

05. Operations with Fractions

Content Area: **Math**
Course(s):
Time Period: **Full Year**
Length: **5 weeks**
Status: **Published**

General Overview, Course Description or Course Philosophy

In Grade 5, instructional time should focus on three critical areas:

- Developing fluency with addition and subtraction of fractions, and developing understanding of the multiplication of fractions and of division of fractions in limited cases (unit fractions divided by whole numbers and whole numbers divided by unit fractions)
- Extending division to 2-digit divisors, integrating decimal fractions into the place value system and developing understanding of operations with decimals to hundredths, and developing fluency with whole number and decimal operations
- Developing understanding of volume

In this unit, students will understand strategies for adding and subtraction fractions, strategies for fraction- of thinking for multiplication, and models for fraction for division.

OBJECTIVES, ESSENTIAL QUESTIONS, ENDURING UNDERSTANDINGS

Students will understand that:

- Strategies for adding and subtracting fractions between 0 and 1 can be applied to add and subtract fractions and mixed numbers greater than 1.
- Strategies for fraction-of thinking are applied to fraction multiplication, resulting in a generalized fraction multiplication algorithm
- Models for fraction division emphasize division as the inverse operation of multiplication.

Essential Questions:

- How can the strategies used to add and subtract fractions between 0 and 1 be extended to add and subtract fractions and mixed numbers greater than 1?
- How do strategies of fraction-of thinking contribute to developing a generalized algorithm for fraction multiplication? How can these strategies be applied to different types of fraction multiplication problems?
- How do fraction division models demonstrate the relationship between division and multiplication as inverse operations? How can these models aid in understanding fraction division?
- In what ways can the strategies learned for adding, subtracting, multiplying, and dividing fractions be interconnected or applied to solve complex fraction problems?
- How do strategies for fraction operations apply to real-life situations, such as cooking recipes,

measurements, or dividing resources, demonstrating the practical significance of these operations?

STUDENT LEARNING TARGETS

Refer to the 'Declarative Knowledge' and 'Procedural Knowledge' sections.

Declarative Knowledge

Students will know:

- It is easier to add, subtract, and compare fractions when the fractions have the same denominator.
- An equivalent fraction can be found by multiplying the numerator and denominator of a given fraction by the same number.
- The least common denominator can be found using factors and multiples of whole numbers and the “quick common denominator” can be found by multiplying the starting denominators.
- Multiplying by a unit fraction can be interpreted as dividing by a whole number.
- The total number of sections shown in the unit square of an area model is the same as the product of the factors’ denominators and the number of shaded sections is the same as the product of the numerators.
- Multiplying both the numerator and denominator of a fraction by n has the same effect as multiplying a fraction by (n/n) ; $(n/n) = 1$ for all non-zero numbers; any number times 1 equals itself.
- The multiplication rule for equivalent fractions holds because multiplying the numerator and denominator of a fraction by the same number has the same effect as multiplying by a fraction equal to 1.
- The dividend is an initial amount being split into a given number of equal shares; for whole numbers divided by

Procedural Knowledge

Students will be able to:

- Generate equivalent fractions by using the multiplication rule for equivalent fractions.
- Use strategies to identify common denominators.

- Generate equivalent fractions with common denominators.
- Find common denominators and rename sums while adding fractions and mixed numbers.
- Rename starting numbers and find common denominators while subtracting fractions and mixed numbers.
- Solve fraction-of problems involving non-unit fractions by first finding the related unit fraction of the whole.
- Use strategies to multiply whole numbers by fractions when the product is a whole number.
- Use paper folding and shading to represent fraction products.
- Use area models to represent fraction products and solve fraction multiplication problems.
- Use an algorithm to multiply fractions.
- Solve fraction number stories by interpreting drawings.
- Relate the multiplication rule for equivalent fractions to the Multiplicative Identity Property.
- Write a multiplication number story involving a fraction and a whole number.
- Use visual models to divide unit fractions by numbers and whole numbers by unit fractions.

