Grade: 5 **Unit 6 –Algebraic Thinking Involving Operations and Word Problems**	**Subject: Math** • **Time Frame: 20 days** • **Domains: Operations and Algebraic Thinking; Number and Operations in Base Ten; Numbers & Operations-Fractions**	
Standards	Content Standards: 5.NF.1, 5.NF.2, 5.NF.3, 5.NF.4, 5.NF.4a, 5.NF.4b, 5.NF.5, 5.NF.5a, 5.NF.5b, 5.NF.6, 5.NBT.5, 5.NBT.6, 5.NBT.4, 5.NBT.7, 5.NBT.7c, 5.OA.1 http://www.corestandards.org/wp-content/uploads/Math_Standards.pdf	Practice Standards: MP 1, 2, 3, 4, 5, 6, 7, 8
Enduring Understandings	1. Fractions express quantities with greater precision. 2. Benchmark fractions help us estimate and determine if our calculations are reasonable. 3. Benchmark fractions help us compare. 4. Fractions can represent division. 5. Estimating helps us determine the reasonableness of our solution. 6. We can use multiplication to solve problems with fractions and mixed numbers. 7. Calculating with decimals is similar to calculating with whole numbers. 8. There is an order of operations that can be used to evaluate expressions and solve problems.	
Essential Questions	1. How are benchmark fractions helpful to mathematicians? 2. How can we use fractions to represent division? 3. How can we determine the reasonableness of our solutions? 4. How can we use multiplication to solve problems with fractions and mixed numbers? 5. How do we add, subtract, multiply, and divide decimals and what does our solution mean? 6. Why do mathematicians follow a specific order when evaluating expressions or solving equations?	

Vocabulary	**online dictionary** **visual math dictionary** decimal place, rounding, standard algorithm, multiply, product, factor, dividend, divisor, array, area model, quotient, tenths, hundredths, add, subtract, multiply, divide, addend, sum, difference, factor, product, quotient, whole number, mixed numbers, improper fraction, equivalent fraction, addend, sum, difference, numerator, denominator, benchmark fraction, addition, subtraction, mixed number, improper fraction, dividend, divisor, quotient, fraction, parenthesis, expression, evaluate, bracket, variable

Priority and Supporting CCSS	Explanations and Examples*
5.OA.1 Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols.	**5.OA.1** This standard builds on the expectations of third grade where students are expected to start learning the conventional order. Students need experiences with multiple expressions that use grouping symbols throughout the year to develop understanding of when and how to use parentheses, brackets, and braces. First, students use these symbols with whole numbers. Then the symbols can be used as students add, subtract, multiply and divide decimals and fractions. Examples: • (26 + 18) 4 Answer: 11 • {[2 x (3+5)] – 9} + [5 x (23-18)] Answer: 32 • 12 – (0.4 x 2) Answer: 11.2 • (2 + 3) x (1.5 – 0.5) Answer: 5 • $6 (-\frac{1}{2} + \frac{1}{3})$ Answer: 5 1/6 • { 80 [2 x (3 ½ + 1 ½)] }+ 100 Answer: 108 To further develop students' understanding of grouping symbols and facility with operations, students place grouping symbols in equations to make the equations true or they compare expressions that are grouped differently. Examples: • 15 + 7 – 2 = 10 → 15 + (7 – 2) = 10 • 3 x 125 ÷ 25 + 7 = 22 → [3 x (125 ÷ 25)] + 7 = 22 • 24 ÷ 12 ÷ 6 ÷ 2 = 2 x 9 + 3 ÷ ½ → 24 ÷ [(12 ÷ 6) ÷ 2] = (2 x 9) + (3 ÷ ½) • Compare 3 x 2 + 5 and 3 x (2 + 5) • Compare 15 – 6 + 7 and 15 – (6 + 7)
5.NF.3 Interpret a fraction as division of the numerator by the denominator (*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*	**5.NF.3** Students are expected to demonstrate their understanding using concrete materials, drawing models, and explaining their thinking when working with fractions in multiple contexts. They read 3/5 as "three fifths" and after many experiences with sharing problems, learn that 3/5 can also be interpreted as "3 divided by 5." Examples: • Ten team members are sharing 3 boxes of cookies. How much of a box will each student get? • When working this problem a student should recognize that the 3 boxes are

