

## 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: Number Sense**

**Grade Level: 7th**

### **7.NS.A Cluster: Apply and extend previous understandings of operations with fractions to add, subtract, multiply and divide rational numbers.**

Students expand their understanding of operations with rational numbers (integers, positive and negative fractions, and positive and negative decimals). Students model, explain and interpret the rules for adding, subtracting, multiplying, and dividing with negative number. Students convert rational numbers to decimals (either terminating or repeating). This prepares them for the introduction of irrational numbers in grade 8.

**\*\*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.*

**7.NS.1** Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram.

- a. Describe situations in which opposite quantities combine to make 0. For example, if you get paid \$5 for babysitting but you owe your friend \$5, you have \$0.
- b. Understand  $p + q$  as the number located a distance  $|q|$  from  $p$ , in the positive or negative direction depending on whether  $q$  is positive or negative. Show that a number and its opposite have a sum of 0 (are additive inverses). Interpret sums of rational numbers by describing real-world contexts.
- c. Understand subtraction of rational numbers as adding the additive inverse,  $p - q = p + (-q)$ . Show that the distance between two rational numbers on the number line is the absolute value of their difference, and apply this principle in real-world contexts.
- d. Apply properties of operations as strategies to add and subtract rational numbers.

**7.NS.2** Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.

- a. Understand that multiplication is extended from fractions to rational numbers by requiring that operations continue to satisfy the properties of operations, particularly the distributive property, leading to products such as  $(-1)(-1) = 1$  and the rules for multiplying signed numbers. Interpret products of rational numbers by describing real-world contexts.
- b. Understand that integers can be divided, provided that the divisor is not zero, and every quotient of integers (with non-zero divisor) is a rational number. If  $p$  and  $q$  are integers, then  $-(p/q) = (-p)/q = p/(-q)$ . Interpret quotients of rational numbers by describing real world contexts.
- c. Apply properties of operations as strategies to multiply and divide rational numbers.
- d. Convert a rational number to a decimal using long division; know that the decimal form of a rational number terminates in 0s or eventually repeats.

**7.NS.3.** Solve real-world and mathematical problems involving the four operations with rational numbers. (Computations with rational numbers extend the rules for manipulating fractions to complex fractions.)

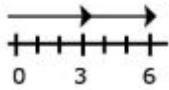
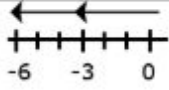
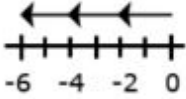
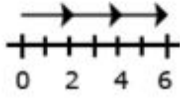
**Aspects of Rigor for Student Learning:**(Conceptual, Procedural, and/or Application)

<b>Conceptual Understanding</b>	<b>Procedural Fluency</b>	<b>Application</b>
<p><b>Note:</b> <u>Given the depth of conceptual understanding when working with integers, the use of integer chips and number lines by students is encouraged.</u></p> <p>A number and its opposite are equidistant from zero. Opposites are called additive inverses because their sum is zero. <b>(7.NS.1)</b></p> <p>Understand that points on a number line show distance and direction <b>(7.NS.1)</b></p> <p>Understand that <math> p </math> is the (positive) distance from <math>p</math> to zero on a number line, regardless of which direction <math>p</math> is from zero <b>(7.NS.1)</b></p> <p>Model combining positive and negative to make zero in real-world situations. <b>(7.NS.1b)</b></p> <p>Understand <math>p + q</math> as the number located a distance <math> q </math> from <math>p</math>, in the positive or negative direction depending on whether <math>q</math> is positive or negative. <b>(7.NS.1)</b></p> <p>Recognize that subtraction of integers is the same as adding the opposite. <b>(7.NS.1)</b></p>	<p>Use properties to add or subtract rational numbers. <b>(7.NS.1d)</b></p>	<p>Demonstrate that the distance between two rational numbers on a number line is the absolute value of their difference, and apply this principle in real-world contexts. <b>(7.NS.1c)</b></p>
<p>Understand rules of multiplying signed numbers and properties of operations that apply to rational numbers, particularly the distributive property. <b>(7.NS.2a)</b></p> <p>Understand that every quotient of integers is a rational number (given the divisor is not zero). <b>(7.NS.2b)</b></p> <p>If <math>p</math> and <math>q</math> are integers, then <math>-(p/q) = (-p)/q = p/(-q)</math>. <b>(7.NS.2b)</b></p> <p>Understand the decimal equivalent of a rational number ends in 0 or repeats. <b>(7.NS.2d)</b></p> <p><b>Note:</b> Students could explore the location of decimal equivalents on a number line, with particular attention to the location of repeating decimals</p>	<p>Multiply and divide rational numbers and use properties of arithmetic to model multiplication and division of rational numbers.<b>(7.NS.2)</b></p> <p>Convert a rational number into a terminating or repeating decimal using long division. <b>(7.NS.2d)</b></p>	<p>Interpret products and quotients of rational numbers in real-world contexts. <b>(7.NS.2)</b></p>

