

## Algebra II

This document provides correlations between the 2023 Indiana Academic Standards (IAS) and the Common Core State Standards (CCSS) for easy reference. This correlation guide is intended to help support conversations regarding state and national standards and may be used as one of many tools to help inform a variety of local decisions (e.g., selection of high-quality curricular materials, curriculum maps).

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

2023 Indiana Academic Standard		Common Core State Standard		Differences Between 2023 IAS and CCSS			
	Domain: Arithmetic and Structure of Expressions, Equations, and Functions						
Number	Text	Number	Text	Description			
All.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 <sup>1/3</sup> ) and explain how this is defined.	N-RN.1	Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. For example, we define $5^{1/3}$ to be the cube root of 5 because we want $(5^{1/3})^3 = 5^{(1/3)3}$ to hold, so $(5^{1/3})^3$ must equal 5.	No content differences identified.			
All.ASE.2	Rewrite algebraic rational expressions in equivalent forms (e.g., using properties of exponents and factoring techniques) and	A.SSE.2	Use the structure of an expression to identify ways to rewrite it.	CCSS requires an understanding of closure.			

	describe how rewriting those expressions reveals mathematical structure. Add, subtract, multiply, and divide algebraic rational expressions. (E)	A-APR.7	Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.	
All.ASE.3	Solve systems of equations consisting of linear and nonlinear equations or functions in two variables algebraically and graphically.	A-REI.7	Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. For example, find the points of intersection between the line $y = -3x$ and the circle $x^2 + y^2 = 3$ .	No content differences identified.
All.ASE.4	Solve exponential and logarithmic equations in one variable.	F-BF.5	Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents.	IAS specifies equations in one variable.
2023	3 Indiana Academic Standard	Co	ommon Core State Standard	Differences Between 2023 IAS and CCSS
		Domain	: Function Families	
Number	Text	Number	Text	Description
All.FF.1	Using technology, identify, create, and connect algebraic and graphical representations of each of the function families listed:			

	<ul> <li>a. Quadratic</li> <li>b. Polynomial</li> <li>c. Square root</li> <li>d. Rational</li> <li>e. Exponential</li> <li>f. Logarithmic</li> <li>g. Piecewise-defined and absolute value functions (E)</li> </ul>			
	AII.FF.2Graph 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. Model real-world situations with each function family. (E)	F-IF.7	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.7a	Graph linear and quadratic functions and show intercepts, maxima, and minima.	
All.FF.2		F-IF.7b	Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.	IAS emphasizes modeling real-world situations. CCSS includes trigonometric functions.
graphically based on a given function. Model real-world situat		F-IF.7c	Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.	
		F-IF.7d	Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.	

		F-IF.7e	Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.	
		F-BF.4	Find inverse functions.	
		A-SSE.3	Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.	
All.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. (E)	F-IF.4	For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch 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.	CCSS includes using tables.
All.FF.4	Solve real-world problems with each function family, including situations in the context of science and economic phenomena. (E)			

2023	2023 Indiana Academic Standard		ommon Core State Standard	Differences Between 2023 IAS and CCSS			
	Domain: Modeling with Functions and Data						
Number	Text	Number	Text	Description			
	Define functions and their inverses	F-BF.4	Find inverse functions.				
All.MFD.1	and illustrate examples algebraically and graphically. Identify real-world situations that can be modeled using functions. (E)	F-BF.4a	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, $f(x) = 2 x^3$ or $f(x) = (x+1)/(x-1)$ for $x \neq 1$ .	IAS emphasizes identifying real-world situations that can be modeled using functions and using graphing.			
All.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)	A-REI.4b	Solve quadratic equations by inspection (e.g., for $x^2 = 49$ ), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as a ± bi for real numbers a and b.	IAS includes exponential and rational functions and emphasizes representing real-world problems. CCSS includes specific forms of complex solutions.			
All.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	S-ID.6a	Fit a function to the data; use functions fitted to data to solve problems in the context of data. Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models.	IAS emphasizes the use of technology.			

