percent rate of change in functions such as y =* *, y =* *, y =* *, y =* *, and classify them as representing exponential growth or decay.*

Remarks/Examples

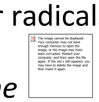
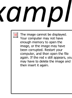
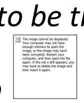
Algebra 1, Unit 5: Note that this unit, and in particular in F.IF.8b, extends the work begun in Unit 2 on exponential functions with integer exponents.

MACC.912.F-IF.3.9:

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.*

	Remarks/Examples
	Algebra 1, Unit 2: For F.IF.7a, 7e, and 9 focus on linear and exponentials functions. Include comparisons of two functions presented algebraically. For example, compare the growth of two linear functions, or two exponential functions such as $y=3^n$ and $y=100^2$ **Algebra 1, Unit 5**: For F.IF.9, focus on expanding the types of functions considered to include, linear, exponential, and quadratic. Extend work with quadratics to include the relationship between coefficients and roots, and that once roots are known, a quadratic equation can be factored. **Algebra 1 Assessment Limits and Clarifications** i) Tasks are limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers. The function types listed here are the same as those listed in the Algebra I column for standards F-IF.4 and F-IF.6. **Algebra 2 Assessment Limits and Clarifications** i) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions. The function types listed here are the same as those listed in the Algebra II column for standards F-IF.4 and F-IF.6.
MACC.912.F-LE.1.4:	For exponential models, express as a logarithm the solution to  = d where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.
MACC.912.F-LE.2.5:	Interpret the parameters in a linear or exponential function in terms of a context. Remarks/Examples
	Algebra 1, Unit 2: Limit exponential functions to those of the form

	$f(x) = b^x + k$. **Algebra 1 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Exponential functions are limited to those with domains in the integers. **Algebra 2 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Tasks are limited to exponential functions with domains not in the integers.
MACC.912.F-TF.1.1:	Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.
MACC.912.F-TF.1.2:	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.
MACC.912.F-TF.2.5:	Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.
MACC.912.F-TF.3.8:	Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and use it to calculate trigonometric ratios.
MACC.912.G-GPE.1.2:	Derive the equation of a parabola given a focus and directrix.
MACC.912.N-CN.1.1:	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.
MACC.912.N-CN.1.2:	Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.
MACC.912.N-CN.3.7:	Solve quadratic equations with real coefficients that have complex solutions.
MACC.912.N-Q.1.2:	Define appropriate quantities for the purpose of descriptive modeling. Remarks/Examples

	Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. **Algebra 1 Content Notes:** Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. **Algebra 1 Assessment Limits and Clarifications** This standard will be assessed in Algebra I by ensuring that some modeling tasks (involving Algebra I content or securely held content from grades 6-8) require the student to create a quantity of interest in the situation being described (i.e., a quantity of interest is not selected for the student by the task). For example, in a situation involving data, the student might autonomously decide that a measure of center is a key variable in a situation, and then choose to work with the mean. **Algebra 2 Assessment Limits and Clarifications** This standard will be assessed in Algebra II by ensuring that some modeling tasks (involving Algebra II content or securely held content from previous grades and courses) require the student to create a quantity of interest in the situation being described (i.e., this is not provided in the task). For example, in a situation involving periodic phenomena, the student might autonomously decide that amplitude is a key variable in a situation, and then choose to work with peak amplitude.
MACC.912.N-RN.1.1:	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*  *to be the cube root of 5 because we want*  =  *to hold, so*  *must equal 5.* Remarks/Examples Algebra 1, Unit 2: In implementing the standards in curriculum, these standards should occur before discussing exponential functions with

	continuous domains.
MACC.912.N-RN.1.2:	Rewrite expressions involving radicals and rational exponents using the properties of exponents. Remarks/Examples
	Algebra 1, Unit 2: In implementing the standards in curriculum, these standards should occur before discussing exponential functions with continuous domains.
MACC.912.S-CP.1.1:	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").
MACC.912.S-CP.1.2:	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.
MACC.912.S-CP.1.3:	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.
MACC.912.S-CP.1.4:	Construct and interpret two-way frequency tables of data when two categories are associated with each object 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.*
MACC.912.S-CP.1.5:	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.*
MACC.912.S-CP.2.6:	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.
MACC.912.S-CP.2.7:	Apply the Addition Rule, P(A or B) = P(A) + P(B) – P(A and B), and

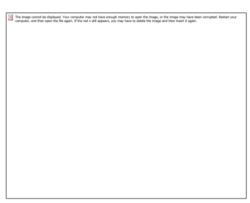
	interpret the answer in terms of the model.
MACC.912.S-IC.1.1:	Understand statistics as a process for making inferences about population parameters based on a random sample from that population.
MACC.912.S-IC.1.2:	Decide if a specified model is consistent with results from a given data-generating process, 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?*
MACC.912.S-IC.2.3:	Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.
MACC.912.S-IC.2.4:	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.
MACC.912.S-IC.2.5:	Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.
MACC.912.S-IC.2.6:	Evaluate reports based on data.
MACC.912.S-ID.1.4:	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.
MACC.K12.MP.1.1:	**Make sense of problems and persevere in solving them.** Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and

	graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.
MACC.K12.MP.2.1:	**Reason abstractly and quantitatively**. Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.
MACC.K12.MP.3.1:	**Construct viable arguments and critique the reasoning of others.** Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is

	a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.
MACC.K12.MP.4.1:	**Model with mathematics.** Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.
MACC.K12.MP.5.1:	**Use appropriate tools strategically.** Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For

	example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.
MACC.K12.MP.6.1:	**Attend to precision.** Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.
MACC.K12.MP.7.1:	**Look for and make use of structure.** Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see 7 × 8 equals the well remembered 7 × 5 + 7 × 3, in preparation for learning about the distributive property. In the expression $x^2 + 9x + 14$, older students can see the 14 as 2 × 7 and the 9 as 2 + 7. They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see

	complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see $5 - 3(x - y)^2$ as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers x and y.
MACC.K12.MP.8.1:	**Look for and express regularity in repeated reasoning.** Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation $(y - 2)/(x - 1) = 3$. Noticing the regularity in the way terms cancel when expanding $(x - 1)(x + 1)$, $(x - 1)(x^2 + x + 1)$, and $(x - 1)(x^3 + x^2 + x + 1)$ might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.



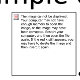
Course: Algebra 2- 1200330

Direct link to this page:http://www.cpalms.org/Courses/CoursePagePublicPreviewCourse3650.aspx

BASIC INFORMATION

Course Title:	Algebra 2
Course Number:	1200330
Course Abbreviated Title:	ALG 2
Course Path:	**Section:** Grades PreK to 12 Education Courses **Grade Group:** Grades 9 to 12 and Adult Education Courses **Subject:** Mathematics **SubSubject:** Algebra
Number of Credits:	One credit (1)
Course length:	Year (Y)
Course Type:	Core
Course Level:	2
Status:	Draft - Board Approval Pending
Version Description:	Building on their work with linear, quadratic, and exponential functions, students extend their repertoire of functions to include polynomial, rational, and radical functions.2 Students work closely with the expressions that define the functions, and continue to expand and hone their abilities to model situations and to solve equations, including solving quadratic equations over the set of complex numbers and solving exponential equations using the properties of logarithms. The Standards for Mathematical Practice apply throughout each course and, together with the content standards, prescribe that students experience mathematics as a coherent, useful, and logical subject that makes use of their ability to make sense of problem situations. The critical areas for this course, organized into four units, are as follows: **Unit 1- Polynomial, Rational, and Radical Relationships:** This unit

	develops the structural similarities between the system of polynomials and the system of integers. Students draw on analogies between polynomial arithmetic and base-ten computation, focusing on properties of operations, particularly the distributive property. Students connect multiplication of polynomials with multiplication of multi-digit integers, and division of polynomials with long division of integers. Students identify zeros of polynomials, including complex zeros of quadratic polynomials, and make connections between zeros of polynomials and solutions of polynomial equations. The unit culminates with the fundamental theorem of algebra. A central theme of this unit is that the arithmetic of rational expressions is governed by the same rules as the arithmetic of rational numbers. **Unit 2- Trigonometric Functions:** Building on their previous work with functions, and on their work with trigonometric ratios and circles in Geometry, students now use the coordinate plane to extend trigonometry to model periodic phenomena. **Unit 3- Modeling with Functions:** In this unit students synthesize and generalize what they have learned about a variety of function families. They extend their work with exponential functions to include solving exponential equations with logarithms. They explore the effects of transformations on graphs of diverse functions, including functions arising in an application, in order to abstract the general principle that transformations on a graph always have the same effect regardless of the type of the underlying function. They identify appropriate types of functions to model a situation, they adjust parameters to improve the model, and they compare models by analyzing appropriateness of fit and making judgments about the domain over which a model is a good fit. The description of modeling as "the process of choosing and using mathematics and statistics to analyze empirical situations, to understand them better, and to make decisions" is at the heart of this unit. The narrative discussion and diagram of the modeling cycle should be considered when knowledge of functions, statistics, and geometry is applied in a modeling context. **Unit 4- Inferences and Conclusions from Data:** In this unit, students see how the visual displays and summary statistics they learned in earlier grades relate to different types of data and to probability distributions. They identify different ways of collecting data—including sample surveys, experiments, and simulations—and the role that randomness and careful design play in the conclusions that

	can be drawn. **Unit 5- Applications of Probability:** Building on probability concepts that began in the middle grades, students use the languages of set theory to expand their ability to compute and interpret theoretical and experimental probabilities for compound events, attending to mutually exclusive events, independent events, and conditional probability. Students should make use of geometric probability models wherever possible. They use probability to make informed decisions.
General Notes:	**Fluency Recommendations** **A-APR.6** This standard sets an expectation that students will divide polynomials with remainder by inspection in simple cases. For example, one can view the rational expression . **A-SSE.2** The ability to see structure in expressions and to use this structure to rewrite expressions is a key skill in everything from advanced factoring (e.g., grouping) to summing series to the rewriting of rational expressions to examine the end behavior of the corresponding rational function. **F-IF.3** Fluency in translating between recursive definitions and closed forms is helpful when dealing with many problems involving sequences and series, with applications ranging from fitting functions to tables to problems in finance.

STANDARDS (74)

LACC.1112.RST.1.3:	Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

LACC.1112.RST.2.4:	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics.
LACC.1112.RST.3.7:	Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.
LACC.1112.SL.1.1:	Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively. a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas. b. Work with peers to promote civil, democratic discussions and decision-making, set clear goals and deadlines, and establish individual roles as needed. c. Propel conversations by posing and responding to questions that probe reasoning and evidence; ensure a hearing for a full range of positions on a topic or issue; clarify, verify, or challenge ideas and conclusions; and promote divergent and creative perspectives. d. Respond thoughtfully to diverse perspectives; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research is required to deepen the investigation or complete the task.
LACC.1112.SL.1.2:	Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data.
LACC.1112.SL.1.3:	Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, assessing the stance, premises, links among ideas, word choice, points of emphasis, and tone used.
LACC.1112.SL.2.4:	Present information, findings, and supporting evidence, conveying a

	clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks.
LACC.1112.WHST.1.1:	Write arguments focused on *discipline-specific content.* a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence. b. Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience's knowledge level, concerns, values, and possible biases. c. Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims. d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing. e. Provide a concluding statement or section that follows from or supports the argument presented.
LACC.1112.WHST.2.4:	Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
LACC.1112.WHST.3.9:	Draw evidence from informational texts to support analysis, reflection, and research.
MACC.912.A-APR.1.1:	Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials. Remarks/Examples

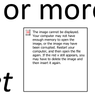
	Algebra 1 - Fluency Recommendations Fluency in adding, subtracting, and multiplying polynomials supports students throughout their work in algebra, as well as in their symbolic work with functions. Manipulation can be more mindful when it is fluent. Focus on polynomial expressions that simplify to forms that are linear or quadratic in a positive integer power of x.
MACC.912.A-APR.2.2:	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).
MACC.912.A-APR.2.3:	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. Remarks/Examples **Algebra 1 Assessment Limits and Clarifications** i) Tasks are limited to quadratic and cubic polynomials in which linear and quadratic factors are available. For example, find the zeros of $(x - 2)(x^2 - 9)$. **Algebra 2 Assessment Limits and Clarifications** i) Tasks include quadratic, cubic, and quartic polynomials and polynomials for which factors are not provided. For example, find the zeros of $(x^2 - 1)(x^2 + 1)$
MACC.912.A-APR.3.4:	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.
MACC.912.A-APR.4.6:	Rewrite simple rational 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.

	Remarks/Examples **Algebra 2 - Fluency Recommendations** This standard sets an expectation that students will divide polynomials with remainder by inspection in simple cases.
MACC.912.A-CED.1.1:	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.* Remarks/Examples **Algebra 1, Unit 1**: Limit A.CED.1 and A.CED.2 to linear and exponential equations, and, in the case of exponential equations, limit to situations requiring evaluation of exponential functions at integer inputs. **Algebra 1, Unit 4**: Extend work on linear and exponential equations in Unit 1 to quadratic equations. **Algebra 1 Assessment Limits and Clarifications** i) Tasks are limited to linear, quadratic, or exponential equations with integer exponents. **Algebra 2 Assessment Limits and Clarifications** i) Tasks are limited to exponential equations with rational or real exponents and rational functions. ii) Tasks have a real-world context.
MACC.912.A-CED.1.2:	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. Remarks/Examples Algebra 1, Unit 1: Limit A.CED.1 and A.CED.2 to linear and exponential equations, and, in the case of exponential equations, limit to situations requiring evaluation of exponential functions at integer inputs.

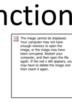
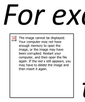
	Algebra 1, Unit 4: Extend work on linear and exponential equations in Unit 1 to quadratic equations.
MACC.912.A-CED.1.3:	Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.* Remarks/Examples
	Algebra 1, Unit 1: Limit A.CED.3 to linear equations and inequalities.
MACC.912.A-CED.1.4:	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law V = IR to highlight resistance R.* Remarks/Examples
	Algebra 1, Unit 1: Limit A.CED.4 to formulas which are linear in the variable of interest. Algebra 1, Unit 4: Extend A.CED.4 to formulas involving squared variables.
MACC.912.A-REI.1.1:	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. Remarks/Examples
	Algebra 1, Unit 1: Students should focus on and master A.REI.1 for linear equations and be able to extend and apply their reasoning to other types of equations in future courses. Students will solve exponential equations with logarithms in Algebra II. **Algebra 1 Assessment Limits and Clarification** i) Tasks are limited to quadratic equations. **Algebra 2 Assessment Limits and Clarification**

	i) Tasks are limited to simple rational or radical equations.
MACC.912.A-REI.1.2:	Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.
MACC.912.A-REI.2.4:	Solve quadratic equations in one variable. a. Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x – p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form. 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. Remarks/Examples
	Algebra 1, Unit 4: Students should learn of the existence of the complex number system, but will not solve quadratics with complex solutions until Algebra II. **Algebra 1 Assessment Limits and Clarifications** i) Tasks do not require students to write solutions for quadratic equations that have roots with nonzero imaginary parts. However, tasks can require the student to recognize cases in which a quadratic equation has no real solutions. Note, solving a quadratic equation by factoring relies on the connection between zeros and factors of polynomials (cluster A-APR.B). Cluster A-APR.B is formally assessed in A2. **Algebra 2 Assessment Limits and Clarifications** i) In the case of equations that have roots with nonzero imaginary parts, students write the solutions as a ± bi for real numbers a and b.
MACC.912.A-REI.3.6:	Solve systems of linear equations exactly and approximately (e.g.,

	with graphs), focusing on pairs of linear equations in two variables. Remarks/Examples
	Algebra 1, Unit 2: Build on student experiences graphing and solving systems of linear equations from middle school to focus on justification of the methods used. Include cases where the two equations describe the same line (yielding infinitely many solutions) and cases where two equations describe parallel lines (yielding no solution); connect to GPE.5 when it is taught in Geometry, which requires students to prove the slope criteria for parallel lines. **Algebra 1 Assessment Limits and Clarifications** i)i) Tasks have a real-world context. ii) Tasks have hallmarks of modeling as a mathematical practice (less defined tasks, more of the modeling cycle, etc.). Note, solving a quadratic equation by factoring relies on the connection between zeros and factors of polynomials (cluster A-APR.B). Cluster A-APR.B is formally assessed in A2. **Algebra 2 Assessment Limits and Clarifications** i) Tasks are limited to 3x3 systems.
MACC.912.A-REI.3.7:	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* $x^2 + y^2 = 3$. Remarks/Examples
	Algebra 1 Honors, Unit 4: Include systems consisting of one linear and one quadratic equation. Include systems that lead to work with fractions. For example, finding the intersections between $x^2+y^2= 1$ and $y = (x+1)/2$ leads to the point (3/5, 4/5) on the unit circle, corresponding to the Pythagorean triple $3^2+4^2=5^2$. Algebra 2, Unit 1: Include systems consisting of one linear and one quadratic equation. Include systems that lead to work with fractions.

	For example, finding the intersections between $x^2+y^2= 1$ and $y = (x+1)/2$ leads to the point (3/5, 4/5) on the unit circle, corresponding to the Pythagorean triple $3^2+4^2=5^2$.
[MACC.912.A-REI.4.11:]()	Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect are the solutions of the equation f(x) = g(x); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where f(x) and/or g(x) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions. Remarks/Examples
	Algebra 1, Unit 2: For A.REI.11, focus on cases where f(x) and g(x) are linear or exponential. **Algebra 1 Assessment Limits and Clarifications** i) Tasks that assess conceptual understanding of the indicated concept may involve any of the function types mentioned in the standard except exponential and logarithmic functions. ii) Finding the solutions approximately is limited to cases where f(x) and g(x) are polynomial functions. **Algebra 2 Assessment Limits and Clarifications** i) Tasks may involve any of the function types mentioned in the standard.
[MACC.912.A-SSE.1.1:]()	Interpret expressions that represent a quantity in terms of its context. a. Interpret parts of an expression, such as terms, factors, and coefficients. b. Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret*  *as the product of P and a factor not depending on P.*

	Remarks/Examples
	Algebra 1 - Fluency Recommendations A-SSE.1.1b - Fluency in transforming expressions and chunking (seeing parts of an expression as a single object) is essential in factoring, completing the square, and other mindful algebraic calculations. **Algebra 1, Unit 1**: Limit to linear expressions and to exponential expressions with integer exponents. **Algebra 1, Unit 4**: Focus on quadratic and exponential expressions. For A.SSE.1b, exponents are extended from the integer exponents found in Unit 1 to rational exponents focusing on those that represent square or cube roots.
MACC.912.A-SSE.1.2:	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* $(x^2 – y^2)(x^2 + y^2)$. Remarks/Examples
	Algebra 1, Unit 4: Focus on quadratic and exponential expressions. For A.SSE.1b, exponents are extended from the integer exponents found in Unit 1 to rational exponents focusing on those that represent square or cube roots. **Algebra 2 - Fluency Recommendations** The ability to see structure in expressions and to use this structure to rewrite expressions is a key skill in everything from advanced factoring (e.g., grouping) to summing series to the rewriting of rational expressions to examine the end behavior of the corresponding rational function. **Algebra 1 Assessment Limits and Clarifications** i) Tasks are limited to numerical expressions and polynomial expressions in one variable. ii) Examples: See an opportunity to

	rewrite $a^2 + 9a + 14$ as (a+7)(a+2). Recognize 53^2-47^2 as a difference of squares and see an opportunity to rewrite it in the easier-to-evaluate form (53+47)(53-47). **Algebra 2 Assessment and Limits and Clarifications** i) Tasks are limited to polynomial, rational, or exponential expressions. ii) Examples: 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 $(x^2 – y^2)(x^2 + y^2)$. In the equation $x^2 + 2x + 1 + y^2 = 9$, see an opportunity to rewrite the first three terms as $(x+1)^2$, thus recognizing the equation of a circle with radius 3 and center (-1, 0). See $(x^2 + 4)/(x^2 + 3)$ as $((x^2+3) + 1)/(x^2+3)$, thus recognizing an opportunity to write it as $1 + 1/(x^2 + 3)$.
MACC.912.A-SSE.2.3:	Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. a. Factor a quadratic expression to reveal the zeros of the function it defines. b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines. c. Use the properties of exponents to transform expressions for exponential functions. *For example the expression*  *can be rewritten as*  ≈  *to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.* Remarks/Examples
	Algebra 1, Unit 4: It is important to balance conceptual understanding and procedural fluency in work with equivalent expressions. For example, development of skill in factoring and completing the square goes hand-in-hand with understanding what different forms of a quadratic expression reveal. **Algebra 1 Assessment Limits and Clarifications** i) Tasks have a real-world context. As described in the standard, there is an interplay between the mathematical structure of the expression and the structure of the situation such that choosing and producing an equivalent form of the expression reveals something

	about the situation. ii) Tasks are limited to exponential expressions with integer exponents. **Algebra 2 Assessment Limits and Clarifications** i) Tasks have a real-world context. As described in the standard, there is an interplay between the mathematical structure of the expression and the structure of the situation such that choosing and producing an equivalent form of the expression reveals something about the situation. ii) Tasks are limited to exponential expressions with rational or real exponents.
MACC.912.A-SSE.2.4:	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.*
MACC.912.F-BF.1.1:	Write a function that describes a relationship between two quantities. a. Determine an explicit expression, a recursive process, or steps for calculation from a context. 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.* c. Compose functions. *For example, if T(y) is the temperature in the atmosphere as a function of height, and h(t) is the height of a weather balloon as a function of time, then T(h(t)) is the temperature at the location of the weather balloon as a function of time.* Remarks/Examples **Algebra 1, Unit 2**: Limit to F.BF.1a, 1b, and 2 to linear and exponential functions. **Algebra 1, Unit 5**: Focus on situations that exhibit a quadratic

