Fifth Grade Standards: MATHEMATICS

*Note: This information has been adapted from the 2020 Colorado State Standards as presented on the Colorado Department of Education (CDE) website. It is *not* an exhaustive or detailed list. All standards mentioned represent skills grade-level students should have mastered by the end of the grade-level year. If you desire further information, please visit the Standards page on the CDE website: https://www.cde.state.co.us/standardsandinstruction/standards

This document provides tiered support in addressing the academic standards. Families can choose to approach their curriculum selection and content-area instruction in one or all of three categories: a general **Overview** of expectations and "mathematic" behaviors, **Learning Objectives** (a "fly by" glance of concepts a student masters throughout the school year) and **Specific Skills** (expanded ideas to explain the learning objectives). As you consider lesson planning for each grade level, use the "Overview" and "Learning Objectives" checklists to help you plan out your year. Start with the end in mind: If my child needs to know how to _____ by the end of the school year, what learning activities can be implemented to introduce and then reinforce the concepts? Think next about smaller steps in learning that your child needs to master in order to reach that end goal (he/she can't count to 100 if he/she can't first count to ten). Also keep in mind that most objectives are not learned in isolation, meaning learning objectives are often combined. You don't need to ensure your child has mastered learning objective #1 before moving on to the next. Combining two or more objectives in a week's lesson plan can make for more creative and integrated learning. If you are using a reputable and research-based curriculum, then your child will most likely be working his/her way through these learning objectives in a well-paced and consistent manner. (A brief sampling of solid curriculum options can be found on the CSP website under "Homeschool Resources.")

Overview

Expectations for 5th Grade Students:

- **Number and Quantity**: Fluently (consistently) multiply multi-digit whole numbers; extend the idea of place value to decimals; begin to divide using multi-digit divisors (fluency isn't expected until sixth grade); multiply fractions; add and subtract fractions by creating equivalent fractions (1/2 is the same as 2/4); understand the relationship between fractions and division (2/5 means 2 ÷ 5); solve simple word problems involving the division of fractions with pictures (the formal procedure for dividing fractions is taught in sixth grade).
- **Algebra and Function**: Write and interpret numerical expressions.
- **Data, Statistics, and Probability**: Convert within the metric system; find the volumes of rectangular prisms using multiplication.
- **Geometry**: Graph points on a grid using positive numbers.

Throughout 5th Grade You May Find Students:

- Exploring patterns (using a calculator) that occur when multiplying by powers of ten (10, 100, 1/10, 1/100).
- Making connections between whole numbers and decimals.
- Playing with money to explore how to add and subtract numbers involving decimals.
- Solving fair share problems (3 submarine sandwiches fairly shared among 4 people) to explore the relationship between fractions and division.
- Drawing pictures to solve simple word problems involving the division of fractions by whole numbers and whole numbers by fractions.
- Filling boxes with cubes to explore the concept of volume and its connection to area.
- Exploring how to find the volume of objects that can be broken into several rectangular boxes.
- Playing games involving coordinates-location on a grid ("Battleship").

Learning Objectives

1. Understand the place value system.

2. Perform operations with multi-digit whole numbers and with decimals to hundredths.

3. Fractions: Use equivalent fractions as a strategy to add and subtract fractions.

4. Fractions: Apply and extend understandings of multiplication and division.

5. Write and interpret numerical expressions.

6. Analyze patterns and relationships.

7. Convert like measurement units within a given measurement system.

8. Represent and interpret data.

9. Geometric measurement: Understand concepts of volume and relate volume to multiplication and to addition.

10. Geometry: Graph points on the coordinate plane to solve real-world and mathematical problems.

11. Geometry: Classify two-dimensional figures into categories based on their properties.

Specific Skills

1. Understand the place value system.
   - Recognize that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and $\frac{1}{10}$ of what it represents in the place to its left.
     - How can you show visually the relationships between 25, 2.5 and 0.25? How can you show these relationships with equations?
   - 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.
   - Read, write, and compare decimals to thousandths. (CCSS: 5.NBT.A.3)
     - Read and write decimals to thousandths using base-ten numerals, number names, and expanded form, e.g., $347.392 = 3 \times 100 + 4 \times 10 + 7 \times 1 + 3 \times \frac{1}{10} + 9 \times \frac{1}{100} + 2 \times \frac{1}{1000}$.
     - Compare two decimals to thousandths based on meanings of the digits in each place, using $>$, $=$, and $<$ symbols to record the results of comparisons.
   - Use place value understanding to round decimals to any place.

