Arizona College & Career Ready Standards Mathematics
High School — Algebra II *(Adopted 2010)*

Major and Supporting Clusters by Course

Not all of the content in a given grade is emphasized equally in the standards. Some clusters require greater emphasis than the others based on the depth of the ideas, the time that they take to master, and/or their importance to future mathematics or the demands of college and career readiness. In addition, an intense focus on the most critical material at each grade allows depth in learning, which is carried out through the Standards for Mathematical Practice.

To say that some things have greater emphasis is not to say that anything in the standards can safely be neglected in instruction. Neglecting material will leave gaps in student skill and understanding and may leave students unprepared for the challenges of a later grade. The following table identifies the Major Clusters, and Supporting Clusters for this grade.

~Achieve the Core

Arizona considers **Major Clusters** as groups of related standards that require greater focus than some of the others due to the depth of the ideas and the time it takes to master these groups of related standards.

Arizona considers **Supporting Clusters** as groups of related standards that support standards within the major clusters in and across grade levels. Supporting clusters also encompass pre-requisite knowledge and extensions of grade level and course content.

Based on the Publishers' Criteria and the critical areas highlighted at each grade level, Arizona suggests instructional time encompass a range of at least 65%-75% for Major clusters and a range of 25%-35% for Supporting cluster instruction.

★ Indicates modeling standards

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Algebra II Course Content Guidance

Course content indicated by: ● major content; ▲ supporting content. Numerals in parentheses designate individual content standards. Bolded numerals (e.g., **1**) indicate standards included in more than one course. See "Course Content Boundaries" table.

The Real Number System (N-RN)

● A. Extend the properties of exponents to rational exponents (1,2)

Quantities * (N-Q)

▲ A. Reason quantitatively and use units to solve problems

The Complex Number System (N-CN)

▲ A. Perform arithmetic operations with complex numbers (1, 2)

▲ B. Use complex numbers in polynomial identities and equations (7)

Seeing Structure in Expressions (A-SSE)

● A. Interpret the structure of expressions (**2**)

● B. Write expressions in equivalent forms to solve problems (**3**, 4)

Arithmetic with Polynomials and Rational Expressions (A-APR)

● A. Understand the relationship between zeros and factors of polynomials (2, **3**)

▲ B. Use polynomial identities to solve problems (4)

▲ C. Rewrite rational expressions (6)

Creating Equations * (A-CED)

● A. Create equations that describe numbers or relationships (**1**)

Reasoning with Equations and Inequalities (A-REI)

● A. Understand solving equations as a process of reasoning and explain the reasoning (**1**, 2)

▲ B. Solve equations and inequalities in one variable (**4**)

● C. Solve systems of equations (**6**, 7)

● D. Represent and solve equations and inequalities graphically (**11**)

Interpreting Functions (F-IF)

▲ A. Understand the concept of a function and use function notation (**3**)

● B. Interpret functions that arise in applications in terms of the context (**4**, **6**)

● C. Analyze functions using different representations (**7**, **8**, **9**)

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Building Functions (F-BF)

A. Build a function that models a relationship between two quantities (**1**, 2)

B. Build new functions from existing functions (**3**, 4a)

Linear, Quadratic, and Exponential Models ★ (F-LE)

A. Construct and compare linear, quadratic, and exponential models and solve problems (**2**, 4)

B. Interpret expressions for functions in terms of the situation they model. (**5**)

Trigonometric Functions (F-TF)

A. Extend the domain of trigonometric functions using the unit circle (1, 2)

B. Model periodic phenomena with trigonometric functions (5)

C. Prove and apply trigonometric identities (8)

Expressing Geometric Properties with Equations (G-GPE)

A. Translate between the geometric description and the equation for a conic section (2)

Interpreting Categorical and Quantitative Data (S-ID)

A. Summarize, represent, and interpret data on a single count or measurement variable (4)

B. Summarize, represent, and interpret data on two categorical and quantitative variables (**6**)

Making Inferences and Justifying Conclusions (S-IC)

A. Understand and evaluate random processes underlying statistical experiments (1, 2)

B. Make inferences and justify conclusions from sample surveys, experiments and observational studies (3, 4, 5, 6)

Conditional Probability and the Rules of Probability (S-CP)

A. Understand independence and conditional probability and use them to interpret data (1, 2, 3, 4, 5)

B. Use the rules of probability to compute probabilities of compound events in a uniform probability model (6, 7)

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COURSE CONTENT BOUNDARIES: AI-G-AII PATHWAY

Table 1. Course content boundary recommendations for standards included in more than one course.

