Sept. 18, 2015

MS Accelerated Unit 2
(7th Grade Module 2 2014-15)
Rational Numbers

Topic A: Proportional Relationships

7.NS.A.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, a hydrogen atom has 0 charge because its two constituents are oppositely charged.*
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.

Lesson 1: Opposite Quantities Combine to Make Zero

Lesson Helps	Additional Supports/ Materials	I can…
• Integer game can be played as a class instead of in groups. • Laminate (or use sheet protectors) 1-page of number lines (vary blank and numbered) for individual use with white board markers. • Create a number line on the floor using painters tape to model the "counting on" principle. • Provide a wall model of the number line at the front of the room for visual reinforcement.	• Dry erase markers • Number lines (-10 to 10)	• Add positive integers by counting up and negative integers by counting down. • Understand that the opposite of a number is called the additive inverse because the sum of the two numbers is zero.

Lesson 2-3: Using the Number line to Model the Addition of Integers (can combine these)

Lesson Helps	Additional Supports/ Materials	I can…
• Combine into one lesson using both vertical and horizontal	• Number lines (-10 to 10)	• Model integer addition on the number line by

SBAC Connection

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.

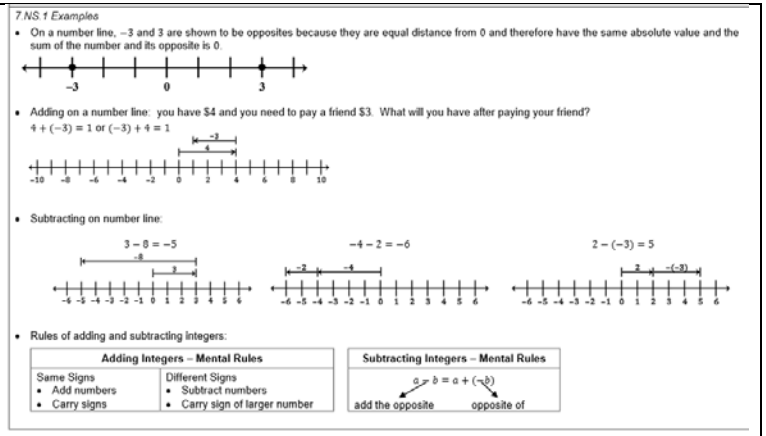
a. Describe situations in which opposite quantities combine to make 0. *For example, a hydrogen atom has 0 charge because its two constituents are oppositely charged.*
b. Understand $p + q$ as the number located a distance $|q|$ from p, in the positive or negative direction depending on whether q is 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.

Explanation: This cluster builds upon the understandings of rational numbers in grade 6:

- Quantities can be shown using + or – as having opposite directions or values
- Points on a number line show distance and direction
- Opposite signs of numbers indicate locations on opposite sides of 0 on the number line
- The opposite of an opposite is the number itself
- The absolute value of a rational number is its distance from 0 on the number line
- The absolute value is the magnitude for a positive or negative quantity
- Locating and comparing locations on a coordinate grid by using negative and positive numbers

Students should explore what happens when negatives and positives are combined. Number lines represent a visual image for students to explore and record addition and subtraction results. Two-color counters or colored chips can be used as physical and kinesthetic model for adding and subtracting integers. Repeated opportunities over time will allow students to compare the results of adding and subtracting pairs of numbers, leading to the generalization of the rules. Visual representations may be helpful as students begin this work—they become less necessary as students become more fluent with the operations.

To view or use these examples, copy and paste into a word document.

number line to model addition. • Create an anchor poster for the Additive Inverse to help access prior knowledge of number line features including arrow placement and direction and ordering of positive and negative numbers. • Use counters or chips to transfer prior learning of additive inverse or zero pairs. • Create a number line model on the floor for kinesthetic and visual learners. • Have early finishers explain how absolute value determined the arrow lengths for each of the addends and how they knew each arrow's direction. • Have students use their same cards to create a different addition number sentence and a new number line representation. • Have students examine how the diagram changes when the order of addition changes to reinforce the commutative property.	• Counters or chips • Number Cards	using arrows to indicate direction of movement. • Recognize that the length of an arrow on the number line is the absolute value of the integer.	