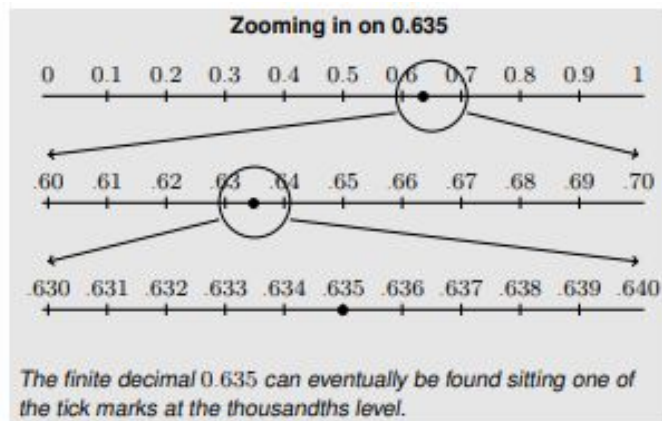
(see example). This prepares students for the work in 8th grade.		
	Apply operations with rational numbers to problems that involve the order of operations. <b>(7.NS.3)</b>	Solve real world problems involving the four operations with rational numbers. <b>(7.NS.3)</b>  Solve real world problems involving complex fractions. <b>(7.NS.3)</b>
<b>Enacting the Mathematical Practices - Evidence of Students Engaging in the Practices</b>		
<ol style="list-style-type: none"> <li>1. <b>Make sense of problems and persevere in solving them.</b></li> <li>2. <b>Reason abstractly and quantitatively.</b></li> <li>3. <b>Construct viable arguments and critique the reasoning of others.</b></li> <li>4. <b>Model with mathematics.</b> <ul style="list-style-type: none"> <li>• Students use multiple strategies to demonstrate the same meaning of an operation which include modeling with manipulatives or on a number line.</li> </ul> </li> <li>5. <b>Use appropriate tools strategically.</b></li> <li>6. <b>Attend to precision.</b> <ul style="list-style-type: none"> <li>• Students are working toward being independent thinkers by self-correcting any errors they find.</li> </ul> </li> <li>7. <b>Look for and make use of structure.</b> <ul style="list-style-type: none"> <li>• Students make use of what they already know about operations and their properties and extend that understanding to rational numbers.</li> </ul> </li> <li>8. <b>Look for and express regularity in repeated reasoning.</b> <ul style="list-style-type: none"> <li>• Students use several examples of inter multiplication to generalize a formal rule.</li> </ul> </li> </ol>		
<b>Vertical and Horizontal Coherence and Learning Progressions</b>		
<u><i>Previous Learning Connections</i></u>	<u><i>Current Learning Connections</i></u>	<u><i>Future Learning Connections</i></u>
<p>In grade 6, learners understand that positive and negative numbers are used together to describe quantities having opposite directions or values.</p> <p>In grade 6, learners solve problems involving fractions by fractions.</p> <p>In grade 6, learners use order of operations to solve problems.</p>	<p>In grade 7, learners apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.</p> <p>In grade 7, learners solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form.</p> <p>In grade 7, learners use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.</p>	<p>In grade 8, learners understand that there are numbers that are not rational, and approximate them by rational numbers.</p> <p>In grade 8, learners use square root and cube root symbols to represent solutions to equations of the form <math>x^2 = p</math> and <math>x^3 = p</math>, where <math>p</math> is a positive rational number.</p>
<b>Vocabulary</b> (Key Terms Used by Teachers and Students in this Cluster):		
<ul style="list-style-type: none"> <li>• Integer</li> <li>• Rational number</li> <li>• Additive inverse</li> </ul>	<ul style="list-style-type: none"> <li>• Commutative property</li> <li>• Associative property</li> <li>• Terminating decimal</li> </ul>	<ul style="list-style-type: none"> <li>• Distributive property</li> <li>• Zero property of multiplication</li> <li>• Multiplicative identity property</li> </ul>

