Gateway Regional School District

Atlas

Unit Plan

Multiplicative Comparison & Measurement

Chester / Littleville Elementary / Grade 4 / Mathematics

Week 19 - Week 22 | 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] 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.
- [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.

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.

Number & Operations—Fractions

4.NF Build fractions from unit fractions by applying and extending previous understandings of operations on whole numbers for fractions with denominators 2, 3, 4, 5, 6, 8, 10, 12, and 100.

- [x] 4c. Solve word problems involving multiplication of a fraction by a whole number, e.g., by using visual fraction models and equations to represent the problem. Show Details
- [x] 4. Apply and extend previous understandings of multiplication to multiply a fraction by a whole number.

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] 1. Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit. Record measurement equivalents in a two-column table. 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. Multiplicative Relationships: Students will understand that multiplication is a way to compare quantities and represents a situation where one quantity is a certain number of times larger or smaller than another. They will recognize that a multiplication equation can convey this relationship and interpret statements like "A is n times as many as B" to form equations like A = n × B.

2. Problem-Solving with Multiplication and Division: Students will understand that real-world problems can be solved using multiplication and division, and that choosing the correct operation is critical to finding the right answer. They will be able to distill the important information from a word problem and represent it with equations, using a symbol to stand for the unknown.

3. Representation and Interpretation of Remainders: Students will understand that remainders in division problems must be carefully interpreted in the context of the problem, and that sometimes a remainder will indicate a need to adjust the final answer up or down.

4. Fluency in Computation: Students will understand the importance of fluency in performing multi-digit addition and subtraction using standard algorithms, as a base for understanding multiplication and division operations.

5. Mathematical Reasoning: Students will understand that mental computation and estimation strategies, including rounding, are important tools for assessing the reasonableness of answers and for problem-solving when exact answers are not required. They will use these skills to check their work and to make educated guesses.

6. Conceptual Models of Multiplication: Students will understand that multiplication can be represented in a variety of ways, including equations, rectangular arrays, and area models. These models not only help to visualize and solve problems but also to explain how multiplication works and to show the relationship between factors and products.

7. Multiplication Algorithms Based on Place Value: Students will understand that multiplication of larger numbers can be broken down into simpler problems using place value knowledge and the properties of operations. They will use this understanding to multiply larger numbers efficiently and accurately.

Essential Questions

1. How can we use multiplication to describe how much larger one quantity is than another?
(Connection to Standard 1)

2. What methods can we use to solve problems that compare quantities using multiplication, and how do we know which method to use?
(Connection to Standard 3)

3. How can understanding multiplication help us to solve real-world measurement problems?
(Connection to Standard 2)

4. When solving a multistep problem, how can we determine the most reasonable answer?
(Connection to Standard 3)

5. How do equations with an unknown help us to represent and solve comparison problems?
(Connection to Standards 1 and 2)

6. How can we use estimation strategies to check if our multiplicative comparison answers make sense?
(Connection to Standard 3)

7. When multiplying large numbers, how does place value influence the strategies we choose?
(Connection to Standard 5)

8. How does the understanding of addition and subtraction algorithms enhance our ability to multiply and divide?
(Connection to Standard 4)

9. How can we use area models or rectangular arrays to visualize and solve multiplication problems?
(Connection to Standard 5)

10. How is multiplication different from addition, and why is it important to distinguish between the two when solving comparison problems?
(Connection to Standard 2)

Content

In this unit, students make sense of multiplication as a way to compare quantities. They use this understanding to solve problems about measurement.
In earlier grades, students related two quantities and made additive comparison, where the key question was "How many more?" Here, they make multiplicative comparison, in which the underlying

Skills

Section A Goals

- Analyze, describe, and represent multiplicative comparison situations.
- Solve one-step and two-step problems involving multiplicative comparison.

Section B Goals

question is “How many times as many?” For example, if Mai has 3 cubes and Tyler has 18 cubes, we can say that Tyler has 6 times as many cubes as Mai does.
Initially, students reason using concrete manipulatives and discrete images. Later, they reason more abstractly, using tape diagrams and equations. Comparative language such as “_____ times as many (or much) as ____” is emphasized, offering students opportunities to attend to precision as they communicate mathematically (MP6).

Next, students use the idea and language of multiplicative relationships to learn about various units of length, mass, capacity, and time, and to convert from larger units to smaller units within the same system of measurement. For example, they describe 1 kilometer as 1,000 times as long as a meter. Students then use their new knowledge to solve measurement problems.

