4^{th} Grade Unit 4 Mathematics

Dear Parents,

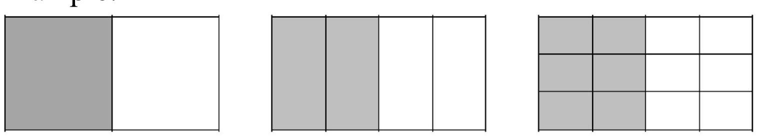
The Mathematics Georgia Standards of Excellence (MGSE), present a balanced approach to mathematics that stresses understanding, fluency, and real world application equally. Know that your child is not learning math the way many of us did in school, so hopefully being more informed about this curriculum will assist you when you help your child at home.

Below you will find the standards from Unit Four in bold print and underlined. Following each standard is an explanation with student examples. Please contact your child's teacher if you have any questions.

NF.1 Explain why two or more fractions are equivalent $a/b = (n \times a)/(n \times b)$, ex; *1/4 = (3x1)/(3x4)* by using visual fraction models. Focus attention to how the number and size of the parts differ even though the two fractions themselves are the same size. Use this principle to recognize and generate equivalent fractions.

This standard addresses equivalent fractions by first having students use visual models such as fraction bars, Cuisenaire rods, or pattern blocks to create equivalent fractions. Students will then examine the idea that equivalent fractions can be created by multiplying both the numerator and denominator by the same number or by dividing a shaded region into various parts.

Example:



1/2 = 2/4 = 6/12

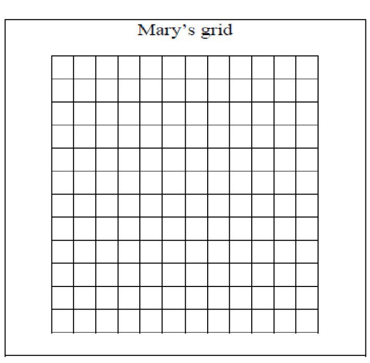
NF.2 Compare two fractions with different numerators and different denominators, e.g., by using visual fraction models, by creating common denominators or numerators, or by comparing to a benchmark fraction such as 1/2. Recognize that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparisons with symbols >, =, or <, and justify the conclusions.

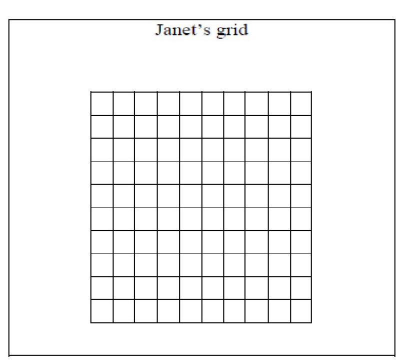
This standard calls for students to compare fractions by creating visual fraction models or finding common denominators or numerators using a variety of strategies. Students' experiences should focus on visual fraction models rather than algorithms. Students should learn to draw fraction models to help them compare. Students must also recognize that they must consider the size of the whole when comparing fractions (i.e., 1/2 of an individual sized pizza is very different from 1/2 of a large pizza).

Example:

Mary used a 12 × 12 grid to represent 1 and Janet used a 10 × 10 grid to represent 1. Each girl shaded grid squares to show ¼. How many grid squares did Mary shade? How many grid squares did Janet shade? Why did they need to shade different numbers of grid squares?

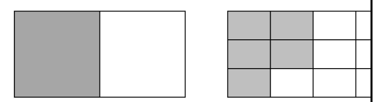
Possible solution: Mary shaded 36 grid squares; Janet shaded 25 grid squares. The total number of little squares is different in the two grids, so ¼ of each total number is different.



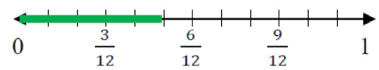


Example:
There are two cakes on the counter that are the same size. One-half of the first cake is left, but 5/12 of the second cake is left. Which cake has more left?

Student 1: ***Area Model***
The first cake has more left over. The second cake has 5/12 left which is smaller than 1/2.



Student 2: ***Number Line Model***
The first cake has more left over: 1/2 is greater than 5/12.



Student 3: ***Verbal Explanation***
I know that 6/12 equals 1/2, and 5/12 is less than 6/12. Therefore, the second cake has less left over than the first cake. The first cake has more left over.

