

06. Investigations in Measurement; Decimal Multiplication and Division

Content Area: **Math**
Course(s):
Time Period: **Full Year**
Length: **5 weeks**
Status: **Published**

General Overview, Course Description or Course Philosophy

In Grade 5, instructional time should focus on three critical areas:

1. Developing fluency with addition and subtraction of fractions, and developing understanding of the multiplication of fractions and of division of fractions in limited cases (unit fractions divided by whole numbers and whole numbers divided by unit fractions)
2. Extending division to 2-digit divisors, integrating decimal fractions into the place value system and developing understanding of operations with decimals to hundredths, and developing fluency with whole number and decimal operations
3. Developing understanding of volume

In this unit, students will understand that place value understandings are applied to multiplying and dividing decimals by powers of 10, use whole number methods are extended to multiply and divide decimals, use patterns in powers of 10 to convert measurements, and line plots are used to organize and analyze measurement data.

OBJECTIVES, ESSENTIAL QUESTIONS, ENDURING UNDERSTANDINGS

Students will understand that:

- Place value understandings are applied to multiplying and dividing decimals by powers of 10.
- Whole number methods are extended to multiply and divide decimals.
- Patterns in powers of 10 are used to convert measurements in metric units.
- Line plots are used to organize and analyze measurement data.

Essential Questions

- How does understanding place values assist in multiplying and dividing decimals by powers of 10? How does this understanding affect the placement of the decimal point?
- How are whole number methods extended to multiply and divide decimals?
- How do patterns in powers of 10 aid in converting measurements between metric units? What role do place values play in these conversions?
- How are line plots utilized to organize and analyze measurement data effectively?
- In what practical scenarios are decimal operations crucial? How do these operations apply to everyday situations, such as finance, measurements, or scientific calculations?

- What strategies or algorithms are effective in multiplying and dividing decimals by powers of 10?
- How do shifts in decimal places correspond to powers of 10 in multiplication and division of decimals? What patterns emerge from these operations?

STUDENT LEARNING TARGETS

Refer to the 'Declarative Knowledge' and 'Procedural Knowledge' sections.

Declarative Knowledge

Students will know:

- Estimation is one strategy used to place the decimal point when multiplying and dividing decimals.
- When a decimal is multiplied by a power of 10, the decimal point moves to the right, shifting digits to the left; when a decimal is divided by 10, the decimal point moves to the left, shifting digits to the right.
- The number of places that the decimal point moves matches the exponent in the power of 10; zeros may need to be attached to the end of a number or inserted to the right of the decimal point to indicate the correct placement of the decimal point.
- When the decimal point moves n places to the right, the digit is multiplied by 10^n times, or multiplied by 10^n ; when the decimal point moves n places to the left, the digit is multiplied by $1/10^n$ times or divided by 10^n times; this is the same as multiplying by $1/10^n$ or dividing by 10^n .
- Finding the average of a set of numbers is one way to “even out” a set of measurements (adding all the data values and dividing by the number of measurements).
- The additive nature of volume is used to find the volume of complex and irregular objects and figures.
- When an object is submerged in a calibrated container of water, it displaces a volume of water equal to the volume of the object that can be measured; one cubic centimeter of water is equivalent to one milliliter of water.
- As an equivalent fraction expresses the same value with a different numerator and denominator, an equivalent problem produces the same quotient using a different dividend and divisor.

Procedural Knowledge

Students will be able to:

- Use a calculator to multiply and divide decimals by powers of ten to describe and explain patterns in the placement of the decimal point.
- Apply an understanding of multiplication and division by powers of 10 to convert measurements in metric units.
- Create line plots to display measurement data in fractions of a unit.
- Use operations with fractions to solve problems based on information presented through line plots.
- Use information presented in line plots to solve problems about redistributing measurement data.
- Use displacement to measure the volumes of objects.
- Use estimation and number sense to predict the relative size of decimal products and quotients.
- Use two strategies for solving decimal multiplication problems.
- Solve a multi-step number story using decimals and explain the reasonableness of the product; revise their work
- Create equivalent problems to help solve division problems involving decimal dividends and divisors.
- Collect reaction-time data and create a line plot; compute with decimals to identify typical reaction times; estimate totals.

