Grade 4 Mathematics Curriculum

Critical Areas for COHERENCE in Mathematics in Grade 4

In Grade 4, instructional time should focus on four critical areas:

1. Developing understanding and fluency with multi-digit multiplication, and developing understanding of dividing to find quotients involving multi-digit dividends. Students generalize their understanding of place value to 1,000,000, understanding the relative sizes of numbers in each place. They apply their understanding of models for multiplication (equal-sized groups, arrays, area models), place value, and properties of operations, in particular the distributive property, as they develop, discuss, and use efficient, accurate, and generalizable methods to compute products of multi-digit whole numbers. Depending on the numbers and the context, they select and accurately apply appropriate methods to estimate or mentally calculate products. They develop fluency with efficient procedures for multiplying whole numbers; understand and explain why the procedures work based on place value and properties of operations; and use them to solve problems. Students apply their understanding of models for division, place value, properties of operations, and the relationship of division to multiplication as they develop, discuss, and use efficient, accurate, and generalizable procedures to find quotients involving multi-digit dividends. They select and accurately apply appropriate methods to estimate and mentally calculate quotients, and interpret remainders based upon the context.

2. Developing an understanding of fraction equivalence, addition and subtraction of fractions with like denominators, and multiplication of fractions by whole numbers. Students develop understanding of fraction equivalence and operations with fractions. They recognize that two different fractions can be equal (e.g., 35/10 = 7/2), and they develop methods for generating and recognizing equivalent fractions. Students extend previous understandings about how fractions are built from unit fractions, composing fractions from unit fractions, decomposing fractions into unit fractions, and using the meaning of fractions and the meaning of multiplication to multiply a fraction by a whole number.

3. Refining use of the four operations with whole numbers to solve multistep word problems. Students refine their use of the four operations in order to solve multistep problems efficiently, flexibly and accurately. Students understand that a word problem can be represented with an equation based on the situation, but the solution may use a related equation that is easier to manipulate (e.g., a word problem may be represented with a situation equation such as 345+? = 578; and students understand that even though the word problem is a joining situation, it is easier to solve using a subtraction equation {578 − 345 =? }).

4. Understanding that geometric figures can be analyzed and classified based on their properties, such as having parallel sides, perpendicular sides, types of angles, and symmetry. Students describe, analyze, compare, and classify two-dimensional shapes. Through building, drawing, and analyzing two-dimensional shapes, students deepen their understanding of properties of two-dimensional objects and the use of them to solve problems involving symmetry.

Standards for Mathematical Practice in Grade 4

The State Standards for Mathematical Practice are practices expected to be integrated into every mathematics lesson for all students Grades K-12. Below are a few examples of how these Practices may be integrated into tasks that Grade 4 students complete.

Practice	Explanation and Example
1) Make sense of problems and persevere in solving them.	Mathematically proficient students in Grade 4 know that doing mathematics involves solving problems and discussing how they solved them. Students explain to themselves the meaning of a problem and look for ways to solve it. Fourth graders may use concrete objects or pictures to help them conceptualize and solve problems. They may check their thinking by asking themselves, "Does this make sense?" They listen to the strategies of others and will try different approaches. They often will use another method to check their answers.
2) Reason abstractly and quantitatively.	Mathematically proficient students in Grade 4 recognize that a number represents a specific quantity. They extend this understanding from whole numbers to their work with fractions and decimals. This involves two processes- decontexualizing and contextualizing. Grade 4 students decontextualize by taking a real-world problem and writing and solving equations based on the word problem. For example, consider the task, Timothy has 418 pizzas left over from his soccer party. After giving some pizza to his friend, he has 218 of pizzas left. How much pizza did Timothy give to his friend? Grade 4 students make sense of a contextual problem and express the actions or events that are described in the problem using numbers and symbols. They need to be able to "show" their thinking using concrete or pictorial representations BEFORE they move to abstract thinking and/or just apply the algorithm without understanding. Further, Grade 4 students write simple expressions, record calculations with numbers, and represent or round numbers using place value concepts.
3) Construct viable arguments and critique the reasoning of others.	Mathematically proficient students in Grade 4 construct arguments using concrete representations, such as objects, pictures, and drawings. They explain their thinking and make connections between models and equations. Students refine their mathematical communication skills as they participate in mathematical discussions involving questions like "How did you get that?" and "Why is that true?" They explain their thinking to others and respond to others' thinking through discussions and written responses.
4) Model with mathematics.	Mathematically proficient students in Grade 4 represent problem situations in various ways, including writing an equation to describe the problem. Students need opportunities to connect the different representations and explain the connections. They should be able to use all of these representations as needed. Students at this level are able to identify important quantities in a contextual situation and use mathematical models to show the relationships of those quantities, particularly in multistep problems or problems involving more than one variable. For example, if there is a penny jar that starts with 3 pennies in a jar, and 4 pennies are added each day, students might use a table to model the relationship between number of days and number of pennies in the jar. They use