2. Perform operations with multi-digit whole numbers and with decimals to hundredths.

- Fluently multiply multi-digit whole numbers.
- Find whole-number quotients of whole numbers with up to four-digit dividends and two-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.
- 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.

3. Fractions: Use equivalent fractions as a strategy to add and subtract fractions.

- 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. *For example,* $\frac{2}{3}+\frac{5}{4}=\frac{8}{12}+\frac{15}{12}=\frac{23}{12}$. *(In general,* $\frac{a}{b}+\frac{c}{d}=\frac{ad+bc}{bd}$.*)*
- 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. *For example, recognize an incorrect result* $\frac{2}{5}+\frac{1}{2}=\frac{3}{7}$*, by observing that* $\frac{3}{7}<\frac{1}{2}$.

4. Fractions: Apply and extend understandings of multiplication and division.

- Interpret a fraction as division of the numerator by the denominator ($\frac{a}{b}=a\div b$). Solve word problems involving division of whole numbers leading to answers in the form of fractions or mixed numbers, e.g., by using visual fraction models or equations to represent the problem. *For example, interpret* $\frac{3}{4}$ *as the result of dividing* 3 *by* 4*, noting that* $\frac{3}{4}$ *multiplied by* 4 *equals* 3*, and that when* 3 *wholes are shared equally among* 4 *people each person has a share of size* $\frac{3}{4}$*. If* 9 *people want to share a* 50*-pound sack of rice equally by weight, how many pounds of rice should each person get? Between what two whole numbers does your answer lie?*
- Apply and extend previous understandings of multiplication to multiply a fraction or whole number by a fraction.
    - Interpret the product $\frac{a}{b}\times q$ as a part of a partition of q into b equal parts; equivalently, as the result of a sequence of operations $a\times q\div b$. *For example, use a visual fraction model to show* $\frac{2}{3}\times 4=\frac{8}{3}$*, and create a story context for this equation. Do the same with* $\frac{2}{3}\times\frac{4}{5}=\frac{8}{15}$*. (In general,* $\frac{a}{b}\times\frac{c}{d}=\frac{ac}{bd}$.*)*
    - Find the area of a rectangle with fractional side lengths by tiling it with unit squares of the appropriate unit fraction side lengths and show that the area is the same as would be found by multiplying the side lengths. Multiply fractional side lengths to find areas of rectangles and represent fraction products as rectangular areas.
- Interpret multiplication as scaling (resizing), by:
    - Comparing the size of a product to the size of one factor on the basis of the size of the other factor, without performing the indicated multiplication.
    - Explaining why multiplying a given number by a fraction greater than 1 results in a product greater than the given number (recognizing multiplication by whole numbers

greater than 1 as a familiar case); explaining why multiplying a given number by a fraction less than 1 results in a product smaller than the given number; and relating the principle of fraction equivalence $\frac{a}{b} = \frac{n \times a}{n \times b}$ to the effect of multiplying $\frac{a}{b}$ by 1.

- Solve real-world problems involving multiplication of fractions and mixed numbers, e.g., by using visual fraction models or equations to represent the problem.
- Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions. (Students able to multiply fractions in general can develop strategies to divide fractions in general, by reasoning about the relationship between multiplication and division. But division of a fraction by a fraction is not a requirement at this grade.)
    - Interpret division of a unit fraction by a non-zero whole number and compute such quotients. *For example, create a story context for* $\frac{1}{3} \div 4$*, and use a visual fraction model to show the quotient. Use the relationship between multiplication and division to explain that* $\frac{1}{3} \div 4 = \frac{1}{12}$ *because* $\frac{1}{12} \times 4 = \frac{1}{3}$.
    - Interpret division of a whole number by a unit fraction and compute such quotients. *For example, create a story context for* $4 \div \frac{1}{5}$*, and use a visual fraction model to show the quotient. Use the relationship between multiplication and division to explain that* $4 \div \frac{1}{5} = 20$ *because* $20 \times \frac{1}{5} = 4$.
    - Solve real-world problems involving division of unit fractions by non-zero whole numbers and division of whole numbers by unit fractions, e.g., by using visual fraction models and equations to represent the problem. *For example, how much chocolate will each person get if* 3 *people share* $\frac{1}{2}$ *lb of chocolate equally? How many* $\frac{1}{3}$*-cup servings are in* 2 *cups of raisins?*
- Solve problems requiring calculations that scale whole numbers and fractions.
- Use fraction models and arrays to interpret and explain fraction calculations.
- How can you rewrite the fraction $\frac{5}{3}$ with an addition equation? How can you rewrite it with a multiplication equation? How does it make sense that both equations are accurate?
- If we can describe the product of 5×3 as "three times as big as 5," what does that tell us about the product of $5 \times \frac{1}{2}$? What about $\frac{1}{5} \times \frac{1}{2}$?

