ANALYTICAL ALGEBRA II

The Process Standards demonstrate the ways in which students should develop conceptual understanding of mathematical content, and the ways in which students should synthesize and apply mathematical skills.

Analytical Algebra II should focus on the application of mathematics in various disciplines including business, finance, science, career and technical education, and social sciences. This course covers most of the traditional Algebra II standards, but the focus is on the application of algebraic concepts rather than theoretical concepts.

Building on previous work with linear, quadratic, and exponential functions, Analytical Algebra II should extend to include polynomial, rational, radical, logarithmic, and other functions. Students should be able to model real-world problems with various functions using and translating between multiple representations. Additionally, students should be able to interpret key features of function models within a given context. Students should also build on previous work done with data analysis, statistics, including univariate and bivariate data, and probability.

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Guiding Principle: Data analysis, statistics, and probability content should be included throughout the course, as students collect and use univariate and bivariate data to create and interpret mathematical models. They should be able to make inferences and justify conclusions from various experimental and survey data, and develop a basic understanding of the structure of a good study, the biases that might exist, and the importance of randomization.

Data Analysis, Statistics, and Probability	AA.DSP.1: Make inferences and justify conclusions from sample surveys, experiments, and observational studies. Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization and possible sources of bias relate to each.
	AA.DSP.2: Choose, create, and critique, with technology, mathematical models (linear, quadratic and exponential) for bivariate data sets. Use the models to interpolate and/or extrapolate, to answer questions, and to draw conclusions or make decisions, addressing limitations and long-term ramifications. Recognize when a change in model is needed. Interpret the correlation coefficient for linear models.
	AA.DSP.3: Read, interpret, and make decisions about data summarized numerically using measures of center and spread, in tables, and in graphical displays (line graphs, bar graphs, scatterplots, and histograms), e.g., explain why the mean may not represent a typical salary; critique a graphical display by recognizing that the choice of scale can distort information.
	AA.DSP.4: Analyze and compare univariate data of two or more different data sets using measures of center (mean, median, and mode), shape, and spread (range, interquartile range, standard deviation, percentiles, and variance) making use of technology. Understand the effects of outliers on the statistical summary of the data.
	AA.DSP.5: Record multiple observations (or simulated samples) of random events and construct empirical models of the probability distributions. Construct a theoretical model and apply the law of large numbers to show the relationship between the two models.

	AA.DSP.6: Evaluate the validity of claims based on empirical probabilities and theoretical probabilities, including those derived from dependent and independent events. Draw conclusions and make decisions in various probabilistic contexts. Make use of different representations of data including two-way tables and tree diagrams.
	AA.DSP.7: Determine the nature and number of elements in a finite sample space to model the outcomes of real-world events using the multiplication counting principle, permutations, and combinations.
Guiding Principle: Extending from work with linear functions in Algebra I, this content should include work with arithmetic sequences and series, understanding the relationship to linear functions. Additionally, students should solidify their understanding of systems of equations. The focus should be on solving systems of equations that represent real-world situations, with technology. Students should be able to solve systems that involve non-linear equations. They should also be able to solve systems of equations with three variables with technology, using various strategies such as matrices.	
Linear Functions and Beyond	AA.LF.1: Model real world situations involving arithmetic sequences and understand that they can be defined both recursively and with an explicit formula.
	AA.LF.2: Find partial sums of arithmetic series that model real world situations. Understand and apply partial sums of arithmetic series written in sigma notation.
	AA.LF.3: Recognize functional relationships in real world contexts. Translate fluently among multiple representations (graphs, tables, equations, and verbal descriptions).
	AA.LF.4: Within real world contexts, understand composition of functions and combine functions by composition.
	AA.LF.5: Describe the effect on the graph of f(x) by replacing f(x) with f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative) with technology. Find the value of k given the graph of f(x) and the graph of f(x) + k, k f(x), f(kx), or f(x + k). Identify and analyze transformations within a real world context.

