Algebra 2 (#9260)

Description In this course, students will revisit key concepts from Algebra 1, Geometry, and other mathematics courses, building upon students' prior knowledge to develop more advanced understanding of algebraic relationships. Emphasis will be placed upon multiple representations of functions (algebraic, graphic, tabular, and descriptive) and application of those functions in a variety of situations. Students who need reinforcement of Algebra concepts are strongly encouraged to take this course before taking Advanced Algebra 2 for Pre-Calculus or College Prep Mathematics. Students will also explore and strengthen mathematical concepts specifically selected for university and technical college preparation.

Credits 1

Prerequisites Algebra 1 or Algebra 1A & 1B, and Geometry

Textbooks/Resources Larson, R. and Boswell, L. *Big Ideas Math Algebra 2.* Big Ideas Learning, 2015. (ISBN 9781608408405)

Required Assessments

District-wide, standards-based assessments

Board Approved

May 1997

Revised

May 2006; August 2015

AASD Mathematics Goals for K-12 Students

- *Become mathematical problem solvers.*
- *Learn to reason mathematically.*
- *Learn to communicate mathematically.*
- *Make mathematical connections.*
- *Develop conceptual understanding of mathematics.*
- *Develop procedural fluency.*
- *Learn to use technology appropriately.*

AASD Mathematics Standards for Students in Algebra 2

Mathematical Practice Standards

Make sense of problems and persevere in solving them.
Reason abstractly and quantitatively.
Construct viable arguments and critique the reasoning of others.
Model with mathematics.
Use appropriate tools strategically.
Attend to precision.
Look for and make use of structure.
Look for and express regularity in repeated reasoning.

Mathematics Content Standards	
Domain	***Cluster***
I. Number and Quantity – The Complex Number System	A. Perform arithmetic operations with complex numbers B. Use complex numbers in polynomial identities and equations.
II. Algebra – Seeing Structure in Expressions	A. Interpret structure of expressions. B. Write expressions in equivalent forms to solve problems
III. Algebra – Arithmetic with Polynomial and Rational Expressions	A. Perform arithmetic operations on polynomials. B. Understand the relationship between zeros and factors of polynomials C. Use polynomial identities to solve problems. D. Rewrite rational expressions.
IV. Algebra – Creating Equations	A. Create equations that describe numbers or relationships
V. Algebra – Reasoning with Equations and Inequalities	A. Understand solving equations as a process of reasoning and explain the reasoning. B. Represent and solve equations and inequalities graphically.
VI. Functions – Interpreting Functions	A. Interpret functions that arise in applications in terms of a context B. Analyze functions using different representations.
VII. Functions – Building Functions	A. Build a function that models a relationship between two quantities. B. Build new functions from existing functions.
VIII. Functions – Linear, Quadratic, and Exponential Models	A. Construct and compare linear, quadratic, and exponential models and solve problems.
IX. Statistics and Probability – Interpreting Categorical and Quantitative Data	A. Summarize, represent, and interpret data on a single count it measurement variable.

★ **Modeling**	Modeling links classroom mathematics and statistics to everyday life, work, and decision-making. Modeling is the process of choosing and using appropriate mathematics and statistics to analyze empirical situations, to understand them better, and to improve decisions. Modeling is best interpreted not as a collection of isolated topics, but rather in relation to other standards, so specific modeling standards are integrated throughout the standards for this course as indicated by a star symbol (*).

(+) High school standards that support advanced coursework

Essential Learning Objectives	Performance Indicators	Classroom Assessments
1. Develop deep conceptual understanding of mathematics by engaging in age-appropriate mathematical habits.	**Performance will be satisfactory when the student:** a. makes sense of problems and perseveres in solving them. b. reasons abstractly and quantitatively. c. constructs viable arguments and critiques the reasoning of others. d. models with mathematics. e. uses appropriate tools strategically. f. attends to precision. g. looks for and makes use of structure. h. looks for and expresses regularity in repeated reasoning.	• Unit Assessment
Objectives are linked to the Mathematical Practice Standards.		
2. Identify complex numbers in polynomial functions and (+) perform arithmetic operations with complex numbers	**Performance will be satisfactory when the student:** a. knows there is a complex number *i* such that $i^2 = -1$. (N.CN.1) b. (+) uses the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers. (N.CN.2 – Optional)	• Unit Assessment
Objectives are linked to the following AASD Mathematics Domains: I. The Complex Number System		
3. Interpret the structure of expressions	**Performance will be satisfactory when the student:** a. interprets expressions that represent a quantity in terms of its context.★ (A.SSE.1) b. uses 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 $(x^2 - y^2)(x^2 + y^2)$.* (A.SSE.2)	• Unit Assessment
Objectives are linked to the following AASD Mathematics Domains: II. Seeing Structure in Expressions		

