Fifth Grade Unit 1 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 Eight 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.

GSE CLUSTER #1: **WRITE AND INTERPRET NUMERICAL EXPRESSIONS**. Mathematically proficient students communicate precisely by engaging in discussion about their reasoning using appropriate mathematical language. The terms students should learn to use with increasing precision with this cluster are: parentheses, brackets, braces, numerical expressions.

MGSE5.OA.1 Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols.

The standard calls for students to evaluate expressions with parentheses ( ), brackets [ ] or braces { }. In upper levels of mathematics, evaluate means to substitute for a variable and simplify the expression. However, at this level students are to only simplify the expressions because there are no variables.

Bill McCallum, Common Core author, states: *In general students in Grade 5 will be using parentheses only, because the convention about nesting that you describe is quite common, and it's quite possible that instructional materials at this level wouldn't even mention brackets and braces. However, the nesting order is only a convention, not a mathematical law; the North Carolina statement (see NC unpacked standards) isn't quite right here. It's important to distinguish between mathematical laws (e.g. the commutative law) and conventions of notation (e.g. nesting of parentheses). Some conventions of notation are important enough that you want to insist on them in the classroom (e.g. order of operations). But I don't think correct nesting of parentheses falls into that category. The main point of the standard is to understand the structure of numerical expressions with grouping symbols.*

In other words- evaluate expressions with brackets or braces or parentheses. No nesting at 5th grade. 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 an 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.

- $(26 + 18)/ 4$ Solution: 11
- $12 – (0.4 \times 2)$ Solution: 11.2
- $(2 + 3) \times (1.5 – 0.5)$ Solution: 5
- $36 – [(12 + 13)/5]$ Solution: 31

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.

Example:

- 15 – 7 – 2 = 10 → 15 – (7 – 2) = 10
- Compare 3 × 2 + 5 and 3 × (2 + 5).
- Compare 15 – 6 + 7 and 15 – (6 + 7).

<u>OA.2 Write simple expressions that record calculations with numbers, and interpret numerical expressions without evaluating them</u>

This standard refers to expressions. Expressions are not equations. Expressions are a series of numbers and symbols (+, -, x, ÷) without an equal sign. Equations, however, have an equal sign.

Example:

- 4(5 + 3) is an expression.
- When we compute 4(5 + 3), we are evaluating the expression. The expression's value is 32.
- 4(5 + 3) = 32 is an equation.

This standard calls for students to verbally describe the relationship between expressions without actually calculating them. This standard does not include the use of variables, only numbers and symbols for operations.

Example:

- Write an expression for "double five and then add 26."

Student: *(2 × 5) + 26*

- Describe how the expression 5(10 × 10) relates to 10 × 10.

Student: The value of the expression 5(10 × 10) is 5 times larger than the expression 10 × 10. I know that because 5(10 × 10) means that I have 5 groups of (10 × 10).

Common Misconceptions Students may believe the order in which a problem with mixed operations is written is the order to solve the problem. Allow students to use calculators to determine the value of the expression, and then discuss the order the calculator used to evaluate the expression. Do this with four-function and scientific calculators.

<u>MGSE5.NBT.1 Recognize that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and 1/10 of what it represents in the place to its left.</u>

<u>MGSENBT.2 Explain patterns in the number of zeros of the product when multiplying a number by powers of 10, and explain patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10. Use whole-number exponents to denote powers of 10.</u>

This standard includes multiplying or dividing by multiples of 10 and powers of 10, including 10^2 which is 10 × 10 = 100, and 10^3 which is 10 × 10 × 10 =1,000.

Examples: 25 × 10^3 = 25 × (10 × 10 × 10) = 25 × 1,000 = 25,000; 25 ÷ 10^3 = 25 ÷ (10 x 10 x 10) = 25 ÷ 1,000 = 0.025

Students should reason that the exponent indicates how many times 10 is multiplied by itself. Multiplying by that power of 10 then increases the place value of the digits in the original number while dividing by that power of 10 decreases the place value of the digits in the original number. For example:

3×10^2 is $3 \times (10 \times 10)$ or 3×100 which is 300; and $3 \div 10^2$ is $3 \div (10 \times 10)$ or $3 \div 100$ which is 0.03.

