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THIRD GRADE MATHEMATICS
UNIT 2 STANDARDS

Dear Parents,

We want to make sure that you have an understanding of the mathematics your child will be learning this year. Below you will find the standards we will be learning in Unit Two. Each standard is in bold print and underlined and below it is an explanation with student examples. Your child is not learning math the way we did when we were in school, so hopefully this will assist you when you help your child at home. Please let your teacher know if you have any questions.
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MGSE3.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 interprets products of whole numbers. Students 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 ‘ \times ’ 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, $5 \times 3 = 15$)

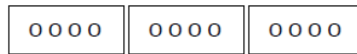
Describe another situation where there would be 5 groups of 3 or 5×3 .

MGSE3.OA.2 Interpret whole-number quotients of whole numbers, e.g., interpret $56 \div 8$ as the number of objects in each share when 56 objects are partitioned equally into 8 shares, 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 $56 \div 8$.

This standard focuses on two distinct models of division: partition models and measurement (repeated subtraction) models.

Partition models focus on the question, “How many in each group?” A context for partition models would be: There are 12 cookies on the counter. If you are sharing the cookies equally among three bags, how many cookies will go in each bag?



Measurement (repeated subtraction) models focus on the question, “How many groups can you make?” A context for measurement models would be: There are 12 cookies on the counter. If you put 3 cookies in each bag, how many bags will you fill?



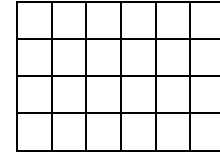
MGSE3.OA.3 Use multiplication and division within 100 to solve word problems in situations involving equal groups, arrays, and measurement quantities, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem.

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This standard references various strategies that can be used to solve word problems involving multiplication and division. Students should apply their skills to solve word problems. Students should use a variety of representations for creating and solving one-step word problems, such as: If you divide 4 packs of 9 brownies among 6 people, how many cookies does each person receive? ($4 \times 9 = 36$, $36 \div 6 = 6$).

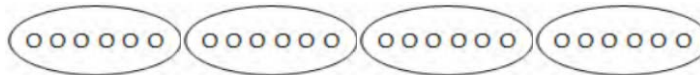
Examples of multiplication: There are 24 desks in the classroom. If the teacher puts 6 desks in each row, how many rows are there?

This task can be solved by drawing an array by putting 6 desks in each row. This is an array model:



This task can also be solved by drawing pictures of equal groups.

4 groups of 6 equals 24 objects

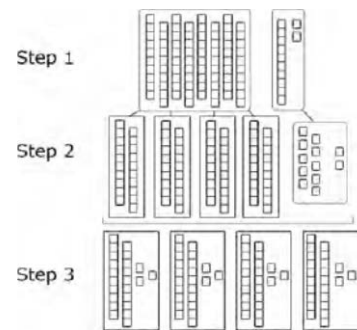


A student could also reason through the problem mentally or verbally, “I know 6 and 6 are 12. 12 and 12 are 24. Therefore, there are 4 groups of 6 giving a total of 24 desks in the classroom.” A number line could also be used to show equal jumps. Third grade students should use a variety of pictures, such as stars, boxes, flowers to represent unknown numbers (variables). Letters are also introduced to represent unknowns in third grade.

Examples of division: There are some students at recess. The teacher divides the class into 4 lines with 6 students in each line. Write a division equation for this story and determine how many students are in the class. ($24 \div 4 = 6$. *There are 24 students in the class.*)

Determining the number of objects in each share (partitive division, where the size of the groups is unknown):

Example: The bag has 92 hair clips, and Laura and her three friends want to share them equally. How many hair clips will each person receive?



Determining the number of shares (measurement division, where the number of groups is unknown):

Example: 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?

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

Solution: The bananas will last for 6 days.

MGSE 3.OA.4 Determine the unknown whole number in a multiplication or division equation relating three whole numbers.