<u>NF.3 Understand a fraction *a*/*b* with *a numerator* > 1 as a sum of fractions 1/*b*.</u>
a. Understand addition and subtraction of fractions as joining and separating parts referring to the same whole.
*****Primary focus on computation within a whole (not requiring regrouping of any kind) in this unit*****

A fraction with a numerator of one is called a unit fraction (i.e, ½, ⅓, ¼ are all unit fractions). When students investigate fractions other than unit fractions, such as ⅔ , they should be able to join (compose) or separate (decompose) the fractions into unit fractions.

Example: ⅔ = ⅓ + ⅓

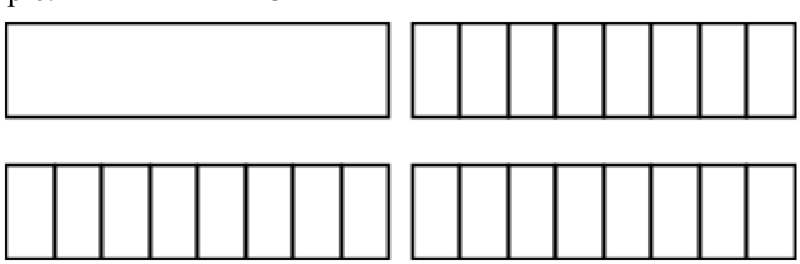
Being able to visualize this decomposition into unit fractions helps students when adding or subtracting fractions. Students need multiple opportunities to work with mixed numbers and be able to decompose them in more than one way. Students may use visual models to help develop this understanding.

Example: 1 ¼ - ¾ = ? 1 ¼ = 4/4 + ¼ = 5/4 5/4 - ¾ = 2/4

b. Decompose a fraction into a sum of fractions with the same denominator in more than one way, recording each decomposition by an equation. Justify decompositions, e.g., by using a visual fraction model. *Examples: 3/8 = 1/8 + 1/8 + 1/8 ; 3/8 = 1/8 + 2/8 ; 2 1/8 = 1 + 1 + 1/8 = 8/8 + 8/8 + 1/8.*

Students should justify their breaking apart (decomposing) of fractions using visual fraction models. The concept of turning mixed numbers into improper fractions needs to be emphasized using visual fraction models and decomposing.

Example: $1\frac{1}{8} = 1 + \frac{1}{8}$ OR $\frac{8}{8} + \frac{1}{8} = \frac{9}{8}$



c. Add and subtract mixed numbers with like denominators, e.g., by replacing each mixed number with an equivalent fraction, and/or by using properties of operations and the relationship between addition and subtraction.

A separate algorithm for mixed numbers in addition and subtraction is not necessary. Students will tend to add or subtract the whole numbers first and then work with the fractions using the same strategies they have applied to problems that contained only fractions.

Example:

Susan and Maria are making gift baskets. Susan has 3 ⅛ feet of ribbon and Maria has 5 ⅜ feet of ribbon. How much ribbon do they have altogether?

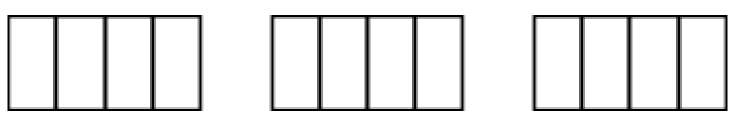
Student: I can add the whole numbers first (3 + 5 = 8 feet of ribbon). Then, ⅛ + ⅜ = 4/8 . So, they have a total of 8 4/8 feet of ribbon.

Mixed numbers are formally introduced for the first time in 4th Grade. Students should have ample experiences of adding and subtracting mixed numbers where they work with mixed numbers or convert mixed numbers into improper fractions.

d. Solve word problems involving addition and subtraction of fractions referring to the same whole and having like denominators, e.g., by using visual fraction models and equations to represent the problem.

Example:

A cake recipe calls for you to use ¾ cup of milk, ¼ cup of oil, and 2/4 cup of water. How much liquid was needed to make the cake?



Student: If I combine the amount of milk with the oil, I will get one full cup. Then, the water will add another 2/4 cup. There will be a total of 1 2/4 cup of liquid.

