Unit 2: Understanding Operations on Fractions

Content Area: **Math**
Course(s):
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NJSLS Math

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.
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.
5.NF.B.3	Interpret a fraction as division of the numerator by the denominator (□/□ = □ ÷ □). 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.
5.NF.B.4	Apply and extend previous understandings of multiplication to multiply a fraction or whole number by a fraction.
5.NF.B.4.a	Interpret the product (□/□) × □ as □ parts of a partition of □ into □ equal parts; equivalently, as the result of a sequence of operations □ × □ ÷ □.
5.NF.B.4.b	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.
5.NF.B.5	Interpret multiplication as scaling (resizing), by:
5.NF.B.5.a	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.
5.NF.B.5.b	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 □/□ = (□ × □)/(□ × □) to the effect of multiplying □/□ by 1.
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.
5.NF.B.7	Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions.
5.NF.B.7.a	Interpret division of a unit fraction by a non-zero whole number, and compute such quotients.
5.NF.B.7.b	Interpret division of a whole number by a unit fraction, and compute such quotients.
5.NF.B.7.c	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.

Unit Focus

- Use equivalent fractions as a strategy to add and subtract fractions
- Apply and extend previous understandings of multiplication and division

Standards for Math Practice

1	Make sense of problems and persevere in solving them
2	Reason abstractly and quantitatively
3	Construct viable arguments and critique the reasoning of others
4	Model with mathematics
5	Use appropriate tools strategically
6	Attend to precision
7	Look for and make use of structure
8	Look for and express regularity in repeated reasoning

Critical Knowledge & Skills

NJSLS Math	Suggested Math Practices	Critical Knowledge and Skills
5.NF.A.1 (M) 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. For example, 2/3 + 5/4 = 8/12 + 15/12 = 23/12. (In general, a/b + c/d = (ad + bc)/bd).	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision.	Concept(s): • Equivalent fractions can be used to add and subtract fractions. Students will be able to: • Produce an equivalent sum (or difference) of fractions with like denominators from the original sum (or difference) of fractions that has unlike denominators. • Add and subtract fractions with unlike denominators, including mixed numbers, by replacing given fractions with equivalent fractions. Learning Goal 1: Add and subtract fractions (including mixed numbers) with unlike denominators by replacing the

	MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.	given fractions with equivalent fractions having like denominators
5.NF.A.2 (M) 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. For example, recognize an incorrect result 2/5 + 1/2 = 3/7, by observing that 3/7 < 1/2.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure.	Concept(s): No new concept(s) introduced Students will be able to: • Add and subtract fractions, including mixed numbers, with unlike denominators to solve word problems. • Represent calculations and solutions with visual fraction models and equations. • Estimate answers using benchmark fractions and explain whether the answer is reasonable. • Estimate answers by reasoning about the size of the fractions and explain whether the answer is reasonable. Learning Goal 2: Solve word problems involving adding or subtracting fractions with unlike denominators, and determine if the answer to the word problem is reasonable, using estimations with benchmark fractions.
5.NF.B.4a-b (M) Apply and extend previous understandings of multiplication to multiply a fraction or whole number by a fraction.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and	Concept(s): No new concept(s) introduced Students will be able to:

a. Interpret the product (a/b) x q as a parts of a partition of q into b equal parts; equivalently, as the result of a sequence of operations a x q ÷ b. For example, use a visual fraction model to show (2/3) x 4 = 8/3, and create a story context for this equation. Do the same with (2/3) x (4/5) = 8/15. (In general, (a/b) x (c/d) = (ac/bd). b. 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.	quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure.	• Apply and extend previous understandings of multiplication to multiply a fraction or whole number by a fraction. • Interpret the product (a/b) x q as a parts of a partition of q into b equal parts; equivalently, as the result of a sequence of operations a x q ÷ b. • Interpret the product of a fraction and a fraction as (a/b) x (c/d) = (ac/bd). • Tile a rectangle using the appropriate fractional unit square in order to find the area of a rectangle that has fractional side lengths. • Show that the area found by tiling would be that same as multiplying the side lengths. • Multiply fractional side lengths to find areas of rectangles. • Represent fraction products as rectangular areas. Learning Goal 6: For whole number or fraction q, interpret the product (a x b) x q as a parts of a whole partitioned into b equal parts added q times (e.g. using a visual fraction model). Learning Goal 3: Tile a rectangle with unit fraction squares to find the area and multiply side lengths to find the area of the rectangle, showing that the areas are the same.

