Richmond Public Schools

Curriculum Framework

Algebra 1

Strand: Expressions and Operations	
A.3 The student will simplify **a) square roots of whole numbers and monomial algebraic expressions;** **b) cube roots of integers; and** **c) numerical expressions containing square or cube roots.**  EOC Algebra I assessments will include a Desmos Calculator	
Suggested Pacing	
First Nine Weeks -Radical Unit A.3 6 blocks	
Related Standards	
Spiral Down **7.1** The student will **d)** determine square roots of perfect squares. **8.3** The student will **a)** estimate and determine the two consecutive integers between which a square root lies; and **b)** determine both the positive and negative square roots of a given perfect square.	**Spiral Up** **G.8** The student will solve problems, including practical problems, involving right triangles. This will include applying **a)** the Pythagorean Theorem and its converse; **b)** properties of special right triangles; and **c)** trigonometric ratios.
Essential Questions	**Common Misconceptions**
• What is a radical? *In mathematics, a radical expression is defined as any expression containing a radical (√) symbol. Many people*	• The student interprets the square root and cube root symbols as indicating division.

mistakenly call this a 'square root' symbol, and many times it is used to determine the square root of a number. However, it can also be used to describe a cube root, a fourth root, or higher. ● How are radical expressions simplified? *A Square root radical is simplified, or in its simplest form, when the radicand has no square factors. ... Its factors are 5, 7, neither of which is a square number. Therefore, is in its simplest form.* ● What are the restrictions on the radicands for both square roots and cube roots? *Negative Radicals – The only restriction that exists for negative signs and radicals is that there cannot be a negative sign under an even root since there is no real solution to this problem. However, a negative sign can exist in front of a radical or under odd roots and still be able to obtain a real number.*	● Saying that the square root of a negative number does not exist; the square roots of negative numbers are covered in Algebra II ● Reading radicals correctly: Understanding $\sqrt[3]{125}$ is called a radical, 125 is the radicand, and 3 is the index.
Understanding the Standard	**Essential Knowledge and Skills**
● A radical expression in Algebra I contains the square root symbol ($\sqrt{\ }$) or the cube root symbol ($\sqrt[3]{\ }$). ● A square root of a number a is a number y such that $y^2 = a$. ● A cube root of a number b is a number y such that $y^3 = b$. ● A square root in simplest form is one in which the radicand has no perfect square factors other than one. ● The inverse of squaring a number is determining the square root.	**The student will use problem solving, mathematical communication, mathematical reasoning, connections, and representations to** ● Express the square root of a whole number in simplest form. (a) ● Express the principal square root of a monomial algebraic expression in simplest form where variables are assumed to have positive values. (a)

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- Any non-negative number other than a perfect square has a principal square root that lies between two consecutive whole numbers.
- A cube root in simplest form is one in which the radicand has no perfect cube factors other than one.
- The cube root of a perfect cube is an integer.
- The cube root of a non perfect cube lies between two consecutive integers.
- The inverse of cubing a number is determining the cube root.

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- Express the cube root of an integer in simplest form. (b)
- Simplify a numerical expression containing square or cube roots. (c)
- Add, subtract, and multiply two monomial radical expressions limited to a numerical radicand. (c)

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<tr>
<td>Vocabulary</td>
<td rowspan="3">Instructional Activities Organized by Learning Objective</td>
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<tr>
<td>Radical
Radicand
Square
Cube
Square Root
Cube Root
Monomial
Simplify Perfect Squares and Cubes
Non-Perfect Squares and Cubes
Consecutive Integers</td>
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<td>Assessment</td>
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<td>Mastery Check:
Radical Quiz A
Student Performance Analysis(slides 17 - 20)</td>
<td>A.3a
Apply: I can express the square root of a whole number in simplest form.
Apply: I can express the square root of a monomial algebraic expression in simplest form.
A.3b
Apply: I can express the cube root of an integer in simplest form.
A.3c
Apply: I can simplify a numerical expression containing square or cube roots.
Apply: I can add and subtract two monomial radical expressions.
Apply: I can multiply two monomial radical expressions.

