

THEME: PLACE VALUE AND MULTI-DIGIT ADDITION AND SUBTRACTION**OPERATIONS AND ALGEBRAIC THINKING (OA)****Represent and solve problems involving multiplication and division.**

3. Use multiplication and division with 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.

Solve problems involving the four operations, and identify and explain patterns in arithmetic.

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.

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.*

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.

GEOMETRY (G)***Reason with shapes and their attributes.***

1. Understand that shapes in different categories (e.g., rhombuses, rectangles, and other) may share attributes (e.g., having four sides), and that the shared attributes can define a larger category (e.g., quadrilaterals). Recognize rhombuses, rectangles, and squares as examples of quadrilaterals, and draw examples of quadrilaterals that do not belong to any of these subcategories.

2. Partition shapes into parts with equal areas of each part as a unit fraction of the whole. *For example, partition a shape into 4 parts with equal area, and describe the area of each part as $\frac{1}{4}$ of the area of the shape.*

Commentary**Operations and Algebraic Thinking:**

The major work of this domain in Grade 3 is to develop students' conceptual understanding of multiplication and division by using concrete materials to model multiplication and then relate their understanding of multiplication to division. Multiplication problem situations provide a context of understanding multiplication as finding the total number of items given a number of equal groups and the number of items

Commentary continued:

in each group. Division problem situations develop the meaning of division and how it is related to multiplication. When you know the total number of items and the number of items in a group, you can find the number of groups. All of these activities culminate in the expectation that students will demonstrate fluency with multiplication and division within 100 using single-digit factors.

Cluster A

The major work of the Operations and Algebraic Thinking domain in Grade 3 is to develop students' conceptual understanding of multiplication and division by using concrete materials to model multiplication and then relate their understanding of multiplication to division. 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 (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 foundation for 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.

Standards for Mathematical Practice

SFMP 1. Make sense of problems and persevere in solving them.

SFMP 2. Use quantitative reasoning.

SFMP 3. Construct viable arguments and critique the reasoning of others.

SFMP 4. Model with Mathematics.

SFMP 5. Use appropriate tools strategically.

SFMP 6. Attend to precision.

SFMP 7. Look for and make use of structure.

SFMP 8. Look for and express regularity in repeated reasoning.

Commentary Cont.

Students solve a variety of problems as contexts for learning what it means to multiply or divide. They use quantitative reasoning to determine what is happening when they multiply (given the number of groups and the number of items in a group, they find the total number of items) and divide (given the total number of items and the number of groups, they find the number of items in a group or given the total number of items and the number items in a group, they find the number of groups). Constructing mathematical arguments to justify their reasoning and comparing their strategies with those of classmates help students to make connections among ideas and between concrete models and numerical notations (expressions and equations). They use a variety of tools to model multiplication and division including sets, arrays, area models, and the number line to represent what is happening when they multiply or divide. Developing the mathematical vocabulary of multiplication and division (factor \times factor = product and product \div factor = missing factor) helps students to explain their thinking not only about the individual operations but also how they are related to each other. The commutative, associative, and distributive properties lay the foundation for fluency with basic facts through looking at the structure of multiplication and division and provide students with strategies for solving problems. Students use patterns and repeated reasoning (multiplication by 0, 1, 5 and 10) to help them identify patterns and become fluent with basic facts.

Cluster D:

Third graders have many experiences solving multiplication and division problems to build conceptual understanding of those operations. These problems should be extended to situation in which students will use an operation or combinations of operations to solve two-step problems using various models and representations. Estimation strategies not only help to extend conceptual understanding, but also help students think about the number in a problem and whether a solution is reasonable. This cluster also includes giving students opportunities to examine patterns in multiplication and division and how those patterns relate to the properties (and vice versa).

Standards for Mathematical Practice

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Commentary Cont.