<u>NF.5 Express a fraction with denominator 10 as an equivalent fraction with denominator 100, and use this technique to add two fractions with respective denominators 10 and 100.</u> ***<u>For example, express 3/10 as 30/100, and add 3/10 + 4/100 = 34/100.</u>***

This standard extends the study of equivalent fractions from third grade by having students change fractions with a 10 in the denominator into equivalent fractions that have a 100 in the denominator. Student experiences should focus on working with grids rather than algorithms in order to prepare for work with decimals in MGSE4.NF.6 and MGSE4.NF7. Students can also use base ten blocks and other place value models to explore the relationship between fractions with denominators of 10 and denominators of 100.

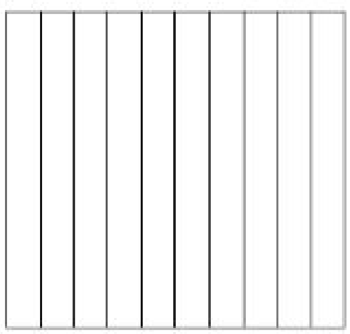
The work completed by students in 4th grade with this standard lays the foundation for performing operations with decimals in 5th grade.

Example:

Represent 3 tenths and 30 hundredths using the decimal grid on the models below.

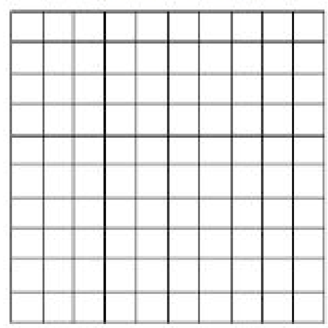
Ones	.	Tenths	Hundredths

Tenths Grid



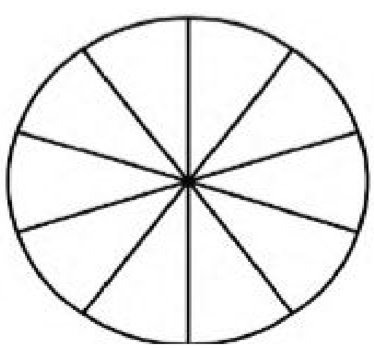
.3 = 3 tenths = 3/10

Hundredths Grid

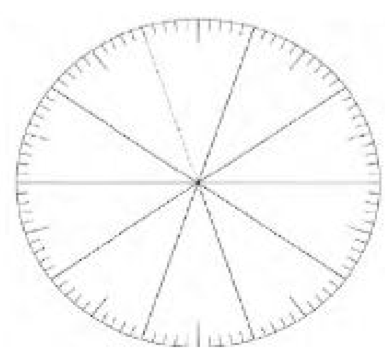


.30 = 30 hundredths = 30/100

Tenths circle



Hundredths circle



NF.6 Use decimal notation for fractions with denominators 10 or 100. ***For example, rewrite 0.62 as 62/100; describe a length as 0.62 meters; locate 0.62 on a number line diagram.***

Decimals are introduced for the first time in fourth grade. Students should have ample opportunities to explore and reason about the idea that a number can be represented as both a fraction and a decimal.
Students make connections between fractions with denominators of 10 and 100 and the place value chart. By reading fraction names, students say $\frac{32}{100}$ as thirty-two hundredths and rewrite this as 0.32 or represent it on a place value model as shown below.

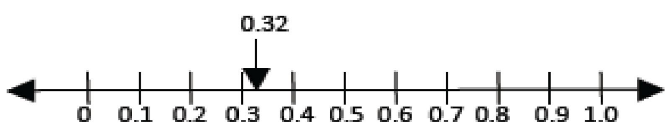
Hundreds	Tens	Ones	.	Tenths	Hundredths
			.	3	2

Students use the representations explored in NF.5 to understand $\frac{32}{100}$ can be expanded to $\frac{3}{10}$ and $\frac{2}{100}$.
Students represent values such as 0.32 or $\frac{32}{100}$ on a number line. $\frac{32}{100}$ is more than $\frac{30}{100}$ (or $\frac{3}{10}$) and less than $\frac{40}{100}$ (or $\frac{4}{10}$). It is closer to $\frac{30}{100}$ so it would be placed on the number line near that value.

NF.7 Compare two decimals to hundredths by reasoning about their size. Recognize that comparisons are valid only when the two decimals refer to the same whole. Record the results of comparisons with the symbols >, =, or <, and justify the conclusions, e.g., by using a visual model.

