3rd 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.

OA.1 Interpret products of whole numbers, e.g., interpret 5 × 7 as the total number of objects in 5 groups of 7 objects each. ***For example, describe a context in which a total number of objects can be expressed as 5 × 7.***

This standard calls for students to understand the concept of multiplication. Students should recognize multiplication as a means to determine the total number of objects when there are a specific number of groups with the same number of objects in each group. Multiplication requires students to think in terms of groups of things rather than individual things. Students learn that the multiplication symbol "×" means "groups of" and problems such as 5 × 7 refer to
5 "groups of" 7.

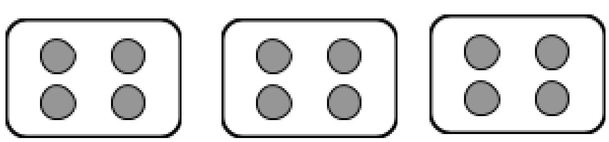
Example: Jim purchased 5 packages of muffins. Each package contained 3 muffins. How many muffins did Jim purchase? *(5 groups of 3, 5 × 3 = 15 muffins)*

OA.2 Interpret whole-number quotients of whole numbers, e.g., interpret 56 ÷ 8 as the number of objects in each share when 56 objects are partitioned equally into 8 shares (how many in each group?), or as a number of shares when 56 objects are partitioned into equal shares of 8 objects each.
For example, describe a context in which a number of shares or a number of groups can be expressed as 56 ÷ 8.

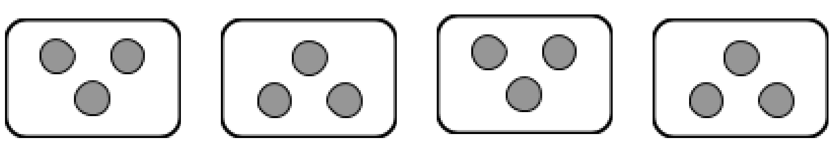
This standard focuses on two distinct models of division: partition models and measurement models.

Examples:

- Partition models focus on the question, "How many in each group?" There are 12 cookies on the counter. If you are sharing the cookies equally among three children, how many cookies will each child get?



- Measurement models focus on the question, "How many groups can you make?" There are 12 cookies on the counter. If each child gets 3 cookies, how many children can eat cookies?



OA.3 Use multiplication and division within 100 to solve word problems in situations involving equal groups, arrays, and measurement quantities, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem.

This standard references various strategies that can be used to solve word problems involving multiplication and division. Students should use a variety of representations for solving word problems.

Examples of multiplication:

- A teacher had 4 rows in her classroom and put 6 desks in each row. How many desks are in her classroom?
  - This problem can be solved by drawing an array (rectangular arrangement of equal rows and columns). The student can use this representation to solve the problem showing 4 rows with 6 in each row making a total of 24.

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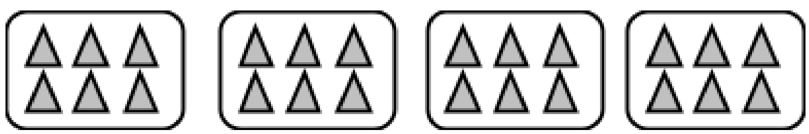
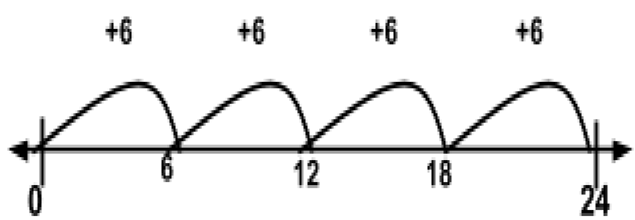
  - This problem can also be solved by drawing pictures of 4 equal groups that contain 6 in each group.