Students might write:

- $36 \times 10^1 = 36 \times 10 = 360$
- $36 \times 10^2 = 36 \times (10 \times 10) = 3600$
- $36 \div 10^1 = 36 \div 10 = 3.6$
- $36 \div 10^2 = 36 \div (10 \times 10) = 0.36$

Students might think and/or say:

- I noticed that every time I multiplied by 10, I added a zero to the end of the number. That makes sense, because each digit's value became 10 times larger. To make a digit 10 times larger, I have to move it one place value to the left.
- I noticed that every time I divided by 10, the number became smaller by 1/10. That makes sense, because each digit's value became 1/10 smaller. To make a digit 1/10 smaller, I have to move it one place value to the right.
- Students should be able to use the same type of reasoning as above to explain why the following multiplication and division problems by powers of 10 make sense.
  $523 \times 10^3 = 523{,}000$ The place value of 523 is increased by 3 places.
  $5.223 \times 10^2 = 522.3$ The place value of 5.223 is increased by 2 places.
  $52.3 \div 10^1 = 5.23$ The place value of 52.3 is decreased by one place.

GSE CLUSTER #2: PERFORM OPERATIONS WITH MULTI-DIGIT WHOLE NUMBERS AND WITH DECIMALS TO HUNDREDTHS.

Students develop an understanding of why division procedures work based on the meaning of base-ten numerals and properties of operations. They finalize fluency with multi-digit addition, subtraction, multiplication, and division. They apply their understandings of models for decimals, decimal notation, and properties of operations to add and subtract decimals to hundredths. They develop fluency in these computations, and make reasonable estimates of their results. Students use the relationship between decimals and fractions, as well as the relationship between finite decimals and whole numbers (i.e., a finite decimal multiplied by an appropriate power of 10 is a whole number), to understand and explain why the procedures for multiplying and dividing finite decimals make sense. They compute products and quotients of decimals to hundredths efficiently and accurately. Mathematically proficient students communicate precisely by engaging in discussion about their reasoning using appropriate mathematical language. The terms students should learn to use with increasing precision with this cluster are: multiplication/multiply, division/division, decimals, decimal point, tenths, hundredths, products, quotients, dividends, rectangular arrays, area models, addition/add, subtraction/subtract, (properties)-rules about how numbers work, reasoning.

NBT.5 Fluently multiply multi-digit whole numbers using the standard algorithm.

This standard builds upon students' work with multiplying numbers in 3rd and 4th grade. In 4th grade, students developed understanding of multiplication using various strategies. While learning the standard algorithm is the focus, alternate strategies are also appropriate to help students develop conceptual understanding. Students' work is limited to multiplying three-digit by two-digit numbers.

Examples of alternate strategies:

- There are 225 dozen cookies in the bakery. How many cookies are there?

Student 1

225×12

I broke 12 up into 10 and 2.

$225 \times 10 = 2{,}250$
$225 \times 2 = 450$

$2{,}250 + 450 = 2{,}700$

Student 2

225×12

I broke 225 up into 200 and 25.

$200 \times 12 = 2{,}400$

I broke 25 up into 5×5, so I had $5 \times 5 \times 12$ or $5 \times (5 \text{ x } 12)$.

$5 \times 12 = 60$ and $60 \times 5 = 300$

Then I added 2,400 and 300.

$2{,}400 + 300 = 2{,}700$

Student 3

I doubled 225 and cut 12 in half to get 450×6. Then I doubled 450 again and cut 6 in half to 900×3.

$900 \times 3 = 2{,}700$

Draw an array model for 225×12

225 x 12

	200	20	5
10	2,000	200	50
2	400	40	10

$$\begin{array}{r} 2{,}000 \\ 400 \\ 200 \\ 40 \\ 50 \\ +\quad 10 \\ \hline 2{,}700 \end{array}$$

<u>NBT.6 Find whole-number quotients of whole numbers with up to four-digit dividends and two-digit divisors, using strategies based on place value, 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.</u>

This standard references various strategies for division. Division problems can include remainders. This standard extends students' prior experiences with strategies, illustrations, and explanations. When the two-digit divisor is a "familiar" number, a student might decompose the dividend using place value.