Visual models for fourth graders to compare decimals include area models, decimal grids, decimal circles, number lines, and meter sticks. Through these experiences and their work with fraction models, they build the understanding that comparisons between decimals or fractions are only valid when the whole is the same for both cases. When the wholes are the same, the decimals or fractions can be compared. In other words, they would not compare 0.5 of an extra-large pizza to 0.8 of an small pizza.

Example:
Draw a model to show that 0.3 < 0.5. (*Students would sketch two models of approximately the same size to show the area that represents three-tenths is smaller than the area that represents five-tenths.*)



<u>**NBT.4 Fluently add and subtract multi-digit whole numbers using the standard algorithm.**</u>

Students build on their understanding of addition and subtraction, their use of place value, and their flexibility with multiple strategies to make sense of the standard algorithm. They continue to use place value in describing and justifying the processes they use to add and subtract.
When students begin using the standard algorithm, their explanation may be quite lengthy. After much practice with using place value to justify their steps, they will develop fluency with the algorithm. Students should be able to explain why the algorithm works.

Example:
$$\begin{array}{r} 3892 \\ \underline{+\ 1567} \end{array}$$

Student explanation for this problem:

1. Two ones plus seven ones is nine ones.
2. Nine tens plus six tens is 15 tens.

3. I am going to write down five tens and think of the10 tens as one more hundred.(*Denotes with a 1 above the hundreds column*).
4. Eight hundreds plus five hundreds plus the extra hundred from adding the tens is 14 hundreds.
5. I am going to write the four hundreds and think of the 10 hundreds as one more 1000. (*Denotes with a 1 above the thousands column*).
6. Three thousands plus one thousand plus the extra thousand from the hundreds is five thousand.

Example:
$$\begin{array}{r} 3546 \\ \underline{-\ \ 928} \end{array}$$

Student explanations for this problem:

1. There are not enough ones to take 8 ones from 6 ones so I have to use one ten as 10 ones. Now I have 3 tens and 16 ones. (*Marks through the 4 and denotes with a 3 above the 4 and writes a 1 above the ones column to be represented as 16 ones.*)
2. Sixteen ones minus 8 ones is 8 ones. (*Writes an 8 in the ones column of the answer.*)
3. Three tens minus 2 tens is one ten. (*Writes a 1 in the tens column of the answer.*)
4. There are not enough hundreds to take 9 hundreds from 5 hundreds so I have to use one thousand as 10 hundreds. (*Marks through the 3 and denotes with a 2 above it. Writes down a 1 above the hundreds column.*) Now I have 2 thousands and 15 hundreds.
5. Fifteen hundreds minus 9 hundreds is 6 hundreds. (*Writes a 6 in the hundreds column of the answer*.)
6. I have 2 thousands left since I did not have to take away any thousands. (*Writes 2 in the thousands place of the answer.*)

NBT.5 Multiply a whole number of up to four digits by a one-digit whole number, and multiply two two-digit numbers, using strategies based on place value and the properties of operations. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.

******Primary focus on 3 digit by 1 digit multiplication in this unit.******

This standard calls for students to multiply numbers using a variety of strategies. **Use of the standard algorithm for multiplication is an expectation in the 5th grade.**

Example:

There are 25 dozen cookies in the bakery. What is the total number of cookies at the bakery?

Student 1	Student 2	Student 3
25 × 12 I broke 12 up into 10 and 2. 25 × 10 = 250 25 × 2 = 50 250 + 50 = 300	25 × 12 I broke 25 into 5 groups of 5. 5 × 12 = 60 I have 5 groups of 5 in 25. 60 × 5 = 300	25 × 12 I doubled 25 and cut 12 in half to get 50 × 6. 50 × 6 = 300

Example:
What would an area model of 74 x 38 look like?

	70	4
30	70x30=2,100	4x30=120
8	70x8=560	4x8=32

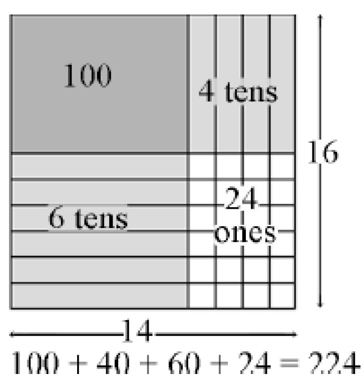
Add all of the partial product to get the final product: 2,100 + 560 + 120 + 32 = 2,812

Examples:
To illustrate 154 × 6, students use base 10 blocks or drawings to show 154 six times. Seeing 154 six times will lead them to understand the distributive property,

$$
\begin{aligned}
154 \times 6 &= (100 + 50 + 4) \times 6 \\
&= (100 \times 6) + (50 \times 6) + (4 \times 6) \\
&= 600 + 300 + 24 = 924.
\end{aligned}
$$

The area model below shows the partial products for 14 x 16 = 224.
Using the area model, students first verbalize their understanding:

- 10 × 10 is 100
- 4 × 10 is 40
- 10 × 6 is 60, and
- 4 × 6 is 24.



