Theme: **Suggested Days of Instruction: 45 days**

Ohio Learning Standards

OPERATIONS AND ALGEBRAIC THINKING (OA)

Represent and solve problems involving multiplication and division.

1. Interpret products of whole numbers, e.g., interpret 5 x 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 x 7.
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 share, 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 number of groups can be expressed as* 56 ÷ 8.
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.*
4. Determine the unknown whole number in a multiplication or division equation relating three whole numbers.

Understand properties of multiplication and the relationship between multiplication and division.

5. Apply properties of operations as strategies to multiply and divide. *Examples: If 6 x 4 = 24 is known, then 4 x 6 = 24 is also known, (Commutative property of multiplication) 3 x 5 x 2 can be found by 3 x 5 = 15, then 15 x 2 = 10, then 3 x 10 = 30. (Associative property of multiplication.) Knowing that 8 x 5 = 4 and 8 x 2 = 16, one can find 8 x 7 as 8 x (5 + 2) = (8 x 5) + (8 x2) = 40 + 16 = 56. (Distributive property.)*
6. Understand division as an unknown-factor problem. *For example, find 32 ÷ 8 by finding the number that makes 32 when multiplied by 8.**
7. Fluently multiply and divide within 100, using strategies such as the relationship between multiplication and division (e.g., knowing that 8 x 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.

NUMBER AND OPERATIONS IN BASE TEN (NBT)

Use place value understanding and properties of operations to perform multi-digit arithmetic.

1. Use place value understanding to round whole numbers to the nearest 10 or 100.
2. Fluently add and subtract within 100 using strategies and algorithms based on place value, properties of operations, and/or the relationship between addition and subtraction.
3. Multiply one-digit whole numbers by multiples of 10 in the range 10 – 90 (e.g., 9 x 80, 5 x 60) using strategies based on place value and properties of operations.

MEASUREMENT AND DATA (MD)

Measure and estimate lengths in standard units.

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.
2. Measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (l). Add, subtract, multiply or divide to solve one-step word problems involving masses or volumes that are given in the same units, e.g., by using drawings (such as a beaker with a measurement scale) to represent the problem.

Represent and interpret data.

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.*
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.

Geometric measurement: understand concepts of area and relate area to multiplication and to addition.

7. Relate area by counting unit squares (square cm, square m, square in, square ft, and improvised units).
    b. Multiply side lengths to find areas of rectangles with whole-number side lengths in the context of solving real world and rectangular areas in mathematical reasoning.

Commentary

Operations and Algebraic Thinking

Third grade students explore the meaning of multiplication as finding the total number of objects (product) when they know the number of groups (factor) and the number of items in each group (factor). The relationship between multiplication and division helps students understand that when dividing, they are finding the number of groups (missing factor) when they know the total count (product) and the number of items in a group (factor), or finding the number of items in a group (missing factor) when they know the number of groups (missing factor) when they know the number of groups (factor) and the total count (product). Problem solving situations and activities that include a variety of representations showing equal-sized groups, arrays, and area models lay the foundations from multiplication and division of whole numbers.

Note that these Standards are not linear. It is important for students to understand the meaning of multiplication and division (3.OA.1, 3.OA.2) through the use of problem situations (3.OA.3). As students demonstrate understanding they begin to relate models to symbolic notation (3.OA.4). The use of symbols for easier facts and relating the symbols to fact families should be happening as students continue to use models to solve problems with the more difficult facts.

As students have a variety of experiences solving problems and modeling multiplication and division situations with one-digit factors, they explore the properties of multiplication, develop strategies based on these properties and use the properties to build their understanding of the relationship between multiplication and division. Properties include the commutative and associative properties, the identity element for multiplication, and the zero property. These properties can be connected to earlier work with addition. The distributive property will help students to develop efficient strategies for multiplication – not only for basic facts but also for more complex multiplication examples. It is also a foundational property for future work with algebra.

Number and Operations in Base Ten

Students enter third grade with knowledge of place value through hundreds and with experience adding and subtracting through 100 using a variety of strategies, concrete materials, and various representations. In Grade 3 they extend their knowledge of place value to include rounding n umbers. They add and subtract fluently through 1000 using place value, properties, and the relationship between addition and subtraction. They extend their understanding of multiplication to include multiplying one-digit numbers times multiples of 10.

Measurement and Data

Students will learn to tell time to the minute and solve elapsed-time word problems with the use of clock models or number lines. Second, students will estimate and weigh objects by filing containers to understand the size and weight of a liter, gram, and kilogram. Third graders will also solve problems involving mass and volume.

This cluster is about crating line plots to display a data set of objects measure in fractional units of ½, ¼ and 1/8. Students will solve problems using the data they collected.

Third graders will recognize are as an attribute of two-dimensional regions. Students will measure the area of a shape by finding the number of square units needed to cover the shape. Students will learn that rectangular arrays can be decomposed into identical rows or into identical com. Students will also connect the concepts of area to multiplication by decomposing rectangles into rectangular arrays of squares.

