

# Unit 1: Rational Numbers

Content Area: **Mathematics**  
Course(s): **Pre Algebra**  
Time Period: **1 marking period**  
Length: **10 Weeks**  
Status: **Published**

## Unit Overview

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During this unit, students will identify, compare, order, and perform the four basic operations of rational numbers.

Throughout this unit, students will continue to improve their fluency with basic mathematical concepts through the use of ST Math instructional software. This software is designed to identify students' strengths and weaknesses and generate programs of review, remediation, and growth through hundreds of interactive computer games. Lessons are engaging, individualized, and self-paced, and instructive feedback is provided to students and their teacher. The teacher will monitor student learning and assist students as they continue to work with ST Math software throughout the unit.

## Transfer

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Students will be able to independently use their learning to...

- relate algebraic terminology to real life problems and applications, and
- order and compute rational numbers using the four basic operations.

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

[http://www.authenticeducation.org/ae\\_bigideas/article.lasso?artid=60](http://www.authenticeducation.org/ae_bigideas/article.lasso?artid=60)

## Meaning

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## Understandings

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Students will understand that...

- There is a process to use when evaluating numeric and algebraic expressions.
- Integers, decimals and fractions are all rational numbers.
- Reducing (Simplifying) a fraction is an equivalent fraction.
- Order that operations are performed matters for the validity of the answer.

## **Essential Questions**

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Students will keep considering...

- What is the best way to evaluate expressions?
- How can critical vocabulary terms be used to better enhance the understanding of mathematics?
- How does this number apply to the parts of rational numbers?
- What rule do you need to use to perform the operation for the integer/fraction?

## **Application of Knowledge and Skill**

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### **Students will know...**

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- How different integers relate to one another
- What rules to use when evaluating expressions with rational numbers
- the difference between rational and irrational numbers

### **Students will be skilled at...**

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- Evaluating numeric and variable expressions.
- Ordering, comparing, and performing operations on rational numbers.
- Identifying rational and irrational numbers.

## **Academic Vocabulary**

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rational number, terminating decimal, repeating decimal

integer, positive integer, negative integer, absolute value, opposite

additive inverse, difference

mean

prime number, composite number, prime factorization, factor tree, monomial

common factor, greatest common factor, relatively prime

equivalent fractions, simplest form

multiple, common multiple, least common multiple, least common denominator

variable expression

numerator, denominator

reciprocals

numerical expression, variable, variable expression, evaluate, verbal model

power, base, exponent

order of operations

## **Learning Goal 1**

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Students will be able to apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers

CRP.K-12.CRP1	Act as a responsible and contributing citizen and employee.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP5	Consider the environmental, social and economic impacts of decisions.
CRP.K-12.CRP11	Use technology to enhance productivity.
TECH.8.1.12.A.CS1	Understand and use technology systems.
TECH.8.1.12.A.CS2	Select and use applications effectively and productively.
TECH.8.1.12.E.CS1	Plan strategies to guide inquiry.
TECH.8.1.12.E.CS4	Process data and report results.
TECH.8.1.12.F.CS2	Plan and manage activities to develop a solution or complete a project.
TECH.8.1.12.F.CS3	Collect and analyze data to identify solutions and/or make informed decisions.
TECH.8.2.12.A.CS2	The core concepts of technology.

## Objective 1--(Level of Difficulty - 1: Retrieval)

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SWBAT identify, compare, and order rational numbers.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
LA.RST.9-10.4	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.
MA.7.NS.A.3	Solve real-world and mathematical problems involving the four operations with rational numbers.

## Objective 2 -- (Level of Difficulty 3: Analysis)

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SWBAT evaluate integer operations.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.N-RN.B.3	Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
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.
LA.RST.9-10.4	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.
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.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.
MA.7.NS.A.2c	Apply properties of operations as strategies to multiply and divide rational numbers.
MA.7.NS.A.3	Solve real-world and mathematical problems involving the four operations with rational numbers.

### **Objective 3--(Level of Difficulty 2: Comprehension)**

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SWBAT describe the relationship between equivalent fractions.

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.
LA.RST.9-10.4	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.
MA.7.7.2	Students develop a unified understanding of number, recognizing fractions, decimals (that have a finite or a repeating decimal representation), and percents as different representations of rational numbers. Students extend addition, subtraction, multiplication, and division to all rational numbers, maintaining the properties of operations and the relationships between addition and subtraction, and multiplication and division. By applying these properties, and by viewing negative numbers in terms of everyday contexts (e.g., amounts owed or temperatures below zero), students explain and interpret the rules for adding, subtracting, multiplying, and dividing with negative numbers. They use the arithmetic of rational numbers as they formulate expressions and equations in one variable and use these equations to solve problems.

### **Objective 4--(Level of Difficulty - 3: Analysis)**

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SWBAT evaluate fraction operations

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.4	Model with mathematics.
MA.K-12.7	Look for and make use of structure.
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.
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.
CCSS.Math.Content.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.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.
MA.7.NS.A.2c	Apply properties of operations as strategies to multiply and divide rational numbers.
MA.7.NS.A.3	Solve real-world and mathematical problems involving the four operations with rational numbers.

## **Objective 5 (Level of Difficulty - 2: Comprehension)**

SWBAT evaluate algebraic expressions when given specific values of variables.

- Identify parts of an expression using mathematical terms (sum, term, product, factor, quotient, coefficient)
- Evaluate expressions as specific values of their variables
- Evaluate expressions that arise from formulas used in real-world problems at specific values of their variables

Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see  $7 \times 8$  equals the well remembered  $7 \times 5 + 7 \times 3$ , in preparation for learning about the distributive property. In the expression  $x^2 + 9x + 14$ , older students can see the 14 as  $2 \times 7$  and the 9 as  $2 + 7$ . They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see  $5 - 3(x - y)^2$  as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers  $x$  and  $y$ .

CCSS.Math.Content.7.NS.A	Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.
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Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation  $(y - 2)/(x - 1) = 3$ . Noticing the regularity in the way terms cancel when expanding  $(x - 1)(x + 1)$ ,  $(x - 1)(x^2 + x + 1)$ , and  $(x - 1)(x^3 + x^2 + x + 1)$  might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

MA.7.NS.A.1d

Apply properties of operations as strategies to add and subtract rational numbers.

CCSS.Math.Content.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.3

Solve real-world and mathematical problems involving the four operations with rational numbers.

## Summative Assessment

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- Unit 1 Exam
- Link It Exam
- Classroom assessments
- ST Math
- Station Activities

## Formative Assessment and Performance Opportunities

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Do now/Exit Ticket

Homework and classwork

Questioning

Guided practice (you try problems)

academic games (white board, jeopardy, set activities, etc)

## Differentiation / Enrichment

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ST Math

calculators (only with decimal equations)

504 accommodations

IEP modifications

Centers/Stations

Small group instruction

Technology

## **Unit Resources**

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- [textbook](#)
- [ST Math](#)
- [Kuta software](#)
- [graphing calculators](#)
- [Be a learning hero](#)
- [nj core](#)