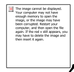
	relationship. **Algebra 1 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Tasks are limited to linear functions, quadratic functions, and exponential functions with domains in the integers. **Algebra 2 Assessment Limits and Clarifications** i) Tasks have a real-world context ii) Tasks may involve linear functions, quadratic functions, and exponential functions.
MACC.912.F-BF.1.2:	Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms. Remarks/Examples
	Algebra 1 Honors, Unit 4: In F.BF.2, connect arithmetic sequences to linear functions and geometric sequences to exponential functions. Algebra 2, Unit 3: In F.BF.2, connect arithmetic sequences to linear functions and geometric sequences to exponential functions. [Please note this standard is not included in the Algebra 1 course; the remarks should reference Algebra 1 Honors/Unit 4 and Algebra 2/Unit 3 Instructional Notes.]
MACC.912.F-BF.2.3:	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.* Remarks/Examples
	Algebra 1, Unit 2: Focus on vertical translations of graphs of linear and exponential functions. Relate the vertical translation of a linear function to its y-intercept. While applying other transformations to a linear graph is appropriate

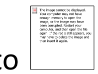
	at this level, it may be difficult for students to identify or distinguish between the effects of the other transformations included in this standard. **Algebra 1, Unit 5**: For F.BF.3, focus on quadratic functions, and consider including absolute value functions. **Algebra 1 Assessment Limit and Clarifications** i) Identifying 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) is limited to linear and quadratic functions. ii) Experimenting with cases and illustrating an explanation of the effects on the graph using technology is limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers. iii) Tasks do not involve recognizing even and odd functions. The function types listed in note (ii) are the same as those listed in the Algebra I column for standards F-IF.4, F-IF.6, and F-IF.9. **Algebra 2 Assessment Limits and Clarifications** i) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions ii) Tasks may involve recognizing even and odd functions. The function types listed in note (i) are the same as those listed in the Algebra II column for standards F-IF.4, F-IF.6, and F-IF.9.
MACC.912.F-BF.2.4:	Find inverse functions. a. Solve an equation of the form f(x) = c for a simple function f that has an inverse and write an expression for the inverse. *For example, $f(x) = 2x^3$ or $f(x) = (x+1)/(x-1)$ for $x \neq 1$.* b. Verify by composition that one function is the inverse of another. c. Read values of an inverse function from a graph or a table, given that the function has an inverse. d. Produce an invertible function from a non-invertible function

	by restricting the domain. Remarks/Examples
	Algebra 1 Honors, Unit 4: For F.BF.4a, focus on linear functions but consider simple situations where the domain of the function must be restricted in order for the inverse to exist, such as $f(x) = x^2$, $x>0$. Algebra 2, Unit 3: For F.BF.4a, focus on linear functions but consider simple situations where the domain of the function must be restricted in order for the inverse to exist, such as $f(x) = x^2$, $x>0$.
MACC.912.F-IF.2.4:	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.* Remarks/Examples
	Algebra 1, Unit 2: For F.IF.4 and 5, focus on linear and exponential functions. **Algebra 1 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Tasks are limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers. Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra I column for standards F-IF.6 and F-IF.9. **Algebra 2 Assessment Limits and Clarifications** i) Tasks have a real-world context ii) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions.

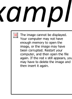
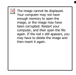
	Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra II column for standards F-IF.6 and F-IF.9.
MACC.912.F-IF.2.5:	Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.* Remarks/Examples
	Algebra 1, Unit 2: For F.IF.4 and 5, focus on linear and exponential functions.
MACC.912.F-IF.2.6:	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. Remarks/Examples
	Algebra 1, Unit 2: For F.IF.6, focus on linear functions and exponential functions whose domain is a subset of the integers. Unit 5 in this course and the Algebra II course address other types of functions. **Algebra 1 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Tasks are limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers. The function types listed here are the same as those listed in the Algebra I column for standards F-IF.4 and F-IF.9. **Algebra 2 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions.

	The function types listed here are the same as those listed in the Algebra II column for standards F-IF.4 and F-IF.9.
MACC.912.F-IF.3.7:	Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. a. Graph linear and quadratic functions and show intercepts, maxima, and minima. b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior. e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude. Remarks/Examples
	Algebra 1, Unit 2: For F.IF.7a, 7e, and 9 focus on linear and exponentials functions. Include comparisons of two functions presented algebraically. For example, compare the growth of two linear functions, or two exponential functions such as $y=3^n$ and $y=100^2$
MACC.912.F-IF.3.8:	Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. a. 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. b. Use the properties of exponents to interpret expressions for exponential functions. *For example, identify percent rate of change in functions such as y = , y = , y = , y =*

	*, and classify them as representing exponential growth or decay.* Remarks/Examples
	Algebra 1, Unit 5: Note that this unit, and in particular in F.IF.8b, extends the work begun in Unit 2 on exponential functions with integer exponents.
MACC.912.F-IF.3.9:	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.* Remarks/Examples
	Algebra 1, Unit 2: For F.IF.7a, 7e, and 9 focus on linear and exponentials functions. Include comparisons of two functions presented algebraically. For example, compare the growth of two linear functions, or two exponential functions such as $y=3^n$ and $y=100^2$ **Algebra 1, Unit 5**: For F.IF.9, focus on expanding the types of functions considered to include, linear, exponential, and quadratic. Extend work with quadratics to include the relationship between coefficients and roots, and that once roots are known, a quadratic equation can be factored. **Algebra 1 Assessment Limits and Clarifications** i) Tasks are limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers. The function types listed here are the same as those listed in the Algebra I column for standards F-IF.4 and F-IF.6. **Algebra 2 Assessment Limits and Clarifications**

	i) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions. The function types listed here are the same as those listed in the Algebra II column for standards F-IF.4 and F-IF.6.
MACC.912.F-LE.1.4:	 For exponential models, express as a logarithm the solution to = d where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.
MACC.912.F-LE.2.5:	Interpret the parameters in a linear or exponential function in terms of a context. Remarks/Examples
	Algebra 1, Unit 2: Limit exponential functions to those of the form $f(x) = b^x + k$. **Algebra 1 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Exponential functions are limited to those with domains in the integers. **Algebra 2 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Tasks are limited to exponential functions with domains not in the integers.
MACC.912.F-TF.1.1:	Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.
MACC.912.F-TF.1.2:	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.
MACC.912.F-TF.2.5:	Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.
MACC.912.F-TF.3.8:	Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and use it to

	calculate trigonometric ratios.
MACC.912.G-GPE.1.2:	Derive the equation of a parabola given a focus and directrix.
MACC.912.N-CN.1.1:	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.
MACC.912.N-CN.1.2:	Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.
MACC.912.N-CN.3.7:	Solve quadratic equations with real coefficients that have complex solutions.
MACC.912.N-Q.1.2:	Define appropriate quantities for the purpose of descriptive modeling. Remarks/Examples
	Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. **Algebra 1 Content Notes:** Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. **Algebra 1 Assessment Limits and Clarifications** This standard will be assessed in Algebra I by ensuring that some modeling tasks (involving Algebra I content or securely held content from grades 6-8) require the student to create a quantity of interest in the situation being described (i.e., a quantity of interest is not selected for the student by the task). For example, in a situation involving data, the student might autonomously decide that a measure of center is a key variable in a situation, and then choose to work with the mean. **Algebra 2 Assessment Limits and Clarifications** This standard will be assessed in Algebra II by ensuring that some modeling tasks (involving Algebra II content or securely held content from previous grades and courses) require the student to create a

	quantity of interest in the situation being described (i.e., this is not provided in the task). For example, in a situation involving periodic phenomena, the student might autonomously decide that amplitude is a key variable in a situation, and then choose to work with peak amplitude.
MACC.912.N-RN.1.1:	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*  *to be the cube root of 5 because we want*  =  *to hold, so*  *must equal 5.* Remarks/Examples Algebra 1, Unit 2: In implementing the standards in curriculum, these standards should occur before discussing exponential functions with continuous domains.
MACC.912.N-RN.1.2:	Rewrite expressions involving radicals and rational exponents using the properties of exponents. Remarks/Examples Algebra 1, Unit 2: In implementing the standards in curriculum, these standards should occur before discussing exponential functions with continuous domains.
MACC.912.S-CP.1.1:	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”).
MACC.912.S-CP.1.2:	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.
MACC.912.S-CP.1.3:	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.
MACC.912.S-CP.1.4:	Construct and interpret two-way frequency tables of data when two categories are associated with each object 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.*
MACC.912.S-CP.1.5:	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.*
MACC.912.S-CP.2.6:	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.
MACC.912.S-CP.2.7:	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.
MACC.912.S-IC.1.1:	Understand statistics as a process for making inferences about population parameters based on a random sample from that population.
MACC.912.S-IC.1.2:	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?*
MACC.912.S-IC.2.3:	Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.
MACC.912.S-IC.2.4:	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.
MACC.912.S-IC.2.5:	Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.
MACC.912.S-IC.2.6:	Evaluate reports based on data.
MACC.912.S-ID.1.4:	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.
MACC.K12.MP.1.1:	**Make sense of problems and persevere in solving them.** Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.
MACC.K12.MP.2.1:	**Reason abstractly and quantitatively**. Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of

	operations and objects.
MACC.K12.MP.3.1:	**Construct viable arguments and critique the reasoning of others.** Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.
MACC.K12.MP.4.1:	**Model with mathematics.** Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs,

	flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.
MACC.K12.MP.5.1:	**Use appropriate tools strategically.** Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.
MACC.K12.MP.6.1:	**Attend to precision.** Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations

	to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.
MACC.K12.MP.7.1:	**Look for and make use of structure.** Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see 7×8 equals the well remembered $7 \times 5 + 7 \times 3$, in preparation for learning about the distributive property. In the expression $x^2 + 9x + 14$, older students can see the 14 as 2×7 and the 9 as $2 + 7$. They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see $5 – 3(x – y)^2$ as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers x and y.
MACC.K12.MP.8.1:	**Look for and express regularity in repeated reasoning.** Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation $(y – 2)/(x – 1) = 3$. Noticing the regularity in the way terms cancel when expanding $(x – 1)(x + 1)$, $(x – 1)(x^2 + x + 1)$, and $(x – 1)(x^3 + x^2 + x + 1)$ might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

Course: Algebra 1-B for Credit Recovery- 1200385

Direct link to this page:http://www.cpalms.org/Courses/CoursePagePublicPreviewCourse3656.aspx

BASIC INFORMATION

Course Title:	Algebra 1-B for Credit Recovery
Course Number:	1200385
Course Abbreviated Title:	ALG 1-B CR
Course Path:	**Section:** Grades PreK to 12 Education Courses **Grade Group:** Grades 9 to 12 and Adult Education Courses **Subject:** Mathematics **SubSubject:** Algebra
Number of Credits:	One credit (1)
Course Type:	Elective
Course Level:	2
Status:	Draft - Board Approval Pending
Version Description:	Special Notes: Credit Recovery courses are credit bearing courses with specific content requirements defined by Next Generation Sunshine State Standards and/or Common Core State Standards. Students enrolled in a Credit Recovery course must have previously attempted the corresponding course (and/or End-of-Course assessment) since the course requirements for the Credit Recovery course is exactly the same as the previously attempted corresponding course. For example, Geometry (1206310) and Geometry for Credit Recovery (1206315) have identical content requirements. It is important to note that Credit Recovery courses are not bound by Section 1003.436(1)(a), Florida Statutes, requiring a minimum of 135 hours of bona fide instruction (120 hours in a school/district implementing block scheduling) in a designed course of study that contains student performance standards, since the students have previously attempted successful completion of the corresponding course. Additionally, Credit Recovery courses should ONLY be used for credit recovery, grade forgiveness, or remediation for students needing to prepare for an End-of-Course assessment retake.
General Notes:	

The fundamental purpose of this course is to formalize and extend the mathematics that students learned in the middle grades. The critical areas, called units, deepen and extend understanding of linear and exponential relationships by contrasting them with each other and by applying linear models to data that exhibit a linear trend, and students engage in methods for analyzing, solving, and using quadratic functions. The Standards for Mathematical Practice apply throughout each course and, together with the content standards, prescribe that students experience mathematics as a coherent, useful, and logical subject that makes use of their ability to make sense of problem situations.

Algebra 1A (Year 1)

Unit 1- Relationships Between Questions and Reasoning with Equations: By the end of eighth grade, students have learned to solve linear equations in one variable and have applied graphical and algebraic methods to analyze and solve systems of linear equations in two variables. Now, students analyze and explain the process of solving an equation. Students develop fluency writing, interpreting, and translating between various forms of linear equations and inequalities, and using them to solve problems. They master the solution of linear equations and apply related solution techniques and the laws of exponents to the creation and solution of simple exponential equations.

Unit 2- Linear and Exponential Relationships: In earlier grades, students define, evaluate, and compare functions, and use them to model relationships between quantities. In this unit, students will learn function notation and develop the concepts of domain and range. They explore many examples of functions, including sequences; they interpret functions given graphically, numerically, symbolically, and verbally, translate between representations, and understand the limitations of various representations. Students build on and informally extend their understanding of integer exponents to consider exponential functions. They compare and contrast linear and exponential functions, distinguishing between additive and multiplicative change. Students explore systems of equations and inequalities, and they find and interpret their solutions. They interpret arithmetic sequences as linear functions and geometric sequences as exponential functions.

Algebra 1B (Year 2)

Unit 3- Descriptive Statistics: This unit builds upon students' prior experiences with data, providing students with more formal means of assessing how a model fits data. Students use regression techniques to describe and approximate linear relationships between quantities. They use graphical representations and knowledge of the context to make judgments about the appropriateness of linear models. With linear models, they look at residuals to analyze the goodness of fit.

Unit 4- Expressions and Equations: In this unit, students build on their knowledge from unit 2, where they extended the laws of exponents to rational exponents. Students apply this new understanding of number and strengthen their ability to see structure in and create quadratic and exponential expressions. They create and solve equations, inequalities, and systems of equations involving quadratic expressions.

Unit 5- Quadratic Functions and Modeling: In this unit, students consider quadratic functions, comparing the key characteristics of quadratic functions to

	those of linear and exponential functions. They select from among these functions to model phenomena. Students learn to anticipate the graph of a quadratic function by interpreting various forms of quadratic expressions. In particular, they identify the real solutions of a quadratic equation as the zeros of a related quadratic function. Students expand their experience with functions to include more specialized functions—absolute value, step, and those that are piecewise-defined.
Version Requirements:	**Fluency Recommendations** **A/G-** Algebra I students become fluent in solving characteristic problems involving the analytic geometry of lines, such as writing down the equation of a line given a point and a slope. Such fluency can support them in solving less routine mathematical problems involving linearity, as well as in modeling linear phenomena (including modeling using systems of linear inequalities in two variables). **A-APR.1-** Fluency in adding, subtracting, and multiplying polynomials supports students throughout their work in Algebra, as well as in their symbolic work with functions. Manipulation can be more mindful when it is fluent. **A-SSE.1b-** Fluency in transforming expressions and chunking (seeing parts of an expression as a single object) is essential in factoring, completing the square, and other mindful algebraic calculations.

STANDARDS (46)

During the 2013-2014 school year, Florida will be transitioning to the Common Core State Standards for Mathematics. The content standards for Algebra 1 are based upon these new standards; however, during this transition year, students will be assessed using the Algebra 1 End-of-Course Assessment aligned with the Next Generation Sunshine State Standards (NGSSS). For this reason, instruction should include the following NGSSS:

MA.912.G.1.4 Use coordinate geometry to find slopes, parallel lines, perpendicular lines, and equations of lines. (Assessed with MA.912.A.3.10.)

MA.912.D.7.2 Use Venn diagrams to explore relationships and patterns and to make arguments about relationships between sets.

MA.912.D.7.1 Perform set operations such as union and intersection, complement, and cross product.

LACC.910.RST.1 Key Ideas and Details

LACC.910.RST.1.3 :	Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Key Ideas and Details

LACC.910.RST.2 Craft and Structure

LACC.910.RST.2.4 :	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Craft and Structure

LACC.910.RST.3 Integration of Knowledge and Ideas

LACC.910.RST.3.7 :	Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Integration of Knowledge and Ideas

LACC.910.SL.1 Comprehension and Collaboration

LACC.910.SL.1.1 :	Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively. a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas. b. Work with peers to set rules for collegial discussions and decision-making (e.g., informal consensus, taking votes on key issues, presentation of alternate views), clear goals and deadlines, and individual roles as needed. c. Propel conversations by posing and responding to

	questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions. d. Respond thoughtfully to diverse perspectives, summarize points of agreement and disagreement, and, when warranted, qualify or justify their own views and understanding and make new connections in light of the evidence and reasoning presented. Cognitive Complexity: Level 3: Strategic Thinking & Complex Reasoning l Date Adopted or Revised: 12/10 Belongs to: Comprehension and Collaboration
LACC.910.SL.1.2 :	Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source. Cognitive Complexity: Level 3: Strategic Thinking & Complex Reasoning l Date Adopted or Revised: 12/10 Belongs to: Comprehension and Collaboration
LACC.910.SL.1.3 :	Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, identifying any fallacious reasoning or exaggerated or distorted evidence. Cognitive Complexity: Level 3: Strategic Thinking & Complex Reasoning l Date Adopted or Revised: 12/10 Belongs to: Comprehension and Collaboration

LACC.910.SL.2 Presentation of Knowledge and Ideas

LACC.910.SL.2.4 :	Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task. Cognitive Complexity: Level 3: Strategic Thinking & Complex Reasoning l Date Adopted or Revised: 12/10 Belongs to: Presentation of Knowledge and Ideas

MACC.912.A-CED.1 Create equations that describe numbers or relationships

MACC.912.A-CED.1.4 :	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law V = IR to highlight resistance R.* Cognitive Complexity: Level 1: Recall l Date Adopted or Revised: 12/10

	Belongs to: Create equations that describe numbers or relationships Remarks/Examples
	Algebra 1, Unit 1: Limit A.CED.4 to formulas which are linear in the variable of interest. Algebra 1, Unit 4: Extend A.CED.4 to formulas involving squared variables.
MACC.912.A-CED.1.1 :	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.* Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Create equations that describe numbers or relationships Remarks/Examples
	Algebra 1, Unit 1: Limit A.CED.1 and A.CED.2 to linear and exponential equations, and, in the case of exponential equations, limit to situations requiring evaluation of exponential functions at integer inputs. **Algebra 1, Unit 4**: Extend work on linear and exponential equations in Unit 1 to quadratic equations. **Algebra 1 Assessment Limits and Clarifications** i) Tasks are limited to linear, quadratic, or exponential equations with integer exponents. **Algebra 2 Assessment Limits and Clarifications** i) Tasks are limited to exponential equations with rational or real exponents and rational functions. ii) Tasks have a real-world context.
MACC.912.A-CED.1.2 :	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

	Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Create equations that describe numbers or relationships Remarks/Examples
	Algebra 1, Unit 1: Limit A.CED.1 and A.CED.2 to linear and exponential equations, and, in the case of exponential equations, limit to situations requiring evaluation of exponential functions at integer inputs. Algebra 1, Unit 4: Extend work on linear and exponential equations in Unit 1 to quadratic equations.

LACC.910.WHST.1 Text Types and Purposes

LACC.910.WHST.1.1 :	Write arguments focused on *discipline-specific content.* a. Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence. b. Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audience's knowledge level and concerns. c. Use words, phrases, and clauses to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims. d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing. e. Provide a concluding statement or section that follows from or supports the argument presented. Cognitive Complexity: Level 4: Extended Thinking &Complex Reasoning l Date Adopted or Revised: 12/10 Belongs to: Text Types and Purposes

LACC.910.WHST.2 Production and Distribution of Writing

LACC.910.WHST.2.4 :	Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. Cognitive Complexity: Level 3: Strategic Thinking & Complex Reasoning l Date Adopted or Revised: 12/10 Belongs to: Production and Distribution of Writing

LACC.910.WHST.3 Research to Build and Present Knowledge

LACC.910.WHST.3.9 :	Draw evidence from informational texts to support analysis, reflection, and research. Cognitive Complexity: Level 3: Strategic Thinking & Complex Reasoning l Date Adopted or Revised: 12/10 Belongs to: Research to Build and Present Knowledge

MACC.912.A-APR.1 Perform arithmetic operations on polynomials

MACC.912.A-APR.1.1 :	Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials. Cognitive Complexity: Level 1: Recall l Date Adopted or Revised: 12/10 Belongs to: Perform arithmetic operations on polynomials Remarks/Examples
	Algebra 1 - Fluency Recommendations Fluency in adding, subtracting, and multiplying polynomials supports students throughout their work in algebra, as well as in their symbolic work with functions. Manipulation can be more mindful when it is fluent. Focus on polynomial expressions that simplify to forms that are linear or quadratic in a positive integer power of x.

