4th Grade Essential Standards Justification

Essential Standards are individual standards selected to receive a greater proportion of questions on the AASA exams. The AASA exams, administered in grades three through eight, are developed based on a standards blueprint approved by the State Board of Education that includes individual standards grouped into clusters and identifies an allocation of questions for each cluster. The identified Essential Standards will receive the maximum number of questions allowed by the standards blueprint. Note that ALL standards will continue to be included in the test design of the annual state exams. ALL STANDARDS WILL BE ASSESSED. The identified Essential Standards are targeted for emphasis, indicating that these standards will have a higher proportion of the AASA when possible. The state assessment will retain the same length and duration. ALL STANDARDS remain valid and subject to inclusion in each year's AASA. *All justifications listed in this document were developed by a working group of Arizona math educators and leaders.*

Fourth Grade: Overview

1. Extend understanding of place value to multi-digit numbers and fluently add and subtract multi-digit numbers.

Students generalize their understanding of place value through 1,000,000, and the relative size of numbers in each place. They use their understanding of properties of operations to perform multi-digit arithmetic with multi-digit whole number less than or equal to 1,000,000. They round multi-digit numbers and fluently add and subtract multi-digit whole numbers within 1,000,000.

2. Develop competency with multi-digit multiplication, and develop understanding of dividing to find quotients involving multi-digit dividends.

Students develop understanding of fraction equivalence and operations with fractions. They recognize that two different fractions can be equal (e.g., 15/9 = 5/3), 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. Develop understanding of fraction equivalence, addition, and subtraction of fractions with like denominators, and multiplication of fractions

by whole numbers.

Students apply their understanding of models for multiplication, place value, and properties of operations, in particular the distributive property, to compute products of multi-digit whole numbers. They develop fluency with efficient strategies for multiplying multi-digit whole numbers through 1,000,000; understand and explain why the strategies work; and use them to solve problems (Table 2). Students apply their understanding of models for division, place value, properties of operations, and the relationship of division to multiplication to find quotients involving multi-digit dividends.

The Standards for Mathematical Practice complement the content standards so that students increasingly engage with the subject matter as they grow in mathematical maturity and expertise throughout the elementary, middle, and high school years.

Extend understanding of place value to multi-digit numbers and fluently add and subtract multi-digit numbers. Students generalize their understanding of place value through 1,000,000, and the relative size of numbers in each place. They use their understanding of properties of operations to perform multi-digit arithmetic with multi-digit whole number less than or equal to 1,000,000. They round multi-digit numbers and fluently add and subtract multi-digit whole numbers within 1,000,000.		
Clusters Included		
4.NBT.A Generalize Place Value Understanding for Multi-Digit Whole Numbers **4.OA.C Generate and Analyze Patterns** **4.G.A Draw and Identify Lines and Angles and Classify Shapes by Properties of Their Lines and Angles**		**4.MD.A Solve Problems Involving Measurement and Conversion of Measurements From a Larger Unit to a Smaller Unit** **4.MD.C Geometric Measurement: Understand Concepts of Angle and Measure Angles**
Coding	**Standard**	**Justification**
4.NBT.A.1	**Apply concepts of place value, multiplication, and division to understand that in a multi-digit whole number, a digit in one place represents ten times what it represents in the place to its right.**	• This standard a major standard related to consolidating place value understanding to use it for multi-digit operations • This is connected to Algebraic Thinking Cluster A standards
4.MD.A.3	**Apply the area and perimeter formulas for rectangles in mathematical problems and problems in real-world contexts, including problems with unknown side lengths. See *Table 2.***	• This is embedded in the standards of cluster A of Algebraic Thinking
Additional standards that support the core concept(s) and grade-level instructional priorities.		
4.NBT.A.2	**Read and write multi-digit whole numbers using base-ten numerals, number names, and expanded form. Compare two multi-digit numbers based on meanings of the digits in each place, using >, =, and < symbols to record the results of comparisons.**	• This standard is a major standard, yet it does not need more testing
4.NBT.A.3	**Use place value understanding to round multi-digit whole numbers to any place.**	• This standard pairs best when utilized with Algebraic Thinking (OA) and Number and