*Source – Connecticut Core Standards for Mathematics as adapted from the Arizona Academic Content Standards

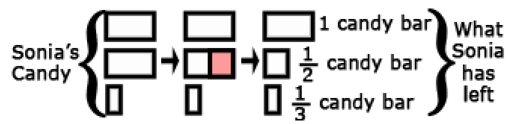
each person get? Between what two whole numbers does your answer lie?	being divided into 10 groups, so s/he is seeing the solution to the following equation, 10 x *n* = 3 (10 groups of some amount is 3 boxes) which can also be written as n = 3 ÷ 10. Using models or diagram, they divide each box into 10 groups, resulting in each team member getting 3/10 of a box. • Two afterschool clubs are having pizza parties. For the Math Club, the teacher will order 3 pizzas for every 5 students. For the student council, the teacher will order 5 pizzas for every 8 students. Since you are in both groups, you need to decide which party to attend. How much pizza would you get at each party? If you want to have the most pizza, which party should you attend? • The six fifth grade classrooms have a total of 27 boxes of pencils. How many boxes will each classroom have to use? Students may recognize this as a whole number division problem but should also express this equal sharing problem as 27/6. They explain that each classroom gets 27/6 boxes of pencils and can further determine that each classroom gets 4 3/6 or 4 ½ boxes of pencils.
5.NF.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. ***For example, 2/3 + 5/4 = 8/12 + 15/12 = 23/12. (In general, a/b + c/d = (ad + bc)/bd.)***	**5.NF.1** Students should apply their understanding of equivalent fractions developed in fourth grade and their ability to rewrite fractions in an equivalent form to find common denominators. They should know that multiplying the denominators will always give a common denominator but may not result in the smallest denominator. Examples: • $\frac{2}{5}+\frac{7}{8}=\frac{16}{40}+\frac{35}{40}=\frac{51}{40}$ • $3\frac{1}{4}-\frac{1}{6}=3\frac{3}{12}-\frac{2}{12}=3\frac{1}{12}$

5.NF.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. ***For example, recognize an incorrect result 2/5 + 1/2 = 3/7, by observing that 3/7 < 1/2.***

5.NF.2

Example: Using a bar diagram

• Sonia had 2 1/3 candy bars. She promised her brother that she would give him ½ of a candy bar. How much will she have left after she gives her brother the amount she promised?



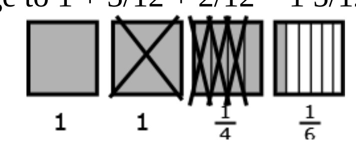
Now students need to use equivalent fractions to find the total of 1 + ½ + 1/3.

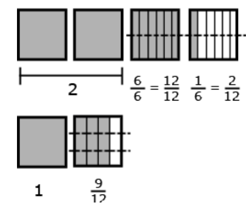
If Mary ran 3 miles every week for 4 weeks, she would reach her goal for the month. The first day of the first week she ran 1 ¾ miles. How many miles does she still need to run the first week?

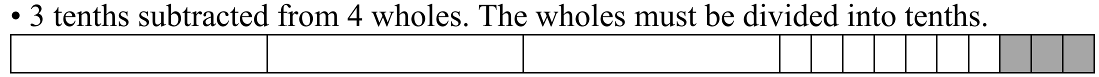
- Using addition to find the answer:1 ¾ + n = 3
- A student might add 1 ¼ to 1 ¾ to get to 3 miles. Then he or she would add 1/6 more. Thus 1 ¼ miles + 1/6 of a mile is what Mary needs to run during that week.

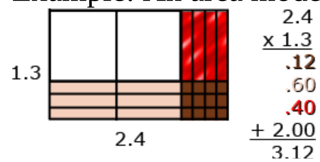
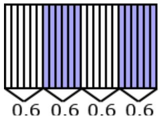
Example: Using an area model to subtract

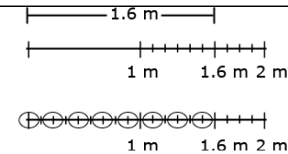
• This model shows 1 ¾ subtracted from 3 1/6 leaving 1 + ¼ + 1/6 which a student can then change to 1 + 3/12 + 2/12 = 1 5/12.



	$3\frac{1}{6}$ and 1 ¾ can be expressed with a denominator of 12. Once this is done a student can complete the problem, 2 14/12 – 1 9/12 = 1 5/12. • This diagram models a way to show how $3\frac{1}{6}$ and 1 ¾ can be expressed with a denominator of 12. Once this is accomplished, a student can complete the problem, 2 14/12 – 1 9/12 = 1 5/12. 
	Estimation skills include identifying when estimation is appropriate, determining the level of accuracy needed, selecting the appropriate method of estimation, and verifying solutions or determining the reasonableness of situations using various estimation strategies. Estimation strategies for calculations with fractions extend from students' work with whole number operations and can be supported through the use of physical models. Example: • Elli drank $\frac{3}{5}$ quart of milk and Javier drank $\frac{1}{10}$ of a quart less than Ellie. How much milk did they drink all together? Solution: • $\frac{3}{5}-\frac{1}{10}=\frac{6}{10}-\frac{1}{10}=\frac{5}{10}$ This is how much milk Javier drank • $\frac{3}{5}+\frac{5}{10}=\frac{6}{10}+\frac{5}{10}=\frac{11}{10}$ Together they drank $1\frac{1}{10}$ quarts of milk

	This solution is reasonable because Ellie drank more than ½ quart and Javier drank ½ quart so together they drank slightly more than one quart.
5.NBT.7 Add, subtract, multiply, and divide decimals to hundredths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used.	**5.NBT.7** This standard requires students to extend the models and strategies they developed for whole numbers in grades 1-4 to decimal values. Before students are asked to give exact answers, they should estimate answers based on their understanding of operations and the value of the numbers. Examples: • 3.6 + 1.7 [A student might estimate the sum to be larger than 5 because 3.6 is more than 3 ½ and 1.7 is more than 1 ½.] • 5.4 – 0.8 [A student might estimate the answer to be a little more than 4.4 because a number less than 1 is being subtracted.] • 6 x 2.4 [A student might estimate an answer between 12 and 18 since 6 x 2 is 12 and 6 x 3 is 18. Another student might give an estimate of a little less than 15 because s/he figures the answer to be very close, but smaller than 6 x 2 ½ and think of 2 ½ groups of 6 as 12 (2 groups of 6) + 3 (½ of a group of 6.)] Students should be able to express that when they add decimals they add tenths to tenths and hundredths to hundredths. So, when they are adding in a vertical format (numbers beneath each other), it is important that they write numbers with the same place value beneath each other. This understanding can be reinforced by connecting addition of decimals to their understanding of addition of fractions. Adding fractions with denominators of 10 and 100 is a standard in fourth grade. Example: 4 - 0.3 • 3 tenths subtracted from 4 wholes. The wholes must be divided into tenths.  The answer is 3 and 7/10 or 3.7.

	Example: An area model can be useful for illustrating products.  Students should be able to describe the partial products displayed by the area model. For example, "3/10 times 4/10 is 12/100. 3/10 times 2 is 6/10 or 60/100. 1 group of 4/10 is 4/10 or 40/100. 1 group of 2 is 2." Example of division: finding the number in each group or share • Students should be encouraged to apply a fair sharing model separating decimal values into equal parts such as 
	5.NBT.7 Example of division: find the number of groups • Joe has 1.6 meters of rope. He has to cut pieces of rope that are 0.2 meters long. How many can he cut? • To divide to find the number of groups, a student might: • draw a segment to represent 1.6 meters. In doing so, s/he would count in tenths to identify the 6 tenths, and be able identify the number of 2 tenths within the 6 tenths. The student can then extend the idea of counting by tenths to divide the one meter into tenths and determine that there are 5 more groups of 2 tenths.

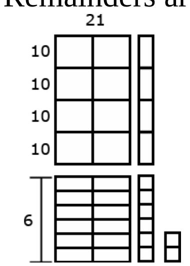


- count groups of 2 tenths without the use of models or diagrams. Knowing that 1 can be thought of as 10/10, a student might think of 1.6 as 16 tenths. Counting 2 tenths, 4 tenths, 6 tenths, . . .16 tenths, a student can count 8 groups of 2 tenths.
- use their understanding of multiplication and think, “8 groups of 2 is 16, so 8 groups of 2/10 is 16/10 or 1 6/10.”

Technology Connections: Create models using Interactive Whiteboard software (such as SMART Notebook)

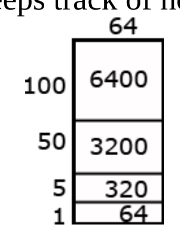
Example: 968 ÷ 21

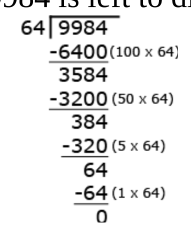
• Using base ten models, a student can represent 962 and use the models to make an array with one dimension of 21. The student continues to make the array until no more groups of 21 can be made. Remainders are not part of the array.

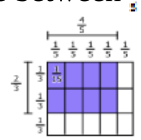


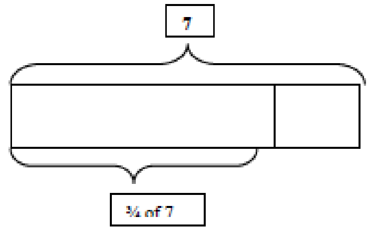
Example: 9984 ÷ 64

• An area model for division is shown below. As the student uses the area model, s/he keeps track of how much of the 9984 is left to divide.





	Technology Connections: • Models created using IWB software (such as SMART Notebook) • Array tools • http://illuminations.nctm.org/ActivityDetail.aspx?ID=64
5.NF.4 Apply and extend previous understandings of multiplication to multiply a fraction or whole number by a fraction. **a. Interpret the product (*a*/*b*) × *q* as *a* parts of a partition of *q* into *b* equal parts; equivalently, as the result of a sequence of operations *a* × *q* ÷ *b*. *For example, use a visual fraction model to show (2/3) × 4 = 8/3, and create a story context for this equation. Do the same with (2/3) × (4/5) = 8/15. (In general, (a/b) × (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.**	**5.NF.4** Students are expected to multiply fractions including proper fractions, improper fractions, and mixed numbers. They multiply fractions efficiently and accurately as well as solve problems in both contextual and non-contextual situations. As they multiply fractions such as 3/5 x 6, they can think of the operation in more than one way. • 3 x (6 ÷ 5) or (3 x 6/5) • (3 x 6) ÷ 5 or 18 ÷ 5 (18/5) Students create a story problem for 3/5 x 6 such as, • Isabel had 6 feet of wrapping paper. She used 3/5 of the paper to wrap some presents. How much does she have left? • Every day Tim ran 3/5 of mile. How far did he run after 6 days? (Interpreting this as 6 x 3/5) Example: • In solving the problem $\frac{2}{3}$ x $\frac{4}{5}$, students use an area model to visualize it as a 2 by 4 array of small rectangles each of which has side lengths 1/3 and 1/5. They reason that 1/3 x 1/5 = 1/(3 x 5) by counting squares in the entire rectangle, so the area of the shaded area is (2 x 4) x 1/(3 x 5) = $\frac{2 \times 4}{3 \times 5}$. They can explain that the product is less than $\frac{4}{5}$ because they are finding $\frac{2}{3}$ of $\frac{4}{5}$. They can further estimate that the answer must be between $\frac{2}{5}$ and $\frac{4}{5}$, and because $\frac{2}{3}$ of $\frac{4}{5}$ is more than $\frac{1}{2}$ of $\frac{4}{5}$ and less than one group of $\frac{4}{5}$.  The area model and the line segments show that the area is the same quantity as the product of the side lengths.

5.NF.5 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*×*a*)/(*n*×*b*) to the effect of multiplying *a*/*b* by 1.**	**5.NF.5** Examples: • $\frac{3}{4} \times 7$ is less than 7 because 7 is multiplied by a factor less than 1 so the product must be less than 7.  • $2\frac{2}{3}$ x 8 must be more than 8 because 2 groups of 8 is 16 and $2\frac{2}{3}$ is almost 3 groups of 8. So the answer must be close to, but less than 24. • $\frac{3}{4} = \frac{5 \times 3}{5 \times 4}$ because multiplying $\frac{3}{4}$ by $\frac{5}{5}$ is the same as multiplying by 1.

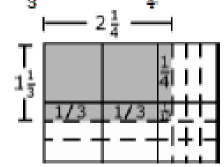
5.NF.6 Solve real world problems involving multiplication of fractions and mixed numbers, e.g., by using visual fraction models or equations to represent the problem.

5.NF.6

Examples:

- Evan bought 6 roses for his mother. $\frac{2}{3}$ of them were red. How many red roses were there?
  - Using a visual, a student divides the 6 roses into 3 groups and counts how many are in 2 of the 3 groups.

  - A student can use an equation to solve.
    $\frac{2}{3} \times 6 = \frac{12}{3} = 4$ red roses
- Mary and Joe determined that the dimensions of their school flag needed to be $1\frac{1}{3}$ ft. by $2\frac{1}{4}$ ft. What will be the area of the school flag?
  - A student can draw an array to find this product and can also use his or her understanding of decomposing numbers to explain the multiplication. Thinking ahead a student may decide to multiply by $1\frac{1}{3}$ instead of $2\frac{1}{4}$.



The explanation may include the following:

- First, I am going to multiply $2\frac{1}{4}$ by 1 and then by $\frac{1}{3}$.
- When I multiply $2\frac{1}{4}$ by 1, it equals $2\frac{1}{4}$.
- Now I have to multiply $2\frac{1}{4}$ by $\frac{1}{3}$.
- $\frac{1}{3}$ times 2 is $\frac{2}{3}$.
- $\frac{1}{3}$ times $\frac{1}{4}$ is $\frac{1}{12}$.
- So the answer is $2\frac{1}{4} + \frac{2}{3} + \frac{1}{12}$ or $2\frac{3}{12} + \frac{8}{12} + \frac{1}{12} = 2\frac{12}{12} = 3$

Resources
Math Expressions–Unit 6, Lessons 1-11 Soar to Success Math Intervention Mega Math Destination Math Common Core Mathematics-Newmark Learning Xtramath.org Connecticut State Department of Education http://www.sde.ct.gov/sde/cwp/view.asp?a=2618&q=320872

Unit Assessments
Unit Test Formative Assessments (Math Expressions) Quick Quizzes Performance Tasks Formative Assessment: http://3-5cctask.ncdpi.wikispaces.net/5.OA.1-5.OA.2

Technology: Videos, Websites, Links
www.learnzillion.com https://grade5commoncoremath.wikispaces.hcpss.org/5.NBT.2 https://grade5commoncoremath.wikispaces.hcpss.org/5.NBT.3 https://grade5commoncoremath.wikispaces.hcpss.org/5.NBT.5 https://grade5commoncoremath.wikispaces.hcpss.org/5.NBT.6 https://grade5commoncoremath.wikispaces.hcpss.org/5.NBT.7