	using different function families. (E)	S-ID.8	Compute (using technology) and interpret the correlation coefficient of a linear fit.	
All.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. (E)	F-BF.3	Identify 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); find 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.	CCSS includes finding the value of k given the graphs and recognizing even and odd functions.
2023	Indiana Academic Standard	Co	ommon Core State Standard	Differences Between 2023 IAS and CCSS
	Dom	ain: Model	ing with Advanced Algebra	
Number	Taut			
	Text	Number	Text	Description
All.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:	Number A-REI.4a	<b>Text</b> Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x - p)^2 = q$ that has the same solutions. Derive the quadratic formula from this.	Description IAS emphasizes solving real-world problems and includes polynomial and rational functions. IAS also specifies the use of discriminants and explaining extraneous roots.

	<ul> <li>b. Determining the number of solutions to a function using graphical and algebraic forms (including the discriminant and complex numbers as appropriate);</li> <li>c. Factoring, grouping, and rewriting functions using properties of exponents; and</li> <li>d. Identifying and explaining extraneous roots.</li> </ul>			
		A-REI.6	Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.	
All.MAA.2	present 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. (E)	A-REI.12	Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.	IAS includes equations and inequalities in three variables and emphasizes real-world problems.
		A-CED.3	Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context.	

AII.MAA.3	Model real-world phenomena using linear programming and matrices.			
2023	Indiana Academic Standard	C	ommon Core State Standard	Differences Between 2023 IAS and CCSS
	Dom	ain: Model	ing with Data and Statistics	
Number	Text	Number	Text	Description
	All.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	S-IC.3	Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.	IAS specifies identifying sources
All.MDS.1		S-IC.5	Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.	of bias in sampling and includes designing simple experiments or investigations.
	sample results.	S-IC.6	Evaluate reports based on data.	
All.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. (E)	S-IC.2	Decide if a specified model is consistent with results from a given data-generating process.	IAS requires students to construct theoretical models and apply the law of large numbers to show the relationship between the two models.

All.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	3 Indiana Academic Standard	Co	ommon Core State Standard	Differences Between 2023 IAS and CCSS
		Domain: M	odeling with Quantities	
Number	Text	Number	Text	Description
All.MQ.1	Model real-world probability situations using permutations, combinations, and the Fundamental Counting Principle. (E)	S-CP.9	Use permutations and combinations to compute probabilities of compound events and solve problems.	IAS includes the Fundamental Counting Principle and emphasizes real-world situations.

2023 Indiana Academic Standard	Common Core State Standard	Differences Between 2023 IAS and CCSS
<b>PS.1: Make sense of problems and persevere</b> <b>in solving them.</b> Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway, rather than simply jumping into a solution attempt. They consider analogous problems and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, "Does this make sense?" and "Is my answer reasonable?" They understand the approaches of others to solving complex problems and identify correspondences between different approaches. Mathematically proficient students understand how mathematical ideas interconnect and build on one another to produce a coherent whole.	MP.1: Make sense of problems and persevere in solving them. Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their	IAS summarizes what mathematically proficient students can do while CCSS gives examples of what mathematically proficient students might do at different grade levels.

	answers to problems using a different method, and they continually ask themselves, "Does this make sense?" They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.	
<b>PS.2: Reason abstractly and quantitatively.</b> Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.	of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the	No content differences identified.