4 groups of 6 equals 24 objects



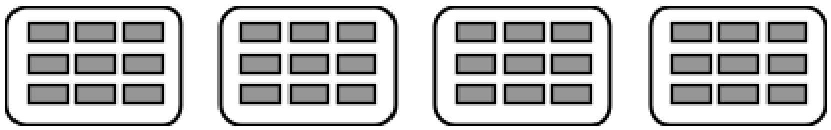
  - A student could also reason through the problem mentally by writing an equation. "I know that there are 4 rows with 6 in each row, and I need to know the total number of desks, so I can write the equation 4 x 6 = ___ to represent the problem. I know that 4 x 6 = 24, so there are 24 desks." (Third grade students should use a variety of pictures, letters, or symbols, such as stars, boxes, flowers, etc. to represent unknown numbers.)

  - A number line could also be used to show equal jumps. A student could skip-count to find that 4 jumps of 6 is 24.



Examples of division:

- *Partition Model Problem—finding the number in each group*
  A bag has 36 hair clips. Laura and her three friends want to share them equally. How many hair clips will each person receive?
  - This problem can be solved by drawing four groups and distributing 36 clips equally to each group. The student can use this representation to solve the problem showing that 4 groups would have 9 in each group for a total of 36. Each friend would receive 9 hairclips.



- *Measurement Model Problem—finding the number of groups*
  Max the monkey loves bananas. Molly, his trainer, has 24 bananas. If she gives Max 4 bananas each day, how many days will the bananas last?
  - This problem can be solved by drawing a table and subtracting 4 from 24 until the student reaches 0. The student must subtract 4 a total of 6 times, so the bananas will last 6 days.

Starting	**Day 1**	**Day 2**	**Day 3**	**Day 4**	**Day 5**	**Day 6**
24	24 – 4 = 20	20 – 4 = 16	16 – 4 = 12	12 – 4 = 8	8 – 4 = 4	4 – 4 = 0

OA.4 Determine the unknown whole number in a multiplication or division equation relating three whole numbers using the inverse relationship of multiplication and division. ***For example, determine the unknown number that makes the equation true in each of the equations 8 × ? = 48, 5 = ? ÷ 3, 6 × 6 = ?***

This standard goes beyond the traditional notion of *fact families*. Students must explore the inverse relationship between multiplication and division.

Example:

If a student knows that 9 x 8 = 72, then they should also know that 72 ÷ 8 = 9.

The standard also requires that students understand that the equal sign means "the same as" and use this understanding to interpret an equation with an unknown.

Example:

When given 4 × ? = 32, they might think:

- 4 groups of some number is the same as 32.
- 4 times some number is the same as 32.
- I know that 4 groups of 8 is 32, so the unknown number is 8.
- The missing factor is 8 because 4 times 8 equals 32.

<u>OA.5 Apply properties of operations as strategies to multiply and divide.</u>

*******Primary focus on the commutative propery with mastered facts and distributive propery for 3s & 6s in this unit.*******

Examples:

- If 6 × 4 = 24 is known, then 4 × 6 = 24 is also known. (Commutative property of multiplication)
- 3 × 5 × 2 can be found by 3 × 5 = 15, then 15 × 2 = 30, or by 5 × 2 = 10, then 3 × 10 = 30. (Associative property of multiplication)
- Knowing that 8 × 5 = 40 and 8 × 2 = 16, one can find 8 × 7 as 8 × (5 + 2) = (8 × 5) + (8 × 2) = 40 + 16 = 56. (Distributive property)

This standard references properties of multiplication. While students DO NOT need to use the formal terms of these properties, students should understand that properties are rules about how numbers work. They need to be able to apply these properties flexibly and fluently. Students represent expressions using various objects, pictures, words, and symbols in order to develop their understanding of properties. They multiply by 1 and 0, and they divide by 1. They change the order of numbers to determine that the order of numbers does not make a difference in multiplication, but it does make a difference in division. Given three factors, they investigate changing the order of how they multiply the numbers to determine that changing the order does not change the product. They also decompose numbers to build fluency with multiplication.