MACC.912.A-APR.2 Understand the relationship between zeros and factors of polynomials

MACC.912.A-APR.2.3 :	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. Cognitive Complexity: Level 1: Recall l Date Adopted or Revised: 12/10

	Belongs to: Understand the relationship between zeros and factors of polynomials Remarks/Examples
	Algebra 1 Assessment Limits and Clarifications i) Tasks are limited to quadratic and cubic polynomials in which linear and quadratic factors are available. For example, find the zeros of $(x - 2)(x^2 - 9)$. **Algebra 2 Assessment Limits and Clarifications** i) Tasks include quadratic, cubic, and quartic polynomials and polynomials for which factors are not provided. For example, find the zeros of $(x^2 - 1)(x^2 + 1)$

MACC.912.A-REI.2 Solve equations and inequalities in one variable

MACC.912.A-REI.2.4:	Solve quadratic equations in one variable. a. Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x – p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form. 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 $a \pm bi$ for real numbers a and b. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Solve equations and inequalities in one variable Remarks/Examples
	Algebra 1, Unit 4: Students should learn of the existence of the complex number system, but will not solve quadratics with complex solutions until Algebra II. **Algebra 1 Assessment Limits and Clarifications**

i) Tasks do not require students to write solutions for quadratic equations that have roots with nonzero imaginary parts. However, tasks can require the student to recognize cases in which a quadratic equation has no real solutions.

Note, solving a quadratic equation by factoring relies on the connection between zeros and factors of polynomials (cluster A-APR.B). Cluster A-APR.B is formally assessed in A2.

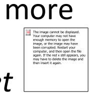
Algebra 2 Assessment Limits and Clarifications

i) In the case of equations that have roots with nonzero imaginary parts, students write the solutions as a ± bi for real numbers a and b.

MACC.912.A-SSE.1 Interpret the structure of expressions

MACC.912.A-SSE.1.1 :

Interpret expressions that represent a quantity in terms of its context.

a. Interpret parts of an expression, such as terms, factors, and coefficients.
b. Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret*  *as the product of P and a factor not depending on P.*

Cognitive Complexity: Level 2: Basic Application of Skills & Concepts I Date Adopted or Revised: 12/10
Belongs to: Interpret the structure of expressions

Remarks/Examples

Algebra 1 - Fluency Recommendations

A-SSE.1.1b - Fluency in transforming expressions and chunking (seeing parts of an expression as a single object) is essential in factoring, completing the square, and other mindful algebraic calculations.

Algebra 1, Unit 1: Limit to linear expressions and to exponential

	expressions with integer exponents. **Algebra 1, Unit 4**: Focus on quadratic and exponential expressions. For A.SSE.1b, exponents are extended from the integer exponents found in Unit 1 to rational exponents focusing on those that represent square or cube roots.
MACC.912.A-SSE.1.2 :	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* $(x^2 - y^2)(x^2 + y^2)$*.* Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Interpret the structure of expressions Remarks/Examples **Algebra 1, Unit 4**: Focus on quadratic and exponential expressions. For A.SSE.1b, exponents are extended from the integer exponents found in Unit 1 to rational exponents focusing on those that represent square or cube roots. **Algebra 2 - Fluency Recommendations** The ability to see structure in expressions and to use this structure to rewrite expressions is a key skill in everything from advanced factoring (e.g., grouping) to summing series to the rewriting of rational expressions to examine the end behavior of the corresponding rational function. **Algebra 1 Assessment Limits and Clarifications** i) Tasks are limited to numerical expressions and polynomial expressions in one variable. ii) Examples: Recognize 532 + 472 as a difference of squares and see an opportunity to rewrite it in the easier-to-evaluate form (53 + 47)(53 + 47). See an opportunity to rewrite $a^2 + 9a + 14$ as (a+ 7)(a+ 2). **Algebra 2 Assessment and Limits and Clarifications** i) Tasks are limited to polynomial, rational, or exponential

expressions. ii) Examples: 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 $(x^2 – y^2)(x^2 + y^2)$. In the equation $x^2 + 2x + 1 + y^2 = 9$, see an opportunity to rewrite the first three terms as $(x+1)^2$, thus recognizing the equation of a circle with radius 3 and center (-1, 0). See $(x^2 + 4)/(x^2 + 3)$ as $((x^2+3) + 1)/(x^2+3)$, thus recognizing an opportunity to write it as $1 + 1/(x^2 + 3)$.

MACC.912.A-SSE.2 Write expressions in equivalent forms to solve problems

MACC.912.A-SSE.2.3 :

Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.

a. Factor a quadratic expression to reveal the zeros of the function it defines.
b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.
c. Use the properties of exponents to transform expressions for exponential functions. *For example the expression can be rewritten as ≈ to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.*

Cognitive Complexity: Level 2: Basic Application of Skills & Concepts I Date Adopted or Revised: 12/10
Belongs to: Write expressions in equivalent forms to solve problems

Remarks/Examples

Algebra 1, Unit 4: It is important to balance conceptual understanding and procedural fluency in work with equivalent expressions. For example, development of skill in factoring and completing the square goes hand-in-hand with understanding what different forms of a quadratic expression reveal.

Algebra 1 Assessment Limits and Clarifications

i) Tasks have a real-world context. As described in the standard, there is an interplay between the mathematical structure of the expression and the structure of the situation such that choosing

	and producing an equivalent form of the expression reveals something about the situation. ii) Tasks are limited to exponential expressions with integer exponents. **Algebra 2 Assessment Limits and Clarifications** i) Tasks have a real-world context. As described in the standard, there is an interplay between the mathematical structure of the expression and the structure of the situation such that choosing and producing an equivalent form of the expression reveals something about the situation. ii) Tasks are limited to exponential expressions with rational or real exponents.

MACC.912.F-BF.1 Build a function that models a relationship between two quantities

MACC.912.F-BF.1.1 :	Write a function that describes a relationship between two quantities. a. Determine an explicit expression, a recursive process, or steps for calculation from a context. 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.* c. Compose functions. *For example, if T(y) is the temperature in the atmosphere as a function of height, and h(t) is the height of a weather balloon as a function of time, then T(h(t)) is the temperature at the location of the weather balloon as a function of time.* Cognitive Complexity: Level 3: Strategic Thinking & Complex Reasoning l Date Adopted or Revised: 12/10 Belongs to: Build a function that models a relationship between two quantities

	Remarks/Examples **Algebra 1, Unit 2**: Limit to F.BF.1a, 1b, and 2 to linear and exponential functions. **Algebra 1, Unit 5**: Focus on situations that exhibit a quadratic relationship. **Algebra 1 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Tasks are limited to linear functions, quadratic functions, and exponential functions with domains in the integers. **Algebra 2 Assessment Limits and Clarifications** i) Tasks have a real-world context ii) Tasks may involve linear functions, quadratic functions, and exponential functions.

MACC.912.N-RN.2 Use properties of rational and irrational numbers.

MACC.912.N-RN.2.3 :	Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Use properties of rational and irrational numbers. Remarks/Examples Algebra 1 Unit 5: Connect N.RN.3 to physical situations, e.g., finding the perimeter of a square of area 2.

MACC.912.S-ID.1 Summarize, represent, and interpret data on a single count or measurement variable

MACC.912.S-ID.1.1 :	Represent data with plots on the real number line (dot plots, histograms, and box plots). Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 10/10 Belongs to: Summarize, represent, and interpret data on a single count or

	measurement variable Remarks/Examples
	In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points.
MACC.912.S-ID.1.2 :	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. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Summarize, represent, and interpret data on a single count or measurement variable Remarks/Examples
	In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points.
MACC.912.S-ID.1.3 :	Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers). Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Summarize, represent, and interpret data on a single count or measurement variable Remarks/Examples
	In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points.
MACC.912.S-ID.1.4 :	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. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Summarize, represent, and interpret data on a single count or

	measurement variable

MACC.912.F-BF.2 Build new functions from existing functions

MACC.912.F-BF.2.3 :	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.* Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Build new functions from existing functions Remarks/Examples
	Algebra 1, Unit 2: Focus on vertical translations of graphs of linear and exponential functions. Relate the vertical translation of a linear function to its y-intercept. While applying other transformations to a linear graph is appropriate at this level, it may be difficult for students to identify or distinguish between the effects of the other transformations included in this standard. **Algebra 1, Unit 5**: For F.BF.3, focus on quadratic functions, and consider including absolute value functions. **Algebra 1 Assessment Limit and Clarifications** i) Identifying 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) is limited to linear and quadratic functions. ii) Experimenting with cases and illustrating an explanation of the effects on the graph using technology is limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers. iii) Tasks do not involve recognizing even and odd functions. The function types listed in note (ii) are the same as those listed in

	the Algebra I column for standards F-IF.4, F-IF.6, and F-IF.9. **Algebra 2 Assessment Limits and Clarifications** i) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions ii) Tasks may involve recognizing even and odd functions. The function types listed in note (i) are the same as those listed in the Algebra II column for standards F-IF.4, F-IF.6, and F-IF.9.

MACC.912.F-IF.2 Interpret functions that arise in applications in terms of the context

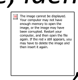
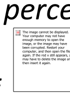
MACC.912.F-IF.2.4 :	For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.* Cognitive Complexity: Level 2: Basic Application of Skills & Concepts I Date Adopted or Revised: 12/10 Belongs to: Interpret functions that arise in applications in terms of the context Remarks/Examples
	Algebra 1, Unit 2: For F.IF.4 and 5, focus on linear and exponential functions. **Algebra 1 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Tasks are limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers. Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra I column for standards F-IF.6 and F-IF.9.

	Algebra 2 Assessment Limits and Clarifications i) Tasks have a real-world context ii) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions. Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra II column for standards F-IF.6 and F-IF.9.
MACC.912.F-IF.2.5 :	Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.* Cognitive Complexity: Level 2: Basic Application of Skills & Concepts I Date Adopted or Revised: 12/10 Belongs to: Interpret functions that arise in applications in terms of the context Remarks/Examples Algebra 1, Unit 2: For F.IF.4 and 5, focus on linear and exponential functions.
MACC.912.F-IF.2.6 :	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. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts I Date Adopted or Revised: 12/10 Belongs to: Interpret functions that arise in applications in terms of the context Remarks/Examples **Algebra 1, Unit 2**: For F.IF.6, focus on linear functions and exponential functions whose domain is a subset of the integers. Unit 5 in this course and the Algebra II course address other types of functions. **Algebra 1 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Tasks are limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions

	(including step functions and absolute value functions), and exponential functions with domains in the integers. The function types listed here are the same as those listed in the Algebra I column for standards F-IF.4 and F-IF.9. **Algebra 2 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions. The function types listed here are the same as those listed in the Algebra II column for standards F-IF.4 and F-IF.9.

MACC.912.F-IF.3 Analyze functions using different representations

MACC.912.F-IF.3.7 :	Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. a. Graph linear and quadratic functions and show intercepts, maxima, and minima. b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior. e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 10/10 Belongs to: Analyze functions using different representations Remarks/Examples

	Algebra 1, Unit 2: For F.IF.7a, 7e, and 9 focus on linear and exponentials functions. Include comparisons of two functions presented algebraically. For example, compare the growth of two linear functions, or two exponential functions such as $y=3^n$ and $y=100^2$
MACC.912.F-IF.3.8 :	Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. a. 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. b. Use the properties of exponents to interpret expressions for exponential functions. *For example, identify percent rate of change in functions such as y =* *, y =* *, y =* *, y =* *, and classify them as representing exponential growth or decay.* Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Analyze functions using different representations Remarks/Examples Algebra 1, Unit 5: Note that this unit, and in particular in F.IF.8b, extends the work begun in Unit 2 on exponential functions with integer exponents.
MACC.912.F-IF.3.9 :	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.* Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Analyze functions using different representations

	Remarks/Examples
	Algebra 1, Unit 2: For F.IF.7a, 7e, and 9 focus on linear and exponentials functions. Include comparisons of two functions presented algebraically. For example, compare the growth of two linear functions, or two exponential functions such as $y=3^n$ and $y=100^2$ **Algebra 1, Unit 5**: For F.IF.9, focus on expanding the types of functions considered to include, linear, exponential, and quadratic. Extend work with quadratics to include the relationship between coefficients and roots, and that once roots are known, a quadratic equation can be factored. **Algebra 1 Assessment Limits and Clarifications** i) Tasks are limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers. The function types listed here are the same as those listed in the Algebra I column for standards F-IF.4 and F-IF.6. **Algebra 2 Assessment Limits and Clarifications** i) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions. The function types listed here are the same as those listed in the Algebra II column for standards F-IF.4 and F-IF.6.

MACC.912.F-LE.1 Construct and compare linear, quadratic, and exponential models and solve problems

MACC.912.F-LE.1.3 :	Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Construct and compare linear, quadratic, and exponential models and solve problems

	Remarks/Examples Algebra 1, Unit 2: For F.LE.3, limit to comparisons between linear and exponential models. Algebra 1, Unit 5: Compare linear and exponential growth to quadratic growth.

MACC.912.S-ID.2 Summarize, represent, and interpret data on two categorical and quantitative variables

MACC.912.S-ID.2.5 :	Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Summarize, represent, and interpret data on two categorical and quantitative variables
MACC.912.S-ID.2.6 :	Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. 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.* b. Informally assess the fit of a function by plotting and analyzing residuals. c. Fit a linear function for a scatter plot that suggests a linear association. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Summarize, represent, and interpret data on two categorical and quantitative variables Remarks/Examples Students take a more sophisticated look at using a linear function to model the relationship between two numerical variables. In addition to fitting a line to data, students assess how well the

	model fits by analyzing residuals. S.ID.6b should be focused on linear models, but may be used to preview quadratic functions in Unit 5 of this course. **Algebra 1 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Exponential functions are limited to those with domains in the integers. **Algebra 2 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Tasks are limited to exponential functions with domains not in the integers and trigonometric functions.

MACC.912.S-ID.3 Interpret linear models

MACC.912.S-ID.3.7 :	Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts I Date Adopted or Revised: 12/10 Belongs to: Interpret linear models Remarks/Examples
	Build on students' work with linear relationships in eighth grade and introduce the correlation coefficient. The focus here is on the computation and interpretation of the correlation coefficient as a measure of how well the data fit the relationship. The important distinction between a statistical relationship and a cause-and-effect relationship arises in S.ID.9.
MACC.912.S-ID.3.8 :	Compute (using technology) and interpret the correlation coefficient of a linear fit. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts I Date Adopted or Revised: 12/10 Belongs to: Interpret linear models Remarks/Examples
	Build on students' work with linear relationships in eighth grade and introduce the correlation coefficient. The focus here is on the

	computation and interpretation of the correlation coefficient as a measure of how well the data fit the relationship. The important distinction between a statistical relationship and a cause-and-effect relationship arises in S.ID.9.
MACC.912.S-ID.3.9 :	Distinguish between correlation and causation. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Interpret linear models Remarks/Examples
	Build on students' work with linear relationships in eighth grade and introduce the correlation coefficient. The focus here is on the computation and interpretation of the correlation coefficient as a measure of how well the data fit the relationship. The important distinction between a statistical relationship and a cause-and-effect relationship arises in S.ID.9.

MACC.K12.MP.1 Make sense of problems and persevere in solving them.

MACC.K12.MP.1.1 :	**Make sense of problems and persevere in solving them.** Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask

	themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches. Cognitive Complexity: Level 3: Strategic Thinking & Complex Reasoning l Date Adopted or Revised: 12/10 Belongs to: Make sense of problems and persevere in solving them.

MACC.K12.MP.2 Reason abstractly and quantitatively.

MACC.K12.MP.2.1 :	**Reason abstractly and quantitatively**. Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects. Cognitive Complexity: Level 3: Strategic Thinking & Complex Reasoning l Date Adopted or Revised: 12/10 Belongs to: Reason abstractly and quantitatively.

MACC.K12.MP.3 Construct viable arguments and critique the reasoning of others.

MACC.K12.MP.3.1 :	**Construct viable arguments and critique the reasoning of others.** Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They

	justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments. Cognitive Complexity: Level 3: Strategic Thinking & Complex Reasoning l Date Adopted or Revised: 12/10 Belongs to: Construct viable arguments and critique the reasoning of others.

MACC.K12.MP.4 Model with mathematics.

MACC.K12.MP.4.1 :	**Model with mathematics.** Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results

	make sense, possibly improving the model if it has not served its purpose. Cognitive Complexity: Level 3: Strategic Thinking & Complex Reasoning l Date Adopted or Revised: 12/10 Belongs to: Model with mathematics.

MACC.K12.MP.5 Use appropriate tools strategically.

MACC.K12.MP.5.1 :	**Use appropriate tools strategically.** Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts l Date Adopted or Revised: 12/10 Belongs to: Use appropriate tools strategically.

MACC.K12.MP.6 Attend to precision.

MACC.K12.MP.6.1 :	**Attend to precision.** Mathematically proficient students try to communicate precisely

	to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions. Cognitive Complexity: Level 3: Strategic Thinking & Complex Reasoning I Date Adopted or Revised: 12/10 Belongs to: Attend to precision.

MACC.K12.MP.7 Look for and make use of structure.

MACC.K12.MP.7.1 :	**Look for and make use of structure.** Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see 7 × 8 equals the well remembered 7 × 5 + 7 × 3, in preparation for learning about the distributive property. In the expression $x^2 + 9x + 14$, older students can see the 14 as 2 × 7 and the 9 as 2 + 7. They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see $5 – 3(x – y)^2$ as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers x and y. Cognitive Complexity: Level 2: Basic Application of Skills & Concepts I Date Adopted or Revised: 12/10 Belongs to: Look for and make use of structure.

MACC.K12.MP.8 Look for and express regularity in repeated reasoning.

MACC.K12.MP.8.1 :	**Look for and express regularity in repeated reasoning.** Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation $(y – 2)/(x – 1) = 3$. Noticing the regularity in the way terms cancel when expanding $(x – 1)(x + 1)$, $(x – 1)(x^2 + x + 1)$, and $(x – 1)(x^3 + x^2 + x + 1)$ might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results. Cognitive Complexity: Level 3: Strategic Thinking & Complex Reasoning l Date Adopted or Revised: 12/10 Belongs to: Look for and express regularity in repeated reasoning.

Course: Algebra 1-B- 1200380

Direct link to this page:http://www.cpalms.org/Courses/CoursePagePublicPreviewCourse3655.aspx

BASIC INFORMATION

Course Title:	Algebra 1-B
Course Number:	1200380
Course Abbreviated Title:	ALG 1-B
Course Path:	**Section:** Grades PreK to 12 Education Courses **Grade Group:** Grades 9 to 12 and Adult Education Courses **Subject:** Mathematics **SubSubject:** Algebra
Number of Credits:	One credit (1)
Course Type:	Core
Course Level:	2
Status:	State Board Approved
Version Description:	The fundamental purpose of this course is to formalize and extend the mathematics that students learned in the middle grades. The critical areas, called units, deepen and extend understanding of linear and exponential relationships by contrasting them with each other and by applying linear models to data that exhibit a linear trend, and students engage in methods for analyzing, solving, and using quadratic functions. The Standards for Mathematical Practice apply throughout each course and, together with the content standards, prescribe that students experience mathematics as a coherent, useful, and logical subject that makes use of their ability to make sense of problem situations. **Algebra 1 A (Year 1)** **Unit 1- Relationships Between Quantities and Reasoning with Equations:** By the end of eighth grade, students have learned to solve linear equations in one variable and have applied graphical and algebraic methods to analyze and solve systems of linear equations in two variables. Now, students analyze and explain the process of solving an equation. Students develop fluency writing, interpreting, and

	translating between various forms of linear equations and inequalities, and using them to solve problems. They master the solution of linear equations and apply related solution techniques and the laws of exponents to the creation and solution of simple exponential equations. **Unit 2- Linear and Exponential Relationships:** In earlier grades, students define, evaluate, and compare functions, and use them to model relationships between quantities. In this unit, students will learn function notation and develop the concepts of domain and range. They explore many examples of functions, including sequences; they interpret functions given graphically, numerically, symbolically, and verbally, translate between representations, and understand the limitations of various representations. Students build on and informally extend their understanding of integer exponents to consider exponential functions. They compare and contrast linear and exponential functions, distinguishing between additive and multiplicative change. Students explore systems of equations and inequalities, and they find and interpret their solutions. They interpret arithmetic sequences as linear functions and geometric sequences as exponential functions. **Algebra 1B (Year 2)** **Unit 3- Descriptive Statistics:** This unit builds upon students' prior experiences with data, providing students with more formal means of assessing how a model fits data. Students use regression techniques to describe and approximate linear relationships between quantities. They use graphical representations and knowledge of the context to make judgments about the appropriateness of linear models. With linear models, they look at residuals to analyze the goodness of fit. **Unit 4- Expressions and Equations:** In this unit, students build on their knowledge from unit 2, where they extended the laws of exponents to rational exponents. Students apply this new understanding of number and strengthen their ability to see structure in and create quadratic and exponential expressions. They create and solve equations, inequalities, and systems of equations involving quadratic expressions. **Unit 5- Quadratic Functions and Modeling:** In this unit, students consider quadratic functions, comparing the key characteristics of quadratic functions to those of linear and exponential functions. They select from among these functions to model phenomena. Students learn to anticipate the graph of a quadratic function by interpreting various forms of quadratic expressions. In particular, they identify the real solutions of a quadratic equation as the zeros of a related quadratic function. Students expand their experience with functions to include more specialized functions—absolute value, step, and those that are piecewise-defined.
General Notes:	**Fluency Recommendations** **A/G-** Algebra I students become fluent in solving characteristic problems involving the analytic geometry of lines, such as writing down the equation of a line given a point and a slope. Such fluency can support them in solving less routine mathematical problems involving linearity, as well as in modeling linear phenomena (including modeling using systems of linear inequalities in two variables).