AZCCRS-M Cluster	AZCCRS-M Code	AZCCRS-M Standard	Algebra I Course Content Boundaries	Algebra II Course Content Boundaries
Reason quantitatively and use units to solve problems.	N-Q	Define appropriate quantities for the purpose of descriptive modeling.	These standards are integrated throughout both the Algebra I and Algebra II course. Most notably in modeling tasks. 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.	These standards are integrated throughout both and Algebra I and Algebra II course. Most notably in modeling tasks. 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.
Interpret the structure of expressions.	A-SSE.A.2	Use the structure of an expression to identify ways to rewrite it. *For example, see $x^4 - y^4$ as $(x^2)^2 - (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 - y^2)(x^2 + y^2)$.*	Focus on numerical expressions and polynomial expressions in one variable. 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 $(a+7)(a+2)$.	Focus on polynomial, rational, or exponential expressions. 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 $1 + 1/(x^2 + 3)$.

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AZCCRS-M Cluster	AZCCRS-M Code	AZCCRS-M Standard	Algebra I Course Content Boundaries	Algebra II Course Content Boundaries
Write expressions in equivalent forms to solve problems.	A-SSE.B.3c	Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. ★ (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%.*	Include problem-solving opportunities utilizing 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. Focus on expressions with integer exponents.	Include problem-solving opportunities utilizing 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. Extend to include expressions with real number exponents.
Understand the relationship between zeros and factors of polynomials.	A-APR.B.3	Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.	Focus on quadratic and cubic polynomials in which linear and quadratic factors are available. For example, find the zeros of $(x - 2)(x^2 - 9)$.	Include quadratic, cubic, and quartic polynomials and polynomials for which factors are not provided. For example, find the zeros of $(x^2 - 1)(x^2 + 1)$.
Create equations that describe numbers or relationships.	A-CED.A.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.*	Focus on linear, quadratic, or exponential equations with integer exponents.	Extend to exponential equations with rational or real exponents and rational functions. Include problem-solving opportunities utilizing a real-world context.
Understand solving equations as a process of reasoning and explain the reasoning.	A-REI.A.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.	Focus on quadratic equations.	Extend to simple rational and radical equations.

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AZCCRS-M Cluster	AZCCRS-M Code	AZCCRS-M Standard	Algebra I Course Content Boundaries	Algebra II Course Content Boundaries
Solve equations and inequalities in one variable.	A-REI.B.4b	Solve quadratic equations in one variable. (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*.	Excluding solutions for quadratic equations that have roots with nonzero imaginary parts. However, include cases that recognize when 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).*	Include all solution cases. 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*.
Solve systems of equations.	A-REI.C.6	Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.	Include problem-solving opportunities utilizing a real-world context. Tasks have hallmarks of modeling as a mathematical practice (less defined tasks, more of the modeling cycle, etc.).	Include 3x3 systems.
Represent and solve equations and inequalities graphically.	A-REI.D.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. ★	Focus on the following function types: linear, quadratic, square root, cube root, exponential, and piece-wise. Focus on exponential functions with domains in the integers.	Include any of the function types mentioned in the standard. Extend to include all exponential functions.

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AZCCRS-M Cluster	AZCCRS-M Code	AZCCRS-M Standard	Algebra I Course Content Boundaries	Algebra II Course Content Boundaries
Understand the concept of a function and use function notation.	F-IF.A.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.*	This standard is part of the Major content in Algebra I.	This standard is Supporting content in Algebra II. This standard should support the Major work in F-BF.2 for coherence.
Interpret functions that arise in applications in terms of a context.	F-IF.B.4	For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.* ★	Include problem-solving opportunities utilizing a real-world context. Focus on the following function types: linear, quadratic, square root, cube root, exponential, and piecewise-defined (including step functions and absolute value functions. Focus on 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.6, F-IF.7, and F-IF.9.*	Include problem-solving opportunities utilizing a real-world context. Function types extend to include polynomial, radical, logarithmic, simple rational, and trigonometric. Extend to include all exponential functions. *The function types listed here are the same as those listed in the Algebra II column for standards F-IF.6, F-IF.7, and F-IF.9.*

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Table 1. Course content boundary recommendations for standards included in more than one course.

