Grade 4 Math Unit 2-Number and Operations in Base Ten: Multiplication & Division

UNIT OVERVIEW

In Grade 4, math instruction should focus around 3 Critical Focus Areas. This unit will address work in Critical Focus Area #1, **Developing understanding and fluency with multi-digit multiplication, and developing understanding of dividing to find quotients involving multi-digit dividends and goes beyond to address Adding and subtracting multi-digit whole numbers.**

(See Connections for explanation)

This unit will address work in these clusters:
- Generalize place value understandings of operations to perform multi-digit arithmetic for multi-digit whole numbers
- Use place value understanding and properties of operations to perform multi-digit arithmetic
- Use the four operations with whole numbers to solve problems
- Gain familiarity with factors and multiples

Students will:
- Multiply a whole number of up to four-digits by a one-digit whole number.
- Multiply two, two-digit numbers.
- Illustrate and explain calculations by using equations, rectangular arrays and/or models.
- Find whole number quotients and remainders with up to four-digit dividends and one-digit divisors.

STANDARDS

CC_Common Core State Standards - Mathematics (2010) - Grade 4
Domain 4.OA Operations and Algebraic Thinking
Cluster Statement *Use the four operations with whole numbers to solve problems.*
Standard 4.OA.1 Interpret a multiplication equation as a comparison, e.g., interpret 35 = 5 × 7 as a statement that 35 is 5 times as many as 7 and 7 times as many as 5. Represent verbal statements of multiplicative comparisons as multiplication equations.
Standard 4.OA.2 Multiply or divide to solve word problems involving multiplicative comparison, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem, distinguishing multiplicative comparison from additive comparison.
Standard 4.OA.3 Solve multistep word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted. 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.

Cluster Statement: *Gain familiarity with factors and multiples.*
Standard 4.OA.4 Find all factor pairs for a whole number in the range 1-100. Recognize that a whole number is a multiple of each of its factors. Determine whether a given whole number in the range 1-100 is a multiple of a given one-digit number. Determine whether a given whole number in the range 1-100 is prime or composite.

Domain 4.NBT Number and Operations in Base Ten
Cluster Statement: *Generalize place value understanding for multi-digit whole numbers.*
Standard 4.NBT.1 Recognize that in a multi-digit whole number, a digit in one place represents ten times what it represents in the place to its right.
Standard 4.NBT.3 Use place value understanding to round multi-digit whole numbers to any place.

Cluster Statement: *Use place value understanding and properties of operations to perform multi-digit arithmetic.*
Standard 4.NBT.5 Multiply a whole number of up to four digits by a one-digit whole number, and multiply two two-digit numbers, using strategies based on place value and the properties of operations. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.
Standard 4.NBT.6 Find whole-number quotients and remainders with up to four-digit dividends and one-digit divisors, using strategies based on place value, the 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.

CONTENT ELABORATIONS

4.NBT.5	Students will extend work on **4.NBT.1 and 4.NBT.3** Students who develop flexibility in breaking apart (decomposing numbers) have a better understanding of the importance of place value and the distributive property in multi-digit multiplication. Students use base ten blocks, area models, partitioning,compensation strategies, etc. when multiplying whole numbers and use words and diagrams to explain their thinking. They use the terms factor and product when communicating their reasoning. Multiple strategies enable students to develop fluency with multiplication and transfer that understanding to division. Use of the standard algorithm for multiplication and understanding why it works, is an expectation in the 5th grade. **MP.2,MP.3, MP.4, MP.5, MP.7** should be emphasized.
4.NBT.6	In fourth grade, students build on their third grade work with division within 100. Students need opportunities to develop their understandings by using problems in and out of context. This standard calls for students to explore division through various strategies such as: using base 10 blocks, using place value, using multiplication, and open array or area model. Refer to**Number Talks** by Sherry Parrish for strategies. **MP.2, MP.3, MP.4, MP.5, MP.7** should be emphasized.
4.OA.1	A multiplicative comparison is a situation in which one quantity is multiplied by a specified number to get another quantity (e.g., "a is n times as much as b"). Students should be able to identify and verbalize which quantity is being multiplied and which number tells how many times. Students should be given opportunities to write and identify equations and statements for multiplicative comparisons. It is essentials that students are provided many opportunities to solve contextual problems. Examples: Sally is five years old. Her mom is eight times older. How old is Sally's mom? Sally has five times as many pencils as Mary. If Sally has 5 pencils, how many does Mary have? **MP.2, MP.4** should be emphasized.