	that model to determine how many pennies are in the jar after 10 days, which in turn helps them model the situation with the expression 4×10+3. Then, students in Grade 4 evaluate their results in the context of the situation and reflect on whether the results make sense.
5) Use appropriate tools strategically.	Mathematically proficient students in Grade 4 consider the available tools (including estimation) when solving a mathematical problem and decide when certain tools might be helpful. For instance, they may use graph paper or a number line to represent and compare decimals and protractors to measure angles. They use other measurement tools to understand the relative size of units within a system and express measurements given in larger units in terms of smaller units. Proficient students are sufficiently familiar with tools appropriate for 4th grade and areas of content to make sound decisions about when each of the tools might be helpful, recognizing both the insight to be gained from their use as well as their limitations. They choose tools that are relevant and useful to the problem at hand.
6) Attend to precision.	Mathematically proficient students in Grade 4 develop their mathematical communication skills, they try to use clear and precise language in their discussions with others and in their own reasoning. They learn to use mathematical symbols correctly and can describe the meaning of symbols they use and are careful about specifying units of measure. Students in Grade 4 can explain and justify their thinking orally and in writing.
7) Look for and make use of structure.	Mathematically proficient students in Grade 4 closely examine numbers to discover a pattern or structure. For instance, students use properties of operations to explain calculations (partial products model). For example, when calculating 16×9, they might apply the structure of place value and the distributive property to find the product: 16×9=(10+9)×9=(10×9)+(6×9). Another example, Grade 4 students relate representations of arrays to the multiplication principal of counting. They generate number or shape patterns that follow a given rule.
8) Look for and express regularity in repeated reasoning.	Mathematically proficient students in Grade 4 notice repetitive actions in computation to make generalizations Students use models to explain calculations and understand and can explain HOW algorithms work. They also use models to examine patterns

Mathematics Content Standards in Grade 4

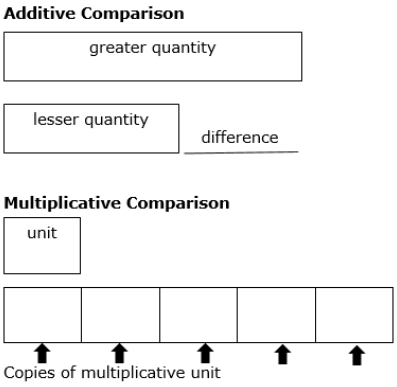
Operations and Algebraic Thinking 4.OA

(Counting and Cardinality and Operations and Algebraic Thinking Progression K-5 Pg. 29-31)

Use the four operations with whole numbers to solve problems.

4.OA.1. Interpret a multiplication equation as a comparison, *(e.g. interpret* $35 = 5 \cdot 7$ *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.

4.OA.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.)*



For Example:
A clown had 20 balloons. He sold some and has 12 left. Each balloon costs $2. How much money did he make?
Situation Equation: $20 - n = 12$
$n \times \$2 = \square$
Solution Equation: $20 - 12 = n$
$n \times \$2 = \square$

4.OA.3. Solve multi-step word problem 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 situation equations and/or solution equations with a letter or symbol standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding.

Gain familiarity with factors and multiples.

