

Grade 5 • Module 2

Multi-Digit Whole Number and Decimal Fraction Operations

OVERVIEW

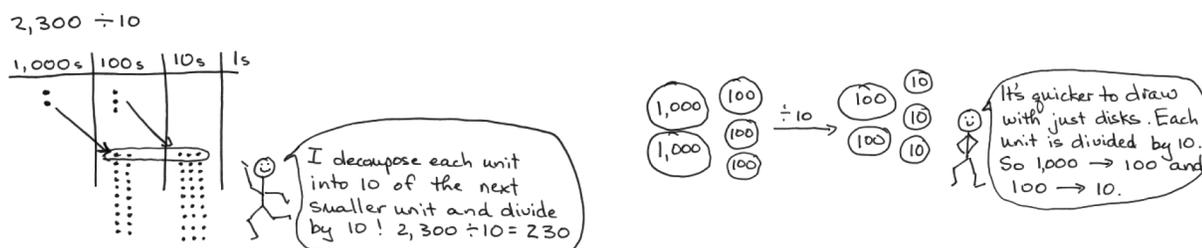
In Module 1, students explored the relationships of adjacent units on the place value chart to generalize whole number algorithms to decimal fraction operations. In Module 2, students apply the patterns of the base ten system to mental strategies and the multiplication and division algorithms.

In Topic A, students explore factors, multiples, and prime and composite numbers within 100 (**5.4A**), gaining valuable insights into patterns of divisibility as they test for primes and find factors and multiples.

Topics B through E provide a sequential study of multiplication. To link to prior learning and set the foundation for understanding the standard multiplication algorithm, students begin at the concrete–pictorial level in Topic B. They use place value disks to model multi-digit multiplication of place value units, for example, 42×10 , 42×100 , $42 \times 1,000$, leading to problems such as 42×30 , 42×300 , and $42 \times 3,000$. They then round factors in Lesson 6 and discuss the reasonableness of their products. Throughout Topic B, students evaluate and write simple expressions to record their calculations using the associative property and parentheses to record the relevant order of calculations (**5.4F**).

In Topic C, place value understanding moves toward understanding the distributive property via area models, which are used to generate and record the partial products (**5.4E**, **5.4F**) of the standard algorithm (**5.3B**). Topic D moves students from whole numbers to multiplication with decimals, again using place value as a guide to reason and make estimations about products (**5.3A–B**, **5.3D–E**). In Topic E, students explore multiplication as a method for expressing equivalent measures. For example, they multiply to convert between meters and centimeters or ounces and cups with measurements in both whole number and decimal form (**5.7**).

Topics F through I provide a similar sequence for division. Topic F begins concretely with place value disks as an introduction to division with multi-digit whole numbers (**5.3A**, **5.3C**).



In the same lesson, $420 \div 60$ is interpreted as $420 \div 10 \div 6$. Next, students round dividends and two-digit divisors to nearby multiples of 10 in order to estimate single-digit quotients (e.g., $431 \div 58 \approx 420 \div 60 = 7$) and then multi-digit quotients. This work is done horizontally, outside the context of the written vertical method. The series of lessons in Topic G lead students to divide multi-digit dividends by two-digit divisors using the

written vertical method. Each lesson moves to a new level of difficulty with a sequence beginning with divisors that are multiples of 10 to non-multiples of 10. Two instructional days are devoted to single-digit quotients with and without remainders before progressing to two- and three-digit quotients (**5.3A, 5.3C, 5.4B**).

In Topic H, students use their understanding to divide decimals by two-digit divisors in a sequence similar to that of Topic G with whole numbers (**5.3A, 5.3F–G, 5.3K**). In Topic I, students apply the work of the module to solve multi-step word problems using multi-digit division with unknowns representing either the group size or number of groups. In this topic, an emphasis on checking the reasonableness of their answers draws on skills learned throughout the module, including refining their knowledge of place value, rounding, and estimation.

Notes on Pacing for Differentiation

If pacing is a challenge, consider the following modifications and omissions. Depending on students' strengths, consider consolidating Lessons 9 and 10. In Lesson 9, omit Problem 1 of the Concept Development, and move directly into renaming with the algorithm after Problem 2. Use the Problem Set from Lesson 10 for independent student practice. Consider consolidating Lessons 11 and 12 as well. Ask students to estimate the product beginning with the Concept Development of Lesson 11, and then use the Problem Set from Lesson 12 for student practice. Similarly, Lessons 15 and 16 can also be consolidated. Use estimation from the outset, and have students practice with the Problem Set from Lesson 16.