		Operations in Base Ten (NBT)
4.NBT.B.4	**Fluently add and subtract multi-digit whole numbers using a standard algorithm.**	• Being fluent means that students are able to choose flexibly among methods and strategies to solve contextual and mathematical problems, they understand and are able to explain their approaches, and they are able to produce accurate answers efficiently. • Efficiency, Accuracy, Flexibility, Appropriately
4.OA.C.6	**When solving problems, assess the reasonableness of answers using mental computation and estimation strategies, including rounding.**	• This standard should not be taught in isolation but should be wrapped into OA and NBT standards.
4.OA.C.5	**Generate a number pattern that follows a given rule. Identify apparent features of the pattern that were not explicit in the rule itself and explain the pattern informally (e.g., 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).**	
4.MD.A.1	**Know relative sizes of measurement units within one system of units, which could include 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 and in a smaller unit in terms of a larger unit. *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).***	• This standard should not be taught in isolation but should be wrapped into OA and NBT standards.
4.MD.C.7	**Understand angle measures as additive. (When an angle is decomposed into non-overlapping parts, the angle measure of the whole is the sum of the angle measures of the parts.) Solve addition and subtraction problems to find unknown angles on a diagram within mathematical problems, as well as problems in real-world contexts.**	• This is a supporting standard in grade 4
4.MD.C.5	**Recognize angles as geometric shapes that are formed wherever two rays share a common endpoint, and understand concepts of angle measurement:**	

	a. An angle is measured with reference to a circle with its center at the common endpoint of the rays, by considering the fraction of the circular arc between the points where the two rays intersect the circle. An angle that turns through 1/360 of a circle is called a "one-degree angle," and can be used to measure angles. **b. An angle that turns through *n* one-degree angles is said to have an angle measure of *n* degrees.**	
4.MD.C.6	**Measure angles in whole-number degrees using a protractor. Sketch angles of specified measure.**	
4.G.A.1	**Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures.**	
4.G.A.2	**Classify two-dimensional figures based on the presence or absence of parallel or perpendicular lines, or the presence or absence of angles of a specified size (e.g., understand right triangles as a category, and identify right triangles).**	

Develop competency with multi-digit multiplication, and develop understanding of dividing to find quotients involving multi-digit dividends. Students apply their understanding of models for multiplication, place value, and properties of operations, in particular the distributive property, to compute products of multi-digit whole numbers. They develop fluency with efficient strategies for multiplying multi-digit whole numbers through 1,000,000; understand and explain why the strategies work; and use them to solve problems (*Table 2*). Students apply their understanding of models for division, place value, properties of operations, and the relationship of division to multiplication to find quotients involving multi-digit dividends.		
Clusters Included		
4.OA.A Use the Four Operations with Whole Numbers to Solve Problems **4.NBT.B Use Place Value Understanding and Properties of Operations to Perform Multi-Digit Arithmetic**		**4.MD.A Solve Problems Involving Measurement and Conversion of Measurements From a Larger Unit to a Smaller Unit**
Coding	**Standard**	**Justification**
4.OA.A.2	**Multiply or divide within 1000 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). *See Table 2.***	• This standard is essential in Grade 4 because it builds on students' place value understanding to help them reason about multiplication and division in terms of size and scale.
4.NBT.B.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.**	• Illustrations could also include conversion and measurement tables (4.MD.A.1)
4.MD.A.3	**Apply the area and perimeter formulas for rectangles in mathematical problems and problems in real-world contexts, including problems with unknown side lengths. See *Table 2.***	• Context for operations and fractions
Additional standards that support the core concept(s) and grade-level instructional priorities.		
4.OA.A.1	**Represent verbal statements of multiplicative comparisons as**	• This foundational standard is embedded in

	multiplication equations. Interpret a multiplication equation as a comparison (e.g., 35 is the number of objects in 5 groups, each containing 7 objects, and is also the number of objects in 7 groups, each containing 5 objects).	4.OA.A.2 and 4.OA.A.3
4.OA.A.3	**Solve multistep word problems using the four operations, including problems in which remainders must be interpreted. Understand how the remainder is a fraction of the divisor. Represent these problems using equations with a letter standing for the unknown quantity.**	
4.OA.B.4	**Find all factor pairs for a whole number in the range 1 to 100 and understand that a whole number is a multiple of each of its factors.**	
4.NBT.B.6	**Demonstrate understanding of division by finding whole-number quotients and remainders with up to four-digit dividends and one-digit divisors.**	• This demonstrates understanding of division, such as using place value understanding, illustrating and explain the calculations using equations, rectangular arrays, and/or area models, conversion and measurement tables • Not assessing a standard algorithm

Develop 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., 15/9 = 5/3), 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.