PS.3: Construct viable arguments and critique the reasoning of others.	<b>MP.3: Construct viable arguments and</b> <b>critique the reasoning of others.</b> Mathematically proficient students understand and use stated assumptions, definitions, and	
Mathematically proficient students understand	previously established results in constructing	
and use stated assumptions, definitions, and	arguments. They make conjectures and build a	
previously established results in constructing	logical progression of statements to explore the	
arguments. They make conjectures and build a	truth of their conjectures. They are able to	
logical progression of statements to explore the	analyze situations by breaking them into cases,	
truth of their conjectures. They analyze situations	and can recognize and use counterexamples.	
by breaking them into cases and recognize and	They justify their conclusions, communicate	IAS explains that mathematically
use counterexamples. They organize their	them to others, and respond to the arguments of	proficient students can justify
mathematical thinking, justify their conclusions	others. They reason inductively about data,	statements that are true always,
and communicate them to others, and respond to	making plausible arguments that take into	sometimes, or never. IAS also
the arguments of others. They reason inductively	account the context from which the data arose.	states that mathematically
about data, making plausible arguments that take	Mathematically proficient students are also able	proficient students participate and
into account the context from which the data	to compare the effectiveness of two plausible	collaborate in a mathematics
arose. Mathematically proficient students are also	arguments, distinguish correct logic or	community. CCSS gives examples
able to compare the effectiveness of two	reasoning from that which is flawed, and—if	of what mathematically proficient
plausible arguments, distinguish correct logic or	there is a flaw in an argument—explain what it	students might do at different
reasoning from that which is flawed, and—if there	is. Elementary students can construct	grade levels.
is a flaw in an argument—explain what it is. They	arguments using concrete referents such as	
justify whether a given statement is true always,	objects, drawings, diagrams, and actions. Such	
sometimes, or never. Mathematically proficient	arguments can make sense and be correct,	
students participate and collaborate in a	even though they are not generalized or made	
mathematics community. They listen to or read	formal until later grades. Later, students learn to	
the arguments of others, decide whether they	determine domains to which an argument	
make sense, and ask useful questions to clarify	applies. Students at all grades can listen or read	
or improve the arguments.	the arguments of others, decide whether they make sense, and ask useful questions to clarify	
	or improve the arguments.	

PS.5: Use appropriate tools strategically.	PS.5	: Use	appropriate	tools	strategically.	
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Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Mathematically proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. Mathematically proficient students identify relevant external mathematical resources, such as digital content, and use them to pose or solve problems. They use technological tools to explore and deepen their understanding of concepts and to support the development of learning mathematics. They use technology to contribute to concept development, simulation, representation, reasoning, communication and problem solving.

MP.5: Use appropriate tools strategically. Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

IAS summarizes what mathematically proficient students can do while CCSS gives examples of what mathematically proficient students might do at different grade levels.

<b>PS.6: Attend to precision.</b> Mathematically proficient students communicate precisely to others. They use clear definitions, including precision. correct mathematical language, in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They express solutions clearly and logically by using the appropriate mathematical terms and notation. They specify units of measure and label axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently and check the validity of their results in the context of the problem. They express numerical answers with a degree of precision appropriate for the problem context.	<b>MP.6: Attend to precision.</b> Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.	IAS summarizes what mathematically proficient students can do while CCSS gives examples of what mathematically proficient students might do at different grade levels.
<b>PS.7: Look for and make use of structure.</b> Mathematically proficient students look closely to discern a pattern or structure. They step back for an overview and shift perspective. They recognize and use properties of operations and equality. They organize and classify geometric shapes based on their attributes. They see expressions, equations, and geometric figures as single objects or as being composed of several objects.	<b>MPS.7:</b> Look for and make use of structure. Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see $7 \times 8$ equals the well remembered $7 \times 5 + 7 \times 3$ , in preparation for learning about the distributive property. In the expression $x^2 + 9x + 14$ , older students can see the 14 as $2 \times 7$ and the 9 as 2	IAS summarizes what mathematically proficient students can do while CCSS gives examples of what mathematically proficient students might do at different grade levels.

	+ 7. They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see $5 - 3(x - y)^2$ as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers x and y.	
PS.8: Look for and express regularity in repeated reasoning. Mathematically proficient students notice if calculations are repeated and look for general methods and shortcuts. They notice regularity in mathematical problems and their work to create a rule or formula. Mathematically proficient students maintain oversight of the process, while attending to the details as they solve a problem. They continually evaluate the reasonableness of their intermediate results.	<b>MP.8: Look for and express regularity in</b> <b>repeated reasoning.</b> Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation $(y - 2)/(x - 1) = 3$ . Noticing the regularity in the way terms cancel when expanding $(x - 1)(x + 1)$ , $(x - 1)(x^2 + x + 1)$ , and $(x - 1)(x^3 + x^2 + x + 1)$ might lead them to the general formula for the sum of a geometric series. As they work to solve a	IAS summarizes what mathematically proficient students can do while CCSS gives examples of what mathematically proficient students might do at different grade levels.

problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their	
intermediate results.	