It is not recommended to omit any lessons from Topic E as it is a foundation for work later in the year. Students convert measurement units from small to large and from large to small using multiplication. This significantly expedites their understanding of and fluency with conversion as the year continues.

Focus Grade Level Standards

Number and Operations

The student applies mathematical process standards to represent, compare, and order positive rational numbers and understand relationships as related to place value. The student is expected to:

- 5.2A** represent the value of the digit in decimals through the thousandths using expanded notation and numerals.¹

Number and Operations

The student applies mathematical process standards to develop and use strategies and methods for positive rational number computations in order to solve problems with efficiency and accuracy.² The student is expected to:

- 5.3A** estimate to determine solutions to mathematical and real-world problems involving addition, subtraction, multiplication, or division;
- 5.3B** multiply with fluency a three-digit number by a two-digit number using the standard algorithm;
- 5.3C** solve with proficiency for quotients of up to a four-digit dividend by a two-digit divisor using strategies and the standard algorithm;
- 5.3D** represent multiplication of decimals with products to the hundredths using objects and pictorial models, including area models;
- 5.3E** solve for products of decimals to the hundredths, including situations involving money, using strategies based on place-value understandings, properties of operations, and the relationship to the multiplication of whole numbers;
- 5.3F** represent quotients of decimals to the hundredths, up to four-digit dividends and two-digit whole number divisors, using objects and pictorial models, including area models;
- 5.3G** solve for quotients of decimals to the hundredths, up to four-digit dividends and two-digit whole number divisors, using strategies and algorithms, including the standard algorithm;
- 5.3K** add and subtract positive rational numbers fluently.

¹ The balance of understanding the place value system is addressed in Module 1.

² Focus on decimal multiplication of a single-digit whole number factor times a multi-digit number with up to two decimal places (e.g., 3×64.98). Restrict decimal division to a single digit whole number divisor with a multi-digit dividend with up to two decimal places (e.g., $64.98 \div 3$). The balance of operations with decimals to hundredths is taught in Module 4.

Algebraic Reasoning

The student applies mathematical process standards to develop concepts of expressions and equations. The student is expected to:

- 5.4A** identify prime and composite numbers;
- 5.4B** represent and solve multi-step problems involving the four operations with whole numbers using equations with a letter standing for the unknown quantity;
- 5.4E** describe the meaning of parentheses and brackets in a numeric expression;
- 5.4F** simplify numerical expressions that do not involve exponents, including up to two levels of grouping.

Geometry and Measurement

The student applies mathematical process standards to select appropriate units, strategies, and tools to solve problems involving measurement. The student is expected to:

- 5.7** solve problems by calculating conversions within a measurement system, customary or metric.

Foundational Standards

The student is expected to:

- 3.5C** describe a multiplication expression as a comparison such as represents 3 times as much as 24;
- 4.2A** interpret the value of each place-value position as 10 times the position to the right and as one-tenth of the value of the place to its left;
- 4.4A** add and subtract whole numbers and decimals to the hundredths place using the standard algorithm;
- 4.4C** represent the product of 2 two-digit numbers using arrays, area models, or equations, including perfect squares through 15 by 15;
- 4.4D** use strategies and algorithms, including the standard algorithm, to multiply up to a four-digit number by a one-digit number and to multiply a two-digit number by a two-digit number. Strategies may include mental math, partial products, and the commutative, associative, and distributive properties;
- 4.4E** represent the quotient of up to a four-digit whole number divided by a one-digit whole number using arrays, area models, or equations;
- 4.4F** use strategies and algorithms, including the standard algorithm, to divide up to a four-digit dividend by a one-digit divisor;
- 4.4G** round to the nearest 10, 100, or 1,000 or use compatible numbers to estimate solutions involving whole numbers;
- 4.4H** solve with fluency one- and two-step problems involving multiplication and division, including interpreting remainders;
- 4.5A** represent multi-step problems involving the four operations with whole numbers using strip diagrams and equations with a letter standing for the unknown quantity.