For example, determine the unknown number that makes the equation true in each of the equations $8 \times ? = 48$, $5 = \div 3$, $6 \times 6 = ?$

The focus of MCC.3.OA.4 goes beyond the traditional notion of *fact families*, by having students explore the inverse relationship of multiplication and division.

Students apply their understanding of the meaning of the equal sign as “the same as” to interpret an equation with an unknown. When given $4 \times ? = 40$, they might think:

- 4 groups of some number is the same as 40
- 4 times some number is the same as 40
- I know that 4 groups of 10 is 40 so the unknown number is 10
- The missing factor is 10 because 4 times 10 equals 40.

Equations in the form of $a \times b = c$ and $c = a \times b$ should be used interchangeably, with the unknown in different positions.

Example: Solve the equations below:

- $24 = ? \times 6$
- $72 \div \Delta = 9$
- Rachel has 3 bags. There are 4 marbles in each bag. How many marbles does Rachel have altogether?
 $3 \times 4 = m$

MGSE3.OA.5 Apply properties of operations as strategies to multiply and divide.

Examples:

If $6 \times 4 = 24$ is known, then $4 \times 6 = 24$ is also known. (Commutative property of multiplication.)

$3 \times 5 \times 2$ can be found by $3 \times 5 = 15$, then $15 \times 2 = 30$, or by $5 \times 2 = 10$, then $3 \times 10 = 30$. (Associative property of multiplication.)

Knowing that $8 \times 5 = 40$ and $8 \times 2 = 16$, one can find 8×7 as $8 \times (5 + 2) = (8 \times 5) + (8 \times 2) = 40 + 16 = 56$. (Distributive property.)

This standard references properties (rules about how numbers work) 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 flexibly and fluently applying each of them. 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 divide by 1. They change the order of numbers to determine that the order of numbers does not make a difference in multiplication (but 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 $7 \times 5 \times 2$, a student could rearrange the numbers to first multiply $5 \times 2 = 10$ and then multiply $10 \times 7 = 70$.

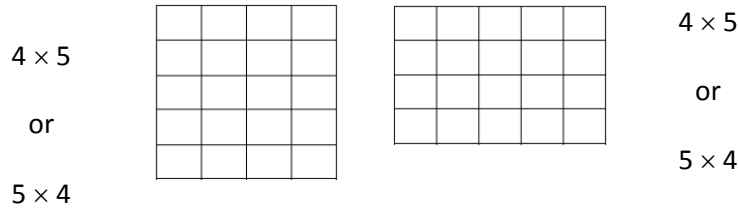
The **commutative property** (order property) states that the order of numbers does not matter when you are adding or multiplying numbers. For example, if a student knows that $5 \times 4 = 20$, then they also know that $4 \times 5 = 20$. The array

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below could be described as a 5×4 array for 5 columns and 4 rows, or a 4×5 array for 4 rows and 5 columns. There is no “fixed” way to write the dimensions of an array as rows \times columns or columns \times rows.

Students should have flexibility in being able to describe both dimensions of an array.

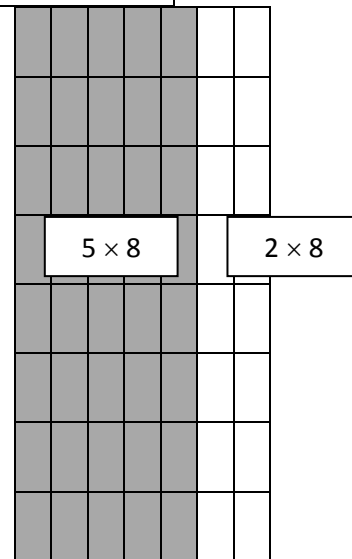
Example:



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”.