Lesson 4: Efficiently Adding Integers and Other Rational numbers

Lesson Helps	Additional Supports/ Materials	I can…
• Provide some pre-made index cards for learners who struggle forming a question with limited time. • Ask students to refer to anchor posters for support	• Pre-made index cards • Anchor posters (Poster Paper) • Clickers for gauging levels of	• Model integer addition on the number line by using arrows to indicate direction of movement. • Recognize that the length of an arrow on the

during the game. • Provide pre-made number lines for use throughout the lesson. • Introduce questions one at a time using projection technology to support non-auditory learners. • Use polling software throughout the lesson to gauge the entire class's understanding. • Create anchor posters when introducing integer addition rules. (i.e., Adding Same Sign and Adding Opposite Signs) • Use a gallery wall to post examples and generate student discussion. • To help build confidence, allow students time to "turn and talk" with partners before posing questions.	understanding.	number line is the absolute value of the integer.	
Lesson 5: Understanding Subtraction of Integers and Other Rational Numbers			
Lesson Helps	Additional Supports/ Materials	I can…	
• Display questions and give students time to discuss in their groups prior to whole-class discussion. • Allow students to use whiteboards, number lines, or tables to formulate and	• Whiteboards • Dry erase markers • Number lines • Chart paper • Integer Cards	• Justify the rule for subtraction: Subtraction is the same as adding it's opposite. • Justify the rule for subtraction for all rational numbers from the inverse	

justify their opinions to the group. • Record selected student responses and examples on chart paper to help identify patterns. • Allow students to use their Integer Cards throughout this example. • Have students circle the integer with the greater absolute value to determine the final sign of the integer.		relationship between addition and subtraction: $(m – n) + n = m$.	
Lesson 6: The Distance Between Two Rational Numbers			
Lesson Helps	Additional Supports/ Materials	I can…	
• Students may find it easier to see the distance if they use a highlighter on the number line and highlight the distance between the two numbers. • **Consider having students determine the distance on the number line first**, and then use the formula to verify (rather than the other way around). • For parts (b)–(e), visual learners will benefit from using the number line to break down the distance into two sections, from zero to each given number?	• Highlighter • Number lines	• Justify the distance formula for rational numbers on a number line (i.e., using p and q to represent variables, $\|p - q\|$) • I know the definition of subtraction in terms of addition and use the definition of subtraction to justify the distance formula. • Solve word problems involving changes in distance or temperature.	

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Lesson 7: Additional practice of addition and subtraction.			
Lesson Helps	Additional Supports/ Materials	I can…	
• Number lines without numbers, just line intervals (both horizontal and vertical). • Laminate number lines to use with dry erase markers or visa via pens. • Have students subdivide their number line intervals into 12's and 14's.	• Number lines (paper and laminated) • Dry erase makers	• Recognize that the rules for adding and subtracting integers apply to rational numbers. • Use the number line to model addition, subtraction, and absolute value of integers.	
Lesson 8 & 9: Apply the Properties of Operations to Subtract Rational Numbers			
Lesson Helps	Additional Supports/ Materials	I can…	
• Select specific cards to give to students to challenge them at their level. • Display an anchor poster in the classroom to show the meaning of "The opposite of a sum is the sum of its opposites." Label the "opposite" and "sum" in a specific math example. • Provide students with a laminate copy of the number line model used in Example 2. Also provide number lines so they can represent each of the following as a sum on the number line.	• Large number line or painter's tape • Poster paper • Laminate copies of number line model • Dry erase markers	• Use properties of operations to add and subtract rational numbers without the use of a calculator • Recognize that any problem involving addition and subtraction of rational numbers can be written as a problem using addition and subtraction of positive numbers only. • Use the commutative and associative properties of addition to rewrite numerical expressions in different forms.	

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Topic B: Multiplication and Division of Integers and Rational Numbers

7.NS.A.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 number using long division; know that the decimal form of a rational number terminates in 0s or eventually repeats.

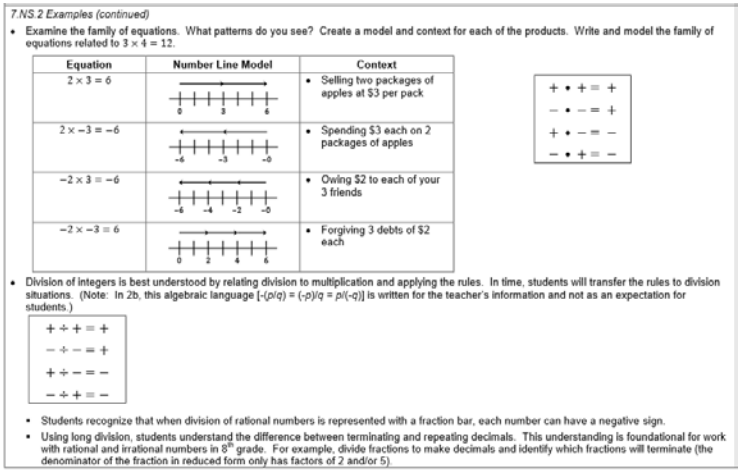
Lesson 10: Understanding Multiplication of Integers

Lesson Helps	Additional Supports/ Materials	I can…
• Students practice and justify their understanding of multiplication of integers by using the Integer Game. • Integer game can be played as a class.	• Integer game revisited (Integers Cards)	• Explain that multiplying by a positive integer is repeated addition. • Use the properties and facts of operations to extend multiplication of whole numbers to multiplication of integers. •

Lesson 11: Develop Rules for Multiplying Signed Numbers

Lesson Helps	Additional Supports/ Materials	I can…
• Students describe, using Integer Game scenarios • Create an "anchor poster" showing the quadrants with the new rules for multiplying integers. • Use color or highlight steps to help students organize and understand the	• Chart paper	• Understand the rules for multiplication of integers and that multiplying the absolute value of integers result in the absolute value of the product. • Understand that (-1)(-1) = 1.

To view or use these examples, copy and paste into a word document.



7.NS.2 Examples (continued)

- Examine the family of equations. What patterns do you see? Create a model and context for each of the products. Write and model the family of equations related to $3 \times 4 = 12$.

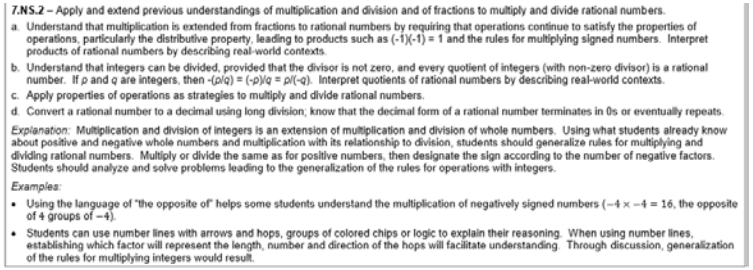
Equation	Number Line Model	Context
$2 \times 3 = 6$	0 3 6	• Selling two packages of apples at $3 per pack
$2 \times -3 = -6$	-6 -3 -0	• Spending $3 each on 2 packages of apples
$-2 \times 3 = -6$	-6 -4 -2 -0	• Owing $2 to each of your 3 friends
$-2 \times -3 = 6$	0 2 4 6	• Forgiving 3 debts of $2 each

+ • + = +
− • − = +
+ • − = −
− • + = −

- Division of integers is best understood by relating division to multiplication and applying the rules. In time, students will transfer the rules to division situations. (Note: In 2b, this algebraic language $[-(p/q) = (-p)/q = p/(-q)]$ is written for the teacher's information and not as an expectation for students.)

+ ÷ + = +
− ÷ − = +
+ ÷ − = −
− ÷ + = −

- Students recognize that when division of rational numbers is represented with a fraction bar, each number can have a negative sign.
- Using long division, students understand the difference between terminating and repeating decimals. This understanding is foundational for work with rational and irrational numbers in 8th grade. For example, divide fractions to make decimals and identify which fractions will terminate (the denominator of the fraction in reduced form only has factors of 2 and/or 5).

manipulations. • Create teacher/student T-chart on which the teacher writes a real -world situation that corresponds with a product, and students write similar situations using different numbers.			**To view or use these examples, copy and paste into a word document.**  **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. *Explanation:* Multiplication and division of integers is an extension of multiplication and division of whole numbers. Using what students already know about positive and negative whole numbers and multiplication with its relationship to division, students should generalize rules for multiplying and dividing rational numbers. Multiply or divide the same as for positive numbers, then designate the sign according to the number of negative factors. Students should analyze and solve problems leading to the generalization of the rules for operations with integers. *Examples:* • Using the language of "the opposite of" helps some students understand the multiplication of negatively signed numbers ($-4 \times -4 = 16$, the opposite of 4 groups of -4). • Students can use number lines with arrows and hops, groups of colored chips or logic to explain their reasoning. When using number lines, establishing which factor will represent the length, number and direction of the hops will facilitate understanding. Through discussion, generalization of the rules for multiplying integers would result.
Lesson 12: Division of Integers			
Lesson Helps	Additional Supports/ Materials	I can…	
• Integer multiplication facts bubble. • Fact fluency can be done more than once so students can see their growth.		• Recognize that division is the reverse process of multiplication, and that integers can be divided provided the divisor is not zero. If p and q are integers, than –(p/q) = -p/q = p/-q.	
Lesson 13 - 14: Converting Between Fractions & Decimals (Long Division)			
Lesson Helps	Additional Supports/ Materials	I can…	
• SKIP	•	•	
Lesson 15 - 16: Multiplication and Division of Rational Numbers			
Lesson Helps	Additional Supports/ Materials	I can…	
• SKIP	•	•	

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MS Accelerated Unit 2
(8th Grade Module 1)
Scientific Notation

Topic A: Exponential Notation and Properties of Integer Exponents
8.EE.1: Know and apply the properties of integer exponents to generate equivalent numerical expressions. *For example,* $3^2 \times 3^{-5} = 3^{-3} = 1/3^3 = 1/27$

Lesson 1: Exponential Notation

Lesson Hints	Additional Supports/ Materials	I can…
• Show You Tube video of Scientific Notation Rap (to Launch Unit)	• Scientific Calculator for all lessons • Exit Task	• Use parenthesis correctly when creating bases with exponents. • Represent repeated multiplication using powers.

Lesson 2: Multiplication of Numbers in Exponential Form

Lesson Hints	Additional Supports/ Materials	I can…
• Problem set can be replaced by using Kuta Software in Multiplying Numbers in Exponential Form	• Kuta Software • Exit Task	• Make sense of the first law of exponents. • Write equivalent expressions with numbers and symbols. • Recognize rules involving division of exponential expressions.

Lesson 3: Numbers in Exponential Form Raised to a Power

Lesson Hints	Additional Supports/ Materials	I can…
• Do all	• Exit Ticket • Kuta Software	• Simplify expressions when a power is raised to a power. • Solve for a power raised to another power.

Lesson 4: Numbers Raised to the Zeroth Power

Lesson Hints	Additional Supports/ Materials	I can…
• Do all	• Exit Ticket • Kuta Software • Copies of the Sprint	• Understand the importance of the properties of exponents. • Raise a number to the zeroth power.

SBAC Connections

8.EE.1

Select **all** of the expressions that have a value between 0 and 1.

Ⓐ $8^7 \cdot 8^{-12}$

Ⓑ $\frac{7^4}{7^{-3}}$

Ⓒ $\left(\frac{1}{3}\right)^2 \cdot \left(\frac{1}{3}\right)^9$

Ⓓ $\frac{(-5)^6}{(-5)^{10}}$

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Lesson 5: Negative Exponents and the Laws of Exponents		
Lesson Hints	Additional Supports/ Materials	I can…
• Do all	• Exit Ticket • Kuta Software	• Understand the importance of the properties of exponents. • Raise a number to the zeroth power.
Lesson 6: Proofs of Laws of Exponents		
Lesson Hints	Additional Supports/ Materials	I can…
• Teacher discretion	• Exit Ticket is great • Kuta Software	• Apply my previous learning to all integer exponents. • Use concrete examples to create proofs using symbols.

Topic B: Magnitude and Scientific Notation

8.EE.3 Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other. *For example, estimate the population of the United States as 3 x 108 and the population of the world as 7 x 109, and determine that the world population is more than 20 times larger.*

8.EE.4 Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology.

Lesson 7: Magnitude		
Lesson Hints	Additional Supports/ Materials	I can…
• SKIP	•	•
Lesson 8: Estimating Quantities		
Lesson Hints	Additional Supports/ Materials	I can…
• SKIP	• Exit Ticket • Copies of sprint	• Compare and estimate quantities using a power of 10. • Simplify expressions using ratios, fractions and the laws of exponents.

SBAC Connections

8.EE.3

The average distance from Jupiter to the Sun is about 5×10^{8} miles. The average distance from Venus to the Sun is about 7×10^{7} miles.

The average distance from Jupiter to the Sun is about how many times as great as the average distance from Venus to the Sun?

_____ times

To view or use these examples, copy and paste into a

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Lesson 9 & 10: Operations with Numbers in Scientific Notation		
Lesson Hints	Additional Supports/ Materials	I can…
• Great real-world situations Problem set is good Begins to connect with Science	• Exit Ticket	• Use parenthesis correctly when creating bases with exponents. • Represent repeated multiplication using powers. • Solve problems written in scientific and standard notation.
Lesson 11 & 12: Efficacy of the Scientific Notation		
Lesson Hints	Additional Supports/ Materials	I can…
• Watch Suggested video Powers of Ten http://www.youtube.com/watch?v=0fKBhvDjuy0 to launch lesson • Substitute with real world situations with conversions	• Exit Ticket • Graphic Organizer for keeping thinking while watching movie	• Become fluent in working with numbers in scientific notation. • Read, write, and solve expressions using scientific notation. • Use scientific notation and choose for measurements of appropriate size of very small & very large quantities.
Lesson 13: Comparison of Numbers Written in Scientific Notation and Interpreting Scientific Notation Using Technology		
Lesson Hints	Additional Supports/ Materials	I can…
SKIP	•	•
End of Module Assessment (Tests over skills from lessons 7-13) Teacher discretion • Rubric is available • Use test and rubric as teacher discretion		

word document.

8.EE.3 – Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other. *For example, estimate the population of the United States as 3×10^8 and the population of the world as 7×10^9, and determine that the world population is more than 20 times larger.*

Explanation: Students express numbers in scientific notation. Students compare and interpret scientific notation quantities in the context of the situation. If the exponent increases by one, the value increases 10 times. Students understand the magnitude of the number being expressed in scientific notation and choose an appropriate corresponding unit. For example, 3×10^8 is equivalent to 30 million, which represents a large quantity. Therefore, this value will affect the unit chosen.

Example:

- An ant has a mass of approximately 4×10^{-3} grams and an elephant has a mass of approximately 8 metric tons.
  a. How many ants does it take to have the same mass as an elephant?
  b. An ant is 10^{-1} cm long. If you put all these ants from your answer to part a. in a line front to back, how long would the line be? Find two cities in the United States that are a similar distance apart to illustrate this length.

  Note: 1 kg = 1000 grams, 1 metric ton = 1000 kg, 1 m = 100 cm, 1 km = 1000 m

To view or use these examples, copy and paste into a word document.

8.EE.4 – Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology.

Explanation: Students can convert decimal forms to scientific notation and apply rules of exponents to simplify expressions. In working with calculators or spreadsheets, it is important that students recognize scientific notation. Students should recognize that the output of $2.45E+23$ is 2.45×10^{23} and $3.5E-4$ is 3.5×10^{-4}. Students enter scientific notation using E or EE (scientific notation), × or * (multiplication), and ^ (exponent) symbols. Students use the laws of exponents to multiply or divide numbers written in scientific notation.

Example:

- The following headline appeared in a newspaper: "Every day 7% of Americans eat at Giantburger restaurants"
  Decide whether this headline is true using the following information:
  - There are about 8×10^3 Giantburger restaurants in America
  - Each restaurant serves on average 2.5×10^3 people every day
  - There are about 3×10^8 Americans

  Explain your reasons and clearly show your work.