Educational Epiphany ™

Districtwide PLC Protocol for **Mathematics**

Teacher/Teacher Team:
Grade/Course: Algebra II
Date: Week of November 14, 2022

#	Planning Question	Teacher/Teacher Team Response
		Algebra 2 Coherence Tool: Access the foundational standards to make connections to previously taught skills during the lesson introduction.
1	Which **state standard** is your lesson progression addressing?	**Lesson 4.4 – Adding and Subtracting Rational Expressions** • **A2.A.SSE.A.1** Use the structure of an expression to identify ways to rewrite it. **Foundational Standard:** A1.A.SSE.A.1 • **A2.A.APR.C.4** Rewrite rational expressions in different forms. **Foundational Standard:** 7.NS.A.2b
2	What **mathematical concepts** are embedded in the state standard?	**Understand that:** • Rational expressions form a system analogous to the system of rational numbers and use that understanding to add and subtract rational expressions. • The properties of operations used to add and subtract rational numbers can be applied to adding and subtracting rational expressions. • Students use their knowledge of adding and subtracting rational numbers to add and subtract rational expressions. They first rewrite each expression in terms of a common denominator, then add or subtract the numerators.
3	What teacher **knowledge, reminders, and misconceptions** are assumed in the standard?	**Knowledge:** • Students should be able to identify the least common denominator of two rational expressions and use it to add and subtract the expressions. • Students should be able to add and subtract rational expressions in order to solve problems involving rate and time. • Students should understand how to rewrite rational expressions to find sums and differences. **Reminders:** • Students should understand the how to find the domain of a rational expression and its restrictions. **Misconceptions:** • Students may want to cancel common variables from the numerator and denominator that have different degrees. • Students may forget to or struggle with completely factoring to simplify. • Students may forget to consider restrictions on the domain.
4	What **objective(s)** must be taught? In what order? Why?	**PBO:** • **SWBAT** rewrite expressions IOT represent the expressions in different forms. • **SWBAT** rewrite rational expressions involving addition, subtraction, multiplication and/or division IOT represent the expressions in different forms. **Lesson Objectives:** • Understand that rational expressions form a system analogous to the system of rational numbers and use that understanding to add and subtract rational expressions.
5	What **academic language** must be taught before the	**Academic Language:** • **Describe** – give an account in words of (someone or something) that includes all the relevant characteristics

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	teacher models for students? How will the academic language be **taught and assessed**?	• **Explain** – make clear by describing • **Graph** – a pictorial diagram used to show a numerical relationship using distinctive plots. lines, bars, etc. • **Transformation** – the mapping, or movement, of all points of a figure in a plane according to a common operation • **Understand** – comprehend; grasp the intended meaning of; infer something from information received • **Expression** – a group of mathematical numbers and/or symbols representing a number or quantity • **Form** – the visible shape or configuration of something • **Rational** – a real number that can be written as a ratio • **Represent** – state or point something out • **Rewrite** – to revise words, symbols, equations, expressions, etc. in a different way • **Compound Fraction** – A fraction that has one or more fractions in the numerator and/or denominator **Instructional Practice 2:** Strategies used to teach unfamiliar words will include: • 30 – 30 – 30 (common math-related word parts in the text, problem, or objective) • Point of Use Annotation of the Performance-Based Objective • Universal Language of Literacy • Word and Definition Walls • Word Parts • Context Clues • Point of Use Annotation of the Text (in Real-Time)
6	What **practice problems** are you planning to use for the I Do, We Do, You Do in Pairs and You Do Without Assistance? What did you learn from working the problems **in advance** of using them in class with students?	**Station Rotation Model Suggestions** **Teacher-Led Station:** Teachers can work with students on additional We Do problems. • 4-4 Reteach to Build Understanding **Online Station**: Students can engage with the Savvas Realize Critique & Explain, engage with MathXL for School: Additional Practice, or watch and engage with a Virtual Nerd Video • 4-4 Critique & Explain • 4-4 Do You Understand? • Virtual Nerd: How Do You Add Two Rational Expressions with Different Denominators? • Virtual Nerd: How Do You Simplify a Mixed Expression Over a Mixed Expression? **Offline Station:** Students would complete problems and exercises selected for the You Do in Pairs part of the lesson. • Lesson Performance Task #35 – Pg. 223 • 4-4 Additional Practice
7	What **manipulatives** might be integrated into the gradual release of responsibility (I Do, We Do, You Do in Pairs, You Do Without Assistance)? What did you learn from using the manipulatives **in advance** of using them in class with students?	**Reference:** Interactive Manipulatives • Didax Virtual Manipulatives • Savvas Math Tools • Realize Desmos (Graphing Calculator) • Realize Desmos (Scientific Calculator)