Focus Mathematical Process Standards

Mathematical Process Standards. The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:

- (A) apply mathematics to problems arising in everyday life, society, and the workplace;
- (B) use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution;
- (D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate;
- (F) analyze mathematical relationships to connect and communicate mathematical ideas.

Overview of Module Topics and Lesson Objectives

TEKS	ELPS	Topics and Objectives	Days
5.4A	1.A 1.C 1.E 2.C 2.E 2.I 3.E 4.G 5.G	A Prime and Composite Numbers Lesson 1: Find factor pairs for numbers to 100, and use understanding of factors to define prime and composite. Lesson 2: Use division and the associative property to test for factors and observe patterns. Lesson 3: Determine if a whole number is a multiple of another number. Lesson 4: Explore properties of prime and composite numbers to 100 by using multiples.	4
5.3A 5.3B 5.4E	1.C 2.I 3.C 3.D 4.J 5.G	B Mental Strategies for Multi-Digit Whole Number Multiplication Lesson 5: Multiply multi-digit whole numbers and multiples of 10 using place value patterns and the distributive and associative properties. Lesson 6: Estimate multi-digit products by rounding factors to a basic fact and using place value patterns.	2

TEKS	ELPS	Topics and Objectives	Days
5.3A 5.3B 5.4B 5.4E 5.4F	1.C 2.C 2.E 2.G 2.I 3.E 3.H 4.G 5.G	C The Standard Algorithm for Multi-Digit Whole Number Multiplication Lesson 7: Write and interpret numerical expressions, and compare expressions using a visual model. Lesson 8: Convert numerical expressions into unit form as a mental strategy for multi-digit multiplication. Lesson 9: Connect visual models and the distributive property to partial products of the standard algorithm without renaming. Lessons 10–11: Connect area models and the distributive property to partial products of the standard algorithm with renaming. Lesson 12: Fluently multiply multi-digit whole numbers using the standard algorithm and using estimation to check for reasonableness of the product. Lesson 13: Fluently multiply multi-digit whole numbers using the standard algorithm to solve multi-step word problems.	7
5.3A 5.3B 5.3D 5.3E 5.4E 5.4F	1.C 1.H 2.H 2.I 3.F 4.K 5.G	D Decimal Multi-Digit Multiplication Lesson 14: Multiply decimal fractions with tenths by multi-digit whole numbers using place value understanding to record partial products. Lesson 15: Multiply decimal fractions by multi-digit whole numbers through conversion to a whole number problem and reasoning about the placement of the decimal. Lesson 16: Reason about the product of a whole number and a decimal with hundredths using place value understanding and estimation.	3
5.2A 5.3B 5.3D 5.3E 5.7	2.C 2.E 2.G 2.I 3.E 4.J 5.G	E Measurement Word Problems with Whole Number and Decimal Multiplication Lesson 17: Use whole number multiplication to express equivalent measurements. Lesson 18: Use decimal multiplication to express equivalent measurements. Lesson 19: Solve two-step word problems involving measurement conversions.	3
		Mid-Module Assessment: Topics A–E (assessment ½ day, return ½ day, remediation or further applications 2 days)	3
5.2A 5.3A 5.3C	2.G 3.E 3.G 3.H 4.K 5.G	F Mental Strategies for Multi-Digit Whole Number Division Lesson 20: Use <i>divide by 10</i> patterns for multi-digit whole number division. Lessons 21–22: Use compatible numbers to approximate quotients with two-digit divisors.	3



TEKS	ELPS	Topics and Objectives	Days
5.3A 5.3C	1.A 2.E 2.G 2.I 3.E 3.G 3.H 4.K 5.G	G Partial Quotients and Multi-Digit Whole Number Division Lesson 23: Divide two- and three-digit dividends by multiples of 10 with single-digit quotients, and make connections to a written method. Lessons 24–25: Divide two- and three-digit dividends by two-digit divisors with single-digit quotients, and make connections to a written method. Lessons 26–27: Divide three- and four-digit dividends by two-digit divisors resulting in two- and three-digit quotients, reasoning about the decomposition of successive remainders in each place value.	5
5.2A 5.3A 5.3F 5.3G 5.3K	2.E 2.G 2.I 4.J 5.G	H Partial Quotients and Multi-Digit Decimal Division Lesson 28: Divide decimal dividends by multiples of 10, reasoning about the placement of the decimal point and making connections to a written method. Lesson 29: Use basic facts to approximate decimal quotients with two-digit divisors, reasoning about the placement of the decimal point. Lessons 30–31: Divide decimal dividends by two-digit divisors, estimating quotients, reasoning about the placement of the decimal point, and making connections to a written method.	4
5.3A 5.3C 5.3F 5.3G 5.4B	1.H 2.E 3.E 3.G 4.K 5.G	I Measurement Word Problems with Multi-Digit Division Lessons 32–33: Solve division word problems involving multi-digit division with group size unknown and the number of groups unknown.	2
		End-of-Module Assessment: Topics A–I (assessment ½ day, return ½ day, remediation or further application 2 days)	3
Total Number of Instructional Days			39