Essential Learning Objectives	Performance Indicators	Classroom Assessments
4. Perform arithmetic operations on polynomials and use polynomial identities to solve problems.	**Performance will be satisfactory when the student:** a. understands 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. (A.APR.1) b. identifies zeros of polynomials when suitable factorizations are available, and uses the zeros to construct a rough graph of the function defined by the polynomial. (A.APR.3) c. rewrites simple rational expressions in different forms; writes $^{a(x)}/_{b(x)}$ 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. (A.APR.6) d. (+) knows and applies 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 $p(x)$. (A.APR.2 – Optional) e. (+) proves polynomial identities and uses 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.*(A.APR.4 – Optional)	• Unit Assessment
Objectives are linked to the following AASD Mathematics Domains: III. Arithmetic with Polynomial and Rational Expressions		

Essential Learning Objectives	Performance Indicators	Classroom Assessments
5. Analyze functions using different representations and use these various representations to solve equations and inequalities.	**Performance will be satisfactory when the student:** a. solves simple rational and radical equations in one variable, and gives examples showing how extraneous solutions may arise. (A.REI.2) b. explains 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 $f(x) = g(x)$; finds the solutions approximately, e.g., using technology to graph the functions, makes tables of values, or finds successive approximations. Includes cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, and exponential.★ (A.REI.11) c. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.★ (F.IF.7))	• Unit Assessment
Objectives are linked to the following AASD Mathematics Domains: V. Reasoning with Equations and Inequalities; VI. Interpreting Functions		
6. Graph, interpret, and compare graphs and equations of functions.	**Performance will be satisfactory when the student:** a. for a function that models a relationship between two quantities, interprets key features of graphs and tables in terms of the quantities, and sketches 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*.★ (F.IF.4) b. relates 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.*★ (F.IF.5) c. calculates and interprets the average rate of change of a	• Unit Assessment

6. Graph, interpret, and compare graphs and equations of functions. *(Continued)*	function (presented symbolically or as a table) over a specified interval. Estimates the rate of change from a graph.★ (F.IF.6) d. graphs functions expressed symbolically and shows key features of the graph, by hand in simple cases and using technology for more complicated cases.★ (F.IF.7) 1. Graph linear and quadratic functions and show intercepts, maxima, and minima. (F.IF.7a) 2. Graph square root, exponential, and absolute value functions. (F.IF.7b,) 3. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. (F.IF.7c) 4. (+) Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior. (F.IF.7d – Optional – only exposure is expected for rational functions) 5. (+) Graph logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude. (F.IF.7e – Optional) e. writes a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. (F.IF.8) f. compares 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.* (F.IF.9)	
Objectives are linked to the following AASD Mathematics Domains: VI. Interpreting Functions		

Essential Learning Objectives	Performance Indicators	Classroom Assessments
7. Write and compare equations (linear, quadratic, exponential) in order to solve problems.	**Performance will be satisfactory when the student:** a. creates equations and inequalities in one variable and uses them to solve problems. *Include equations arising from linear and quadratic functions, and simple rational and exponential functions.*(A.CED.1) b. creates equations in two or more variables to represent relationships between quantities; graphs equations on coordinate axes with labels and scales.(A.CED.2) c. represents constraints by equations or inequalities, and by systems of equations and/or inequalities, and interprets solutions as viable or nonviable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.* (A.CED.3) d. rearranges 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.* (A.CED.4) e. write a function that describes a relationship between two quantities.★ (F.BF.1) 1. Determine an explicit expression, a recursive process, or steps for calculation from a context. (F.BF.1a) 2. 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.* (F.BF.1b) 3. (+) 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.* (F.BF.1c - Optionl) f. (+) for exponential models, expresses 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*; evaluates the logarithm using technology.(F.LE.4 – Optional – for exposure in the context of UNDOING exponential)	• Unit Assessment

Objectives are linked to the following AASD Mathematics Domains:
IV. Creating Equations; VII. Building Functions; VIII. Linear, Quadratic and Exponential Models

Essential Learning Objectives	Performance Indicators	Classroom Assessments
8. Build new functions from existing functions.	**Performance will be satisfactory when the student:** a. identifies 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); finds 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. (F.BF.3) b. finds inverse functions. 1. 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 $x \neq 1$.* (F.BF.4a)	
Objectives are linked to the following AASD Mathematics Domains: VII. Building Functions		

Essential Learning Objectives	Performance Indicators	Classroom Assessments
9. Through statistical analysis summarize, represent, and interpret data as well as make inferences and justify conclusions.	**Performance will be satisfactory when the student:** a. uses 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. (S.ID.4) b. understands statistics as a process for making inferences about population parameters based on a random sample from that population. (S.IC.1) c. decides 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?* (S.IC.2) d. recognizes the purposes of and differences among sample surveys, experiments, and observational studies; explains how randomization relates to each. (S.IC.3) e. uses data from a sample survey to estimate a population mean or proportion; develops a margin of error through the use of simulation models for random sampling.(S.IC.4) f. uses data from a randomized experiment to compare two treatments; uses simulations to decide if differences between parameters are significant. (S.IC.5) g. evaluates reports based on data.(S.IC.6)	
Objectives are linked to the following AASD Mathematics Domains: IX. Interpreting Categorical and Quantitative Data		

Note: If time permits, cover Logarithms and then Conic Sections.

Resources and learning activities that address course objectives: