Unit 2: The Number System

Content Area: **Mathematics**
Course(s): **Accelerated Math 7**
Time Period: **2nd Marking Period**
Length: **3 weeks**
Status: **Published**

Unit Overview

In this unit, students extend the operations of addition, subtraction, multiplication, and division from fractions to all rational numbers, written as decimals or in the form *a/b*.

Transfer

Students will be able to independently use their learning to solve real-world problems involving...

- representing and using rational numbers in solve real-life situation problems.
- representing rational numbers with visuals (including distance models), language, and real-life contexts.
- using a number line model to represent the unique placement of any number in relation to other numbers.
- apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers

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For more information, read the following article by Grant Wiggins.

http://www.authenticeducation.org/ae_bigideas/article.lasso?artid=60

Meaning

Understandings

Students will understand that...

- One representation may sometimes be more helpful than another; and, used together, multiple representations give a fuller understanding of a problem.
- A quantity can be represented numerically in various ways.

- Numeric fluency includes both the understanding of and the ability to appropriately use numbers.
- Computational fluency includes understanding not only the meaning, but also the appropriate use of numerical operations.
- In many cases, there are multiple algorithms for finding a mathematical solution, and those algorithms may be more or less efficient.

Essential Questions

Students will consider...

- What happens when you add, subtract, multiply, and divide rational numbers?
- Why is it useful to write numbers in different ways?
- What are the differences between rational and irrational numbers and how do they relate to each other?

Application of Knowledge and Skill

Students will know...

Students will know...

- Negative integers can be used in everyday contact that involve values below zero.
- Every quotient (with non-zero divisor) is a rational number.
- Numbers that are not rational are called irrational.
- Every rational number can be expressed as a decimal, fraction, or percent.
- Numbers can be expressed in scientific notation.

Students will be skilled at...

Interpreting

- situations involving signed numbers
- tables with signed numbers
- bank statements with signed numbers

Representing

- addition of signed numbers on a number line
- situations involving signed numbers
- changes in elevation
- position, speed, and direction

Generalizing

- about subtracting and adding signed numbers
- about differences and magnitude
- about multiplying negative numbers
- about additive and multiplicative inverses

Academic Vocabulary

absolute value
account balance
additive inverse
coordinate
debt
decrease
degrees Celsius
deposit
difference
distance
elevation
expression
factor
increase
multiplicative inverse
negative
number line
operation
opposite
rational number
sea level
signed numbers
solution (to an equation)
sum
temperature
variable
velocity
vertical
withdrawal

Learning Goal 1

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

Target #1.1 -- DOK: 2 Skill/Concept

SWBAT:

- use a number line to add positive and negative numbers.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.K-12.5	Use appropriate tools strategically.
MA.7.NS.A.1a	Describe situations in which opposite quantities combine to make 0.
MA.7.NS.A.1b	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.

Target #1.2 -- DOK: 2 Skill/Concept

SWBAT

- understand how to add positive and negative numbers in general.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.7.NS.A.1a	Describe situations in which opposite quantities combine to make 0.
MA.7.NS.A.1b	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.
MA.7.NS.A.1c	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.
MA.7.NS.A.1d	Apply properties of operations as strategies to add and subtract rational numbers.

Target #1.3 -- DOK: 2 Skill/Concept

SWBAT:

- understand what positive and negative numbers mean in a situation involving money.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.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.

Target #1.4 -- DOK: 2 Skill/Concept

SWBAT

- explain the relationship between addition and subtraction of rational numbers.
- use a number line to subtract positive and negative numbers.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.K-12.7	Look for and make use of structure.
MA.7.NS.A.1c	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.

Target #1.5 -- DOK: 2 Skill/Concept

SWBAT:

- find the difference between two rational numbers.
- understand how to subtract positive and negative numbers in general.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.

MA.K-12.8	Look for and express regularity in repeated reasoning.
MA.7.NS.A.1a	Describe situations in which opposite quantities combine to make 0.
MA.7.NS.A.1c	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.

Target #1.6 -- DOK: 2 Skill/Concept

SWBAT

- solve problems that involve adding and subtracting rational numbers.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.7.NS.A.1c	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.
MA.7.NS.A.3	Solve real-world and mathematical problems involving the four operations with rational numbers.

Target#1.7 -- DOK: 2 Skill/Concept

SWBAT

- multiply a positive number with a negative number.
- use rational numbers to represent speed and direction.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.7.RP.A	Analyze proportional relationships and use them to solve real-world and mathematical problems.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.K-12.8	Look for and express regularity in repeated reasoning.
MA.7.NS.A.2a	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.

Target #1.8 -- DOK: 2 Skill/Concept

SWBAT

- explain what it means when time is represented with a negative number in a situation about speed and direction.
- multiply two negative numbers.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.7.RP.A.2	Recognize and represent proportional relationships between quantities.
MA.K-12.4	Model with mathematics.
MA.K-12.7	Look for and make use of structure.
MA.7.NS.A.2	Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.
MA.7.NS.A.2a	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.
MA.7.NS.A.2c	Apply properties of operations as strategies to multiply and divide rational numbers.