5.NF.B.5a-b (M) Interpret multiplication as scaling (resizing), by: a. 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. b. 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 x a)/(n x b) to the effect of multiplying a/b by 1.	MP.2 Reason abstractly and quantitatively. MP.4 Model with mathematics. MP.6 Attend to precision. MP.7 Look for and make use of structure.	Concept(s): • Multiplication as resizing (scaling) Students will be able to: • Interpret multiplication as scaling (resizing) by comparing the size of a product to the size of one factor without performing the multiplication. • Explain why multiplying a given number by a fraction greater than one results in a product greater than one and why multiplying a given number by a fraction less than one results in a product smaller than the given number. • Multiplying a fraction a/b by n/n (a/b = (n x a / n x b)) has the same effect as multiplying a/b by 1 and creates an equivalent fraction. Learning Goal 4: Explain how a product is related to the magnitude of the factors, including cases in which one factor is a fraction greater than 1 and cases in which one factor is a fraction less than 1.
5.NF.B.6 (M) Solve real world problems involving multiplication of fractions and mixed numbers, e.g., by using visual fraction models or equations to represent the problem.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others.	Concept(s): • No new concept(s) introduced Students will be able to: • Multiply fractions and mixed numbers in order to solve real world problems. • Represent the solution to these real world problems with visual fraction models

	MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.	and equations. Learning Goal 5: Solve real-world problems involving multiplication of fractions (including mixed numbers), using visual fraction models or equations to represent the problem.
5.NF.B.3 (M) Interpret a fraction as division of the numerator by the denominator (i.e., a/b = a ÷ 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. For example, interpret 3/4 as the result of dividing 3 by 4, noting that 3/4 multiplied by 4 equals 3, and that when 3 wholes are shared equally among 4 people each person has a share of size 3/4. If 9 people want to share a 50-pound sack of rice equally by weight, how many pounds of rice should each person get? Between what two whole numbers does your answer lie? Climate Change Example: To examine the impact climate change has on agriculture, students may solve word problems about the reduced yields of staple crops and their distribution that involve division of whole numbers and lead to answers in the form of fractions.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure.	Concept(s): • Fractions represent division. Students will be able to: • Interpret a fraction as division of the numerator by the denominator using visual fraction models or equations. • Solve word problems involving division of whole numbers resulting in a fraction or mixed number quotient. Learning Goal 6: Interpret a fraction as a division of the numerator by the denominator; solve word problems in which division of whole numbers leads to fractions or mixed numbers as solutions.
5.NF.B.7a-c (M) Apply and extend previous understandings of	MP.1 Make sense of problems and	Concept(s):

division to divide unit fractions by whole numbers and whole numbers by unit fractions. a. Interpret division of a unit fraction by a non-zero whole number, and compute such quotients. For example, create a story context for (1/3) ÷ 4, and use a visual fraction model to show the quotient. Use the relationship between multiplication and division to explain that (1/3) ÷ 4 = 1/12 because 1/12 x 4 = 1/3. b. Interpret division of a whole number by a unit fraction, and compute such quotients. For example, create a story context for 4 ÷ (1/5), and use a visual fraction model to show the quotient. Use the relationship between multiplication and division to explain that 4 ÷ (1/5) = 20 because 20 x (1/5) = 4. c. 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. For example, how much chocolate will each person get if 3 people share 1/2 lb. of chocolate equally? How many 1/3-cup servings are in 2 cups of raisins? Climate Change Example: To examine the impact climate change has on agriculture, students may solve real-world problems about the reduced yields of staple crops and their distribution that involve	persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.	• No new concept(s) introduced Students will be able to: • Compute and interpret the quotients of a unit fraction by a non-zero whole number. • Compute and interpret the quotients of a non-zero whole number by a unit fraction. Learning Goal 7: Divide a unit fraction by a non-zero whole number and interpret by creating a story context or visual fraction model. Learning Goal 8: Divide a whole number by a unit fraction and interpret by creating a story context or visual fraction model. Learning Goal 9: Solve real-world problems involving division of unit fractions by whole numbers or whole numbers by unit fractions.

division of unit fractions by non-zero whole numbers and/or division of whole numbers by unit fractions.		

