Indiana Academic Standards for Mathematics – Finite Math
Adopted April 2014 – Standards Correlation Guide Document 10/02/2017

	Indiana Academic Standard for Finite Math Mathematics – Adopted April 2014	Indiana Academic Mathematics Standard Adopted 2000	Common Core State Standard for Mathematics	Differences From Previous Standards
Process Standards				
MA.FM.PS.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. 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.	Connections Connecting mathematical concepts includes linking new ideas to related ideas learned previously, helping students to see mathematics as a unified body of knowledge whose concepts build upon each other. Major emphasis should be given to ideas and concepts across mathematical content areas that help students see that mathematics is a web of closely connected ideas (algebra, geometry, the entire number system). Mathematics is also the common language of many other disciplines (science, technology, finance, social science, geography) and students should learn mathematical concepts used in those disciplines. Finally, students should connect their mathematical learning to appropriate real-world contexts.	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 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.	IAS 2014 removes criteria involving a graphing calculator and does not distinguish between younger and older students.
MA.FM.PS.2: Reason abstractly and quantitatively.	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.		2 Reason abstractly and quantitatively. Mathematically proficient students make sense of the quantities and their relationships in problem situations. Students 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.	IAS 2014 is similar to common core, both expand upon IAS 2000 by having the student decontextualize problems and develop quantitative reasoning.

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MA.FM.PS.3: Construct viable arguments and critique the reasoning of others.	Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They analyze situations by breaking them into cases and recognize and use counterexamples. They organize their mathematical thinking, justify their conclusions and communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. They justify whether a given statement is true always, sometimes, or never. Mathematically proficient students participate and collaborate in a mathematics community. They listen to or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.	Communication The ability to read, write, listen, ask questions, think, and communicate about math will develop and deepen students' understanding of mathematical concepts. Students should read text, data, tables, and graphs with comprehension and understanding. Their writing should be detailed and coherent, and they should use correct mathematical vocabulary. Students should write to explain answers, justify mathematical reasoning, and describe problem-solving strategies. Mathematical Reasoning and Problem Solving In a general sense, mathematics is problem solving. In all of their mathematics, students use problem-solving skills: they choose how to approach a problem, they explain their reasoning, and they check their results. At this level, students apply these skills to combinatorial reasoning, recursive thinking, critical path analysis, and other counting situations.	3 Construct viable arguments and critique the reasoning of others. Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.	IAS 2014 is similar to common core, both expand upon IAS 2000 by having students construct arguments , use counterexamples, and critique others arguments. IAS 2014 does not distinguish between younger and older students.
MA.FM.PS.4: Model with mathematics.	Mathematically proficient students apply the mathematics they know to solve problems arising in everyday life, society, and the workplace using a variety of appropriate strategies. They create and use a variety of representations to solve problems and to organize and communicate mathematical ideas. Mathematically proficient students apply what they know and are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.	Representation The language of mathematics is expressed in words, symbols, formulas, equations, graphs, and data displays. The concept of one-fourth may be described as a quarter, , one divided by four, 0.25, + , 25 percent, or an appropriately shaded portion of a pie graph. Higher-level mathematics involves the use of more powerful representations: exponents, logarithms, π, unknowns, statistical representation, algebraic and geometric expressions. Mathematical operations are expressed as representations: +, =, divide, square. Representations are dynamic tools for solving problems and communicating and expressing mathematical ideas and concepts.	4 Model with mathematics. Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.	IAS 2014 has removed examples and does not distinguish between younger and older students.

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MA.FM.PS.5: Use appropriate tools strategically.	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.		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 2014 does not distinguish between younger and older students. Both IAS 2014 and CCSS expand upon IAS 2000 by having students consider more than just graphing.
MA.FM.PS.6: Attend to precision.	Mathematically proficient students communicate precisely to others. They use clear definitions, including 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.	Communication The ability to read, write, listen, ask questions, think, and communicate about math will develop and deepen students' understanding of mathematical concepts. Students should read text, data, tables, and graphs with comprehension and understanding. Their writing should be detailed and coherent, and they should use correct mathematical vocabulary. Students should write to explain answers, justify mathematical reasoning, and describe problem-solving strategies.	6 Attend to precision. 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 2014 does not distinguish between younger and older students.