Students explain their thinking using materials, pictures, words, and numbers. They listen to the reasoning of others and look for similarities and differences in various strategies used to solve problem. Using a variety of representations and models helps students to solve problems and to deepen their understanding of the meaning of the operations. They begin to develop problem solving strategies, including make a model, draw a picture, make an organized list and find a pattern. Students select appropriate tools, including concrete materials, graph paper and pictures to help solve problems. They begin to develop problems solving strategies, including concrete materials, graph paper, and picture, make an organized list, and find a pattern. Students select appropriate tools, including concrete materials, graph paper and pictures to help solve problems. They also ask themselves if a task can be completed by mental computation, estimation, or paper and pencil. For more complex situations, they might use a calculator. Using appropriate mathematical vocabulary and accurate units of measure are areas of focus as students begin to solve more sophisticated problems. They look for and extend mathematical patterns in a variety of situations, including table and problems, and connect those patterns to the properties. These patterns help students to understand the structure of the four operations and should also be connected to the work in the Number and Operations in Base Ten (NBT) domain.

Number and Operations in Base Ten

In grade 3 students use place value to extend previous work in addition and subtraction to 1,000. They use number line models to develop an understanding of rounding numbers. They build on multiplication facts and understanding to multiply one-digit numbers times multiple of 10.

Cluster A

Students enter third grade with knowledge of place value through hundreds and with experience adding and subtracting though 100 using a variety of strategies, concrete materials and various representations. In Grade 3 they extend their knowledge of place value to include rounding numbers. 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.

Standards for Mathematical Practice

SFMP 1. Make sense of problems and persevere in solving them.

SFMP 2. Use quantitative reasoning.

SFMP 3. Construct viable arguments and critique the reasoning of others.

Commentary continued**SFMP 4. Model with Mathematics.****SFMP 5. Use appropriate tools strategically.****SFMP 6. Attend to precision.****SFMP 7. Look for and make use of structure.****SFMP 8. Look for and express regularity in repeated reasoning.**

Problem solving continues to provide a context for ongoing work with place value in rounding experiences as well as in adding and subtracting through 1000. Students use quantitative reasoning throughout this cluster as they use representations, including number lines, bundling straws into groups of tens and groups of one hundred, to model and explain their thinking. They continue to develop appropriate vocabulary and use that vocabulary in their explanations. As students extend their previous work with addition and subtraction, they use the structure of place value (composing and decomposing tens and hundreds) to develop efficient strategies to add and subtract. They explore and discuss the structure of multiplication by using models to see what happens when multiplying by multiples of 10. After many opportunities to multiply by 10 and multiples of 10, students generalize that when multiplying by 10, for example 3×10 , they have three 10s, which is written as 30. It is important that students recognize this pattern and why it works rather than being given a shortcut to avoid other misconceptions. They extend this understanding to all multiples of 10, making generalizations to find efficient ways to multiply.

Geometry

The study of geometry in third grade builds upon previous experiences from Grade 2. Students have been exposed to numerous shapes as they play, draw, color, build, and explore with toys and technology. These experiences help to develop spatial reasoning, which is important in daily life for interpreting and making drawings, forming mental images, visualizing changes, and generalizing about perceptions in the environment. At this level students will identify and draw triangles, pentagons, and hexagons and specifically concentrate on quadrilaterals. Third graders will also focus on fractions by partitioning a whole shape such as a circle or rectangle into equal parts.

Standards for Mathematical Practice**SFMP 6 Attend to precision.**

Third graders will use clear, precise language to describe quadrilaterals in discussions with others.

SFMP 7 Look for and make use of structure.

Commentary Continued

The students will conceptualize a quadrilateral as a closed figure with four straight sides and notice characteristics of the angles and the relationship between opposite sides. The experience of discussing and thinking about attributes of shapes will help third graders understand geometric structure.

Instructional Resources

Text: Math Expressions Common Core Assessment Guide

Unit 4: Multi-digit Addition and Subtraction (Sections 4.7-4.18)

- Addition and Subtraction Strategies and Group to Add
- Ungroup to Subtract

Unit 5: Write Equations to Solve Word Problems (Sections 5.1-5. 11)

- Types of Word Problems
- Solve Two Step Problems

Unit 6: Polygons, Perimeter, and Area (Sections 6.1-6.4)

- Analyzing Triangles and Quadrilaterals

Materials:

Unit 4: Activity cards; Math Board materials; base ten blocks; game cards; index cards; math journals; number cubes; rulers; scissors; recording sheet; score boards; sticky notes; paper bags

