Gateway Regional School District

Atlas

# Unit Plan

## Multiplying & Dividing Multi-digit Numbers

Chester / Littleville Elementary / Grade 4 / Mathematics

Week 23 - Week 28 | 5 Curriculum Developers | Last Updated: Mar 20, 2024 by LeBlanc, Deanna

Style Guide

## What is the purpose of the unit? What are the major take-aways?

### Standards

**MA: Mathematics (2017)**

**MA: Grade 4**

**Operations & Algebraic Thinking**

**4.OA Use the four operations with whole numbers to solve problems.**

- [x] 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.
- [x] 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.

**4.OA Gain familiarity with factors and multiples.**

- [x] 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.

**4.OA Generate and analyze patterns.**

- [x] 5. Generate a number or shape pattern that follows a given rule. Identify apparent features of the pattern that were not explicit in the rule itself. Show Details

**Number & Operations in Base Ten**

**4.NBT Use place value understanding and properties of operations to perform multi-digit arithmetic of whole numbers less than or equal to 1,000,000.**

- [x] 4. Fluently add and subtract multi-digit whole numbers using the standard algorithm.
- [x] 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.
- [x] 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.

**Measurement & Data**

**4.MD Solve problems involving measurement and conversion of measurements from a larger unit to a smaller unit.**

- [x] 3. Apply the area and perimeter formulas for rectangles in real world and mathematical problems. Show Details
- [x] 2. Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit. Represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale.

## Enduring Understandings

1. **Relationship Between Operations**: Students will understand that multiplication and division are inverse operations; the mastery of these operations is foundational for solving real-world problems involving comparison, equal groups, area, and volume. Multiplication can be seen as a faster way to add repeated groups of the same size, whereas division can be thought of as determining the number of such groups or the size of each group when the total and the number of groups are known.

2. **Commutativity and Distributive Properties**: Students will recognize that the commutative property of multiplication and the distributive property of division apply to multi-digit numbers, just as they do to single digits. This understanding allows for flexible strategies in computation, such as breaking down numbers into smaller parts to simplify calculations.

3. **Mathematical Reasoning**: Students will become adept at using estimation and mental math to assess the reasonableness of answers when multiplying and dividing. They will understand that estimating, rounding, and using benchmark numbers are helpful strategies to predict and verify the results of calculations.

4. **Problem-Solving with Equations**: Students will learn to translate real-world problems into mathematical equations, using a letter to represent the unknown quantity. This skill is crucial for solving multistep word problems and understanding the algebraic foundations that will be built upon in higher grades.

5. **Factor Pairs and Multiples**: Learners will explore the concept of factors and multiples, recognizing that whole numbers have specific factor pairs, and multiples result from the product of a number and an integer. They will learn strategies to determine whether a number is prime or composite and to identify factor pairs within the range of 1–100.

6. **Patterns and Rules**: Students will understand that number patterns are governed by specific rules, which can be algebraic or geometric in nature. They will be able to extend patterns, make predictions based on these patterns, and identify features of patterns that emerge from the application of the given rule.

7. **Applications in Measurement and Geometry**: Through their understanding of multiplication and division, students will be able to apply these operations to measure and solve problems related to area, surface area, and other geometric computations, fostering a connection between arithmetic and geometric concepts.

8. **Interpreting Remainders**: Students will grasp the significance of remainders in division problems and learn methods to interpret them based on the context, such as deciding when to round up or down or when a remainder represents something measurable and meaningful in a scenario.

9. **Strategic Use of Algorithms**: Students will develop fluency in adding and subtracting multi-digit whole numbers using the standard algorithm and will transfer these skills to understand and perform multi-digit multiplication and division. The efficient use of

## Essential Questions

1. How can we use multiplication and division to solve real-world problems with whole numbers?
- How might we interpret remainders in division problems within the context of real-world scenarios?

2. What strategies can we use to check if our answers to multiplication or division problems are reasonable?
- How does estimation help us determine the reasonableness of answers?

3. How does understanding multiplication and division help us with multiplicative comparison problems?
- How are multiplicative comparisons different from additive comparisons?

4. How can we determine all the factor pairs of a whole number and what do these factors tell us about the number itself?
- How can recognizing a number as a multiple of its factors help us with multiplication and division tasks?

5. How can we identify a number as prime, composite, or neither, and why is that important in multiplication and division?
- What characteristics do prime and composite numbers have that influence our approach to multiplication and division problems?

6. In what ways can patterns help us understand and apply the principles of multiplication and division?
- How can identifying patterns assist us in solving more complex mathematical problems?

7. What role does the standard algorithm play in adding and subtracting multi-digit numbers, and how does it support our understanding of multiplication and division?
- How does being fluent in addition and subtraction contribute to learning and mastering multiplication and division?

these algorithms is essential for accuracy and speed in mathematical operations.

10. **Multiplicative versus Additive Comparison**: Pupils will differentiate between situations that require multiplication or division (multiplicative comparison) and those that involve addition or subtraction (additive comparison). They will understand that multiplicative comparisons involve a scaling factor or ratio, unlike additive comparisons that involve a difference or sum.

