

# Algebra 2

## Radicals and Complex Numbers **RC**

### Radical Expressions and Rational Exponents: Students apply properties to radical expressions and rational exponents.

- 1 Explain how extending the properties of integer exponents to rational exponents provides an alternative notation for radicals. **A2.RC.1**
- 2 Apply the properties of exponents to translate between radical and exponential forms of expressions. **A2.RC.2**
- 3 Simplify and perform operations with radical expressions with and without variables; rationalizing denominators should include conjugates. **A2.RC.3**

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### Complex Numbers: Students apply properties to complex numbers.

- 4 Know there is a complex number  $i$  and describe contexts from which complex numbers appear. **A2.RC.4**
- 5 Perform the operations of addition, subtraction, multiplication, and conjugation of complex numbers. **A2.RC.5**
- 6 Use polynomial identities with complex numbers. **A2.RC.6**

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## Functions **FN**

### Compositions: Students compose and compare functions.

- 1 Combine functions by addition, subtraction, multiplication, division, and composition to model the relationship between two quantities in mathematical and real-world contexts. **A2.FN.1**

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### Transformations: Students perform transformations in the coordinate plane.

- 2 Decide if a function is even or odd from a graph or an algebraic expression. **A2.FN.2**
- 3 Explain how restricting the domain of a function allows the creation of its inverse. **A2.FN.3**
- 4 Write and graph the inverse of a given function; understand that the graph of an inverse function is a reflection of the function over the line  $y = x$ . **A2.FN.4**

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## Linear Functions and Equations **LFE**

### Arithmetic Sequences: Students use arithmetic sequences to model problems.

- 1 Write and use arithmetic sequences recursively and explicitly to model situations; translate between the two forms when given a graph, a description of the relationship, or two input-output pairs. **A2.LFE.1**

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**Matrices: Students perform operations and matrices.**

- 2 Multiply a matrix by a scalar. [A2.LFE.2](#)
  - 3 Add and subtract matrices. [A2.LFE.3](#)
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**Systems of Equations: Students solve systems of equations.**

- 4 Solve systems of linear equations in three variables using matrices; use Gaussian elimination or technology. [A2.LFE.4](#)
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**Quadratic Functions,  
Equations and  
Inequalities** [QFE](#)

**Create & Solve: Students create and solve problems that model quadratic relationships.**

- 1 Calculate and interpret the average rate of change of a quadratic function represented in a table, graph, or as an equation in the context of mathematical and real-world problems. [A2.QFE.1](#)
  - 2 Solve quadratic equations with complex number solutions. [A2.QFE.2](#)
  - 3 Represent and solve real-world problems using quadratic inequalities. [A2.QFE.3](#)
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**Graph & Key Features: Students graph and interpret key features of equations that model quadratic relationships.**

- 4 Use the discriminant to determine the number and type of solutions of a quadratic equation. [A2.QFE.4](#)
  - 5 Sketch the graph of a quadratic function given a verbal description and show key features. [A2.QFE.5](#)
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**Systems of Equations: Students solve systems of equations.**

- 6 Solve a system of equations consisting of a linear equation and a nonlinear equation in two variables by choosing substitution or graphically (with or without technology) as appropriate for the system of equations. [A2.QFE.6](#)
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**Exponential &  
Logarithmic Functions &  
Equations**

**Create & Solve: Students create and solve problems that model exponential and logarithmic relationships.**

- 1 Use the properties of exponents to find equivalent expressions and to solve equations, including those involving rational exponents. [A2.ELF.1](#)
- 2 Write and solve equations from real-world problems that can be represented as a logarithmic or exponential function in one variable. [A2.ELF.2](#)
- 3 Write exponential equations that model the relationship between two quantities when given a graph, a written description, or a table of values within a mathematical or real-world context. [A2.ELF.3](#)
- 4 Write and use geometric sequences recursively and explicitly to model situations; translate between the two forms when given a graph, a description of the relationship, or two input-output pairs. [A2.ELF.4](#)

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**Logarithms: Students define and use logarithms.**

- 5 Translate between logarithmic and exponential forms of an equation. [A2.ELF.5](#)
- 6 Use properties of logarithms to simplify and evaluate logarithmic expressions, with or without technology. [A2.ELF.6](#)
- 7 Use the inverse relationship between exponents and logarithms to solve problems. [A2.ELF.7](#)

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**Graph & Key Features: Students graph and interpret key features of exponential and logarithmic models.**

- 8 Determine the domain and range of logarithmic functions in mathematical problems. [A2.ELF.8](#)
  - 9 Determine reasonable domain and range values of logarithmic functions representing real-world situations, both continuous and discrete; interpret the solution as reasonable or unreasonable in context. [A2.ELF.9](#)
  - 10 Sketch the graph of an exponential function given a verbal description and show key features. [A2.ELF.10](#)
  - 11 Calculate and interpret the average rate of change of an exponential function represented in a table, graph, or as an equation in the context of mathematical and real-world problems. [A2.ELF.11](#)
  - 12 Graph exponential and logarithmic functions with and without context, identifying key features, and determining constraints in a given context. [A2.ELF.12](#)
  - 13 Graph and generalize the effect of transformations on exponential and logarithmic functions. [A2.ELF.13](#)
    - a Transformations include: stretches, compressions, vertical shifts, and horizontal shifts [A2.ELF.13.A](#)
  - 14 Given the graphs of exponential and logarithmic functions, explain the effects of the transformation from the parent function. [A2.ELF.14](#)
    - a Exponentials:  $y = ab^x$ ,  $a \neq 0$ ,  $b > 0$ , and  $b \neq 1$  [A2.ELF.14.A](#)
    - b Logarithms:  $y = \log_b(x)$ ,  $b > 0$ ,  $x > 0$  and  $b \neq 1$  [A2.ELF.14.B](#)
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## Polynomial, Rational, & Other Functions & Equations PRF