Target #1.9 -- DOK: 2 Skill/Concept

SWBAT

- solve problems that involve multiplying rational numbers.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.7.NS.A.2c	Apply properties of operations as strategies to multiply and divide rational numbers.

Target #1.10 -- DOK: 2 Skill/Concept

SWBAT

- divide rational numbers.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.K-12.7	Look for and make use of structure.
MA.7.NS.A.2	Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.

MA.7.NS.A.2b	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.

Target #1.11 -- DOK: 3 Strategic Thinking

SWBAT

- solve problems that involve multiplying and dividing rational numbers.
- solve problems that involve negative rates.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.7.RP.A.2	Recognize and represent proportional relationships between quantities.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.K-12.7	Look for and make use of structure.
MA.7.NS.A.3	Solve real-world and mathematical problems involving the four operations with rational numbers.
MA.7.EE.B.3	Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies.

Target #1.12 DOK: 2 Skill/Concept

SWBAT

- add, subtract, multiply, and divide rational numbers.
- evaluate expressions that involve rational numbers.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.7.NS.A	Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.
MA.7.NS.A.3	Solve real-world and mathematical problems involving the four operations with rational numbers.

Target #1.13 -- DOK: 3 Strategic Thinking

SWBAT:

- represent situations with expressions that include rational numbers.
- solve problems using the four operations with rational numbers.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.7.RP.A.2	Recognize and represent proportional relationships between quantities.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.7.NS.A.3	Solve real-world and mathematical problems involving the four operations with rational numbers.

Target #1.14 -- DOK: 2 Skill/Concept

SWBAT:

- solve equations that include rational numbers and have rational solutions.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.7	Look for and make use of structure.
MA.7.NS.A.3	Solve real-world and mathematical problems involving the four operations with rational numbers.
MA.7.EE.B.4	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.
MA.7.EE.B.4a	Solve word problems leading to equations of the form $px + q = r$ and $p(x + q) = r$, where p, q, and r are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach.

Target #1.15 DOK: 2 Skill/Concept

SWBAT

- explain what the solution to an equation means for the situation.
- write and solve equations to represent situations that involve rational numbers.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.

MA.7.NS.A.3	Solve real-world and mathematical problems involving the four operations with rational numbers.
MA.7.EE.B.4a	Solve word problems leading to equations of the form $px + q = r$ and $p(x + q) = r$, where p, q, and r are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach.

Formative Assessment and Performance Opportunities

- cK-12 Adaptive Practice
- Clickers
- Exit/Admit Ticket
- Journal
- Kahoot
- My Favorite No
- Status Check (Thumbs up/down...)
- Student-Teacher Conference
- Think-Pair-Share

Summative Assessment

- End of Unit Test
- Portfolio
- Pre-Unit Diagnostic Test
- Project
- Quiz

21st Century Life and Careers and Technology

CRP.K-12.CRP1	Act as a responsible and contributing citizen and employee.
CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP.K-12.CRP11	Use technology to enhance productivity.
CAEP.9.2.8.B.3	Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.
CAEP.9.2.8.B.4	Evaluate how traditional and nontraditional careers have evolved regionally, nationally, and globally.
TECH.8.1.8	Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.
TECH.8.1.8.C	Communication and Collaboration: Students use digital media and environments to

communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others.

Accommodations & Modifications

- Adaptive Practice (cK-12 modality)
- calculators
- lesson extensions
- leveled centers
- manipulatives
- modifications as per IEP/504
- PLIX (cK-12 modality)
- small group instruction
- teacher conference
- Use number lines and counters to help students find the distance from 0 for both positive and negative integers to see the distance, represented by absolute value, is always positive
- word bank

Unit Resources

See also: Illustrative Math Tasks Folder in Curriculum Portal

ALEKS

cK-12 Accelerated 7th Grade Book

Mr. Morgan's Math Help

Unit 7.5 Rational Number Arithmetic

NJCTL (New Jersey Center for Teaching and Learning)

Numbers & Operations

cK-12 PLIX:

Add rational numbers: Baking with Butter

Fraction Subtraction: Garlic Bread

Add and subtract mixed numbers: Making Juice Popsicles

Dividing fractions by fractions: Flipping Fractions

Absolute Value: Diving Depth

Addition of Integers: Polka Dots

Subtract integers with the same sign: The Secret of Subtraction

Desmos activities:

Fraction Challenge

Polygraph: Rational Numbers

Adding Integers

Decimal Challenge

Interdisciplinary Connections

Students research the record low temperature for each month in a specific location and use their knowledge of comparing and ordering integers to order the temperatures.

SCI.MS-ESS2-5	Collect data to provide evidence for how the motions and complex interactions of air masses result in changes in weather conditions.