CONTENT AREA STANDARDS

5.NF

A. Use equivalent fractions as a strategy to add and subtract fractions

B. Apply and extend previous understandings of multiplication and division to multiply and divide fractions

5.M

A. Convert like measurement units within a given measurement system

B. Geometric measurement: understand concepts of volume and relate volume to multiplication and to addition

5.DL

A. Understand and analyze data visualizations

5.G

A. Graph points on the coordinate plane to solve real-world and mathematical problems

B. Classify two-dimensional figures into categories based on their properties

MA.5.NF.A.1	Add and subtract fractions with unlike denominators (including mixed numbers) by replacing given fractions with equivalent fractions in such a way as to produce an equivalent sum or difference of fractions with like denominators.
MA.5.NF.A.2	Solve word problems involving addition and subtraction of fractions referring to the same whole, including cases of unlike denominators, e.g., by using visual fraction models or equations to represent the problem. Use benchmark fractions and number sense of fractions to estimate mentally and assess the reasonableness of answers.
MA.5.NF.B.3	Interpret a fraction as division of the numerator by the denominator ($a/b = a \div b$). Solve word problems involving division of whole numbers leading to answers in the form of fractions or mixed numbers, e.g., by using visual fraction models or equations to represent the problem.
MA.5.NF.B.4	Apply and extend previous understandings of multiplication to multiply a fraction or whole number by a fraction.
MA.5.NF.B.4a	Interpret the product $(a/b) \times q$ as a parts of a partition of q into b equal parts; equivalently, as the result of a sequence of operations $a \times q \div b$.
MA.5.NF.B.4b	Find the area of a rectangle with fractional side lengths by tiling it with unit squares of the appropriate unit fraction side lengths, and show that the area is the same as would be found by multiplying the side lengths. Multiply fractional side lengths to find areas of rectangles, and represent fraction products as rectangular areas.
MA.5.NF.B.5a	Comparing the size of a product to the size of one factor on the basis of the size of the other factor, without performing the indicated multiplication.
MA.5.NF.B.5b	Explaining why multiplying a given number by a fraction greater than 1 results in a product greater than the given number (recognizing multiplication by whole numbers greater than 1 as a familiar case); explaining why multiplying a given number by a fraction less than 1 results in a product smaller than the given number; and relating the principle of fraction equivalence $a/b = (n \times a)/(n \times b)$ to the effect of multiplying a/b by 1.
MA.5.NF.B.6	Solve real world problems involving multiplication of fractions and mixed numbers, e.g., by using visual fraction models or equations to represent the problem.
MA.5.NF.B.7	Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions.
MA.5.NF.B.7a	Interpret division of a unit fraction by a non-zero whole number, and compute such quotients.
MA.5.NF.B.7b	Interpret division of a whole number by a unit fraction, and compute such quotients.
MA.5.NF.B.7c	Solve real world problems involving division of unit fractions by non-zero whole numbers and division of whole numbers by unit fractions, e.g., by using visual fraction models and equations to represent the problem.

INTERDISCIPLINARY CONNECTIONS

Math and Cooking Integration:

- Students will create recipes that involve adding or subtracting fractions and mixed numbers greater than 1. Students can measure ingredients, adjust quantities, and follow instructions, applying strategies learned in fraction addition and subtraction.

RELATED STANDARDS (Technology, 21st Century Life & Careers, ELA Companion Standards are Required)

CS.K-12.2.d	Evaluate and select technological tools that can be used to collaborate on a project.
CS.K-12.7.a	Select, organize, and interpret large data sets from multiple sources to support a claim.
WRK.K-12.P.4	Demonstrate creativity and innovation.
WRK.K-12.P.5	Utilize critical thinking to make sense of problems and persevere in solving them.
WRK.K-12.P.8	Use technology to enhance productivity increase collaboration and communicate effectively.
TECH.K-12.P.4	Demonstrate creativity and innovation.
TECH.K-12.P.5	Utilize critical thinking to make sense of problems and persevere in solving them.

RESOURCES (Instructional, Supplemental, Intervention Materials)

Core Instructional Materials:

- Everyday Math Unit 5 Resources (Math Masters, Student Journal Volume 2, ConnectED)
- Calendar Math

Supplemental Materials:

- Illustrative Math Tasks
- IXL
- Games
 - Decimal Top-It: Subtraction (Lesson 5-1): Subtracting decimals
 - Hidden Treasure (Lesson 5-2): Plotting and naming points on a coordinate grid
 - Buzz or Bizz-Buzz (Lesson 5-2): Finding multiples
 - Build It with Common Denominators (Lesson 5-2): Comparing fractions and finding common denominators
 - Decimal Top-It: Addition (Lesson 5-3): Adding decimals
 - Fraction Of (Lesson 5-5): Solving fraction-of problems
 - Fraction/Whole Number Top-It (Lessons 5-6, 5-14): Multiplying fractions by whole numbers or fractions by fractions
 - Division Top-It: Larger Numbers (Lesson 5-7): Dividing multi-digit whole numbers
 - Multiplication Top-It: Larger Numbers (Lesson 5-8): Multiplying multi-digit whole numbers
 - Fraction Top-It: Addition (Lesson 5-11): Adding fractions
 - Spend and Save (Lesson 5-12): Adding and subtracting decimals in a money context
- Manipulatives
 - Fraction circles
 - Number card sets 1-9, 0-9, 1-10, 0-10, 10-20
 - Counters
 - 6-sided dice
 - Rulers

Intervention Materials:

- Number Worlds
- Touch Math Now

EVIDENCE OF LEARNING

Refer to the 'Formative, Summative, and Benchmark Assessments' sections.

Alternative Assessments

- Portfolios
- Verbal Assessment (instead of written)
- Multiple choice
- Modified Rubrics
- Performance Based Assessments

Formative Assessments

- Journal Pages
- Homelinks
- Math Boxes
- Observations
- Classwork
- Homework Assignments
- Do Now Questions
- Exit Tickets
- Self Assessment Questions

Summative Assessments

- Check Points
- Mid-Year Assessment
- Unit 5 Assessment
- Graded Assignments
- Project-based assessments

Benchmark Assessments

- IXL Screener / Diagnostic Snapshot BOY
- Trimester 1 Benchmark Assessment
- IXL Diagnostic Snapshot MOY
- Trimester 2 Benchmark Assessment
- IXL Diagnostic Snapshot EOY
- Trimester 3 Benchmark Assessment

ACCOMMODATIONS & MODIFICATIONS FOR SUBGROUPS

See link to Accommodations & Modifications document in course folder.