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8	What **graphic organizer(s)** might support students' conceptual understanding of the process outlined by the performance-based objective(s)?	**Reference:** • Graphic Organizer Templates • Google Drawing Graphic Organizers • Teacher Vision

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	Algebra 2 Coherence Tool: Access the foundational standards to make connections to previously taught skills during the lesson introduction.		
1	Which **state standard** is your lesson progression addressing?	**Lesson 4.5 – Solving Rational Equations** • **A2.A.REI.A.2** Solve rational and radical equations in one variable and identify extraneous solutions when they exist. **Foundational Standard:** None • **A2.N.Q.A.1** Identify, interpret, and justify appropriate quantities for the purpose of descriptive modeling. **Foundational Standard:** A1.N.Q.A.1	**Lesson 5.1 – nth Roots, Radicals, and Rational Exponents** • **A2.N.RN.A.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. **Foundational Standard:** 8.EE.A.1, 8.EE.A.2 • **A2.N.RN.A.2** Rewrite expressions involving radicals and rational exponents using the properties of exponents. **Foundational Standard:** None • **A2.A.SSE.A.1** Use the structure of an expression to identify ways to rewrite it. **Foundational Standard:** A1.A.SSE.A.1
2	What **mathematical concepts** are embedded in the state standard?	**Understand that:** • Rational equations contain a rational expression and can be solved by multiplying each side of the equation by a common denominator to eliminate the fractions. Any solution that is excluded from the domain of the original equation is extraneous. • Students solve rational equations in one variable.	**Understand that:** • Rational exponents and radicals represent the number of roots a polynomial has. The roots of a polynomial are used to simplify expressions and solve equations. • Students relate radical expressions and expressions with rational exponents. They use the properties of exponents to rewrite radical expressions as expressions with a fractional exponent, and vice versa.

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		• Students build on the concept of retaining equivalency when performing the same operation on both sides of an equation and properties of inverse operations.	• Students evaluate radical expressions, in either the radical or exponential form, and find all real nth roots of a number. Then students solve equations using nth roots.
3	What teacher **knowledge, reminders, and misconceptions** are assumed in the standard?	**Knowledge:** • To solve rational equations, students must first be taught to simplify rational expressions using methods like factoring trinomials and factoring out common factors in the numerator and denominator. • Concepts of fractions, such as finding common denominators to add and subtract rational expressions and how to multiply and divide fractions, will be vital to the mastery of solving various complexities of rational equations. **Reminders:** • Provide multiple types of equations with both real and extraneous solutions existing. • Expect students to check that a solution is appropriate, especially when working with variables in the denominator. • Ensure students connect visual representations of equations to solutions and extraneous solutions. **Misconceptions:** • Students frequently forget to check for extraneous solutions.	**Knowledge:** • Students should be able to explain the relationship between the rational exponent, the index of the radical, and the power of the expression. • Students should be able to explain the difference between rewriting equivalent expressions by taking the square root of a number and solving an equation which includes a square root, using the principal square root function. • Compare properties of integer exponents with properties of rational exponents. **Reminders:** • In Algebra I, standard A1.A.SSE.B.3c, students experienced using the power of a power, power of a product, and quotient of powers properties with integer exponents. In Algebra II, students extend their knowledge of these to include rational exponents. Instruction should include problems where students see a connection between the inverse operations of multiplication and division and how these inverse operations are expanded to radical and exponential forms of numbers. **Misconceptions:** • A common misconception for students is confusing the meaning of an exponent such as -2 with the meaning of ½ power. • Students may confuse $(9^{-2})^2$ as being the same as $(9^{1/2})^2$
4	What **objective(s)** must be taught? In what order? Why?	**PBO:** • **SWBAT** solve rational and radical equations in one variable IOT identify extraneous solutions when they exist. **Lesson objectives**: • Solve rational equations in one variable. • Identify extraneous solutions to rational equations and give examples of how they arise.	**PBO:** • **SWBAT** explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values IOT enhance understanding, find any errors, and correct mistakes. • **SWBAT** rewrite expressions involving radical and rational exponents using the properties of exponents IOT to simplify these expressions. • **SWBAT** move fluently between radical and exponential form of expressions IOT to simplify these expressions. **Lesson objectives**: • Find all real nth roots of a number. • Evaluate expressions with rational exponents. • Use nth roots to solve equations by rewriting expressions using