Instructional Resources
Text: Math Expressions Common Core Assessment Guide

Unit 2: Multiplication and Division with 6s, 7s, 8s and Multiply with
Multiples of 10 (Sections: 2.9-2.15)
- Problems Solving and Multiples of 10

Unit 3: Measurement, Time, and Graphs (Sections 3.1-3. 15)
- Length, Capacity, Weight, and Mass
- Time and Date
- Pictographs, Bar Graphs, and Line Plots

Unit 4: Multi-digit Addition and Subtraction (Sections 4.1-4.6)
- Understand Place Value and Rounding

Differentiated Instruction Activities
Pages: 239, 247, 255, 261, 273, 282, 287, 301, 311, 319, 329, 335, 343, 349,
357, 363, 369, 379, 387, 393, 399, 405, 411, 421, 427, 435, 441, 449 and 457

Think Central Resources: www.thinkcentral.com
Below Level-Soar to Success, On Level-Mega Math, Challenge-Destination Math

Literacy connection: **Who Sank the Boat** by Pamela Alllen

Materials:

Unit 2:

Activity cards 2-9, drawing paper, symbol cards, math journals, activity cards 2-10, high lighters, game cards, index cards, secret code cards, math board materials, activity cards 2-11, activity cards 2 -12, base ten blocks, activity cards 2 -13, game cards, calculator, activity cards 2 -14, division strategy cards, factor field, grid paper, Spinner A, Spinner C, paper clips

Unit 3:

Activity cards 3-1, ¼ inch ruler, index cards, math journals, activity cards 3-2, drawing paper, empty containers of various shapes and sizes, activity cards 3-3, large measuring cup, activity 3-4, water, metric measurement cups, centimeter cubes, small clear containers, 1-liter water bottle, containers of various sizes, index cards, spring scale, aluminum foil, large bucket, various small objects, activity cards 3-5, index cards, activity cards 3-6, activity 3-7, paper clock, activity cards 3-8, activity cards 3-9, activity cards 3 -10, math board materials, grid paper, activity cards 3 -11, activity cards 3 -12, centimeter grid paper, crayons, data tables, activity 3 -13, Spinner D, number cards, ruler, activity 3 -14, inch ruler, ribbon,

Materials continued

Unit 4:

Activity cards 4-1, Demonstration secret code cards, secret code cards, pointer, Math Board materials, dot grid, scissors, base ten blocks, number cubes, math journals, activity cards 4-3, sentence strips, index cards, activity cards 4 -4, place value strips

Assessments:
Unit 2: Quick Quiz 2; Unit 2 Assessment Form A and Unit 2 Assessment Form B Formative Assessment: Check for Understanding embedded in each lesson
Unit 3: Quick Quiz 1, 2 and 3; Unit 3 Assessment Form A and Unit 3 Assessment Form B Unit 4: Quick Quiz 1

Adding Students Misconnections and Common Errors

3.OA.A.1

In previous work with addition, both addends represented the count or number to items that are joined for a total count. For example, 6 markers and 3 more markers give a total of 9 markers. In multiplication, one factor represents the number of groups, sets, or collections and the other factor represents the number of items in each group, set, or collection. Students need multiple experiences identifying which factor represents the number of groups and which factor represents the number of items in each group. Early experiences with concrete models and pictures and explicit connections to the symbolic notation will not only help students to identify multiplication situation is but also support student understanding of division.

3.OA.A.2

Because multiplication is commutative (3 *x* 7 = 7 *x* 3), some students think that $21 \div 3 \; and \; 3 \div 21$ mean the same thing. This is especially true the equations are written two different ways.
$21 \div 3 \; and \; 3\sqrt{21}$
Connecting concrete and pictorial models to both forms of division equations is essential to eliminating the misconception.

Adding Students Misconnections and Common Errors

Students read $3\sqrt{21}$ as 3 "goes into" 21. Although these words are commonly used, they do not reinforce the meaning of division. Getting students to read this as "3 divides 21" or "21 divided by 3" or "How many groups of 3 are in 21?" is a habit that should be developed early in division instruction.

The sharing model (How many in a group?) is often easier for students to recognize s division. The measurement model is more difficult. Students need to work with many problem situations for each type of division using concrete materials and drawing pictures.

3.OA.3

Students who have trouble identifying information in a problem situation (which number represents the total, the number of groups and/or the number of items in a group) need more experience making explicit connections between their representations (concrete models or pictures) and determining the number of groups or the number of items in a group.

3.OA.4

Now that students are working more frequently with numeric equations for multiplication and division, reinforce accurate reading of the equations. $15 \div 3 \; and \; 3\sqrt{15}$ should be read as "15 divided by 3" or "3 divides 15". In algebra, the use of a symbol in one problem cannot represent a different number in a different but related situation. When writing missing factor equations, be sure to use different symbols for the missing factor that represent the number of groups and the missing factor that represents the total number in a group or the total number of items. For example: $15 \div 3 = x \quad 15 \div 5 = y$

3.OA.5

Students often confuse multiplying by zero with adding to zero. Although this property seems obvious, providing students with problems and using models will help to reinforce the correct understanding.