4.OA.2	This standard calls for students to translate comparative situations into equations with an unknown and solve. Students need many opportunities to solve contextual problems. Refer to Table 2 in CCSS for more examples. **MP.2, MP.4, MP.5, MP.7** should be emphasized.
4.OA.3	The focus of this standard is to have students use and discuss various strategies. It refers to estimation strategies, including using compatible numbers (numbers that sum to 10 or 100) or rounding. Problems should be structured so that all acceptable estimation strategies will arrive at a reasonable answer. Students need many opportunities solving multistep story problems using all four operations. This standard references interpreting remainders. Remainders should be put into context for interpretation. Ways to address remainders: - Remain as a left over - Partitioned into fractions or decimals - Discarded leaving only the whole number answer - Increase the whole number answer up one - Round to the nearest whole number for an approximate result Estimation skills include identifying when estimation is appropriate, determining the level of accuracy needed, selecting the appropriate method of estimation, and verifying solutions or determining the reasonableness of situations using various estimation strategies. Estimation strategies include, but are not limited to: - front-end estimation with adjusting - clustering around an average - rounding and adjusting - using friendly or compatible numbers such as factors - using benchmark numbers that are easy to compute **MP.1, MP.2, MP.4, MP.5, MP.6, MP.7** should be emphasized.
4.OA.4	This standard requires students to demonstrate understanding of factors and multiples of whole numbers. This standard also refers to prime and composite numbers. Prime numbers have exactly two factors, the number one and their own number. Composite numbers have more than two factors. A common misconception is that the number 1 is prime, when in fact; it is neither prime nor composite. Another misconception is that all prime numbers are odd numbers. This is not true since the number 2 has only 2 factors. Students investigate whether numbers are prime or composite by: - building rectangles (arrays) with the given area and finding which numbers have more than two rectangles (e.g., 7 can be made into only 2 rectangles, 1 x 7 and 7 x 1, therefore it is a prime number) - finding factors of the number **MP.2, MP.7** should be emphasized.

UNIT VOCABULARY

dividend	Commutative Property of Multiplication	regroup
divisor	Identity Property of Multiplication	Distributive Property
fact family	Zero Property of Multiplication	operation
factor	Associative Property of Multiplication	compatible numbers
quotient	decompose	remainder
product	multiple	partial quotients
repeated subtraction	partial products	

BIG IDEAS

ENDURING UNDERSTANDINGS	ESSENTIALS QUESTIONS Choose a few questions based on the needs of your students

● Multiplication may be used to find the total number of objects when objects are arranged in equal groups.
● One of the factors in multiplication indicates the number of objects in a group and the other factor indicates the number of groups.
● Products may be calculated using invented strategies.
● Unfamiliar multiplication problems may be solved by using known multiplication facts and properties of multiplication and division. For example, 8 x 7 = (8 x 2) + (8 x 5) and 18 x 7 = (10 x 7) + (8 x 7).
● Multiplication may be represented by rectangular arrays/area models.
● There are two common situations where division may be used: fair sharing (given the total amount and the number of equal groups, determine how many/much in each group) and measurement (given the total amount and the amount in a group, determine how many groups of the same size can be created).
● Some division situations will produce a remainder, but the remainder will always be less than the divisor. If the remainder is greater than the divisor, that means at least one more can be given to each group (fair sharing) or at least one more group of the given size (the dividend) may be created.
● How the remainder is explained depends on the problem situation.
● The dividend, divisor, quotient, and remainder are related in the following manner: dividend = divisor x quotient + remainder.
● The quotient remains unchanged when both the dividend and the divisor are multiplied or divided by the same number.
● The properties of multiplication and division help us solve computation problems easily and provide reasoning for choices we make in problem solving

● How are multiplication and division related?
● How can I communicate multiplication?
● How can I multiply by a two-digit number?
● How does division affect numbers?

CONNECTIONS

In Critical Focus Area #1, students generalize their understanding of place value to 1,000,000, understanding relative sizes of numbers in each place. They apply their understanding of models for multiplication (equal-sized groups, arrays, area models), place value, and properties of operations in particular the distributive property, as they develop, discuss, and use efficient, accurate, and generalizable methods to compute products of multi-digit whole numbers. Depending on the numbers and the context, they select and accurately apply appropriate methods to estimate or mentally calculate products. They develop fluency with efficient procedures for multiplying whole numbers; understand and explain why the procedures work based on pace value and properties of operations; and use them to solve problems. Students apply their understanding of models for division, place value, properties of operations, and the relationship of division to multiplication as they develop, discuss, and use efficient, accurate and generalizable procedures to find quotients involving multi-digit dividends. They select and accurately apply appropriate methods to estimate and mentally calculate quotients, and interpret remainders based upon the context.