	A-APR.1- Fluency in adding, subtracting, and multiplying polynomials supports students throughout their work in Algebra, as well as in their symbolic work with functions. Manipulation can be more mindful when it is fluent. **A-SSE.1b-** Fluency in transforming expressions and chunking (seeing parts of an expression as a single object) is essential in factoring, completing the square, and other mindful algebraic calculations.
Version Requirements:	During the 2013-2014 school year, Florida will be transitioning to the Common Core State Standards for Mathematics. The content standards for Algebra 1 are based upon these new standards; however, during this transition year, students will be assessed using the Algebra 1 End-of-Course Assessment aligned with the Next Generation Sunshine State Standards (NGSSS). For this reason, instruction should include the following NGSSS: **MA.912.G.1.4** Use coordinate geometry to find slopes, parallel lines, perpendicular lines, and equations of lines. (Assessed with MA.912.A.3.10.) **MA.912.D.7.2** Use Venn diagrams to explore relationships and patterns and to make arguments about relationships between sets. **MA.912.D.7.1** Perform set operations such as union and intersection, complement, and cross product.

STANDARDS (46)

LACC.910.RST.1.3:	Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
LACC.910.RST.2.4:	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.
LACC.910.RST.3.7:	Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
LACC.910.SL.1.1:	Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others’

	ideas and expressing their own clearly and persuasively. a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas. b. Work with peers to set rules for collegial discussions and decision-making (e.g., informal consensus, taking votes on key issues, presentation of alternate views), clear goals and deadlines, and individual roles as needed. c. Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions. d. Respond thoughtfully to diverse perspectives, summarize points of agreement and disagreement, and, when warranted, qualify or justify their own views and understanding and make new connections in light of the evidence and reasoning presented.
LACC.910.SL.1.2:	Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source.
LACC.910.SL.1.3:	Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, identifying any fallacious reasoning or exaggerated or distorted evidence.
LACC.910.SL.2.4:	Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.
LACC.910.WHST.1.1:	Write arguments focused on *discipline-specific content.* a. Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence. b. Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-

	appropriate form and in a manner that anticipates the audience's knowledge level and concerns. c. Use words, phrases, and clauses to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims. d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing. e. Provide a concluding statement or section that follows from or supports the argument presented.
LACC.910.WHST.2.4:	Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
LACC.910.WHST.3.9:	Draw evidence from informational texts to support analysis, reflection, and research.
MACC.912.A-APR.1.1:	Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials. Remarks/Examples
	Algebra 1 - Fluency Recommendations Fluency in adding, subtracting, and multiplying polynomials supports students throughout their work in algebra, as well as in their symbolic work with functions. Manipulation can be more mindful when it is fluent. Focus on polynomial expressions that simplify to forms that are linear or quadratic in a positive integer power of x.
MACC.912.A-APR.2.3:	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. Remarks/Examples
	Algebra 1 Assessment Limits and Clarifications

	i) Tasks are limited to quadratic and cubic polynomials in which linear and quadratic factors are available. For example, find the zeros of $(x - 2)(x^2 - 9)$. **Algebra 2 Assessment Limits and Clarifications** i) Tasks include quadratic, cubic, and quartic polynomials and polynomials for which factors are not provided. For example, find the zeros of $(x^2 - 1)(x^2 + 1)$
MACC.912.A-CED.1.1:	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.* Remarks/Examples **Algebra 1, Unit 1**: Limit A.CED.1 and A.CED.2 to linear and exponential equations, and, in the case of exponential equations, limit to situations requiring evaluation of exponential functions at integer inputs. **Algebra 1, Unit 4**: Extend work on linear and exponential equations in Unit 1 to quadratic equations. **Algebra 1 Assessment Limits and Clarifications** i) Tasks are limited to linear, quadratic, or exponential equations with integer exponents. **Algebra 2 Assessment Limits and Clarifications** i) Tasks are limited to exponential equations with rational or real exponents and rational functions. ii) Tasks have a real-world context.
MACC.912.A-CED.1.2:	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. Remarks/Examples

	Algebra 1, Unit 1: Limit A.CED.1 and A.CED.2 to linear and exponential equations, and, in the case of exponential equations, limit to situations requiring evaluation of exponential functions at integer inputs. Algebra 1, Unit 4: Extend work on linear and exponential equations in Unit 1 to quadratic equations.
MACC.912.A-CED.1.4:	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law V = IR to highlight resistance R.* Remarks/Examples Algebra 1, Unit 1: Limit A.CED.4 to formulas which are linear in the variable of interest. Algebra 1, Unit 4: Extend A.CED.4 to formulas involving squared variables.
MACC.912.A-REI.2.4:	Solve quadratic equations in one variable. a. Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x – p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form. 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 $a \pm bi$ for real numbers a and b. Remarks/Examples **Algebra 1, Unit 4**: Students should learn of the existence of the complex number system, but will not solve quadratics with complex solutions until Algebra II. **Algebra 1 Assessment Limits and Clarifications** i) Tasks do not require students to write solutions for quadratic equations that have roots with nonzero imaginary parts. However,

	tasks can require the student to recognize cases in which a quadratic equation has no real solutions. Note, solving a quadratic equation by factoring relies on the connection between zeros and factors of polynomials (cluster A-APR.B). Cluster A-APR.B is formally assessed in A2. **Algebra 2 Assessment Limits and Clarifications** i) In the case of equations that have roots with nonzero imaginary parts, students write the solutions as a ± bi for real numbers a and b.
MACC.912.A-SSE.1.1:	Interpret expressions that represent a quantity in terms of its context. a. Interpret parts of an expression, such as terms, factors, and coefficients. b. Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret* *as the product of P and a factor not depending on P.* Remarks/Examples
	Algebra 1 - Fluency Recommendations A-SSE.1.1b - Fluency in transforming expressions and chunking (seeing parts of an expression as a single object) is essential in factoring, completing the square, and other mindful algebraic calculations. **Algebra 1, Unit 1**: Limit to linear expressions and to exponential expressions with integer exponents. **Algebra 1, Unit 4**: Focus on quadratic and exponential expressions. For A.SSE.1b, exponents are extended from the integer exponents found in Unit 1 to rational exponents focusing on those that represent square or cube roots.
MACC.912.A-SSE.1.2:	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 $(x^2 - y^2)(x^2 + y^2)$. Remarks/Examples
	Algebra 1, Unit 4: Focus on quadratic and exponential expressions. For A.SSE.1b, exponents are extended from the integer exponents found in Unit 1 to rational exponents focusing on those that represent square or cube roots. **Algebra 2 - Fluency Recommendations** The ability to see structure in expressions and to use this structure to rewrite expressions is a key skill in everything from advanced factoring (e.g., grouping) to summing series to the rewriting of rational expressions to examine the end behavior of the corresponding rational function. **Algebra 1 Assessment Limits and Clarifications** i) Tasks are limited to numerical expressions and polynomial expressions in one variable. ii) Examples: Recognize 532 + 472 as a difference of squares and see an opportunity to rewrite it in the easier-to-evaluate form (53 + 47)(53 + 47). See an opportunity to rewrite $a^2 + 9a + 14$ as (a+ 7)(a+ 2). **Algebra 2 Assessment and Limits and Clarifications** i) Tasks are limited to polynomial, rational, or exponential expressions. ii) Examples: 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 $(x^2 - y^2)(x^2 + y^2)$. In the equation $x^2 + 2x + 1 + y^2 = 9$, see an opportunity to rewrite the first three terms as $(x+1)^2$, thus recognizing the equation of a circle with radius 3 and center (-1, 0). See $(x^2 + 4)/(x^2 + 3)$ as $((x^2+3) + 1)/(x^2+3)$, thus recognizing an opportunity to write it as $1 + 1/(x^2 + 3)$.
MACC.912.A-SSE.2.3:	Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. a. Factor a quadratic expression to reveal the zeros of the function it defines. b. Complete the square in a quadratic expression to reveal the

	maximum or minimum value of the function it defines. c. Use the properties of exponents to transform expressions for exponential functions. *For example the expression can be rewritten as ≈ to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.* Remarks/Examples
	Algebra 1, Unit 4: It is important to balance conceptual understanding and procedural fluency in work with equivalent expressions. For example, development of skill in factoring and completing the square goes hand-in-hand with understanding what different forms of a quadratic expression reveal. **Algebra 1 Assessment Limits and Clarifications** i) Tasks have a real-world context. As described in the standard, there is an interplay between the mathematical structure of the expression and the structure of the situation such that choosing and producing an equivalent form of the expression reveals something about the situation. ii) Tasks are limited to exponential expressions with integer exponents. **Algebra 2 Assessment Limits and Clarifications** i) Tasks have a real-world context. As described in the standard, there is an interplay between the mathematical structure of the expression and the structure of the situation such that choosing and producing an equivalent form of the expression reveals something about the situation. ii) Tasks are limited to exponential expressions with rational or real exponents.
MACC.912.F-BF.1.1:	Write a function that describes a relationship between two quantities.

	a. Determine an explicit expression, a recursive process, or steps for calculation from a context. 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.* c. Compose functions. *For example, if T(y) is the temperature in the atmosphere as a function of height, and h(t) is the height of a weather balloon as a function of time, then T(h(t)) is the temperature at the location of the weather balloon as a function of time.* Remarks/Examples
	Algebra 1, Unit 2: Limit to F.BF.1a, 1b, and 2 to linear and exponential functions. **Algebra 1, Unit 5**: Focus on situations that exhibit a quadratic relationship. **Algebra 1 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Tasks are limited to linear functions, quadratic functions, and exponential functions with domains in the integers. **Algebra 2 Assessment Limits and Clarifications** i) Tasks have a real-world context ii) Tasks may involve linear functions, quadratic functions, and exponential functions.
MACC.912.N-RN.2.3:	Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational. Remarks/Examples
	Algebra 1 Unit 5: Connect N.RN.3 to physical situations, e.g., finding the perimeter of a square of area 2.

<table>
<tr><td rowspan="3">MACC.912.S-ID.1.1:</td><td>Represent data with plots on the real number line (dot plots, histograms, and box plots).
Remarks/Examples</td></tr>
<tr><td>In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points.</td></tr>
<tr><td></td></tr>
<tr><td rowspan="2">MACC.912.F-BF.2.3:</td><td>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.

Remarks/Examples</td></tr>
<tr><td>Algebra 1, Unit 2: Focus on vertical translations of graphs of linear and exponential functions. Relate the vertical translation of a linear function to its y-intercept.

While applying other transformations to a linear graph is appropriate at this level, it may be difficult for students to identify or distinguish between the effects of the other transformations included in this standard.

Algebra 1, Unit 5: For F.BF.3, focus on quadratic functions, and consider including absolute value functions.

Algebra 1 Assessment Limit and Clarifications

i) Identifying 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) is limited to linear and quadratic functions.
ii) Experimenting with cases and illustrating an explanation of the effects on the graph using technology is limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers.
iii) Tasks do not involve recognizing even and odd functions.</td></tr>
</table>

	The function types listed in note (ii) are the same as those listed in the Algebra I column for standards F-IF.4, F-IF.6, and F-IF.9. **Algebra 2 Assessment Limits and Clarifications** i) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions ii) Tasks may involve recognizing even and odd functions. The function types listed in note (i) are the same as those listed in the Algebra II column for standards F-IF.4, F-IF.6, and F-IF.9.
MACC.912.F-IF.2.4:	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.* Remarks/Examples
	Algebra 1, Unit 2: For F.IF.4 and 5, focus on linear and exponential functions. **Algebra 1 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Tasks are limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers. Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra I column for standards F-IF.6 and F-IF.9. **Algebra 2 Assessment Limits and Clarifications** i) Tasks have a real-world context ii) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions.

	Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra II column for standards F-IF.6 and F-IF.9.
MACC.912.F-IF.2.5:	Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.* Remarks/Examples
	Algebra 1, Unit 2: For F.IF.4 and 5, focus on linear and exponential functions.
MACC.912.F-IF.2.6:	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. Remarks/Examples
	Algebra 1, Unit 2: For F.IF.6, focus on linear functions and exponential functions whose domain is a subset of the integers. Unit 5 in this course and the Algebra II course address other types of functions. **Algebra 1 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Tasks are limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers. The function types listed here are the same as those listed in the Algebra I column for standards F-IF.4 and F-IF.9. **Algebra 2 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions.

	The function types listed here are the same as those listed in the Algebra II column for standards F-IF.4 and F-IF.9.
MACC.912.F-IF.3.7:	Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. a. Graph linear and quadratic functions and show intercepts, maxima, and minima. b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior. e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude. Remarks/Examples
	Algebra 1, Unit 2: For F.IF.7a, 7e, and 9 focus on linear and exponentials functions. Include comparisons of two functions presented algebraically. For example, compare the growth of two linear functions, or two exponential functions such as $y=3^n$ and $y=100^2$
MACC.912.F-IF.3.8:	Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. a. 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. b. Use the properties of exponents to interpret expressions for exponential functions. *For example, identify percent rate of change in functions such as y = , y = , y = , y =*

	, and classify them as representing exponential growth or decay. Remarks/Examples
	Algebra 1, Unit 5: Note that this unit, and in particular in F.IF.8b, extends the work begun in Unit 2 on exponential functions with integer exponents.
MACC.912.F-IF.3.9:	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.* Remarks/Examples
	Algebra 1, Unit 2: For F.IF.7a, 7e, and 9 focus on linear and exponentials functions. Include comparisons of two functions presented algebraically. For example, compare the growth of two linear functions, or two exponential functions such as $y=3^n$ and $y=100^2$ **Algebra 1, Unit 5**: For F.IF.9, focus on expanding the types of functions considered to include, linear, exponential, and quadratic. Extend work with quadratics to include the relationship between coefficients and roots, and that once roots are known, a quadratic equation can be factored. **Algebra 1 Assessment Limits and Clarifications** i) Tasks are limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers. The function types listed here are the same as those listed in the Algebra I column for standards F-IF.4 and F-IF.6. **Algebra 2 Assessment Limits and Clarifications**

	i) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions. The function types listed here are the same as those listed in the Algebra II column for standards F-IF.4 and F-IF.6.
MACC.912.F-LE.1.3:	Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function. Remarks/Examples
	Algebra 1, Unit 2: For F.LE.3, limit to comparisons between linear and exponential models. Algebra 1, Unit 5: Compare linear and exponential growth to quadratic growth.
MACC.912.S-ID.1.2:	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. Remarks/Examples
	In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points.
MACC.912.S-ID.1.3:	Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers). Remarks/Examples
	In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points.
MACC.912.S-ID.1.4:	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.

MACC.912.S-ID.2.5:	Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.
MACC.912.S-ID.2.6:	Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. 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.* b. Informally assess the fit of a function by plotting and analyzing residuals. c. Fit a linear function for a scatter plot that suggests a linear association. Remarks/Examples
	Students take a more sophisticated look at using a linear function to model the relationship between two numerical variables. In addition to fitting a line to data, students assess how well the model fits by analyzing residuals. S.ID.6b should be focused on linear models, but may be used to preview quadratic functions in Unit 5 of this course. **Algebra 1 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Exponential functions are limited to those with domains in the integers. **Algebra 2 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Tasks are limited to exponential functions with domains not in the integers and trigonometric functions.
MACC.912.S-ID.3.7:	Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.

	Remarks/Examples Build on students' work with linear relationships in eighth grade and introduce the correlation coefficient. The focus here is on the computation and interpretation of the correlation coefficient as a measure of how well the data fit the relationship. The important distinction between a statistical relationship and a cause-and-effect relationship arises in S.ID.9.
MACC.912.S-ID.3.8:	Compute (using technology) and interpret the correlation coefficient of a linear fit. Remarks/Examples Build on students' work with linear relationships in eighth grade and introduce the correlation coefficient. The focus here is on the computation and interpretation of the correlation coefficient as a measure of how well the data fit the relationship. The important distinction between a statistical relationship and a cause-and-effect relationship arises in S.ID.9.
MACC.912.S-ID.3.9:	Distinguish between correlation and causation. Remarks/Examples Build on students' work with linear relationships in eighth grade and introduce the correlation coefficient. The focus here is on the computation and interpretation of the correlation coefficient as a measure of how well the data fit the relationship. The important distinction between a statistical relationship and a cause-and-effect relationship arises in S.ID.9.
MACC.K12.MP.1.1:	**Make sense of problems and persevere in solving them.** Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they

	need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.
MACC.K12.MP.2.1:	**Reason abstractly and quantitatively**. Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.
MACC.K12.MP.3.1:	**Construct viable arguments and critique the reasoning of others.** Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to

	compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.
MACC.K12.MP.4.1:	**Model with mathematics.** Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.
MACC.K12.MP.5.1:	**Use appropriate tools strategically.** Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make

	sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.
MACC.K12.MP.6.1:	**Attend to precision.** Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.
MACC.K12.MP.7.1:	**Look for and make use of structure.** Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see 7×8 equals the well remembered $7 \times 5 + 7 \times 3$, in preparation for learning about the distributive property. In the expression $x^2 + 9x + 14$, older students can see the 14 as 2×7 and the 9 as $2 + 7$. They recognize the significance of an existing line in a geometric figure and can use the

	strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see $5 - 3(x - y)^2$ as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers x and y.
MACC.K12.MP.8.1:	**Look for and express regularity in repeated reasoning.** Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation $(y - 2)/(x - 1) = 3$. Noticing the regularity in the way terms cancel when expanding $(x - 1)(x + 1)$, $(x - 1)(x^2 + x + 1)$, and $(x - 1)(x^3 + x^2 + x + 1)$ might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

Course: Algebra 1-A for Credit Recovery-1200375

Direct link to this page:http://www.cpalms.org/Courses/CoursePagePublicPreviewCourse3654.aspx

BASIC INFORMATION

Course Title:	Algebra 1-A for Credit Recovery
Course Number:	1200375
Course Abbreviated Title:	ALG 1-A CR
Course Path:	**Section:** Grades PreK to 12 Education Courses **Grade Group:** Grades 9 to 12 and Adult Education Courses **Subject:** Mathematics **SubSubject:** Algebra
Course Type:	Elective
Course Level:	2
Status:	State Board Approved
Version Description:	Special notes: Credit Recovery courses are credit bearing courses with specific content requirements defined by Next Generation Sunshine State Standards and/or Common Core State Standards. Students enrolled in a Credit Recovery course must have previously attempted the corresponding course (and/or End-of-Course assessment) since the course requirements for the Credit Recovery course are exactly the same as the previously attempted corresponding course. For example, Geometry (1206310) and Geometry for Credit Recovery (1206315) have identical content requirements. It is important to note that Credit Recovery courses are not bound by Section 1003.436(1)(a), Florida Statutes, requiring a minimum of 135 hours of bona fide instruction (120 hours in a school/district implementing block scheduling) in a designed course of study that contains student performance standards, since the students have previously attempted successful completion of the corresponding course. Additionally, Credit Recovery courses should ONLY be used for credit recovery, grade forgiveness, or remediation for students needing to prepare for an End-of-Course assessment retake.
General Notes:	The fundamental purpose of this course is to formalize and extend the mathematics that students learned in the middle grades. The critical areas, called units, deepen

and extend understanding of linear and exponential relationships by contrasting them with each other and by applying linear models to data that exhibit a linear trend, and students engage in methods for analyzing, solving, and using quadratic functions. The Standards for Mathematical Practice apply throughout each course and, together with the content standards, prescribe that students experience mathematics as a coherent, useful, and logical subject that makes use of their ability to make sense of problem situations.

Algebra 1A (Year 1)

Unit 1-Relationships Between Questions and Reasoning with Equations: By the end of eighth grade, students have learned to solve linear equations in one variable and have applied graphical and algebraic methods to analyze and solve systems of linear equations in two variables. Now, students analyze and explain the process of solving an equation. Students develop fluency writing, interpreting, and translating between various forms of linear equations and inequalities, and using them to solve problems. They master the solution of linear equations and apply related solution techniques and the laws of exponents to the creation and solution of simple exponential equations.

Unit 2- Linear and Exponential Relationships: In earlier grades, students define, evaluate, and compare functions, and use them to model relationships between quantities. In this unit, students will learn function notation and develop the concepts of domain and range. They explore many examples of functions, including sequences; they interpret functions given graphically, numerically, symbolically, and verbally, translate between representations, and understand the limitations of various representations. Students build on and informally extend their understanding of integer exponents to consider exponential functions. They compare and contrast linear and exponential functions, distinguishing between additive and multiplicative change. Students explore systems of equations and inequalities, and they find and interpret their solutions. They interpret arithmetic sequences as linear functions and geometric sequences as exponential functions.

Algebra 1B (Year 2)

Unit 3- Descriptive Statistics: This unit builds upon students' prior experiences with data, providing students with more formal means of assessing how a model fits data. Students use regression techniques to describe and approximate linear relationships between quantities. They use graphical representations and knowledge of the context to make judgments about the appropriateness of linear models. With linear models, they look at residuals to analyze the goodness of fit.

Unit 4- Expressions and Equations: In this unit, students build on their knowledge from unit 2, where they extended the laws of exponents to rational exponents. Students apply this new understanding of number and strengthen their ability to see structure in and create quadratic and exponential expressions. They create and solve equations, inequalities, and systems of equations involving quadratic expressions.