Clusters Included	
4.NF.A Extend Understanding of Fraction Equivalence and Ordering **4.NF.B EBuild Fractions From Unit Fractions by Applying and Extending Previous Understanding of Operations on Whole Numbers** **4.NF.C Understand Decimal Notation for Fractions and Compare Decimal Fractions**	**4.MD.A Solve Problems Involving Measurement and Conversion of Measurements From a Larger Unit to a Smaller Unit** **4.G.A Draw and Identify Lines and Angles and Classify Shapes by Properties of Their Lines and Angles**

Coding	Standard	Justification
4.NF.A.1	**Explain why a fraction *a/b* is equivalent to a fraction (*n x a*)/(*n x 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 understand and generate equivalent fractions.**	• Visual models to help students understand how to create equivalent fractions
4.NF.B.3.b	**Decompose a fraction into a sum of fractions with the same denominator in more than one way (e.g., 3/8 = 1/8 + 1/8+1/8; 3/8 = 2/8 + 1/8; 2 1/8 = 1 + 1 + 1/8 + or 2 1/8 = 8/8 + 8/8 + 1/8).**	• Flexibly decomposing involves the joining and separating of fractional parts
4.NF.B.3.d	**Solve word problems involving addition and subtraction of fractions referring to the same whole and having like denominators.**	• Apply understanding of fractions to real-world contexts
4.NF.C.6	**Use decimal notation for fractions with denominators 10 (tenths) or 100 (hundredths), and locate these decimals on a number line.**	• Connect fractions to decimals using place value understanding

		• The number line builds decimal number sense and supports comparing, ordering, and operating with decimals.
4.MD.B.4	**Make a line plot to display a data set of measurements in fractions of a unit (1/2, 1/4, 1/8). Solve problems involving addition and subtraction of fractions by using information presented in line plots.**	• Connects data representation with fraction operations
Additional standards that support the core concept(s) and grade-level instructional priorities.		
4.NF.A.2.a	**Understand that comparisons are valid only when the two fractions refer to the same size whole.**	• Foundational for fractional understanding and embedded in 4.NF.A.2b
4.NF.A.2.b	**Record the results of comparisons with symbols >, =, or <, and justify the conclusions.**	• When assessing this standard, students also show understanding of equivalent fractions (NF.A.1) and understanding that comparisons are valid only when the two fractions refer to the same whole (NF.A.2a)
4.NF.B.3.a	**Understand addition and subtraction of fractions as joining and separating parts referring to the same whole.**	• This is embedded in 4.NF.B.3d
4.NF.B.3.c	**Add and subtract mixed numbers with like denominators (e.g., by using properties of operations and the relationship between addition and subtraction and/or by replacing each mixed number with an equivalent fraction).**	• This is embedded in 4.NF.B.3d
4.NF.B.4.a	**Understand a fraction a/b as a multiple of a unit fraction 1/b. In general, a/b = a x 1/b and use this understanding to multiply a whole number by a fraction. In general, *n x a/b = (n x a)/b***	
4.NF.B.4.b	**Understand a multiple of a/b as a multiple of a unit fraction 1/b.**	• Similar to 4.NF.B.4a
4.NF.B.4.c	**Solve word problems involving multiplication of a whole number by a fraction. *For example, if each person at a party will eat 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?***	

4.NF.C.5	**Express a fraction with a denominator of 10 as an equivalent fraction with a denominator of 100, and use this technique to add two fractions with respective denominators 10 (tenths) and 100 (hundredths). *For example, express 3/10 as 30/100, and 3/10 + 4/100 = 34/100.* (Note: Students who can generate equivalent fractions can develop strategies for adding fractions with unlike denominators in general. But addition and subtraction with unlike denominators, in general, is not a requirement at this grade.)**	• This is embedded into 4.NF.C.6
4.NF.C.7	**Compare two decimals to hundredths by reasoning about their size. Understand that comparisons are valid only when the two decimals refer to the same whole. Record the results of comparisons with the symbols >, =, or <.**	• This is embedded into 4.NF.C.6
4.MD.A.2	**Use the four operations to solve word problems and problems in real-world contexts involving distances, intervals of time (hr, min, sec), liquid volumes, masses of objects, and money, including decimals and problems involving fractions with like denominators, and problems that require expressing measurements given in a larger unit in terms of a smaller unit. Represent measurement quantities using a variety of representations, including number lines that feature a measurement scale.**	• This is embedded in Algebraic Thinking
4.G.A.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.**	