A strong foundation in whole-number place value and rounding is critical for the expansion to decimal place value and decimal rounding.

The work in this unit's clusters are connected to:

2.NBT.1-4

3.NBT.1-3, 3.OA.5-6, 3.OA.8, 3MD.7a

4.NBT.1-2

6.NS.4

Standards for Mathematical Practice (SMP)

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

MP.2 Reason abstractly and quantitatively

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

MP.4 Model with mathematics

MP.5 Use appropriate tools strategically

MP.6 Attend to precision

MP.7 Look for and make use of structure (Deductive reasoning)

MP.8 Look for and express regularity in repeated reasoning (Inductive Reasoning)

Use the four operations with whole numbers to solve problems

	CONTENT	SKILLS
4.OA.1	Interpret a multiplication equation as a comparison.	Interpret a multiplication equation as a comparison. 1. Identify an equation to match a multiplicative comparison statement. 2. Write an equation to match a multiplicative comparison statement. 3. Write a multiplicative comparison statement to match an equation.
4.OA.2	Multiply or divide to solve word problems involving multiplicative comparison.	Multiply or divide to solve word problems involving multiplicative comparison. 1. Use drawings or equations with a symbol for the unknown number to represent a problem. 2. Solve comparison problems with an unknown product. 3. Solve comparison problems with the group size unknown. 4. Solve comparison problems with the number of groups unknown.
4.OA.3	Solve multistep word problems posed with whole numbers and having whole-number answers using the four operations.	Solve multistep word problems posed with whole numbers and having whole-number answers using the four operations. 1. Use drawings or equations with a symbol for the unknown number to represent problems. 2. Justify and explain mathematical reasoning used to solve problem.

	CONTENT	SKILLS
4.OA.3	Interpret remainders in division problems.	Interpret remainders in division problems. 1. Use the context of problem to interpret a remainder as a left over 2. Use the context of problem to interpret the remainder be partitioned into a fraction or decimal 3. Use the context of problem to determine if the remainder should be discarded leaving only the whole number answer 4. Use the context of the problem to determine if the remainder should increase the whole number answer up one 5. Use the context of the problem to determine if the remainder should be rounded to the nearest whole number for an approximate result
4.OA.3	Assess reasonableness of answer.	Assess reasonableness of answer. 1. Use mental computation 2. Use estimation strategies (e.g., front-end, clustering around an average, rounding and adjusting, using friendly or compatible numbers as factors, using benchmark numbers that are easy to compute)

Gain familiarity with factors and multiples

	CONTENT	SKILLS
4.OA.4	Find all factor pairs for a whole number in the range of 1-100	Find all factor pairs for a whole number in the range of 1-100 1. build rectangles (arrays) for a given number 2. using arrays, determine whether a number is prime or composite 3. use skip counting of prime numbers to determine the number of factors 4. recognize that a whole number is a multiple of each of its factors 5. find factors for a number using factor pairs 6. recognize multiples of 5 end in 0 and 5 7. recognize multiples of 2 are even numbers 8 recognize multiples of 4 are all even numbers that can be halved twice 9. determine whether a given whole number 1-100 is a multiple of a given one-digit number

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

	CONTENT	SKILLS
4.NBT.5	Multiply a whole number of up to 4 digits by one-digit whole number.	Multiply a whole number of up to 4 digits by one-digit whole number. 1. use base ten blocks to show multiplication 2. multiply using base ten blocks and the distributive property (e.g.= 154 x 6 = (100 + 50 + 4) x 6 = (100 x 6) + (50 x 6) + (4 x 6) = 600 + 300 + 24 = 924 3. multiply using the array area model; verbalizing understanding
4.NBT.5	Multiply two two-digit numbers.	Multiply two two-digit numbers. 1. multiply using the array area model; verbal understanding
4.NBT.6	Find whole-number quotients and remainders with up to four-digit dividends and one-digit divisors.	Find whole-number quotients and remainders with up to four-digit dividends and one-digit divisors. 1. divide using base ten blocks 2. divide using place value [e.g. 260 ÷ 4 = (200 ÷ 4) + (60 ÷ 4)] 3. divide using multiplication (e.g. 260 ÷ 4 = 4 x 50 = 200, 4 x 10 = 40, 4 x 5 = 20; 50 + 10 + 5 = 65; 260 ÷ 4 = 65)

UNIT RESOURCES

Common Core Model Curriculum
McGraw-Hill, **My Math** chapters 3-6
Number Talks by Sherry Parrish
Georgia Math frameworks, Grade 4 Unit 2
Manipulatives
Smart Board resources
Discovery Video
Hands-On Standards
The King's Commissioners - Literery Reading