School/District Formative Assessment Plan

- Topic 7-1 through 7-12 Quick Check (found in Savvas Realize)
- Topic 8-1 through 8-9 Quick Check (found in Savvas Realize)
- Topic 9-1 through 9-8 Quick Check (found in Savvas Realize)

School/District Summative Assessment Plan

- Topic 7 Assessment
- Topic 8 Assessment
- Topic 9 Assessment

Benchmark & Alternative Assessments

- STAR Renaissance
- LinkIt Benchmarks
- Performance Task (found in Savvas Realize)

Focus Mathematical Concepts

Pre-requisite skills:

- Add multi-digit whole numbers using the standard algorithm (4.NBT.B.4).
- Subtract multi-digit whole numbers using the standard algorithm (4.NBT.B.4).

- Add within 1000 using strategies and algorithms based on place value, properties of operations, and/or the relationship between addition and subtraction (3.NBT.A.2).
- Subtract within 1000 using strategies and algorithms based on place value,properties of operations, and/or the relationship between addition and subtraction (3.NBT.A.2).
- Find whole-number quotients and remainders with up to four-digit dividends and one-digit divisors using strategies based on place value (4.NBT.B.6).
- Find whole-number quotients and remainders with up to four-digit dividends and one-digit divisors using strategies based on properties of operations and/or the relationship between multiplication and division (4.NBT.B.6).
- Explain why a fraction a/b is equivalent to a fraction (n x a) / (n x b) by using visual fraction models (4.NF.A.1).
- Recognize and generate equivalent fractions (4.NF.A.1).
- Understand that the number and size of the parts of equivalent fractions differ even though the two fractions are the same size (4.NF.A.1).
- Add and subtract mixed numbers with like denominators (4.NF.B.3).
- Recognize that, when comparing two fractions, they must refer to the same whole (4.NF.A.2).
- Compare two fractions with different numerators and denominators by comparing to benchmark fraction such as ½ (4.NF.A.2).
- A fraction a/b is a multiple of 1/b (4.NF.B.4).
- A multiple of a/b is also a multiple of 1/b using a visual fraction model (4.NF.B.4).
- Multiply a fraction by a whole number by using the idea that a/b is a multiple of 1/b (4.NF.B.4).
- Interpret multiplication equations as a comparison statement (4.OA.A.1).
- Represent verbal comparison statements as multiplication equations (4.OA.A.1).
- Distinguish multiplicative comparison from additive comparison (4.OA.A.1).
- Multiply and divide to solve word problems involving multiplicative comparisons, using drawings and equations containing a variable to represent the problem (4.OA.A.2).
- Interpret whole number quotients of whole numbers as the number of objects in each share (or groups) or as the number of shares (or groups) that result from partitioning a total number of objects (3.OA.A.2).
- A related multiplication problem with an unknown factor can be used to solve a division problem (3.OA.B.6).
- A fraction is a quantity formed when a whole is partitioned into equal parts where a unit fraction 1/b is the quantity formed by 1 part when a whole is partitioned into b equal parts. (For example, 1/4 is the quantity that is formed by 1 part of the 4 total parts when the whole is partitioned into 4 equal parts)

(3.NF.A.1).

- A fraction ab as the quantity formed by a parts, where each part has a size of 1/b. (For example, 3/4 is the quantity that is formed by 3 parts of the 4 total parts where each part has a size of 1/4.) (3.NF.A.1).