Unit 5- Quadratic Functions and Modeling: In this unit, students consider quadratic functions, comparing the key characteristics of quadratic functions to those of linear and exponential functions. They select from among these functions to

	model phenomena. Students learn to anticipate the graph of a quadratic function by interpreting various forms of quadratic expressions. In particular, they identify the real solutions of a quadratic equation as the zeros of a related quadratic function. Students expand their experience with functions to include more specialized functions—absolute value, step, and those that are piecewise-defined.
Verion Requirements:	**Fluency Recommendations** **A/G-** Algebra I students become fluent in solving characteristic problems involving the analytic geometry of lines, such as writing down the equation of a line given a point and a slope. Such fluency can support them in solving less routine mathematical problems involving linearity, as well as in modeling linear phenomena (including modeling using systems of linear inequalities in two variables). **A-APR.1-** Fluency in adding, subtracting, and multiplying polynomials supports students throughout their work in Algebra, as well as in their symbolic work with functions. Manipulation can be more mindful when it is fluent. **A-SSE.1b-** Fluency in transforming expressions and chunking (seeing parts of an expression as a single object) is essential in factoring, completing the square, and other mindful algebraic calculations.

STANDARDS (49)

LACC.910.RST.1.3:	Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
LACC.910.RST.2.4:	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.
LACC.910.RST.3.7:	Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
LACC.910.SL.1.1:	Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively. a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by

	referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas. b. Work with peers to set rules for collegial discussions and decision-making (e.g., informal consensus, taking votes on key issues, presentation of alternate views), clear goals and deadlines, and individual roles as needed. c. Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions. d. Respond thoughtfully to diverse perspectives, summarize points of agreement and disagreement, and, when warranted, qualify or justify their own views and understanding and make new connections in light of the evidence and reasoning presented.
LACC.910.SL.1.2:	Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source.
LACC.910.SL.1.3:	Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, identifying any fallacious reasoning or exaggerated or distorted evidence.
LACC.910.SL.2.4:	Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.
LACC.910.WHST.1.1:	Write arguments focused on *discipline-specific content.* a. Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence. b. Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audience's knowledge level and concerns. c. Use words, phrases, and clauses to link the major sections of the text, create cohesion, and clarify the relationships

	between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims. d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing. e. Provide a concluding statement or section that follows from or supports the argument presented.
LACC.910.WHST.2.4:	Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
LACC.910.WHST.3.9:	Draw evidence from informational texts to support analysis, reflection, and research.
MACC.912.A-CED.1.1:	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.* Remarks/Examples
	Algebra 1, Unit 1: Limit A.CED.1 and A.CED.2 to linear and exponential equations, and, in the case of exponential equations, limit to situations requiring evaluation of exponential functions at integer inputs. **Algebra 1, Unit 4**: Extend work on linear and exponential equations in Unit 1 to quadratic equations. **Algebra 1 Assessment Limits and Clarifications** i) Tasks are limited to linear, quadratic, or exponential equations with integer exponents. **Algebra 2 Assessment Limits and Clarifications** i) Tasks are limited to exponential equations with rational or real exponents and rational functions. ii) Tasks have a real-world context.

MACC.912.A-CED.1.2:	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. Remarks/Examples
	Algebra 1, Unit 1: Limit A.CED.1 and A.CED.2 to linear and exponential equations, and, in the case of exponential equations, limit to situations requiring evaluation of exponential functions at integer inputs. Algebra 1, Unit 4: Extend work on linear and exponential equations in Unit 1 to quadratic equations.
MACC.912.A-CED.1.3:	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. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.* Remarks/Examples
	Algebra 1, Unit 1: Limit A.CED.3 to linear equations and inequalities.
MACC.912.A-CED.1.4:	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law V = IR to highlight resistance R.* Remarks/Examples
	Algebra 1, Unit 1: Limit A.CED.4 to formulas which are linear in the variable of interest. Algebra 1, Unit 4: Extend A.CED.4 to formulas involving squared variables.
MACC.912.A-REI.1.1:	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. Remarks/Examples
	Algebra 1, Unit 1: Students should focus on and master A.REI.1 for linear equations and be able to extend and apply their reasoning to other types of equations in future courses. Students will solve

	exponential equations with logarithms in Algebra II. **Algebra 1 Assessment Limits and Clarification** i) Tasks are limited to quadratic equations. **Algebra 2 Assessment Limits and Clarification** i) Tasks are limited to simple rational or radical equations.
MACC.912.A-REI.2.3:	Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters. Remarks/Examples
	Algebra 1, Unit 1: Extend earlier work with solving linear equations to solving linear inequalities in one variable and to solving literal equations that are linear in the variable being solved for. Include simple exponential equations that rely only on application of the laws of exponents, such as $5^x=125$ or $2^x=1/16$ **Algebra 1 Assessment Limits and Clarifications** i) Tasks do not require students to write solutions for quadratic equations that have roots with nonzero imaginary parts. However, tasks can require the student to recognize cases in which a quadratic equation has no real solutions. Note, solving a quadratic equation by factoring relies on the connection between zeros and factors of polynomials (cluster A-APR.B). Cluster A-APR.B is formally assessed in A2. **Algebra 2 Assessment Limits and Clarifications** i) In the case of equations that have roots with nonzero imaginary parts, students write the solutions as a ± bi for real numbers a and b.
MACC.912.A-REI.3.5:	Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of

	the other produces a system with the same solutions. Remarks/Examples
	Algebra 1, Unit 2: Build on student experiences graphing and solving systems of linear equations from middle school to focus on justification of the methods used. Include cases where the two equations describe the same line (yielding infinitely many solutions) and cases where two equations describe parallel lines (yielding no solution); connect to GPE.5 when it is taught in Geometry, which requires students to prove the slope criteria for parallel lines.
MACC.912.A-REI.3.6:	Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. Remarks/Examples
	Algebra 1, Unit 2: Build on student experiences graphing and solving systems of linear equations from middle school to focus on justification of the methods used. Include cases where the two equations describe the same line (yielding infinitely many solutions) and cases where two equations describe parallel lines (yielding no solution); connect to GPE.5 when it is taught in Geometry, which requires students to prove the slope criteria for parallel lines. **Algebra 1 Assessment Limits and Clarifications** i)i) Tasks have a real-world context. ii) Tasks have hallmarks of modeling as a mathematical practice (less defined tasks, more of the modeling cycle, etc.). Note, solving a quadratic equation by factoring relies on the connection between zeros and factors of polynomials (cluster A-APR.B). Cluster A-APR.B is formally assessed in A2. **Algebra 2 Assessment Limits and Clarifications** i) Tasks are limited to 3x3 systems.
MACC.912.A-	Understand that the graph of an equation in two variables is the set

REI.4.10:	of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line). Remarks/Examples Algebra 1, Unit 2: For A.REI.10, focus on linear and exponential equations and be able to adapt and apply that learning to other types of equations in future courses.
MACC.912.A-REI.4.11:	Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect are the solutions of the equation f(x) = g(x); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where f(x) and/or g(x) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions. Remarks/Examples **Algebra 1, Unit 2**: For A.REI.11, focus on cases where f(x) and g(x) are linear or exponential. **Algebra 1 Assessment Limits and Clarifications** i) Tasks that assess conceptual understanding of the indicated concept may involve any of the function types mentioned in the standard except exponential and logarithmic functions. ii) Finding the solutions approximately is limited to cases where f(x) and g(x) are polynomial functions. **Algebra 2 Assessment Limits and Clarifications** i) Tasks may involve any of the function types mentioned in the standard.
MACC.912.A-REI.4.12:	Graph the solutions to a linear inequality in two variables as a halfplane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.
MACC.912.A-SSE.1.1:	Interpret expressions that represent a quantity in terms of its context.

	a. Interpret parts of an expression, such as terms, factors, and coefficients. b. Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret* $P(1+r)^n$ *as the product of P and a factor not depending on P.* Remarks/Examples
	Algebra 1 - Fluency Recommendations A-SSE.1.1b - Fluency in transforming expressions and chunking (seeing parts of an expression as a single object) is essential in factoring, completing the square, and other mindful algebraic calculations. **Algebra 1, Unit 1**: Limit to linear expressions and to exponential expressions with integer exponents. **Algebra 1, Unit 4**: Focus on quadratic and exponential expressions. For A.SSE.1b, exponents are extended from the integer exponents found in Unit 1 to rational exponents focusing on those that represent square or cube roots.
MACC.912.F-BF.1.1:	Write a function that describes a relationship between two quantities. a. Determine an explicit expression, a recursive process, or steps for calculation from a context. 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.* c. Compose functions. *For example, if T(y) is the temperature in the atmosphere as a function of height, and h(t) is the height of a weather balloon as a function of time, then T(h(t)) is the temperature at the location of the weather balloon as a function of time.*

	Remarks/Examples
	Algebra 1, Unit 2: Limit to F.BF.1a, 1b, and 2 to linear and exponential functions. **Algebra 1, Unit 5**: Focus on situations that exhibit a quadratic relationship. **Algebra 1 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Tasks are limited to linear functions, quadratic functions, and exponential functions with domains in the integers. **Algebra 2 Assessment Limits and Clarifications** i) Tasks have a real-world context ii) Tasks may involve linear functions, quadratic functions, and exponential functions.
MACC.912.F-BF.2.3:	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.* Remarks/Examples
	Algebra 1, Unit 2: Focus on vertical translations of graphs of linear and exponential functions. Relate the vertical translation of a linear function to its y-intercept. While applying other transformations to a linear graph is appropriate at this level, it may be difficult for students to identify or distinguish between the effects of the other transformations included in this standard. **Algebra 1, Unit 5**: For F.BF.3, focus on quadratic functions, and consider including absolute value functions. **Algebra 1 Assessment Limit and Clarifications**

	i) Identifying 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) is limited to linear and quadratic functions. ii) Experimenting with cases and illustrating an explanation of the effects on the graph using technology is limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers. iii) Tasks do not involve recognizing even and odd functions. The function types listed in note (ii) are the same as those listed in the Algebra I column for standards F-IF.4, F-IF.6, and F-IF.9. **Algebra 2 Assessment Limits and Clarifications** i) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions ii) Tasks may involve recognizing even and odd functions. The function types listed in note (i) are the same as those listed in the Algebra II column for standards F-IF.4, F-IF.6, and F-IF.9.
MACC.912.F-IF.1.1:	Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then f(x) denotes the output of f corresponding to the input x. The graph of f is the graph of the equation y = f(x). Remarks/Examples Algebra 1, Unit 2: Students should experience a variety of types of situations modeled by functions. Detailed analysis of any particular class of functions at this stage is not advised. Students should apply these concepts throughout their future mathematics courses. Draw examples from linear and exponential functions.
MACC.912.F-IF.1.2:	Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context. Remarks/Examples Algebra 1, Unit 2: Students should experience a variety of types of situations modeled by functions. Detailed analysis of any particular

	class of functions at this stage is not advised. Students should apply these concepts throughout their future mathematics courses. Draw examples from linear and exponential functions.
MACC.912.F-IF.1.3:	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. Remarks/Examples
	Algebra 1, Unit 2: In F.IF.3, draw connection to F.BF.2, which requires students to write arithmetic and geometric sequences. Emphasize arithmetic and geometric sequences as examples of linear and exponential functions. **Algebra 1 Assessment Limits and Clarifications** i) This standard is part of the Major work in Algebra I and will be assessed accordingly. **Algebra 2 Assessment Limits and Clarifications** i) This standard is Supporting work in Algebra II. This standard should support the Major work in F- BF.2 for coherence. **Algebra 2 - Fluency Recommendations** Fluency in translating between recursive definitions and closed forms is helpful when dealing with many problems involving sequences and series, with applications ranging from fitting functions to tables to problems in finance.
MACC.912.F-IF.2.4:	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.*

	Remarks/Examples
	Algebra 1, Unit 2: For F.IF.4 and 5, focus on linear and exponential functions. **Algebra 1 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Tasks are limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers. Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra I column for standards F-IF.6 and F-IF.9. **Algebra 2 Assessment Limits and Clarifications** i) Tasks have a real-world context ii) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions. Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra II column for standards F-IF.6 and F-IF.9.
MACC.912.F-IF.2.5:	Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.* Remarks/Examples
	Algebra 1, Unit 2: For F.IF.4 and 5, focus on linear and exponential functions.
MACC.912.F-IF.2.6:	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.

	Remarks/Examples
	Algebra 1, Unit 2: For F.IF.6, focus on linear functions and exponential functions whose domain is a subset of the integers. Unit 5 in this course and the Algebra II course address other types of functions. **Algebra 1 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Tasks are limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers. The function types listed here are the same as those listed in the Algebra I column for standards F-IF.4 and F-IF.9. **Algebra 2 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions. The function types listed here are the same as those listed in the Algebra II column for standards F-IF.4 and F-IF.9.
MACC.912.F-IF.3.7:	Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. a. Graph linear and quadratic functions and show intercepts, maxima, and minima. b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.

	e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude. Remarks/Examples
	Algebra 1, Unit 2: For F.IF.7a, 7e, and 9 focus on linear and exponentials functions. Include comparisons of two functions presented algebraically. For example, compare the growth of two linear functions, or two exponential functions such as $y=3^n$ and $y=100^2$
MACC.912.F-IF.3.9:	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.* Remarks/Examples
	Algebra 1, Unit 2: For F.IF.7a, 7e, and 9 focus on linear and exponentials functions. Include comparisons of two functions presented algebraically. For example, compare the growth of two linear functions, or two exponential functions such as $y=3^n$ and $y=100^2$ **Algebra 1, Unit 5**: For F.IF.9, focus on expanding the types of functions considered to include, linear, exponential, and quadratic. Extend work with quadratics to include the relationship between coefficients and roots, and that once roots are known, a quadratic equation can be factored. **Algebra 1 Assessment Limits and Clarifications** i) Tasks are limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers. The function types listed here are the same as those listed in the Algebra I column for standards F-IF.4 and F-IF.6.

	Algebra 2 Assessment Limits and Clarifications i) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions. The function types listed here are the same as those listed in the Algebra II column for standards F-IF.4 and F-IF.6.
MACC.912.F-LE.1.1:	Distinguish between situations that can be modeled with linear functions and with exponential functions. a. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals. b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.
MACC.912.F-LE.1.2:	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). Remarks/Examples **Algebra 1, Unit 2**: In constructing linear functions in F.LE.2, draw on and consolidate previous work in Grade 8 on finding equations for lines and linear functions (8.EE.6, 8.F.4). **Algebra 1 Assessment Limits and Clarifications** i) Tasks are limited to constructing linear and exponential functions in simple context (not multi- step). **Algebra 2 Assessment Limits and Clarifications** i) Tasks will include solving multi-step problems by constructing linear and exponential functions.
MACC.912.F-LE.1.3:	Observe using graphs and tables that a quantity increasing

	exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function. Remarks/Examples
	Algebra 1, Unit 2: For F.LE.3, limit to comparisons between linear and exponential models. Algebra 1, Unit 5: Compare linear and exponential growth to quadratic growth.
MACC.912.F-LE.2.5:	Interpret the parameters in a linear or exponential function in terms of a context. Remarks/Examples
	Algebra 1, Unit 2: Limit exponential functions to those of the form $f(x) = b^x + k$. **Algebra 1 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Exponential functions are limited to those with domains in the integers. **Algebra 2 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Tasks are limited to exponential functions with domains not in the integers.
MACC.912.N-Q.1.1:	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. Remarks/Examples
	Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions.

MACC.912.N-Q.1.2:	Define appropriate quantities for the purpose of descriptive modeling. Remarks/Examples
	Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. **Algebra 1 Content Notes:** Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. **Algebra 1 Assessment Limits and Clarifications** This standard will be assessed in Algebra I by ensuring that some modeling tasks (involving Algebra I content or securely held content from grades 6-8) require the student to create a quantity of interest in the situation being described (i.e., a quantity of interest is not selected for the student by the task). For example, in a situation involving data, the student might autonomously decide that a measure of center is a key variable in a situation, and then choose to work with the mean. **Algebra 2 Assessment Limits and Clarifications** This standard will be assessed in Algebra II by ensuring that some modeling tasks (involving Algebra II content or securely held content from previous grades and courses) require the student to create a quantity of interest in the situation being described (i.e., this is not provided in the task). For example, in a situation involving periodic phenomena, the student might autonomously decide that amplitude is a key variable in a situation, and then choose to work with peak amplitude.
MACC.912.N-Q.1.3:	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. Remarks/Examples
	Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions,

	equations, and functions.
MACC.912.N-RN.1.1:	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.* Remarks/Examples
	Algebra 1, Unit 2: In implementing the standards in curriculum, these standards should occur before discussing exponential functions with continuous domains.
MACC.912.N-RN.1.2:	Rewrite expressions involving radicals and rational exponents using the properties of exponents. Remarks/Examples
	Algebra 1, Unit 2: In implementing the standards in curriculum, these standards should occur before discussing exponential functions with continuous domains.
MACC.K12.MP.1.1:	**Make sense of problems and persevere in solving them.** Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, "Does this make sense?" They can understand the

	approaches of others to solving complex problems and identify correspondences between different approaches.
MACC.K12.MP.2.1:	**Reason abstractly and quantitatively**. Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.
MACC.K12.MP.3.1:	**Construct viable arguments and critique the reasoning of others.** Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read

	the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.
MACC.K12.MP.4.1:	**Model with mathematics.** Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.
MACC.K12.MP.5.1:	**Use appropriate tools strategically.** Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences,

	and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.
MACC.K12.MP.6.1:	**Attend to precision.** Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.
MACC.K12.MP.7.1:	**Look for and make use of structure.** Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see 7×8 equals the well remembered $7 \times 5 + 7 \times 3$, in preparation for learning about the distributive property. In the expression $x^2 + 9x + 14$, older students can see the 14 as 2×7 and the 9 as $2 + 7$. They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see $5 - 3(x - y)^2$ as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers x and y.

MACC.K12.MP.8.1:	**Look for and express regularity in repeated reasoning.** Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation $(y – 2)/(x – 1) = 3$. Noticing the regularity in the way terms cancel when expanding $(x – 1)(x + 1)$, $(x – 1)(x^2 + x + 1)$, and $(x – 1)(x^3 + x^2 + x + 1)$ might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

Course: Algebra 1-A- 1200370

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BASIC INFORMATION

Course Title:	Algebra 1-A
Course Number:	1200370
Course Abbreviated Title:	ALG 1-A
Course Path:	**Section:** Grades PreK to 12 Education Courses **Grade Group:** Grades 9 to 12 and Adult Education Courses **Subject:** Mathematics **SubSubject:** Algebra
Number of Credits:	One credit (1)
Course length:	Year (Y)
Course Type:	Core
Course Level:	2
Status:	Draft - Board Approval Pending
Version Description:	The fundamental purpose of this course is to formalize and extend the mathematics that students learned in the middle grades. The critical areas, called units, deepen and extend understanding of linear and exponential relationships by contrasting them with each other and by applying linear models to data that exhibit a linear trend, and students engage in methods for analyzing, solving, and using quadratic functions. The Standards for Mathematical Practice apply throughout each course and, together with the content standards, prescribe that students experience mathematics as a coherent, useful, and logical subject that makes use of their ability to make sense of problem situations. **Algebra 1A (Year 1)** **Unit 1- Relationships Between Quantities and Reasoning with Equations:** By

	the end of eighth grade, students have learned to solve linear equations in one variable and have applied graphical and algebraic methods to analyze and solve systems of linear equations in two variables. Now, students analyze and explain the process of solving an equation. Students develop fluency writing, interpreting, and translating between various forms of linear equations and inequalities, and using them to solve problems. They master the solution of linear equations and apply related solution techniques and the laws of exponents to the creation and solution of simple exponential equations. **Unit 2- Linear and Exponential Relationships:** In earlier grades, students define, evaluate, and compare functions, and use them to model relationships between quantities. In this unit, students will learn function notation and develop the concepts of domain and range. They explore many examples of functions, including sequences; they interpret functions given graphically, numerically, symbolically, and verbally, translate between representations, and understand the limitations of various representations. Students build on and informally extend their understanding of integer exponents to consider exponential functions. They compare and contrast linear and exponential functions, distinguishing between additive and multiplicative change. Students explore systems of equations and inequalities, and they find and interpret their solutions. They interpret arithmetic sequences as linear functions and geometric sequences as exponential functions. **Algebra 1B (Year 2)** **Unit 3- Descriptive Statistics:** This unit builds upon students' prior experiences with data, providing students with more formal means of assessing how a model fits data. Students use regression techniques to describe and approximate linear relationships between quantities. They use graphical representations and knowledge of the context to make judgments about the appropriateness of linear models. With linear models, they look at residuals to analyze the goodness of fit. **Unit 4- Expressions and Equations:** In this unit, students build on their knowledge from unit 2, where they extended the laws of exponents to rational exponents. Students apply this new understanding of number and strengthen their ability to see structure in and create quadratic and exponential expressions. They create and solve equations, inequalities, and systems of equations involving quadratic expressions. **Unit 5- Quadratic Functions and Modeling:** In this unit, students consider quadratic functions, comparing the key characteristics of quadratic functions to those of linear and exponential functions. They select from among these functions to model phenomena. Students learn to anticipate the graph of a quadratic function by interpreting various forms of quadratic expressions. In particular, they identify the real solutions of a quadratic equation as the zeros of a related quadratic function. Students expand their experience with functions to include more specialized functions—absolute value, step, and those that are piecewise-defined.
General Notes:	**Fluency Recommendations** **A/G-** Algebra I students become fluent in solving characteristic problems involving the analytic geometry of lines, such as writing down the equation of a line given a point and a slope. Such fluency can support them in solving less routine

	mathematical problems involving linearity, as well as in modeling linear phenomena (including modeling using systems of linear inequalities in two variables). **A-APR.1-** Fluency in adding, subtracting, and multiplying polynomials supports students throughout their work in Algebra, as well as in their symbolic work with functions. Manipulation can be more mindful when it is fluent. **A-SSE.1b-** Fluency in transforming expressions and chunking (seeing parts of an expression as a single object) is essential in factoring, completing the square, and other mindful algebraic calculations.