<p style="text-align: center; margin: 0;">Student 1</p> <p style="margin: 5px 0;">7×6</p> <p style="margin: 5px 0;">$7 \times 5 = 35$</p> <p style="margin: 5px 0;">$7 \times 1 = 7$</p> <p style="margin: 5px 0;">$35 + 7 = 42$</p>	<p style="text-align: center; margin: 0;">Student 2</p> <p style="margin: 5px 0;">7×6</p> <p style="margin: 5px 0;">$7 \times 3 = 21$</p> <p style="margin: 5px 0;">$7 \times 3 = 21$</p> <p style="margin: 5px 0;">$21 + 21 = 42$</p>	<p style="text-align: center; margin: 0;">Student 3</p> <p style="margin: 5px 0;">7×6</p> <p style="margin: 5px 0;">$5 \times 6 = 30$</p> <p style="margin: 5px 0;">$2 \times 6 = 12$</p> <p style="margin: 5px 0;">$30 + 12 = 42$</p>
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Another example if the distributive property helps students determine the products and factors of problems by breaking numbers apart. For example, for the problem $7 \times 8 = ?$, students can decompose the 7 into a 5 and 2, and reach the answer by multiplying $5 \times 8 = 40$ and $2 \times 8 = 16$ and adding the two products ($40 + 16 = 56$).



To further develop understanding of properties related to multiplication and division, students use different representations and their understanding of the relationship between multiplication

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and division to determine if the following types of equations are true or false.

- $0 \times 7 = 7 \times 0 = 0$ (Zero Property of Multiplication)
- $1 \times 9 = 9 \times 1 = 9$ (Multiplicative Identity Property of 1)
- $3 \times 6 = 6 \times 3$ (Commutative Property)
- $8 \div 2 = 2 \div 8$ (Students are only to determine that these are not equal)
- $2 \times 3 \times 5 = 6 \times 5$
- $10 \times 2 < 5 \times 2 \times 2$
- $2 \times 3 \times 5 = 10 \times 3$
- $0 \times 6 > 3 \times 0 \times 2$

MGSE3.OA.6 Understand division as an unknown-factor problem.

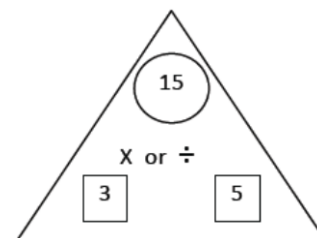
For example, find $32 \div 8$ by finding the number that makes 32 when multiplied by 8.

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 $2 \times 9 = 18$. 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.

Multiplication and division are inverse operations and that understanding can be used to find the unknown. 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. Examples:



- $3 \times 5 = 15$ $5 \times 3 = 15$
- $15 \div 3 = 5$ $15 \div 5 = 3$

MGSE3.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.

MGSE3.OA.7 Fluently multiply and divide within 100, using strategies such as the relationship between multiplication and division (e.g., knowing that $8 \times 5 = 40$, one knows $40 \div 5 = 8$) or properties of operations. By the end of Grade 3, know from memory all products of two one-digit numbers.

This standard uses the word fluently, which means accuracy, efficiency (using a reasonable amount of steps and time), and flexibility (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).

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

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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 flexibly, accurately, 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 (ex: 3×3)
- 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 6×6 plus one more group of 6)
- Turn-around facts (Commutative Property)
- Fact families (Ex: $6 \times 4 = 24$; $24 \div 6 = 4$; $24 \div 4 = 6$; $4 \times 6 = 24$)
- Missing factors

General Note: Students should have exposure to multiplication and division problems presented in both vertical and horizontal forms.

MGSE.3.MD.3 Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories. Solve one- and two-step “how many more” and “how many less” problems using information presented in scaled bar graphs. For example, draw a bar graph in which each square in the bar graph might represent 5 pets. This standard continues throughout the third grade year.