AZCCRS-M Cluster	AZCCRS-M Code	AZCCRS-M Standard	Algebra I Course Content Boundaries	Algebra II Course Content Boundaries
Interpret functions that arise in applications in terms of a context.	F-IF.B.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. ★	Include problem-solving opportunities utilizing a real-world context. Focus on the following function types: linear, quadratic, square root, cube root, exponential, and piecewise-defined (including step functions and absolute value functions. Focus on 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.6, F-IF.7, and F-IF.9.*	Include problem-solving opportunities utilizing a real-world context. Function types extend to include polynomial, radical, logarithmic, simple rational, and trigonometric. Extend to include all exponential functions. *The function types listed here are the same as those listed in the Algebra II column for standards F-IF.6, F-IF.7, and F-IF.9.*

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AZCCRS-M Cluster	AZCCRS-M Code	AZCCRS-M Standard	Algebra I Course Content Boundaries	Algebra II Course Content Boundaries
	F-IF.C.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. (e) Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.	Include problem-solving opportunities utilizing a real-world context. Focus on the following function types: linear, quadratic, square root, cube root, exponential, and piecewise-defined (including step functions and absolute value functions. Focus on 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.6, F-IF.7, and F-IF.9.*	Include problem-solving opportunities utilizing a real-world context. Function types extend to include polynomial, radical, logarithmic, simple rational, and trigonometric. Extend to include all exponential functions. *The function types listed here are the same as those listed in the Algebra II column for standards F-IF.6, F-IF.7, and F-IF.9.*
Analyze functions using different representations.	F-IF.C.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.*	Include problem-solving opportunities utilizing a real-world context. Focus on the following function types: linear, quadratic, square root, cube root, exponential, and piecewise-defined (including step functions and absolute value functions. Focus on exponential functions with domains in the integers.	Include problem-solving opportunities utilizing a real-world context. Function types extend to include polynomial, radical, logarithmic, simple rational, and trigonometric. Extend to include all exponential functions.

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AZCCRS-M Cluster	AZCCRS-M Code	AZCCRS-M Standard	Algebra I Course Content Boundaries	Algebra II Course Content Boundaries
Build a function that models a relationship between two quantities.	F-BF.A.1a	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.	Include problem-solving opportunities utilizing a real-world context. Focus on the following function types: linear, quadratic, square root, cube root, exponential, and piecewise-defined (including step functions and absolute value functions. Focus on exponential functions with domains in the integers.	Include problem-solving opportunities utilizing a real-world context. Function types extend to include polynomial, radical, logarithmic, simple rational, and trigonometric. Extend to include all exponential functions.
Build new functions from existing functions.	F-BF.A.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.*	Focus on the following function types: linear, quadratic, square root, cube root, exponential, and piecewise-defined (including step functions and absolute value functions. Focus on exponential functions with domains in the integers.	Function types extend to include polynomial, radical, logarithmic, simple rational, and trigonometric. Extend to include all exponential functions.
Construct and compare linear, quadratic, and exponential models and solve problems.	F-LE.A.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).	Focus on constructing linear and exponential functions in simple contexts (not multi-step).	Extend to include solving multi-step problems by constructing linear and exponential functions.

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Interpret expressions for functions in terms of the situation they model.	F-LE.B.5	Interpret the parameters in a linear or exponential function in terms of a context.	Include problem-solving opportunities utilizing a real-world context. Focus on exponential functions with domains in the integers.	Include problem-solving opportunities utilizing a real-world context. Extend to all exponential functions.
Summarize, represent, and interpret data on two categorical and quantitative variables.	S-ID.B.6a	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.*	Include problem-solving opportunities utilizing a real-world context. Focus on exponential functions with domains in the integers.	Include problem-solving opportunities utilizing a real-world context. Extend to include all exponential functions.