The **associative property** states that the sum or product stays the same when the grouping of addends or factors is changed. For example, when a student multiplies 7 × 5 × 2, a student could rearrange the numbers to first multiply 5 × 2 = 10 and then multiply 10 × 7 = 70.

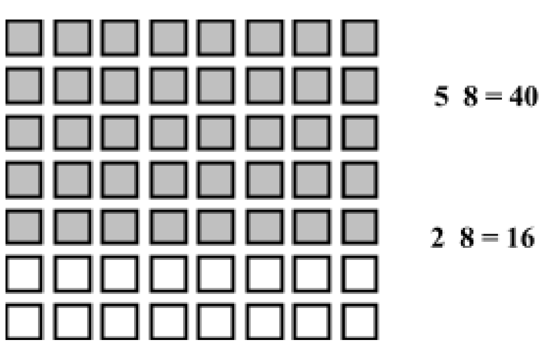
The **commutative property** (order property) states that the order of numbers does not matter when you are adding or multiplying numbers. For example, if a student knows that 5 × 4 = 20, then they also know that 4 × 5 = 20.

Students are introduced to the **distributive property of multiplication over addition** as a strategy for using products they know to solve products they don't know. Students would be using mental math to determine a product. Here are ways that students could use the distributive property to determine the product of 7 × 6. Again, students should use the distributive property, but can refer to this in informal language such as "breaking numbers apart".

Student 1	**Student 2**	**Student 3**
7 × 6 I know that 7 × 5 = 35 and 7 × 1 = 7. So, 7 x 6 = 35 + 7 which is 42.	**7 × 6** I know 7 × 3 = 21. So, since 6 is twice as much as 3, I can double 21 to get 42.	**7 × 6** I can break 7 into 5 and 2. I know 5 × 6 = 30 and 2 × 6 = 12 and 30 + 12 = 42. So, 7 x 6 = 42.

Shown below is another example of how the **distributive property** helps students determine the products and factors of problems by breaking numbers apart.

Example:
In the problem 7 × 8 = ?, students can decompose the 7 into a 5 and 2, and reach the answer by multiplying 5 × 8 = 40 and 2 × 8 =16 and adding the two products (40 +16 = 56).



OA.6 Understand division as an unknown-factor problem.

Since multiplication and division are inverse operations, students are expected to solve problems and explain their processes of solving division problems that can also be represented as unknown factor multiplication problems.

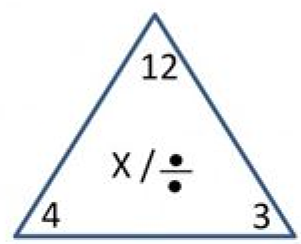
Example: A student knows that 2 x 9 = 18. How can they use that fact to determine the answer to the following question: 18 people are divided into pairs in P.E. class. How many pairs are there? Write a division equation and explain your reasoning.

- Student: A pair means 2 people. I need to divide to find the answer: 18 ÷ 2 = ____. I can think of this problem as 2 x ? = 18. I know that 2 x 9 = 18. There would be 9 pairs, so 18 ÷ 2 = 9.

Fact family triangles demonstrate the inverse operations of multiplication and division by showing the two factors and how those factors relate to the product and/or quotient.

Example:

- 4 × 3 = 12
- 3 × 4 = 12
- 12 ÷ 3 = 4
- 12 ÷ 4 = 3



OA.7 Fluently multiply and divide within 100, using strategies such as the relationship between multiplication and division (e.g., knowing that 8 × 5 = 40, one knows 40 ÷ 5 = 8) or properties of operations. By the end of Grade 3, know from memory all products of two one-digit numbers.