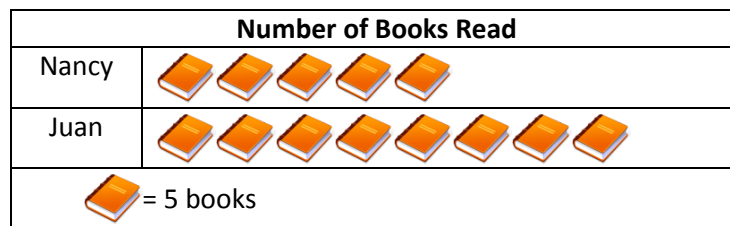
Students should have opportunities reading and solving problems using scaled graphs before being asked to draw one. The following graphs all use five as the scale interval, but students should experience different intervals to further develop their understanding of scale graphs and number facts. While exploring data concepts, students should Pose a question, Collect data, Analyze data, and Interpret data (PCAI). Students should be graphing data that is relevant to their lives.

Example:

Pose a question: Student should come up with a question. What is the typical genre read in our class?

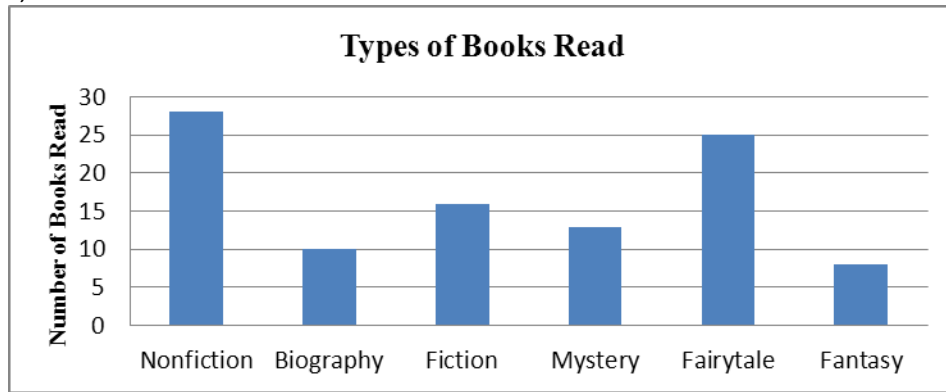
Collect and organize data: student survey

Pictographs: Scaled pictographs include symbols that represent multiple units. Below is an example of a pictograph with symbols that represent multiple units. Graphs should include a title, categories, category label, key, and data. How many more books did Juan read than Nancy?



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Single Bar Graphs: Students use both horizontal and vertical bar graphs. Bar graphs include a title, scale, scale label, categories, category label, and data.



Analyze and Interpret data:

- How many more nonfiction books were read than fantasy books?
- Did more people read biography and mystery books or fiction and fantasy books?
- About how many books in all genres were read?
- Using the data from the graphs, what type of book was read more often than a mystery but less often than a fairytale?
- What interval was used for this scale?
- What can we say about types of books read? What is a typical type of book read?
- If you were to purchase a book for the class library which would be the best genre? Why?

Common Misconceptions

Although intervals on a bar graph are not in single units, students count each square as one. To avoid this error, have students include tick marks between each interval. Students should begin each scale with 0. They should think of skip-counting when determining the value of a bar since the scale is not in single units.

MGSE.3.MD.4 Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by making a line plot, where the horizontal scale is marked off in appropriate units – whole numbers, halves, or quarters.

This standard continues throughout the third grade year.

Students in second grade measured length in whole units using both metric and U.S. customary systems. It is important to review with students how to read and use a standard ruler including details about halves and quarter marks on the ruler. Students should connect their understanding of fractions to measuring to one-half and one-quarter inch. Third graders need many opportunities measuring the length of various objects in their environment. This standard provides a context for students to work with fractions by measuring objects to a quarter of an inch. Example: Measure objects in your desk to the nearest $\frac{1}{2}$ or $\frac{1}{4}$ of an inch, display data collected on a line plot. How many objects measured $\frac{1}{4}$? $\frac{1}{2}$? etc.

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Objects on My Desk