Common Misconceptions:

- Students think that as you move to the left of the decimal point, the number increases in value. Reinforcing the concept of powers of ten is essential for addressing this issue.
- Students think that the longer the number the greater the number.
- Students might compute the sum or difference of decimals by lining up the right-hand digits as they would the whole number.
- Students often mix models when adding, subtracting or comparing fractions. Students will use a circle for thirds and a rectangle for fourths when comparing fractions with thirds and fourths. Remind students that the representations need to be from the same whole models with the same shape and size.
- Students may believe that multiplication always results in a larger number.
- Students may believe that division always results in a smaller number.

Number Fluency:

- 5.NBT.B.5 Multiply multi-digit whole numbers using the standard algorithm.

District/School Tasks

- Pick A Project (found in Savvas Realize)
- Performance Tasks (found in Savvas Realize)

District/School Primary, Supplemental and Intervention Resources

- Envisions by Savvas (P)
- STAR Renaissance (S)
- Freckle Math (S)
- Connecting Math Concepts (I)
- Corrective Math (I)

Instructional Best Practices/Open Educational Resources

Illustrative Mathematics

Desmos

Numeracy Tasks

Building Thinking Classrooms Tasks

Open Middle Math Tasks

Resources from Dr. Eric Milou

Career Readiness, Life Literacies & Key Skills

9.1.5.CR.1	Compare various ways to give back and relate them to your strengths, interests, and other personal factors.
9.2.5.CAP.3	Identify qualifications needed to pursue traditional and non-traditional careers and occupations.
9.2.5.CAP.4	Explain the reasons why some jobs and careers require specific training, skills, and certification (e.g., life guards, child care, medicine, education) and examples of these requirements.
9.4.5.CT.1	Identify and gather relevant data that will aid in the problem-solving process (e.g., 2.1.5.EH.4, 4-ESS3-1, 6.3.5.CivicsPD.2).
9.4.5.CT.3	Describe how digital tools and technology may be used to solve problems.
9.4.5.CT.4	Apply critical thinking and problem-solving strategies to different types of problems such as personal, academic, community and global (e.g., 6.1.5.CivicsCM.3).
9.4.5.IML.2	Create a visual representation to organize information about a problem or issue (e.g., 4.MD.B.4, 8.1.5.DA.3).
9.4.5.IML.3	Represent the same data in multiple visual formats in order to tell a story about the data.
9.4.5.TL.2	Sort and filter data in a spreadsheet to analyze findings.

Computer Science & Design Thinking

8.1.5.DA.1	Collect, organize, and display data in order to highlight relationships or support a claim.
8.1.5.DA.2	Compare the amount of storage space required for different types of data.
8.1.5.DA.3	Organize and present collected data visually to communicate insights gained from different views of the data.
8.1.5.DA.4	Organize and present climate change data visually to highlight relationships or support a

	claim.
8.1.5.DA.5	Propose cause and effect relationships, predict outcomes, or communicate ideas using data.

Interdisciplinary Connections

5-PS1-1	Develop a model to describe that matter is made of particles too small to be seen.
RI.CR.5.1	Quote accurately from an informational text when explaining what the text says explicitly and make relevant connections when drawing inferences from the text.
RI.MF.5.6	Interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, timelines, animations, or interactive elements on web pages) and explain how the information contributes to an understanding of the text in which it appears.
RI.AA.5.7	Explain how an author uses reasons and evidence to support particular points in a text, identifying which reasons and evidence support which point(s).
RI.CT.5.8	Compare and contrast the authors' approaches across two or more informational texts within the same genre or about texts on the same or similar topics.
W.AW.5.1	Write opinion pieces on topics or texts, supporting a point of view with reasons and information.
W.AW.5.1.A	Introduce a topic or text clearly, state an opinion, and create an organizational structure in which ideas are logically grouped to support the writer's purpose.
W.AW.5.1.B	Provide logically ordered reasons that are supported by facts and details from text(s), quote directly from text when appropriate.
W.AW.5.1.C	Link opinion and reasons using words, phrases, and clauses (e.g., consequently, specifically).
W.AW.5.1.D	Provide a conclusion related to the opinion presented.
5-ESS1-1	Support an argument that differences in the apparent brightness of the sun compared to other stars is due to their relative distances from Earth.