	AA.LF.6: Solve a system of equations and/or inequalities consisting of a linear equation and a quadratic equation in two variables algebraically and graphically with technology (e.g., find the points of intersection between the line y = –3x and the parabola $y=x^2- 6x-5$).
	AA.LF.7: Represent real-world problems using a system of linear equations and/or inequalities in two or three variables. Solve such systems graphically or with matrices, as appropriate to the system, with technology. Interpret the solution and determine whether it is reasonable.
Guiding Principle: Extending from Algebra I, students should be able to represent real-world problems that can be modeled with quadratic or higher-order polynomial functions, interpreting key attributes in a given context.	
Quadratic and Other Polynomial Functions	AA.QP.1: Represent real-world problems that can be modeled with quadratic functions using tables, graphs, and equations; translate fluently among these representations. Solve such problems with technology. Interpret the solutions and determine whether they are reasonable.
	AA.QP.2: Rewrite quadratic functions into the form $y = a(x - h)^2 + k$ using a variety of strategies and graph these functions with technology. Understand that different forms of an equation can provide different information. Identify and interpret within a given context intercepts, zeros, domain and range, and lines of symmetry.
	AA.QP.3: Use the discriminant to determine the number and type of solutions of a quadratic equation in one variable with real coefficients. Know there is an imaginary number, i, such that $i^2 = -1$, and understand the relationship to non-real complex roots.
	AA.QP.4: Represent real-world problems that can be modeled with polynomial functions using graphs and equations. Solve such problems with technology. Interpret the solutions and determine whether they are reasonable.

	AA.QP.5: Graph polynomial functions that model a real-world situation with technology. Identify, describe, and interpret key features in the context of the situation, such as intercepts, zeros, domain and range, end behavior, maxima and minima, and lines of symmetry.
Guiding Principle: Extending from initial work with exponential functions in Algebra I, students should understand the relationship between logarithmic and exponential functions. Additionally, this content should include representing real-world problems that can be modeled with either exponential or logarithmic functions, interpreting key attributes in a given context. Arithmetic and geometric sequences and series should also be introduced, making the connection to linear and exponential functions respectively.	
Exponential and Logarithmic Functions	AA.EL.1: Model real world situations involving geometric sequences and understand that they can be defined both recursively and with an explicit formula.
	AA.EL.2: Find partial sums of geometric series that model real world situations. Understand and apply partial sums of geometric series written in sigma notation.
	AA.EL.3: Represent real-world problems using exponential functions in one or two variables and solve such problems with technology. Interpret the solutions and determine whether they are reasonable.
	AA.EL.4: Graph exponential functions that model real-world situations with technology. Identify, describe, and interpret key features, such as intercepts, zeros, domain, range, asymptotic and end behavior.
	AA.EL.5: Given real-world contexts, identify the percent rate of change in exponential functions written as equations, 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. Analyze growth and decay using absolute and relative change and make comparisons using absolute and relative difference.
	AA.EL.6: Use the properties of exponents to transform expressions for exponential functions in a given real-world context. (e.g., 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%).

	AA.EL.7: Know that the inverse of an exponential function is a logarithmic function. Represent exponential and logarithmic functions that model real-world situations using graphing technology and describe their inverse relationship. Use the inverse relationship between exponential functions and logarithms to evaluate expressions and solve equations in one variable.
Guiding Principle: This content should include representing real-world problems that can be modeled with rational, radical, and piecewise-defined functions. Students should be able to translate between various representations and interpret key attributes in a given context.	
Rational, Radical, and Other Functions	AA.R.1: Represent and solve real-world problems that can be modeled with rational functions (including direct, inverse, and joint variation) using tables, graphs, and equations; translate among these representations. Graph rational functions with technology. Identify, describe, and interpret features, such as intercepts, zeros, asymptotes, domain and range, and end behavior.
	AA.R.2: Represent and solve real-world problems that can be modeled with radical functions using tables, graphs, and equations; translate among these representations. Graph radical functions with technology. Identify, describe, and interpret features, such as intercepts, zeros, asymptotes, domain and range, and end behavior.
	AA.R.3: Represent and solve real-world problems that can be modeled with piecewise-defined functions (including step functions and absolute value functions) using tables, graphs, and equations; translate among these representations. Graph piecewise-defined functions with technology. Identify, describe, and interpret features, such as intercepts, zeros, asymptotes, domain and range, and end behavior.
	AA.R.4: Translate expressions between radical and exponent form and simplify them using the laws of exponents. Understand that, while they name the same expression, one form may be more advantageous than another given the context.