Unit 5: Math journals; activity cards; number cubes; Math Boards; chart paper; equation challenge; markers; index cards; game cards; secret code cards; number path; two color counter; 2 different color highlighters; strips of paper; sentence strips

Unit 6: Straws; activity cards; Math journals; drawing paper; index cards; tangrams; parallelograms and squares; scissors; rulers; rectangular sheets of paper; quadrilaterals

Assessment Resources

Source: Math Expressions: Common Core Assessment Guide

Unit 4: Quick Quiz 2 and 3 Unit 4 Assessment Form A and Unit 4 Assessment Form B

Performance Assessment

Pages: 67-69

Unit 5: Quick Quiz 1 and 2; Unit 5 Assessment Form A and Unit 5 Assessment Form B

Performance Assessment

Pages: 80-82

Unit 6: Quick Quiz 1

Formative Assessment: Check for Understanding embedded in each lesson

Source: Math Expressions: Common Core Assessment Guide

Differentiated Instruction Activities

Pages: 465, 473, 479, 485, 495, 505, 511, 521, 527, 533, 543, 549, 565, 573, 581, 595, 601, 609, 615, 627, 633, 639, 645, 663, 671, 677 and 685

Think Central Resources: www.thinkcentral.com

Below Level-Soar to Success, On Level-Mega Math, Challenge-Destination MathMath

Addressing Student Misconceptions and Common Errors cont.**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 experiences 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 $15/3$ should both 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 represents the number of groups and the missing factor that represents the total number in a group or the total number of items.

For example: $15 \div 3 = x$ $15 \div 5 = y$

3.OA.8

Students who struggle with knowing what to do to solve problems will find it helpful to restate the problem in their own words. They should identify and underline the important information in the problem and determine what other information they might need in order to solve the problem. When they explain what the problem is asking, students will find that it will help them determine whether their answer is reasonable. Students who become easily frustrated with word problems may need carefully constructed questions to help direct them in determining what to do to solve the problem, but they should never be told what to do to reach a solution.

3.OA.9

Students who have difficulty finding and describing patterns should start with simple examples and build to more complex patterns. They are more likely to notice visual patterns before numerical patterns. If possible, project the multiplication or additional tables and shaded patterns for all to see. This will help struggling students to visualize the patterns and then look at characteristics of the numbers.

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

Addressing Student Misconceptions and Common Errors cont.

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 have many experiences using number line models and justifying their solutions. +-

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 connections from models to written work. They should also explain their reasoning in composing and decomposing numbers when regrouping using pictures, number and words.

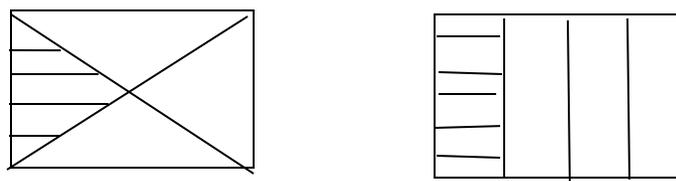
3. G.1

Some third graders may identify a square as a “non-rectangle” or a “non-rhombus” and may not understand a square is a rectangle because it has all of the properties of a rectangle. Some children may be able to tell the properties of each shape separately, but may not figure out the relationships between the shapes. For example, students may not notice the properties of a square that are characteristic of other shapes too. To address this misconception, provide toothpicks or straw to create shapes. To help students visually see the relationship between a rhombus and a square, ask students to change the angles. Have students talk about the relationship they noticed as they moved the angles. As students develop definitions for specific shapes, relationships between the properties will make sense to them.

3. G. 2

Some third graders are confused with the concept that equal shares of identical wholes may not have the same shape. Some students may not understand an area model represent one out of two or three or four fractional parts without understanding the parts are equal shares. Additional experiences and discussions about equal shares with different shapes will help students begin to understand this confusing concept.

Fourths



Source: The Common Core Mathematics Companion: The Standards Decoded (What They Say, What They Mean, How to Teach Them)
Authors: Ruth Harbin Miles and Lois A. Williams, 2016 NCTM