Addressing Student Misconceptions and Common Errors Cont.

The distributive property forms the foundation for all future work with multiplying whole number. However, in Grade 3, students should use this valuable property to help learn more difficult basic facts through array models. Introduce and continue work with this property throughout early work with multiplication. Students need opportunities to use and describe this property in order to make sense of it.

3.OA.6

Students often consider multiplication and division as discrete operations and do not understand the importance of the relationship between them as they learn basic facts to solve problems. It is important for students to understand division in terms of finding a missing factor and relate this work to writing division expressions and equations. Students need much experience identifying what information is known and what they are looking for using concrete materials and drawing pictures as well as asking themselves the right question, such as "How many groups of 7 can I make from 28?" Relating work with models to written missing factor multiplication equations and division equations is essential for students to develop this understanding.

3.OA.7

The development of conceptual understanding must precede drill and practice exercises. Students who struggle with facts need more experience with concrete and pictorial representations, including describing what their models represent to make connections to basic facts.

They need time and experience with developing strategies that are based on patterns and properties to help support leaning their facts. It is important to give students time to learn and understand these concepts before procedural skill practices takes place.

3.NBT.1

The rounding "rules" can cause students a variety of misconceptions. Rounding up to the nearest ten means the digit in the tens place will increase by one. Rounding down can lead students to believe the digit in the tens place would decrease by one when in reality it remains the same. Following rules that do not make sense can be more complicated than the number line representation. Students should have many experiences using number line models and justifying their solutions.

Addressing Student Misconceptions and Common Errors Cont.

3.NBT.2

Students who learn to add and subtract procedurally without a deep understanding of place value and regrouping will struggle to determine whether their answers are reasonable. They also make common errors when subtracting with zero in the sum or take the smaller number from the larger as shown in the following examples. Students who make these errors need more experience with concrete models, using place value charts with bundling/unbundling straws. They should make explicit make explicit connections, from models to written work. They should also explain their reasoning in composing and decomposing numbers when regrouping using pictures, numbers and words.
Common Errors in Subtraction

7 3 6	6 0 0
-2 5 9	-4 6 5
5 2 3	2 6 5

3NBT.3

Teaching shortcuts (adding a zero to the product of the two non-zero whole numbers rather than understanding the relationship between the product and its place value does not establish the underlying importance of place value in multiplication. Understanding the multiplying 4X30 means I have 4 groups of 3 tens and that is 12 tens or 120(rather than multiply 4 X 3 and "add a zero at the end") is fundamental to ongoing work with multiplication and working with partial products. Students who recognize and can explain a pattern rather than following

a rule begin to understand the structure of multiplication rather than a meaningless short cut.

3.MD.1

Some third graders may have difficulty simply reading a clock to tell time. Before teaching elapsed time, make sure students can tell time to the minute. Allow students to use a clock with movable hands, but keep in mind that numerous ongoing practices telling time to the minute using a clock or number line to show elapsed time will help students become proficient.

3. MD.2

Students may incorrectly think about size as they determine estimated for mass. To avoid this common error, allow students to handle and

Addressing Student Misconceptions and Common Errors Cont.

touch all objects before they give an estimate.

3.MD. 3

Some students may be challenged by interpreting a graph because we read from left to right. Reading a graph required students to interpret the information both horizontally and vertically. Pointing this out to students may help. Often, intervals on a bar graph may confuse students. Although intervals are not in single units, students may count each square as one unit. To address this misconception, have students pencil in tick marks between each interval, beginning each scale with zero to skip count when thinking about the value of a bar.

3.MD.4

Some students may mark Xs on the line plot as different sizes, some small and some large. Talk with students to help them discover that different sizes of Xs on the plot may make it difficult to analyze and interpret. A common error made in measuring is that some students do not accurately line up the object to measure. Instead of starting with the zero point on the ruler, students often start measuring at the one-inch marking on the ruler. To address this, discuss how this affects the measurement of an object. Draw a chalk number line on the playground for students to walk. Remind students that a space is covered before they step on the number one, and it is the same idea for measuring with a ruler. Another common error students may make is not knowing what measurement to use if the object measures between ¼, and ½ inch. Help students understand that measuring is approximate and that items will not exactly measure to ¼, ½ , or one whole inch.

3.MD.7b

Instead of multiplying, some students may merely count unit squares to determine the area. Applying multiplication facts may be an issue. To address this, have them sketch a rectangle with arrows of squares and ask them to write a number sentences instead of counting, such as "4 rows of 5 squares = 5 + 5 + 5 + 5 = 4 X 5 = 20 squares."

Source: The Common Core Mathematics Companion: The Standards Decoded (What They Say, What They Mean, How to Teach Them)
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