5. Write and interpret numerical expressions.

- Use grouping symbols (parentheses, brackets, or braces) in numerical expressions, and evaluate expressions with these symbols.
- Write simple expressions that record calculations with numbers and interpret numerical expressions without evaluating them. *For example, express the calculation "add* 8 *and* 7*, then multiply by* 2*" as* $2 \times (8 + 7)$*. Recognize that* $3 \times (18932 + 921)$ *is three times as large as* $18932 + 921$*, without having to calculate the indicated sum or product.*

6. Analyze patterns and relationships.

- Generate two numerical patterns using two given rules. Identify apparent relationships between corresponding terms. Form ordered pairs consisting of corresponding terms from the two patterns and graph the ordered pairs on a coordinate plane. *For example, given the rule "Add* 3*" and the starting number* 0*, and given the rule "Add* 6*" and the starting number* 0*, generate*

terms in the resulting sequences, and observe that the terms in one sequence are twice the corresponding terms in the other sequence. Explain informally why this is so.

7. Convert like measurement units within a given measurement system.

- 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.
    - What is happening mathematically when we convert from centimeters to meters? What about when we convert from meters to centimeters?
    - How can you use fractions to change 53 kilograms to grams? How can you use decimals to do this conversion?

8. Represent and interpret data.

- Make a line plot to display a data set of measurements in fractions of a unit ($\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$). Use operations on fractions for this grade to solve problems involving information presented in line plots. *For example, given different measurements of liquid in identical beakers, find the amount of liquid each beaker would contain if the total amount in all the beakers were redistributed equally.*

9. Geometric measurement: Understand concepts of volume and relate volume to multiplication and to addition.

- Recognize volume as an attribute of solid figures and understand concepts of volume measurement.
    - A cube with side length 1 unit, called a "unit cube," is said to have "one cubic unit" of volume and can be used to measure volume.
    - A solid figure which can be packed without gaps or overlaps using n unit cubes is said to have a volume of n cubic units.
- Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and improvised units.
- Relate volume to the operations of multiplication and addition and solve real-world and mathematical problems involving volume.
    - Model the volume of a right rectangular prism with whole-number side lengths by packing it with unit cubes and show that the volume is the same as would be found by multiplying the edge lengths, equivalently by multiplying the height by the area of the base. Represent threefold whole-number products as volumes, e.g., to represent the associative property of multiplication.
    - 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.
    - Use the additive nature of volume to 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.

10. Geometry: Graph points on the coordinate plane to solve real-world and mathematical problems.

- Use a pair of perpendicular number lines, called axes, to define a coordinate system, with the intersection of the lines (the origin) arranged to coincide with the 0 on each line and a given point in the plane located by using an ordered pair of numbers, called its coordinates. Understand that the first number indicates how far to travel from the origin in the direction of one axis, and the second number indicates how far to travel in the direction of the second axis, with the convention that the names of the two axes and the coordinates correspond (e.g., x-axis and x-coordinate, y-axis and y-coordinate).
- Represent real-world and mathematical problems by graphing points in the first quadrant of the coordinate plane and interpret coordinate values of points in the context of the situation.

11. Geometry: Classify two-dimensional figures into categories based on their properties.

- Explain that attributes belonging to a category of two-dimensional figures also belong to all subcategories of that category. *For example, all rectangles have four right angles and squares are rectangles, so all squares have four right angles.*