STANDARDS (49)

LACC.910.RST.1.3:	Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
LACC.910.RST.2.4:	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.
LACC.910.RST.3.7:	Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
LACC.910.SL.1.1:	Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively. a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas. b. Work with peers to set rules for collegial discussions and decision-making (e.g., informal consensus, taking votes on key issues, presentation of alternate views), clear goals and deadlines, and individual roles as needed. c. Propel conversations by posing and responding to questions

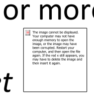
	that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions. d. Respond thoughtfully to diverse perspectives, summarize points of agreement and disagreement, and, when warranted, qualify or justify their own views and understanding and make new connections in light of the evidence and reasoning presented.
LACC.910.SL.1.2:	Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source.
LACC.910.SL.1.3:	Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, identifying any fallacious reasoning or exaggerated or distorted evidence.
LACC.910.SL.2.4:	Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.
MACC.912.A-REI.1.1:	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. Remarks/Examples **Algebra 1, Unit 1**: Students should focus on and master A.REI.1 for linear equations and be able to extend and apply their reasoning to other types of equations in future courses. Students will solve exponential equations with logarithms in Algebra II. **Algebra 1 Assessment Limits and Clarification** i) Tasks are limited to quadratic equations. **Algebra 2 Assessment Limits and Clarification** i) Tasks are limited to simple rational or radical equations.

LACC.910.WHST.1.1:	Write arguments focused on *discipline-specific content.* a. Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence. b. Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audience's knowledge level and concerns. c. Use words, phrases, and clauses to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims. d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing. e. Provide a concluding statement or section that follows from or supports the argument presented.
LACC.910.WHST.2.4:	Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
LACC.910.WHST.3.9:	Draw evidence from informational texts to support analysis, reflection, and research.
MACC.912.A-CED.1.1:	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.* Remarks/Examples
	Algebra 1, Unit 1: Limit A.CED.1 and A.CED.2 to linear and exponential equations, and, in the case of exponential equations, limit to situations requiring evaluation of exponential functions at integer inputs. **Algebra 1, Unit 4**: Extend work on linear and exponential equations in Unit 1 to quadratic equations.

	Algebra 1 Assessment Limits and Clarifications i) Tasks are limited to linear, quadratic, or exponential equations with integer exponents. **Algebra 2 Assessment Limits and Clarifications** i) Tasks are limited to exponential equations with rational or real exponents and rational functions. ii) Tasks have a real-world context.
MACC.912.A-CED.1.2:	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. Remarks/Examples Algebra 1, Unit 1: Limit A.CED.1 and A.CED.2 to linear and exponential equations, and, in the case of exponential equations, limit to situations requiring evaluation of exponential functions at integer inputs. Algebra 1, Unit 4: Extend work on linear and exponential equations in Unit 1 to quadratic equations.
MACC.912.A-CED.1.3:	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. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.* Remarks/Examples Algebra 1, Unit 1: Limit A.CED.3 to linear equations and inequalities.
MACC.912.A-CED.1.4:	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law V = IR to highlight resistance R.* Remarks/Examples Algebra 1, Unit 1: Limit A.CED.4 to formulas which are linear in the variable of interest. Algebra 1, Unit 4: Extend A.CED.4 to formulas involving squared

	variables.
MACC.912.A-REI.2.3:	Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters. Remarks/Examples
	Algebra 1, Unit 1: Extend earlier work with solving linear equations to solving linear inequalities in one variable and to solving literal equations that are linear in the variable being solved for. Include simple exponential equations that rely only on application of the laws of exponents, such as $5^x=125$ or $2^x=1/16$ **Algebra 1 Assessment Limits and Clarifications** i) Tasks do not require students to write solutions for quadratic equations that have roots with nonzero imaginary parts. However, tasks can require the student to recognize cases in which a quadratic equation has no real solutions. Note, solving a quadratic equation by factoring relies on the connection between zeros and factors of polynomials (cluster A-APR.B). Cluster A-APR.B is formally assessed in A2. **Algebra 2 Assessment Limits and Clarifications** i) In the case of equations that have roots with nonzero imaginary parts, students write the solutions as a ± bi for real numbers a and b.
MACC.912.A-REI.3.5:	Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions. Remarks/Examples
	Algebra 1, Unit 2: Build on student experiences graphing and solving systems of linear equations from middle school to focus on justification of the methods used. Include cases where the two equations describe the same line (yielding infinitely many solutions) and cases where two equations describe parallel lines (yielding no solution); connect to GPE.5 when it is taught in Geometry, which requires students to prove the slope criteria for parallel lines.

MACC.912.A-REI.3.6:	Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. Remarks/Examples
	Algebra 1, Unit 2: Build on student experiences graphing and solving systems of linear equations from middle school to focus on justification of the methods used. Include cases where the two equations describe the same line (yielding infinitely many solutions) and cases where two equations describe parallel lines (yielding no solution); connect to GPE.5 when it is taught in Geometry, which requires students to prove the slope criteria for parallel lines. **Algebra 1 Assessment Limits and Clarifications** i)i) Tasks have a real-world context. ii) Tasks have hallmarks of modeling as a mathematical practice (less defined tasks, more of the modeling cycle, etc.). Note, solving a quadratic equation by factoring relies on the connection between zeros and factors of polynomials (cluster A-APR.B). Cluster A-APR.B is formally assessed in A2. **Algebra 2 Assessment Limits and Clarifications** i) Tasks are limited to 3x3 systems.
MACC.912.A-REI.4.10:	Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line). Remarks/Examples
	Algebra 1, Unit 2: For A.REI.10, focus on linear and exponential equations and be able to adapt and apply that learning to other types of equations in future courses.
MACC.912.A-REI.4.11:	Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect are the solutions of the

	equation f(x) = g(x); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where f(x) and/or g(x) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions. Remarks/Examples **Algebra 1, Unit 2**: For A.REI.11, focus on cases where f(x) and g(x) are linear or exponential. **Algebra 1 Assessment Limits and Clarifications** i) Tasks that assess conceptual understanding of the indicated concept may involve any of the function types mentioned in the standard except exponential and logarithmic functions. ii) Finding the solutions approximately is limited to cases where f(x) and g(x) are polynomial functions. **Algebra 2 Assessment Limits and Clarifications** i) Tasks may involve any of the function types mentioned in the standard.
MACC.912.A-REI.4.12:	Graph the solutions to a linear inequality in two variables as a halfplane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.
MACC.912.A-SSE.1.1:	Interpret expressions that represent a quantity in terms of its context. a. Interpret parts of an expression, such as terms, factors, and coefficients. b. Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret*  *as the product of P and a factor not depending on P.* Remarks/Examples

	Algebra 1 - Fluency Recommendations A-SSE.1.1b - Fluency in transforming expressions and chunking (seeing parts of an expression as a single object) is essential in factoring, completing the square, and other mindful algebraic calculations. **Algebra 1, Unit 1**: Limit to linear expressions and to exponential expressions with integer exponents. **Algebra 1, Unit 4**: Focus on quadratic and exponential expressions. For A.SSE.1b, exponents are extended from the integer exponents found in Unit 1 to rational exponents focusing on those that represent square or cube roots.
MACC.912.F-BF.1.1:	Write a function that describes a relationship between two quantities. a. Determine an explicit expression, a recursive process, or steps for calculation from a context. 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.* c. Compose functions. *For example, if T(y) is the temperature in the atmosphere as a function of height, and h(t) is the height of a weather balloon as a function of time, then T(h(t)) is the temperature at the location of the weather balloon as a function of time.* Remarks/Examples **Algebra 1, Unit 2**: Limit to F.BF.1a, 1b, and 2 to linear and exponential functions. **Algebra 1, Unit 5**: Focus on situations that exhibit a quadratic relationship. **Algebra 1 Assessment Limits and Clarifications** i) Tasks have a real-world context.

	ii) Tasks are limited to linear functions, quadratic functions, and exponential functions with domains in the integers. **Algebra 2 Assessment Limits and Clarifications** i) Tasks have a real-world context ii) Tasks may involve linear functions, quadratic functions, and exponential functions.
MACC.912.F-BF.2.3:	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.* Remarks/Examples
	Algebra 1, Unit 2: Focus on vertical translations of graphs of linear and exponential functions. Relate the vertical translation of a linear function to its y-intercept. While applying other transformations to a linear graph is appropriate at this level, it may be difficult for students to identify or distinguish between the effects of the other transformations included in this standard. **Algebra 1, Unit 5**: For F.BF.3, focus on quadratic functions, and consider including absolute value functions. **Algebra 1 Assessment Limit and Clarifications** i) Identifying 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) is limited to linear and quadratic functions. ii) Experimenting with cases and illustrating an explanation of the effects on the graph using technology is limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers. iii) Tasks do not involve recognizing even and odd functions.

	The function types listed in note (ii) are the same as those listed in the Algebra I column for standards F-IF.4, F-IF.6, and F-IF.9. **Algebra 2 Assessment Limits and Clarifications** i) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions ii) Tasks may involve recognizing even and odd functions. The function types listed in note (i) are the same as those listed in the Algebra II column for standards F-IF.4, F-IF.6, and F-IF.9.
MACC.912.F-IF.1.1:	Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then f(x) denotes the output of f corresponding to the input x. The graph of f is the graph of the equation y = f(x). Remarks/Examples Algebra 1, Unit 2: Students should experience a variety of types of situations modeled by functions. Detailed analysis of any particular class of functions at this stage is not advised. Students should apply these concepts throughout their future mathematics courses. Draw examples from linear and exponential functions.
MACC.912.F-IF.1.2:	Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context. Remarks/Examples Algebra 1, Unit 2: Students should experience a variety of types of situations modeled by functions. Detailed analysis of any particular class of functions at this stage is not advised. Students should apply these concepts throughout their future mathematics courses. Draw examples from linear and exponential functions.
MACC.912.F-IF.1.3:	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.

	Remarks/Examples
	Algebra 1, Unit 2: In F.IF.3, draw connection to F.BF.2, which requires students to write arithmetic and geometric sequences. Emphasize arithmetic and geometric sequences as examples of linear and exponential functions. **Algebra 1 Assessment Limits and Clarifications** i) This standard is part of the Major work in Algebra I and will be assessed accordingly. **Algebra 2 Assessment Limits and Clarifications** i) This standard is Supporting work in Algebra II. This standard should support the Major work in F- BF.2 for coherence. **Algebra 2 - Fluency Recommendations** Fluency in translating between recursive definitions and closed forms is helpful when dealing with many problems involving sequences and series, with applications ranging from fitting functions to tables to problems in finance.
MACC.912.F-IF.2.4:	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.* Remarks/Examples
	Algebra 1, Unit 2: For F.IF.4 and 5, focus on linear and exponential functions. **Algebra 1 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Tasks are limited to linear functions, quadratic functions, square root functions, cube root

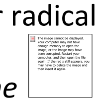
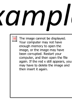
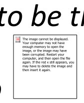
	functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers. Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra I column for standards F-IF.6 and F-IF.9. **Algebra 2 Assessment Limits and Clarifications** i) Tasks have a real-world context ii) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions. Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra II column for standards F-IF.6 and F-IF.9.
MACC.912.F-IF.2.5:	Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.* Remarks/Examples
	Algebra 1, Unit 2: For F.IF.4 and 5, focus on linear and exponential functions.
MACC.912.F-IF.2.6:	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. Remarks/Examples
	Algebra 1, Unit 2: For F.IF.6, focus on linear functions and exponential functions whose domain is a subset of the integers. Unit 5 in this course and the Algebra II course address other types of functions. **Algebra 1 Assessment Limits and Clarifications** i) Tasks have a real-world context.

	ii) Tasks are limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers. The function types listed here are the same as those listed in the Algebra I column for standards F-IF.4 and F-IF.9. **Algebra 2 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions. The function types listed here are the same as those listed in the Algebra II column for standards F-IF.4 and F-IF.9.
MACC.912.F-IF.3.7:	Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. a. Graph linear and quadratic functions and show intercepts, maxima, and minima. b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior. e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude. Remarks/Examples
	Algebra 1, Unit 2: For F.IF.7a, 7e, and 9 focus on linear and exponentials functions. Include comparisons of two functions presented algebraically. For example, compare the growth of two linear functions, or two exponential functions such as $y=3^n$ and $y=100^2$

[MACC.912.F-IF.3.9:]	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.* Remarks/Examples
	Algebra 1, Unit 2: For F.IF.7a, 7e, and 9 focus on linear and exponentials functions. Include comparisons of two functions presented algebraically. For example, compare the growth of two linear functions, or two exponential functions such as $y=3^n$ and $y=100^2$ **Algebra 1, Unit 5**: For F.IF.9, focus on expanding the types of functions considered to include, linear, exponential, and quadratic. Extend work with quadratics to include the relationship between coefficients and roots, and that once roots are known, a quadratic equation can be factored. **Algebra 1 Assessment Limits and Clarifications** i) Tasks are limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers. The function types listed here are the same as those listed in the Algebra I column for standards F-IF.4 and F-IF.6. **Algebra 2 Assessment Limits and Clarifications** i) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions. The function types listed here are the same as those listed in the Algebra II column for standards F-IF.4 and F-IF.6.
[MACC.912.F-LE.1.1:]	Distinguish between situations that can be modeled with linear functions and with exponential functions.

	a. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals. b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.
MACC.912.F-LE.1.2:	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). Remarks/Examples
	Algebra 1, Unit 2: In constructing linear functions in F.LE.2, draw on and consolidate previous work in Grade 8 on finding equations for lines and linear functions (8.EE.6, 8.F.4). **Algebra 1 Assessment Limits and Clarifications** i) Tasks are limited to constructing linear and exponential functions in simple context (not multi- step). **Algebra 2 Assessment Limits and Clarifications** i) Tasks will include solving multi-step problems by constructing linear and exponential functions.
MACC.912.F-LE.1.3:	Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function. Remarks/Examples
	Algebra 1, Unit 2: For F.LE.3, limit to comparisons between linear and exponential models. Algebra 1, Unit 5: Compare linear and exponential growth to quadratic growth.
MACC.912.F-LE.2.5:	Interpret the parameters in a linear or exponential function in terms

	of a context. Remarks/Examples
	Algebra 1, Unit 2: Limit exponential functions to those of the form $f(x) = b^x + k$. **Algebra 1 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Exponential functions are limited to those with domains in the integers. **Algebra 2 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Tasks are limited to exponential functions with domains not in the integers.
MACC.912.N-Q.1.1:	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. Remarks/Examples
	Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions.
MACC.912.N-Q.1.2:	Define appropriate quantities for the purpose of descriptive modeling. Remarks/Examples
	Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. **Algebra 1 Content Notes:**

	Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. **Algebra 1 Assessment Limits and Clarifications** This standard will be assessed in Algebra I by ensuring that some modeling tasks (involving Algebra I content or securely held content from grades 6-8) require the student to create a quantity of interest in the situation being described (i.e., a quantity of interest is not selected for the student by the task). For example, in a situation involving data, the student might autonomously decide that a measure of center is a key variable in a situation, and then choose to work with the mean. **Algebra 2 Assessment Limits and Clarifications** This standard will be assessed in Algebra II by ensuring that some modeling tasks (involving Algebra II content or securely held content from previous grades and courses) require the student to create a quantity of interest in the situation being described (i.e., this is not provided in the task). For example, in a situation involving periodic phenomena, the student might autonomously decide that amplitude is a key variable in a situation, and then choose to work with peak amplitude.
MACC.912.N-Q.1.3:	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. Remarks/Examples
	Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions.
MACC.912.N-RN.1.1:	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*  *to be the cube root of 5 because we want*  =  *to hold, so*  *must equal 5.* Remarks/Examples

	Algebra 1, Unit 2: In implementing the standards in curriculum, these standards should occur before discussing exponential functions with continuous domains.
MACC.912.N-RN.1.2:	Rewrite expressions involving radicals and rational exponents using the properties of exponents. Remarks/Examples Algebra 1, Unit 2: In implementing the standards in curriculum, these standards should occur before discussing exponential functions with continuous domains.
MACC.K12.MP.1.1:	**Make sense of problems and persevere in solving them.** Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, "Does this make sense?" They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.
MACC.K12.MP.2.1:	**Reason abstractly and quantitatively**. Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two

	complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.
MACC.K12.MP.3.1:	**Construct viable arguments and critique the reasoning of others.** Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.
MACC.K12.MP.4.1:	**Model with mathematics.** Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the

	workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.
MACC.K12.MP.5.1:	**Use appropriate tools strategically.** Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

MACC.K12.MP.6.1:	**Attend to precision.** Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.
MACC.K12.MP.7.1:	**Look for and make use of structure.** Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see 7 × 8 equals the well remembered 7 × 5 + 7 × 3, in preparation for learning about the distributive property. In the expression $x^2 + 9x + 14$, older students can see the 14 as 2 × 7 and the 9 as 2 + 7. They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see $5 – 3(x – y)^2$ as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers x and y.
MACC.K12.MP.8.1:	**Look for and express regularity in repeated reasoning.** Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the

	calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation $(y – 2)/(x – 1) = 3$. Noticing the regularity in the way terms cancel when expanding $(x – 1)(x + 1)$, $(x – 1)(x^2 + x + 1)$, and $(x – 1)(x^3 + x^2 + x + 1)$ might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

Course: Algebra 2 Honors- 1200340

Direct link to this page:http://www.cpalms.org/Courses/CoursePagePublicPreviewCourse3652.aspx

BASIC INFORMATION

Course Title:	Algebra 2 Honors
Course Number:	1200340
Course Abbreviated Title:	ALG 2 HON
Course Path:	**Section:** Grades PreK to 12 Education Courses **Grade Group:** Grades 9 to 12 and Adult Education Courses **Subject:** Mathematics **SubSubject:** Algebra
Course length:	Year (Y)
Course Type:	Core
Course Level:	3
Status:	Draft - Board Approval Pending
Honors?	Yes
Version Description:	Building on their work with linear, quadratic, and exponential functions, students extend their repertoire of functions to include polynomial, rational, and radical functions.2 Students work closely with the expressions that define the functions, and continue to expand and hone their abilities to model situations and to solve equations, including solving quadratic equations over the set of complex numbers and solving exponential equations using the properties of logarithms. The Mathematical Practice Standards apply throughout each course and, together with the content standards, prescribe that students experience mathematics as a coherent, useful, and logical subject that makes use of their ability to make sense of problem situations. The critical areas for this course, organized into four units, are as follows:

	Unit 1- Polynomial, Rational, and Radical Relationships: This unit develops the structural similarities between the system of polynomials and the system of integers. Students draw on analogies between polynomial arithmetic and base-ten computation, focusing on properties of operations, particularly the distributive property. Students connect multiplication of polynomials with multiplication of multi-digit integers, and division of polynomials with long division of integers. Students identify zeros of polynomials, including complex zeros of quadratic polynomials, and make connections between zeros of polynomials and solutions of polynomial equations. The unit culminates with the fundamental theorem of algebra. A central theme of this unit is that the arithmetic of rational expressions is governed by the same rules as the arithmetic of rational numbers. **Unit 2- Trigonometric Functions:** Building on their previous work with functions, and on their work with trigonometric ratios and circles in Geometry, students now use the coordinate plane to extend trigonometry to model periodic phenomena. **Unit 3- Modeling with Functions:** In this unit students synthesize and generalize what they have learned about a variety of function families. They extend their work with exponential functions to include solving exponential equations with logarithms. They explore the effects of transformations on graphs of diverse functions, including functions arising in an application, in order to abstract the general principle that transformations on a graph always have the same effect regardless of the type of the underlying function. They identify appropriate types of functions to model a situation, they adjust parameters to improve the model, and they compare models by analyzing appropriateness of fit and making judgments about the domain over which a model is a good fit. The description of modeling as "the process of choosing and using mathematics and statistics to analyze empirical situations, to understand them better, and to make decisions" is at the heart of this unit. The narrative discussion and diagram of the modeling cycle should be considered when knowledge of functions, statistics, and geometry is applied in a modeling context. **Unit 4- Inferences and Conclusions from Data:** In this unit, students see how the visual displays and summary statistics they learned in earlier grades relate to different types of data and to probability distributions. They identify different ways of collecting data—

	including sample surveys, experiments, and simulations—and the role that randomness and careful design play in the conclusions that can be drawn. **Unit 5- Applications of Probability:** Building on probability concepts that began in the middle grades, students use the languages of set theory to expand their ability to compute and interpret theoretical and experimental probabilities for compound events, attending to mutually exclusive events, independent events, and conditional probability. Students should make use of geometric probability models wherever possible. They use probability to make informed decisions.
General Notes:	**Fluency Recommendations** **A-APR.6** This standard sets an expectation that students will divide polynomials with remainder by inspection in simple cases. For example, one can view the rational expression as = = . **A-SSE.2** The ability to see structure in expressions and to use this structure to rewrite expressions is a key skill in everything from advanced factoring (e.g., grouping) to summing series to the rewriting of rational expressions to examine the end behavior of the corresponding rational function. **F-IF.3** Fluency in translating between recursive definitions and closed forms is helpful when dealing with many problems involving sequences and series, with applications ranging from fitting functions to tables to problems in finance.

