Algebra 2 Big Ideas

Algebra 2 students learn to use and understand the following five fundamental concepts:

1. Simplify expressions
2. Solve equations
3. Use numerical representations
4. Use graphical representations
5. Algebraic notation

Through the topics presented in this course students solidify understandings introduced in Algebra 1 and extend these concepts. In addition, several new topics are introduced. A student completing both Algebra 1and Algebra 2 should be confident and competent in using algebra to represent and analyze real situations.

The following matrix lists topics covered in Algebra 2 and is designed to show flow of understanding for students as they progress from other math classes to this course. The two columns following each big idea detail how this topic should be covered. "Solidify" indicates students have seen this concept in a previous course (see Algebra 1 and Geometry outlines); it is not intended to be an exhaustive list of all topics previously covered. These concepts may need to be reviewed and should be used throughout the course so that students have mastery by the end of this class. "Develop" indicates new aspects of the big idea presented in this course and it is expected that students successfully completing Algebra 2 will have facility with these new topics. The USOE Core is linked to big ideas and sub topics, and should be referenced for clarification of concepts. In addition, a blank column is included for textbook alignment. It is suggested that each school match this curriculum with their text book and other instructional resources for alignment.

Indicators have been created in outline form for each "develop" topic and are included as an attachment to this document. These indicators provide clarification for each topic.

Big Idea	Solidify	Develop	State Core Correlation	Textbook Alignment
Number Systems	• Identify subsets of real number system	• Define imaginary and complex numbers	• 1.3.b	
		• Add, subtract, multiply, and divide complex numbers	• 1.3.b	
Exponents	• Use laws of exponents including zero exponent • Scientific notation	• Simplify algebraic expressions involving rational and negative exponents	• 1.1.e	
		• Simplify numerical expressions, including those with rational exponents	• 1.1.e	
Linear Functions	• Represent linear relationships using tables, graphs, equations, and stories • Define absolute value	• Solve absolute value equations algebraically and graphically	• 1.1.a	
		• Graph absolute value equations including using transformations.	• 3.1.b, 3.1.c	
Quadratic Functions	• Recognize non-linearity algebraically, numerically, or graphically • Write and graph equation of circles in standard form • Multiply polynomials • Factor (leading coefficient = 1)	• Model real-world situation using quadratic equations	• 1.4.a	
		• Factor quadratics (include by grouping) with real coefficients including special cases	• 1.4.c	
		• Solve quadratic equations of a single variable over the set of complex numbers (factoring, completing the square, quadratic formula, graphically)	• 1.4.b, 1.4.c	
		• Write the equation of a parabola in form $y = a(x-h)^2 + k$ when given a graph	• 3.1.d	
		• Graph quadratic equations by identifying transformations and identify vertex, intercepts, and axis of symmetry.	• 3.1.b, 3.1.c	
		• Connect roots, zeros, solutions, and x-intercepts		
		• Write possible quadratic equations when given the solutions of an equation	• 1.4.e	

Radicals Expressions and Functions	• Connect radicals with rational exponents • Simplify radicals involving numerical values	• Solve radical equations algebraically, numerically, and graphically including consideration of extraneous roots	• 1.1.b	
		• Graph radical functions including using transformations	• 3.1.b, 3.1.c	
		• Simplify expressions with radicals involving variables and exponents.	• 1.1.e	
		• Use radicals with indices other than 2	• 1.1.e	
Rational Expressions and Functions	• Solve ratios and equations with rational coefficients $\left(\frac{1}{3}x+\frac{7}{8}=4\right)$	• Simplify rational expressions with variables in numerator and denominator	• 1.1.d	
		• Add, subtract, multiply, and divide rational expressions	• 1.1.d	
		• Solve rational equations algebraically, numerically, and graphically including those with extraneous solutions.	• 1.1.d	
Functions	• Use input/output tables, graphs, and terminology	• Model real-world relationships with functions	• 2.1.a	
		• Describe a pattern using function notation	• 2.1.b	
		• Find the value of a function at a given point	• 2.2.a	
		• Determine when a relation is a function	• 2.1.c	
		• Determine domain/range of relations (absolute value, quadratic, radical, sine, cosine, exponential, logarithmic, composition, and combinations) from ordered pairs, table, algebraic representation, or graph	• 2.1.d, 2.2.e, 3.1.a	
		• Determine whether or not a function has an inverse, and find the inverse when it exists (one-to-one)	• 2.2.d	
		• Use composition and combination of functions	• 2.2.b, 2.2.c	
Exponential and Logarithmic Functions		• Define exponential functions as functions of the form $y = ab^x$, $b > 0$, $b \neq 0$ including natural base e	• 2.3.a	
		• Model problems of growth and decay using exponential and logarithmic functions	• 2.3.b, 2.4.f	

		• Graph exponential and logarithmic functions	• 2.3.c, 2.4.e	
		• Relate logarithmic and exponential functions	• 2.4.a	
		• Convert logarithms between bases	• 2.4.c	
		• Solve exponential and logarithmic equations	• 2.4.d	
Data, Statistics, and Probability	• Regression line • Fundamental counting principle • Calculate simple probabilities	• Identify the difference between a permutation and a combination.	• 4.1.a	
		• Calculate probabilities using permutations and combinations to count events	• 4.1.b	
		• Compute conditional and unconditional probabilities in various ways, including by definitions, the general multiplication rule, and probability trees	• 4.1.c	
		• Define simple discrete random variables	• 4.1.d	
		• Compute different measures of spread, including the range, standard deviation, and interquartile range.	• 4.2.a	
		• Compare the effectiveness of different measures of spread, including the range, standard deviation, and interquartile range in specific situations	• 4.2.b	
		• Use percentiles to summarize the distribution of a numerical variable	• 4.2.c	
		• Use histograms to obtain percentiles	• 4.2.d	
Inequalities	• Solve and graph inequalities • Solve and graph compound inequalities of a single variable	• Solve absolute value and quadratic inequalities (algebraically, numerically, and graphically) using interval notation	• 1.1.c, 1.4.d	
		• Solve systems of linear inequalities (linear programming)	• 1.2.c	
Systems of Equations	• Solve systems of two linear equations (algebraically, data tables, and graphically)	• Solve systems of linear, absolute value, and quadratic equations algebraically and graphically and graph their solutions.	• 1.2.a, 1.2.b	
		• Solve application problems involving systems of equations and inequalities (i.e. linear programming)	• 1.2.c	

Trigonometry	• Use right triangle definition of trigonometric functions	• Use radians as measurement of angle (including converting from degrees to radians)	• 3.2.a	
		• Graph sine and cosine functions including transformations to graphs (amplitude, period, phase shift, vertical shift, and reflections)	• 3.1.b, 3.1.c	
		• Find exact values for sine, cosine, and tangent of familiar angles	• 3.2.b	
		• Use the sine and cosine graphs to solve real problems		
		• Find the arc length and sector area using radian measure	• 3.3.c, 3.3.d	
		• Define and determine the exact values of the sine, cosine, and tangent functions using the units circle.	• 3.3.a, 3.3.b	
		• Find angle measures in degrees and radians using inverse trigonometric functions including exact values for special triangles.	• 3.2.b	