*******Working with specific fact families (new facts 3 & 6/ continued practice of 0, 1, 2, 4, 5, 8 & 10) in this unit.*******

This standard uses the word fluently, which means being accurate, efficient (using a reasonable amount of steps and time), and flexible (using strategies such as the distributive property). ***"Know from memory" should not focus only on timed tests and repetitive practice, but ample experiences working with manipulatives, pictures, arrays, word problems, and numbers to internalize the basic facts (up to 9 × 9).*** Exposure to the 10s facts through place value is also helpful in building number sense as well as assisting students in learning their 5s facts.

By studying patterns and relationships in multiplication facts and relating multiplication and division, students build a foundation for fluency with multiplication and division facts. Students demonstrate fluency with multiplication facts through 10 and the related division facts. Multiplying and dividing fluently refers to knowledge of procedures, knowledge of when and how to use them appropriately, and skill in performing them accurately, flexibly, and efficiently. Strategies students may use to attain fluency include:

- Multiplication by zeros and ones
- Doubles (2s facts), Doubling twice (4s), Doubling three times (8s)
- Tens facts (relating to place value, 5 × 10 is 5 tens or 50)
- Five facts (half of tens)
- Skip counting (counting groups of __ and knowing how many groups have been counted)
- Square numbers (3 × 3, 4 x 4, 5 x 5, etc)
- Nines (10 groups less one group, e.g., 9 × 3 is 10 groups of 3 minus one group of 3)
- Decomposing into known facts (6 × 7 is 6 x 6 plus one more group of 6)
- Turn-around facts (Commutative Property)
- Fact families (6 × 4 = 24; 24 ÷ 6 = 4; 24 ÷ 4 = 6; 4 × 6 = 24)

NOTE: By the end of Grade 3, students should know from memory all the products of two 1-digit numbers. Students should also have exposure to multiplication and division problems presented in both vertical and horizontal forms.

OA.8 Solve two-step word problems using the four operations. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding.

This standard refers to two-step word problems using the four operations. The size of the numbers should be limited. Adding and subtracting numbers should include numbers within 1,000. Multiplying and dividing numbers should include single-digit factors and products less than 100. Students should represent problems using equations with a letter to represent unknown quantities.

Example:

Mike runs 2 miles a day. His goal is to run 25 miles. After 5 days, how many miles does Mike have left to run in order to meet his goal? Write an equation and find the solution ($2 \times 5 + m = 25$).

This standard also refers to estimation strategies, including using compatible numbers (numbers that sum to 10, 50, or 100) or rounding. The focus in this standard is to have students use and discuss various strategies. Students should estimate during problem solving, and then revisit their estimate to check for reasonableness.

Example:

On a vacation, your family travels 267 miles on the first day, 194 miles on the second day, and 34 miles on the third day. About how many total miles did they travel? Here are some typical estimation strategies for the problem:

Student 1	**Student 2**	**Student 3**
I first thought about 267 and 34. I noticed that their sum is about 300. Then I knew that 194 is close to 200. When I put 300 and 200 together, I get 500.	I first thought about 194. It is really close to 200. I also have 2 hundreds in 267. That gives me a total of 4 hundreds. Then I have 67 in 267 and the 34. When I put 67 and 34 together that is really close to 100. When I add that hundred to the 4 hundreds that I already had, I end up with 500.	I rounded 267 to 300. I rounded 194 to 200. I rounded 34 to 30. When I added 300, 200, and 30, I know my answer will be about 530.

OA.9 Identify arithmetic patterns (including patterns in the addition table or multiplication table), and explain them using properties of operations. *For example, observe that 4 times a number is always even, and explain why 4 times a number can be decomposed into two equal addends.*

This standard calls for students to examine arithmetic patterns involving both addition and multiplication. Arithmetic patterns are patterns that change by the same rate, such as adding the same number. For example, the series 2, 4, 6, 8, 10 is an arithmetic pattern that increases by 2 between each term. This standard also mentions identifying patterns related to the properties of operations.