STANDARDS (82)

LACC.1112.RST.1.3:	Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.
LACC.1112.RST.2.4:	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics.
LACC.1112.RST.3.7:	Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.
LACC.1112.SL.1.1:	Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively. a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas. b. Work with peers to promote civil, democratic discussions and decision-making, set clear goals and deadlines, and establish individual roles as needed. c. Propel conversations by posing and responding to questions that probe reasoning and evidence; ensure a hearing for a full range of positions on a topic or issue; clarify, verify, or challenge ideas and conclusions; and promote divergent and creative perspectives. d. Respond thoughtfully to diverse perspectives; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research is required to deepen the investigation or complete the task.
LACC.1112.SL.1.2:	Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to

	make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data.
LACC.1112.SL.1.3:	Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, assessing the stance, premises, links among ideas, word choice, points of emphasis, and tone used.
LACC.1112.SL.2.4:	Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks.
LACC.1112.WHST.1.1:	Write arguments focused on *discipline-specific content.* a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence. b. Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience's knowledge level, concerns, values, and possible biases. c. Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims. d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing. e. Provide a concluding statement or section that follows from or supports the argument presented.
LACC.1112.WHST.2.4:	Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

LACC.1112.WHST.3.9:	Draw evidence from informational texts to support analysis, reflection, and research.
MACC.912.A-APR.1.1:	Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials. Remarks/Examples **Algebra 1 - Fluency Recommendations** Fluency in adding, subtracting, and multiplying polynomials supports students throughout their work in algebra, as well as in their symbolic work with functions. Manipulation can be more mindful when it is fluent. Focus on polynomial expressions that simplify to forms that are linear or quadratic in a positive integer power of x.
MACC.912.A-APR.2.2:	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).
MACC.912.A-APR.2.3:	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. Remarks/Examples **Algebra 1 Assessment Limits and Clarifications** i) Tasks are limited to quadratic and cubic polynomials in which linear and quadratic factors are available. For example, find the zeros of $(x - 2)(x^2 - 9)$. **Algebra 2 Assessment Limits and Clarifications** i) Tasks include quadratic, cubic, and quartic polynomials and polynomials for which factors are not provided. For example, find the zeros of $(x^2 - 1)(x^2 + 1)$
MACC.912.A-APR.3.4:	Prove polynomial identities and use them to describe numerical relationships. For example, the polynomial identity $(x^2 + y^2)^2 = (x^2 –$

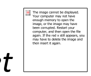
	$y^2)^2 + (2xy)^2$ can be used to generate Pythagorean triples.
MACC.912.A-APR.3.5:	Know and apply the Binomial Theorem for the expansion of (x  in powers of x and y for a positive integer n, where x and y are any numbers, with coefficients determined for example by Pascal's Triangle.
MACC.912.A-APR.4.6:	Rewrite simple rational 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. Remarks/Examples
	Algebra 2 - Fluency Recommendations This standard sets an expectation that students will divide polynomials with remainder by inspection in simple cases.
MACC.912.A-APR.4.7:	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.
MACC.912.A-CED.1.1:	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.* Remarks/Examples
	Algebra 1, Unit 1: Limit A.CED.1 and A.CED.2 to linear and exponential equations, and, in the case of exponential equations, limit to situations requiring evaluation of exponential functions at integer inputs. **Algebra 1, Unit 4**: Extend work on linear and exponential equations in Unit 1 to quadratic equations. **Algebra 1 Assessment Limits and Clarifications** i) Tasks are limited to linear, quadratic, or exponential equations with integer exponents.

	Algebra 2 Assessment Limits and Clarifications i) Tasks are limited to exponential equations with rational or real exponents and rational functions. ii) Tasks have a real-world context.
MACC.912.A-CED.1.2:	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. Remarks/Examples
	Algebra 1, Unit 1: Limit A.CED.1 and A.CED.2 to linear and exponential equations, and, in the case of exponential equations, limit to situations requiring evaluation of exponential functions at integer inputs. Algebra 1, Unit 4: Extend work on linear and exponential equations in Unit 1 to quadratic equations.
MACC.912.A-CED.1.3:	Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.* Remarks/Examples
	Algebra 1, Unit 1: Limit A.CED.3 to linear equations and inequalities.
MACC.912.A-CED.1.4:	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law V = IR to highlight resistance R.* Remarks/Examples
	Algebra 1, Unit 1: Limit A.CED.4 to formulas which are linear in the variable of interest. Algebra 1, Unit 4: Extend A.CED.4 to formulas involving squared variables.
MACC.912.A-REI.1.1:	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. Remarks/Examples
	Algebra 1, Unit 1: Students should focus on and master A.REI.1 for linear equations and be able to extend and apply their reasoning to other types of equations in future courses. Students will solve exponential equations with logarithms in Algebra II. **Algebra 1 Assessment Limits and Clarification** i) Tasks are limited to quadratic equations. **Algebra 2 Assessment Limits and Clarification** i) Tasks are limited to simple rational or radical equations.
MACC.912.A-REI.1.2:	Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.
MACC.912.A-REI.2.4:	Solve quadratic equations in one variable. a. Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x – p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form. 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 $a \pm bi$ for real numbers a and b. Remarks/Examples
	Algebra 1, Unit 4: Students should learn of the existence of the complex number system, but will not solve quadratics with complex solutions until Algebra II.

	Algebra 1 Assessment Limits and Clarifications i) Tasks do not require students to write solutions for quadratic equations that have roots with nonzero imaginary parts. However, tasks can require the student to recognize cases in which a quadratic equation has no real solutions. Note, solving a quadratic equation by factoring relies on the connection between zeros and factors of polynomials (cluster A-APR.B). Cluster A-APR.B is formally assessed in A2. **Algebra 2 Assessment Limits and Clarifications** i) In the case of equations that have roots with nonzero imaginary parts, students write the solutions as a ± bi for real numbers a and b.
MACC.912.A-REI.3.6:	Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. Remarks/Examples
	Algebra 1, Unit 2: Build on student experiences graphing and solving systems of linear equations from middle school to focus on justification of the methods used. Include cases where the two equations describe the same line (yielding infinitely many solutions) and cases where two equations describe parallel lines (yielding no solution); connect to GPE.5 when it is taught in Geometry, which requires students to prove the slope criteria for parallel lines. **Algebra 1 Assessment Limits and Clarifications** i)i) Tasks have a real-world context. ii) Tasks have hallmarks of modeling as a mathematical practice (less defined tasks, more of the modeling cycle, etc.). Note, solving a quadratic equation by factoring relies on the connection between zeros and factors of polynomials (cluster A-APR.B). Cluster A-APR.B is formally assessed in A2.

	Algebra 2 Assessment Limits and Clarifications i) Tasks are limited to 3x3 systems.
MACC.912.A-REI.3.7:	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* $x^2 + y^2 = 3$. Remarks/Examples
	Algebra 1 Honors, Unit 4: Include systems consisting of one linear and one quadratic equation. Include systems that lead to work with fractions. For example, finding the intersections between $x^2+y^2= 1$ and y = (x+1)/2 leads to the point (3/5, 4/5) on the unit circle, corresponding to the Pythagorean triple $3^2+4^2=5^2$. Algebra 2, Unit 1: Include systems consisting of one linear and one quadratic equation. Include systems that lead to work with fractions. For example, finding the intersections between $x^2+y^2= 1$ and y = (x+1)/2 leads to the point (3/5, 4/5) on the unit circle, corresponding to the Pythagorean triple $3^2+4^2=5^2$.
MACC.912.A-REI.4.11:	Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect are the solutions of the equation f(x) = g(x); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where f(x) and/or g(x) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions. Remarks/Examples
	Algebra 1, Unit 2: For A.REI.11, focus on cases where f(x) and g(x) are linear or exponential. **Algebra 1 Assessment Limits and Clarifications** i) Tasks that assess conceptual understanding of the indicated concept may involve any of the function types mentioned in the standard except exponential and logarithmic functions. ii) Finding the solutions approximately is limited to cases where f(x)

	and g(x) are polynomial functions. **Algebra 2 Assessment Limits and Clarifications** i) Tasks may involve any of the function types mentioned in the standard.
[MACC.912.A-SSE.1.1:]()	Interpret expressions that represent a quantity in terms of its context. a. Interpret parts of an expression, such as terms, factors, and coefficients. b. Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret*  *as the product of P and a factor not depending on P.* Remarks/Examples
	Algebra 1 - Fluency Recommendations A-SSE.1.1b - Fluency in transforming expressions and chunking (seeing parts of an expression as a single object) is essential in factoring, completing the square, and other mindful algebraic calculations. **Algebra 1, Unit 1**: Limit to linear expressions and to exponential expressions with integer exponents. **Algebra 1, Unit 4**: Focus on quadratic and exponential expressions. For A.SSE.1b, exponents are extended from the integer exponents found in Unit 1 to rational exponents focusing on those that represent square or cube roots.
[MACC.912.A-SSE.1.2:]()	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* $(x^2 - y^2)(x^2 + y^2)$*.* Remarks/Examples

	Algebra 1, Unit 4: Focus on quadratic and exponential expressions. For A.SSE.1b, exponents are extended from the integer exponents found in Unit 1 to rational exponents focusing on those that represent square or cube roots. **Algebra 2 - Fluency Recommendations** The ability to see structure in expressions and to use this structure to rewrite expressions is a key skill in everything from advanced factoring (e.g., grouping) to summing series to the rewriting of rational expressions to examine the end behavior of the corresponding rational function. **Algebra 1 Assessment Limits and Clarifications** i) Tasks are limited to numerical expressions and polynomial expressions in one variable. ii) Examples: See an opportunity to rewrite $a^2 + 9a + 14$ as $(a+7)(a+2)$. Recognize 53^2-47^2 as a difference of squares and see an opportunity to rewrite it in the easier-to-evaluate form $(53+47)(53-47)$. **Algebra 2 Assessment and Limits and Clarifications** i) Tasks are limited to polynomial, rational, or exponential expressions. ii) Examples: 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 $(x^2 – y^2)(x^2 + y^2)$. In the equation $x^2 + 2x + 1 + y^2 = 9$, see an opportunity to rewrite the first three terms as $(x+1)^2$, thus recognizing the equation of a circle with radius 3 and center (-1, 0). See $(x^2 + 4)/(x^2 + 3)$ as $((x^2+3) + 1)/(x^2+3)$, thus recognizing an opportunity to write it as $1 + 1/(x^2 + 3)$.
MACC.912.A-SSE.2.3:	Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. a. Factor a quadratic expression to reveal the zeros of the function it defines. b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines. c. Use the properties of exponents to transform expressions for exponential functions. *For example the expression*  *can*

	be rewritten as  ≈  *to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.* Remarks/Examples
	Algebra 1, Unit 4: It is important to balance conceptual understanding and procedural fluency in work with equivalent expressions. For example, development of skill in factoring and completing the square goes hand-in-hand with understanding what different forms of a quadratic expression reveal. **Algebra 1 Assessment Limits and Clarifications** i) Tasks have a real-world context. As described in the standard, there is an interplay between the mathematical structure of the expression and the structure of the situation such that choosing and producing an equivalent form of the expression reveals something about the situation. ii) Tasks are limited to exponential expressions with integer exponents. **Algebra 2 Assessment Limits and Clarifications** i) Tasks have a real-world context. As described in the standard, there is an interplay between the mathematical structure of the expression and the structure of the situation such that choosing and producing an equivalent form of the expression reveals something about the situation. ii) Tasks are limited to exponential expressions with rational or real exponents.
MACC.912.A-SSE.2.4:	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.*
MACC.912.F-BF.1.1:	Write a function that describes a relationship between two quantities. a. Determine an explicit expression, a recursive process, or steps

	for calculation from a context. 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.* c. Compose functions. *For example, if T(y) is the temperature in the atmosphere as a function of height, and h(t) is the height of a weather balloon as a function of time, then T(h(t)) is the temperature at the location of the weather balloon as a function of time.* Remarks/Examples
	Algebra 1, Unit 2: Limit to F.BF.1a, 1b, and 2 to linear and exponential functions. **Algebra 1, Unit 5**: Focus on situations that exhibit a quadratic relationship. **Algebra 1 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Tasks are limited to linear functions, quadratic functions, and exponential functions with domains in the integers. **Algebra 2 Assessment Limits and Clarifications** i) Tasks have a real-world context ii) Tasks may involve linear functions, quadratic functions, and exponential functions.
MACC.912.F-BF.1.2:	Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms. Remarks/Examples
	Algebra 1 Honors, Unit 4: In F.BF.2, connect arithmetic sequences to linear functions and geometric sequences to exponential functions. Algebra 2, Unit 3: In F.BF.2, connect arithmetic sequences to linear functions and geometric sequences to exponential functions. [Please note this standard is not included in the Algebra 1 course; the

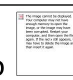
	remarks should reference Algebra 1 Honors/Unit 4 and Algebra 2/Unit 3 Instructional Notes.]
MACC.912.F-BF.2.3:	Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment 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.* Remarks/Examples
	Algebra 1, Unit 2: Focus on vertical translations of graphs of linear and exponential functions. Relate the vertical translation of a linear function to its y-intercept. While applying other transformations to a linear graph is appropriate at this level, it may be difficult for students to identify or distinguish between the effects of the other transformations included in this standard. **Algebra 1, Unit 5**: For F.BF.3, focus on quadratic functions, and consider including absolute value functions. **Algebra 1 Assessment Limit and Clarifications** i) Identifying 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) is limited to linear and quadratic functions. ii) Experimenting with cases and illustrating an explanation of the effects on the graph using technology is limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers. iii) Tasks do not involve recognizing even and odd functions. The function types listed in note (ii) are the same as those listed in the Algebra I column for standards F-IF.4, F-IF.6, and F-IF.9. **Algebra 2 Assessment Limits and Clarifications**

	i) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions ii) Tasks may involve recognizing even and odd functions. The function types listed in note (i) are the same as those listed in the Algebra II column for standards F-IF.4, F-IF.6, and F-IF.9.
MACC.912.F-BF.2.4:	Find inverse functions. a. Solve an equation of the form f(x) = c for a simple function f that has an inverse and write an expression for the inverse. *For example, $f(x) = 2x^3$ or $f(x) = (x+1)/(x-1)$ for $x \neq 1$.* b. Verify by composition that one function is the inverse of another. c. Read values of an inverse function from a graph or a table, given that the function has an inverse. d. Produce an invertible function from a non-invertible function by restricting the domain. Remarks/Examples
	Algebra 1 Honors, Unit 4: For F.BF.4a, focus on linear functions but consider simple situations where the domain of the function must be restricted in order for the inverse to exist, such as $f(x) = x^2$, $x>0$. Algebra 2, Unit 3: For F.BF.4a, focus on linear functions but consider simple situations where the domain of the function must be restricted in order for the inverse to exist, such as $f(x) = x^2$, $x>0$.
MACC.912.F-IF.2.4:	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.* Remarks/Examples
	Algebra 1, Unit 2: For F.IF.4 and 5, focus on linear and exponential functions.

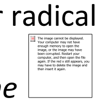
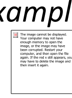
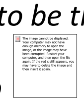
	Algebra 1 Assessment Limits and Clarifications i) Tasks have a real-world context. ii) Tasks are limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers. Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra I column for standards F-IF.6 and F-IF.9. **Algebra 2 Assessment Limits and Clarifications** i) Tasks have a real-world context ii) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions. Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra II column for standards F-IF.6 and F-IF.9.
MACC.912.F-IF.2.5:	Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.* Remarks/Examples
	Algebra 1, Unit 2: For F.IF.4 and 5, focus on linear and exponential functions.
MACC.912.F-IF.2.6:	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. Remarks/Examples
	Algebra 1, Unit 2: For F.IF.6, focus on linear functions and exponential functions whose domain is a subset of the integers. Unit 5 in this course and the Algebra II course address other types of

	functions. **Algebra 1 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Tasks are limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers. The function types listed here are the same as those listed in the Algebra I column for standards F-IF.4 and F-IF.9. **Algebra 2 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions. The function types listed here are the same as those listed in the Algebra II column for standards F-IF.4 and F-IF.9.
MACC.912.F-IF.3.7:	Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. a. Graph linear and quadratic functions and show intercepts, maxima, and minima. b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior. e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude. Remarks/Examples

	Algebra 1, Unit 2: For F.IF.7a, 7e, and 9 focus on linear and exponentials functions. Include comparisons of two functions presented algebraically. For example, compare the growth of two linear functions, or two exponential functions such as $y=3^n$ and $y=100^2$
MACC.912.F-IF.3.8:	Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. a. 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. b. Use the properties of exponents to interpret expressions for exponential functions. *For example, identify percent rate of change in functions such as y = , y = , y = , y = , and classify them as representing exponential growth or decay.* Remarks/Examples Algebra 1, Unit 5: Note that this unit, and in particular in F.IF.8b, extends the work begun in Unit 2 on exponential functions with integer exponents.
MACC.912.F-IF.3.9:	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.* Remarks/Examples **Algebra 1, Unit 2**: For F.IF.7a, 7e, and 9 focus on linear and exponentials functions. Include comparisons of two functions presented algebraically. For example, compare the growth of two linear functions, or two exponential functions such as $y=3^n$ and $y=100^2$

	Algebra 1, Unit 5: For F.IF.9, focus on expanding the types of functions considered to include, linear, exponential, and quadratic. Extend work with quadratics to include the relationship between coefficients and roots, and that once roots are known, a quadratic equation can be factored. **Algebra 1 Assessment Limits and Clarifications** i) Tasks are limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers. The function types listed here are the same as those listed in the Algebra I column for standards F-IF.4 and F-IF.6. **Algebra 2 Assessment Limits and Clarifications** i) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions. The function types listed here are the same as those listed in the Algebra II column for standards F-IF.4 and F-IF.6.
MACC.912.F-LE.1.4:	For exponential models, express as a logarithm the solution to  = d where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.
MACC.912.F-LE.2.5:	Interpret the parameters in a linear or exponential function in terms of a context. Remarks/Examples **Algebra 1, Unit 2**: Limit exponential functions to those of the form $f(x) = b^x + k$. **Algebra 1 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Exponential functions are limited to those with domains in the integers.

	Algebra 2 Assessment Limits and Clarifications i) Tasks have a real-world context. ii) Tasks are limited to exponential functions with domains not in the integers.
MACC.912.F-TF.1.1:	Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.
MACC.912.F-TF.1.2:	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.
MACC.912.F-TF.2.5:	Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.
MACC.912.F-TF.3.8:	Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and use it to calculate trigonometric ratios.
MACC.912.G-GPE.1.2:	Derive the equation of a parabola given a focus and directrix.
MACC.912.N-CN.1.1:	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.
MACC.912.N-CN.1.2:	Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.
MACC.912.N-CN.3.7:	Solve quadratic equations with real coefficients that have complex solutions.
MACC.912.N-CN.3.8:	Extend polynomial identities to the complex numbers. *For example, rewrite* $x^2 + 4$ *as* $(x + 2i)(x - 2i)$.
MACC.912.N-CN.3.9:	Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.
MACC.912.N-Q.1.2:	Define appropriate quantities for the purpose of descriptive modeling. Remarks/Examples **Algebra 1, Unit 1**: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions.

	Algebra 1 Content Notes: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. **Algebra 1 Assessment Limits and Clarifications** This standard will be assessed in Algebra I by ensuring that some modeling tasks (involving Algebra I content or securely held content from grades 6-8) require the student to create a quantity of interest in the situation being described (i.e., a quantity of interest is not selected for the student by the task). For example, in a situation involving data, the student might autonomously decide that a measure of center is a key variable in a situation, and then choose to work with the mean. **Algebra 2 Assessment Limits and Clarifications** This standard will be assessed in Algebra II by ensuring that some modeling tasks (involving Algebra II content or securely held content from previous grades and courses) require the student to create a quantity of interest in the situation being described (i.e., this is not provided in the task). For example, in a situation involving periodic phenomena, the student might autonomously decide that amplitude is a key variable in a situation, and then choose to work with peak amplitude.
MACC.912.N-RN.1.1:	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*  *to be the cube root of 5 because we want*  =  *to hold, so*  *must equal 5.* Remarks/Examples Algebra 1, Unit 2: In implementing the standards in curriculum, these standards should occur before discussing exponential functions with continuous domains.