Virginia Department of Education

Textbook</td>
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Textbook: Virginia Glencoe, Algebra I, ©2012, Carter, et al, McGraw-Hill School Education Group, page(s) 612 – 623

Eureka

Eureka - (Insert Lesson Title)			
Eureka Grade	**Module**	**Topic**	**Lesson(s)**

Notes

Using Depths of Knowledge (DOK)

- Powerpoint: Radicals
- Youtube Video Intro to radicals

Resources

- **Print**

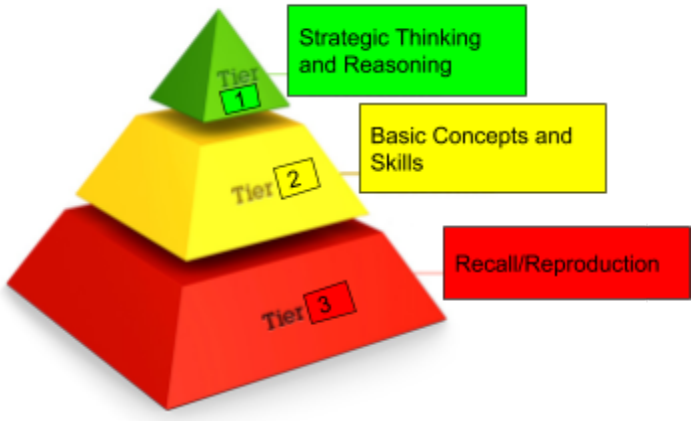
  Virginia End-of-Course Coach, © 2012, Triumph Learning, Algebra I, page(s) 10 -15

- **Technology-Based**
  - Quizziz
    - Simplifying Radicals
    - Simplifying Radicals With Variables
    - Radicals

Station Activities

Station 1

	Jigsaw(layout only) activity for radicals. Teacher will create a worksheet for students to solve problems with square roots of whole numbers and monomial algebraic expressions;cube roots of integers; and numerical expressions containing square or cube roots. Example: Simplify: $\sqrt[3]{405x^6y^4}$ In the station the students will work the steps to solve the problem. Student one will solve for the cube root of 405. Student two will expand the variables of x and y. Lastly the students will combine the answers to rewrite in simplest form. Station 2 Teacher will create a quiz with ten problems which include problems with correct and incorrect answers. Student will sort the problems into two columns: correct or incorrect.
Cross-Curricular Connections	**Tiered Differentiations**
Writing: Have students write a letter to one of their peers on how to simplify a radical. **Research:** Why are square roots the inverse operation of squaring a number? Why is the cube root the inverse operation of cubing a number?	



Tier 3 Activity: Build Understanding

Given a piece of Dot Paper students will review concepts of Perfect Squares. Teachers will use the activity for students to discover the relationship between the side length of a square and its area. The students will understand the side squared is equal to a perfect square if the side is a whole number and the square root of the area is equal to length of the side of the square. Students will learn the perfect squares through 15 by memory.

Tier 2 Activity: Extend understanding

Students will extend their understanding by practicing simplifying each radical by finding the square root(s) of the radicand(the number or variable under the square root.

Game: Quia - Radicals

	Tier 1 Activity: Apply understanding Students will determine the difference between providing an exact answer and an approximate answer. Students will find the exact answer in simplest radical form by taking the square root of the area of the square. The second problem students will approximate their answers with decimals instead of multiplying, adding or subtracting radicals. Students will realize how to estimate radicals using mental math. The exact answer for the side of the square is 2 square root of 33. I model estimating radicals often so that students form an idea of what the radical form represents even if they are going to use a calculator. For example, square root of 33 is between the two perfect squares of 25 and 36, so it is a number between 5 and 6 that is being multiplied by 2. **Worksheet: Radical**