Analytical Algebra II

This document provides correlations between the 2023 Indiana Academic Standards and the 2020 Indiana Academic Standards for easy reference.

The 2023 Indiana Academic Standards resulted from the standards streamlining process required by Indiana Code 20-31-3-1(c-d) and were adopted by the Indiana State Board of Education in June 2023. Standards designated as essential (E) are shaded in gray and all standards were renumbered to avoid gaps in sequencing.

Analytical Algebra II standards were revised with a heightened emphasis on data and modeling to align with recommendations from the Indiana Modernization of Mathematics Task Force. These revisions resulted in new standard wording, numbering, and six new domains, including Arithmetic and Structure of Expressions, Equations, and Functions, Function Families, Modeling with Functions and Data, Modeling with Advanced Algebra, Modeling with Data and Statistics, and Modeling with Quantities. This course should focus on the application of mathematics in various disciplines, including business, finance, science, CTE, and social sciences using technology to model real-world problems and translate between multiple representations.

2023 Indiana Academic Standard		2020 Indiana Academic Standard	
Domain: Arithmetic and Structure of Expressions, Equations, and Functions			
Number	**Text**	**Number**	**Text**
AAII.ASE.1	Explain how extending the properties of integer exponents to rational numbers allows for a notation for radicals in terms of rational exponents (e.g., $5^{1/3}$) and explain how this is defined.		
AAII.ASE.2	Rewrite algebraic rational expressions in equivalent forms (e.g., using properties of exponents and factoring techniques) and describe how rewriting		

	those expressions reveals mathematical structure. Add, subtract, multiply, and divide algebraic rational expressions.		
AAII.ASE.3	Solve systems of equations consisting of linear and nonlinear equations or functions in two variables algebraically and graphically.	**AA.LF.6**	Represent and solve real-world problems using a system of equations and/or inequalities consisting of a linear equation and a quadratic equation in two variables with technology.
		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.
2023 Indiana Academic Standard		**2020 Indiana Academic Standard**	
Domain: Function Families			
Number	**Text**	**Number**	**Text**
AAII.FF.1	Using technology, identify, create, and connect algebraic and graphical representations of each of the function families listed. Model real-world situations with each function family: a. Quadratic b. Polynomial c. Square root d. Rational e. Exponential f. Piecewise-defined and absolute value functions (E)	**AA.QP.4**	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.
		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.R.3	Graph real-world functions including polynomial, rational, square root, step functions, absolute value functions, and piecewise-defined functions with technology. Identify and describe features, such as intercepts, domain and range, end behavior, asymptotic behavior, and/or lines of symmetry
AAII.FF.2	Graph each of the families of function with and without technology. Identify and describe key features, such as intercepts, domain and range, asymptotes, symmetry, and end behavior. Create inverse functions algebraically and/or graphically based on a given function.		
AAII.FF.3	Use graphical and algebraic structures and techniques to transform functions into equivalent forms to expose different information and identify key features. Connect the meaning of the key features to contextual situations.		
AAII.FF.4	Solve real-world problems with each function family, including situations in the context of science and economic phenomena. (E)	**AA.QP.3**	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.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.5	Given real-world contexts, identify the percent rate of change in exponential functions. Classify them as representing exponential growth or decay.
		AA.EL.6	Analyze growth and decay using absolute and relative change and make comparisons using absolute and relative difference.

		AA.R.1	Represent and solve real-world problems that can be modeled with rational functions using tables, graphs, and equations. Graph rational functions with technology. Identify, describe, and interpret features, such as intercepts, zeros, asymptotes, domain and range, and end behavior.
2023 Indiana Academic Standard		**2020 Indiana Academic Standard**	
Domain: Modeling with Functions and Data			
Number	**Text**	**Number**	**Text**
AAII.MFD.1	Define functions and their inverses and illustrate examples algebraically and graphically. Identify real-world situations that can be modeled using functions. (E)		
AAII.MFD.2	Represent real-world problems that can be modeled by linear, quadratic, exponential, and rational functions using tables, graphs, and equations. Use technology to represent the functional relationships and translate and interpret different forms (e.g., vertex form of a quadratic, intercepts, end behavior) with respect to the context. (E)	**AA.LF.3**	Recognize functional relationships in real world contexts. Translate fluently among multiple representations (graphs, tables, equations, and verbal descriptions).

AAII.MFD.3	Use technology to find a linear, quadratic, or exponential function that models a relationship for a bivariate data set to make predictions; interpret the correlation coefficient for linear models. Compare and evaluate model fit using different function families. (E)	**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	Understand that different forms of a quadratic equation can provide different information. Identify and interpret within a given context the vertex, intercepts, zeros, domain and range, and lines of symmetry.
		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.
AAII.MFD.4	Explore the effects of function transformations using graphing technology. Explain the effects of transformations of functions such as $f(x) + k$, $kf(x)$, $f(kx)$, or $f(x + k)$ for different functions and values of k.	**AA.LF.5**	Explore and describe the effect on the graph of $f(x)$ by replacing $f(x)$ with $f(x) + k$, $kf(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative) with and without 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 $f(x + k)$.

2023 Indiana Academic Standard		2020 Indiana Academic Standard	
Domain: Modeling with Advanced Algebra			
Number	**Text**	**Number**	**Text**
AAII.MAA.1	Use algebraic and graphical strategies to make use of structure with quadratic, polynomial, and rational functions to solve real-world problems, including but not limited to: a. Completing the square to rewrite contextual quadratic functions in vertex form and interpret the outcome; b. Determining the number of solutions to a function using graphical and algebraic forms (including the discriminant and complex numbers as appropriate); c. Factoring, grouping, and rewriting functions using properties of exponents; and d. Identifying and explaining extraneous roots.		
AAII.MAA.2	Represent and solve real-world systems of linear equations and inequalities in two or three variables algebraically and using technology. Interpret the solution, and determine whether it is reasonable.		
AAII.MAA.3	Model real-world phenomena using linear programming and matrices.		

2023 Indiana Academic Standard		2020 Indiana Academic Standard	
Domain: Modeling with Data and Statistics			
Number	**Text**	**Number**	**Text**
AAII.MDS.1	Distinguish between random and non-random sampling methods, identify possible sources of bias in sampling, describe how such bias can be controlled and reduced, evaluate the characteristics of a good survey and well-designed experiment, design simple experiments or investigations to collect data to answer questions of interest, and make inferences from sample results. (E)	**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.
AAII.MDS.2	Using the results of a simulation, decide if a specified model is consistent with the results. Construct a theoretical model, and apply the law of large numbers to show the relationship between the two models.	**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.
AAII.MDS.3	Use data science techniques such as predictive modeling, linear algebra, and conditional probability to analyze data sets and make and evaluate claims.		
2023 Indiana Academic Standard		**2020 Indiana Academic Standard**	
Domain: Modeling with Quantities			
Number	**Text**	**Number**	**Text**
AAII.MQ.1	Using technology, model real-world probability situations using permutations, combinations, and the Fundamental Counting Principle. (E)	**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 Fundamental Counting

			Principle, permutations, and combinations.
2023 Indiana Academic Standard		**2020 Indiana Academic Standard**	
Number	**Text**	**Number**	**Text**
		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.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.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.
	AA.LF.4	Within real world contexts, understand composition of functions and combine functions by composition.
	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.
	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.
	AA.R.2	Represent and solve real-world problems that can be modeled with radical functions using tables, graphs, and equations. Graph radical functions with technology. Identify, describe, and interpret features, such as intercepts, zeros, asymptotes, domain and range, and end behavior.