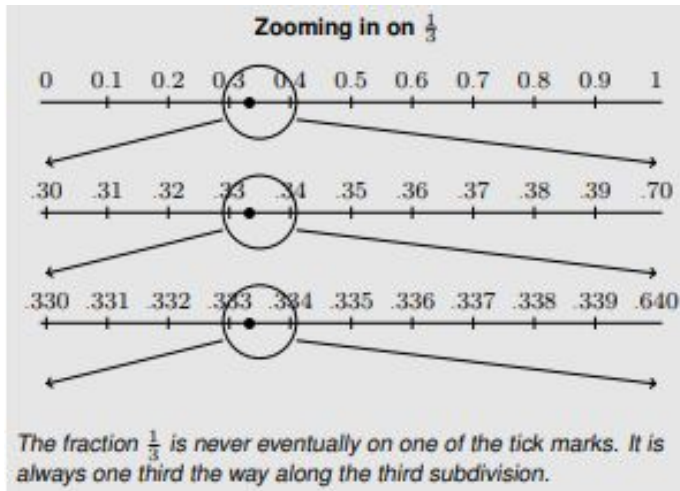
**Relevance, Explanations, and Examples:**

7.NS.2a

Equation	Number Line Model	Context
$2 \cdot 3 = 6$		Selling two packages of apples at \$3.00 per pack
$2 \cdot -3 = -6$		Spending 3 dollars each on 2 packages of apples
$-2 \cdot 3 = -6$		Owing 2 dollars to each of your three friends
$-2 \cdot -3 = 6$		Forgiving 3 debts of \$2.00 each

7.NS.2d





7.NS.2d

Commutative Property of Multiplication:  $3.6 \times 2 = 2 \times 3.6$

Associative Property of Multiplication:  $3 \times (6 \times (-7)) \times (-2) = (3 \times 6) \times ((-7) \times (-2))$

Distributive Property:  $-4(4 + (-3)) = ((-4) \times 4) + ((-4) \times (-3))$

Multiplicative Identity:  $1 \times (-9) = (-9)$

Zero Property of Multiplication:  $(-4.6) \times 0 = 0$

Taken from *Your Mathematics Standards Companion, Grades 6-8*

7.NS.3

Example 1: Calculate:  $[-10(-0.9)] - [(-10) \cdot 0.11]$  Solution: 10.1

Example 2: It took a submarine 20 seconds to drop to 100 feet below sea level from the surface. What was the rate of the descent? Solution: -5 feet per second

Example 3:

A newspaper reports these changes in the price of a stock over four days:  $\frac{-1}{8}, \frac{-5}{8}, \frac{3}{8}, \frac{-9}{8}$ . What is the average daily change?

*Solution:*

The sum is  $\frac{-12}{8}$ ; dividing by 4 will give a daily average of  $\frac{-3}{8}$

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### Achievement Level Descriptors

**Cluster:** Apply and extend previous understandings of operations with fractions to add, subtract, multiply and divide rational numbers.

#### Concepts and Procedures

**Level 1:** Level 1 students should be able to add, subtract, multiply, and divide nonnegative rational numbers. They should be able to add, subtract, multiply,

	and divide rational numbers with a number line or other manipulative.
	<b>Level 2:</b> Level 2 students should be able to apply and extend previous understandings and properties of addition and subtraction to add and subtract with rational numbers; identify the absolute value of a rational number and understand when opposites combine to make 0; and convert between familiar fractions and decimals.
	<b>Level 3:</b> Level 3 students should be able to solve mathematical problems using the four operations on rational numbers and convert from a fraction to a decimal. They should be able to extend previous understandings of subtraction to realize it is the same as adding the additive inverse. They should also be able to understand $p + q$ as a number located $ q $ units from $p$ on a number line in either direction depending on the sign of $q$ . They should also know, understand, and use the rules for multiplying and dividing signed numbers.
	<b>Level 4:</b> Level 4 students should be able to apply previous understandings of operations to solve real-world problems involving rational numbers with addition, multiplication, subtraction, and division.