Example:

- There are 1,716 students participating in Field Day. They are put into teams of 16 for the competition. How many teams will there be? If you have left over students, what do you do with them?

Student 1

1,716 ÷ 16

There are 100 16's in 1,716.

1,716 – 1,600 = 116

I know there are at least 6 16's in 116.

116 – 96 = 20

I can take out one more 16.

20 – 16 = 4

There were 107 teams with 4 students left over. If we put the extra students on different teams, 4 teams will have 17 students.

Student 2

1,716 ÷ 16

There are 100 16's in 1,1716.

Ten groups of 16 is 160. That's too big. Half of that is 80, which is 5 groups.

I know that 2 groups of 16's is 32.

I have 4 students left over.

1,716 − 1,600	100
116 − 80	5
36 − 32	2
4	

Student 3

1,716 ÷ 16

I want to get to 1,716. I know that 100 16's equals 1,600. I know that 5 16's equals 80.

1,600 + 80 = 1,680

Two more groups of 16's equals 32, which gets us to 1,712. I am 4 away from 1,716.

So, we had 100 + 6 + 1 = 107 teams. Those other 4 students can just hang out.

Student 4

How many 16's are in 1,716?

We have an area of 1,716. I know that one side of my array is 16 units long. I used 16 as the height. I am trying to answer the question: What is the width of my rectangle if the area is 1,716 and the height is 16?

	100	7
16	100 × 16 = 1,600	7 × 16 = 112

1,716 – 1,600 = 116

116 – 112 = 4

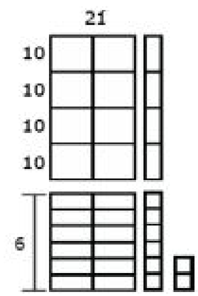
100 + 7 = 107 R 4

Examples:

- Using expanded notation: 2682 ÷ 25 = (2000 + 600 + 80 + 2) ÷ 25
- Using understanding of the relationship between 100 and 25, a student might think:
    - I know that 100 divided by 25 is 4 so 200 divided by 25 is 8 and 2000 divided by 25 is 80.
    - 600 divided by 25 has to be 24.
    - Since 3 × 25 is 75, I know that 80 divided by 25 is 3 with a reminder of 5. (Note that a student might divide into 82 and not 80.)
    - I can't divide 2 by 25 so 2 plus the 5 leaves a remainder of 7.
    - 80 + 24 + 3 = 107. So, the answer is 107 with a remainder of 7.
- Using an equation that relates division to multiplication, 25 × *n* = 2682, a student might estimate the answer to be slightly larger than 100 because s/he recognizes that 25 × 100 = 2500.

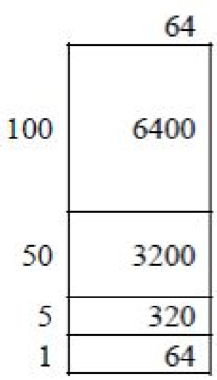
Example: 968 ÷ 21

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.



$$\begin{array}{rl}
64\overline{)9984} & \\
\underline{-6400} & (100 \times 64) \\
3584 & \\
\underline{-3200} & (50 \times 64) \\
384 & \\
\underline{-320} & (5 \times 64) \\
64 & \\
\underline{-64} & (1 \times 64) \\
0 &
\end{array}$$

Example: 9984 ÷ 6

A partial quotient model for division is shown below. As the student uses the partial quotient model, he/she keeps track of how much of the 9984 is left to divide.

$$\begin{array}{rl}
64\overline{)9984} & \\
\underline{-6400} & (100 \times 64) \\
3584 & \\
\underline{-3200} & (50 \times 64) \\
384 & \\
\underline{-320} & (5 \times 64) \\
64 & \\
\underline{-64} & (1 \times 64) \\
0 &
\end{array}$$

There were 100 + 50 + 5 + 1 or 156 sets of 64 in 9,984. The final quotient for 9984 ÷ 64 is 156 with no remainder.