Examples:

- Even numbers are always divisible by 2. Even numbers can always be decomposed into 2 equal addends (14 = 7 + 7).
- Multiples of even numbers (2, 4, 6, and 8) are always even numbers.
- On a multiplication chart, the products in each row and column increase by the same amount (skip counting).
- On an addition chart, the sums in each row and column increase by the same amount.

x	0	1	2	3	4	5	6	7	8	9	10
0	0	0	0	0	0	0	0	0	0	0	0
1	0	1	2	3	4	5	6	7	8	9	10
2	0	2	4	6	8	10	12	14	16	18	20
3	0	3	6	9	12	15	18	21	24	27	30
4	0	4	8	12	16	20	24	28	32	36	40
5	0	5	10	15	20	25	30	35	40	45	50
6	0	6	12	18	24	30	36	42	48	54	60
7	0	7	14	21	28	35	42	49	56	63	70
8	0	8	16	24	32	40	48	56	64	72	80
9	0	9	18	27	36	45	54	63	72	81	90
10	0	10	20	30	40	50	60	70	80	90	100

Teacher: What do you notice about the numbers highlighted in pink in the multiplication table? Explain a pattern using properties of operations.
Student: When you change the order of the factors (commutative property), you still get the same product; for example 6 x 5 = 30 and 5 x 6 = 30.

Teacher: What pattern do you notice when 2, 4, 6, 8, or 10 are multiplied by any number (even or odd)?
Student: The product will always be an even number.
Teacher: Why?

x	0	1	2	3	4	5	6	7	8	9	10
0	0	0	0	0	0	0	0	0	0	0	0
1	0	1	2	3	4	5	6	7	8	9	10
2	0	2	4	6	8	10	12	14	16	18	20
3	0	3	6	9	12	15	18	21	24	27	30
4	0	4	8	12	16	20	24	28	32	36	40
5	0	5	10	15	20	25	30	35	40	45	50
6	0	6	12	18	24	30	36	42	48	54	60
7	0	7	14	21	28	35	42	49	56	63	70
8	0	8	16	24	32	40	48	56	64	72	80
9	0	9	18	27	36	45	54	63	72	81	90
10	0	10	20	30	40	50	60	70	80	90	100

What patterns do you notice in this addition table? Explain why the pattern works this way.

Examples:

- Any sum of two even numbers is even.
- Any sum of two odd numbers is even.
- Any sum of an even number and an odd number is odd.
- The doubles (2 addends the same) in an addition table fall on a diagonal.

+	0	1	2	3	4	5	6	7	8	9	10
0	0	1	2	3	4	5	6	7	8	9	10
1	1	2	3	4	5	6	7	8	9	10	11
2	2	3	4	5	6	7	8	9	10	11	12
3	3	4	5	6	7	8	9	10	11	12	13
4	4	5	6	7	8	9	10	11	12	13	14
5	5	6	7	8	9	10	11	12	13	14	15
6	6	7	8	9	10	11	12	13	14	15	16
7	7	8	9	10	11	12	13	14	15	16	17
8	8	9	10	11	12	13	14	15	16	17	18
9	9	10	11	12	13	14	15	16	17	18	19
10	19	11	12	13	14	15	16	17	18	19	20

Students need ample opportunities to observe and identify important numerical patterns related to operations. They should build on their previous experiences with properties related to addition and subtraction. Students investigate addition and multiplication tables in search of patterns and explain why these patterns make sense mathematically.

Students also investigate a hundreds chart in search of addition and subtraction patterns. They record and organize all the different possible sums of a number and explain why the pattern makes sense.

<u>NBT.3 Multiply one-digit whole numbers by multiples of 10 in the range 10–90 (e.g., 9 × 80, 5 × 60) using strategies based on place value and properties of operations.</u>

This standard expects that students go beyond tricks that hinder understanding such as "just adding zeros". Students should explain and reason about their products.

Example:

- To find 60 x 4, a student should think, "4 groups of 6 tens is 24 tens. Twenty-four tens equals 240."