Terminology

New or Recently Introduced Terms

- Composite number (positive integer having three or more whole number factors)
- Conversion factor (the factor in a multiplication sentence that renames one measurement unit as another equivalent unit, e.g., $14 \times (1 \text{ in}) = 14 \times (\frac{1}{12} \text{ ft})$; 1 in and $\frac{1}{12}$ ft are the conversion factors)
- Decimal fraction (a proper fraction whose denominator is a power of 10)
- Multiplier (a quantity by which a given number—a multiplicand—is to be multiplied)
- Parentheses (the symbols used to relate order of operations)
- Prime number (positive integer greater than 1 having whole number factors of only 1 and itself)

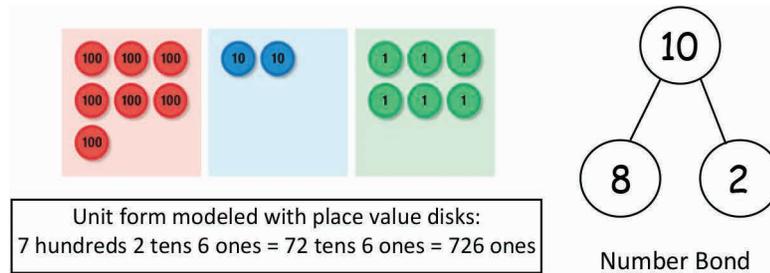
Familiar Terms and Symbols³

- Associative property (e.g., $96 = 3 \times (4 \times 8) = (3 \times 4) \times 8$)
- Decimal (a fraction whose denominator is a power of ten and whose numerator is expressed by figures placed to the right of a decimal point)
- Digit (a symbol used to make numbers: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9)
- Divisor (the number by which another number is divided)
- Equation (a statement that the values of two mathematical expressions are equal)
- Equivalence (a state of being equal or equivalent)
- Equivalent measures (e.g., 12 inches = 1 foot; 16 ounces = 1 pound)
- Estimate (approximation of the value of a quantity or number)
- Multiple (a number that can be divided by another number without a remainder like 15, 20, or any multiple of 5)
- Pattern (a systematically consistent and recurring trait within a sequence)
- Product (the result of multiplying numbers together)
- Quotient (the answer of dividing one quantity by another)
- Remainder (the number left over when one integer is divided by another)
- Renaming (decomposing or composing a number or units within a number)
- Rounding (approximating the value of a given number)
- Unit form (place value counting, e.g., 34 stated as 3 tens 4 ones)

³These are terms and symbols students have used or seen previously.

Suggested Tools and Representations

- Area models (e.g., an array)
- Number bond
- Place value disks



- Partial product (an algorithmic method that takes base ten decompositions of factors, makes products of all pairs, and adds all products together)
- Partial quotient (an algorithmic method using successive approximation)

Scaffolds

The scaffolds integrated into *A Story of Units*[®] give alternatives for how students access information as well as express and demonstrate their learning. Strategically placed margin notes are provided within each lesson, elaborating on the use of specific scaffolds at applicable times. They address many needs presented by English language learners, students with disabilities, students performing above grade level, and students performing below grade level. Many of the suggestions are organized by Universal Design for Learning (UDL) principles and are applicable to more than one population.

Assessment Summary

Type	Administered	Format	Standards Addressed
Mid-Module Assessment Task	After Topic D	Constructed response with rubric	5.2A 5.3A 5.3B 5.3D–E 5.3K 5.4A 5.4B 5.4E 5.4F 5.7
End-of-Module Assessment Task	After Topic H	Constructed response with rubric	5.2A 5.3A 5.3B 5.3C–G 5.3K 5.4B 5.4E 5.4F 5.7