### Create & Solve: Students create and solve rational and polynomial equations.

- 1 Write and solve equations from real-world problems that can be represented as a rational or square root function in one variable. [A2.PRF.1](#)
- 2 Solve non-linear formulas for a specified variable. [A2.PRF.2](#)
- 3 Find zeros of polynomial functions with a degree of 3 or higher when suitable factorizations are available in a real-world and mathematical context. [A2.PRF.3](#)
- 4 Use zeros and an understanding of multiplicity to sketch a graph of a polynomial function with a degree of 3 or higher. [A2.PRF.4](#)
- 5 Apply the Fundamental Theorem of Algebra to determine the number and potential types of roots of polynomial functions based on the degree of the polynomial. [A2.PRF.5](#)
- 6 Solve rational and radical equations containing one variable specifying extraneous solutions. [A2.PRF.6](#)

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### Graph & Key Features: Students graph and identify key features of functions.

- 7 Determine the domain and range of polynomial and rational functions in mathematical problems. [A2.PRF.7](#)
- 8 Determine reasonable domain and range values of polynomial and rational functions representing real-world situations, both continuous and discrete; interpret the solution as reasonable or unreasonable in context. [A2.PRF.8](#)
- 9 Interpret the key features of polynomial functions that model a relationship between two quantities in a given context; translate between different representations of the function, especially graphs, tables, and equations. [A2.PRF.9](#)
- 10 Sketch the graph of a polynomial function given a verbal description and show key features. [A2.PRF.10](#)
- 11 Calculate and interpret the average rate of change of polynomial functions represented in a table, graph, or as an equation in context of mathematical and real-world problems. [A2.PRF.11](#)
- 12 Graph functions with and without context, identifying key features and determining constraints in a given context. [A2.PRF.12](#)
  - a Functions include: polynomial, rational, square root, and piecewise-defined [A2.PRF.12.A](#)
- 13 Graph and generalize the effect of transformations on square root, cubic, and rational functions. [A2.PRF.13](#)
  - a Transformations include: stretches, compressions, vertical shifts, and horizontal shifts [A2.PRF.13.A](#)
- 14 Given a graph, explain the effects of the transformation from the parent function. [A2.PRF.14](#)
  - a Square Roots:  $y = \sqrt{\phantom{x}}$  [A2.PRF.14.A](#)
  - b Cubics:  $y = x^3$  [A2.PRF.14.B](#)
  - c Rationals:  $y = \frac{1}{\phantom{x}}$  [A2.PRF.14.C](#)

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**Factor Polynomials: Students factor polynomials.**

- 15 Apply the Remainder Theorem to factor and create equivalent forms of polynomial functions. [A2.PRF.15](#)
- 16 Verify polynomial identities and use them to describe numerical relationships. [A2.PRF.16](#)

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**Rational Expressions: Students perform operations on rational expressions.**

- 17 Apply understanding of rational number operations to add, subtract, multiply, and divide by nonzero rational expressions. [A2.PRF.17](#)
- 18 Rewrite simple rational expressions in different forms. [A2.PRF.18](#)
- 19 Divide polynomial expressions using inspection, long division, and synthetic division, with and without a remainder. [A2.PRF.19](#)

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**Systems of Equations: Students solve systems of equations.**

- 20 Explain why a solution to the equation  $f(x) = g(x)$  is the  $x$ -coordinate where the  $y$ -coordinate of  $f(x)$  and  $g(x)$  are the same using graphs, tables, or approximations. [A2.PRF.20](#)
  - a Include cases where  $f(x)$  and/or  $g(x)$  are linear, polynomial, exponential, logarithmic, or rational and where at least one of the functions is not linear. [A2.PRF.20.A](#)

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**Statistics &  
Probability** SP**Statistical Experiments & Studies: Students evaluate processes for statistical experiments, make inferences, and justify conclusions from statistical studies.**

- 1 Use data from a random sample to make inferences about a population. [A2.SP.1](#)
- 2 Compare theoretical and empirical probabilities using simulations. [A2.SP.2](#)
- 3 Distinguish between sample surveys, experiments, and observational studies and explain the purpose of randomization in statistical studies. [A2.SP.3](#)
- 4 Read and explain, in context, the validity of data from outside reports by: [A2.SP.4](#)
  - a Identifying the variables as quantitative or categorical. [A2.SP.4.A](#)
  - b Describing how the data was collected. [A2.SP.4.B](#)
  - c Indicating any potential biases or flaws. [A2.SP.4.C](#)
  - d Identifying inferences the author of the report made from sample data. [A2.SP.4.D](#)