4.OA.4. Find all factor pairs for a whole number in the range 1 to 100. Recognize that a whole number is a multiple of each of its factors. Determine whether a given whole number in the range 1 to 100 is a multiple of a given one-digit number. Determine whether a given whole number in the range 1 to 100 is prime or composite.

Generate and analyze patterns.

4.OA.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. *For example, given the rule "Add 3" and the starting number 1, generate terms in the resulting* **sequence** *and observe that the terms appear to alternate between odd and even numbers.* Explain informally why the numbers will continue to alternate in this way.

Number and Operations in Base Ten 4.NBT

(Numbers & Operations Base 10 Progression K-5 Pg. 13-17)

Generalize place value understanding for multi-digit whole numbers. (Limited to whole numbers less than or equal to 1,000,000.)

4.NBT.1. Recognize that in a multi-digit whole number, a digit in one place represents ten times what it represents in the place to its right. *For example, recognize that* $700 \div 70 = 10$ *by applying concepts of place value and division.*

4.NBT.2. Read and write multi-digit whole numbers using base-ten **numerals**, number names, expanded form, and unit form. Compare two multi-digit numbers based on meanings of the digits in each place, using >, <, =, and ≠ symbols to record the results of comparisons. *(Note: Students should demonstrate understanding and application of place value decomposition. For example, 127 can be 1 hundred, 2 tens, 7 ones or 12 tens, 7 ones Refer to 2.NBT.1)*

4.NBT.3. Use place value understanding to round multi-digit whole numbers to any place.

Use place value understanding and properties of operations to perform multi-digit arithmetic.

4.NBT.4. Fluently (efficiently, accurately, and flexibly) add and subtract multi-digit whole numbers using an efficient algorithm (including, but not limited to: traditional, partial-sums, etc.), based on place value understanding and the properties of operations.

4.NBT.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.

4.NBT.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.

Number and Operations—Fractions 4.NF

Extend understanding of fraction equivalence and ordering. (Limited to fractions with denominators 2, 3, 4, 5, 6, 8, 10, 12, 100.)
(Number and Operations – Fractions Progression Pg. 3)

4.NF.1. Explain why a fraction $\frac{a}{b}$ is equivalent to a fraction $\frac{(n \cdot a)}{(n \cdot b)}$ by using visual fraction models, with attention to how the number and size of the parts differ even though the two fractions themselves are the same size. Use this principle to recognize and generate equivalent fractions.

(Number and Operations—Fractions Progression 3–5 Pg. 6)

4.NF.2. Compare two fractions with different numerators and different denominators, *(e.g. by creating common numerators or denominators, or by comparing to a benchmark fraction such as* $\frac{1}{2}$*.)* Recognize that comparisons are valid only when the two fractions

refer to the same whole. Record the results of comparisons with relational symbols >, <, =, or ≠, and justify the conclusions, *(e.g. by using visual fraction models.).*

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

4.NF.3. Understand a fraction $\frac{a}{b}$ with *a* > 1 as a sum of fractions $\frac{1}{b}$.

4.NF.3a. Understand addition and subtraction of fractions as joining and separating parts referring to the same whole.

4.NF.3b. **Decompose** a fraction into a sum of fractions with the same denominator in more than one way, recording each decomposition by an equation. Justify decompositions, *e.g. by using a visual fraction model.*

Examples: $\frac{3}{8} = \frac{1}{8} + \frac{1}{8} + \frac{1}{8}$; $\frac{3}{8} = \frac{1}{8} + \frac{2}{8}$; $2\frac{1}{8} = 1 + 1 + \frac{1}{8} = \frac{8}{8} + \frac{8}{8} + \frac{1}{8}$.

4.NF.3c. Add and subtract mixed numbers with like denominators, *e.g. by replacing each mixed number with an equivalent fraction (simplest form is not an expectation), and/or by using properties of operations and the relationship between addition and subtraction.*

4.NF.3d. Solve word problems involving addition and subtraction of fractions referring to the same whole and having like denominators, *e.g. by using visual fraction models and equations to represent the problem.*

4.NF.4. Apply and extend previous understandings of multiplication (refer to 2.OA.3, 2.OA.4, 3.OA.1, 3.NF.1, 3.NF.2) to multiply a fraction by a whole number.