Students use different strategies to record this type of thinking.
Students explain this strategy and the one below with base 10 blocks, drawings, or numbers.

$$
\begin{array}{rl}
25 & \\
\underline{\times\ 24} & \\
400 & (20 \times 20) \\
100 & (20 \times 5) \\
80 & (4 \times 20) \\
\underline{+\ 20} & (4 \times 5) \\
600 &
\end{array}
$$

NBT.6 Find whole-number quotients and remainders with up to four-digit dividends and one-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.

******Primary focus on 3 digit by 1 digit division in this unit.******

In fourth grade, students build on their third grade work with division within 100. Students need opportunities to develop their understandings by using problems in and out of context.

Example:

A 4th grade teacher bought 4 new pencil boxes. She has 260 pencils. She wants to put the pencils in the boxes so that each box has the same number of pencils. How many pencils will there be in each box?

- **Using Base 10 Blocks:** Students build 260 with base 10 blocks and distribute them into 4 equal groups. Some students may need to trade the 2 hundreds for tens but others may easily recognize that 200 divided by 4 is 50.
- **Using Place Value:** $260 \div 4 = (200 \div 4) + (60 \div 4)$
- **Using Multiplication:** $4 \times 50 = 200$, $4 \times 10 = 40$, $4 \times 5 = 20$; $50 + 10 + 5 = 65$; so $260 \div 4 = 65$

This standard also calls for students to explore division through various strategies.

Example:

There are 592 students participating in Field Day. They are put into teams of 8 for the competition. How many teams get created?

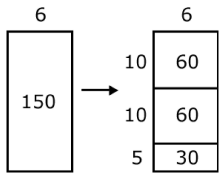
Student 1 592 divided by 8 There are 70 eights in 560. 592 – 560 = 32 There are 4 eights in 32. 70 + 4 = 74	**Student 2** 592 divided by 8 I know that 10 eights is 80. If I take out 50 eights that is 400. 592 − 400 = 192 I can take out 20 more eights which is 160. 192 − 160 = 32 There are 4 eights in 32. I have none left. I took out 50, then 20 more, then 4 more. That's 74.	**Student 3** I want to get to 592. 8 × 25 = 200 8 × 25 = 200 8 × 25 = 200 200 + 200 + 200 = 600 600 – 8 = 592 I had 75 groups of 8 and took one away, so there are 74 teams.

Example:

Using an Open Array or Area Model

After developing an understanding of using arrays to divide, students begin to use a more abstract model for division. This model connects to a recording process that will be formalized in the 5th grade.

150 ÷ 6



Students make a rectangle and write 6 on one of its sides. They express their understanding that they need to think of the rectangle as representing a total of 150.

1. Students think, “6 times what number is a number close to 150?” They recognize that 6 × 10 is 60 so they record 10 as a factor and partition the rectangle into 2 rectangles and label the area aligned to the factor of 10 with 60. They express that they have only used 60 of the 150 so they have 90 left.
2. Recognizing that there is another 60 in what is left, they repeat the process above. They express that they have used 120 of the 150 so they have 30 left.
3. Knowing that 6 × 5 is 30, they write 30 in the bottom area of the rectangle and record 5 as a factor.
4. Student express their calculations in various ways:

    a.
    $$\begin{array}{rl} 150 & \\ \underline{-60} & (6 \times 10) \\ 90 & \\ \underline{-60} & (6 \times 10) \\ 30 & \\ \underline{-30} & (6 \times 5) \\ 0 & \end{array}$$

    150 ÷ 6 = 10 + 10 + 5 = 25

    b. 150 ÷ 6 = (60 ÷ 6) + (60 ÷ 6) + (30 ÷ 6) = 10 + 10 + 5 = 25