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MA.FM.PS.7: Look for and make use of structure.	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.		7 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 × 8 equals the well remembered 7 × 5 + 7 × 3, in preparation for learning about the distributive property. In the expression x2 + 9x + 14, older students can see the 14 as 2 × 7 and the 9 as 2 + 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.	IAS 2014 has removed examples and does not distinguish between younger and older students. Both IAS 2014 and CCSS expand upon IAS 2000 by having students discern patterns, structure, geometric figures, and composition of objects.
MA.FM.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.		8 Look for and express regularity in repeated reasoning. 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)(x2 + x + 1), and (x – 1)(x3 + x2 + x + 1) might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.	IAS 2014 has removed examples and does not distinguish between younger and older students.
Sets				
MA.FM.S.1:	FM.S.1: Know and use the concepts of sets, elements, and subsets.			This standard is NEW
MA.FM.S.2:	FM.S.2: Perform operations on sets (union, intersection, complement, cross product) and illustrate using Venn diagrams.			This standard is NEW
Matrices				
MA.FM.MA.1:	FM.MA.1: Add, subtract, and multiply matrices of appropriate dimensions (i.e. up to 3x3 matrices). Multiply matrices by scalars. Calculate row and column sums for matrix equations.		N-VM.7 Multiply matrices by scalars to produce new matrices, e.g., as when all of the payoffs in a game are doubled. N-VM.8 Add, subtract, and multiply matrices of appropriate dimensions.	IAS2014 Combine the two CCSS Standards

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MA.FM.MA.2:	FM.MA.2: Understand that the zero and identity matrices play a role in matrix addition and multiplication similar to the role of 0 and 1 in the real numbers.		N-VM.10 Understand that the zero and identity matrices play a role in matrix addition and multiplication similar to the role of 0 and 1 in the real numbers. The determinant of a square matrix is nonzero if and only if the matrix has a multiplicative in-verse.	IAS2014 Splits the CCSS standard into two standards
MA.FM.MA.3:	FM.MA.3: Understand the determinant of a square matrix is nonzero if and only if the matrix has a multiplicative inverse.		N-VM.10 Understand that the zero and identity matrices play a role in matrix addition and multiplication similar to the role of 0 and 1 in the real numbers. The determinant of a square matrix is nonzero if and only if the matrix has a multiplicative in-verse.	IAS2014 Splits the CCSS standard into two standards
MA.FM.MA.4:	FM.MA.4: Solve problems represented by matrices using row-reduction techniques and properties of matrix multiplication, including identity and inverse matrices.	DM.2.2 Use matrix operations to solve problems. DM.2.3 Use row-reduction techniques to solve problems. DM.2.4 Use the inverse of a matrix to solve problems.		IAS2014 Combines the three IAS2000 standards into one to teach the concept in context and not isolated individual skills
MA.FM.MA.5:	FM.MA.5: Use matrices to solve real-world problems that can be modeled by a system of equations (i.e. up to 3 linear equations) in two or three variables using technology.	DM.2.1 Use matrices to organize and store data.		IAS2014 Relates matrices to real-world problems and uses technology to solve these problems
MA.FM.MA.6:	FM.MA.6: Build and use matrix representations to model polygons, transformations, and computer animations.			This standard is NEW
Networks				
MA.FM.N.1:	FM.N.1: Use networks, traceable paths, tree diagrams, Venn diagrams, and other pictorial representations to find the number of outcomes in a problem situation.	DM.1.1 Use networks, traceable paths, tree diagrams, Venn diagrams, and other pictorial representations to find the number of outcomes in a problem situation.		The IAS 2014 is identical to the IAS 2000 and the CCSS did not have standards that use networks
MA.FM.N.2:	FM.N.2: Optimize networks in different ways and in different contexts by finding minimal spanning trees, shortest paths, and Hamiltonian paths including real-world problems.	DM.4.4 Use minimal spanning trees to solve problems.		IAS2014 Goes in to more detail including real-world problems and Hamiltonian paths
MA.FM.N.3:	FM.N.3: Use critical-path analysis in the context of scheduling problems and interpret the results.	DM.4.2 Use critical path analysis to solve scheduling problems.		The IAS 2014 is identical to the IAS 2000 and the CCSS did not have standards that use networks
MA.FM.N.4:	FM.N.4: Construct and interpret directed and undirected graphs, decision trees, networks, and flow charts that model real-world contexts and problems.	DM.1.1 Use networks, traceable paths, tree diagrams, Venn diagrams, and other pictorial representations to find the number of outcomes in a problem situation.		The IAS 2014 is identical to the IAS 2000 and the CCSS did not have standards that use networks
MA.FM.N.5:	FM.N.5: Use graph-coloring techniques to solve problems.	DM.4.3 Use graph coloring techniques to solve problems.		The IAS 2014 is identical to the IAS 2000 and the CCSS did not have standards that use networks
MA.FM.N.6:	FM.N.6: Construct vertex-edge graph models involving relationships among a finite number of elements. Describe a vertex-edge graph using an adjacency matrix. Use vertex-edge graph models to solve problems in a variety of real-world settings.			This standard is NEW
Optimization				
MA.FM.O.1:	FM.O.1: Use bin-packing techniques to solve problems of optimizing resource usage.	DM.4.5 Use bin-packing techniques to solve problems.		The IAS 2014 is identical to the IAS 2000 and the CCSS did not have standards that use optimization
MA.FM.O.2:	FM.O.2: Use geometric and algebraic techniques to solve optimization problems with and without technology.	DM.6.1 Use geometric techniques to solve optimization problems.		The IAS 2014 is identical to the IAS 2000 and the CCSS did not have Calculus Standards
MA.FM.O.3:	FM.O.3: Use the Simplex method to solve optimization problems with and without technology.	DM.6.2 Use the Simplex method to solve optimization problems with and without technology.		The IAS 2014 is identical to the IAS 2000 and the CCSS did not have Calculus Standards
Probability				