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			the properties of exponents.
5	What **academic language** must be taught before the teacher models for students? How will the academic language be **taught and assessed**?	**Academic Language:** • **Equation** – a mathematical statement containing an equal sign to show that two expressions are equal • **Extraneous** – irrelevant or unrelated to the subject being dealt with • **Identify** – to recognize and name; to make sense of and assign meaning to the data • **Radical** – an expression containing a root • **Rational** – any number that can be written as a ratio • **Solution** – the answer to a problem; the value(s) of a variable that satisfies a given algebraic equation • **Solve** – to apply an operation(s) in order to find a value; to find an answer • **Variable** – a quantity that changes or can have different values • **Rational Equation** – An equation that contains a rational expression. • **Extraneous Solution** – A solution of an equation derived from an original equation that is not a solution of the original equation. **Instructional Practice 2:** Strategies used to teach unfamiliar words will include: • 30 – 30 – 30 (common math-related word parts in the text, problem, or objective) • Point of Use Annotation of the Performance-Based Objective • Universal Language of Literacy • Word and Definition Walls • Word Parts • Context Clues • Point of Use Annotation of the Text (in Real-Time)	**Academic Language:** • **Correct** – put right • **Definition** – a statement of the exact meaning of a word • **Explain** – make clear by describing • **Find** – to determine and make a statement about • **Exponent** – used to show the number of times the base number is multiplied by itself • **Integers** – whole numbers and their opposites • **Property** – a character or attribute that something has • **Rational** – a real number that can be written as a ratio • **Understand** – comprehend; grasp the intended meaning of; infer something from information received • **Exponential form** – a way to write repeated multiplication by the same number or letter using a base and an exponent • **Expression** – a group of mathematical numbers and/or symbols representing a number or quantity • **Fluent** – express easily; readily available to speak or write • **Radical** – an expression containing a root • **Simplify** – producing an equivalent form; combine like terms and apply properties to make computation easier • **Form** – the visible shape or configuration of something • **Represent** – state or point something out • **Rewrite** – to revise words, symbols, equations, expressions, etc. in a different way • **Index** – With a radical sign, indicates the degree of the root. • **Nth Root** – For any real numbers a and b, and any positive integer n, if $a^n = b$, then a is an nth root of b. • **Radicand** – The expression under the radical sign. **Instructional Practice 2:** Strategies used to teach unfamiliar words will include: • 30 – 30 – 30 (common math-related word parts in the text, problem, or objective) • Point of Use Annotation of the Performance-Based Objective • Universal Language of Literacy • Word and Definition Walls • Word Parts • Context Clues • Point of Use Annotation of the Text (in Real-Time)

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