MACC.912.N-RN.1.2:	Rewrite expressions involving radicals and rational exponents using the properties of exponents. Remarks/Examples Algebra 1, Unit 2: In implementing the standards in curriculum, these standards should occur before discussing exponential functions with continuous domains.
MACC.912.S-CP.1.1:	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”).
MACC.912.S-CP.1.2:	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.
MACC.912.S-CP.1.3:	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.
MACC.912.S-CP.1.4:	Construct and interpret two-way frequency tables of data when two categories are associated with each object 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.*
MACC.912.S-CP.1.5:	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.*
MACC.912.S-CP.2.6:	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.
MACC.912.S-CP.2.7:	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.
MACC.912.S-CP.2.8:	Apply the general Multiplication Rule in a uniform probability model,

	P(A and B) = P(A)P(B|A) = P(B)P(A|B), and interpret the answer in terms of the model.
MACC.912.S-CP.2.9:	Use permutations and combinations to compute probabilities of compound events and solve problems.
MACC.912.S-IC.1.1:	Understand statistics as a process for making inferences about population parameters based on a random sample from that population.
MACC.912.S-IC.1.2:	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?*
MACC.912.S-IC.2.3:	Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.
MACC.912.S-IC.2.4:	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.
MACC.912.S-IC.2.5:	Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.
MACC.912.S-IC.2.6:	Evaluate reports based on data.
MACC.912.S-ID.1.4:	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.
MACC.912.S-MD.2.6:	Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator).
MACC.912.S-MD.2.7:	Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).
MACC.K12.MP.1.1:	**Make sense of problems and persevere in solving them.** Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a

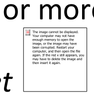
	solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.
MACC.K12.MP.2.1:	**Reason abstractly and quantitatively**. Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.
MACC.K12.MP.3.1:	**Construct viable arguments and critique the reasoning of others.** Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical

	progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.
MACC.K12.MP.4.1:	**Model with mathematics.** Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

MACC.K12.MP.5.1:	**Use appropriate tools strategically.** Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.
MACC.K12.MP.6.1:	**Attend to precision.** Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.
MACC.K12.MP.7.1:	**Look for and make use of structure.** Mathematically proficient students look closely to discern a pattern

	or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see 7 × 8 equals the well remembered 7 × 5 + 7 × 3, in preparation for learning about the distributive property. In the expression $x^2 + 9x + 14$, older students can see the 14 as 2 × 7 and the 9 as 2 + 7. They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see $5 – 3(x – y)^2$ as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers x and y.
MACC.K12.MP.8.1:	**Look for and express regularity in repeated reasoning.** Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation $(y – 2)/(x – 1) = 3$. Noticing the regularity in the way terms cancel when expanding $(x – 1)(x + 1)$, $(x – 1)(x^2 + x + 1)$, and $(x – 1)(x^3 + x^2 + x + 1)$ might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

	Note, solving a quadratic equation by factoring relies on the connection between zeros and factors of polynomials (cluster A-APR.B). Cluster A-APR.B is formally assessed in A2. **Algebra 2 Assessment Limits and Clarifications** i) Tasks are limited to 3x3 systems.
MACC.912.A-REI.3.7:	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* $x^2 + y^2 = 3$. Remarks/Examples
	Algebra 1 Honors, Unit 4: Include systems consisting of one linear and one quadratic equation. Include systems that lead to work with fractions. For example, finding the intersections between $x^2+y^2= 1$ and y = (x+1)/2 leads to the point (3/5, 4/5) on the unit circle, corresponding to the Pythagorean triple $3^2+4^2=5^2$. Algebra 2, Unit 1: Include systems consisting of one linear and one quadratic equation. Include systems that lead to work with fractions. For example, finding the intersections between $x^2+y^2= 1$ and y = (x+1)/2 leads to the point (3/5, 4/5) on the unit circle, corresponding to the Pythagorean triple $3^2+4^2=5^2$.
MACC.912.A-REI.4.10:	Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line). Remarks/Examples
	Algebra 1, Unit 2: For A.REI.10, focus on linear and exponential equations and be able to adapt and apply that learning to other types of equations in future courses.
MACC.912.A-REI.4.11:	Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect are the solutions of the equation f(x) = g(x); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where f(x) and/or g(x) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.

	Remarks/Examples
	Algebra 1, Unit 2: For A.REI.11, focus on cases where f(x) and g(x) are linear or exponential. **Algebra 1 Assessment Limits and Clarifications** i) Tasks that assess conceptual understanding of the indicated concept may involve any of the function types mentioned in the standard except exponential and logarithmic functions. ii) Finding the solutions approximately is limited to cases where f(x) and g(x) are polynomial functions. **Algebra 2 Assessment Limits and Clarifications** i) Tasks may involve any of the function types mentioned in the standard.
MACC.912.A-REI.4.12:	Graph the solutions to a linear inequality in two variables as a halfplane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.
MACC.912.A-SSE.1.1:	Interpret expressions that represent a quantity in terms of its context. a. Interpret parts of an expression, such as terms, factors, and coefficients. b. Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret*  *as the product of P and a factor not depending on P.* Remarks/Examples
	Algebra 1 - Fluency Recommendations A-SSE.1.1b - Fluency in transforming expressions and chunking (seeing parts of an expression as a single object) is essential in factoring, completing the square, and other mindful algebraic

	calculations. **Algebra 1, Unit 1**: Limit to linear expressions and to exponential expressions with integer exponents. **Algebra 1, Unit 4**: Focus on quadratic and exponential expressions. For A.SSE.1b, exponents are extended from the integer exponents found in Unit 1 to rational exponents focusing on those that represent square or cube roots.
MACC.912.A-SSE.1.2:	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 $(x^2 – y^2)(x^2 + y^2)$.* Remarks/Examples
	Algebra 1, Unit 4: Focus on quadratic and exponential expressions. For A.SSE.1b, exponents are extended from the integer exponents found in Unit 1 to rational exponents focusing on those that represent square or cube roots. **Algebra 2 - Fluency Recommendations** The ability to see structure in expressions and to use this structure to rewrite expressions is a key skill in everything from advanced factoring (e.g., grouping) to summing series to the rewriting of rational expressions to examine the end behavior of the corresponding rational function. **Algebra 1 Assessment Limits and Clarifications** i) Tasks are limited to numerical expressions and polynomial expressions in one variable. ii) Examples: Recognize $53^2 – 47^2$ as a difference of squares and see an opportunity to rewrite it in the easier-to-evaluate form (53 - 47)(53 + 47). See an opportunity to rewrite $a^2 + 9a + 14$ as (a+ 7)(a+ 2). **Algebra 2 Assessment and Limits and Clarifications** i) Tasks are limited to polynomial, rational, or exponential expressions. ii) Examples: 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 $(x^2 – y^2)(x^2 + y^2)$. In the equation $x^2 + 2x + 1 + y^2 = 9$, see an opportunity to rewrite the first three terms as $(x+1)^2$, thus recognizing the equation of a circle with radius 3 and center (-1, 0). See $(x^2 + 4)/(x^2 + 3)$ as $((x^2+3) + 1)/(x^2+3)$, thus recognizing an opportunity to write it as $1 + 1/(x^2 + 3)$.
MACC.912.A-SSE.2.3:	Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. a. Factor a quadratic expression to reveal the zeros of the function it defines. b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines. c. Use the properties of exponents to transform expressions for exponential functions. *For example the expression can be rewritten as ≈ to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.* Remarks/Examples
	Algebra 1, Unit 4: It is important to balance conceptual understanding and procedural fluency in work with equivalent expressions. For example, development of skill in factoring and completing the square goes hand-in-hand with understanding what different forms of a quadratic expression reveal. **Algebra 1 Assessment Limits and Clarifications** i) Tasks have a real-world context. As described in the standard, there is an interplay between the mathematical structure of the expression and the structure of the situation such that choosing and producing an equivalent form of the expression reveals something about the situation. ii) Tasks are limited to exponential expressions with integer exponents. **Algebra 2 Assessment Limits and Clarifications** i) Tasks have a real-world context. As described in the standard,

	there is an interplay between the mathematical structure of the expression and the structure of the situation such that choosing and producing an equivalent form of the expression reveals something about the situation. ii) Tasks are limited to exponential expressions with rational or real exponents.
MACC.912.A-SSE.2.4:	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.*
MACC.912.F-BF.1.1:	Write a function that describes a relationship between two quantities. a. Determine an explicit expression, a recursive process, or steps for calculation from a context. 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.* c. Compose functions. *For example, if T(y) is the temperature in the atmosphere as a function of height, and h(t) is the height of a weather balloon as a function of time, then T(h(t)) is the temperature at the location of the weather balloon as a function of time.* Remarks/Examples
	Algebra 1, Unit 2: Limit to F.BF.1a, 1b, and 2 to linear and exponential functions. **Algebra 1, Unit 5**: Focus on situations that exhibit a quadratic relationship. **Algebra 1 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Tasks are limited to linear functions, quadratic functions, and exponential functions with domains in the integers.

	Algebra 2 Assessment Limits and Clarifications i) Tasks have a real-world context ii) Tasks may involve linear functions, quadratic functions, and exponential functions.
MACC.912.F-BF.1.2:	Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms. Remarks/Examples
	Algebra 1 Honors, Unit 4: In F.BF.2, connect arithmetic sequences to linear functions and geometric sequences to exponential functions. Algebra 2, Unit 3: In F.BF.2, connect arithmetic sequences to linear functions and geometric sequences to exponential functions. [Please note this standard is not included in the Algebra 1 course; the remarks should reference Algebra 1 Honors/Unit 4 and Algebra 2/Unit 3 Instructional Notes.]
MACC.912.F-BF.2.3:	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.* Remarks/Examples
	Algebra 1, Unit 2: Focus on vertical translations of graphs of linear and exponential functions. Relate the vertical translation of a linear function to its y-intercept. While applying other transformations to a linear graph is appropriate at this level, it may be difficult for students to identify or distinguish between the effects of the other transformations included in this standard. **Algebra 1, Unit 5**: For F.BF.3, focus on quadratic functions, and consider including absolute value functions.

	Algebra 1 Assessment Limit and Clarifications i) Identifying 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) is limited to linear and quadratic functions. ii) Experimenting with cases and illustrating an explanation of the effects on the graph using technology is limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers. iii) Tasks do not involve recognizing even and odd functions. The function types listed in note (ii) are the same as those listed in the Algebra I column for standards F-IF.4, F-IF.6, and F-IF.9. **Algebra 2 Assessment Limits and Clarifications** i) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions ii) Tasks may involve recognizing even and odd functions. The function types listed in note (i) are the same as those listed in the Algebra II column for standards F-IF.4, F-IF.6, and F-IF.9.
MACC.912.F-BF.2.4:	Find inverse functions. a. Solve an equation of the form f(x) = c for a simple function f that has an inverse and write an expression for the inverse. *For example, f(x) =2 x³ or f(x) = (x+1)/(x–1) for x ≠ 1.* b. Verify by composition that one function is the inverse of another. c. Read values of an inverse function from a graph or a table, given that the function has an inverse. d. Produce an invertible function from a non-invertible function by restricting the domain. Remarks/Examples Algebra 1 Honors, Unit 4: For F.BF.4a, focus on linear functions but consider simple situations where the domain of the function must be restricted in order for the inverse to exist, such as f(x) = x^2, x>0.

	Algebra 2, Unit 3: For F.BF.4a, focus on linear functions but consider simple situations where the domain of the function must be restricted in order for the inverse to exist, such as $f(x) = x^2$, x>0.
MACC.912.F-IF.1.1:	Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then f(x) denotes the output of f corresponding to the input x. The graph of f is the graph of the equation y = f(x). Remarks/Examples
	Algebra 1, Unit 2: Students should experience a variety of types of situations modeled by functions. Detailed analysis of any particular class of functions at this stage is not advised. Students should apply these concepts throughout their future mathematics courses. Draw examples from linear and exponential functions.
MACC.912.F-IF.1.2:	Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context. Remarks/Examples
	Algebra 1, Unit 2: Students should experience a variety of types of situations modeled by functions. Detailed analysis of any particular class of functions at this stage is not advised. Students should apply these concepts throughout their future mathematics courses. Draw examples from linear and exponential functions.
MACC.912.F-IF.1.3:	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. Remarks/Examples
	Algebra 1, Unit 2: In F.IF.3, draw connection to F.BF.2, which requires students to write arithmetic and geometric sequences. Emphasize arithmetic and geometric sequences as examples of linear and exponential functions. **Algebra 1 Assessment Limits and Clarifications**

	i) This standard is part of the Major work in Algebra I and will be assessed accordingly. **Algebra 2 Assessment Limits and Clarifications** i) This standard is Supporting work in Algebra II. This standard should support the Major work in F- BF.2 for coherence. **Algebra 2 - Fluency Recommendations** Fluency in translating between recursive definitions and closed forms is helpful when dealing with many problems involving sequences and series, with applications ranging from fitting functions to tables to problems in finance.
MACC.912.F-IF.2.4:	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.* Remarks/Examples **Algebra 1, Unit 2**: For F.IF.4 and 5, focus on linear and exponential functions. **Algebra 1 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Tasks are limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers. Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra I column for standards F-IF.6 and F-IF.9. **Algebra 2 Assessment Limits and Clarifications**

	i) Tasks have a real-world context ii) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions. Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra II column for standards F-IF.6 and F-IF.9.
MACC.912.F-IF.2.5:	Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.* Remarks/Examples
	Algebra 1, Unit 2: For F.IF.4 and 5, focus on linear and exponential functions.
MACC.912.F-IF.2.6:	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. Remarks/Examples
	Algebra 1, Unit 2: For F.IF.6, focus on linear functions and exponential functions whose domain is a subset of the integers. Unit 5 in this course and the Algebra II course address other types of functions. **Algebra 1 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Tasks are limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers. The function types listed here are the same as those listed in the Algebra I column for standards F-IF.4 and F-IF.9. **Algebra 2 Assessment Limits and Clarifications**

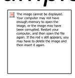
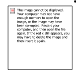
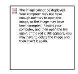
	i) Tasks have a real-world context. ii) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions. The function types listed here are the same as those listed in the Algebra II column for standards F-IF.4 and F-IF.9.
MACC.912.F-IF.3.7:	Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. a. Graph linear and quadratic functions and show intercepts, maxima, and minima. b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior. e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude. Remarks/Examples Algebra 1, Unit 2: For F.IF.7a, 7e, and 9 focus on linear and exponentials functions. Include comparisons of two functions presented algebraically. For example, compare the growth of two linear functions, or two exponential functions such as $y=3^n$ and $y=100^2$
MACC.912.F-IF.3.8:	Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. a. 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.

	b. Use the properties of exponents to interpret expressions for exponential functions. *For example, identify percent rate of change in functions such as y = , y = , y = , y = , and classify them as representing exponential growth or decay.* Remarks/Examples Algebra 1, Unit 5: Note that this unit, and in particular in F.IF.8b, extends the work begun in Unit 2 on exponential functions with integer exponents.
MACC.912.F-IF.3.9:	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.* Remarks/Examples **Algebra 1, Unit 2**: For F.IF.7a, 7e, and 9 focus on linear and exponentials functions. Include comparisons of two functions presented algebraically. For example, compare the growth of two linear functions, or two exponential functions such as $y=3^n$ and $y=100^2$ **Algebra 1, Unit 5**: For F.IF.9, focus on expanding the types of functions considered to include, linear, exponential, and quadratic. Extend work with quadratics to include the relationship between coefficients and roots, and that once roots are known, a quadratic equation can be factored. **Algebra 1 Assessment Limits and Clarifications** i) Tasks are limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers. The function types listed here are the same as those listed in the

	Algebra I column for standards F-IF.4 and F-IF.6. **Algebra 2 Assessment Limits and Clarifications** i) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions. The function types listed here are the same as those listed in the Algebra II column for standards F-IF.4 and F-IF.6.
MACC.912.F-LE.1.1:	Distinguish between situations that can be modeled with linear functions and with exponential functions. a. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals. b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.
MACC.912.F-LE.1.2:	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). Remarks/Examples **Algebra 1, Unit 2**: In constructing linear functions in F.LE.2, draw on and consolidate previous work in Grade 8 on finding equations for lines and linear functions (8.EE.6, 8.F.4). **Algebra 1 Assessment Limits and Clarifications** i) Tasks are limited to constructing linear and exponential functions in simple context (not multi- step). **Algebra 2 Assessment Limits and Clarifications** i) Tasks will include solving multi-step problems by constructing linear and exponential functions.

MACC.912.F-LE.1.3:	Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function. Remarks/Examples
	Algebra 1, Unit 2: For F.LE.3, limit to comparisons between linear and exponential models. Algebra 1, Unit 5: Compare linear and exponential growth to quadratic growth.
MACC.912.F-LE.2.5:	Interpret the parameters in a linear or exponential function in terms of a context. Remarks/Examples
	Algebra 1, Unit 2: Limit exponential functions to those of the form $f(x) = b^x + k$. **Algebra 1 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Exponential functions are limited to those with domains in the integers. **Algebra 2 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Tasks are limited to exponential functions with domains not in the integers.
MACC.912.N-Q.1.1:	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. Remarks/Examples
	Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions,

	equations, and functions.
MACC.912.N-Q.1.2:	Define appropriate quantities for the purpose of descriptive modeling. Remarks/Examples
	Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. **Algebra 1 Content Notes:** Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions. **Algebra 1 Assessment Limits and Clarifications** This standard will be assessed in Algebra I by ensuring that some modeling tasks (involving Algebra I content or securely held content from grades 6-8) require the student to create a quantity of interest in the situation being described (i.e., a quantity of interest is not selected for the student by the task). For example, in a situation involving data, the student might autonomously decide that a measure of center is a key variable in a situation, and then choose to work with the mean. **Algebra 2 Assessment Limits and Clarifications** This standard will be assessed in Algebra II by ensuring that some modeling tasks (involving Algebra II content or securely held content from previous grades and courses) require the student to create a quantity of interest in the situation being described (i.e., this is not provided in the task). For example, in a situation involving periodic phenomena, the student might autonomously decide that amplitude is a key variable in a situation, and then choose to work with peak amplitude.
MACC.912.N-Q.1.3:	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

	Remarks/Examples Algebra 1, Unit 1: Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions.
MACC.912.N-RN.1.1:	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*  *to be the cube root of 5 because we want*  =  *to hold, so*  *must equal 5.* Remarks/Examples Algebra 1, Unit 2: In implementing the standards in curriculum, these standards should occur before discussing exponential functions with continuous domains.
MACC.912.N-RN.1.2:	Rewrite expressions involving radicals and rational exponents using the properties of exponents. Remarks/Examples Algebra 1, Unit 2: In implementing the standards in curriculum, these standards should occur before discussing exponential functions with continuous domains.
MACC.912.N-RN.2.3:	Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational. Remarks/Examples Algebra 1 Unit 5: Connect N.RN.3 to physical situations, e.g., finding the perimeter of a square of area 2.
MACC.912.S-ID.1.1:	Represent data with plots on the real number line (dot plots, histograms, and box plots). Remarks/Examples In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points.

MACC.912.S-ID.1.2:	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. Remarks/Examples
	In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points.
MACC.912.S-ID.1.3:	Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers). Remarks/Examples
	In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points.
MACC.912.S-ID.1.4:	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.
MACC.912.S-ID.2.5:	Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.
MACC.912.S-ID.2.6:	Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. 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.* b. Informally assess the fit of a function by plotting and analyzing residuals. c. Fit a linear function for a scatter plot that suggests a linear

	association. Remarks/Examples
	Students take a more sophisticated look at using a linear function to model the relationship between two numerical variables. In addition to fitting a line to data, students assess how well the model fits by analyzing residuals. S.ID.6b should be focused on linear models, but may be used to preview quadratic functions in Unit 5 of this course. **Algebra 1 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Exponential functions are limited to those with domains in the integers. **Algebra 2 Assessment Limits and Clarifications** i) Tasks have a real-world context. ii) Tasks are limited to exponential functions with domains not in the integers and trigonometric functions.
MACC.912.S-ID.3.7:	Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data. Remarks/Examples
	Build on students' work with linear relationships in eighth grade and introduce the correlation coefficient. The focus here is on the computation and interpretation of the correlation coefficient as a measure of how well the data fit the relationship. The important distinction between a statistical relationship and a cause-and-effect relationship arises in S.ID.9.
MACC.912.S-ID.3.8:	Compute (using technology) and interpret the correlation coefficient of a linear fit. Remarks/Examples
	Build on students' work with linear relationships in eighth grade and introduce the correlation coefficient. The focus here is on the computation and interpretation of the correlation coefficient as a

	measure of how well the data fit the relationship. The important distinction between a statistical relationship and a cause-and-effect relationship arises in S.ID.9.
MACC.912.S-ID.3.9:	Distinguish between correlation and causation. Remarks/Examples
	Build on students' work with linear relationships in eighth grade and introduce the correlation coefficient. The focus here is on the computation and interpretation of the correlation coefficient as a measure of how well the data fit the relationship. The important distinction between a statistical relationship and a cause-and-effect relationship arises in S.ID.9.
MACC.K12.MP.1.1:	**Make sense of problems and persevere in solving them.** Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, "Does this make sense?" They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.
MACC.K12.MP.2.1:	**Reason abstractly and quantitatively**. Mathematically proficient students make sense of quantities and

	their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.
MACC.K12.MP.3.1:	**Construct viable arguments and critique the reasoning of others.** Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.
MACC.K12.MP.4.1:	**Model with mathematics.** Mathematically proficient students can apply the mathematics they

	know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

MACC.K12.MP.5.1:	**Use appropriate tools strategically.** Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.
MACC.K12.MP.6.1:	**Attend to precision.** Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.
MACC.K12.MP.7.1:	**Look for and make use of structure.** Mathematically proficient students look closely to discern a pattern

	or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see 7 × 8 equals the well remembered 7 × 5 + 7 × 3, in preparation for learning about the distributive property. In the expression $x^2 + 9x + 14$, older students can see the 14 as 2 × 7 and the 9 as 2 + 7. They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see $5 – 3(x – y)^2$ as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers x and y.
MACC.K12.MP.8.1:	**Look for and express regularity in repeated reasoning.** Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation $(y – 2)/(x – 1) = 3$. Noticing the regularity in the way terms cancel when expanding $(x – 1)(x + 1)$, $(x – 1)(x^2 + x + 1)$, and $(x – 1)(x^3 + x^2 + x + 1)$ might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.