Elena’s frisbee went 3 times as far as Clare’s did.
Andre’s frisbee went 4 times as far as Tyler’s did.
How far did Elena and Tyler throw the frisbee?

Han	17 yards
Lin	51125112 feet
Clare	21132113 feet
Andre	22 yards 2 feet
Elena	
Tyler	
student	**distance**

Throughout the unit
The Number Talks in this unit allow students to use what they previously learned about numbers and operations to support their current learning. Students use the relationship between multiplication and division to solve missing factor equations, which is helpful for multiplicative comparison work. They mentally find the value of expressions involving multiplication by 100 and 1,000, which is helpful when converting metric units of measurement. Some Number Talks offer ongoing practice toward end-of-year fluency goals, such as in multi-digit addition. Students also practice multiplying fractions by whole numbers, which supports the problem-solving work in the unit.

- Convert from larger units to smaller units within a given system of measurement.
- Solve multi-step problems involving multiplicative comparison and measurement.
- Understand the relative sizes of kilometers, meters and centimeters, liters and milliliters, kilograms and grams, and pounds and ounces.

Section C Goals

- Solve multi-step problems involving multiplicative comparison and measurement.

How will you gauge student learning?

Assessments

4.5 End-of-Unit Assessment | Summative | Written Test

Grade4-5-End-of-Unit-Assessment-assessment.pdf

6 State Standards Assessed

How will students learn?

Learning Activities

Section A:
In this section, students learn to compare two quantities in terms of multiplication and to solve multiplicative comparison problems.
In earlier grades, students made comparisons in terms of addition or subtraction. To describe the number of cubes in the image, they may say, “Han has 3 more cubes than Andre,” or “Andre has 3 fewer cubes than Han.” Here, they make this comparison by saying “Han has 2 times (or twice) as many cubes as Andre.”

Students begin with comparisons that involve small factors and familiar situations (such as comparing blocks), using familiar multiplicative comparison language (such as “twice,” or “twice as many”). They progress from using concrete representations (actual cubes) to discrete diagrams (showing cubes, or showing sections that each represent single objects). As they encounter larger factors and more-abstract situations, students interpret and use diagrams where each section represents any quantity.

Students write multiplication equations to express comparisons. As the problems become more complex, they reason with given diagrams (or diagrams they draw) and use division to find a missing factor.

Section B:
Students have encountered units of measurement in earlier grades and in their daily lives. They have measured and estimated lengths in centimeters and meters, recognized the number of minutes in an hour and measured intervals of time, and solved problems involving capacity and mass.
In this section, students expand on these concepts to convert measurements within the same system (metric or customary) from larger units to smaller units. These conversions require an understanding of the multiplicative relationship between units.
Students begin by exploring lengths in metric units. To develop a sense of the multiplicative relationship between centimeters and meters, students build a length of 1 meter from centimeter grid paper. They recognize that 1 meter is 100 times as long as 1 centimeter and use this reasoning to convert meters to centimeters. Later, they make sense of 1 kilometer by relating it to multiples of shorter measurements, such as the length of a basketball court or a soccer field.

Later, students learn the relationships between grams and kilograms, milliliters and liters, ounces and pounds, and hours, minutes, and seconds. As they solve problems and use multiplication to perform conversion, they develop a sense of the relative size of the units.

Section C:
In this section, students use multiplicative comparison and measurement conversion strategies to solve multi-step problems. As they convert customary and metric units of length, mass, and capacity, they continue to develop their understanding of relative sizes of units within the same system.
The problems here involve measurement units introduced in the previous section (pounds, ounces, kilometers, meters, centimeters), some from previous grades (yards, feet, and inches), as well as some new ones (gallons, quarts, and cups). As they make sense of situations, create representations, and write equations to solve problems, students practice reasoning quantitatively and abstractly (MP2).
Students also explore multiplicative relationships in geometric contexts. They analyze the relationship between the side lengths and perimeters of quadrilaterals, performing unit conversion along the way.
The section ends with an optional lesson in which students apply the understandings from this unit to make sense of measurements related to animals and analyze statements about them.

Differentiated Instruction

Technology Integration

21st Century Skills

Positive Behavior

CASEL

Collaborative for Academic, Social, and Emotional Learning

Resources

Teacher Notes and Reflections