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MA.FM.P.1:	FM.P.1: Use Markov chains to solve problems with and without technology.	DM.2.5 Use Markov chains to solve problems.		IAS2014 Has students use technology when solving problems with Markov chains
MA.FM.P.2:	FM.P.2: Understand and use the addition rule to calculate probabilities for mutually exclusive and non-mutually exclusive events.			This standard is NEW
MA.FM.P.3:	FM.P.3: Understand and use the multiplication rule to calculate probabilities for independent and dependent events. Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent.		S-CP.2 Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent.	IAS2014 Includes the Multiplication rule to calculate probabilities
MA.FM.P.4:	FM.P.4: Understand the multiplication counting principle, permutations, and combinations; use them to solve real-world problems. Use simulations with and without technology to solve counting and probability problems.		S-CP.9 Use permutations and combinations to compute probabilities of compound events and solve problems.	IAS2014 Has students use technology and simulations to solve counting and probability problems
MA.FM.P.5:	FM.P.5: Calculate the probabilities of complementary events.	PS.2.4 Calculate the probabilities of complementary events.		The IAS2014 is the same as the IAS2000
MA.FM.P.6:	FM.P.6: Calculate the expected value of a random variable; interpret it as the mean of the probability distribution.			This standard is NEW
MA.FM.P.7:	FM.P.7: Analyze decisions and strategies using probability concepts. Analyze probabilities to interpret odds and risk of events.			This standard is NEW
MA.FM.P.8:	FM.P.8: Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events.		S-CP.1 Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events ("or," "and," "not").	The IAS2014 is the same as the CCSS
MA.FM.P.9:	FM.P.9: Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated; find the expected value.		S-MD.3 Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated; find the expected value. For example, find the theoretical probability distribution for the number of correct answers obtained by guessing on all five questions of a multiple-choice test where each question has four choices, and find the expected grade under various grading schemes.	The IAS2014 is the same as the CCSS without the specific example
MA.FM.P.10:	FM.P.10: Use the relative frequency of a specified outcome of an event to estimate the probability of the outcome and apply the law of large numbers in simple examples.			This standard is NEW

Unaligned Indiana Academic Mathematics Standard Adopted 2000	Unaligned Common Core State Standard for Mathematics
DM.1.4 Use counting techniques to solve probability problems.	N-VM.6 Use matrices to represent and manipulate data, e.g., to represent payoffs or incidence relationships in a network.
DM.1.5 Use simulations to solve counting and probability problems.	N-VM.9 Understand that, unlike multiplication of numbers, matrix multiplication for square matrices is not a commutative operation, but still satisfies the associative and distributive properties.

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		DM.3.2 Use finite differences to solve problems.	A-APR.5 Know and apply the Binomial Theorem for the expansion of (x + y)n in powers of x and y for a positive integer n, where x and y are any numbers, with coefficients determined for example by Pascal's Triangle.	
		DM.4.1 Use graphs consisting of vertices and edges to model a problem situation.	A-REI.8 Represent a system of linear equations as a single matrix equation in a vector variable.	
		DM.5.3 Use fair division techniques to divide continuous objects.	A-REI.9 Find the inverse of a matrix if it exists and use it to solve systems of linear equations (using technology for matrices of dimension 3 x 3 or greater).	
		DM.5.4 Use fair division techniques to solve apportionment problems.	S-CP.8 Apply the general Multiplication Rule in a uniform probability model, P(A and B) = P(A)P(B|A) = P(B)P(A|B), and interpret the answer in terms of the model.	
		DM.7.1 Use game theory to solve strictly determined games.	S-MD.5 Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values.	
		DM.7.2 Use game theory to solve non-strictly determined games.	S-MD.5.a Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values. Find the expected payoff for a game of chance. For example, find the expected winnings from a state lottery ticket or a game at a fast-food restaurant.	
			S-MD.5.b Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values. Evaluate and compare strategies on the basis of expected values. For example, compare a high-deductible versus a low-deductible automobile insurance policy using various, but reasonable, chances of having a minor or a major accident.	
			S-MD.6 Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator).	