4.NF.4a. Understand a fraction $\frac{a}{b}$ as a multiple of $\frac{1}{b}$. *For example, use a visual fraction model to represent* $\frac{5}{4}$ *as 5 copies of* $\frac{1}{4}$*, recording the conclusion by the equation* $\frac{5}{4} = 5 \cdot \frac{1}{4}$.

4.NF.4b. Understand a multiple of $\frac{a}{b}$ as a multiple of $\frac{1}{b}$, and use this understanding to multiply a fraction by a whole number. *For example, use a visual fraction model to express* $3 \cdot \frac{2}{5}$ *as* $6 \cdot \frac{1}{5}$*, recognizing this product as* $\frac{6}{5}$. *(In general,* $n \cdot \frac{a}{b} = \frac{n \cdot a}{b}$*.).*

4.NF.4c. Solve word problems involving multiplication of a fraction by a whole number, (See Table 2) *(e.g. by using visual fraction models and equations to represent the problem.) For example, if each person at a party will eat* $\frac{3}{8}$ *of a pound of roast beef, and there will be 5 people at the party, how many pounds of roast beef will be needed? Between what two whole numbers does your answer lie?*

Understand decimal notation for fractions, and compare decimal fractions. (Students are expected to learn to add decimals by converting them to fractions with the same denominator, in preparation for general fraction addition in grade 5.)

4.NF.5. Express a fraction with denominator 10 as an equivalent fraction with denominator 100, and use this technique to add two fractions with respective denominators 10 and 100. *For example, express* $\frac{3}{10}$ *as* $\frac{30}{100}$*, and add* $\frac{3}{10} + \frac{4}{100} = \frac{34}{100}$.

4.NF.6. Use decimal notation for fractions with denominators 10 or 100. *For example, rewrite 0.62 as* $\frac{62}{100}$*; describe a length as 0.62 meters; locate 0.62 on a number line diagram.*

4.NF.7. Compare two decimals to hundredths by reasoning about their size. Recognize that comparisons are valid only when the two decimals refer to the same whole. Record the results of comparisons with the relational symbols >, < =, or ≠, and justify the conclusions, *(e.g. by using a visual model.).*

Measurement and Data 4.MD

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

4.MD.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. *For example, know that 1 ft is 12 times as long as 1 in. Express the length of a 4 ft snake as 48 in. Generate a conversion table for feet and inches listing the number pairs* (*1, 12*), (*2, 24*), (*3, 36*), *…*

(Measurement and Data (measurement part) Progression K–5 Pg. 20)

4.MD.2. Use the four operations to solve word problems (See Table 1 and Table 2) 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.

4.MD.3. Apply the area and perimeter formulas for rectangles in real world and mathematical problems explaining and justifying the appropriate unit of measure. *For example, find the width of a rectangular room given the area of the flooring and the length, by viewing the area formula as a multiplication equation with an unknown factor.*

Represent and interpret data.

4.MD.4. Make a data display (line plot, bar graph, pictograph) to show a set of measurements in fractions of a unit $\left(\frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{1}{16}\right)$. Solve problems involving addition and subtraction of fractions by using information presented in the data display. *For example, from a line plot find and interpret the difference in length between the longest and shortest specimens in an insect collection.*

Geometry 4.G

(Geometry Progression K-6 Pg. 15-16)

Draw and identify lines and angles, and classify shapes by properties of their lines and angles.

4.G.1. Draw points, lines, line segments, rays, angles (right, acute, obtuse, straight, reflex), and perpendicular and parallel lines. Identify these in two-dimensional figures.

4.G.2. Classify two-dimensional figures based on the presence or absence of parallel or perpendicular lines, or the presence or absence of angles (right, acute, obtuse,

straight, reflex). Recognize and categorize triangles based on angles (acute, obtuse, equiangular, and right) and/or sides (scalene, isosceles, and equilateral).

4.G.3. Recognize a line of symmetry for a two-dimensional figure as a line across the figure such that the figure can be folded along the line into matching parts. Identify line-symmetric figures and draw lines of symmetry.