## Content

In this unit, students extend their knowledge of multiplication and division to find products and quotients of multi-digit numbers.
In grade 3, students learned that they could find the value of a product by decomposing one factor into smaller parts, finding partial products, and then combining them. To support this reasoning, they used base-ten diagrams (decomposing two-digit factors into tens and ones) and area diagrams (decomposing one side length into smaller numbers). Here, students use those understandings to multiply up to four digits by single-digit numbers, and to multiply a pair of two-digit numbers.
Students begin by describing features of geometric and numerical patterns using ideas and language related to multiplication and multiplicative relationships (such as factors, multiples, double, and triple).
Next, students reason about products of multi-digit numbers. They transition from using diagrams to using algorithms to record partial products.
Students learn that they can multiply the factors by place value, one digit at a time, and then organize the partial products vertically. Here are two ways to show partial products for 3,419×83,419×8.
Later, students divide dividends up to four-digit by single-digit divisors. Students see that it helps to decompose a dividend into smaller numbers and find partial quotients, just as it helped to decompose factors and find partial products.
They also recognize that sometimes it is most productive to decompose a dividend by place value. For instance, to find 465÷5, we can divide each 400, 60, and 5 by 5.
Students encounter various ways to record the division process, including an algorithm that records partial quotients in a vertical arrangement.
At the end of the unit, students apply their expanded knowledge of operations to solve multi-step problems about measurement in various contexts—calendar days, distance, and population.

**Throughout the unit**

The Number Talk routines in this unit offer opportunities for students to look for structure in multiplication and division expressions. Their observations of structure in turn support their ability to operate on or otherwise work with larger multi-digit numbers. For instance:

- In lessons 3 and 18, students compose familiar multiples of a number to help them recognize other multiples that are less familiar or are much larger.
- In lessons 5 and 10, students use doubling and halving to find products of one- and two-digit numbers.
- In lesson 8, students decompose a factor in multiplication expressions and use the distributive property to multiply pairs of two-digit numbers.

## Skills

**Section A Goals**

- Generate a number or shape pattern that follows a given rule.
- Identify apparent features of a number pattern that were not explicit in the rule itself.

**Section B Goals**

- Multiply a whole number of up to four digits by a one-digit whole number, and 2 two-digit numbers using strategies based on place value and the properties of operations.

**Section C Goals**

- Divide numbers of up to four digits by one-digit divisors to find whole-number quotients and remainders, using strategies based on place value, properties of operations, and the relationship between multiplication and division.

**Section D Goals**

- Use the four operations to solve problems that involve multi-digit whole numbers and assess the reasonableness of answers.

- In lesson 14, students use what they know about familiar multiples of 7 to notice that a larger number is not a multiple of 7 (and will therefore have a remainder if divided by 7).

## How will you gauge student learning?

### Assessments

**4.6 End-of-Unit Assessment | Summative | Written Test**

Grade4-6-End-of-Unit-Assessment-assessment.pdf

6 State Standards Assessed

## How will students learn?

### Learning Activities

Section A:
In this section, students observe and describe features of geometric and numerical patterns. Given the rule of a pattern, they predict the values or features of future terms in a pattern sequence. To make predictions, students use their understanding of operations and place value.
The section begins with patterns that are more concrete—such as shapes with features that change quantitatively and thus elicit addition or multiplication. It then moves toward patterns with repeating objects or numbers, which require students to reason more abstractly.
Later, students explore patterns in the features of rectangles—side length, perimeter, and area—that change by a rule. Along the way, students apply their knowledge of factors and multiples.

Section B:

In this section, students use their knowledge of multiplication, place value, and area of rectangles to multiply one-digit numbers and numbers up to four digits, and to multiply pairs of two-digit numbers.
A key thread here is the idea of decomposing factors—particularly by place value—as a productive way of finding products. Students explore this idea with concrete and visual representations: arrays, base-ten diagrams, and rectangles with grids. As they decompose larger factors, they see the limits of these representations, motivating more efficient representations and strategies.
In grade 3, students saw that rectangles can help us reason about multiplication—the side lengths of a rectangle can represent the two factors and its area can represent the product. As the factors become larger (for instance, 3×2,1353×2,135), it becomes necessary to draw rectangles whose side lengths are not to scale. When rectangles no longer accurately represent area, the term “area diagrams” is not used. Instead, “rectangular diagrams” is used in teacher materials and “diagrams” in student materials.
Students use such diagrams as a visual tool to decompose factors by place value and to organize partial products.

Section C:

In grade 3, students made sense of division in relation to multiplication and equal-size groups. They reasoned about division problems in context and found whole-number quotients from two-digit dividends and one-digit divisors. Here, students find quotients from larger dividends (up to four digits), investigate new division strategies and ways to represent them, and interpret division situations that involve remainders.
Students begin by solving problems in various situations, including those about equal-size groups, factors and multiples, and area of rectangles. These experiences reinforce students' understanding of the relationship between multiplication and division. They also build students' intuition for the kinds of situations that involve division (including those where a remainder may be involved), before focusing on finding the value of quotients.
Students first reason about division problems in any way that makes sense to them, and later use base-ten representations. They recall that to find the value of 64÷464÷4, for instance, they could first put 4 tens and 4 ones into 4 groups (1 ten and 1 one in each group), and then decompose the remaining 2 tens into 20 ones and put 5 ones in each group.

Students see that, just as they can distribute blocks of tens and ones into groups incrementally, they can decompose a dividend into parts and find partial quotients.
While there is not a single way to decompose a dividend, doing so by place value is often helpful, as was the case when finding partial products.
Students learn to use a series of equations and a vertical recording method to organize partial quotients.

Later in the section, students take a closer look at division problems that do not have whole-number quotients and interpret the remainders in the context of the problem.

Section D:
In the final section of this unit, students engage with a variety of contextual problems that involve multi-digit numbers and all four operations. The problems can be approached in many ways, presenting students with opportunities to choose their strategies and representations strategically. Many of them also involve multiple steps and justifications, prompting students to practice constructing logical reasoning and critiquing the reasoning of others (MP3).

## Differentiated Instruction

## Technology Integration

## 21st Century Skills

## Positive Behavior

## CASEL

Collaborative for Academic, Social, and Emotional Learning

## Resources

## Teacher Notes and Reflections