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| **Unit Title** | Radical and rational functions | **Length of Unit** | 11 days |
| **Focusing Lens(es)** | Students will understand that radical and rational expressions can be mathematically manipulated to create equivalent forms of the expression and that concepts involving simple expressions can be applied to more complex expressions. Students will also apply rules of exponents to demonstrate how an expression can be mathematically manipulated realizing that a function describes a relationship between two quantities and that radical and rational functions have restricted domains. | **North Carolina State Standards** | **Cluster:** *Interpret the structure of expressions and write expressions in equivalent forms to solve problems***A-SSE.1, A-SSE.1a, A-SSE.1b,** **Cluster:** *Create equations that describes numbers or relationships***A-CED.1, A-CED.2, A-CED.3****Cluster:** *Understand solving equations as a process of reasoning and explain the reasoning and solve equations in one variable***A-REI.1, A-REI.2****Cluster:** *Represent and solve equations graphically***A-REI.11****Cluster:** *Interpret functions that arise in applications in terms of a context***F-IF.4****Cluster:** *Analyze functions using different representations***F.IF.7, F.IF.9****Cluster:** *Build a function that models a relationship between two quantities***F.BF.1****Cluster:** *Build new functions from existing functions***F.BF.3****Cluster:** *Extend the properties of exponents to rational exponents***N-RN.1, N-RN.2****Cluster:** *Defining complex numbers***N-RN.3** |
| **Inquiry Questions (Engaging- Debatable):**  | 1. What is the relationship between radical and rational functions?2. How can key features of radical and rational functions model real world situations?3. How are graphs of different functions the same? How are they different?4. How would you analyze a system of equations to predict one, infinitely many or no solutions? |
| **Unit Strands** | Expressions, Equations, Functions |
| **Concepts** | Mathematical operations, graphing, transformations, systems, real world applications |

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| **Generalizations****My students will Understand that…** | **Guiding Questions** **Factual Conceptual** |
| Mathematical operations with square root and inverse variation expressions and equations are parts of various mathematical contexts.**A-SSE.1, A-CED.1, A-CED.2, A-REI.1, A-REI.2, A-REI.11,** **N-RN.1, N-RN.2, N-RN.3** | What happens when you simplify a radical? | How can you use properties of real numbers to help navigate rational numbers and expressions? |
| Equations and systems of equations to represent square root and inverse variation.**A-CED.1, A-CED.2, A-CED.3, F-BF.3** | How are radical and rational functions similar?How are the different? | What are real world applications of square root and inverse variation functions? Give an example to justify your reasoning. |
| Equations have multiple ways to solve and integrated into multiple representations.**A.REI.1, A.REI.2**, **A.REI.11, F-IF.4, F-IF.7** | How can you determine whether a extraneous solution may be produced? | Explain the use of revealing key features given different representations to model and solve rational and radical functions. |

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| **Key Knowledge and Skills:****My students will…** | *What students will know and be able to do are so closely linked in the concept-based discipline of mathematics. Therefore, in the mathematics samples what students should know and do are combined.* |
| * Write a function that describes a relationship between two quantities by building quadratic functions with real solution(s) and inverse variation functions given a graph, a description of a relationship, or ordered pairs (include reading these from a table).
* Understand the effects of the graphical and tabular representations of a linear, quadratic, square root, and inverse variation function f with $k\*f(x)$ , $f\left(x+k\right)$, and $f\left(x\right)+k$for specific values of $k$ (both positive and negative).
* Interpret key features of graphs, tables, and verbal descriptions in context to describe functions that arise in applications relating two quantities, including: domain, range, and end behavior.
* Analyze square root, and inverse variation (rational) functions by generating different representations, by hand in simple cases and using technology for more complicated cases, to show key features, including: domain and range; intercepts; intervals where the function is increasing, decreasing, positive, or negative; rate of change; maximums and minimums; symmetries; and end behavior.
* Compare key features of two functions (linear, square root, or inverse variation functions) each with a different representation (symbolically, graphically, numerically in tables, or by verbal descriptions).
* Interpret expressions that represent a quantity in terms of its context.
* Identify and interpret parts of a square root and inverse variation (rational) function, including terms, factors, coefficients, radicands, and exponents.
* Interpret quadratic and square root expressions made of multiple parts as a combination of single entities to give meaning in terms of a context.
* Create equations and inequalities in one variable that represent quadratic, square root, and inverse variation, and use them to solve problems.
* Create and graph equations in two variables to represent quadratic, square root and inverse variation/rational relationships between quantities.
* Create systems of linear, quadratic, square root, and inverse variation equations to model situations in context.
* Justify a chosen solution method and each step of the solving process for quadratic, square root and inverse variation equations using mathematical reasoning.
* Solve and interpret one variable inverse variation and square root equations arising from a context, and explain how extraneous solutions may be produced.
* Extend the understanding that the 𝑥-coordinates of the points where the graphs of two square root and/or inverse variation equations $y=f(x)$ and $y=g(x)$ intersect are the solutions of the equation $f(x)=g(x) $and approximate solutions using graphing technology or successive approximations with a table of values.
* Explain how expressions with rational exponents can be rewritten as radical expressions.
* Rewrite expressions with radicals and rational exponents into equivalent expressions using the properties of exponents.
* Use the properties of rational and irrational numbers to explain why:
* the sum or product of two rational numbers is rational;
* the sum of a rational number and an irrational number is irrational; and
* the product of a nonzero rational number and an irrational number is irrational.
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| **Critical Language:** includes the Academic and Technical vocabulary, semantics, and discourse which are particular to and necessary for accessing a given discipline.EXAMPLE: A student in Language Arts can demonstrate the ability to apply and comprehend critical language through the following statement: *“Mark Twain exposes the hypocrisy of slavery through the use of satire.”* |
| **A student in \_\_\_\_\_\_\_\_\_\_\_\_\_\_ can demonstrate the ability to apply and comprehend critical language through the following statement(s):**  | 1. Extend the properties of exponents to rational exponent.
2. Apply the properties of irrational numbers to interpret the structure of expressions.
3. Graph, transform and solve equations to represent square root and inverse variation relationships
4. Explain different representations of square root and inverse variation functions to reveal key features.
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| **Vocabulary:** | Decreasing function, domain, expression, extraneous solution, function, increasing function, Index, inverse variation (rational equation), like radicals, negative exponent, negative exponent rule, nth root, perfect square, power to a power rule, product rule, quotient rule, radical equation, radical function, radical notation, radical sign, radicand, range, ratio, rational exponent, rational expression, rational equation, rational number, restricted domain, restricted range, simplified radical, square root, square root function, square root parent function, transformations (of square root parent graph), unlike radicals, variable, zero-factor property |