

Unpacked South Dakota State Mathematics Standards

Purpose: In order for students to have the best chance of success, standards, assessment, curriculum resources, and instruction must be aligned in focus, coherence, and rigor. Unpacked standards documents are intended to help align instruction to the focus, coherence, and rigor of the South Dakota State Mathematics Standards. The standards have been organized in clusters as they are not so much built from topics, but rather woven out of progressions. Not all content in a given grade is emphasized equally in the mathematics standards. Some clusters require greater emphasis than others based on the depth of the ideas, the time that they take to master, and/or their importance to future mathematics or the demands of college and career readiness. To say that some things have greater emphasis is not to say that anything in the standards can safely be neglected in instruction. Neglecting standards will leave gaps in student skill and understanding and may leave students unprepared for the challenges of a later grade.

Domain: The Real Number System		Grade Level: Algebra 1
A1.N.RN.A Cluster: Extend the properties of exponents to rational exponents.		
Rewrite expressions with rational exponents as radical expressions and vice versa. Use properties of exponents to simplify expressions with rational exponents.		
<p>**This is a MAJOR cluster. Students should spend the large majority of their time (65-85%) on the major work of the grade. Supporting work and, where appropriate, additional work should be connected to and engage students in the major work of the grade.</p> <p>A1.N.RN.1: Explain how the definition of rational exponents follows from extending the properties of integer exponents, allowing for a notation for radicals in terms of rational exponents.</p> <p>A1.N.RN.2: Rewrite expressions involving radicals and rational exponents using the properties of exponents.</p>		
Aspects of Rigor: (Conceptual, Procedural, and/or Application)		
A1.N.RN.1: Explain how the definition of rational exponents follows from extending the properties of integer exponents, allowing for a notation for radicals in terms of rational exponents.		
Conceptual Understanding	Procedural Fluency	Application
<p>Understand an expression with a rational exponent can be a radical expression. For example, an exponent of $\frac{1}{3}$ is equivalent to a cube root; an exponent of $\frac{1}{4}$ is equivalent to a fourth root, etc.</p> <p>Understand that the denominator of the rational exponent is the root index and the numerator is the exponent of the radicand. For example, $5^{2/3} = \sqrt[3]{5^2}$</p>		
A1.N.RN.2: Rewrite expressions involving radicals and rational exponents using the properties of exponents.		
Conceptual Understanding	Procedural Fluency	Application
	<p>Convert expression with rational exponents to radical expressions.</p> <p>Convert radical expression to expressions with rational exponents.</p>	

	Simplify expressions with rational exponents and radical expressions using the properties of exponents.	
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Enacting the Mathematical Practices - Evidence of Students Engaging in the Practices

1. **Make sense of problems and persevere in solving them.**
 - Use the properties of exponents to rewrite expressions with rational exponents to radical expressions and vice versa.
2. **Reason abstractly and quantitatively.**
3. **Construct viable arguments and critique the reasoning of others.**
 - Explain how rational exponents and radicals are related.
4. **Model with mathematics.**
5. **Use appropriate tools strategically.**
 - Use technology to explore the relationship between expressions with rational exponents and radical expressions.
6. **Attend to precision.**
7. **Look for and make use of structure.**
 - Use the structure of exponential rules to make sense of rational exponents and relate different forms of an expression.
8. **Look for and express regularity in repeated reasoning.**
 - Explore patterns in computations to discover connections between rational exponents and radical expressions.

Vertical and Horizontal Coherence and Learning Progressions

<u>Previous Learning Connections</u>	<u>Current Learning Connections</u>	<u>Future Learning Connections</u>
In middle school, learners: <ol style="list-style-type: none"> 1. use square root and cube root symbols 2. understand and apply the properties of exponents. 	In Algebra 1, learners: <ol style="list-style-type: none"> 1. apply the properties of exponents to rewrite exponential functions. 	In future courses, learners will: <ol style="list-style-type: none"> 1. solve equations using rational exponents and radical operations 2. continue to use exponent properties as they arise in various situations.

Vocabulary (Key Terms Used by Teachers and Students in this Cluster):

- radical sign
- rational exponent
- radicand

Relevance, Explanations, and Examples:

Achievement Level Descriptors

Cluster: Extend the properties of exponents to rational exponents.

Concepts and Procedures	Level 1: Students should be able to rewrite expressions with rational exponents of the form $(1/n)$ to radical form and vice versa.
	Level 2: Students should be able to look for and use structure to extend the properties of integer exponents to multiply and divide expressions with rational exponents that have common denominators.

	<p>Level 3: Students should be able to rewrite expressions with rational exponents of the form (m/n) to radical form, and vice versa, and look for and use structure to extend the properties of integer exponents to all laws of exponents on radical expressions and expressions with rational exponents.</p>
	<p>Level 4: Students should be able to identify the exponent property used when rewriting expressions and recognize when laws of exponents cannot be used to rewrite an expression.</p>