CONTENT AREA STANDARDS

5.NF

A. Use equivalent fractions as a strategy to add and subtract fractions

B. Apply and extend previous understandings of multiplication and division to multiply and divide fractions

5.M

A. Convert like measurement units within a given measurement system

B. Geometric measurement: understand concepts of volume and relate volume to multiplication and to addition

5.DL

A. Understand and analyze data visualizations

5.G

A. Graph points on the coordinate plane to solve real-world and mathematical problems

B. Classify two-dimensional figures into categories based on their properties

MA.5.NBT.A.2	Explain patterns in the number of zeros of the product when multiplying a number by powers of 10, and explain patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10. Use whole-number exponents to denote powers of 10.
MA.5.NBT.A.3	Read, write, and compare decimals to thousandths.
MA.5.NBT.A.3b	Compare two decimals to thousandths based on meanings of the digits in each place, using $>$, $=$, and $<$ symbols to record the results of comparisons.
MA.5.NBT.B.5	Fluently multiply multi-digit whole numbers using the standard algorithm.
MA.5.NBT.B.7	Add, subtract, multiply, and divide decimals to hundredths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used.
MA.5.NF.A.1	Add and subtract fractions with unlike denominators (including mixed numbers) by replacing given fractions with equivalent fractions in such a way as to produce an equivalent sum or difference of fractions with like denominators.
MA.5.NF.A.2	Solve word problems involving addition and subtraction of fractions referring to the same whole, including cases of unlike denominators, e.g., by using visual fraction models or equations to represent the problem. Use benchmark fractions and number sense of fractions to estimate mentally and assess the reasonableness of answers.
MA.5.MD.A.1	Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real world problems.
MA.5.MD.B.2	Make a line plot to display a data set of measurements in fractions of a unit ($1/2$, $1/4$, $1/8$). Use operations on fractions for this grade to solve problems involving information presented in line plots.
MA.5.MD.C.3	Recognize volume as an attribute of solid figures and understand concepts of volume measurement.
MA.5.MD.C.5	Relate volume to the operations of multiplication and addition and solve real world and mathematical problems involving volume.
MA.5.MD.C.5b	Apply the formulas $V = l \times w \times h$ and $V = B \times h$ for rectangular prisms to find volumes of right rectangular prisms with whole number edge lengths in the context of solving real world and mathematical problems.
MA.5.MD.C.5c	Recognize volume as additive. Find volumes of solid figures composed of two non-overlapping right rectangular prisms by adding the volumes of the non-overlapping parts, applying this technique to solve real world problems.

INTERDISCIPLINARY CONNECTIONS

Math and Science: Metric Conversions Lab

- Conduct a lab experiment where students measure various objects using metric units. Apply patterns in powers of 10 to convert these measurements, then create line plots to analyze and compare the data collected.

RELATED STANDARDS (Technology, 21st Century Life & Careers, ELA Companion Standards are Required)

CS.K-12.2.d	Evaluate and select technological tools that can be used to collaborate on a project.
CS.K-12.7.a	Select, organize, and interpret large data sets from multiple sources to support a claim.
WRK.K-12.P.4	Demonstrate creativity and innovation.
WRK.K-12.P.5	Utilize critical thinking to make sense of problems and persevere in solving them.
WRK.K-12.P.8	Use technology to enhance productivity increase collaboration and communicate effectively.
TECH.K-12.P.4	Demonstrate creativity and innovation.
TECH.K-12.P.5	Utilize critical thinking to make sense of problems and persevere in solving them.
TECH.K-12.P.8	Use technology to enhance productivity increase collaboration and communicate effectively.

RESOURCES (Instructional, Supplemental, Intervention Materials)

Core Instructional Materials

- Everyday Math Unit 6 Resources (Math Masters, Student Journal Volume 2) / [ConnectED](#)
- Calendar Math

Supplemental Materials:

- [Illustrative Math Tasks](#)
- [IXL](#)
- Games
 - Exponent Ball (Lesson 6-2, 6-7): Multiplying and dividing decimals by powers of 10
 - Decimal Top-It: Addition or Subtraction (Lesson 6-4): Adding or subtracting decimals
 - Decimal Top-It: Decimal Subtraction Variation (Lesson 6-6): Comparing and subtracting decimals
 - Prism Pile-Up (Lesson 6-6): Finding volumes of rectangular prisms
 - Doggone Decimal (Lesson 6-8): Estimating decimals products
 - Decimal Domination (Lesson 6-9): Predicting decimal products and multiplying decimals
 - Spend and Save (Lesson 6-11): Adding and subtracting decimals
 - Division Top-It: Larger Numbers (Lesson 6-11): Dividing multi-digit whole numbers
 - Fraction/Whole Number Top-It (Lesson 6-13): Multiplying whole numbers and fractions
- Manipulatives
 - Base 10-blocks (flats, longs, cubes)
 - Number card sets 1-4, 0-9, 1-9, 1-10
 - 6-sided dice
 - Counters
 - Meterstick
 - Tape measure
 - Unifix cubes
 - Stopwatch

Intervention Materials:

- Number Worlds
- Touch Math Now

EVIDENCE OF LEARNING

Refer to the 'Formative, Summative, and Benchmark Assessments' sections.

Alternate Assessments

- Portfolios
- Verbal Assessment (instead of written)
- Multiple choice
- Modified Rubrics
- Performance Based Assessments

Formative Assessments

- Journal Pages
- Homelinks
- Math Boxes
- Observations
- Classwork
- Homework Assignments
- Do Now Questions
- Exit Tickets
- Self Assessment Questions

Summative Assessments

- Check Points
- Unit 6 Assessment
- Graded Assignments
- Project-based assessments

Benchmark Assessments

- IXL Screener / Diagnostic Snapshot BOY
- Trimester 1 Benchmark Assessment
- IXL Diagnostic Snapshot MOY
- Trimester 2 Benchmark Assessment
- IXL Diagnostic Snapshot EOY
- Trimester 3 Benchmark Assessment

ACCOMMODATIONS & MODIFICATIONS FOR SUBGROUPS

See link to Accommodations & Modifications document in course folder.