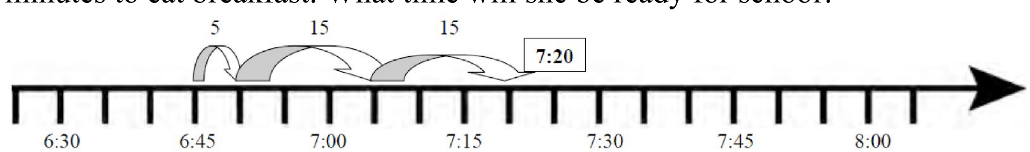
<u>MD.1 Tell and write time to the nearest minute and measure time intervals in minutes. Solve word problems involving addition and subtraction of time intervals in minutes, e.g., by representing the problem on a number line diagram, drawing a pictorial representation on a clock face, etc..</u>

*******Primary focus of telling time to the nearest minute in this unit.*******

This standard calls for students to determine elapsed time, including elapsed time embedded within word problems. Students can use number line diagrams to determine elapsed time. On the number line, students should be given the opportunity to determine the intervals and size of jumps on their number line. Students could use pre-determined number lines (intervals every 5 or 15 minutes) or open number lines (intervals determined by students).

Example:

Tonya wakes up at 6:45 a.m. It takes her 5 minutes to shower, 15 minutes to get dressed, and 15 minutes to eat breakfast. What time will she be ready for school?

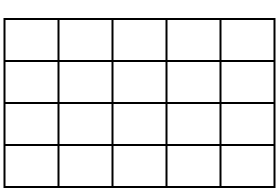


<u>MD.5 Recognize area as an attribute of plane figures and understand concepts of area measurement.</u>

a. A square with side length 1 unit, called "a unit square," is said to have "one square unit" of area, and can be used to measure area.

b. A plane figure which can be covered without gaps or overlaps by *n* unit squares is said to have an area of *n* square units.

These standards call for students to explore the concept of covering a region with "unit squares," which could include square tiles or shading on grid or graph paper.



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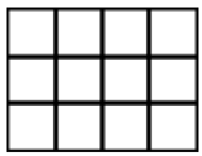
5 ↖ One square unit

<u>MD.6 Measure areas by counting unit squares (square cm, square m, square in, square ft, and improvised units).</u>

Students should be counting the square units to find the area that could be shown in metric, customary, or non-standard square units. Using different sized graph paper, students can explore the areas measured in square centimeters and square inches.

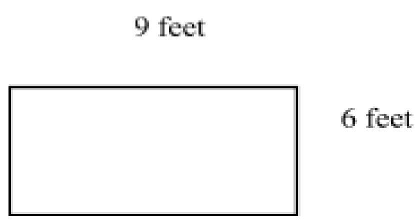
<u>MD.7 Relate area to the operations of multiplication and addition.</u>
a. Find the area of a rectangle with whole-number side lengths by tiling it, and show that the area is the same as would be found by multiplying the side lengths.

Students should tile rectangles then multiply their side lengths to show it is the same as counting all the tiles.
Example: To find the area of this rectangle, students can first count the squares (12), then multiply the side lengths (3 x 4) to find the area.



b. Multiply side lengths to find areas of rectangles with whole-number side lengths in the context of solving real world and mathematical problems, and represent whole-number products as rectangular areas in mathematical reasoning.

Students should solve real world and mathematical problems that involve area of rectangles.
Example:
Drew wants to tile the bathroom floor using 1 foot tiles. How many square foot tiles will he need? What is the area of his bathroom?



c. Use tiling to show in a concrete case that the area of a rectangle with whole-number side lengths *a* and *b* + *c* is the sum of *a* × *b* and *a* × *c*. Use area models to represent the distributive property in mathematical reasoning.

This standard extends students' work with the distributive property. For example, in the picture below the area of an 8 × 7 figure can be determined by finding the area of a 8 × 5 and 8 × 2 and adding the two sums.